DRS CUMULUS Oslo 2013

Design Learning for Tomorrow

Design Education from Kindergarten to PhD

Proceedings from
the 2nd International Conference
for Design Education Researchers,
14-17 May 2013, Oslo, Norway

Vol. 1-4

Reds.: Janne Beate Reitan, Peter Lloyd,
Erik Bohemia, Liv Merete Nielsen
Ingvild Digranes and Eva Lutnæs

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Volume 2

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Introductions

DRS // CUMULUS 2013
2nd International Conference for Design Education Researchers
Oslo, 14–17 May 2013

Design Learning for Tomorrow – Design Education from Kindergarten to PhD

Many thanks to the Design Research Society (DRS) and Cumulus for giving the Oslo and Akershus University College of Applied Sciences the confidence to chair and organise this 2nd international conference for design education researchers in Oslo May 14–17, 2013. Researchers from more than 74 universities have undertaken a rigorous double blind review process used to select papers for inclusion in these conference proceedings. We received 225 full papers and of these 165 were selected and included in the conference proceedings and presented at the conference. Thanks to all, and a special thank to professor Peter Lloyd of the Open University, who served as chair of the scientific review committee and to dr. Janne Reitan of the Oslo and Akershus University College of Applied Sciences who chaired the committee with him.

The 2nd international conference for design education researchers in Oslo May 14–17, 2013 on the theme of 'Design learning for tomorrow – Design education from Kindergarten to PhD' received an overwhelming response. This is gratifying for us, the organisers, as we see design in a broad interdisciplinary perspective in support for a *better tomorrow*. For years we have promoted the idea that sustainable design solutions should include more than 'professional' designers; they should also include a general public as 'conscious' consumers and decision makers with responsibility for quality and longevity, as opposed to a "throw-away" society.

This is also the reason why we as the conference hosts have chosen to focus on design education from Kindergarten to PhD. This perspective was put forward as a contrast to most design education conferences where there is either a focus on design education for professionals or general education for children and non-designers. In the call the conference papers we have argued for a longitudinal perspective on design education where the education of professional designers is seen in *relation* to general education of a people. This is becoming increasingly relevant as more and more decisions are being made on the basis of visual representation. With this conference we have the ambition to see education at many different levels in securing a sustainable future for the design of everyday life solutions. For that we need qualified and reflective decision makers with a consciousness for quality of design and solutions.

Why are these issues of concern for Norwegian researchers in this field? The answer goes back to the 1960 National Curriculum for primary and lower secondary schools in Norway, when art and crafts were merged into one subject. Currently this subject includes art, architecture, design and visual communication. No other Nordic–or European–country seems to have developed a model similar to this and today we see

the benefit of this merger where design is at the core of the subject for youngsters – building upon the best from art and the best from craft to become creative problem solvers and critical consumers. I am looking forward to the day when UNESCO, or other organisations with responsibility for funding research, recognise that we need more research and knowledge on what impact design education from Kindergarten to PhD have on consumer habits and sustainable development at large. I hope that such projects are not far away. Politicians have far too long been told that advanced mathematics is the main way to stimulate youngsters to abstract thinking. The designerly way of solving problems can be even more suitable in training abstract thinking, and it will also include ethical aspects of sustainable development and ecology. A design literate general public would therefore be a step forward in supporting the statement of commitment by the members of Cumulus; the 'Kyoto Design Declaration 2008'.

For this DRS//cumulus Oslo 2013 conference we are happy to continue our international cooperation for design education research. In advance of the conference we have cooperated on editing the conference proceedings at level 1 in the Norwegian system. After the conference we will cooperate for special issues of the following academic journals; *Art, Design & Communication in Higher Education*, *TechneA*, *Design and Technology Education*, *Studies in Material Thinking* and *FORMakademisk*. The role of journals as an arena for design education research is essential for the advancement of knowledge production within the field. For the Nordic design and design education research field, *FORMakademisk* has played a crucial role in its five years of existence, as a digital open-access journal for both design and design education research. Its first editorial wrote that:

> The aim of the journal is to provide a venue for research in design and design education, and thereby develop an interest and working community of scholars in the field. The editorial team perceives design as a generic term that includes creative and performing activities in the great span of the artefacts 'from the spoon to the city'. The editorial team relates to design education as a field that includes the dissemination of design in society and the teaching of design at all levels general education, vocational preparation, professional education and research education - from kindergarten to doctorate.(www.formakademisk.org)

The Norwegian design education community includes design education for professional designers and teacher training for design educators. The teacher training is mainly developed through two master programmes–one in Oslo (Institute of Art, Design and Drama, Faculty of Technology, Art and Design, Oslo and Akershus University College of Applied Sciences - HiOA) and one in Notodden (Department of Art Education, Telemark University College - HiT). Two PhD-programmes; Oslo School of Architecture and Design (AHO) and Cultural Studies at the Telemark University College, have a focus on both design and design education. The AHO programme was chaired by professor Halina Dunin-Woyseth, who has played a key role in developing research within the 'making disciplines'. From the AHO programme the research network *DesignDialog* was established in 2002 with research focus on three themes; 1) Studies of dialogues of design in context, 2) Studies of design education, and 3) Studies of public dialogues on design.

I see this conference as a further step to international collaboration in design education research. Thanks to all those at HiOA, Faculty of Technology, art and design, who have supported this conference; Dean Petter Øyan and institute leaders Åshild

Vethal – Institute of Art, Design and Drama, Gunnar H. Gundersen – Institute of Product Design, and Laurence Habib – Institute of Computer Science. Without their support this conference would not have been possible. Thanks are also due to the leaders of Oslo and Akershus University College of Applied Sciences, rector Kari Toverud Jensen and head of research Frode Eika Sandnes, for general support to the internationalisation of design education research at HiOA, including this conference.

It is an honour for us that the DRS-Cumulus partnership will be signed in Oslo by DRS chair professor Seymour Roworth-Stokes and Cumulus vice-president professor Luisa Collina. Professor Michael Tovey and co-chair of this conference Erik Bohemia have played a central role in preparing for this partnership and this 2nd conference for design education researchers.

Warm thanks to the Scientific review committee, the Scientific review panel, the Programme Committee, the Organising committee, and the rest of the Editorial team; Janne Beate Reitan, Peter Lloyd, Erik Bohemia, Ingvild Digranes and Eva Lutnæs. Thanks also to colleagues and students for valuable contributions.

We are also grateful to our supporters and sponsors; the National Museum, the Research Council of Norway, the musicians and designers Peter Opsvik and Svein Gusrud, the furniture companies SAVO, HÅG, STOKKE and Variér for generously providing display chairs for the exhibition, and all the other supporters and cooperation partners.

We hope, as the organizers, that the conference will promote design and design education as a field of practice and inquiry. We hope that it will create a fertile context for establishing new networks of future co-operation, nationally and internationally, and that design education research in its broad context will be recognized both inside and outside the design research community. The general public's interest for design and quality is developed from the kindergarten, through primary and secondary education and the public's attitude is central for professional activities and a broad democratic design participation.

Liv Merete NIELSEN
Professor, designer
Chair of the conference

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Design Pedagogy Special Interest Group of DRS

This is the second symposium organised jointly by the Design Research Society and CUMULUS. The two organizations complement each other. CUMULUS is the International Association of Universities and Colleges of Art, Design and Media. It is a non-profit organization consisting of 165 universities and colleges of art, design and media from 43 countries. Cumulus was founded in 1990 and since then has been acting as an umbrella for many purposes and numerous projects for education and research of art, design and media. The Design Research Society is a multi-disciplinary learned society for the design research community worldwide. The DRS was founded in 1966 and facilitates an international design research network in around 40 countries.

The Design Research Society has three main aims. It focuses on recognising design as a creative act, common to many disciplines. It has the intention of understanding research and its relationship with education and practice. Then there is the overall aim of advancing the theory and practice of design. The membership of DRS is international.

The Society's Special Interest Group in Design Pedagogy is one of five in the society. It aims to bring together design researchers, teachers and practitioners, and others responsible for the delivery of design education, and to clarify and develop the role of design research in providing the theoretical underpinning for design education. These aims are not directed simply at one type of design education, but are intended to include all ages. However as the current membership of DRS is predominantly from universities inevitably the conference stream has concentrated on design education at that level.

The first DRS/CUMULUS Symposium was held in Paris in 2011. Its overarching aim was to explore how innovation in education is informed by and is informing design research. The symposium focused on design education, innovation in general education through design, and on innovation in business and engineering education through design integration. There was a particular emphasis on developing research in the area of Design Pedagogy. It was successful and it marked the point at which the Design Pedagogy Special Interest Group became could be said to be established as an effective force in design research.

This was consolidated at the DRS Biennial Conference in July 2012 in Bangkok. Papers aligned with SIGs were streamed through the conference programme. The Design Pedagogy stream consisted of 24 papers which was a strong representation within the conference. They focused on teaching and assessment, education and learning, design methods and processes, design approaches, cognition and creativity, and design culture, with papers grouped accordingly. Attendance at the sessions was good with informed and lively discussion.

In recognition of the strength of the papers at the conference, 8 of them were selected to form the basis of a special issue of the Design and Technology Education Journal. It was edited by Erik Bohemia and Mike Tovey and it included a review of the conference and an editorial which related the developments in design pedagogy in

higher education which the papers focused upon, to the wider issues of design teaching at the school level.

This second DRS/CUMULUS conference builds on these developments and develops them into new areas. Its theme of design learning for tomorrow encompassing design education from kindergarten to PhD is large and ambitious. The conference is intended to be an international springboard for sharing ideas and concepts about contemporary design education research. It is open to different facets of contemporary approaches to such research in any aspect and discipline of design education.

The context for this is set well by the organizers who say:

'Designed artefacts and solutions influence our lives and values, both from a personal and societal perspective. Designers, decision makers, investors and consumers hold different positions in the design process, but they all make choices that will influence our future visual and material culture. To promote sustainability and meet global challenges for the future, professional designers are dependent on critical consumers and a design literate general public. For this purpose design education is important for all. We propose that design education in general education represents both a foundation for professional design education and a vital requirement for developing the general public competence for informed decision making.'

This is a powerful and energising assertion for all of us involved in research in design pedagogy. It is possible that you could argue that this is what is needed, for despite a richness of activity, the number of journal papers on design pedagogy research could be higher. In a ranking of design research journals (Gemser et al, 2012) Design Studies was placed first. In the last year it has published only three papers on design pedagogy. This is better than the second placed journal, Design Issues, which has none, or another highly rated publication, The Design Journal which also has none. A challenge for scholars of research in design pedagogy is to achieve a greater impact amongst our journals.

Design research is not the same as research in some other disciplines. (Ref) In a fundamental science such as physics if research stops then effectively the discipline comes to a halt. If there is no physics research then there is no physics. Design is not like that. If design research were to stop then design would continue, more or less regardless. Designers would continue designing things, and probably the world would notice no difference. It would seem that design research is not central to design practice.

Design research is an activity which is directed to exploring and understanding the nature of design, its processes and methods. It has loftier academic aspirations than the data gathering part of the design process. It is usually undertaken by academics, and it is expected to conform to conventional standards of academic scholarship and rigour. Design research is clearly necessary for the academic respectability of the discipline.

One of the purposes of design education within schools is to equip students with the information and capabilities they need if they are to apply to study design at a university. It is an intention which probably applies to a minority of the students, but it is important nonetheless. In schools design education overall has to achieve much more and its broader reach is extremely important. It is important that research into design pedagogy should also have this wider relevance.

The recently published 'Design and Designing: a Critical Introduction' (editors S. Garner and C. Evans) is intended to provide an overview of design for those at school who are considering embarking on a university or college education in design. It

consists of a collection of essays from a large number of contributors each concerned with a different aspect of design. In the first chapter for example Tovey asserts that the purpose of design education at this level is to provide students with a passport to enter the community of practice of professional design (Tovey 2012). For a significant time this has been the intention of practice based design education. Many students have the ambition of achieving a level of capability to function as designers in the professional world. In order to reach this standard they need to demonstrate a level of professional 'polish' and presentation to match that of the practising designer. However Tovey also argues that the most fundamental quality they need is one of creativity. The key to their achieving this lies in their abilities to think in a solution focused way employing visuo-spatial intellectual abilities. The ability to engage in creative thinking, and more particularly the creative synthesising of ideas through design thinking, is the most important capability required to enter the community of professional practice.

These are capabilities which need development from an early age. Abilities such as tackling problems with a solution focus, and thinking visuo-spatially are not developed ab intitio at university and college level. It has been argued that spatial ability is a fundamental form of intelligence along with others such a numerical and literary abilities.(Gardner, 1984) Cross has gone further in suggesting that designerly thinking might be a basic form of intelligence (Cross, 2006). Although the case for such a view is not proven, it is a productive stance to take as it helps to identify and clarify features of the nature of design ability and it offers a framework for understanding and developing it. What seems to be generally agreed is that these underlying capabilities are ones which need to be nurtured early and developed, not only as the basis for studying design but also to equip students with abilities needed across a range of occupations. As the organizers of this conference propose design education can make a vital contribution to the development of the general public competence for informed decision making. Thus design education can be seen to have a wide remit in both providing the next generation of designers, and developing competence in decision making more generally. If it is to meet these challenges then research into design pedagogy has a crucial role in supporting the development of innovative and effective design teaching.

Michael TOVEY
Convenor of the DSR Design Pedagogy Special Interest Group (PedSIG)

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About the Design Research Society

Design Research Society (DRS) is commending time, effort and energy and having already been investing these over the past 40 years to give rise to the most astute and relevant research in design.

When asked on numerous occasions to comment on design and design research, I've always been very careful, if not harsh, with regards to certain research projects whose content and/or approach seemed to fall short on the front of the relevant things in design. My reaction hit even closer to home in France where design is absent from academic disciplines, and design research has yet to really take off. I have to admit, nonetheless, that the strides undertaken by several universities abroad and continued by DRS have swayed me into believing that there really is an area that craves further learning and discovery, and cultivates fresh, relevance-hungry skills and competencies. Conferences and DRS-published works reflect a tremendous proliferation of new ideas, new projects and new ways to breed knowledge.

In 2010, and after having sat in on a conference in Seoul organized by the International Association of Societies of Design Research, I wrote the following: "Taking advantage of design's coming out and its lack of visibility research-wise for the purposes of Sociology, Psychology, Education Science, or even hard science, and playing them off as "design research" can only prove beneficial to design in the end. Employing the design research notion loosely, when, in reality, its usage is clearly career-geared, does not seem all that fitting to me either.

The scope of research needs to be clearly outlined in a category of its own, and based on a language that both captures and communicates the knowledge from all fields spanning social and hard science, not to mention the socio-economic challenges that riddle our everyday. Design is a language doubling as an interface that connects people, ideas and knowledge, and imagines them in a better tomorrow. We could come up with our own scientific version of it as long as we don't get carried away and throw everything together haphazardly merely because design is omnipresent, and it suffices to get the intellectual juices flowing every now and then."

Time may have elapsed since these thoughts first emerged, but the issue remains the same. This text reflected the questions that crossed my mind following the various presentations I had attended. One presentation, in particular, caught my attention. It was given by a doctoral student who claimed that the work he was doing on the design of a bicycle was research. Twenty years ago, designing a bike was considered design. Today, that same bicycle now aspires to fall under the category of "design research." Let's try and refrain from wanting to label any idea, even the most relevant, "research." Despite their efforts to make a hard science out of Marketing, business schools are

busy filling in the gaps left behind by research done in the Marketing field. Every business owner and retailer in the world will tell you that Marketing is not a science, and wanting it to be one is just as futile as deciphering the gender of angels.

Design research is alive and well, and several universities have incorporated it into their agendas. It means nurturing a different kind of knowledge and insight at a time when other research fields lack the necessary to go head-to-head with the problems facing Mankind. There within is the incredible opportunity to truly, once and for all, set the fields of social and hard science apart. Kudos to DRS for being vigilant in choosing projects that are apt to map out a new direction between the two.

Just as design, creation and innovation are being positioned as solutions to problems in a world whose paradigms are crumbling, it would be, without a doubt, counterproductive for design research to cut ties with design practice. From an academic standpoint, it would also be a shame for design research to appear more virtuous and prestigious than design itself. That said, the loss would be just as great to reduce design to nothing other than a technique or representation. What design can offer goes beyond practicality. Design research goes beyond the designer. Their interconnectedness does not impede their individuality.

Design research and design itself are complementary. While loyal to the fundamental principles specific to each, both strive to find common ground and engage in a healthy give-and-take relationship to ensure balance and difference. With Mankind and its uses at the center of these issues, design gives impetus to an ideal or a potential, and not only pushes the limits of creativity and optimism to new heights, but seeks to defy them. At a time when science and technology are encountering a wary public, and where wealth and welfare are hitting glass ceilings, design provides an alternative future, and enables us to imagine it through a new lens. One thing is sure: Design researchers have their work cut out for them!

Christian GUELLERIN
President of Cumulus, International Association of Universities and Schools of Design, Art and Media

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Teaching Constraints, Learning Creativity: Leveraging the Guided Distractions

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Abstract: *Different disciplines require different approaches to education.*
The teaching of formalized sciences (such are physics, chemistry, etc.) requires the study of consolidated and already verified results and is conveniently carried out through lecturing (e.g. lectures or books) while formalisms and techniques are learned together with disciplinary contents. Soft disciplines (such are fine arts, interior design, media production, journalism, etc.) require "learning by doing": the study of facts and techniques that is weakly related to the ability to produce masterpieces or new ideas. Design is in an intermediate position: techniques can be learned (e.g. modelling, representation, materials, colours, etc.), but the ability to design "new meanings", i.e. creativity, is left to personal sensitivity and to teaching by examples. Creativity can be stimulated, and methods can be provided: constraints. In our experience in teaching design (in particular communication and service design) at our university, we combine theoretical lessons with many design activities, together with constraint driven activities. Constraints stimulate the lateral thinking and make students aware of their mental frames that oppose limits to their creative capacities; constraint driven assignments force the students to focus on the technical aspects, distracting their attention from the creative content so reducing "conceptual censorship". This paper presents the methodology we use and some of the experiences we carried out with respect to different design fields (products, communication artefacts and services), both in academic as well as in professional environments.

Keywords: Constraints, creativity, design, education, methodology.

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The notion of constraint

In many courses we held at our university, we repeated the following experience:

a) Students are required to write five short sentences about the concept of communication: they have ten minutes to write about that, and some of them verbally report the results to the audience;
b) Afterwards, students are required to write a short composition, in hendecasyllables, with "enchained rhymes" (ABA BCB CDC ...), an acrostic of COMMUNICATION; again with some verbal report.

The results are unequivocal:

a) The first of two production is usually trivial, and uninteresting, and students quite often write what they think the teachers would be happy to read;
b) The second production present "suffered" writings, with many signs of strike out and changes; the content is often critical, however never trivial and usually deeply personal.

We are convinced that the difference between the products is caused by the use of constraints: in the second case, the attention to technical aspects of the composition reduced the brain censorship, letting deeper thoughts come to the surface and to present itself. Such an experience repeated several times and always with comparable results, suggests that constraints can be employed as a way to unchain creativity. This is confirmed in other fields: e.g. the literary avant-garde OULIPO applied the use of constraint to generate new literary experiences several years ago, and with significant results[1]. Thus, the idea to use constraints to foster creativity in design is natural.

Which constraints?

A constraint requires a specific application field: we can provide a restriction either in the "language"[2], or in the "process"[3], or in some perceptual aspects[4], etc. Of course, the idea of a constraint requires some kind of rule to be broken, or at least a taxonomy of the areas in which the freedom can be constrained.
According to numerous studies in Design (Maiocchi and Pillan 2009), this discipline can be considered as the ability of providing emotions through artefacts; while an artefact is, in general, a support to some function or a solution of some usage, Design is the ability to add communication (meanings and recognisability) to tangible and non tangible products and services. Following the two authors, a design artefact provides, along with functions, some perceptual signs that are able to produce meanings and

[1] OULIPO, acronym of Ovrouire de Littérature Potentielle, founded by François Le Lionnése in 1961, is a literary movement spread from pataphysics experiences: many famous authors were part of the group — Raymond Queneau, George Perec, Italo Calvino, and many others.
[2] For example the experience mentioned above on hendecasyllables and acrostic, or simpler, as "La Disparition" by George Perec, a romance of more than three hundred pages in which the letter "e" (the most frequent in French) disappeared in the book.
[3] Many of experiences of OULIPO are related to "generative" mechanisms, in which algorithms are provided for transforming famous works into new others; examples are antonymic translations (changing texts by substituting each word with its opposite), or the style translation (transforming a picture into an equivalent for a different culture/style). Very interesting examples of the latter are provided in (Queneau 1979).
[4] According to the fact that perceptual properties are related to aesthetic emotions [Ramachandran 1999], many experiences have been carried in constraining perceptual principles, as testified in (Maiocchi 2006).

emotions; this is made possible thanks to the processing performed by the human brain on simple and complex perception signals.

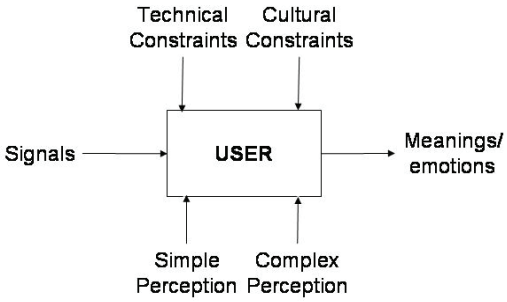


Figure 1. Constraint model.

As referred in works of neuroscientists exploring the nature of the artistic emotions (Ramachandran 1999), simple perceptions are related to some of the characteristics of the signals (exaggeration, contrast, grouping, etc.).

Complex perceptions are related to the ability of those signals to cause the arousal of some metaphoric meanings by analogy (i.e. the structure, the shape and some details of a sport car connect to the concept of young, dynamic, sportive, rich person, etc.) (Lakoff 1980).

Of course, a number of obvious technical constraints influence the perception of any kind of artefacts (the respect of physical laws, cost issues, mechanical properties of the materials, etc.) affecting final perceptual result; on the other hand, other cultural factors can modify perception, such as cultural factors. The latters can make the artefact acceptable or not (as an instance, some countries do not accept at all distinct roles for the genders, while in others it is a common thought, and so on) (Hofstede 2010).

Accepting this model, we have a natural organisation of the constraints: on simple perception, on complex perception, on cultural aspects.

In and out of mental frames: consciousness and creativity

The mind of every human being, by its very nature, organizes memories and knowledge that come from past experiences, into mental frames, mind-sets, automatic decision-making and evaluation references. During each creative experience, these mental frames have the power to condition and bribe each cognitive process and the emotional mix associated with it. Creativity can be seen as the capability to deal with mental frames, surfing through culture traditions, playing with archetypes; producing little or relevant innovation by violation of constraints.

Design as a discipline can be described as the ability to watch at the reality that surrounds us with a new look, and as the capability to see new opportunities in old contexts; for this reason it is very important to ensure that students do some experiences making them aware of the internal barriers which are real obstacles to creativity. We are looking for ways to build awareness and to manage the tendency to stiffness that we tend to underestimate in ourselves.

We believe in the importance of self-consciousness about mental frames and cultural tacit constraints fencing creativity and we fight it through pro-active design experiences. On the other hand, we are investigating the role of external constraints (through over-constrained briefs), in deviating the attention from false priorities with the purpose to unbribe innovative thought.

Creativity and the methods for stimulating it, have been the subject of several researches in the community of designers (Cross 2001, Kruger 2006 and Tonkinwise 2011). Among others, Nigel Cross has indicated a relevant approach to this topic based on a deeper understanding of the cognitive processes that compose the creative experience. On the other hand, Marianella Sclavi in her book *L'arte di ascoltare e mondi possibili* (Sclavi 2006) provides a pragmatic approach based on Bateson's theory about ecology of the mind – to induce self-awareness about the mental frames in young designers. Moreover, brain sciences face a fast development, and some scientists (some of which have been mentioned above) are know spreading their discoveries making them more and more accessible out of their discipline surrounding.

Design as a discipline, traditionally dialogs with human and social sciences and richly refers to perception and cognitive sciences to explain perception phenomena; on the other hand, the outcomes of brain sciences in terms of creativity empowerment and design methodologies are still scarcely investigated and should be explored. As the authors carry on research through design practice and theoretical work with the goal to enhance creativity, this paper intends to offer a contribution to this respect.

The Experiences

In the following chapter, we present a set of experiences carried on with the previously mentioned constraints. For each one, the following elements will be discussed: (i) the context of the experience, (ii) the involved actors, (iii) the given constraints and (iv) the results. The examples will be shown in order of constraints complexity. Many of them have been organized by the design avant-garde association Opdipo (Lariani 2005).

a. The fool glass

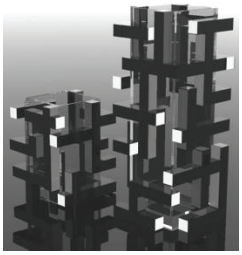
Context: a contest for the production of crystal glasses, organised by Opdipo during the Salone Internazionale del Mobile di Milano, in 2005. Sponsored by Opdipo and a company producing crystal products.

Actors: Designers, professionals and students;

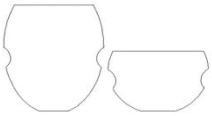
Constraints: Application of the first principle of Ramachandran (Ramachandran 1999): *Peak Shift*. The designers were asked to identify a specific exaggeration effect, inspired by the work of some architect, artistic event or by the style of some specific author, and to isolate and exaggerate the related perceptual factors;

Results: More than 40 designers participated, providing sketches, technical schemes, and in some cases also a prototype. Among the others, some of the results are presented in Figure 2.

Copa-Cabana
Inspired to the samba movements of the Rio Carnival
by Flavia Alves de Souza
Rio de Janeiro - Brasil



Rietveld
The reference to the Rietveld's chair is evident
by José Eduardo Luna Garza
Monterrey - Mexico



Botero
Evident references to the shapes of the persons portrayed by the painter
by Paola Macchi – Milano - Italy

Flute
Based on the joke flute as glass and as musical instruments, you can drink only by closing the holes
by Aldo Spinelli - Milan - Italy

Figure 2. The fool glass results.

Remarks: the effects of the constraint are evident, as well as it is evident the process followed by the designers: (i) first, think of the field defined by the constraint; (ii) next, think of the peak shift; (iii) then, a solution emerge. As an example, the "fat" linearity of Botero would not be possible without the constraint.

b. The Three Ages

Context: a contest for the production of sofas, organised by OPDIPO during the Salone Internazionale del Mobile di Milano, in 2005. Sponsored by OPDIPO and by the company RE-Space, producing beds and sofas.

Actors: fifteen professional designers;

Constraints: the goal of this experience was the translation of the same emotions from one discipline to another, i.e. to have the same feeling when comparing the painting and the produced sofa. We opted to use Ramachandran's principles and choose 5 paintings with the same subject and painted with different styles:

The three ages
Giorgione – 1510 ca.

The three ages
Tiziano – 1510 ca.

The three ages of the woman – Hans Baldung Grien - 1539.

The three ages (part.) – Gustav Klimt - 1905.

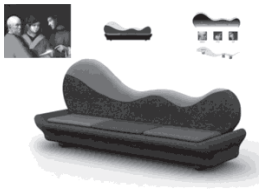
The three ages
Dalì – 1940.

Figure 3a. - Variations on "The three ages"

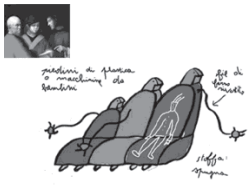
Each painting has been described in terms of the principles of Ramachandran (peak shift, contrast, symmetries, balance, metaphors, ambiguities and grouping); then a brief

for a sofa has been provided for each painting, describing the corresponding perceptual structure as constraints of the sofa – without any reference neither to the painting nor to the painter. Each designer had a couple of weeks to provide a concept and the most interesting projects were prototyped by RE-Space.

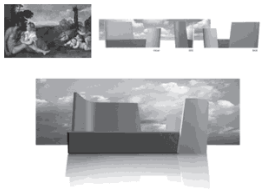
RESULTS:



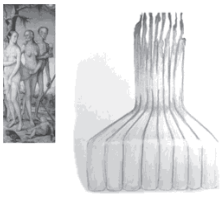
Giorgione –Michele Cecchini, Milano, Italy (prototyped)



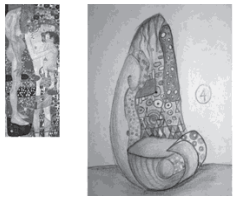
Giorgione –Chiara Rapaccini, Roma, Italy (prot.)



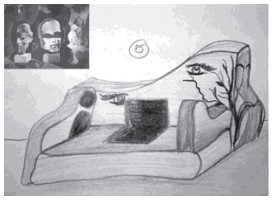
Tiziano - Margherita Colleoni - Studio FT&Associati - Milano –Italy (prot.)



Grien - Amanda Aguilar Boiton - Monterrey – Mexico



Klimt - Amanda Aguilar Boiton - Monterrey - Mexico



Dalì - Amanda Aguilar Boiton - Monterrey - Mexico

Grien - Paolino di Benedetto - Milano - Italy

Grien - José Eduardo Luna Garza – Monterrey – Mexico

Grien - Francesco Civelli - Bergamo - Italy

Figure 3b. - Results on "The Three Ages"

Remarks: The strong net of constraints, most of them based on simple perceptions, was able to convey to the concepts not only shapes and balances, but also a mood – that is explicitly evident in all the "translations" carried on from the work of Grien.

The prototyped pieces were those evaluated as excellent by an independent jury.

They were exhibited in a showroom during the Salone Internazionale del Mobile, and some of them demonstrated success in sales as well.

c. Stereotypes

Context: various courses in Design at our University, both for graduate and post-graduated students. The goal was the design of door handles;

Actors: students;

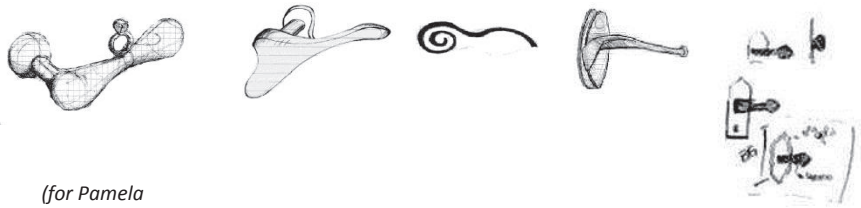
Constraints: we presented several different samples produced by famous designers. We asked the students to classify them as suitable for men/women, rich/normal, professional/employees, young/old, etc.; then we observed that perceptual properties (colour, curves, thickness, etc.) were commonly related to specific characteristics, and

we proposed to correlate them to famous personalities. Afterwards, we asked the students to design their own handles, according to the stereotypes usually associated to them. The chosen handles were:

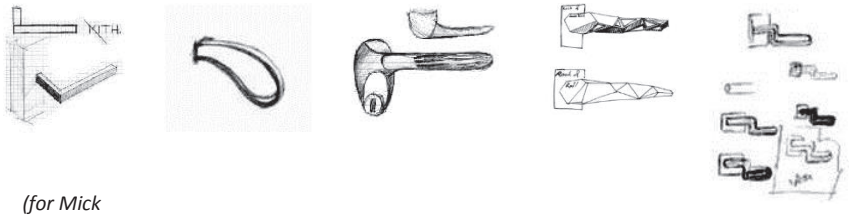
Sottsass *Fuksas* *Aulenti* *Cini Boeri* *Gregotti* *Rossi* *Mongiardino* *Arad* *Krier* *Kono*

Figure 4. - Several door handles.

The chosen personalities were Mick Jagger and Pamela Anderson.
Results:



(for Pamela Anderson)



(for Mick Jagger)

Figure 5. – Stereotype mock-ups.

d. Metafiring

Context: MSc. thesis "Metafiring: Project Management Techniques for Stimulation of Collective Creativity. The tasks were: (i) to select one of three case studies: Applications of font; Ameliorating Metro User Experience in Italy; and Communication Design for Fukushima nuclear disaster; and (ii) to brainstorm potential solutions with: (a) a person from any profession; (b) two designers; (c) two persons from any profession; (d) four designers; (e) four persons of any profession. In total, 15 experiments were conducted with the purpose of following the generation of creative ideas in mixed;

Actors: Inter-disciplinary and multi-disciplinary student groups with the author as a person guiding the method;

Constraints: Students were asked to choose a problem (from one of the three case studies) and to confront it with XII-step matrix depicted in Figure 6. These XII steps are grouped in 4 conceptual areas - (a) concrete, (b) conscious, (c) unconscious and (d) fantasy. Conversely, each step is suggested to last 2 min ca. and is previously briefly explained. The XII steps are: (i) Empathize - with problem, (ii) Fly on the wall - to

observe a specific moment, (iii) Tag-along - to observe through time frame, (iv) Decode - to perform linguistic/visual/narrative analysis, (v) Distort - to change order, negation, contradiction, (vi) Hybridize - to unite with other possible field, (vii) Emotion portrait - to distance and observe how group feels, (viii) Choose metaphor - to place finding in other context), (ix) Scenography (to model a possible stage), (x) Contradict & oppose (to criticize and use the opposite), (xi) Wild analogy - to test the furthest application and (xii) Live act-out - to perform live storytelling;

Results: In abstract, Metafiring thesis demonstrated that: (i) number of ideas are increasing as the XII steps increase; (ii) potential solutions could be found evenly in XI (out of XII steps), assuming that first step serves to understand better the context of the problem; and finally that (iii) multidisciplinary teams could contribute equally to the problem-solving as well as the teams consisted of solely designers (Radeta 2011). Figure 6. demonstrates several results of the case study on Communication for Fukushima nuclear disaster

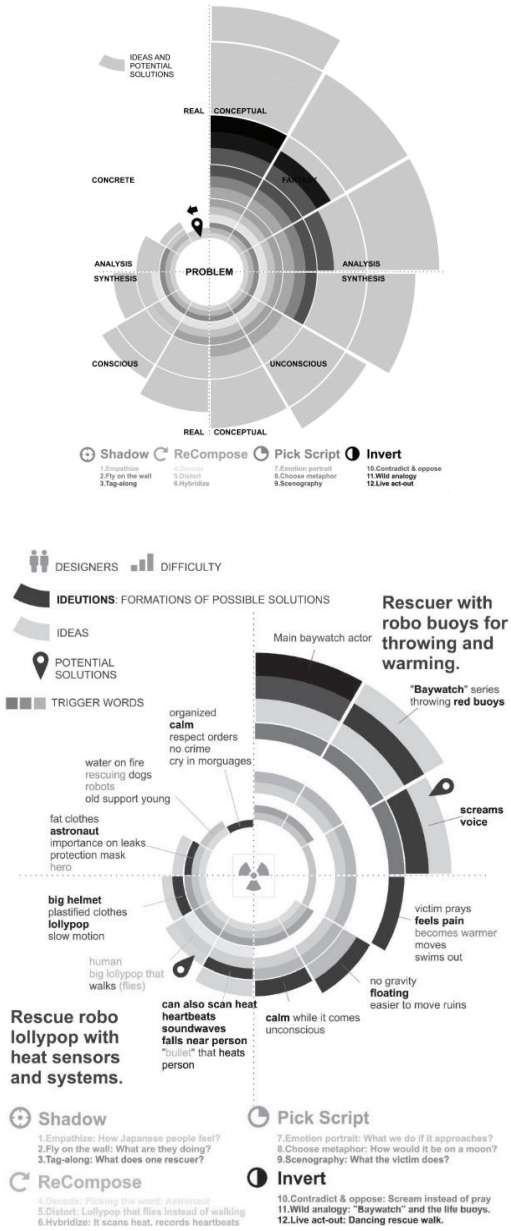


Figure 6. – Metafiring method (top); Applied method for Fukushima disaster (bottom).

Remarks: Although while still on a shallow level – at the time of developing the thesis of Metafiring – several steps (out of XII) were separately conducted in practical applications such as: (i) creation of an exhibition stand for participating in the Clinton Global Initiative University in Miami 2010; (ii) written report of conducted internships in all Ministries of Republic of Serbia that has been given to a Prime Minister.

Figure 7. – Pure Wings team presenting their project about H2- propelled aircraft at CGIU 2010.

e. Other experiences

Numerous other examples could be presented and discussed, but we present just some pictures, without further analysis, however respecting already explained the previous principles. In further we present two examples, one of a designer and other from the course with students.

(I) IMITATION OF NATURE OR OF THINGS

A Korean architect and designer took inspiration from nature and things as depicted on picture below.In this case, the constraint is mainly metaphorical, i.e. it refers to the complex perception. For instance, the last two installations refer to the magic world of the nature; in other cases, the peak shift is the effect of the scale change, as in the second picture in second row. It is to be noted that, according to following observations, the change of the scale had not affected the role of toy for constructions. Any pieces put on a floor during some events were occasions for the children to play, build and climb exactly as they were playing with pieces of wood.

Tree chandelier

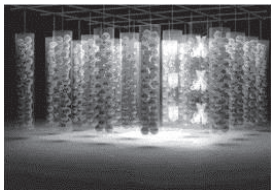
Book lamps

Chinese Spoon seats

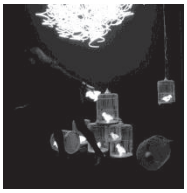
Toy pouff

Cloud lamps

Shell lamps



Forest
(installation for lightning)



Mangrovia and Birds
(installation for lightening)

Figure 8. – Artworks by Youngju Oh

(II) IMITATION OF STYLES

Students had to transform a clip into a single image. After having chosen a specific style, they viewed a video clip of an advertisement about an energetic chocolate, in which there are: a rich and corpulent person is stretching his muscles on his Porsche, a slim "rastaman" eating an energetic bar wants to help him, a conflict of misunderstanding occurs with the end Porsche hurl. On Figure 9. is an original frame from the advertising and on Figure 10. are several interpretations done by students.

Remarks: These experiments had mainly educational purposes while the constraint had the goal of investigating on the stylistic elements able to locate a period or a culture. It has been carried out in a course of Communication Design at our university.

These interesting results demonstrate lucidly not only the style of the chosen context, but also the individual style of the author.

Figure 9. – Frame from advertising

Figure 10. - Interpretations (from left to right): prehistoric, Russian icon, enigmatic, church windows, Maya art, puppets, comics, ASCII art, embroidery, child drawing, Japanese art, disco stamps, urban stencils, heraldic, road signs, LEGO, Greek pottery.

Final remarks

Creativity is the core of Design as a discipline. Acting on functions and appearances (shape of material artifacts, organization and procedures shape for non tangible artifacts such as services), designers provide new and renewed emotional experiences, meanings and metaphors. Design education is aimed to provide technical skills (drawing), cultural bases (about industrial process, economical systems, market,…) and to empower creativity. The last one is of course the most relevant and specific goal, signing the difference with respect to other domains, but also the most critical and worst understood.

In this paper we propose the usage of constraints as a method of gaining more knowledge about the mental processes associated to creativity (through the use of theoretical models coherent with scientific literature), and as a tool to stimulate creativity. We do believe that brain sciences provide knowledge employable as a base to produce new awareness about creative design, but also to invent tools capable to un-bribe creativity. All of the experiences presented above, used constraints and produced significant results that can be summarized in the following:

(i) in professional surroundings: according to the professionals being involved during the experiments, thankfully to constraints, they were able to develop new, unusual ideas and to enhance their creativity;

(ii) in educational surroundings: constraints gave to students more freedom in creation of new proposals; participants to our experiences escaped the usual (and tacit) slavery of demonstrating to the teachers their ability in following the set of rules and methods learned during lectures and previous design labs.

Obviously, most of the above reported design experiences cannot be considered as scientific experiments, since it is only possible to observe that the constraint driven design processes produced interesting results in terms of innovative designed artifacts.

On the other hand, the simple experiments reported in the first paragraph of this paper, shows quite clearly that the introduction of an apparently formal and technical constraint (as an instance the requirement to present a content in hendecasyllables), has the power to modify priorities during the design process, significantly affecting the final results in terms of content. Students participating to the experiments appeared both very distracted by the constraints and surprised by their relevance on the final results.

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Teaching Design Project in sight of Design Partnership: a new-old way to teach Design

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Abstract: *This work intends to deepen the discussion on Design Partnership. To build this argument we propose a reflection that will be introduced by a bibliographic revision followed by a presentation of different Design concepts. In a second moment, we examine the concept of Design Partnership, and analyze how it occurred in the undergraduated Design programme. The Design Partnership experience is a model of teaching, used in the project disciplines also offered in the first year of the course, the student, a future designer, have to work with a partner in a defined context, and to work with a real problem. These disciplines contribute to the development of autonomy and self-expression of the student, helping also to recover and develop the creative potential of them. This helps to develop their critical sense and give them the possibility of the easier discovery of opportunities and problems and present solutions to the real society that they belongs to. The analysis will be held drawing on examples from real classroom practices and projects realized by the students.*

Keywords: Partnership design, design teaching.

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Conceiving design

Despite several authors link the origins of design to the first human attempt to create a tool, this can be considered a poetic image and a historical evocation. Although the production of utilitarian objects is as old as humanity, design is a relatively new professional activity, and the real interest in utensils and machine projects only began during the Industrial Revolution.

Many authors, such as Dreyfuss, Bonsiepe, Maldonado, among many others, dedicated themselves to defining the Design activity from different points of view. Sometimes focusing on the activities purely technical aspects, other times emphasizing its social, economic and cultural aspects.

In the 1957, during the first meeting of the International Societies of Industrial design, ICSID, in the occasion of its foundation this definition emerged:

> A designer is distinguished for his education, his technical knowledge, his experience and his sensibility in the task of determining materials, structures, mechanisms, shape, surface treatment and ornaments of mass-produced objects. In some cases, the designer can also be responsible for the packaging, publicity and marketing. (UNESCO/ICSID, 1967 in Bonsiepe, 1972:20)

The reference of mass production, presented in this definition, is essential to establish the limit between Design and the Applied Arts, the handcraft. In 1963, Maldonado suggested a new reading for the design concept, one that is still adopted and accepted by ICSID. According to Maldonado, design is a project activity, concerning formal properties of the object to be industrialized. In this case, formal properties being understood not only as external aspects of the object, but, above all, its structural and function relations. Maldonado believes that a product is the result of an integrated project process, and that the designer activity is an anthropological one.

Based on Maldonado's definition, Soloviev, developed his definition of Design, with emphasis in its social function. According to him, Design is a creative activity, regarding the construction of a coherent material environment, fulfilling, in an ideal way, men's physical and spiritual needs. This means that the object's formal properties should be understood not only as external aspects, but also as structural relations that are responsible for its functional coherence and, at the same time, contribute to productivity growth. For Soloviev, the planning of a project is not creating objects, indifferently, but creating objects with an anthropological feeling, since they will be part of the environment, and should be submitted to the users value scale. On the other hand, the requirement for productivity growth links the Design to technological disciplines. This diversity of ideas on the subject is better elucidated through the following definitions, quoted by Christopher Jones (1976):

"Design is the disclosure of the real physical components of a physical structure." (Alexander, 1963 in Jones, 1976:3)

"Design is the elaboration of a decision, with great penalties for the mistake." (Asimov, 1962 in Jones, 1976:3)

"Design is the simulation of what we want to construct, as many time as necessary, to trust the result." (Booker, 1964 in Jones, 1976:3)

"Design is the optimal solution for a group of real needs under particular conditions." (Matchett, 1967 in Jones, 1976:3)

"Design is the beginning of the change in things done by men, including not only the object's project, but also its whole life, as part of an integrated project process." (Jones, 1976:13)

Comparing the Design definitions presented above, one finds a diversity of visions, sometimes focusing on the activities purely technical aspects, other times emphasizing its social, economic and cultural aspects. Many other definitions of Design can be found in the specialized literature, since, like many other human activities, it is in permanent process of discussion regarding its nature and purpose. It's important to say, however, that the purpose of this bibliographic research is not to give a final touch on the subject, but solely to define Design and, therefore, to introduce the Design Partnership concept.

All the ideas presented above lead us to the conclusion that the characteristics attributed to the Design activity vary, mostly, according to the interests and culture of the individuals that elaborated these definitions. This means that Design is not socially neutral, but an activity that influences and is influenced by the balance of interests between different social groups that participate in the process, therefore, dealing with the objects and the systems. In other words Design is an intrinsically a social interactive process. Therefore, dealing with the objects and the systems. In other words Design is an intrinsically a social interactive process.

Design Partnership at PUC-Rio

The Design definition presented above functions as introduction to the Design Partnership discussion, since the activity derives from interests needs and cultural models from particular contexts, being, essentially, an social interactive process.

The Design Partnership experience at the Arts & Design Department of PUC-Rio illustrates this very well. According to Prof. Ripper (1990), a pioneer in this field of study, the teaching of projects aligned to real social contexts being developed at PUC-Rio, since 1982, brings changes to the way it used to be done, when project situations were imagined and simulated in the class. The imagined social context situations ended up producing projects with no social impact, and, moreover, the results didn't seem proper to a department that is part of the university's humanity Center. The use of real social context situations was a landmark of the Design Partnership at PUC-Rio.

In this model of teaching, used in the project disciplines also offered in the first year of the course, the student, a future designer, have to work with a partner in a defined context, and to work with a real problem. These disciplines contribute to the development of autonomy and self-expression of the student, helping also to recover and develop the creative potential of them. This helps to develop their critical sense and give them the possibility of the easier discovery of opportunities and problems and present solutions to the real society that they belongs to.

In 1981, Professor José Luiz Mendes Ripper, upon taking over the Department, received a request to define the guidelines of the Design course and called on Professor Anne White, designer graduated from PUC-Rio to help in the task. After a survey of proposals from other courses around the country, the professors cited above, identified the uniqueness in the design course at PUC-Rio. The result of this study, generated a set of recommendations, which eventually became guidelines incorporated into a new curriculum which considered the Brazilian context and a shift in focus with an emphasis on project development process over the production of objects, with that personal development was valued.

Many changes have occurred in the curricular structure of the course since then, but the essence, ever since, has remained adapting to the needs of today's classroom. Despite the change in faculty, workload, etc., the authentic pillars / objectives that Ripper called "Design Partnership" were maintained. They are:

Emphasize much more than the process of making the product than the product itself, avoiding the practice imposed by a world already oversaturated mere repetition.

Thus, one ends up discovering a native theme that is the demands of a reality much closer to their wishes and needs involve not only new solutions but solutions adjusted to reality. This aims to integrate the student in the university without indoctrinated technical knowledge and theoretical knowledge doctrine, but something he incorporates his training, adapting to the reality of cultural and socioeconomic context in which act (...) The notion of native theme refers to the construction of an identity that characterizes our own design, not only distinguished from the others by its cultural complexity, such as integrating it into a cross-cultural universe. (RIPPER apud Oliveira, 2001, p.22)

The curriculum changes over the years, for the most part ended up as repair functions, emphasizing the discipline axis, and the need for articulation of different skills, thus taking its interdisciplinary nature.

In its first version, the practice of Design Partnership as a driver education project was implemented in what was called the Integrated Project, the student chose the teacher and not the discipline of design in this way, this teacher was responsible for a group of students heterogeneous. The class consisted of students from various periods, there may be freshmen and students together designing the last period, ie, with different levels of information. In this work the idea was the design process to generate inquiries and demands knowledge that would be answered by theoretical and technical disciplines of the course. (Oliveira, 2001)

The Social Design was implemented in two basic design modules, the first and second discipline of design degree course in Design at PUC-Rio, and his methodological approach was capable of putting students in touch with real design problems, with the user in discussions throughout the project development, enhancing the student's design process and knowledge construction as it projected. (Apud Oliveira Couto, 2001). In this curriculum, students went six modules in a sequential design, the first two modules being understood by the Social Design, where classes were composed of students in two majors available (Visual Communication and Product Design) and the other modules the students developed projects entered their suitability.

These experiences combined the discussion of the role of designer in training, the need for flexibility in the curriculum allowing a constant maintenance and updating of contents in order to monitor the development of society, being a teaching proposal alive, corroborated to a curriculum reform proposal for the course degree in Design at PUC-Rio.

Being a teaching methodology adopted since 1982 we can say that is natural that over the years it has been rethought and has been acquiring new nuances dictated by the curriculum changes and also, in a certain way, dictated to some of it changes.

This work is a reflection of what has been happening at LIDE, more precisely in the Design Center for Teaching about the changes from 2010. Other works have been developed in the last ten years. Thus, the Design Partnership as of now, in this text will be contextualized in the current practice of this discipline that has experienced its last change in the first semester of 2010

Considered an innovative curriculum for the time, the structure reinforces the idea of discipline as the backbone of the project, increasing the number of project modules throughout the course, and the significant increase in credits for this course.

An important feature of this structure is attributed to the composition of classes from first to sixth period, which are routed by the students of the four qualifications offered - Visual Communication, Product Design, Fashion and Digital Media. For these classes are taught by teachers from a couple of different qualifications, responsible for leading the design methodology and teachers responsible for conducting additional content. Only in the last two periods the student takes courses specific to their concentration.

During the formation of the first course of the Department of Arts and this curriculum, some innovative actions also were created for professional development to work with design, intentionally directing the project development in basic design modules for social groups since other institutions had not contemplated social and productive reality and therefore did not meet the needs of individuals for whom these products were being designed.

Design Partnership in the context of the DSG1002 projects

The curriculum in question reinforces and consolidates the understanding of the project class as the axis of the program. It must be said that today the undergraduate Industrial Design Course in the Department of Art and Design at PUC-Rio offers majors in Visual Communication and Product Design, Fashion and Digital Media. In this current curriculum, the project modules are connected to non-sequenced program and the allocation of emphasis for each module. The use of integrated methodology, bringing together content, attitudes and actions is proposed.

The backbone is composed of eight modules of the project, divided into three groups as follows:

Table 1. *Projects' Modules*

BASIC MODULES	ADVANCED MODULES	SPECIFIC MODULES
Project – Context and Concept	Project – Strategy and Management	Specific Project
Project – Planning	Project – Production and Distribution	Final Project
Project – Development	Project – Social and Environmental Uses and Impacts	

The classes are composed of 10 hours/week distributed in two days, being one day with 6 hours of class and the other with 4 hours of class. The basic modules are offered in the afternoon and the advanced and specific modules are offered in the morning.

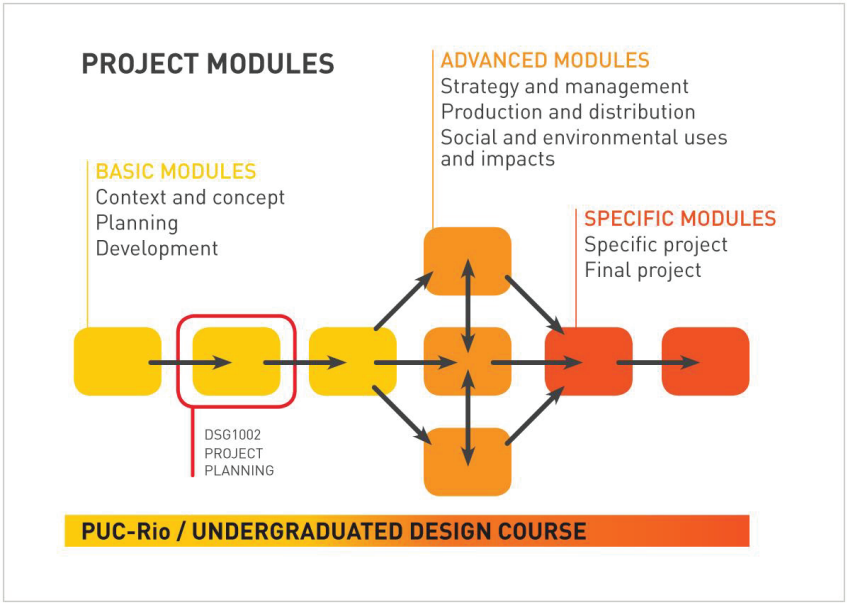
In the reformulation proposal and in the initial phase of implantation, the basic modules were offered without pre-requisites; however, the student enrolled in the first module, Project Context and Concepts, and afterwards had the possibility Project – Planning or Project – Development, to be taken in preferential order. Over the years of implantation, it was affirmed that the non-sequentially of the three basic modules was

impacting projectual foundation comprehension in addition to some operational obstacles (the interview stage should bring some reflection on this discussion and clarification about the decision to change this order which should be incorporated in this topic). Therefore, it was decided to demand sequentially in this initial phase of the curriculum, maintaining freedom of choice for the three advanced modules. In the specific modules, the order is naturally sequenced because of the final project's necessity to be taken as the last class

We take the above structure to present two features of the program of projects implemented in the curriculum reform, which are a result of previous experience with the Integrated Project and Design Partnership. One is recovering the coexistence between students of different periods and second, bringing back interaction between students of different qualifications.

From the first to sixth project module, the students undertake a common core, where they make no distinction between concentrations. For the last two modules, they are required to enroll in classes within their concentration. The non-sequentially In advanced modules proportions a complement of knowledge stemming from each module project, strengthening the design process of students and working groups, since they may be developing the project as a duo, trio or teams, rarely developing individually. The development of an individual project is required in specific modules which require greater autonomy from the student.

Table 2. *Projects' Modules dynamic*



These features enrich teaching practice since there is the possibility of developing hybrid projects, exercising effectively, the interdisciplinary nature of design. The difference in students' knowledge in relation to variations in the timeline provides meetings and exercises interrelationship individuals.

The project module lasts one semester, and the composition of the class, in addition to the aspects described above is made by the staff of two teachers with a maximum of 20 students each, totaling a maximum of 40 students for a project module. Eight classes are offered each semester, which are grouped in two pairs of two thus totaling 4 pairs per module. The pair of teachers, which should represent distinct qualifications, is responsible for the projectual methodology conduct that is aligned with the module's emphasis.

The module load is 10 hours per week, divided into two different days, one day of 6 hours / class, and another 4 hours / class. The methodology monitoring has duration of 4 hours, divided into two periods of 2 hours. The remaining 6 hours are meant to complement classroom topics and are taught by different by professors to professors monitoring the methodology being applied to the project and may be distributed between theoretical or practical. Additional topics are grouped into categories and given enough hours that are aligned to the emphasis of the module.

We present the following hourly load distribution chart as an example for complementary topics, remembering that at any moment the reader can consult the document that shows the curriculum change in the research's attachments.

It can be seen by the workload distribution among the topics that the emphasis will be determined by the content. What happens is that in the implantation, it was found that this distribution should not be inflexible and should be flexible enough to allow for a more organic operation to constantly maintain a curriculum based on actual demand.

The commission has proposed an overhaul of the curriculum, its content, weight, hourly load , and where complementary threads should be applied, considering the need for continuity, complementarity between the topics and paying attention not to overlap content across the modules. We can see from the tables presented in the attached document, that the grouping of modules (basic, advanced and specific) received the same categories of content and emphasis that each receives a specific role so that content that enhances the essence of the possible methodologies to be employed in the class. What happens is that the operation of a discipline as this is the order of the complex and even this statement seems obvious, we cannot immediately understand the tensions that act directly on secondary education. As additional content is taught by different teachers through practical and theoretical classes, each topic has its own menu, goals and specific lesson plan.

When they attend this course, it is expected that the first year student will become independent enough so they can demonstrate their ability to choose a theme, a chance to cut into the project, discuss the issue addressed, generate alternatives, produce models / prototypes, more flexible steps, try new models for evaluating the proposals and decide the final configuration of the object and is able to generate the technical detailing, positioning and distribution strategies. It is thought that the student is able to gain their projectual autonomy and certain skills to be a professional field of design.

DSG1002 - Designing in partnership for the real world

The vision of a path and not a place, coupled with the pedagogical proposal, runs counter to the experience being gained in the implementation of the curriculum in question. For each semester, adjustments are made allowing for methodology refinement, the starting point to a consolidation of the guidelines proposed by the Department of Art & Design at PUC-Rio.

As shown previously, the project modules function as the backbone of the undergraduate course in Design, and the different emphases assigned to them allow a rich diversity of experiences. In the basic cycle, understood by the subjects Context and Concept, Planning, Development, the experience of the student to pursue an outside project, allows for direct contact with the social nature of design, and the exercise of projecting for real situations in society.

The Project Planning class, which will be presented here, corresponds to the second projectual travel experience and is one of the main challenges of the task of harmoniously connecting the first and third project modules, allowing the student to the achieve autonomy through the design process . The teaching for this module considers that the registered student, is having his first experience, projecting for an identified opportunity based on the relationship established with his project partner in a specific context, and that will lead to a module designed for a social group for considering his proposal may be implanted in groups with similar needs. This advancement must be malleable and extremely careful, because the student is very unconfident and it should give him enough confidence for the challenges of a new methodology. In presenting the inaugural lecture on discipline, we often compare this path to the feeling of a child in learning to ride a bike: first he is taught to ride with training wheels, eventually taking one and then the other off.

In addition to the challenges described above, the emphasis of the course should enable students to understand the project planning stage. This is not an easy task because upon entering, the student has only one projectual experience and still does not have full awareness of the stages of the project to be covered so that they can propose appropriate planning. Therefore, we decided that this module should enable the exercise of planning and reflection of the relationship between the proposed design and planning carried out during the semester. This content is available through contact with planning tools, reading and reflection on different methodologies and experience of design for dynamic planning exercise. In addition to this important content, topics are given equal importance as representation and textual production that help students communicate their ideas and document the process by reporting and the relationship between text and image. In order for the class emphasis to be fully addressed, e we have articulated the topics presented in the table below, with the guidance and monitoring of the design process, thus setting the class methodology. The total of ten hours per week, are distributed among four hours of instruction, taught by a pair of teachers, and six hours of content under the responsibility of a specific group of seven teachers. This sets up a dynamic operative group, where each member assumes a role and the tensions between teachers and students are managed by the class supervisor.

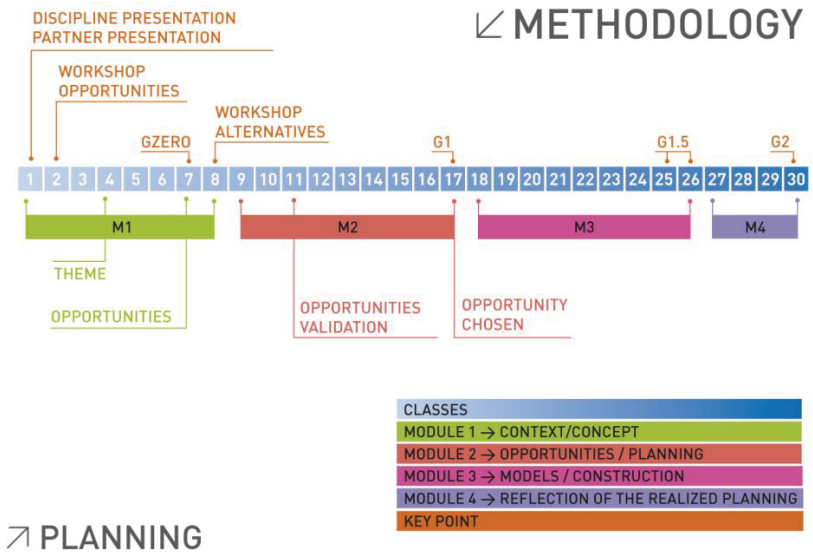
Table 3. Distribution chart of semester hours for the Planning Project module.

HOURS	CONTENT
40	Project methodology monitoring
15	Evaluation stages
20	Representation – photography and design
10	Sustainability, structures and materials
10	Creative thinking
10	Planning tools
10	Design in partnership, Design Theory and research
10	Graphics – typography, composition and color
5	Anatomy
20	Text – literature, reflection and writing

Faced with many challenges, how to operate this program without neglecting the interdisciplinary vocation, the technological nature and the methodology of Design in Partnership? In order to accomplish this complex task, an agreement between the PUC-Rio and a nonprofit organization is made each semester that develops necessary social work. This institution serves as a project partner for all classes of this module. Over the past three semesters we have partnered with institutions based in the city of Rio de Janeiro - Brazil, with this profile. They were: MSF - Doctors without Borders, Projeto Baía da Nossa Guanabara and Viva Rio. The first is a world renowned medical and humanitarian organization that provides emergency relief by bringing medical care to at-risk groups. The second, now extinct, was active in programs to clean up the Bay of Guanabara and medical care for the local communities. The third works through research, fieldwork and public policies aiming to promote a culture of peace and social inclusion.

In order to promote the necessary integration between students and the partner institution, collective and individual meetings are defined to allow students to know the work context, different mapping project opportunities and establish a dialogue that provides the generation of alternatives and development in Design in partnership methodology. The operationalization of this proposal is carried out through a series of steps that are presented in four modules with defined objectives. For better understanding of the methodology, see the following diagram which represents the path to be taken by the student during the semester and from there, we describe the steps.

Table 4. Methodology's diagram which represents the path to be taken by the student during the semester.



MODULE 1 - THIS MODULE AIMS TO IDETIFY AND MAP THE DESIGN OPPORTUNITIES.

This is the first module of the class methodology; its beginning is marked by an inaugural class conference divided into two stages. Initially we present the teachers, the discipline, its objectives, methodology, evaluation criteria, and additional partner information for the semester. In the second phase the institution makes a presentation about the work context, themes, mission, goals, challenges and opens up for questions. Students ask questions and start their initial researcher phase there.

On the second day of class, a workshop with the entire group of teachers is given with the aim of enhancing the process of identifying opportunities. For this, the students are divided into groups of ten students on average, representing the themes presented by the partner. In the experiment with Viva Rio, four groups were created: health, security, education and culture, and environment. In this activity students are encouraged to create an "opportunity bank" which should be updated until class 11 (module 2), where they will paired according to opportunity affinity.

In developing this stage, students are encouraged to visit the project context and identify similar contexts in other groups. This task aims to summarize the experience of the subject Project Context and Concepts, where it was a projected to a partner and arouse the student to the possibility of application in groups with similar necessities, allowing the reflection of a possible generalization.

This module ends with the first evaluation (GZERO), where the groups present charted opportunities and mapped each group member highlight at least two opportunities they identified. The evaluation is both collective and individual.

MODULE 2 - THIS MODULE AIMS TO VALIDATE THE OPPORTUNITIES AND GENERATE ALTERNATIVES FOR THE OPPORTUNITY CHOSEN.

In the first lecture of this module a workshop is given with the aim of enhancing the step of generating alternatives. In this activity each group assembles a panel with all the opportunities mapped out and presented in the first evaluation. With outstanding opportunities, members must relate words to help conceptualize the opportunity. From the panel assembly groups change tables in a clockwise manner, leaving the material realized on the table. The new group will sit at the table and evaluate opportunities and associated words and propose at least one alternative for each opportunity, always respecting the conceptualization made by the original group. The goal of this activity is that students can collectively contribute to the project opportunities to be developed. From class 2 on, the students are organized projecting in large groups, in class 11, the teams must work in pairs and each student this signals an opportunity for the class project which he is interested in developing. This choice is personal and in most cases the pairs that were formed; the partner chose the opportunity within the same group that they were already in. A minority chose thematic change.

During this module, the pairs are encouraged to generate an average of ten design alternatives for the opportunity chosen. This stage involves a heavy hourly load, training the student to communicate the idea, or draw something that in fact, does not exist, and observation drawing, which is made from the observation of the project context and researched references.

This module is finalized with a second stage evaluation (G1), where the pairs must present all of the alternatives generated, analyzing the three most adequate and the three least adequate, pointing out which alternative was chosen to be developed, with supporting evidence. In this evaluation, the student must propose planning for prototype construction, which will be done at the next phase.

MODULE 3 - THIS MODULE AIMS TO BUILD A PROTOTYPE OF THE CHOSEN ALTERNATIVE.

This phase is structured to allow the development of the final prototype to be presented at the third evaluation (G1.5). For this, students are encouraged to build several models in different materials and interfaces in order to promote discussion through action. The graphics laboratories, volume, animation, rapid prototyping and fashion support this phase.

We perceived that the student, upon proposing the planning for this phase, establishes generic stages, precisely by only having had projectual experience, and in the prototype construction trajectory, he is stimulated to reflect and document the project stages that he is conducting as a way of becoming conscientious of what is happening. We understand the importance here, of doing without thinking and of reflecting about doing. In the evaluation stage, along with the prototype presentation, the student will hand in a report with its process documentation.

MODULE 4 – THIS MODULE AIMS TO REFINE THE PROTOTYPE AND REFLECTION OF THE REALIZED PLANNING.

This is the last phase of the class where prototype refining and reflection between the proposed planning is done and the planning executed. After the module 3 evaluation, all of the professors work in the system of collective orientation, allowing the student to consult professors with different experience, thus assisting with the final prototype construction that will be presented during the last evaluation.

The evaluation of module 4 (G2) has a different format than the previous ones. In the GZERO evaluations, G1 and G1.5, the student makes classroom presentations for the professors responsible for monitoring methodology with pre-defined exposition time. In G2, the evaluation assumes the exposition format where all of the professors, the coordination and Art & Design Department heads and the partner institution are invited in order to have the possibility of seeing all of the projects united.

In order for this exposition to happen, students present a project synthesis in an A2 (420 x 594 mm) drawing format and the final prototype. The reports presented in the G1.5 evaluation will be available for the visitor to consult and see, in detail, the development process of the exhibited project. This exposition is done in two related rooms, enabling the integration of all the students, professors and partners.

Figure 1 *- Students and their projects in the final exposition Source: PORTAS, RIBEIRO and TILL (2012)*

Class Layout

The whole development process done by the students is accompanied by the partner institution through classroom encounter and by student visits to possible

locations for implantation of the projects being developed. During this process, the students interview users, conduct research to deepen the project situation knowledge, permitting concept recognition and concept recognition. They map out worksite producing diagrams, drawings, chronograms and use several representation forms as communication exercises between the institution representative, social group and class professors.

Along the trajectory, the progress report is requested of the student in the form of an oral presentation and handing in process documentation, permitting the exercise of though organization, choice foundation, analysis, synthesis and visual organization of the information.

Upon finishing the semester, we organize a publication, containing the summary of each project designed by the students, which is officially delivered to the partner institution. This publication has the objective of documenting the semester's work and makes it possible to create usage agreements for implantation of the selected projects.

Conclusion

This paper aim to show that the interaction between the designer and the social group allows a better understanding of the real context and guarantees the selection of a problem situation, indentified and defined within the group and it's perfectly possible to be practiced by undergraduated students already in their first year of the university, and it is also a way to explore and encourage their autonomy, criativity e and also the development of maturity of design practice.

The educational proposal for the class project in question has the objective of enabling the student to consolidate the knowledge acquired in the first semester and the expansion of his projectual vision. It's worth mentioning that upon entering the course, the student is presented with the participating observational methodology, based on the design in partnership concept, where he designs his project for a specific user and with his participation, or in other words, the user is his project partner, giving his opinion and interceding in the student's process when it presents the alternatives in development. This relation proportions the context approximation and identification and the validation of the generated alternatives.

In the second experiment (DSG1002 – Planning Project) the choice of an institution which represents and acts in a determined social group, instead of a specific user, places the student face-to-face with the challenge of remembering the trajectory in the first experiment and to project considering the implantation of his alternative for a larger group. This exercise proportions the understanding of a generalization and production on an industrial scale.

The workshops, specific content classes and project methodology orientation have planning dynamics exercises as a main objective. These dynamics exercise creative potential, bring back previous experiences, stimulate reflection about the existence of stages in object development, the possible relations and necessity for the flexibility and articulation, culminating in the consciousness it's process and the projectual autonomy victory.

The methodological choice of adopting a social group, mediated by an institutional partner, put the student in contact with real issues, many times in areas unknown to him, discovering problems and opportunities that require reflection on society's problems and civics. In this way, what we believe to be the interdisciplinary nature of

Design is reinforced as well as encourages the development of a professional who already finds projected into real situations since he started out.

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Enhancing structured reflective practice to complement the “Design Praxium” vision

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Abstract: *This paper suggests that an Enhanced Reflective Practice model, as part of a structured reflective practice discipline, supports the vision of an initiative known as “Design Praxium”. This initiative aims to fulfil: (i) a need for a new type of design practice; (ii) a deeper design educational experience; (iii) a new generation of designers that are able to shape new contexts through design. Design Education would benefit from the inclusion of practical ways to cultivate values that may develop hand in hand with design theory and technique. If mental training disciplines that aim to ultimately foster cooperative human qualities can be inserted within existing structured reflective disciplines in an educational context, then rising design students may progress into professional endeavours with higher potential of making more sustainable and socially responsible choices. This paper presents the theoretical context for a developing study that will investigate if the techniques of Enhanced Reflective Practice stimulate mindfulness and promote cooperative human qualities. It is argued that developing these qualities within a design education environment holds the potential to move 'Design' towards the vision of 'Design Praxium'. Moreover, it is concluded that the significant value of this approach is the seamless integration of the disciplines of mindfulness and that of structured reflective practice.*

Keywords: Enhanced Reflective Practice; Mindfulness; Stillness; Meditation.

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Introduction

Young et al. (2001) coined the term "Design Praxium" as an exhortation to a new way of thinking that may support a new ideology for the future of design education. They suggest that the current focus of design is on tangible, aesthetic elements disregarding wider social implications. In this light, they establish that:

> The designer's engagement with both intangible and tangible levels of designing requires new understanding modes of investigation and new methods of assessment. The virtue of this challenge will be in re-aligning the designer's values, to broaden the remit of design to move beyond our immediate sphere of influence and address our sphere of concern. (Young et al. 2001)

"Design Praxium" advocates a new approach to design education that contends with the current world-view that separates ethics and values from rational and logical thinking. This paper introduces the idea that an Enhanced Reflective Practice (Rojas et al. 2012) discipline can be a significant part and support of this new proposed approach to design education.

Action research through the structured application of reflective practice models is part of current design education and aims to develop reflective design practitioners (English 2009). Blaiklock (2010) proposes a structured critical reflection teaching and learning framework to cope with student's difficulties in understanding and articulating relationships between design practice, processes and research. Ultimately, the goal of such approach is to train students to "build, apply and disseminate new knowledge from their practice" (ibid). This paper suggests that a structured reflective practice model can be enhanced with synchronous mindfulness-based techniques to complement and illuminate the research component, cultivate attentive awareness, and to promote cooperative human qualities. Design literature reflects the need to include the promotion of such qualities. This document reviews literature concerning values and desirable human qualities in Design; the concept of mindfulness; and details the structure and rationale of the Enhanced Reflective Practice model. Moreover, this paper aims to serve as a base for a developing study seeking to validate the impact of this model on the fostering of such qualities to support the "Design Praxium" initiative.

Values and design

Schön (1987) explains that when "professionals fail to recognize or respond to value conflicts, when they violate their own ethical standards, fall short of self-created expectations for expert performance, or seem blind to public problems they have helped to create, they are increasingly subject to expressions of disapproval and dissatisfaction". Lawson (2006) states that design inevitably involves subjective value judgement and explains that questions about which are the most important problems, and which solutions most successfully resolve those problems, are often value laden. He further suggests that designers may be seen to prescribe and to create the future, and thus their process deserves not just ethical but also moral scrutiny.

Inácio & Gerardo (2006) illustrate clearly the moral dilemma faced by the design practitioner by differentiating between application of a "better action" to support the demands of a design problem, and the "moral action" which could, upon analysis, be obviously beneficial to a larger good. They establish that the designer can only be akratic in almost every action, and define akrasia as incontinence in moral actions. This could be also understood as acting in a way contrary to one's sincerely held moral

values. Furthermore, they utilize a "table of torture argument" as an experience of thought. The "better action" is a design that considers "construction with resistant and beautiful materials, with an enhancement of the tormentor usability, inflicting the most possible amount of pain to the victim without letting him pass out" (ibid). The "moral action" in this case is obviously not to commission such project. Of course, our day-to-day moral decisions may not be so extreme and can have wide room for moral opinion and debate. An example that is more accessible is the one where they describe a graphic designer's decision between the uses of sustainable paper as a "moral action" as opposed to non-sustainable paper as a "better action" because it will grant better results. The pragmatism that is inherent to the striving for subsistence of course has an impact on a designers' dilemma of balancing values with actions. Inácio & Gerardo refer to this as dilemmas of two wills, the internal and external dilemmas of the designer.

> In the internal dilemma, the designer could be confronted with two wills, between reason and pathos; both interfere with the internal rational capacity of creating intentions. In pathos we can subdivide it in two categories: first, is what we may call immediate necessity, the basic needs of the quotidian, like the necessity to earn a living, to eat, to have a job, etc; second, what we may call of pathosmania, or selfindulgence, the need of recognition and ambition, to excel in the better action. In the external dilemma there is the will of the designer and the will of another agent exterior to himself. In this case the will of the client. (Inácio & Gerardo 2006)

To avoid a general assumption of what is or is not universally moral, it is important, that within the scope of this document, values are considered very individual and defined only by what the designer holds to be meaningful and dear. Having said that, it could be argued that the promotion of valuable human qualities such as compassion, empathy and eco-centrism, could make for a purposeful aspiration to establish worthwhile common ground in the experience of design practice value choices.

Cooperative qualities as contemporary design demands

The Design Industry is moving towards bigger participating roles in improved ways to contribute to sustainable global solutions. Young et al. (2001) propose that there is "an irony to design"; they state that:

> The activity of creating the new is stuck in an out of date orthodoxy. How is it that we can produce so many wonderful looking artifacts yet utterly fail to create real connection, peace, harmony, balance with each other and the world we stand on? (Young et al. 2001)

Scharmer (2009) declares that we live in a time of massive institutional failure, collectively creating results that nobody wants. Inácio & Gerardo (2006) point to the fact that design has an impact in the world yet, most of the time, "…it is a negative one, not only in social-cultural aspects, but also in an environmental perspective".

The last few decades have been bursting with calls for change to the way we relate to the world and to each other. Young et al. (2001) suggest that design "can and will act as a catalyst for positive, sustainable change to the economic, political, ecological and social future of our countries and their societies – now and in the future". It would seem reasonable to assert that as designers, it is necessary to rethink our relationships

with the Earth and our fellow living beings, and consider the impact of our design choices. It is also important to merge the evolution of design practice and education with the exploration and development of cooperative human attributes. Words like balance, harmony, sustainability and the considerations of others, and of the well-being of the world, continue to expand topics of profound academic research and professionally sound applications. And it would seem as if meaning and fulfilment are found in actions that have at the heart of it, the intention of benefiting others and perhaps in a future that we may not see. Much like the definition of the true meaning of life offered by Henderson (1986) to be: "to plant trees, under whose shade you do not expect to sit". In this light, Young et al. (2001) introduce a new idea of success that is, design that "operates with full awareness of context, honouring a world we would want for our children". They further state:

> We could use the Native American definition of longevity that takes into account not just our succeeding generation but a total of seven generations. This would mean two new challenges for design, greater awareness and holism in meeting real needs, and longevity and sustainability in practice. (Young et al. 2001)

It is obvious that beyond the technical and theoretical aspects of design, there are contemporary demands that call for evolving human qualities to meet with attainment of practical skills. This calls for attributes such as empathy and compassion, which allow taking into one's view the considerations of larger groups of people. Thus perhaps kindling design behaviour that is socially responsible and sustainable. Furthermore, the educational setting offers the opportunity to study and cultivate design behaviour within a fertile environment where new disciplines could potentially be inserted as part of future components within basic design education and practicum settings.

Meditation, mindfulness, stillness & awareness

Extensive empirical evidence supports the notion that meditative and/or mindfulness-based disciplines improve overall human well-being and predict less cognitive and emotional disturbance (Kabat-Zinn 1990; Lynch et al. 2006; Shapiro et al. 2006; Brown & Ryan 2003). A wide range of cooperative human qualities is claimed to derive from such practices including: empathy (Shapiro et al. 1998; Krasner et al. 2009), equanimity (Spencer 2008), spontaneous non-egocentric action (Rosch 1997); social connectedness (Hutcherson et al. 2008); compassion & eco-centricity (Austin 1999). Terms like "meditation", "mindfulness", "stillness" and "awareness" are used interchangeably in literature as both, techniques and also as qualities of being. Such techniques are non-analytical mental exercises that range widely from breath, body and emotion awareness, to various other forms of active and passive meditative activity (Ekblad 2008; Lazar et al. 2005; Kabat-Zin 2002).

Meditation has been referred to as "living in the present moment" and as a family of techniques that attempt to focus attention in a non-analytical way, and not to dwell on ruminating thought (Austin 1999). Wallace (1999) describes it as methods "to train the attention". Spencer (2008) suggests that, through meditation practice, a design practitioner learns how to develop attentive awareness and to be connected fully with the present moment. He further states that it can promote experiencing the design process with equanimity, calm and clarity.

Mindfulness is referred to as both, a form of meditation and as a result of it. Lazar et al. (2005) call it a mental capacity, which is "a specific non-judgmental awareness of

present-moment stimuli without cognitive elaboration". Nhat Hanh (1976) uses the term "mindfulness" to refer to keeping one's consciousness alive to the present reality. It is further suggested that:

> Although attention and awareness are relatively constant features of normal functioning, mindfulness can be considered an enhanced attention to and awareness of current experience or present reality. (Brown & Ryan 2003)

Spencer (2010) describes meditative activity as a "gentle effort to be still", and refers to "stillness" as a letting-go of attachment to the flow of thoughts. He further explains that "acceptance" is central to the experience of gradual stillness. Scharmer (2009) speaks of an "inner place of stillness where knowing comes to the surface". Furthermore he suggests that when a shift in awareness is recognized, it involves an essential quieting of the mind that Buddhists call "cessation," wherein the normal flow of thoughts ceases and the normal boundaries between self and world dissolve. The concept of "stillness" was introduced as competence of design intelligence and described as:

> An ability to access a range of mental states that are characterized by: considerably reduced habitual reaction and non-attachment to uncontrolled streams of thought; and by mindful awareness and acceptance of a designer's inner condition, and of perception of the present circumstances. (Rojas et. al 2012)

These and other similar disciplines and terms are inspired by Wisdom Traditions, and a common thread or purpose can be established. In this sense, it can be stated that these disciplines aim to enhance and cultivate attentive awareness and acceptance of the present moment and of one's current inner-condition. Ultimately, as part of the philosophy of Wisdom Traditions, they seek to foster desirable human qualities such as: loving kindness, compassion, joy, and equanimity (Kraus & Sears 2009). Vyas et al. (2012) allude to these disciplines as "awareness development practices" and relate them to particular qualities of attention such as: being fully present, empathy, compassion and non-judgement. Austin (1999) says that a highly compassionate being enters into what he calls the ultimate human equation: "self equals other", and states that:

> Once compassion issues from this ground level of being, the whole person becomes free to relate, ecologically, to the entire environment. Where is the old egocentricity? It has turned inside out. Eco-centricity prevails (Austin 1999).

In the spirit of clarity, this document will refer to "mindfulness", as both the quality of attentive awareness and acceptance, as well as to the techniques that cultivate such mental state. Furthermore, this paper describes the way to enhance structured reflective practice with mindfulness-based techniques with the aim of cultivating mindfulness as a quality of being; and ultimately to foster cooperative human qualities in a design student, in support the "Design Praxium" vision.

Enhancing structured reflective practice

Stemming from a pilot study, Rojas et al. (2012) introduced the "Enhanced Reflective Practice Reporting Template" (Figure 1), which incorporated non-analytical mental training techniques inspired by Wisdom Traditions. They highlighted the value, within the context of professional practice, of improving a designer's professional inner

self-awareness through reflective practice enhanced with techniques aiming to enhance attentive awareness. It was further claimed that improving a designer's inner self-awareness through enhanced reflective practice can: "promote dynamic self-awareness to include previously tacit elements of a designer's inner-environment", and "aid the access to, and recognition of, mental states of stillness" (ibid).

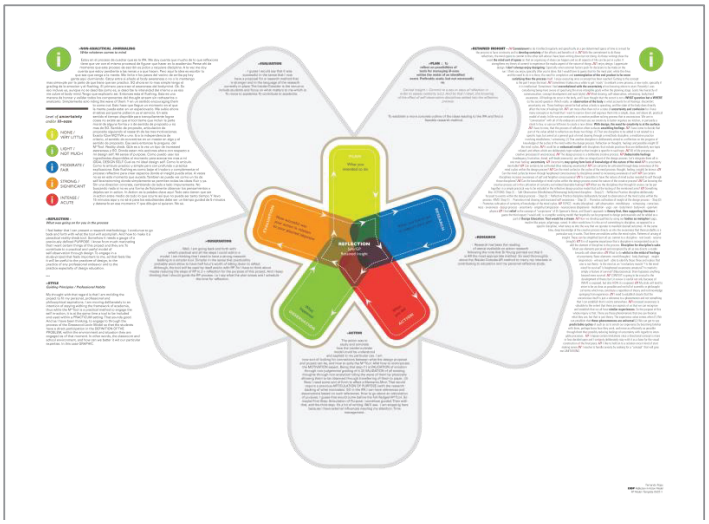

Figure 1. Example of an "Enhanced Reflective Practice Model Template". The model incorporates mental training techniques inspired by Wisdom Traditions. Source: Rojas et al. 2012.

The Enhanced Reflective Practice model is a modification of the action research reflective model that is part of a Master of Arts program that encourages design students to develop a structured reflective practice discipline (English 2009). This model, in turn, is an adaptation of the typical action research moments: plan, act, observe and reflect, as described by Zuber-Skerritt (1992). The mindfulness-based enhancements, which aim to help practitioners learn to "concurrently hold, observe and consider multiple points of view with non-attachment to their reactions" (Rojas et al. 2012) are outlined as follows:

> The original reflective moments as presented in the structure of the MA are: plan, research, action, observation, evaluation, and reflection. These are all analytical. The meditative techniques incorporated are: (1) Non-analytical journaling; a cathartic approach to quickly writing whatever comes to mind, and, (2) Self-observation of the perceived level of emotional fluctuation as an effect of uncertainty before and after reflection. (Rojas et al. 2012)

Moreover, they propose that the Enhanced Reflective Practice template was conceived as a base for evolving models that can be further developed to "focus and elicit reporting on of self-assessment and self-transformation" (ibid). Yip (2007) proposes that in the process of self-reflection within reflective practice, the self is turned into an observable object, a process that can "gradually release individual's deep-seated feelings, cognition, memory suppressed in the unconscious". This focus on

self, adds the element of critical reflection as part of the analytical aspect of a reflective cycle, to be further synchronized with the non-analytical attentive awareness techniques. This point of view, as it relates to a reflective design practice, was explained as follows:

> This approach is concerned with unconscious habitual reactions that may inhibit exploration and investigation. It is an inclusive acknowledgement of: a) the details of a design situation; b) the designer's value judgments of such facts, and; c) the third element, the witness who observes from a space in-between. Therefore, the environment of design, and a consideration of the multiple perspectives of a design situation, should include a designer's dynamic awareness, assessment and potential transformation of their own inner environments. (Rojas et al. 2012)

Critical reflection calls for questioning of values, beliefs and assumptions (Fisher 2003; Blaiklock 2010), which is a process of "making evaluations about ethics, morals, wider social, political and cultural implications that occur throughout a design project" (Lynch 2005 cited in Blaiklock 2010). While mindfulness is a non-analytical, non-judgemental process, the enhanced awareness and human qualities that it seeks to cultivate can, not only, illuminate those aspects of the self that are being observed, but also effect cognitive change. If a discipline of Enhanced Reflective Practice can improve a designer's inner self-awareness, then it could open a space for a clear view of aspects specific to critical reflection. In this light:

> The ontology of critical social science suggests that human beings, through critical self-reflection, can come to see the true nature of their existence and act to change their situation, based on this understanding. (Fay 1987 cited in Fisher 2003)

Spencer (2010) explored a point of view suggesting that continuous commitment to a rigorous process of reflection is key to be able to benefit fully from the accumulated experience of the reflection cycles, and that non-analytical disciplines complement the reflective process as tools for increased attentive awareness. Blaiklock (2010) highlights "structure" and "cohesion" in the context of design students reaching a "high level of academic literacy, writing, critical reflection and knowledge construction". He further points out that a "structured and applied critical reflection teaching and learning framework, can enhance the effectiveness of design research education" (ibid). The act of disciplined commitment may also somehow nurture our creative natures, so creativity (and any other quality of self or endeavour) may occur proportionally to the level of commitment to the practice. Vyas et al. (2012) say that the cultivation of the capacity "of becoming aware" is the "basis for human creativity and success" (Sice & French 2004 cited in Vyas et al. 2012). And further propose that a "disciplined act of cultivating our capacity "of becoming aware" of the sources of our experience and, thus, opening up new possibilities in our habitual mind stream", is needed as an alternative to reflection (ibid). They further differentiate "becoming aware" from reflection:

> Action in terms of "doing" or "reflection" is an activity of the actor towards or in response to the environment. The act of becoming aware, on the other hand, is one of uniting, connecting within (to self and body) and without, i.e. being part of the environment, experiencing being part of the universe. (Vyas et al. 2012)

Ekman et al. (2005) stated that "in Buddhism, rigorous, sustained training in mindfulness and introspection is conjoined with the cultivation of attentional stability

and vividness". Disciplined mindfulness practices are further considered in literature to physically alter brain structure (Lazar et al. 2005). Wenk-Sormaz (2005) suggests that cognitive change is what Eastern practitioners have concentrated on for centuries and that meditation practice leads to a change in cognitive function. Austin (1999) offers the analogy of a "highly salient alternate state etching itself into memory" to imply how, through awareness disciplines, a "brain can become structurally different from before". This is akin to the concept of neuroplasticity. Schwartz & Begley (2003) define neuroplasticity as "the ability of neurons to forge new connections, to blaze new paths to the cortex, even to assume new roles"; in other words "footprints of the experiences we have had". Recent scientific research on the "causal efficacy of will" supports this notion:

> The implications of directed neuroplasticity combined with quantum physics cast new light on the question of human kind's place, and role, in nature. At its core, the new physics combined with the emerging neuroscience suggest that the natural world evolves through interplay between two causal processes. The first includes the physical processes we are all familiar with - electricity streaming, gravity pulling. The second includes the contents of our consciousness, including volition.
> (Schwartz & Begley 2003)

As a result, a reflective design practitioner with improved inner self-awareness and outer world-awareness may consciously and continuously witness the cognitive evolution of, what could be known as, his or her own "Design-Self" (Figure 2).

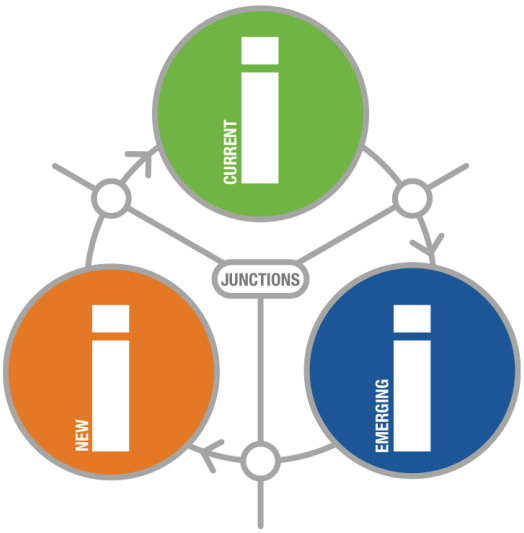

Figure 2. In this diagram the letter "i" represents the "Design-Self" in an ever-evolving cycle.

English (2010) proposes that design happens simultaneously in both the designer and the thing designed. In this sense, a "Design-Self" can be viewed as an ever-evolving entity that is created anew through reflective designing in a process that transforms our self-perception and even our brain structure. As we examine a "Design-Self" that seeks to honour meaning as well as practicality, an attempt at establishing context is

helpful. Cognition of a "Design-Self" can be understood, for the purposes of this document, as the result of the degree of intersection between: (i) a designer's set of evolving values and world views; and (ii) a designer's behaviour and actions. Disciplines advancing attentive awareness can potentially help designers reach inner places of aware stillness and prospectively allow them to witness the extent to which such elements meet and define their current "Design-Self".

These inner-places of stillness are junctions where a designer can dwell within a space of awareness that is contained in-between the end of an old, and the beginning of a new, cycles of process and/or of being. This place is, at the same time the end of one cycle, and the beginning of another. It is a gap of alert attention in which mindful-perception occurs. A place of stillness that "operates in that moment between the facts of experience, and a designer's perception and value judgment of such experience" (Rojas et al. 2012). And as such, designers can realize and become familiar with what could be known within the design process as: (i) a Current, (ii) an Emerging, and (iii) a New "Design-Self". The latter, for the next cycle would be an enhanced Current "Design-Self", in an ever-evolving development.

Mindfulness-based enhancements

As established, the mindfulness-based techniques integrated to enhance a structured reflective practice template consist of: (i) a form of Non-analytical Journaling, and (ii) a form of Self-Observation. These techniques are inspired by the vast array of mindfulness-based means to cultivate attentive awareness and acceptance of the present moment. Yet, their compelling value is in their seamless inclusion within a structured reflective practice model and thus, making the cultivation of mindfulness a part of the reflective process itself, as opposed to a peripheral annex.

Non-analytical Journaling

The process of recording narrative in a structured reflective practice template can be seen as a form of directed or guided journaling. English & Gillen (2001) offer a general definition of it as "writing focused on learning from daily experience", and consider it a form of reflective practice that allows for "puzzling through" and extracting meaning from events and experience. This refers to the analytical component of journaling and/or reflection. In contrast, Non-analytical Journaling is a cathartic stream-of-consciousness. English & Gillen refer to this non-analytical process as a way of suspending all judgement and ultimately fostering creativity. While this is still an act of generating output within the reflective template, its purpose is to empty the current unfiltered mind contents as they become available. Such a goal is comparable to a concept in Buddhism known as "emptying your cup"; a process that aims to unfetter the mind of opinions, ideas and speculations, and increase "non-verbal awareness" (Hyams 1982; Kodish 1998). The directive is of "quickly writing whatever comes to mind" (Rojas et al. 2012) as fast as possible and for a specific number of words[1]. This technique is used in higher learning schools such as RMIT University in Australia (2012), which includes it as part of a course on creativity concepts. The

[1] The original process, as conceived by Cameron (1999) and known as the 'morning pages', consists of three pages handwritten on a notebook. No more, no less. Since reflective practice templates can be approached in different ways, it was estimated that the section pertaining to non-analytical journaling should be of approximately 700 words.

inspiration for this step is a discipline that Cameron (1999) introduced and described as private meanderings where “nothing is too petty, too silly, too stupid or too weird to be included”. It is a meditation that gives us “the light of insight and the power for expansive change”, and a way to “separate our login brain that works on known principles, from our artist brain, that is our inventor” (ibid). The purpose of the practice is to cause a “brain-drain” of sorts where excess ruminating thought is “transferred” to the recorded words and thus create a sense of “mind-purging”. In the end, the purpose of the practice is to reduce ruminating thought and cultivate the “qualities of mental non-attachment and mindful awareness” (Rojas et al. 2012).

Self-Observation

Self-observation, for the purposes of this document, is understood as an act of taking account of one’s own inner-environment in an objective and non-judgemental way. Akin methods are widely researched as tangible scientific concrete processes. Beitman & Soth (2006) describe self-observation as “entailing an active scan of one’s inner landscape”. Rodríguez & Ryave (2002), propose that the ability to self-observe and report is a skill that can be cultivated, and also a way of gathering methodical data on elements of the self that are “tacit, hidden, and elusive”. Their instruction for observation of an aspect of one's inner-environment is “not judge it or question it. JUST observe it” (ibid). It has been suggested that to promote mindfulness “we need to break through established patterns of perception and experience” (Langer 1989 and Udall 1996 cited in Niedderer 2007). Self-observation, within the Enhanced Reflective Practice model, aims to enhance attentive awareness of a reflective practitioner’s inner-condition as a way to promote such break in perception and serve as a bridge to mindful-awareness. This is achieved through a colour-coded grading scale where a practitioner can assess, in a non-analytical way, and record their perception of their current inner-condition. Thus encouraging an internally focused perspective, as opposed to a reactive situational point of view.

Conclusion and further research

There is a growing need to include meaning in our professional activities and to discover that fulfilment and success have broader definitions. While the claimed benefits of mindfulness are wide-ranging, the significant contribution of the Enhanced Reflective Practice model is that it seamlessly synchronizes mindfulness-based practices with structured reflective practice. This allows for a multiple-perspective approach to the reflective process that integrates analytical narrative and non-analytical witnessing. Furthermore, it promotes attentive inner-awareness of self as well as outer-awareness of circumstance. Reflective practice as action research promotes reflecting on what it is learned and thus learning, not just about action, but also through action (McNiff & Whitehead 2006). Mindfulness promotes the fostering of valuable human qualities that support wider social views compatible with the vision of “Design Praxium” and co-design contexts. Young et al. (2001) see “Design Praxium” as a “catalyst to identify vital insights into the future of design education and to foster meaningful design”. They further suggest that:

> Its time to move on! But in moving on we need to become mindful of the way we can unconsciously see the world. Every society ever known rests on some largely tacit, basic set of assumptions about which we are, what kind of universe we live in and what is ultimately important to us. (Young et al. 2001)

This paper's aim is to serve as bases for a study that will investigate if the techniques presented here to enhance structured reflective practice, stimulate mindfulness and promote cooperative human qualities. Beyond the action research component of narrative analysis, several validated methods of measuring mindfulness are being considered. The "Mindful Attention Awareness Scale" (MAAS) is described by Brown & Ryan (2003) as focusing on "the presence or absence of attention to and awareness of what is occurring in the present". This scale seeks to examine the aspect of attention of mindfulness and not the other associated attributes like empathy or acceptance. In a study, the MAAS showed that it "not only predicts well-being outcomes but also has value in the study of the temporal and situational dynamics of self-regulated behaviour and well-being" (ibid). The "Self-Other Four Immeasurables" (SOFI) scale was developed and validated by Kraus & Sears (2009) to measure the component of mindfulness that is associated with cultivation of human qualities. They describe the "four immeasurables" as the qualities that are at the heart of Buddhist teachings, namely: "loving kindness, compassion, joy and acceptance toward both self and others" (ibid). By assessing these "aspirational qualities" the value of their contribution is described further:

> Whereas previous measures appear to focus on the fact that we pay attention, our focuses primarily on how we pay attention. By attempting to measure these previously "immeasurable" qualities, we facilitate study of both wings of mindfulness, attention and compassion. (Kraus & Sears 2009)

It is expected that enhancing structured reflective practice with mindfulness-based disciplines, becomes a validated method to cultivate mindful-awareness and cooperative human qualities in design students. In co-design contexts this will assist by promoting the development of "an adequate co-creative capability to allow for socially responsible action" (Vyas et al. 2012); and will also complement the "Design Praxium" vision of a new breed of creative professional that can "rise to the challenges of designing better schools, better democracies and better ways of living" (Young et al. 2001).

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Design for a city state: An overview of design education in Singapore

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Abstract: *Singapore, which started its modern life as a trading port under the British rule in 1819, became a sovereign nation in 1965, breaking away from the federation of Malaya just a few years after independence. Since 1965, the leaders of Singapore have transformed Singapore many times, starting from its trading roots, to being a manufacturing centre, to financial centre, to a service economy till its present state as R&D centre for science & technology. This paper presents an overview of the development of design education in Singapore, starting with vocational schools that taught design as a skills, through the polytechnic education systems to the present state where there are three universities offering design education at bachelor's level together with a semi-autonomous college of the arts. While sketching the overview of design education as it unfolded since 1988, the author offers his personal insights into how the emergence of design education in this island state coincided with the changing phases of Singapore's economy, concluding with his observation of where design education could be heading in the age of 'design thinking'.*

Keywords: *design education, economic development, education development, overview of programmes*

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Introduction

Modern Singapore's history starts in 1819 when a young clerk from the East India Company named Stamford Raffles set up a trading post in 1819, before signing a treaty later with the Sultan of Johore, a sultanate located at the southern end of the Malayan peninsula, just north of Singapore, to make Singapore a part of the 'Straits Settlement' of the East India Company. In 1963, Malaysia and Singapore gained independence from the British and was named as Malaya & Singapore before Singapore broke away from this confederation to become the Republic of Singapore in August 1965.

Figure 1 shows the island of the Republic of Singapore relations to it two large neighbours, Malaysia and Indonesia. With a population of 5.31 million as at June 2012, Singapore today is a plural society with a population distribution of: Chinese 74%, Malays 13.5%, Indians 9% and others 3.5% (source: Department of Statistics of Singapore).

Figure 1. *Singapore and its neighbours in the Malyasian archipelago*
Source: http://asean.fta.govt.nz/singapore-overview

Before setting out to give an overview of design education in Singapore, this paper will give a brief outline of the economic growth of Singapore since 1965, in order to give credence to the development of education over this period. In reviewing the economic growth and education development of Singapore over the last 47 years, the author will identify factors that have influenced the growth of design education in general and the acceptance of design as an economic driver by the government of Singapore, paving way for the present design education ecosystem in the country.

From a debacle to a miracle

Chang (1998), in a book titled *'From an Economic Debacle to an Economic Miracle'* published by the Economic Development Board (EDB) of Singapore, has described the

extensive planning and meticulous execution of the strategies by EDB as well as other government agencies that has brought Singapore to what it is today. Embedded within the text is also the development of vocational and technical education, which ultimately has lead to the introduction of formal design education in Singapore. This in a way highlights the importance of economic growth in the development of education in Singapore. Yip et al (1997) in the chapter titled '25 Years of Educational Reform' in a book titled 'Education in Singapore' quotes the first Prime Minister of Singapore, Mr. Lee Kwan Yew as saying during a speech in 1966:

> We must have qualities of leadership at the top and qualities of cohesion on the ground. This pyramidal structure of top leaders, good executives, well-disciplined civic-conscious broad mass can only be produced by our education (page 4)

Yip et al (1997) go on to say that, ' faith in the potential power of education is backed up by a high degree of political will, meticulous planning and resource support to attain the goals set for education'. Statements such as these make education development look like the main driver for the growth of the country during the initial years as a sovereign country. However, with the geo-political situations surrounding Singapore being gloomy, the political will of Singapore to survive as a free nation meant that the government had to look at two basic issues that confronted them in 1965; firstly, the need to unify the English based education system and the language based education systems into a common education thread at the primary and secondary education levels. Secondly, the government had to deal swiftly in bringing down the unemployment rate, which stood at 14% (source: National Heritage Board). The young government of 1965 soon faced a third issue, with the occurrence of two racial riots that tore communities apart. There was an urgent need for unity and cohesion in order for Singapore to survive, leave alone grow. Yip et al (1997) show the change in the tone and tenor in the Prime Minister in the following:

> …produce a community that feels together…The reflexes of group thinking must be built to ensure the survival of the community…this means a reorientation of emphasis and a reshuffling of *values* (italics by the author). (page 10).

In the author's opinion, this reorientation of emphasis and the reshuffling of values meant that Singapore could not afford to de-couple the development of education from the economic development at that point in time.

Economic Development

Gopinthan (1997) in the chapter titled 'Education and Development in Singapore' clearly outlines the relationship between economic growth and education development in Singapore. Hence a brief understanding of the spectacular economic growth may be necessary. A good measure of economic growth of a country would be its Gross Domestic Product (GDP). The GDP of a nation could be defined as the total market value of all final goods and services produced by that country in a given year, equal to total consumer, investment and government spending, plus the value of exports, minus the value of imports. (source: www.investorwords.com). Since the citizen and resident population of Singapore has risen from 1.89 million in 1965 to 3.8 million in 2012

(source: www.singstat.gov.sg), it may be better to measure the economic progress of Singapore by GDP per Capita. Investorwords.com again defines GDP per Capita as an approximation of the value of goods produced per person in the country, equal to the country's GDP divided by the total number of people in the country. Table 1 shows the growth of GDP per Capita since 1965.

Table 1. Growth and Development in Singapore Economy
Source : http://www.singstat.gov.sg

Sector	1965	1985	2005	2012
GDP per Capita (USD)	516	6748	29,400	50,000 (est)

The figures in Table 1 shows that, technically, Singapore's economy has grown roughly one hundred times since 1965. It is a very high order for a small city-state, which is smaller than many of the megacities in the world such as, New York City, Mexico City, Shanghai and others. Gopinathan (1997) also suggests another way of viewing the transformation of Singapore economy by examining the structural changes in the economy that reflects the shift in inter-sector growth. In 1965, Singapore had a small agricultural sector with some 20,000 farms then occupying more than 14,000 hectares of land, according to the Agr-food & Veterinary Authority of Singapore (AVA). Today there is hardly any agricultural activity left with a few farms located near Lim Chu Kang area of Singapore.

How did the education system grow during this period of steady upward growth of Singapore economy? How did Singapore get to where it is today in terms of design education?

Education Development

One way to understand the development of design education in Singapore is to follow the development of technical education in Singapore since 1965. Sathikh (2011) in a chapter titled *'Transformal Role of Product Design in Singapore's Transition to a Service Economy*' groups this development into five stages.

From 1965 – Setting the scene

Sathikh (2011) says that in order to fulfill the immediate requirement for technical manpower, Singapore's Ministry of Education started concentrating on 'technical and vocational schools'. Several such schools such as the Singapore Vocational Institute (SVI) graduated workers with certificates in Mechanical Engineering Practice, Electrical Fitting, Electrical Installation, Radio Servicing, Motor Vehicle Mechanics, Refrigeration and Air-conditioning, Plumbing, Wood Craft and Construction, Building Drawing, Ship Building, Sheet Metal and Welding, etc. Even the Teachers Training College was pressed into introducing a two-year course in Certificate of Teaching (Technical) in order to fill the vacancies for qualified 'technical' teachers. This approach seem to have fulfilled the type of industrial growth that Singapore was experiencing, with the Economic Development Board (EDB) taking an all out initiative to persuade foreign businesses and industries to invest in Singapore and open factories. Realising that Singapore needed technical manpower beyond what was offered by the vocational schools,

Singapore established six special training centres with the support from the United Nations through its UNDP programme.

With many factories in operation in a short period of time, with the need to fill supervisory level technical manpower, Singapore established the first two polytechnics, the Singapore Polytechnic and Ngee Ann Polytechnic (initially named Ngee Ann Technical College), which paved the way for post secondary school (post high school) education in areas such as Mechanical Engineering, Electrical and Electronic Engineering, Civil Engineering, Architectural Studies, etc. Graduates from these polytechnics were awarded a diploma after three years of study (Sathikh 2011).

Realising the need to produce more than a diploma level technical manpower, Singapore established a faculty of engineering at the University of Singapore (renamed as National University of Singapore) in 1968, paving the way for a bachelor level degree course for the first time.

This level of education development brought Singapore to its first stage of technical proficiency, namely the ability to manufacture parts that could be assembled in Singapore or elsewhere into products for consumption.

Was there any attempt to introduce design education at this stage of economic development? Singapore did have an art school named the Nanyang Academy of Fine Arts (NAFA- established in 1938) and the Baharuddin Vocational Institute (BVI- established in 1969) which were sending out students with diplomas in 'pure arts' and 'applied arts (Sathikh 2011). Both NAFA and BVI graduates were fulfilling the need for creative manpower in the fledging advertisement and other market industries that had started in the face of the economic boom.

1970s – Foundation

The seventies saw the continuation of industrialisation when manufacturing becoming the largest economy, with rapid infrastructure development of ports, airport, road transportation and telecommunications to match. With a steady growth of economy, it seemed like the technical education of Singapore was adequate to feed this growth. With production moving from simple processes to more sophisticated ones, Singapore needed to build manpower with both the skill and knowledge in quality control and productivity if it wanted to convince companies to set up their research and development (R&D) activities locally (Sathikh 2011). With the vocational schools, the specialist training centres, the two polytechnics and the university producing sufficient manpower, Singapore's government turned its attention to establishing statutory bodies that will have the task of training the existing technical manpower in quality control, productivity techniques and best practices for standardization. The National Productivity Board (NPB) was established in 1972 for this purpose. The NPB has since been renamed twice, once to Singapore Institute of Standards ad Industrial Research (SISIR) to its present form, Standards, Productivity and Innovation Board (SPRING Singapore).

As for design education, NAFA and BVI remained the only source of (still) skill based creative artists to support the advertising and media industries, which had established itself by then. Industrial design was not an area that Singapore was interested during this stage, although the author suspects that the EDB and other statutory bodies such as Trade and Development Board (TDB) had been wondering what would be the next beyond, manufacturing, assembly, quality & productivity and R&D.

1980s – Enter Design and Design Education

As a part of Singapore's effort to move into 'knowledge-intensive activities such as R&D, engineering design and computer software services' and to develop 'Singapore as a premier international trade hub and to promote the nation's goods and services' (Sathikh 2011), Singapore turned to industrial design, initially by encouraging talented students to study aboard through scholarships. Pioneering batch of students who came back after their studies were absorbed by SISIR, which had started a design consulting group in the early 1980s, to support Singapore industries upgrade themselves through design. Nothing significant was initiated by the Government towards establishing design or design education in Singapore till the late 1980s, when the Trade Development Board (TDB) set up a Design Centre to promote design awareness, design education and the business of design. In 1988, the TDB, together with the Designers Association Singapore, organised the First International Design Forum together with the Singapore Design Awards (SDA) and the Young Designers Award (YDA). This forum, together with an exhibition that highlighted several countries at the forefront of design and the display of award winning designs, attracted designers, design students and design educators from around the world. This, in author's opinion, helped in creating a positive atmosphere that was conducive to establishing tertiary level education.

In 1989, a third polytechnic working committee was appointed to study the establishment of a polytechnic to offer three year diplomas in areas beyond the traditional realm of technical education. This paved the way for the Temasek Polytechnic, which was to have a School of Design besides several other schools within it. On another development, a Catholic priest, Brother Joseph McNally (Fig.2) founded a small school to teach art and design in the east of Singapore, which soon gained popularity amongst students and the general public; and sponsorship from the Singapore Airlines (for a period of time) to become LaSalle – college of the arts today. LaSalle offers certificates, diplomas, Bachelors' and Masters in art, design, media, performing arts, art history, art management and others.

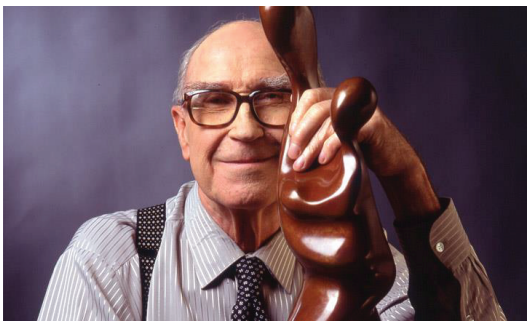

Figure 2. Late Brother Joseph McNally, founder of LaSalle – college of the arts: Source: http://www.lasalle.edu.sg/

1990s – Start of design education era

April 1990 saw the official establishment of Temasek Polytechnic and with that, students with artistic talents could do a three-year diploma in product design or graphic design. Temasek Polytechnic, which was housed in different locations in Singapore got its own buildings in 1995 by which time, it had graduated two batches of designers. At the private education level Raffles Design Institute was started in 1990 to initially offer a three year diploma level course in fashion design and within a short period offered

courses in 3D design and interior design, multimedia design, etc. Mid 1990s saw the establishment of the fourth polytechnic, Nanyang Polytechnic that offered a three-year diploma in industrial design. In 1999, the grand old institution of Nanyang Academy of Fine Arts (NAFA) had its status upgraded by the government to that of a tertiary institution paving the way for NAFA to offer courses in both diploma level as well as undergraduate level. The year 1999, was also when the National University of Singapore started a four year Bachelor of Art (Hons) degree programme in industrial design under the Faculty of Architecture and Planning (now renamed as the School of Design and Environment). Singapore Polytechnic, one of the earliest polytechnics in Singapore also started diploma programmes in areas related to design.

2000 TO THE PRESENT

With the start of the new millennium, the government set up 'the Economic Review Committee (ERC) bringing together local and foreign experts from each sector of the economy to fundamentally review Singapore's development strategy, and formulate strategies to upgrade, transform and revitalise the economy' (Sathikh 2011). As a part of the ERC, a subcommittee on Service Industries was set up to evolve a 'Creative Industries Development Strategy' for Singapore. Based on this subcommittee's recommendations, The DesignSingapore Council was formed under the Ministry of Information, Communication and the Arts (MICA) to oversee all aspect of design activities in Singapore. Acting on another recommendation from the same subcommittee, the Nanyang Technological University (NTU) opened the School of Art, Design and Media (ADM), in 2005, to offer a four year Bachelor of Fine Arts (Hons) – BFA (Hons) – degree in six different areas of design and media. Figure 3 shows the iconic building, which houses ADM within NTU. The wide ranging activities of DesignSingapore, together with a global awareness of the rapid development in internet and related technologies, has lead design education in Singapore in the 2000s, with diploma level and undergraduate level courses being offered in wide range of areas within design and media, including animation, interactive media, amongst others. This global awareness has also lead the Economic Development Board (EDB) of Singapore to persuade well known design institutes from the United States of America to open branches in Singapore. DigiPen Institute of Technology and TISCH from New York State University were started in the last five years. Today, students wanting to pursue design education have a lot more to choose apart from industrial/product design and graphics design/visual communication. In a very interesting manner, the Institute of Technical Education (ITE), which had catered to vocational education for, mostly, underachieving junior high school leavers, started a three year certification courses in design and media as an alternative to the three year diploma courses offered by the polytechnics. Aspiring students, today, can choose to take up studies in the course of their choice, in an institution of their choice and at a level and pace that suits them. This panoramic view of design (and media) education is presented in the next chapter.

Figure 3. School of Art, Design and Media, Nanyang Technological University, Singapore
Source: www.ntu.edu.sg

Design within the education system

It is pertinent, at this point for the readers to be introduced to Singapore's education system, especially in schools. At the school level, the 6 + 4 + 2 or the 6 + 4 + 3 system of education is dominant. In both the systems, a student spends 6 years in the primary school and 4 years in the secondary school (junior high school). At the end of the secondary school the student sits for the GCE 'O' level examinations administered mostly by the Cambridge International Examinations. It is after obtaining the GCE 'O' level certification that a student decides to go for the +2 system or the + 3 system. The +2 system takes the student to a Junior College for 2 years after which he/she sit s for the GCE 'A' level examinations administered by the Cambridge International Examinations. An 'A' level certification allows the student to pursue a bachelor degree programme[1] within Singapore or outside. The +3 system, on the other hand, allows a student to study for three in a polytechnic (or in this case, at LaSalle – college of the arts and NAFA) to get a diploma after which he/she could start working immediately.

Safety nets for underperforming students are also built into the educational system at all levels to ensure opportunities for students to make up their shortfall and move up the education ladder at their own pace. For example there is a GCE 'N' (normal level) for underperforming students in the secondary school in which case a student would be doing a 6 + 5 + (3) system. For students who find themselves with lower than qualifying grades for polytechnic admission in the 'O' Levels or 'N' Levels, they can opt to do a three year National ITE Certificate (NITEC) in any one of the many Institutes of Technical Education, which is purely a vocational certificate giving the students a skill or trade. However, NITEC is not the end point in education for these students. Top NITEC performers are given places in Polytechnics to further themselves through a diploma. Top diploma holders are also encouraged to join the university to pursue an undergraduate education. There are examples of Singaporeans who have become

[1] All Singapore and permanent resident males have to do National Service in the armed forces, police forces or the civil defense for a period of 2 years. This is done at the end of +2 or +3 examinations.

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successful businesspeople after going through the arduous route, which started at an ITE, thus proving the effectiveness of the education system in Singapore.

Design Education: an overview

In the socio-economic climate of a globalised world, Singapore has moved away from being a manufacturing centre to a knowledge centre, in its bid to attract cutting edge research and development (R&D) activities of leading companies in science and technology. This shift has meant more room for lateral expansion of design education on both directions to encompass art, design and media, from the vertical positioning of industrial/product design and graphics/visual communication. Design education today straddles, not only on the traditional pedagogy based on visual thinking, but also on the astonishing development of information and computing technologies such as, computer aided design, rapid prototyping/3D printing, motion capture and digital image processing, amongst the multitude of others. In presenting an overview of design education in Singapore today, the author has considered this horizontal positioning of design education by including the areas of media and animation together with product /industrial design and graphics/visual communication. However courses in fashion design and merchandising as well as courses in photography and filmmaking have not been included in this overview.

Table 2 shows the technical institutes, polytechnics, and private and sem-autonomous art and design schools that offer a post 'O' or 'N' level programmes and courses in design and media.

Table 2. Institutions offering post junior high school level design courses

Institution	**Entry Qualification**	**Courses**	**Years**	**Type of Certification**
Institute of Technical Education (ITE)	Post Junior High School ('O' Level or equivalent)	• Product Design • Visual Communication • Interactive Media Design • Space Design • Digital Animation • Visual Effects	3	National ITE Certificate (NITEC)
Nanyang Polytechnic	Post Junior High School ('O" Level or equivalent) Post NITEC	• Industrial Design • Visual Communication • Space & Interior Design • Digital Media Design (Interaction or Games or Animation) • Visual Effects • Motion Graphics and Broadcast	3	Diploma

Ngee Ann Polytechnic	Post Junior High School ('O" Level or equivalent) Post NITEC	• Product Design & Innovation • Multimedia & Animation • Animation & 3D Arts • Digital Visual Effects	3	Diploma
Republic Polytechnic	Post Junior High School ('O" Level or equivalent) Post NITEC	• Design for Interactivity • Game Design • New Media	3	Diploma
Singapore Polytechnic	Post Junior High School ('O" Level or equivalent) Post NITEC	• Experience and Product Design • Games Design and Development • Interior Design • Visual Communication and Media Design	3	Diploma
Temasek Polytechnic	Post Junior High School ('O" Level or equivalent) Post NITEC	• Product & Industrial Design • Visual Communication • Interactive Media Design • Interior Architecture & Design • Environment Design	3	Diploma
Raffles Design Institute	Post Junior High School ('O' Level or equivalent)	• Product Design • Transportation Design • Jewellery Design • Visual Communication • Interior Design • Multimedia Design • Animation • Video Game Design	3	Advanced Diploma (private)
LaSalle – college of the Arts	Post Junior High School ('O" Level or equivalent)	• Product Design • Digital Communication	3	Diploma (private)

		• Interior Design • Animation		
Nanyang Academy of Fine Arts (NAFA)	Post Junior High School ('O" Level or equivalent) Post NITEC	• 3D Design • Design & Media	3	Diploma

Table 3 shows the universities that offer a post 'A' or diploma level programmes and courses in design and media.

Table 3. Universities offering tertiary level design courses in Singapore

Institution	**Entry Qualification**	**Courses**	**Years**	**Type of Certification**
National University of Singapore (NUS)	Post Senior High School/Junior College/ Equivalent Post Diploma	• Industrial Design • Transportation Design • Jewellery Design • Visual Communication • Interior Design • Multimedia Design • Animation • Video Game Design	4	Bachelor of Arts (Hons) – BA(Hons)
Nanyang Technological University (NTU)	Post Senior High School/Junior College/ Equivalent Post Diploma	• Product Design • Digital Communication • Interior Design • Animation	4	Bachelor of Fine Arts (Hons) – BFA(Hons)

Table 4 shows institutes that offer a post diploma level programmes and courses in design and media. These programmes allow a diploma holder to either 'top up' by spending one more year in an institute or gives a one-year exemption to recognise earlier studies in the polytechnics or art/design schools. Universities, usually located abroad, issue the degree certificates.

Table 4. Institutions offering tertiary level design courses in conjunction with other universities

Institution	**Entry Qualification**	**Courses**	**Years**	**Type of Certification**
Singapore Institute of Management (UniSIM)	Specific diploma in courses related to visual communication from polytechnics /	• Communication Studies	1 (top up course)	Bachelor of Design (B.Des) - RMIT University, Australia

	Equivalent			
Singapore Institute of Technology (SIT)	Specific diploma in courses related to courses polytechnics / Equivalent	• Communication Design • Interior Design • Digital Art and Animation • Game Design • Game Design	2 (top up course) 3 (one year exemption) 3 (one year exemption) 4 (8 semesters)	Bachelor of Arts (Hons) Glasgow School of Art, UK Bachelor of Fine Arts (BFA) Bachelor of Arts (BA) Bachelor of Science (BS) DigiPen Institute of Technology, Singapore branch
LaSalle – college of the arts	Post Senior High School/Junior College/ Equivalent Post Diploma from LaSalle	• Product Design • Design Communication • Interior Design • Animation Art	3 years for post senior high school 2 year for diploma holders	Bachelor of Art (Hons) – BA(Hons) Various partner universities NOTE : LaSalle's partnership with Goldsmiths, University of London is not included here since information is not available
Nanyang Academy of Fine Art (NAFA)	Diploma holders from NAFA in related fields	• 3D Design : New Practice • Graphic Communication	1 (top up course) 1 (top up course)	Bachelor of Arts (Honours) – BA(Hons) Loughborough University, UK Bachelor of Arts (Honours) – BA(Hons) Loughborough University, UK

		• 3D Design : Spatial Design • Visual Communication with Business	1 (top up course) 1 (top up course)	Bachelor of Arts (Honours) – BA(Hons) University of Central Lancashire, UK Bachelor of Arts (Honours) – BA(Hons) **UniSIM**, Singapore
Raffles Design Institute	Advanced Diploma from Raffles Design Institute	• Industrial Design • Transportation Design • Jewellery Design • Visual Communication • Interior Design • Multimedia Design	1 (top up course)	Bachelor of Design (B.Des) Raffles College of Higher Education (private)

Table 5 shows institutes that are branches of famous institutes from abroad, that offer a post 'A' level programmes and courses in design and media.

Table 5.Singapore branches of institutions offering tertiary level courses in design

Institution	**Level**	**Courses**	**Years**	**Type of Certification**
DigiPen Institute of Technology	Post Senior High School/Junior College/ Equivalent Post Diploma	• Engineering Product Development	4	Bachelor of Science (BS)*

Table 6 shows a university that offers degree programmes, for post 'O' level and diploma holders, in areas that are related in some aspects of design. The degree programmes offered by this university are unique in the way architectural and engineering and systems design have been blended together with the analytical end of engineering education.

Table 6.University offering tertiary level courses related to design

Institution	Level	Courses	Years	Type of Certification
Singapore University of Technology and Design (SUTD)*	Post Senior High School/Junior College/ Equivalent Post Diploma	• Engineering Product Development	4	Bachelor of Science (BS)*

Table 7 shows institutes that offer a postgraduate education in design and areas related to design and media.

Table 7. Institutions offering post graduate education in design

Institution	Level	Courses	Years	Type of Certification
National University of Singapore (NUS)	Bachelor degree in the relevant field(s)	• Industrial design	2 – 3	Master of Art
	Master's degree in relevant fields	• Industrial Design	3 – 5	Doctor of Philosophy (PhD)
Nanyang Technological University (NTU)	Master's degree in related fields	• Art, design and media	5	Doctor of Philosophy (PhD)
TISCH, New York Univesity, Singapore Campus	Bachelor degree – not limited to related fields alone	• Animation & Digital Arts	2	Master of Fine Arts NOTE : TISCH, Singapore Campus has decided to close its campus and stop student admissions as of 08 November 2012

Design Education: a panorama

Tables 2 to 7 show that, within a short period of twenty two years since the opening of a design school in Temasek Polytechnic in 1990, Singapore's design education scene has grown many folds, offering programmes and courses at different levels of the educational spectrum. Unless we understand the underlying learning objectives at each of the level, there is a possibility that these different institutes may be repeating themselves in terms of curriculum and syllabus. In the author's opinion a journey

through formal design education across the spectrum, from a post 'O' level education to doctoral studies, involves the following learning outcomes :

- Techniques
- Skill sets
- Knowledge Build
- Thinking Skills
- Strategy
- Research /Original output

While risking simplification, these six progressive leaning outcomes could possibly define a designer's journey through formal education, any where in the world. How do these six key learning outcome play out if one considers the different level of design and media education depicted in tables 2 to 7? In Figure 4, each square or rectangle depicts a typical level of design education offered in Singapore. Overlaps of these squares or rectangles depict the approximated overlap of learning outcomes between two levels of programmes.

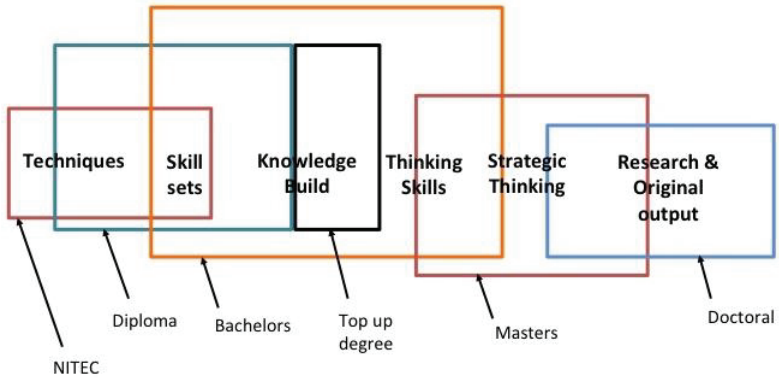

Figure 4. A Panoramic model of design education in Singapore

A first glance of the panoramic model of Fig. 4 gives an idea of the learning outcome expectation of each programme. This is presented in Table 8.

Table 8. Learning outcome expectation in the different design programmes

Programme	Learning outcome focus	Other learning outcomes	Peripheral learning outcomes
NITEC	Techniques and Skill Sets		
Diploma	Skill Sets	Techniques and Knowledge Build	Thinking Skills
Top up degree	Knowledge Build		

Bachelors	Knowledge Build	Skill Sets and Thinking Skills	Techniques, Strategic Thinking
Masters	Strategic Thinking	Thinking Skills	Research & Original Output
Doctoral	Research & Original Output	Strategic Thinking	(Philosophy – not shown in Fig.4)

From a stand point of design as a profession, one can see from Table 8 that a bachelor programme in design and media offers the most balanced education and the diploma programme adequately equips a student with the sufficient learning outcomes to start working. Masters level programmes start leaning towards strategic thinking and could be the essential first for a designer embarking on design research and academics. Doctoral programme suits qualified designers and design educators to attain a higher level of scholarship required to be an academician.

Discussion

How does this panoramic model fit in with the development model of Singapore? Going by the direction that Singapore is to be a knowledge hub for this region, one would expect a logical shift from skill set build to knowledge build to research & original output in the progress towards design education. However, panning back to the reality of Singapore being an island nation with only 3.8 million citizens and residents (source: www.singstat.gov.sg), one could question if Singapore is producing far more designers than required for such a small nation. The author estimates that easily 1000 students could be graduating every year at all levels from NITEC till postgraduate studies. Without a comprehensive study into the job placement of graduating designers, it is difficult to tell what is excessive and what is the optimum level of design graduates that Singapore can absorb into meaningful workforce, which would include research and academics.

What is important from the authors point of view is that design education programmes, both at the diploma level as well as bachelor level, need to be developed from ground up to suit the requirements of the nation and the surrounding region of ASEAN. In that respect, one could acknowledge that Singapore has done well in its diploma programme and the degree programmes. What seems to be at question is the wisdom of bringing in 'top up' programmes in conjunction with foreign universities, with the good intention of upgrading a 'diploma' designers into a 'degree' designers. The panoramic model of Fig.4 indicates to the possibility that, what is taught in a short duration of time (usually one year) in top up courses, by roving lecturers from the parent art schools and universities, in what could be inadequate facilities here in Singapore, could be detrimental to the aims and intent of Singapore to become a knowledge hub in this region. While the parent art/design schools and universities maybe famous and respected in the countries of their origin, supplanting an educational model from another country, in whatever modified form to suit Singapore's environment, will not be a long term solution for Singapore. Nor is the notion that design education standards will be raised to the levels of the country of origin of the parent school/university through a short cut solution. Case in this point is the closure of the Singapore branch of TISCH, a famous film school of the New York State University in USA, on 08 November 2012.

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Design knowledge

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The Music without Melody of John Cage, the Literature without Words of James Joyce, the Art without a Subject of Joseph Beuys and the Architecture without Construction of Enric Miralles

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Abstract: *The contradictory is an appearance. Investigating John Cage, James Joyce, Joseph Beuys and Enric Miralles we get to learn that game, constriction, contradiction and chance are homogeneous strategies in the processes based on an artistic evolutionary commitment, being this a key factor to assume established creative processes in a critical realism and a relational aesthetic. Taking reality as it is, not escaping from what the voices mean to be a block for the development and even be open to the dialogue, assume the complexity of the real thing, not shutting oneself up in the known, but being open to the unknown, relaxing in swampy fields without yearning for safe structures, is the base of an education which will teach self-sufficiency capacity and self-management to people, promoting the ambition for a critical and constructive life together. Contradictions must underlie the echo of the memories, which emerges from the subconscious, forming an essential part of the creative processes and being on the other hand the mirror of the context we live and in which we take active part. The paradox as a unifier of reflection. Reality is also an appearance.*

Keywords: Creative processes, critical realism, relational aesthetic.

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Introduction

It is through art appreciation that citizens develop their judgment. (Kant 1790)

Through reflections on these four characters from different artistic disciplines, this paper attempts to investigate the processes that established their practices in order to observe from there the existence of a relationship in the method of working the projective intelligence.

The results are formally different, but establishing the substrate beneath them answers a common nature, the reality with which we work.

After understanding the starting point from where their social and cultural processes are established, the processes developed in drifts, facing a direction not only consistent with the starting point, but also with the manner of driving, this goal and this process being vehicular; the true soul of the discourse for those who strive towards a careful search to record, filter, observe, and reflect, critically and responsibly.

Among all the disciplines collected from the exercise of these four artists, there is one that needs especially to be reconsidered: architecture.

(...) it will point the way towards an architecture liberated from buildings to engage the central issues of our society instead of the tombs of architecture, ie buildings, present specific installations, visions and experiences to help us understand, make sense and feel at home in our modern world. (Betsky, Aaron)

The real crisis of architecture is not in the recent real estate bubble burst affecting with more intensity some groups and sectors. The reality of the crisis of architecture lies essentially in the mismanagement focused on the field of teaching (at least in some countries), framing it in sectors that do not belong, separating it from the creative field to other ways closer to the technological and scientific.

Miralles collects Schindler's words:

Here's the authentic way of architecture: space. (Miralles, Enric 1990)

And Miralles affirms and says:

This means that what exists before us supports our back of construction (Miralles, Enric 1990)

Architecture is not just construction, building, knowledge of the stability of buildings in science and physics, in compliance and management, attention to materials from their weather resistance, temperature or noise.

Architecture is a tool which allows us, by analogy, to compare it to a musical instrument that vibrates and sounds, where what matters is the effect, operation, its role in the broader sense. To Inhabit is to extract the music from an instrument. The narrative aspects of architecture are based on this way of understanding the room because the story is like a melody issued by that instrument capable of sounding a variety of ways. (Navarro Baldeweg, Juan 2007)

Rejecting the nature of "fine art" reveals some data of the society in which we live: it have to be aware to be able to exercise the necessary pressure to restructure not a new robust and hierarchical system (like the one used to dominate the world) but to create the real network system in force in the functioning of the structures but not

consolidated, designed, graphing and published – probably because it is more complex than we think, and the inherited structure of power is even not interested.

This network is established and currently lives with us. It has a molecular structure similar to liquids where the molecules are further apart than in solids, randomly located and changing over time. Furthermore, the liquid has infinite forms that are dependent on its container.

The architecture develops and communicates ideas of man's confrontation with the world through plastic emotions. The eternal task of architecture is to create embodied existential metaphors and intensities that materialize and structure our being in the world. Architecture is the art of reconciliation between ourselves and the world, it is this meditation that takes place through the senses. (Pallasmaa, Juhani 2005)

The fact that architecture is detached from its reality and has been assigned an outdated and anachronistic teaching responds to the way that the economy has influenced it. Architecture is a complex discipline. Architects not only live with it, but also politicians who rely on it to sell the glory of their towns while risking failure; but also involved are planners, national budgets and international manufacturers and factories, interior designers, etc.. And all this to give shelter to a society totally manipulated by the aforementioned, who are really defining the architectural product rather than the client who meets every week with the architect.

The architecture has become powerful. The economic market that moves around you is large and involves several sectors. That is why education is forged, in every way, in its structure, dynamics and methodology, directly or indirectly to promote this channel.

Architecture needs to be understood and framed in a standard objective knowledge undoubtedly based on certainties, where the emotional side, or as they say "romantic", is capricious and unrelated to what is really important, scientific, objective, registered in reports, tables, measurements and budgets.

The architecture therefore is framed in some countries within polytechnics which understand much of science.

In the current and outdated educational system, the objective knowledge has no doubts. Educating within these margins, forging these thoughts, points out that in the countries where there are cut-off marks for university access, higher marks are always referred to universities based on established studies or in objective or scientific knowledge. On the other side stand university education as art studies or even teacher training colleges for which the lower marks for access are required.

The fact is totally ridiculous, while biased and manipulative. The universities requesting access to higher grades are related to those studies that form people in handling the current economic system. The reality in which we now stand is that the economic system has changed, and secondly, even if changed, does it makes sense that education is based on these reflections? Does it makes sense that education is at the service of the disciplines, emphasizing the other disciplines and training to become an economic production system in the style of the industrial revolution? Or maybe education should affect more people in order to train them as committed individuals, critical, reflective, thoughtful and well-regarded in the community?

Of course, the current “remote control” training offered to trainees to be working in the economic system is, on the other hand, showing the ineffectiveness of premeditated objectives, since the system is changing and not education. It also shows that this type of training deprotects the individual as a complete and educated entity and aware, unable to be a cohesive unit.

Is it the right time to see the reality of the collapse of the structures, the status change, disintegration of solids, to understanding the degree zero exercise in relocating parts and the relationship between them?

Dysfunction between science and emotion, between objective knowledge and intuition, deserves to be reconsidered, trying to bring the two left and right hemispheres to configure a single unit. Creativity is the engine that can solve these dysfunctions and empower students in mastering skills and strategies for developing and channeling data.

The reality of the crisis in architecture is this: Addressing the discipline from education is the way to unlock the ghosts that dominate it.

That is why making comparisons with the processes which develop other artistic disciplines will help us to establish guidelines to govern the process, based on creativity and attention to the surrounding reality. Knowing how to look and develop a judgment while at the same time conducting a process or reflection through creative mechanisms that promote dialogue with the author's practice to refine and shape while fully integrating agents and data, offering a polished and exquisite product , offering embedded and just questions and answers.

I believe in the power of the imagination to remake the world, to release the truth within us, to stop the night, to transcend death, to charm motorways, to ingratiate ourselves with birds, to achieve confidences of madmen. (Ballard, JG 2008)

To operate from creativity it is necessary to undersatnd the starting point where the structures are located, as we mentioned above, but on the other hand, it is necessary to unlock all preset burdens in the collective imagination associated with words like fear, drift, game , distracting looks, infinite integration, fall, ruin, maze, contradiction or error, as they are what will help us understand more, process, and plan better.

In one's consideration and real understanding, not only lies a world of creative possibilities, but censorship reveals what the current system exercises on them, precisely how powerful they are, the reality and force they contain, by the creative capacities that lie in them and because in consideration they open the doors of freedom.

These are the bases of operation of the four artists featured. These are concepts, data, reflections that necessarily must be considered in order to work out in the creative process, in a planned intelligence, which educates us to develop strategies and skills to solve without fear, through play, often drifting without fear of falling, integrating everything that we find oftentimes contradictory where it is often wrong.

The strength (of observation) is not easy to grasp the truth of things and to express as accurately as possible, but in discovering hidden and hidden connections. (...) It is expected the interest of the circle of pure sensitivity to penetrate in the field of productive forces, trainers and creators. (Miralles, Enric 1988)

If we analyze the creative strategies that each artist uses in its processes, we can understand the power of their tools, awareness of their actions, the consistency of their actions, the use of factors and using the creative process.

The "Literature without words" by James Joyce is a brilliant artistic dialectic.

James Joyce sought the artwork that constituted the equivalent of the world, moving from the ordered universe of his childhood and adolescence to the open

universe, ever expanding, trying to find an module of order, a rule, a reading, an education that defines a form.

This conflict of trying to shape the natural and real chaos in moving society, is part of the work of James Joyce that develops through his literary practices.

In the James Joyce's work, Ulysses, there lives in exemplary and miraculous balance the image of the new world resting on the foundations of the old world, where he keeps the form but not the substance of that structure. James Joyce's following works try to represent chaos across multiple modules more appropriate to their nature. The evolution of his work assumes a search for balance and form, once disclosed the disturbing contemporary movements. According to Wilder (1957) terrible is the day to live with a mindset past, not current. James Joyce is a good example in the struggle and search for that accommodation and investigation of processes in which the work of art must be involved from now on.

It is in early 1900s when this pyramid that organizes references, knowledge and possibilities begins to falter. A solid structure that vanishes, appearing in the anti-hierarchical values game without intentions of " being supreme", where the complex man by nature, but not in order or external documentation, takes place in everyday life, quiet, capable of revealing and showing the extremes of humanity lie hidden and that shape the fundamentals of the universo.

James Joyce, like other artists of the time, expressed in these circumstances the need to understand, record and display his work through the contemporary spirit that began to emerge.

The continuity which manifest reflective and analytical agents of that time in the development of contemporary discovery, is the difficulty of misunderstanding arising from a structure that still remains tied to the classical values of order, permanent and enforceable, and which remain willfully blind when fear and chaos and destruction processes of man's own daily living are manifested in its true light. This last finding still has echoes in the present. The need to unlock the fear and take on the chaos as realities are necessary to be able to proceed into the future. Building an education where it is assumed the true reality is the basis from where we can establish and form ourselves.

Finnegans Wake is a work of James Joyce that warns of the formulas of a new logic that can find a "figure" corresponding to this new order. The figure may not always be able to translate abstract forms, being able to generate figures "ambiguous" porters emotional component, rather than the reflection of something not imaginable.

Finnegans Wake is actually the prototype of a new vessel into another type of structure, the linguistics, capable of offering a vision of an expressible world by hypothesis only as reason and verifiable through tools that go beyond the senses. The narrative structure is presented is confronted with logic, full of emotional content and tries to expose a world that we do not yet understand.

Through these unveiled records the procedure and positioning James Joyce generates before the new reality, offering a creative response within the literary action log.

James Joyce's attitude against this new stage involves acquiring a new use of language caused by a new contemporary reality.

James Joyce was able to intuit all relevant issues that were brewing at the time, the fall of the myths, the slaking of time, the vertigo of consciousness, the deaf and fluctuating life of cities. The characters in his works are true vagabonds of our time who

reflect the importance of a human life governed largely by the irrelevant and guided by an everyday behavior.

James Joyce's handling is in the approach to the problems of contemporary man, always rich in experiences and realities, reflected in his works, where the conglomerate is spectacular.

The "Music without melody" of John Cage is a brilliant reflection on the margins and environment considerations that the system established on the music, extrapolated to to the other side of another dimensions. To access the music of John Cage forest, these true margins reveal and may enter only those fortunate to be able to understand the keys that are hidden there.

Acceptance of sounds, silence and noise, resulting from the exercise of sound artists as John Cage, with its strategies and philosophy, have opened architectures sound to current realities, with solid foundations and materials. Delving into these terms is concluded in a sound material, synthesis of the artist's work.

Today the sounds do not suffer discrimination. Within them the noise as sound is a fight in favor of what the Varèse began with his "Lonistation" in the thirties and in which John Cage has continued, opening the margins of music, existing margins, not created or taxes .

Only a fine educated ear can enjoy more records. Only a well-educated person is able to access more knowledge, to live more intensely, to know more and himself, to empower the strategies and better focus his mission.

This is the basis of education, shaping people to expand margins and exercise skills in order to be more open and operate in the world around us.

We have become aware of the sounds we'd never heard before. (Cage, John 1970)

Sound, noise and silence are the tools faithful to the strategies that the artist pursues and that makes possible his work.

Instruments capable of generating this discourse must also be reconsidered in order to establish sound strategies raised.

The old instruments, inherited, are reinvented by John Cage generating these new sounds, eliminating the old idea of an instrument as an item that engages in pre-existing sounds.

The use of material instruments sacredly reserved for the eighteenth and nineteenth centuries, under which coined the word "music", is altered to produce under the language of John Cage the handling of broader contemporary times, committed as it is released as an "organization of sounds."

Technology, which John Cage sees as a potential diversifier, is assumed by this artist as a tool capable of improving the world that can be implemented. The ability to create differences and multiplicities for John Cage has three objectives. First, the technology will be the reléase of an element that leads to social equality; secondly, the technology will restore harmony with nature and technology; and thirdly it will operate in a change of mind, transmuting hierarchies.

Through this discourse, John Cage implements the possibility of using electronic instruments at the service of the "organization of sound" which can be heard. The exploration in this field will propose a new focused debate between noise and so-called musical sounds and not between dissonance and consonance, belonging to past structures that are governed by harmony as a measurement tool in the field of sound and of useless value in the more universal camp of sound and the time when John Cage resides.

Another consideration in the environment of this new instrument for generating musical understanding are the elements that surround us and are with us, like trucks, microwaves, coffee or washing machine. They are also "organized sound" and therefore to John Cage deserve special attention as components of discourse.

Again, as we see with James Joyce, open margins of disciplines, strategies enabled by consideration, reflection, critique and creativity, assist in favor of a free and conscious system, established in current databases and with capacity for the future.

For John Cage, composer and listener, is similarly situated to the world, rejecting art and theology of man, obliterating the notion of work, opening the relationship between art and life. This rejection of the "I" is also a rejection of the world based on the subject-object duality, where memory and emotion perception ability break.

Arguably, this blurring of distinctions between composers, performers and listeners is ongoing evidence of a change society, not only in the structure of society, but the feelings that people have toward each other. (Cage, John 1970)

It is crucial and hopeful, as well as lucky and reassuring to understand that life and the everyday acts are necessary to understand the art, life and art are not watertight compartments in thought. The intention of John Cage and the contemporary art movement is gauging the art through life.

Sometimes we blur the distinction between art and life, sometimes we try to clarify it. We hold onto one leg. We argue about the two. (Cage, John 1970)

This reflection is key to understanding how learning proceeds, how to understand the objectives and methodologies to address and not separate individuals who are one, both physically, intellectually or emotionally.

I have a conscience, and spent a long time in my creative work, the permanent transfer of issues arising in the field of painting or architecture to another medium, for example the interaction of creative work done in each domain. I moved from painting to architecture an idea of transmission of objects, their continuity with the outside, the incorporation of its externality, all aspects that deny any claim to autonomy of the architectural object. (Navarro Baldeweg, Juan 2007)

The "Art without Subject" of Joseph Beuys, is a reflection on the environment man's engaged attitude, thus reflecting the importance of form from commitment.

Joseph Beuys aims for symbolic reconciliation between art and science.

A call to unity with the originating forces that determine life, whose discovery should enable a whole complexion of being.(Neumann, E. 1992)

The artist says that the values of life have suffered, for that matter, have gone through the necessary healing of an expanded concept of art.

In search of a new vision of art, stands the figure of Joseph Beuys, an artist who knows about science through study and practice, approaches the order of the sensible, actually trying to approach the "new order of the sensible ", while rescuing science from the rigid, radical and rational understanding which contemporary scientists commit to.

As Heraclitus of Ephesus said, "All existence passes through the flow of creation and destruction." In this sense the gaze of the cycle of infinite integration of the imagination to create the drawing as dialogue, the record as a basis for the construction of the store, the value of the wreck or the place, are necessary considerations with which Joseph Beuys articulates its work.

Joseph Beuys perceives this expanded vision and for him his artistry and science expands through his creativity in order to receive more of the world and not just a fragment thereof. Records to carry out these approaches are varied, but they are the

"actions" which are consolidated as a key element in his work where are found the objects and sculpture, space and time, drawing and language the body and music.

The artist's reflections focus on silence, life and death, catharsis, place and time, all tools that seek constant provocation crisis and production mechanisms.

The format of action is chosen by the artist bythe need to involve the viewer as an active part of the work, reflection, experimentation. This reflection can reveal another key factors in the understanding of education as framing comes along this text.

The "action" as a record of active experimentation, according to the degree of involvement required, the impact generated, procedure for development, derived from its implementation, the lack of awareness of their channels and excitement raises behind it, makes this means a key strategy to convey the knowledge and education. The memory was a tool that forged objective knowledge, fixed and stable, helping to work with the machines of the production system of the industrial revolution. Now the governing rule belongs to the service sector and the media, so the memory is not needed as the basis of the education system. Learning linked to experimentation and mainstreaming affects more directly on the actual needs of actual training.

The concept of flow involves the exercise derived from the "action" format revealing the innermost part of the individual who has to respond to the guidelines that the process generates, not the rational side through knowledge acquired and implemented, rooted knowledge -that is very different to the above mentioned and to the hidden knowledge (the one that is innate), belonging to oneself and establishing together with individual talent, education must influence in a direct to strengthen and expand.

Through the "Architecture without Building" of Enric Miralles, we can see how this exercise, in which we navigated through James Joyce, John Cage and Joseph Beuys, as well as a teaching aimed in this direction, strengthens training in the field of art, creativity and intelligence projective.

Enric Miralles's work intended as the ultimate goal, approachs the complexity of reality through the tools we have as an architect. In this sense, it is not just building process that the architect has to get closer to truly understanding, it is the process of architecture, the profile of the architect and the attitude which helps to approach. This tool is provided as a reflection, a chance, intuition, the place, the time, the ruin, the trace, error, imagination, substance, dialogue, distracted look, and actions like the discovery, store, walk, play, score.

Careful log of plastic communication generates, helps Enric Miralles to establish a rich dialogue with all the factors involved, making the architecture an infinite process, where the construction is an intermediate state of the architecture process, although the final the architect.

Educating for communication and dialogue with oneself to debug processes through plastic registers and creative resources, helps to achieve project and content richness unattainable for one who has not been educated in these values and in this management.

Enric Miralles was fully aware of his actions, also the starting field, and their tools. So its his architecture was real, was approaching the complexity of reality and gave a service to reality.

The authentic exercise of compromiso of persons in the middle of what they do involves understanding the actual training that person needs. In this way and outside the pre-established codes we can knowingly form the cause.

Through the foregoing considerations it is clear that interdisciplinary and mainstreaming in the structures of the contents, and in general spacetime, trains and helps without casualties or injuries, serving a reality inherent in the definitions of game but which should especially result in an attentive, analytical and critical engagement system where we establish and can focus with this look and decide strategies in freedom.

The real crisis of architecture lies in the bad procedures of teachers, who are the architects of the architecture outside.

The contradiction is an appearance.

The reality that defines today's architectural appearance.

We must rescue the true scope of the architect and architecture, the reality of architecture.

Education must be rebuilt.

Methodology

The paper presented contains certain insights drawn from my PhD: "Architecture is not building".

PhD methodological strategies began with readings, reviewing critical and analytical issues of the discipline of architecture, followed by a concern to meet the architectural project methodology as activity revealing the identity of the discipline.

To do this, I structured a parallelism between artists from the world of visual art, literature and music, which allowed me to see how the architecture has to be processed in parameters and attitudes like the other arts.

All this, in a context such as Spanish, where the architecture is far from these methodologies and belongs to the world of science and technology, both professionally and training.

This parallelism found is the result of dialogue between Enric Miralles, architect with a strategy and attitude to architecture and its processes, and timely contemporary and other chosen artists. The result is a series of records and attitudes common action against the project processes.

It is my job after my PhD research, and to observe and investigate through different subjects I teach, and my commitment to the research on teaching, of which I am part of the university EINA, that structured this release .

Rescuing those parallels and identities cross found in my research, restated what should be a teaching attitude against project processes, and not only in architecture but in art.

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The introduction of new technologies in design: a Brazilian perspective

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Abstract: *Design as a field of developing new products and interfaces has been following some technological innovations, such as the appearance of new software and tools that allow the product designer perform various tasks such as product analysis. Today there are new challenges to the design field, such as continuous learning and operation of computerized equipment. The objective of this paper is to show how new technologies are related to the development process of product design by Brazilian designers.*

Keywords: Design methodology, Design education, Product design.

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Introduction

The first Design School, ESDI (Escola Superior de Desenho Industrial – ESDI/UERJ) was founded in 1960, and due to a reproductivist tradition, their faculty lacked the formation that would benefit both, teaching and research. This fact helped to enable an education based in pour fundaments and records, guided by oral knowledge broadcasting. (FREITAS, 1999)

Not many researches mention how Design discipline is taught in Brazilian Schools. A concise standardization is needed, regarding the most fit design program to be taught in specialized Schools. There can still be seen the reproduction of Bauhaus and Ulm patterns.

Freitas, who by 1999 was defending his doctored thesis on this subject, sustained that there were only three researches addressing the same theme in a broad manner:

The first research was developed by the designer Gustavo Amarante BOMFIM, in 1978, 15 years after the first Design School was founded; the second research was conducted 6 years after BOMFIM's, in 1984 by Geraldina WITTER; and the third 11 years after WITTER's, in 1995, by the designer Lucy Niemeyer.

A theme that has been emergent in design post graduate classes discussion of ESDI, even more than in graduation itself, is that the activity has been receiving influences of behavioral, cultural and technological changes the city has been going through.

Since the 90s, when the Internet started to become popular, information spread, becoming faster and accessible to a large number of users. Technology, in turn, had proved its influence on professionals' framework, such as designers. The changes related to technology are organized in three major moments according to Tarouco (2007):

Each one of the past three centuries was dominated by a single technology. The eighteenth century was the era of great mechanical systems followed by the Industrial Revolution. Nineteenth century was the era of the steam engine. The twentieth century, in turn, was named as the information age. Additionally, we have witnessed technological advances in several areas. Among them there are Computers and Telecommunications, which affect many people's lifestyle. In this scenario of technological advances, we are facing an increasing load of information and technology resources.

It can be said that the 80s was the decade of personal computer, while the 90s was the Internet. This first decade of this century has been marked by digital inclusion, an explosion in access to information and technologies that, until then, were privilege of a small group of people.

In Brazil, design as a profession and also as part of this historical movement is gaining importance for its involvement in computerized technological world. Activities involving the multidisciplinary aspect of the design and the increasing development of new ways of growing technology require continuous knowledge and interest to access information. Being updated has proven essential for anyone who already operates and also for who intends to work on the design field.

The creative capacity of designer is suffering, each time more, the interference of the technological resources, for the simple fact of that each day new programs appear and tools that in allow them to carry through tasks that would be improbable the little time behind. For everything this is necessary to know until point the new technologies affect the creativity human being and of that form this if it sees affected. (Tarouco, 2007)

Motion capture systems, 3D scanning and additive manufacturing technologies are part of this field and are used daily at research centers and universities that develop projects on product design and engineering. These technologies help professional designers and also students to extend their capabilities as they offer highly complex, geometric shapes and features: 3D printing and 3D imaging are causing design and manufacturing professional to rethink their approach to new products development.

However, the reality in Brazilian Schools is based on the difficulty to import these machines, due to high taxes and the bureaucracy steps set by the government. This results in a slow process that, when translated into students lives, generates formation gaps, making their entry on the job market difficult.

And now with the introduction of low cost technologies in the market, new opportunities arrive for these students, who are able to study and learn the implications of the insertion of these technologies in design process even earlier than it was possible before. Nowadays it is possible to see new designs that previously would have been too expensive or even impossible to manufacture.

This work shows the results of a research that has been conducted, based on structured interviews with design experts, aiming to gather their opinions and experiences on how these new technologies change design process in product development – from its conception to user experience.

Criteria for participating in the research were designers who use these new technologies in product development on a daily basis, and also have contact with the academia, in which critics and reflection about new designers who are entering the can be gathered.

General goal

The goal of this work was to understand the perception of people who work with 3D scanning, additive manufacturing technologies and motion capture, and their opinion on how design was taught in their days and how it has changed, as well as improvements that should be done. It was sought to check the degree of interference of technological resources in the creation and implementation of a product design, from conception of ideas to the initial visualization of the final result.

Population

The population chosen for this research consisted in Brazilian Product Designers who work with motion capture technology, 3D scanning and construction of prototypes for design evaluation. Professionals with different levels of experience were searched, in order to find also subjects with experience in traditional product development, as to before the arrival of these technologies. This was set as a criteria in order to enable gathering information about how design process and design teaching has changed over the years.

It was considered titling, work experience and time since graduation, as important indicators; 7 expert designers were interviewed with working time experience between 8 and 34 years.

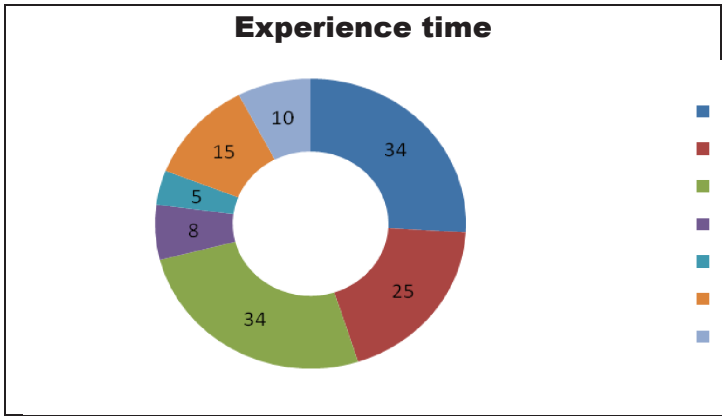

Figure 1. Graph showing the work experience of the 7 respondents in years.

It can be observed that of all interviewees, three people could be considered very experienced, two with average experience and two with little experience.

Context and activity

The context of the present work are research institutes and design laboratories located in Rio de Janeiro/Brazil, that work with demands of services in product design.

The activity is Product Design development process.

Methodology

A pilot test was conducted in order to adequate the questions sequence, as well as observe if the answers met each questions' objectives. With the results of this pilot test, the agenda was set for implementation with the 7 designers selected. All interviews had audio recording, which were then transcribed into digital documents. Experiences evaluations were made considering the purpose of the research.

A phenomenographic research was conducted in order to gather experiences from a sample of subjects sharing similar experiences regarding the implementation of these new technologies in design workflow. The aim was to collect qualitative data, both conceptual and experiential from the subjects, as well as their practical experiences with design education after these advents.

Data analysis consisted in clustering these information into structured hierarchies. This allowed identifying information groups and setting patterns.

New technologies definition used in this work

The new Technologies mentioned on this work are: additive manufacturing, 3D scanning and motion capture systems.

Additive Manufacturing (AM) concerns the methods in which digital files are materialized in 3D physical objects, building up parts by successively adding material, often in layers. These processes use a computer-digitalized model of the part, typically cut into slices, rather than tooling. Such methods allow designers to quickly create tangible prototypes from their projects, rather than 2D figures. These models have

many uses. They are excellent visual and tactile cues during the previous discussion of the project with colleagues or clients (Gorni, 2001).

This technology can shorten supply chains, eliminate shipping costs and also help designers and manufacturing engineers to extend their capabilities as it offers highly complex, geometric shapes and features. AM is considered distinct from traditional machining techniques (subtractive processes) which mostly rely on the removal of material by methods such as cutting and drilling. The term additive manufacturing describes technologies, which can be used anywhere throughout the product life cycle from pre-production (i.e. rapid prototyping) to full-scale production (also known as rapid manufacturing) and even for tooling applications or postproduction customization.

3D Scanning is the process in which a body or product is captured into a digital 3D file. A 3D scanner is the device that performs this scanning process and also collects data that can be used to construct a digital file. The point cloud obtained, either by laser or white light scanning, is transformed into a polygonal mesh that can be applied for a wide variety of applications, for example, in games, animations, movies, reverse engineering, virtual simulations, quality control / inspection, documentation of cultural artifacts, prototyping, and more.

Motion capture systems are used to track, record and translate motion of a body inside a digital model. Among the technologies available in the market are the optics, magnetic, acoustic, mechanical and inertial. Its application range from the entertainment industry to applications in product usability and virtual simulations: can be used in military, entertainment, sports, and medical applications, and for validation of computer vision and robotics.

When it includes face and fingers or captures subtle expressions, it is often called as performance capture. In many fields, motion capture is also called motion tracking. Motion capture offers several advantages over traditional computer animation of a 3D model such as real time results, reduction of the costs of key frame-based animation and complex and realistic physical movements.

The influence in the design process

> Many are the current definitions of what design is. Factors such as the incompatibility of predetermined concepts, the difficulty of integration and standardization of academic language as practiced in industry, as well as variants of excessive individualism and resistance to changes practiced by some designers, hinder and impede the design process as a whole (Ferroli *et al.,* 2007).

A variety of design definitions is common during the academic life of a future designer and, according to some respondents, many professionals remain with the lack of clarity over the working life. The most frequent criticism from experts with over 30 years of experience is that industrial design professionals miss a comprehensive view of what is design.

These respondents pointed some criticism to the kind of thinking on the Industrial Design Universities, considered different from the reality found in the market, which impairs the performance of some professionals, but also the ability to work effectively. The Brazilian labor market is much more restricted, because of the lack of a more comprehensive training.

Another criticism made by these experts was the apparent lack of interest of some students to practice and study all the steps that design involves. Respondents characterize the design activity by its process, with all the methodology that encompasses. This leads us to Ferroli (2007), which says that 'the term design is a general concept, which accounts for a broader process, starting with the development of an idea, which can be realized in a design phase'.

The way to work this process may vary depending on the experience gained on projects, and some interviewees indicate that already used, about 25 years ago, the same methodology they use currently. The part of the thought process, the product development, is still the same, basically still uses the methodological knowledge grounded at the university.

Respondents indicated that the change in the process was the improved and more agile way of designing, coming from years of design experience, coupled with technological resources. The technology helps in the sense that the designer has the flexibility to burn a few steps. According to the interviewees, design is not the final form of the product but how it was built. The result, by analogy, can be considered merely the tip of the iceberg, as illustrated by the words of one respondent:

> "What makes it [the designer activity] is not quite the tip of the iceberg, which appears on top but how you built it. That characterizes our activity. It is the process. Design is a process."

Another important feature pointed out by one respondent, is that this activity is made by teamwork, often multidisciplinary. The project is a meeting of minds, a debate of worldviews, from how to prepare a solution, what are the possible solutions. Every product has numerous solutions, there isn't only one solution.

> "Every project you do is a learning experience (...) I think that [using design methodology] is ok, but that will change, first, depending on experience, and second, according to the group which you work with. I cannot, perhaps because my experience has been that my whole life, develop a design project than with a group of people."

External influences

Nowadays a problem that is making difficult the work of product designer in Brazil is the lack of clarity regarding the definition of the term itself, as was shown earlier. Some respondents pointed out that the way the profession is shown in the media is unspecific and confusing, since a wide range of activities is characterized as "design".

Many respondents pointed out that many customers think that who can draw can be a designer. Or even an expert in some software can also be considered designer. Often these two individuals are acting as technicians, are not thinking the whole project, as the profession is characterized.

To the real designer, technology streamlined the art of design. You can do it much faster, with fewer errors. With new technologies allied to the design process, you can virtually be able to think before entering the practice, thus enabling cost reduction. You can also get answers much more visually interesting than compared to the mode without technological devices. This means greater inclusion of stakeholders in the project.

Comparison of responses

A group of interview questions aimed to find out how the equipment interfere with the production process, as well as understand the perception in relation to possible changes in the design process. What we noticed about the answers was a division of responses into two distinct groups, which are uniform over the length of professional experience.

Professionals with over 25 years of experience criticized the inclusion of new technologies in the design process, while the younger experienced between 8 and 10 years, were more emphatic use of technology, ignoring methodologies and processes.

Technology usage

The use of new technologies can streamline a variety of processes and bring valuable information during project development. More time is focused in development than in execution, optimizing the work process. Some design steps have been streamlined, such as rendering, product visualization: a projection of what the designer imagines in an image on the computer is much lighter and faster.

These technologies create many opportunities for the development and evaluation of products (ergonomics, usability, interaction, etc.) and also eliminates restrictions techniques to build the product - an example of the initiative is the Freedom of Creation (FOC), which allows designers to develop innovative projects with the use of additive manufacturing techniques:

> Since the world is becoming ever more digital, decentralized and connected, our approach on product development will change the world forever. (...) now the same transition is already occurring for consumer products as well, and people will be able to create their own products with great ease and will not need to be bound by the selection they can find in stores. As a result, the value for consumers will increase and waste will decrease. (Freedom of Creation, 2012)

Respondents were emphatic in stressing that simply having the technology is not the most effective solution. They argued the need to keep learning new uses for each tool and constantly upgrade.

> "The tools save time. Of course that the time I save will be spent on another thing. Today I spent a lot of time viewing tutorials, studying tools."

Respondents showed that it is useless to seek the automation itself. It is also necessary to deeply know each of the equipments in use. The designer now has to spend much time viewing tutorials, studying tools. It is no use having a computer and do not know how to improve its processing. The tools only facilitate the accuracy of what you want if you know how to use them.

One respondent mentioned that now the designer is much more likely to speak the same language other project stakeholders, discussing in groups with other areas of knowledge such as architects, doctors, psychologists. With these tools the designer can even study what the other does, quickly understand via Internet.

The 3D modeling software *Solidworks*, for example, makes the designer may even become independent of the engineer. This made the design more complete. They also help because the software works like an open book, the designer models and leaves the steps for assembly. The software allows the entire record of project thought.

Many of software that exists today provide opportunity for the development of products or ideas. They allow professionals can provide elaborate answers, or produce products with attractive designs. There is much material available on the Internet and the layman who has skill - and not just skill, but also of perception - do things that give attractive results, that another layman might find interesting.

Additive Manufacture technologies

In the opinion of respondents, additive manufacturing technologies are part of physical 3D modeling, and may be used in the development of models of scale models, workplaces, or 3D human models. One respondent said that the majority of the products that will be sold in the market are tested through additive manufacturing technologies and / or manual prototyping.

In the end of a project, if the customer has any questions on the virtual modeling or if the product itself has some interaction with humans, it is advisable for customers to make a physical model.

> "The 3D printing [now called additive manufacturing technology] makes much difference when testing the product. It brings a great help at the time of testing, evaluation of your product."

Also according to the experts, the choice of method depends on the complexity of the product and the project budget. Others said that mock-ups in size to evaluate projects are really good however this practice is completely unused.

3D Scanning

Respondents in the case of redesign use normally 3D scanners when they have a product without electronic the corresponding file. The product is scanned to facilitate the work of the designer to place the product in an electronic file, and then they modify it, upgrade, change the product.

According to 3 experts, 3D scanning is also an important tool for 3D anthropometry area, where instead of products, people are scanned. This way, one comes to the development of product designs and working environments with the use of 3D digital human models in static or dynamic simulations.

According to one interviewee, human 3D scanning allowed a technological leap in the field of anthropometry. It was around the year 2000 that the use of laser scanning for capturing the human body in space started to become more active. The technology has been developed to the point of being able to withdraw anthropometric data from the scanner and now allow obtaining more complete data, more precise information to be applied in design projects.

The expert said the interest in using this technology in design, is the use of a scanned file of a person, because it enables to view the project differently. There is another perception of the environment with a 3D human model inserted. This is completely different than if observed in orthogonal views. With 3D files it is possible to see more information, look at other issues that would not be noticed without the human model.

Interesting information that was highlighted by respondents in relation to this tool is that with it, the researcher can criticize the projects that he elaborates. They give information and allowance for this, which can help the designer to constantly improve the way they work.

Motion capture

For interviewees, as one must know the human shape in space, the designer is required to understand the human motion space. This association with the movement of the captured scan is considered quite interesting ambiance in the project. How 'ambiance' respondents meant the issue of workflow, the movement of workers within the environment studied, as inside a cabin, in the operation of a car etc.

This tool is widely used to integrate the motion captured 3D digital human models, enabling the animation of people. When this human model is derived from a 3D scan, it can give the human model, its own handling characteristics. Note that each person possesses, besides its physical identity, a kinematics identity.

Some interviews highlighted that motion capture can also be used in ergonomic design, usability, social sector projects, where products are designed to help people with special needs, or in sports, when the designer designs tools to help the practice of certain activity or sport athlete in training.

> "The motion capture has a greater influence on the development [of the project]. It will give parameters to change many things."

Without the information provided by these devices, the designer works more intuitively. With them, designers have at their disposal concrete data for use in design. One respondent said that almost every project has interactivity with the product, the tool and the human being. If product demand specialized or complex movements, they need to measure the force applied by the user, they make a biomechanical analysis.

Of the three different tools mentioned in this paper, the motion capture is the least used in the project, as many designers only work with mechanical models, which have predictable movements. That has been changing due to the use of game consoles such as the *Kinect*, from *Microsoft*, who popularized the motion capture.

Demand

The range of customers attended by respondents range from micro to large enterprises. According to the interviewees, micro and small enterprises rarely have the technical data of their complete products.

"Oftentimes is the owner or manager who dominates the production of the product, and then the project is only in his imagination, or are presented primitive drawings, which the designer has to interpret and then modernize."

It must be provided help and information for this class of entrepreneurs who are less fortunate, who have less access to these technologies and use a very precarious technological craft. Another point raised is that, by being placed in institutions and/or government laboratories, partnership with private company completely changes the designer team timing. This happens internally in the project; the team is pressed to suit the response time of the productive sector, and must meet their deadlines.

Customers knowledge level

According to experts people currently have a very large level of information, since there are many available data about new technologies on the Internet. In other situations the client knows how some machines work, but does not seek the service because they find that type of service is beyond the level they can afford.

One respondent mentioned that today many clients send 3D files of their products, some of them already know some free modeling software. It was recalled that around

2003, when it was hired the services of designers, the project was sent drawn in a paper.

Conclusions

From the advent of access to information, it is possible to imagine that some technologies spread are going to be revolutionized very soon. Some research groups are currently engaged in making people have access to their researches, putting their doubts, their questions about the project and information. The Internet can provide the international exchange of data and democratize information, as has happened to many softwares.

It is necessary that designers understand the limits of their profession, that is, from their academic background, must understand precisely what is design, to finally meet not only the technology available, but also take them into the design process. Instead of seeking a function from the tool, use it and enjoy its maximum on a possible solution.

Additionally, with the ease in generating 3D data and the growing demand for additive manufacturing technologies, there is the possibility that these technologies become cheaper and more accessible. On the Internet, through crownfunding sites, one can buy homemade machines for about US$200.00. The additive manufacturing technologies have become popular, and there are Brazilian offices and design firms buying machinery, instead of hiring the service.

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Developing (architectural) design knowledge: A learner-researcher study

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Abstract: *While design researchers use diverse approaches to study designing, non-designers face specific impediments in adopting these research approaches in their quest to gain design knowledge. Recognizing such challenges, this paper outlines how one education academic engineered a first-person methodology to investigate the nature of designing. Through undertaking a learner-researcher study in an undergraduate architectural design basics subject, learning about design through learning to design, she tracked her developing design ideas and crystallized a view of architectural designing as a three-phase heuristic for value selection: imagining possibilities, interpreting ideas to form architectural principles and distilling quality. Her subsequent small-scale test of this value-selection design heuristic in recent cases of architectural design provided preliminary affirmation of its viability. This paper concludes by speculating on various research directions arising from this learner-researcher methodology and a view of designing as value selection and, in particular, provoking consideration of how similar developmental data might be collected and analysed for explanatory insights in diverse design and educational contexts.*

Keywords: Architectural design knowledge, first-person research methodology, learner-researcher, value selection, design heuristic.

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Approaches to gain knowledge about design

As a non-designer and education academic, there is an opportunity for me (first author) to fill a gap in how design knowledge has been gathered to date. Before outlining how I might achieve this, I begin this paper by describing some of the ways in which data about designing has been collected previously. Analysing why these approaches were or were not available to me, I outline how a methodology was engineered to learn about the nature of designing. I acknowledge upfront that this work was undertaken as part of a doctoral investigation (Golja 2011) under the research mentorship of my doctoral supervisor (second author).

Interview study

When undertaking interview studies, researchers seek to elicit participants' recount of, reflection and opinion on their processes, observations, views and experiences. For example, Björklund (2013) and Cross and Clayburn Cross (1996) gathered data through interviewing professional designers to study design expertise. That was also Lawson's (1994) approach when he undertook in-depth interviews with eleven distinguished architects, arguing for the usefulness of knowing how a few outstanding architects work and think. However, Lawson had previously developed a design model (Lawson 1990) which became the basis for how he subsequently framed his interview questions. Using that interview data, he wrote detailed case studies and examined them against his particular views of designing. In contrast, unlike these researchers (Björklund 2013; Cross and Clayburn Cross 1996; Lawson 1994), design is a discipline outside my area of expertise and experience. I would therefore be confronted by the dilemma of which design meaning or approach to select from the various ideas that different designers would put forward. So, it would be very difficult, if not impossible, for me to attempt to identify designing in such interviews: I could not examine design as it actually occurred.

Addressing this problem of distance, Loukissas (2008) conducted a series of sixty in-depth unstructured interviews in situ with design practitioners whilst at the same time gathering related data from "observations, simulations, journal articles, technical papers, books, images, and popular media" (p. 41). Collecting such material over a period of one year, he not only studied design artefacts but also tested personal conceptions of design in various ways. Though such data, together with the interviews, enabled Loukisass (2008) to gain snapshots of designing in operation, this approach would provide me with very limited opportunities to witness design development and, therefore, the actual process.

Archival study

In archival studies, researchers access documents and artefacts as traces of ideas, observations and experiences from the past, and they use that data to interpret events and evaluate particular ideas. Innovative buildings, for example, are often richly documented cases of designing with extensive material published in different media. For one case, 30 St Mary Axe in London, such archival data included a video documentary (von Arx and Müller 2006a), published accounts (Powell 2006), visual data (Foster 2007; Gregory 2003; Jenkins 2007; Powell 2006), models (Hwang et al. 2006; Powell 2006; Stacey 2004; von Arx and Müller 2006b), participant accounts (von Arx and Müller 2006b), interviews (von Arx and Müller 2006c) and monographs mapping historical developments in that firm's projects (Foster and Partners 2005; Jenkins 2002, 2004, 2007, 2009). On the other hand, Schön (1981, 1983, 1984, 1985,

1987) used archival material drawn from design education to study designing. The chosen event was taken from the Architectural Education Study (AES) which undertook ethnographic observations of learning and teaching in various design studios over six-month periods (Porter and Kilbridge 1981a, 1981b). It was Roger Simmonds' (1981) AES fieldwork of a professional graduate degree course from which Schön selected data: a single audio-recorded design dialogue. He produced a long transcript of that design encounter between a teacher (Quist) and his student (Petra), subsequently analysing it for insights into designing. Though this approach was also open to me, I recognize that such archival material (including any primary sources) is already layered with interpretation and constrained in ways that might not be evident: specifically, in the varying and particular perspectives selected as data sources, the media or techniques used to collect that data, the extent to which such data represented the rich contextual influences at the study site and in the reporting of data. As a non-designer, it was also not possible for me to corroborate designing in such archival material unless I already had well-developed insights.

Observational study

When researchers carry out observational studies they collect data in situ and in real time, engaging with the everyday activities of the group they are studying, as Bucciarelli (1994) and Vinck (2003) did in their investigations of how engineering design occurred. Observing design practitioners in their natural settings is what Yaneva (2005, 2006, 2009) also did in her ethnographic studies of Rem Koolhaas' Office for Metropolitan Architecture (OMA). Bemoaning that buildings were not investigated in the process of planning and designing, she wanted to shed light on "architecture in the making". There would be challenges, however, for me to gain such access to professional practice. Similar studies, though in other settings, have observed students learning to design: for example, as Simmonds (1981) did in his ethnographic study of a graduate studio class and as von Buttlar (1981) documented in his fieldwork observations and chronological account of day-to-day development in an eleven-week design studio. For me, that more familiar educational context would make it possible to gather data as designing took place and was supported by designers. However, it is not immediately apparent when designing actually occurs for these practitioners or students and there is difficulty in knowing how much designing is actually visible. Observations of the interactions and conversations between designers and with materials might be strongly bound to one particular context and time. As an observer, therefore, I might not be privy to various psychological processes knowable and accessible to the design practitioner or student. Furthermore, an observer's experience or lack of experience of designing could overlay or even distort this evidence in ways that might be difficult to detect.

Participatory study

In participatory studies, researchers become active participants in and the subjects of what they are studying, gaining first-hand experience and therefore access to developing insights. For example, Pedgley (2007) devised ways to collect data that elicited specific elements of his design activity amendable to verbal accounts. Researchers at the Spatial Information Architecture Laboratory also had such a research agenda in mind for their Australian Research Council funded project, Embedded Research Within Architectural Practice (SIAL, RMIT 2006). There, participating architect-researchers formed up distinctive investigations within different

and unique practices to understand how innovation and development could be supported in contemporary architectural designing. One participating architect-researcher, for example, gathered data naturalistically "to capture the background, current conditions, development and environmental interactions of … [her] role as an architectural designer in a firm whose practice is increasingly engaging with digital media" (Benton 2008, p. 50). Likewise, a participatory study, carefully chosen, could give me direct, real-time access to gathering data related to the processes of design and its development. At the same time, it would be possible for me to test the worth of any of my developing insights in the real-time context in which they arose. So, this participatory approach seemed promising as a way for me to gain knowledge about the nature of design.

To shed further light on particular strengths and weaknesses of such first-person studies, I consulted two related and well-established research traditions. Both self-experimentation (Altman 1987; Martinelli, Czelusta and Peterson 2008a, 2008b) and autobiography (Clements 1999; Lancy 1993) provided evidence of the power of these methodologies and highlighted particular challenges that needed to be considered and addressed: for example, the complexity integral to a first-person naturalistic study, particularly with the unlimited access to the researcher-subject's observations, thoughts and ideas, the potentially large, comprehensive data set and the inherent noise operating in this real-life setting. Though I subsequently adopted a first-person research approach to gain design knowledge, I customized it in ways I now describe.

Developing a first-person methodology to gain design knowledge

My background in Education (formerly as a teacher and more recently as an academic supporting learning and teaching in a university) and my strong interest but lack of previous formal study in Architecture pre-disposed me towards undertaking a first-person study in architectural design. In essence, I set out to gain knowledge about the nature of design through learning to design, becoming a learner-researcher.

In taking account of my limited experiences of architectural designing and so as to hedge the chances that I might learn to design successfully, or at least gain useful insights into designing, what was needed was a context within higher education in which I could grow, first-hand and in real time, an understanding of design. All these considerations suggested participating as a mainstream student in a first year undergraduate architectural design subject. To locate a suitable subject, I consulted with colleagues at my university's School of Architecture. The objectives of Architectural Design: Design Basics, a core first year design subject, supported my focus on seeking to understand designing. I subsequently became a fully participating student in this design basics subject, learning alongside other students.

In a novel study such as this, it was crucial to identify, address and therefore diffuse the ethical risks involved, not only for me but also for the students and academics who would be participating in the subject and, therefore, in the research context. For example, in reporting this research, I recognized and acknowledged all references to students' and teaching staff's contributions to my learning to design, as is academic practice at my university (Assessment Procedures Manual UTS 2001/2010). Students and teachers could choose whether such acknowledgement was by real name or pseudonym, reflecting recent research practices that argue for participants' right to be identified and thereby safeguarding their ownership of work (Kelly 2009; Tilley and

Woodthorpe 2011; Walford 2005). This study's context was also identified, to highlight its particularity and to avoid implying its generalizability by dislodging it from its particular history and geography (Nespor 2000; Walford 2005). Indeed, many scholarly architectural design communities accept and practise such protocols (for example, Hensel and Menges 2006, 2008a, 2008b; Sunguroglu 2008).

During the fourteen-week semester, as both researcher and subject, I had unlimited access to when data could be collected. So the contexts in which I found myself, both within the formal arrangements of the subject and in the activities of my life more broadly, provided diverse opportunities to learn about design. For example, as part of my academic life I attended public seminars where practising architects talked about their processes and projects. To keep track of and document my learning to design over the semester, I gathered various data including:

- Subject documentation such as subject outline, studio handouts and assessment guidelines
- Extensive audio recordings of lecture and studio sessions
- Notes I made during lecture and studio sessions
- Selective video recordings during studio sessions, including of other students' designing, when and if I felt it might help my own learning
- A journal in which I recorded extensive chronological field notes of my own thoughts, questions, observations and ideas as they occurred, and in such a way as not to disrupt the designing itself
- Design artefacts I made including drawings and models as well as digital photographs I took at various times to document consecutive development of my modelling
- Formal assessment submissions and formal written feedback
- Records of various related experiences outside of formal learning in Design Basics
- Video recordings of a series of four conversations held individually with students on completion of this subject to elicit their experiences and views of designing

Amassing a large, complex dataset, I developed a system to organize this data in such a way as to enable ready access, comparison, interrogation and referral.

As a learner-researcher, I used that data to track my own designing in the context of my class community's learning over time, how my architectural design ideas were tested and the nature of any progression that occurred in my thinking about design. Furthermore, to preserve the integrity of the research in its reporting, I organized the reporting of my findings according to the key milestones marked out as the subject assessments. As each milestone section of the account was written, I could analyse it for evidence of my ideas about design, focusing on my development and critique of those understandings of design. By attending to such detail, I was able to write a careful descriptive and analytical case study of my learning to design. As such, this extensive account was cumulative and developmental (see Golja 2011).

So, in this first-person study, I set out to investigate: What insights into design, if any, can I gain as a learner-researcher in an undergraduate architectural design basics subject? Design Basics was studio based, with students undertaking a project-based design exercise. During my participation this project involved designing a weekender for a particular client in a specified location and on a defined site. Here, I report the key findings of this learner-researcher study.

Gaining design knowledge through learning to design

My analysis of data from the early weeks suggested to me that I had a view of designing as developing the fit of my building idea with the client's expressed needs and desires. To create this fit, it appeared to me that I was eliciting, analysing and enacting qualities important to this particular client.

In subsequent weeks, my analysis indicated that development of ideas over time were integral to designing. Indeed, it became increasingly clear to me that designing did not entail instructions, nor could the design be known a priori. Rather, ideas emerged as we were designing, and these ideas developed through testing, modifying and refining. I also began to recognize various contextual influences shaping my design ideas, factors that I was taking into account to enhance fit between the client's and my design ideas.

Over the final weeks, I was able to form a developmentally coherent view of designing as three phases, a view that made clear the changes in my ideas about designing over the semester. I identified and described these three phases through which I came to appreciate that my ideas about designing passed in this way:

Imagining possibilities

In learning to design I sought inspiration from various sources and in different ways. Designing encouraged me to be open to experiences, opportunities and changes, to observe my surroundings and to scout into new areas. Such explorations were driven by an enquiring urge that gave rise to copious questions over the 14 weeks. Once such questions were made explicit, I noticed that new ideas emerged to be explored and investigated for their fruitfulness, through engagement in a broad and rich communal setting. Such engagement occurred, for example, through,

- An iterative process of meeting with *the client*, exploring possibilities together in conversation;
- Analysing *the site* map, its particular topographical features, as well as using first hand experiences of the site's *location*;
- My own experience and access to the work of others, becoming aware of the pivotal role of *media and technologies* in designing;
- Comparing *other students' interpretations* of the same client's brief with my own, noting similarities and questioning differences;
- Immersion in the immediate physical environment, closely observing *objects* of importance or interest to us*;*
- Becoming familiar with the *work of architects preceding us*, recognizing this inherited pool of architectural ideas could be used to learn from, to think with and to generate contemporary possibilities;
- A growing awareness of *diagrams* and their potential as a generative technique;
- Considering the potential of ideas originating in *disciplines outside Architecture*, exploring by way of interpretation and experimentation; and,
- A seemingly insatiable curiosity in attempting *to meet design challenges*, and venturing beyond what I knew, for example, in exploring ideas about curvature that challenged square box housing.

In all these ways, as we engaged with diverse opportunities, possibilities could be imagined.

Interpreting ideas to form architectural principles

I recognized design ideas in the studio setting had their roots in these early explorations and imaginings. Initial ideas were interpreted and represented in architectural terms, through form and shape. I noticed, as I experimented using various media, that modelling enabled greater fluency in my transition to working with ideas in spatial ways. From such interpretation and exploration, I generated curving forms.

From an initial curiosity about architectural design as a conceptual process, I came to understand architectural design as a particular way of carving up a space, where concepts in design were organizing principles or broad patterns. On that view, a concept organized and structured spatial thinking in designing. Once we had generated a concept for a particular project, questions and possibilities emerged that began to constrain the choices we could make and subsequently, how a building idea developed under contextual influences (developing fit with client and environment). In other words, we interpreted and tested various emerging ideas and influences against this concept for fit and relevance, and so, concepts acted as a useful constraint in our designing. I came to observe how concepts offered a rigorous way of thinking about a spatial idea, for exploring possibilities and guiding development.

Through my exploration of curvature, I sought to understand the spatial principles that could guide the development of such organic forms. I had organized and structured these curving spatial ideas so they expressed a sense of flow and movement, a welcoming gesture, as they encompassed the natural bush environment within their spaces. However, such structuring seemed to lack rigour. Though I did not know what spatial principles might shape curving forms in architectural designing, I speculated that these values would not originate from Euclidean spatial rules. I came to recognize that spatial principles were dynamic: that conceptual development in architectural designing was influenced by broader cultural knowledge and change, for example, of materials, technologies and theories. Such exploration of spatial ideas and concepts provoked insights into how designing development seemed to occur, in my own designing over one semester and in the discipline of Architecture over longer time spans.

Distilling quality

From one project brief, we were to generate many and diverse ideas over the course of our designing in this subject. In developing our design proposals, clearly we were selecting some ideas and discarding others, as were the teaching staff. Therefore, we were making value judgements (whether tacitly or explicitly) about the ideas we were generating and the choices we were making: for example, what was good about particular ideas, what was not; what was working, what was not. In our designing, as these selections seemed to be made for their particular worth or value, our design ideas developed in particular ways: through processes of analysing and testing these values, modifying and rethinking, refining and making changes.

In the first week of my learning to design, I wondered how the conceptual process in architectural designing occurred. Much later, serendipitous events exposed me to various broader conceptual shifts that had influenced Architecture. I came to understand knowledge, in itself, as value choices, and so, such conceptual shifts represented value change or development. Similarly, in our designing over the 14

weeks, our design concepts also underwent many changes; their qualities were tested in various ways and developed. For example, our early design ideas aimed to develop initial fit with the client and we took a proactive approach to elicit, analyse and enact values important to our client. Then, I began to conceive how contextual influences could enhance this fit between the client's and my design ideas. In such development over time, our design ideas were subject to tests and from such tests we could begin to generate criteria for being able to recognize the quality of our design choices. For example, I reviewed the client's and the tutor's responses to my design idea and clearly, I took their value judgments into account in my subsequent design decisions; my early investigation into curvature had seeded questions about judging quality; and, perhaps most poignantly for me, when I could not generate the architectural criteria on which to judge my curving design idea, I radically changed my design concept. I adopted a new concept which, when subsequently put to architectural tests for quality, failed.

On this view of designing, I came to recognize that when the academic teacher discussed our learning to design, he was actually describing a process of distilling quality over time. He provoked us to consider *why* we were designing in the way we were and the choices we were making. He urged us to interrogate the architectural ideas we were inheriting, as Venturi did in challenging modernist values with their absence of cultural meaning and contextual relationship. He took opportunities to expose us to how, historically, architects had imbued their architectural designs with particular qualities: for example, values such as beauty, form, emotional effect. So, I came to understand how, through designing, such broad values were interpreted to form coherent, rigorous architectural principles. We were encouraged in our designing to interrogate how different qualities *might* be conceived and evaluated and subsequently, how we might test the architectural interpretation of the value itself. In essence, it seemed to me that criteria surfaced during the process of designing for, in that dynamic context, values could be examined, and re-examined, over time.

So I came to understand that designing intimately concerned the quality of what was designed, quality that was distilled over time: so designing was not only about a process, about development or reaching a solution. Rather, designing involved making explicit why particular choices or decisions were selected as values and realized and it involved judging quality by testing in the physical and social world. Of course, quality could be judged solely on internal criteria (what the academic teacher termed "self-referential": testing that occurred against geometrical criteria). However, this self-referential testing seemed to signal a deficit view of architectural design, lacking external value tests. Paradoxically, such designing failed the most fundamental tests of quality at the individual and collective (or societal) levels (for example, designing could ignore the client's core desires, as some students had done when they unsuccessfully presented their initial design ideas to the client).

Essentially, then, by being a learner-researcher in an undergraduate architectural design basics subject and progressing my views of designing over the weeks of studying this subject, I was able to refine my view of architectural designing to develop a three-part heuristic of imagining possibilities, interpreting ideas to form architectural principles and distilling quality (Figure 1). As such, this view of architectural designing is a heuristic for value selection.

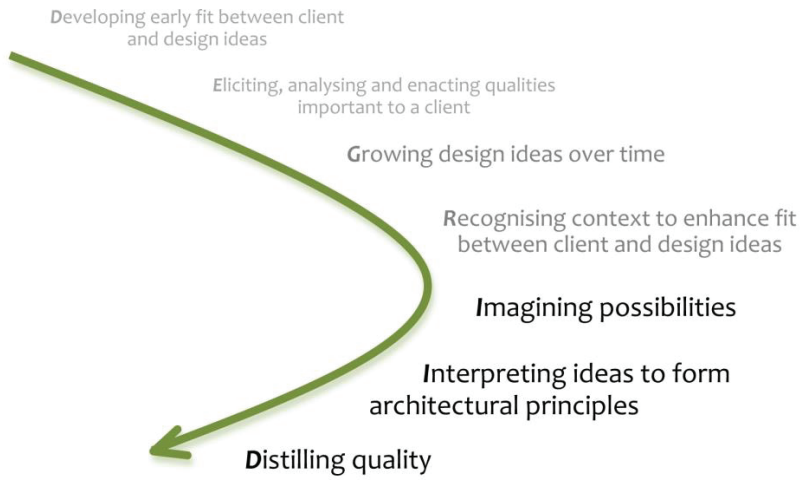

Figure 1. My value selection heuristic of architectural designing. Source: Golja 2011.

The detailed evidence of this learner-researcher account legitimizes such a view of designing and the idiosyncratic pathway by which it crystallized. However, it was then necessary to test its broader viability. I did so by analysing whether this particular design knowledge, gained through learning to design, could also describe and explain architectural designing more broadly.

Testing the viability of my design knowledge

So as to perform a preliminary, small-scale test of the viability of my value-selection design heuristic, I selected a small number of recent cases of architectural designing, conceived and realized at the cusp of the twenty-first century, where I could access designs and design development by way of extensive archival material (including commentary on designing events from different perspectives). So that my small set of test cases might be as representative and diverse as possible, I decided to include architectural designs with different cultural and environmental contexts, different uses or functions and different project scales. Based on this criteria, three cases were chosen: Beijing's National Aquatic Centre for the 2008 Olympic Games (the Watercube); 30 St Mary Axe, London; the Modern Education and Training Institute (METI) School, Rudrapur.

There were obvious constraints and limitations of this archival approach. For example:

- I could access only selective and, in some places, fragmented and necessarily subjective records of designing as development over time.
- Accounts might have been written retrospectively thereby neglecting possibly significant fine-grained detail while designing was occurring, at best possibly jeopardizing chronological accuracy, and at worst, risking presenting a different story.
- The discourse of professional architectural designing might have masked the struggle that such human activity encompassed and instead, may have emphasized particular successes or failures as end points.

Nevertheless, from the detailed and rich archival data available for these three cases, I could track development using both designing events and design artefacts to write detailed case studies (see Golja 2011). From those accounts, I gauged whether such designing could be recognized as value selection. What follows is a brief analytical summary.

1. National Aquatic Centre, Beijing

The design of the National Aquatic Centre for the 2008 Olympic Games had its genesis in playful exploration of the fundamental element of an aquatic environment: water. The state of water became an inspiration for organic curvilinear forms, wall features, entrances and cladding. However, given the cultural location of this Olympic venue, traditional Chinese geometries of axial arrangement and rectilinearity were deemed important and explored in relation to this Aquatic Centre's historical precinct. Clearly, the Watercube designers imagined possibilities.

Key contextual factors (such as light, heat, acoustics) were subsequently identified, influences against which these early ideas of water and square form could be further tested. Indeed, such influences provoked ideas about an insulated greenhouse with its structure in a cavity and ETFE as cladding material. As design ideas were being investigated and refined, the choice of an innovative structure became crucial. A novel structural system incorporating space and façade was conceived architecturally from previous design explorations of bubbles and recent concepts derived from theoretical physics. So these designers interpreted crucial ideas to form architectural principles. As they tested their evolving imaginative and architectural ideas against various contextual and cultural factors, they distilled quality in their developing architectural concept which went on to receive public recognition and be awarded the winning entry in this prestigious Olympic design competition.

Throughout this contingent, iterative process of the Watercube's early designing over time, evidently, different possibilities emerged and were explored and tested architecturally, before being selected on the basis of their value. In essence, I could recognize the designing of the Watercube as a case of value selection.

2. 30 St Mary Axe, London

The historic site of 30 St Mary Axe created particular architectural opportunities, bringing together three distinctive agendas. The historical significance of an urban setting, a client's drive for innovation and sustainability and an architectural firm's conceptual development of ideas (articulated and realized in their previous projects) acted to ignite early imaginative possibilities for a skyscraper.

Initially, client-based desires and aspirations shaped the architects' form-finding experiments, generating non-conventional complex forms. Social spaces, a key design priority for this architectural firm, were then explored as atria in those forms and such ideas were shaped aesthetically by economic considerations. Over time, curvaceous forms, a spiralling language generated by rotating atria, viable construction of floor plates and a simple complementary structural logic emerged as architects explored and interpreted various social, environmental and economic agendas to fuel ongoing design progression and new possibilities.

Parametric modelling enabled designers to create and test dynamic models to better understand the qualities of these complex geometries. As testing occurred on these developing architectural ideas, particular aesthetic principles were also explored, selected and refined to distil quality. For example, qualities initially tested intuitively

were then examined technologically as parameters for elegant curvaceous forms, for ecological benefits, for a feasible structural system and for an economically viable program.

Again, this second case of designing resembles a value-selection view of design. In developing the concept for 30 St Mary Axe through intensive modelling, various agendas were taken into consideration to trigger innovative possibilities. Such values were interpreted as, for example, aesthetic principles in form, structure and program. These qualities were then refined when design ideas underwent further tests (for example, of feasibility, viability, sustainability and profitability) and were modified. Therefore, in this second case, I can also recognize designing as value selection.

3. Modern Education and Training Institute (METI), Rudrapur

The design of the METI School arose from a series of fortuitous events. An architecture student's early experiences in a foreign community awakened particular cultural sensitivities. Then, opportunities in her architectural studies enabled continuing pursuit of her interests and concerns for this community through designing, in particular, a school. In these fertile environments, possibilities emerged and were imagined.

As she designed the school, this student identified qualities important to the village community, the local educational system (METI) and the children. She explored these qualities architecturally against a wash of her own personal views and experiences. For example, having articulated a concept of beauty as sustainability and harmony with the ecosystem, she used this concept to re-examine the use of local materials and resources. For her, designing involved generating fit between the community's desires and their ecological sustainability (including economic self-sufficiency and environmental balance). So, in reconceiving endogenous resources (mud, bamboo) and generating a novel structure in collaboration with another architect, she clearly interpreted ideas gained from her cultural and educational experiences to form architectural principles. Once such design principles were deemed to have been successfully enacted in the METI School, they were utilized by the community in other building projects. So, in designing to respect the sustained growth of local identity, testing her architectural ideas against various cultural responses and support of a community's development, she distilled quality.

The METI School and the designs it subsequently generated also illustrate how the process of values development can occur in designing. Cultural qualities were made explicit and examined. An imaginative, architectural re-interpretation of such qualities generated new principles for designing. These principles provoked value change in a community and the creation of a new knowledge system. (For example, children were learning in a built environment that itself was an innovative embodiment of new community values; more broadly, the community used the new architectural principles to drive their own development.) This third case affirmed designing as value selection.

Just as my view of designing anticipates a developmental pathway (shown in Figure 1), influenced by contextual factors and individual agendas, so too, the designing in each of these three cases, through responding to various influences and opportunities, set distinctive trajectories. Furthermore, in each unique case, a value-selection heuristic could describe and explain how designing occurred. Therefore, the evidence I found suggests that a view of designing as value selection was viable in contemporary architectural designing (to the extent that these three cases represented it).

Conclusion

Of the wide range of possible research approaches to gain design knowledge, a learner-researcher approach was ideally suited for me, as an educator, to be able to gain insights about design in an unfamiliar discipline. Indeed, just as I had engineered a methodology to undertake research outside my field of expertise, so too have other scholars undertaking design research: for example, Lyon's (2009, 2011) studies, as an "outsider" researcher, in the Centre for Excellence in Teaching and Learning through Design (CETLD), illustrating how it is possible to engineer a range of different methodologies appropriate to the circumstances of particular researchers. I was able to locate one other leaner-researcher study in an educational setting (McGinn and Boote 2003), although the learner-researchers in that study were not novices, as I was, but expert mathematicians who chose to study problem solving by enrolling in an undergraduate history of mathematics subject.

In my study, I acknowledge that I could only approximate the experience of a real student. (For example, I was only studying one subject and could not benefit from complementary insights from other subjects as other students did; and no matter how genuinely I tried to assume the role of a student, the subject teaching team was aware, in the final analysis, that I was not a student.) Nevertheless, I believe that the approach had integrity in that I was and felt that I was, in every sense, a learner in this subject context and the subject teaching team, as well as other learners, could see that I was. Though this methodology can be demanding, further learner-researcher studies, where such an approach has integrity for researchers, would complement the single perspective I have reported here and provide further valuable insights for academics and for professional practitioners.

As already noted, I am not a designer nor an architect, although I have undertaken a preliminary test of my view of designing as value selection by consulting available accounts of three recent architectural designs. Other studies, undertaken in different architectural contexts, have also viewed designing as having an important valuing component (for example, Beinart 1981a, 1981b; Billings and Akkach 1992; Lera 1981; Loukissas 2008). Design scholars might now examine my view of designing to see if they agree with it or whether it needs to be modified or extended. In fact, design scholars may wish to revisit the findings of these two studies as set out in my data (Golja 2011) to see if they affirm, reject, modify or extend my interpretations. Such undertakings could provide fruitful ways of triangulating and/or corroborating the design knowledge I gained through these two studies. These suggested research directions could also provide these scholars with valuable learning, teaching and research data.

At core, my value selection heuristic – in which I crystallized the three components of imagining possibilities, interpreting ideas to form (architectural) principles and distilling quality – attempts to explain how designing occurs, and thereby lays the ground for theory development. Here, in my learner-researcher study, I reported on development (or progression) in designing. To do so, I engineered and used a research approach that sought to detect designing development as it occurred over real time. Other researchers in various designing disciplines have chosen to gain insight into development in a different way: by investigating specific snapshots of development – novices, design graduates or expert designers – and comparing the designing of these different populations (for example, Atman, Chimka, Bursic and Nachtmann 1999; Bonnardel and Marmèche 2004; Kavakli and Gero 2002; Seitamaa-Hakkarainen and Hakkaraninen 2001). Now, overarching developmental explanations of designing are

needed that will go some way towards unifying research findings from these differing approaches. Whilst it is difficult to induce a resilient theory from my developmental data, on its own, my investigation can provide a small exemplar of how such data, required for theorizing, might be collected and analysed for explanatory insights in diverse design and educational contexts.

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Informal peer critique and the negotiation of habitus in a design studio

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Abstract: *Critique is considered to be a central feature of design education, serving as both a structural mechanism that provides regular feedback, and a high stakes assessment tool. This study utilizes informal peer critique as a natural extension of this existing form, engaging the practice community in reflection-in-action due to the natural physical co-location of the studio environment. The purpose of this study is to gain greater understanding of the pedagogical role of informal critique in shaping design thinking and judgment, as seen through the framing of Bourdieu's habitus. The methodology of this study is informed by a critical theory perspective, and uses a combination of interview, observation, and stimulated recall in the process of data collection. Divergent viewpoints on the role of informal v. formal spaces, objectivity v. subjectivity of critique, and differences between professor and peer feedback are addressed. Additionally, beliefs about critique on the individual and group level are analysed as critical elements of an evolving habitus, supported by or developed in response to the culture inscribed by the pedagogy and design studio. This form of critique reveals tacit design thinking and conceptions of design, and outlines the co-construction of habitus by individual students and the design pedagogy.*

Keywords: Critique, habitus, design studio, peer assessment, reflection

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Introduction

The role of self-reflection with a design artifact or problem is widely acknowledged as an important factor leading to developing as a designer (Schön 1985; Cross 2007). This self-reflection can take many forms, including internal dialogue (Schön 1985), sketching (Do and Gross, 1996), and a community of practice surrounding the designer (Brandt, Cennamo, Douglas, Vernon, McGrath, and Reimer 2011). Within the studio environment, I propose informal peer critique as a natural extension of these existing forms, engaging the practice community in *reflection-in-action* due to the natural physical co-location of the studio environment.

This paper will address critique as an emergent epistemology within the design studio environment, socially constructed through a synergy of interaction between peers, individual design of artifacts, and Smith and the supportive role of the underlying design pedagogy. In this context, Bourdieu's construct of *habitus* will be used to describe the social norms (Anthony 1991; Boling and Smith 2010) and epistemological structures (Shaffer 2003) that comprise the studio, which functions as an organism or system that supports the development of student designers.

Critique in Design Education

Critique has long been considered a central feature of design education (Hokanson 2012), serving as both a structural mechanism with which to provide regular feedback (Cennamo, Brandt, and Scott, 2010), and as a high stakes assessment tool (Anthony 1991). Critique is represented in the research literature primarily in formal pedagogical implementations, ranging from an informal desk crit (Boling and Smith 2010; Reimer and Douglas 2003) to a formal critique attended by multiple professors and practitioners that comprise a "design jury" (Anthony 1991; Webster 2006). Hokanson (2012) synthesizes this wide range of critique as a form of distributed learning and evaluation, which occurs through social interaction and engagement in the design studio, while Percy (2004) notes the role of critique as a socializing and enculturation device in design education. The role of developing appropriate patterns of communication about design has been a minor focus, including the development of practice-oriented discourse (Logan 2008; Morton and O'Brien 2006) and a discourse directly surrounding the critique and feedback process (Dannels, Gaffney, and Martin 2008), but the amount of work in this area is limited. Some comparisons may be drawn between critique and assessment, particularly in more formal implementations of critique (e.g., pin-ups or design juries), but informal critique appears to be more emergent, mirroring the professional obligations to communicate and externally reflect with peers (Hokanson 2012), rather than as formative or summative assessment. While some authors have addressed critique that happens outside of the strictures of the design classroom, which is often led by instructors, this area of social life in the studio has not been comprehensively studied or evaluated in its own right.

Bourdieu and Habitus

The work of Pierre Bourdieu has been invoked relatively infrequently in the realm of design education, although his work has been used on a few occasions in architectural education to discuss the social climate of the design studio and the shaping effect of the pedagogy (Stevens 1995; Webster 2006). The primary Bourdivin concepts that have been addressed in the literature heretofore include the concepts of *habitus, fields*, and *doxa* (see Figure 1). These concepts are covered at length in *Distinction* (Bourdieu,

1984), and in condensed form in a summary oriented toward design education by Stevens (1995). I will provide a baseline definition of each primary construct to shape the overall conversation of peer critique within the design studio, although this treatment is not intended to be comprehensive.

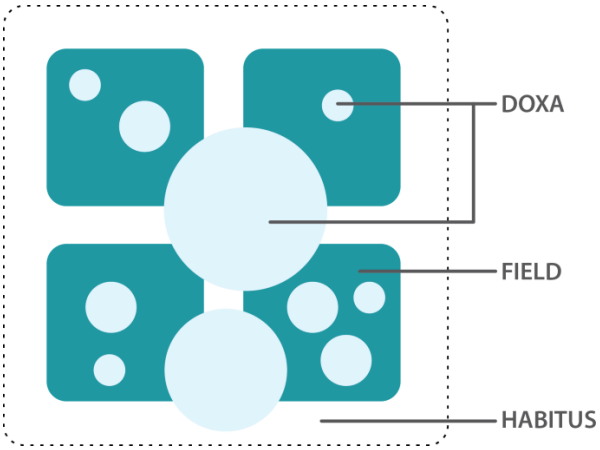

Figure 1. A visualization of how habitus, field, and doxa relate. Doxa may overlap several (or all) fields within a habitus.

Habitus describes a construct that is both individual/psychological and social, and through this individual to group relationship, defines a given culture or set of social norms. It is an "active, unconscious set of unformulated dispositions to act and to perceive" that produces the "feeling" of a given culture or culturally derived space (in this case, the design studio) (Stevens 1995, p. 112).

Fields are the contexts and environments where these relations and norms play out. These fields, which can be intellectual, religious, educational, or appear in other forms, explain the varying actions of an individual when they are placed in different contexts, including the individual's awareness of and participation in underlying power structures (Bourdieu 1980).

Doxa is a combination of unstated, unconscious norms and beliefs that are seen by the individual to be self-evident or "common sense." As ideas move from the realm of the undisputed or undiscussed to matters of opinion, they move into the "universe of discourse" where heterodoxy and orthodoxy reside (Bourdieu 1977).

These constructs can be used to describe the enculturation that is seen as desirable in design education, as Stevens (1995) notes: "Habitus does not determine, but it does guide. Individuals are both completely free and completely constrained…" (p. 112). When approaching the design studio through this lens, we can understand the barriers to enculturation (Siegel and Stolterman 2008) that have already been established in various design disciplines more completely, and identify the divide between the habitus envisioned by the individual novice designer and the habitus that is socially formed and mediated by the surface structures, pedagogy, and epistemology (Shaffer 2003) as experienced between students and professors. Nelson and Stolterman (2012) come to a similar conclusion, stating: "The process of becoming a designer is not a solitary, individual under-taking. It always takes place within a design milieu." (p. 224).

Purpose of Study

Based on the framing of informal peer critique in the design studio, as mediated through the socially constructed *habitus*, the purpose of this study is to gain greater understand of the pedagogical and developmental role of informal critique in shaping design thinking and judgment. While critique is considered to be a vital part of the design studio pedagogy (Hokanson 2012; Shulman 2005), formal critique is often emphasized, with a strong delineation between an expert and novice within that domain (Schön 1985). This delineation reinforces a pedagogically centric view of *habitus,* while largely ignoring the role of the individual in shaping their own design perspective and approach (Crysler 1995; Webster 2008). This paper addresses the structures that are invoked during informal peer critique as compared to stated beliefs about critique, and how these structures may indicate a formation of habitus in opposition to or in support of the pedagogically assumed *doxa*.

Method

The methodology of this study is informed by a critical theory perspective, and uses a combination of interview and observation techniques in the process of data collection. A critical theory perspective allows the researcher to elicit responses for which the participants have tacit awareness (Carspecken 1996), and serves as an exploratory vehicle in understanding initial patterns of design thinking and critique. In addition, the use of stimulated recall allows the researcher to make sense of that participant's responses during the critique dyad and confirm and triangulate responses from previous interviews and observations.

Setting

The study was conducted at a large Midwestern USA university, focusing on students in a School of Informatics. These students were enrolled in a Master's program in Human-Computer Interaction design (HCI/d), which trains future practitioners in interaction and user experience design. The curriculum for this program includes courses in user research methods, prototyping, design theory, and foundational readings in the field. A majority of the students come from a non-design background, with students commonly holding undergraduate degrees in computer science, sociology, engineering, and journalism.

Participants

Participants were solicited through email, using separate departmental list-servs established for first- and second-year Master's students. A similar recruitment message was disseminated within Facebook groups similarly established for first- and second-year Master's students. All participants that requested to be part of the study were recruited.

Data Collection

A series of three interviews were requested from each study participant. These semi-structured interviews included an individual interview, a constructed critique dyad, and an individual stimulated recall and member checking interview.

Initial interview

The initial individual interview included questions relating to the participant's beliefs about critique, the ways they used and thought about critique in relation to their design process, and an autocritique of a self-selected design project that they had recently completed, or were in the process of completing.

Critique dyad

The second interview was a constructed critique dyad, comprised of two participants that were similar in ability and educational level. These participants were asked to critique the project that had been self-selected by their critique partner in turn, with each participant playing the role of critic and recipient. The projects critiqued in this session were the same projects that were used in the individual autocritiques.

Stimulated Recall

After transcription and initial analysis from these two interviews was complete, a third interview session was conducted, including stimulated recall and member checking. The recall session included the selection of five or six video segments from the participant's previous two interview sessions, representing either exemplars in a thematic sense, or segments where intent or motivations were unclear. After each segment was presented to the participant, a series of clarifying questions were asked. Primary themes from preliminary analysis of the data were discussed to clarify meaning and ensure that thematic and reconstructive analysis matched the perceived intent of the participant.

Analysis

The initial interview about the participant's belief about and practice of critique was transcribed and coded using an open coding scheme based on emergent themes. The observation of critique dyads was transcribed and coded using a one open coding scheme for the participant critiquing and another for the participant being critiqued, and complete results of this sequence analysis are included in another manuscript under review. The data from the initial interview and sequence analysis were analyzed, including a comparison of the autocritique to the peer critique to the designer response to note changes in verbalization of design thinking or rationale. Where contradictions or similarities were found in these analyses, discussion of participant reactions from the stimulated recall will be discussed.

Participants

Four participants were enrolled into the study, all of which were students in the HCI/d Master's program. These participants (Table 1) were equally divided between the first and second year of the program. Three participants were from the USA, while one participant was from China. The program as a whole was comprised of approximately 40% international students in the year this data collection took place, and all students had experience working in diverse teams through a variety of coursework. Because students of the same academic year had worked with each other previously, they were previously aware of the projects that they critiqued in the course of this study and had some knowledge of the design process of the related artifacts.

Table 1. Chart of study participants

Participant Name*	Gender	Academic Classification	Country of Origin	Critique Dyad
Paul	Male	2nd Year M.S. in HCI/d	USA	A
Emily	Female	2nd Year M.S. in HCI/d	USA	A
Lisa	Female	1st Year M.S. in HCI/d	USA	B
Jiao	Female	1st Year M.S. in HCI/d	China	B

**All participants were assigned a pseudonym.*

Findings

Beliefs About Critique

The participants' beliefs about the substance of critique ranged widely, even within a relatively small number of participants. These beliefs seemed bound not only to individual personality and design approach, but also to level of experience (e.g., first year or second year), and how each individual used the shared studio space.

Environment

While the researcher expected to find informal critique within the design studio based on a previous study, participants reported a wide range of locations where critique took place. These environments of critique included: classroom space before or after class (Emily, Lisa), email/chat (Lisa, Jiao), home (Paul, Emily, Lisa, Jiao), phone (Lisa), or outside while smoking (Lisa). The two second year students were enrolled in a capstone design course during the semester of data collection for this study, and also engaged in informal critique during the studio format of that course. All students had experience engaging in critique in a classroom setting that was led by a professor or advanced students, which, while not considered informal peer critique for this study, is important to note in characterizing the overall critique culture of the program and studio.

Participants

Study participants reported a wide range of people that were engaged in informal critique. Some participants used the convenience of the studio space to engage in critique with fellow Master's students and PhD students, while others appreciated the perspective of students outside the program. The people engaged in critique also seem to be bound to the environment of critique. For those who frequently worked from home (Paul and Lisa), a spouse or friend was commonly a critique partner, while for those who worked in the studio, engaging fellow Master's students in that space, or locating students from other programs in common areas was typical.

Embedded Structures

Based on the beliefs that were identified in the first round of interviews, several contrasts or binary oppositions emerged that are helpful to discuss critique in a more structural way. These contrasts include formal v. informal spaces, the role of subjectivity and objectivity in critique, and the divide between professor and student critique. These structures will be discussed in isolation, and then will be synthesized in relation to the development of *habitus* in the next section.

Formality v. Informality

Lisa created a significant divide between formal and informal spaces, concluding that "[the classroom is] sort of the place to like know that it's not about you, it's about the design, and it's more compartmentalized if you're actually talking about it in that formal setting." While she was the only participant that felt this strongly about the classroom space as a legitimized space for critique, her strong statement that "most real critique I reserve for the classroom" served as an important contrast to the beliefs and actions of the other participants. Paul saw this formal space of critique as reducing legitimacy, since it was done for a grade, and often done "for the sake of critique," explaining: "I'm offering critique for the sake of helping you, not necessarily because like this is a grade […] it's critique for the sake of getting better." Even while Lisa rejected the informal space of the studio as appropriate for critique, she substituted it with another informal space—outside the building, where she smoked and engaged in informal discussion about design with her colleagues. Lisa described the classroom—a formal space—as the environment where "the shit really hits the fan […] and that's where you expect it to be," but engaged frequently in informal conversations (often outside) that dealt with "big things—concept things, problem space things."

The binary of formal and informal spaces extends, based on these reflections, to the quality, legitimacy, and appropriateness of critique. While both of these participants were recipients of informal critique that had been helpful to them in their design process, Lisa saw the classroom as a safe, legitimate place for dissent, while Paul saw critique in that same formal space as *pro forma* and often inauthentic.

Objectivity v. Subjectivity

A tension between what constituted "right" and helpful critique revealed a number of important beliefs about the nature of knowledge that critique generates. While the participants as a whole believed that their critique (or the critique they got from others) was subjective in nature, they appeared to attach more utility to the generative or provocative nature of the critique than its conformance to objective criteria. Paul described this tension, explaining: "it's too hard to offer kind of a generalized critique […] like parameter-based critique," concluding "it's just too difficult to say […] I know all of this stuff enough to say that this is wrong and this is wrong and this is wrong, because there's no way you can—in this field." Emily explained this same tension by shifting the expectation of content, noting: "I feel like critiquing is just as much about asking questions as it is about giving an opinion." In contrast, Jiao considered critique as a synergistic process between participants, where the received critique may trigger tacit design decisions or thinking you already innately understand:

> Like they probably—there is a like light ball lighting [light bulb] that's kind of stuff, but they—um those critiques they are originally probably they've been in your mind, you don't realize it. Just need someone to talk to you and let you tease out that part. […] I don't think that sometimes the critique seems different when it's the same to you, you internalize it by yourself.

In this way, critique moves from a subjective space characterized by limited access (Carspecken 1996) to an intersubjective space, from tacit, individual design understanding to a space where meaning is shared between both participants in the critique. Even in this move towards intersubjectivity, there is still a personal design perspective; Jiao reflects: "every time you are working on a design or looking at other's design, you are trying to see it from your perspectives, no matter how um sympathetic

you are. […] you will bring it—bring your own (.) I would say experience or history or educational background into it." This tension between an individual's design perspective and the desire for intersubjectivity describes the general arc of the critique process, with communication among participants simultaneously clarifying individual intentions and bringing about a shared, intersubjective space in a reflexive, often generative way.

PROFESSOR V. STUDENT

The participants presented a wide range of perspectives on how to include professors in the critique process, and how to balance the professors' opinions and critique against that of their peers. These encompassed excluding the professor entirely from certain forms of critique because they could get more targeted critique from fellow students, hiding the messiness of their process from the professor so they could get critique on a finished product, or using the professor to identify key flaws in the design process.

Paul pointed out that he tried to treat critique from professors and fellow students equally, but concluded that professors often didn't have the "conversational knowledge about your topic that maybe a lot of the people in our cohort have," and that the critique from professors was not as "tailored to my specific needs or abilities as well as like getting critique from classmates." Lisa represented a different perspective, noting that she often requested informal critique from her fellow students almost exclusively, because she wanted to surprise the professor with her final design and didn't want the professor to see the messiness of her process: "I don't really want him to see like the messy bits where we're losing our minds [laughs] I want him to see like the finished pretty version." Emily represented a third perspective, pointing out the ability of a design expert (e.g., professor) to ask probing questions more succinctly than an informal critique with a fellow student:

> I think the faculty here […] are just like really good at you know, I'll spend ten minutes trying to explain to them what I'm doing, and they ask me like one question, and they're like, answer me that in one sentence. And it's almost like it's a critique and a—I don't think ultimatum is the word, but like a—them kind of almost like demanding that I change my perspective or that I like gather my thoughts.

Discussion

The environment and personal assumptions or beliefs about critique proved to be influential in the actual process of critique. This interplay of personal agency, belief, and action interact through the social construction of normative behaviours and beliefs—in a shared understanding of what comprises the *habitus* of the studio. In this study, the role of the pedagogy and underlying epistemological structures of the studio were seen to support and contrast with the actions and beliefs of the individual design student.

All of the participants interacted in the same studio space and were enrolled in the same general set of coursework. In this way, they shared a cultural understanding of what critique is and how it should be conducted from a curricular perspective. The student understands the pedagogical approach toward design critique as what Bourdieu calls the *structuring structure* of habitus, which "organizes practices and the perception of practices" (1984, p. 170). This structuring structure is what allows for the

existence of intersubjective space, where the pedagogy and individual actions meet. As Calhoun (1993) elaborates, habitus "gives expression to certain meanings that things and people have for us, and it is precisely by giving such expression that it makes these meanings exist for us." (1993, p. 58). A sample interaction between two individuals sharing a similar pedagogical understanding is described in Figure 2, picturing the emergence of an intersubjective space around a specific doxa (legitimacy of critique) within a specific field (the design classroom).

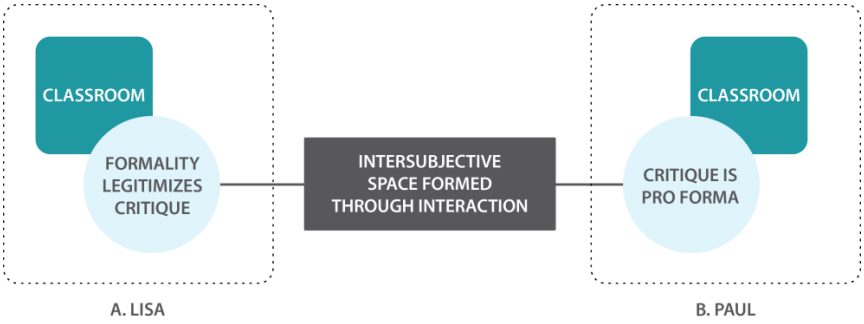

Figure 2. A sample interaction between two student perceptions of the classroom field as mediated through a specific doxa (from the formality v. informality binary). This interaction is resolved by the creation of an intersubjective space, where competing doxa, or implicit beliefs, are made explicit.

While these intersubjective spaces are intentional and desirable when reproduced through the pedagogy or studio environment, attention to the agency and identity of the individual learner within this space is also important to consider. As Webster (2008) notes, the structure of the pedagogy can actually restrict individual freedom or perception of choice, which may result in the production of a certain "type" or "personality" of designer. In the process of performing the stimulated recall, several of the participants realized some of the ways in which the pedagogy had affected their perception of practice—and how their "buy-in" to various elements of the pedagogy or overarching studio habitus had changed their practice in specific ways. For instance, Emily discussed her belief that critique should include three distinct phases: a positive contribution, a critical analysis, and a recommendation of a way forward. This pattern was modelled in a course she had previously taken, and she had unconsciously learned to apply this pattern in her practice of informal critique. However, after she watched the video of her tediously reciting positive elements of the design in an unmotivated manner, she realized that she had reproduced the desired behaviours from the pedagogy, but without explicit awareness of her actions or agreement that this practice was valuable. Even while Emily's experience included tacit agreement that this structure of critique was valuable in practice, Jiao reported an opposite experience, describing her approach: "I throw out steak or meat right away [a metaphor describing how different cultures present an argument, with the steak meaning the primary criticism]. So that makes someone some people feel uncomfortable about that."

While many of the beliefs discussed in the previous section touch on environmental or participatory factors, there are a number of practical beliefs about critique that emerged in the process of performing an autocritique and participating in a critique dyad. Many of these beliefs were expressed through the discursive structure of

critique, including the way critique began, ended, and what important conversational setting shifts occurred during the body of the critique. These discursive structure findings are discussed at length in a related manuscript under review.

While some structures of critique were clearly imported from the larger pedagogy, forming an unspoken *doxa* for some students (e.g., Emily), for others, cultural standards of appropriateness (e.g., Jiao) or prior professional experience (e.g., Paul) shaped these structures more explicitly. It is in this contrast of individual beliefs—or an individual and subjective sense of *habitus*—as compared to the studio or pedagogical assumption of *habitus* that tensions between the pedagogy and the individual student become clear. A difference in *field* may also contribute to some of these tensions, both from a cultural and professional perspective. The studio *habitus* is one of many fields that an individual learner may have come in contact with, so the pedagogical process can be seen as one of enculturation to the practices of HCI/d as a discipline, which is observed through externalized practices like critique.

Implications for Future Research

This study represents an exploratory first step toward understanding how informal peer critique functions within a specific design pedagogy. Additional research that expands this study, both in number of participants and in diversity of methods used would serve to strengthen the initial findings of this study. While the critique dyads revealed interesting and valuable information about the way students structure a design argument and think about design, a more highly ethnographic, observational study may reveal natural patterns of emergence of this form of critique in the studio environment, including frequency, common participants, and themes of discussion.

More work on understanding the role that students play in shaping a unique studio *habitus* is needed. This includes an understanding, from a pedagogical level, of the enculturation process that students are expected to go through, and how a student's identity and agency are implicated in the educational process at large. Factors might consist of attention to all forms of social interaction, including interaction between peers and professors, through internships, and through planned elements of the pedagogy or studio. Addressing elements of the pedagogy and surrounding studio in this critical way is foundational to extending or importing elements of studio pedagogy into new disciplines, as well as creating a more holistic picture of implementations of studio pedagogy in traditional design fields. Beyond the pedagogy, other elements of the sociocultural milieu are also important to consider, including individual conceptions of gender, ethnicity, and culture, and how these conceptions relate to prevailing norms, behaviours, and expectations for achievement in professional practice. These elements represent additional implicit *doxa* that are embedded in the *habitus* of the studio, and may also exist in similar or different forms in a professional design environment.

Other outstanding questions include the role of the educational *habitus*, and how this structure relates to the community of professional practice. It appears that there is often a gap between these cultures of design, and if this gap truly exists, attention to potentially conflicting *doxa* may be at issue. This lens also points out different contexts of learning and working, but there are limited structures and existing literature in place to understand the *habitus* that is assumed by an individual design program—bringing together perspectives of the surface features of the studio, the pedagogy, professors, and students, and the epistemological assumptions of the discipline (Shaffer 2003).

In a more specific sense, greater understanding of critique practice and critique culture is needed, both in a pedagogically-mediated construction like the studio, and in how critique moves from formal, structured educational environments to informal critique embedded in the practice of design (Dannels, Gaffney, and Martin 2008). Both the content of this critique, and the epistemological assumptions about design practice that this content reveals, is critical to understanding how design students are thinking about design and how practitioners are applying these conceptions of design in practice.

Although this study does not provide definitive conclusions as to the emergence or structure of peer critique in a studio environment, especially in other design disciplines, these implications for individual development, pedagogy, and professional practice represent tensions that can heighten sensitivity to peer critique in the ongoing evolution of the design studio. For design educators, understanding the conflicting *doxa* and *habitus* that may exist when comparing the individual design student and the planned pedagogy, especially in the early stages of a design curriculum, may allow for a deeper investigation of incoming student behaviours or conceptions of design as compared to the planned pedagogy. Additionally, understanding the use of design "talk" in formal and informal contexts may allow the pedagogy to naturally support the transition from formal, high-stakes environments consistent with higher education and informal, communicative interactions consistent with professional practice.

Conclusion

In this study, I have described an exploratory study investigating the role of informal peer critique in revealing tacit design thinking, conceptions of design, and the co-construction of *habitus* within the design pedagogy and studio. While work has been done previously on the role of identity and socialization in the studio (Crysler 1995; Webster 2008), more work in this framing of design pedagogy is needed, both in a transdisciplinary and domain-specific context. The framing of *habitus* in this study reveals students struggling to integrate some elements of the pedagogy into their personal practice of design critique, even while there is tacit acceptance and ongoing development of many elements of their critique practice. This agreement or tension between a student's beliefs about critique and the overarching assumptions about critique within the studio pedagogy forms a dialectic that is only resolved by the development of the student, including their personal conception of *habitus* in reaction to or in support of the studio pedagogy, or capitulation by the student or pedagogy. While this study represents only the commencement of inquiry into this form of critique, the framing structures of the studio and the developmental tensions between the student and the pedagogy in this exploratory study provide a substantial foundation for future work.

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Agile Thinking in Motion Graphics Practice and its potential for Design Education

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Abstract: *Motion Graphics is relatively new subject and its methodologies are still being developed. There are useful lessons to be learnt from the practice in early cinema from the 1890's to the 1930's where Agile thinking was used by a number of practitioners including Fritz Lang. Recent studies in MA Motion Graphics have accessed some of this thinking incorporating them in a series of Motion Graphic tests and experiments culminating in a two minute animation "1896 Olympic Marathon". This paper demonstrates how the project and its design methodology can contribute new knowledge for the practice and teaching of this relatively new and expanding area of Motion Graphic Design. This would be not only invaluable to the International community of Motion Graphic practitioners, Educators and Researchers in their development of this maturing field. But also to the broader Multidisciplinary disciplines within Design Education. These methodologies have been arrived at by accessing the work of creative and reflective practice as defined by Carol Grey and Julian Marlin in Visualizing Research (2004) and reflective practice as defined by Donald Schon (1983). Central to the investigation has been the approach of Agile thinking from the methodology of "Bricolage" by Levi Strauss "The Savage Mind" (1966)*

Keywords: Design knowledge, Multidisciplinary Design Education, Practice, Target, Reflection.

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Introduction

This paper looks at how agile thinking as expressed by Levi Strauss "The Savage Mind" 1962, English translation 1966, has a direct relationship to the practice of the newly emerging creative field of Motion Graphic Design.

The paper intends to demonstrate this showing example of practice from early cinema as well as recent contemporary motion practice. A series Motion Graphic practice based creative tests and experiments have been undertaken that explore this agile thinking forming an animation "1896 Olympics". This paper reports on these tests and experiments whose results intend to aid other researchers and practitioners.

Because of the multidisciplinary approach to the project these findings could transfer to other practice based disciplines. One thing that appears to be common across many Art and Design teaching discipline is a students tendency to spend too much time focussing on research. Not starting to create prototypes and tests early enough in the design process.

Practice based research methods

"Agile thinking" coming from Claude Levi Strauss's "Bricolage" method has been used as a practice based research method throughout this investigation. The French anthropologist used "Bricolage" to describe any spontaneous action and further extending this to include the characteristic patterns of mythological thought. "The Savage Mind" developed the term Bricolage that in summary is seizing things on the wing, a kind of instinctive method, seizing opportunities from a number of sources as they arise.

For an Artist or Designer using this method it is important to have a clear sense of what you want to do. During the "1896 Olympics"project a system has been developed to help make sense of large disparate creative opportunities. Using a series of three concentric circles that we are calling the "Target Method". This can be used to help define early design ideas stage and during the production phase prototypes. Helping to gain focus and direction in a project with multiple inputs and influences.

The Target Method has also been used to help define this newly emerging subject discipline "Motion Graphics" outlined later in the paper.

Research Method for Practice

Two methods have also been used within the Practice based models from Carole Grey and Julian Malins book "Visualising Research" 2004. The chosen research methods "Action and Reflection" and "Revising Traditional Practices in new contemporary contexts".

Reflective practice as defined by Donald Schön in his book The Reflective Practitioner in 1983 has been used for "reflection on " and " reflection in "practice throughout all the stages of the project. The "Reflective Practice "method is also being used, as it is implicit in all Art and Design investigations.

There has also been the use of Case Studies method (as Grey and Malins reference its use in Social Science) to look at a range of Motion Graphics works to better understand the subject and compare and contrast different works looking for connections and differences and influences on the "1896 Olympics animation."

Agility and Bricolage

Agility – A core element of being able to seize opportunities is the need to be continually agile. This paper is suggesting that Agile is important in two senses. Firstly by not becoming too immersed in any one way of working. Secondly to keep looking for opportunities and new ways of working. This is especially important when working with computers where the software can often give the user the feeling that they need to know the entire programme to make any creative work. But also relevant to the current generation of Art and Design student learners.

This is especially common with Motion Graphics Software. This agility can also be where a camera can really play its role in the creative process. Particularly when filming Live Action where the camera operator or director is constantly responding to the live event and seeking ways to capture the event without becoming to deeply immersed and bogged down instead remaining agile. The 1896 Olympics project uses live action filming extensively. Agile thinking as Strauss suggests is appropriate to the Bricolure - seeing opportunities and being agile.

This can also be applied to creative practice. The practice of working fast - getting to the “first stage prototype” or rough design as soon as possible is really appropriate to innovative and experimental practice. Typically the outcome is difficult to predict and a series of quick agile tests will need to be undertaken and evaluated.

First, Second and Third Stage Prototypes

First stage prototypes

The first stage prototype is a very quick visualization of an idea. This can take several forms; it can be a quick drawing, often called a thumbnail, which quickly explores the quick visualization and composition. During the act of drawing or making evaluation of this initial visualization often occurs leading to adaptation or creations of other new designs. These can sometimes lead to second stage prototypes.

This does not just apply to drawing, other forms can be; paper and card constructions useful when making three-dimensional early stage prototypes. The most important thing here is to work fast using simple cutting and simple fixing systems such as masking tape and or metal fasteners. As was the case with the first stage prototype running man puppets for the "1896 Olympics" animation.

Second stage prototypes

Second stage prototypes are a development from the first utilizing the knowledge created from the first stage. For example adding colour to a two dimensional composition, considering texture or materials. In the case of the puppets it was trying to create a more realistic running motion. Again these prototypes are rough and created without attention to detail. Working quickly with agility is still key to keeping ideas flowing. With a high level of importance put on not getting too bogged down with just one idea, design or mechanical methods.

Third stage prototypes

The third stage prototype becomes much closer to beginning the final type of design or more resolved design. In the example of the puppet theatre it was starting to put the running figures in context in a shadow puppet theatre construction.

Here it was important to see what the running figure would look like on a shadow puppet screen. It was important for the puppeteers to see things from an audience perspective using a camera connected to a large television showing this view-point. It was important for the puppeteers to view the TV screen and learn how to move the running figure in the most effective way possible.

Reflective practice was occurring "in action" with puppeteers able to evaluate different methods of controlling the puppet figures enabling them to understand what was the most important controlled movements to give the illusion of a running figure. The camera served two functions firstly to enable reflection in action but also as it was recording the footage live it could be used for recording reflection on action, by replaying the recorded footage the puppeteers could make a more objective evaluation of there different movement control tests.

A third stage prototype is taking the knowledge created from the second stage prototypes. Sometimes this will be considering a designs context, or working with the actual materials or using the actual tools that would be used in the final work. There will be a larger degree of reflection "in action" as well as reflection "on action". For example when working with colour several similar shades may be mixed and tested but a significant amount of attention will be given to comparing and evaluating which colour is the right way to go. Often these may be compared to initial designs or research.

The third stage prototype will be characterized by fewer designs being made compared to the first and second stage prototype and more time spent on reflection and evaluation. A third stage prototype is also characterized by a refining process as well as gaining a fuller understanding of what the main issues are of the design.

Through the case studies the paper will show that early reflection on this early agile work is essential to both Motion Graphic Design and Multidisciplinary practice in general. This method can be significant for other contemporary design disciplines their practice and pedagogy.

Practitioners and Educators are still yet to find methodologies for Motion Graphics being a relatively new subject in Art and Design using both modern technology and traditional areas. This paper aims to help contribute to this defining of methods. The investigations have been looking at some cues from practice in early cinema from the 1890s to the 1930s and connecting them with contemporary Motion Graphic practice.

The paper suggests that the design methodologies for Motion Graphic Design and Multidisciplinary Design are different to other design areas. This project contributes both new thinking for Motion Graphic Design practice but also the teaching of this new expanding area. As this project is multi disciplinary as its core these methods may be useful beyond Motion Graphics and be of use to other disciplines and Art and Design pedagogy.

Making sense from complexity; The Target Method

Defining Motion Graphics and the 1896 Olympics project

A common asked question is; ”What is Motion Graphic Design?” During Jonathan Hamilton’s recent MA study into Motion Graphics “1896 Olympics” the project looked into a variety of moving image methods. Collating these together realising that some of these methods were more central to the subject than others. As a result the project team developed a method for this research that they are calling the “Target Method” as a way of starting to define this new and emerging area of Motion Graphic Design.

This Target Method uses three concentric circles in a diagram form where the middle circle represents core subjects the second circle subjects that are central and the third and final circle are areas that are on the fringes of the subject. Beyond the third circle is a section that is called “outside-but close“ For example in the core circle is title sequences for film and television. In the central circle split screen video and film on the circle called fringes would be colourist work and on the extreme edge of this circle is character animation in the outside but close area would be traditional narrative editing.

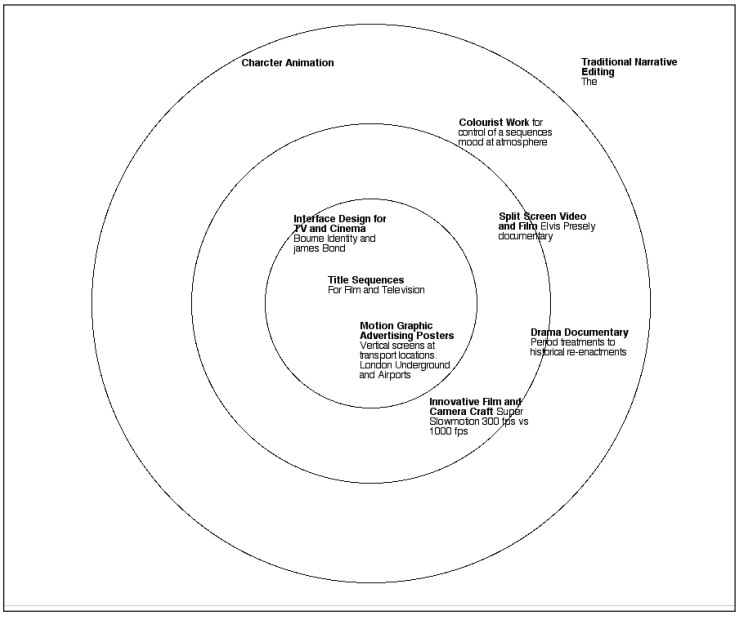

Figure 2; The “Target Method” in use; Defining Motion Graphic Design

The Target method Explained;

The target method is used for analyzing data this data is created at the early stages of the design process. It is most commonly used during the research period at the start of a project and its intention is to clarify the focus but to also not omit any findings and to get all findings in one place.

This method has been devised through teaching design students in the UK over several years. It has been clear that students have struggled to manage the wealth of ideas and designs and research material. From their previous studies at secondary school students arrive on undergraduate courses with a variety of working methods taught or adopted in earlier study. Where an over emphasis on research has occurred.

Generally students spend far too much time researching when they should really be working on first and second stage prototypes. The target method was devised to enable students to get a clearer idea of what the main issues are and to gain clarity. The common British phrase "I can’t see the wood for the trees" is often the case for students at this stage. The target method aims to create a pathway through this mass of trees.

Using the diagram;

The diagram works best when printed out on a piece of paper but could be used on screen as well. Some students find it useful to use a large piece of paper if they have a lot of material to quantify. The three circles are drawn out at the beginning and here each research finding is positioned in one of the circles. The student needs to evaluate which location is most appropriate. Students often find this most useful with a tutor present or with other students. One of the really valuable elements for the student is that every research finding is used having its own location on the diagram.

Students often come to a project at this stage feeling overwhelmed with the quantity of material they have found, they also feel that they have too many ideas that they are wrestling with. The target methods helps with all of these problems.

The three circles in the diagram, have particular uses each one requiring different content. Each circle has its own regional name. The "core" is self explanatory; this is where findings are central to the the topic. The "Contiguous Core" is the more important of these two circles; here material is put which is more ambiguous. Using a full width of this circle is useful sometimes. A finding may be put on the boundary of two circles it may be in the centre of this band. More consideration and evaluation is taken at this time deciding where this content should locate. The third circle called "Perimeter "follows a similar method .

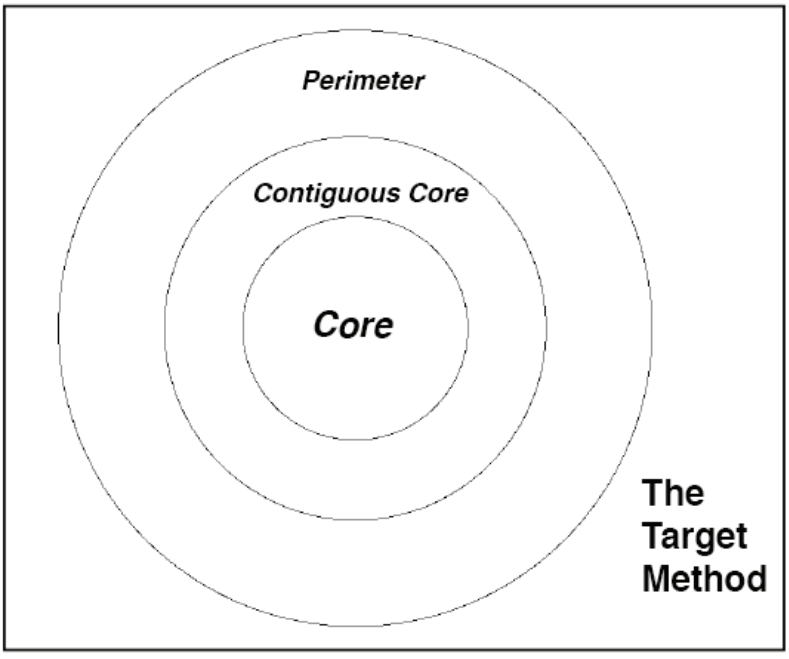

Figure 2; “The Target Method “

Agile Methodology

Learning from practice in early cinema.

One of the key practitioners from early cinema whose work utilises agile methods for practice is Fritz Lang. His feature film “M” from 1931 demonstrates many examples of agile thinking. The Café scene where a camera in one take moves in a complex journey through the set past a series of characters spending time in the café is particularly effective and impressive.

Film cameras from this period were generally large static cameras on fixed tripods anchored to the ground. Yet Lang by using smaller cameras was able to design a sequence where camera movement was at its core. We can see here in the photograph that a very early “Dolly” system has been invented enabling a unique and sophisticated scene to be created.

Lang’s Dolly is made from a simple three wheeled trolley adapted from a previous use. The Camera has its own movable mount on top of the dolly that allows the camera to slide sideways independently as the trolley moves throughout the shot.

The technical simplicity of these agile methods, yet giving such sophisticated results in camera, has given our study permission to take similar approaches. “M” had a direct influence on the “1896 Olympics” animation sequence. A similar makeshift dolly was made for the Poly-vinyl tunnel sequence, discussed later in the paper.

In addition to this Café scene in M other examples of agile methods are shown through the publicity photographs for the film and in the accompanying booklet for the “M” Masters of Cinema Series DVD. Photographs on the set of “M” show the camera positions used in several of the other scenes. To get the low down shot of the businessman at his desk the desk has been raised up in the set .In a more extreme example shows the camera at an extreme high view point where the crew and camera are at the top of a very high ladder looking down on the actors performance.

At the core of agile thinking is simple and uncomplicated working methodology. Whilst the practice may include technically advanced equipment, DSLR Cameras for example, these are used with non-complex working methods in simple non-technical ways. Enabling work to be created faster and adapted quickly.

Comparing agile thinking in historical and contemporary practice. Examples of where agile methods could have benefited recent contemporary practice.

In Anthony Nolan’s 2010 Hollywood film "Inception" innovative large scale moving sets were used in the filming of several scenes. These scenes were developed to demonstrate changes in perception of natural force of gravity on the scene. But rather than using computer generated images (CGI) Anthony Nolan decided to do this for real. This was extremely ambitious and would involve significant amounts of planning and manpower to build the scenes in the film. But seems to lack dynamism on the screen.

The cameras used in the scene are mostly static and do not seem to consider multiple viewpoints. This suggests that a lot of the director’s attention was in the construction of these large moving sets with less thought or testing done for the camera positions and movement for the scenes. The suggestion here is that early quick prototyping would have allowed time to experiment and test alternate cameras positions by using smaller scale constructions including Low Fi card and paper models and very small cameras the director could have discovered more effective ways to change viewpoints and film with these innovative sets.

Other directors notably James Cameron in the original 1984 "Terminator" movie did significant pre production work for scenes building small scale models filling them with smoke and using small periscope cameras to work out how and where to position and

move the camera in a scene. Here Cameron is accessing agile working methods at an early design stage to gain knowledge early on in the production process.

Anthony Nolan in “Inception” clearly seems to have taken influence from Stanley Kubrick’s 1968 film "2001 A Space Odyssey". Here Kubrick uses two memorable rotating sets but with much greater success on screen for the viewer. Here the camera clearly asks the audience to question physical gravity for the characters in the scene. In the space station scene the main character Dr David Bowman is seen exercising. Running in the sleeping quarters yet the set moves in a circular fashion rotating like a hamster wheel the camera itself moves with the actor. As the set rotates around the audience are forced to think about gravity and suspend disbelief helping to immerse the viewer towards an experience of living in outer spaces weightless environment.

In production stills for the film shown in *Stanley Kubrick ; A Life in Pictures* we can see the scale of Kubrick’s ambitious set with reference to the testing of cameras and positions. Another famous scene from the movie further demonstrates the filmic exploration of a weightless environment. The scene where an airline waitress brings trays of food to the pilots and crew of the spacecraft. She is shown to be wearing anti gravity slippers that appear to allow her the ability to walk upside down whilst not dropping any of the things she is carrying. Here Kubrick has again utilised a rotating set and camera to make the audience believe they are defying gravity.

Both of these scenes demonstrate sophisticated use of cameras, sets and performers with an almost seamless experience for the audience. It is well documented that Kubrick in all his films did extensive testing and experimentation for special scenes such as these. Whilst he had a very large budget for the special sets he never lost sight of the importance of the image on camera and the viewpoint for the audience.

Here both Kubrick and Cameron have not lost sight of the importance of what is seen on screen their use of early stage prototypes when filming with a complex set. The filming resulting from these has been used to great effect. This agility and speed is extremely beneficial to both Cameron and Nolan could have benefited from these working agile methods too.

Recent practice from an MA investigation into Motion Graphics. Several examples of using agile working methods and the importance of reflection at early stages;

Through these examples of Motion Graphics practice this paper demonstrates that agility applies not just to thinking in an agile manner but that agility can apply to the speed in which first and second prototypes are made. These tests and experiments are believed to show how working quickly can have a considerable impact on the creative process. In the same way that first and second prototypes are being made quickly this paper proposes that reflective practice as defined by Donald Schoen needs to happen as soon as possible during the prototype stages.

Donald Schon and Reflective Practice;

Reflective practice has always been a key part of an artists approach to creating art works. The famous image of Mark Rothko sitting in his chair in his studio looking at one of his paintings for a long period of time thinking about his work and deciding what to do next is a great image of reflective practice.

In this case this is reflection on action. Thinking and evaluating work after it has been made. Equally important and very commonly used is reflecting in action whilst creating an artwork. Making decisions about how a line is drawn a colour is mixed or a texture is applied. A key component of this is being instinctive. But there are some dangers in reflection in action as it is not a fully objective way of assessing. It is quite

common when drawing to become frustrated and dislike the drawing produced. It is quite common for a tutor to say to a student to put a drawing away for two weeks and not look at it, as they are too close and immersed in the drawing, it is deficiencies and errors to be able to judge it.

Other dangers can be quite opposite to disliking the work produced. Especially with fast work where a live event may be happening an artist or designer can get carried away with the moment and be enjoying the process so much and the vibe of the moment that they could unwittingly become self indulgent yet think the work is really good.

Both these examples highlight the need for reflection on action. To evaluate the work objectively with a clear head and an analytical mind. This can be done by a single person but can work especially well with a very small group. Here again knowing and understanding what was trying to be achieved and being clear on the focus of the work is crucial.

Applying agile working methods to multidisciplinary design practice and education;

At the core of this agile working method is the importance of working quickly. There seems to have been a change in the way students work. Computers have become more of an integral part of the design process; this has affected both the research and practice stage of design projects. With Internet based research, searching can lead to a group of students coming up with similar research. In the practice based work similar narrowness can occur where the software it takes to the students and dominates the visual language of the design work.

Using a computer is not a problem but it can be when the entire source is coming from this tool. Too much time creating work on the computer can end up with the student overly focusing on this one tool this time element can be tackled by being more agile working more quickly almost limited time on the computer and be more beneficial to the design process.

Seeing the computer just as tool and one of many sources can help a student access other tools and other sources. This will help them to come up with more original unique and personal design proposals. This will come with some negative aspects though it will cause some insecurity as coming out of the comfort zone of just one source will sometimes raise more questions and make the analysis and reflection of this material more lengthy.

One of the key areas of the design process; the need to experiment and take risks could really be helped by using agile methods. By constantly looking for new opportunities and new ways of working this experimental approach to design can be accessed. These approaches to working agile methods need to work definitely at different stages of the design process. At initial stages of the design process the agility should look for opportunity from all areas and look very widely. However during the mid and final part of the design process constantly looking wider for new opportunities would be inappropriate. Instead at the mid point where a second and third stage prototypes are being made the agile methods need to be used to solve problems. For example when a tool for cutting does not appear to be working looking widely and thinking laterally for different ways of cutting or different tools or perhaps substituting different materials that can be cut instead.

Example 1: Agile methods leading to Invention, experimentation and reflection.

The 1896 Olympics animation featured towards the end of the film has the Olympic runner entering the Greek Olympic stadium with the crowd cheering "Hellene! Hellene!" The scene was to show this from the runner's point of view. The camera was to show his view of the tunnel, as he is about to enter the stadium. Having experienced the moving camera sequence in Fritz Lang's "M", the project team was keen to have a moving camera travelling through this scene. A high quality DSLR was chosen for its exceptional HD video quality and yet very small size. Connected to a small homemade Dolly made out of a wooden plank and small castor wheels. Some quick tests were made using the DSLR dolly unit and props easily to hand.

With an understanding and a need for speed this first test or prototype used the underneath of a dining chair to simulate and approximate a tunnel. Two things were being tested; the view of the makeshift tunnel and the movement of the camera. The footage was played back and reviewed on the medium sized screen on the back of the camera and then on a larger computer screen. This enabled us to evaluate both the scale and proportions of the makeshift tunnel and the appropriateness of the homemade Dolly. This footage looked very convincing and had a degree of cinematic sophistication that allowed this prototype to inform the construction of the tunnel itself. Having understood that many film and television sets are often made to a surprising low quality when viewed by the naked eye yet look very convincing on camera there was no reason to be concerned about sophisticated model making of the tunnel.

The tunnel itself was intended to have the sound of the crowd depicted through moving animated lettering. Being aware of the possibilities of rear projection and of the potential of flexible Poly -vinyl sheeting that had been seen in a local art store and realised its potential as a projection surface. Construction started on the tunnel using this material with 5mm foam-board as main structural support at either end of the tunnel. A variety of quick prototypes were made and tested moving the camera through the tunnel. After quickly evaluating this footage the team could tell that the tunnel was not tall enough to show its curved qualities, as the camera was too close. The tunnel construction was quickly re-adapted, raised higher film tested and evaluated.

The animation projected on the back of the tunnel construction also used agile working methods. Traditionally animations would be rendered out as a QuickTime movie and then projected. Realising this would need to quickly adapt and change to fit the tunnel construction the team discovered that they could play back the animations without having to render a final movie by just playing back directly from the animation timeline itself. This allowed the movies to quickly change and adapt and tailor make the animations to fit the tunnel construction rather than re- render a new animation each time.

Agile reflection in practice

The original intention was to have the animated lettering "reversed out" with white lettering on a black background. When filming with the moving camera underneath the projection it was found to be very difficult to get the exposure correct on the camera and still have the lettering legible. Several solutions were tried but none solved the problem. It was realised later that the team were too fixed on one way of working.

Luckily the team were forced to reflect on the animation approach. They had to stop work for that day. After stopping work and discussing the problems amongst the team they realised how exposure critical the camera was. Realising that the camera had reached its limitations the animation would need to change. The reversed out nature of the lettering was actually the problem for the camera. The solution was to change the animation from a negative image to positive. A white background with black animated lettering was the solution. Then the exposure settings for the camera were not so critical compared to reversed out projected lettering and the camera exposure could be more finely adjusted throughout the shot sequence.

Making this change solved the problem very successfully and demonstrated very clearly the need to make quick prototypes that were easily adapted and most crucially the need for rapid and timely reflective on practice for first and second stage prototypes.

EXAMPLE 2: AGILE PRACTICE AND LEARNING NEW WORKING METHODS

Having seen a recent music 2012 music video; Kate Bush "Lake Tahoe" which featured contemporary live action shadow puppets it was realised the potential of this method for the Olympic project and the marathon runner as the central character. The team had no previous experience at all of making or performing with shadow puppets and had to seek knowledge in this area. Again using agile methods it was not too concerned with the quality of its first stage prototypes. Several useful videos on You Tube were found that showed how to easily and simply it was to make a very basic shadow puppets and theatres. This enabled the team to make first stage prototype quickly and evaluate them through filming. The shadow puppet theatre did work convincingly yet the figures were lacking believable movement.

Making agile method prototypes for new ways of working

Running figures

These very first simple shadow puppet figures were made to move using very basic supports made out of drinking straws. Cameras were set up in front of the puppet theatre linked up to a large TV screen. This enabled the puppeteers to see immediately what the camera was seeing. Whilst these first stage prototype figures had a sense of movement and energy they were not going to work for the animated feature as this was going to focus on one person; Spiridon Louis the winner of the first Olympic marathon in 1896.

As the main scenes were going to focus on one runner he had to have a convincing running action, the team tried out more sophisticated jointed figures but were struggling with the mechanics and the materials being used.

These second stage prototypes worked better using metal supports and more sophisticated jointing but the team needed to seek some expert advice. The team had a couple of meetings with a professional puppeteer based at a UK University who showed a plastic sheeting that he had used for shadow puppet figures. Two things were significant; the plastic sheeting immediately looked more effective than the black paper and was structurally more rigid. Also he had used Velcro on the figures to connect supports where the team had been using Gaffer tap before.

Figure 3; Puppeteers live TV and Camera Set up

AGILE REFLECTION ON THIRD STAGE PROTOTYPES

Using this new material and the Velcro attachments to metal rods allowed much better control. When comparing the Video footage between the first and second prototypes and the current prototypes it was clear that this was a big improvement. However the running action was still not as believable as intended. Through researching into current and past shadow puppet practice it became evident that the running figure was seldom used and when it was the legs were often working in a very simple swaying way.

This raises the question that the 1896 Olympics project may be doing something new within the field of shadow puppetry. This quickly allowed the team to focus on the movement of the legs themselves. The current prototypes had originally focussed on the mechanics of the puppets legs themselves but then quickly realised after seeing other puppet methods used in productions that a different approach was needed. The emphasis now being on how the puppeteers control rather than the leg mechanics could make a believable running action. Again using the method of a camera in front of the theatre screen showing live footage on the large screen the puppeteers could immediately see the movement of the legs. This immediate feedback for the puppeteers allows small changes to be made with significant effect. As these subtle movements were so important for a believable running action it was clear that more than one puppeteer working on the running figure was needed. Puppeteers had their own puppet leg to control. Using a number of rehearsals and takes a more convincing running action was achieved.

Reflective practice

This approach to first second and third stage prototypes relied heavily on agile thinking methods as well as reflection in action and reflection on action. The puppeteers' watching their puppet performance live on a big TV screen as they perform is a good example of reflection in action. On the video footage soundtrack it is possible to hear the puppeteers reflecting in practice; communicating to each other about the effectiveness of their control. As they learn and discover how to co-ordinate the figures limbs and notice subtle adjustments in the angles of the legs and feet which appear to be crucial for a believable running action. The puppeteers also quickly reviewed the recorded footage to confirm their live reaction decisions and to establish the most important working methods for the next takes.

This enabled planning forward for a sequence of further tests. This reviewing of the video footage after performance and evaluation of different takes and sequences are good examples of reflection on action to confirm the teams' next strategy.

Visual and motion language selection and reflectionAgile Photograms

At the beginning of the planning process for the animation it was the intention to create a range of animations from different periods of Art and Design history. The 1930s work by the Bauhaus artist and designer Laszlo Moholy-Nagy seemed to have some potential. Looking through a book of Moholy-Nagy Photograms it was possible to see how this visual approach could be used to represent some of the Olympic disciplines. The strong sharp triangular shapes that Nagy had produced could be used to visually represent a Javelin flying through the air. His circular shapes used in some of his Photograms could be used to visually represent a Discus in flight.

A number of quick Photograms were made by moving the objects across and then exposed on the rectangular photographic paper creating a number of frames for a stop frame animation. Scanning the photographic photogram into a digital video software programme quickly animated these. On reviewing these animations as a moving sequence it was surprising that the Photograms from the circular images representing a discus were quite beautiful as a series of individual stills but in the moving format of QuickTime movie they were surprisingly dull and did little to suggest the kinetic movement of a metal object through the air. Conversely the team was more surprised by the Photograms of the Javelin sequence. As individual stills they were less aesthetically pleasing to the eye but when combined into a QuickTime movie they had significantly more dynamic movement than the beautiful discus stills.

Stills and moving image

One thing was clear that what worked as a still did not necessarily work as a moving image it appears that subtle movement is not always going to work and that it is important not to discard or pre-judge the less attractive but more dynamic kinetic images. Certainly it is not possible to always predict if a good still will make a good moving image.

This difference between stills and moving image surprised the team. When looking at stills made from moving image sequences for example the photographic tile sequence storyboards from the 1995 film "Seven" as shown in page 38 of "Type In Motion" by Jeff Bellantoni and Matt Woolman these images demonstrate the sequence

clearly. Especially the moving scratched lettering but the difference is here that these are mostly lens-based shots not abstracted Photograms. In addition the sequence is so well known and has been viewed so many times that it is easy to attach the memory of the moving image to the still that we are looking at.

In reflection when thinking of how television and some cinema productions approach making images and stage sets which tend to be bold and sometimes brash and this may be for the same reason that they find that subtlety does not always make for good moving image.

Conclusions

Advantages to agile working methods

One of the advantages of working quickly has been the ability to produce a number of different sequences this has allowed the team to use reflection more effectively. Creating five approaches as short sequences enables comparative analysis with a greater scope of projects to compare and contrast.

A second advantage to the agile working methods has been the speed in which they have been produced allowed the team to be more objective when deciding between different sequences. If the sequence has been made quickly it is both easier to evaluate as the team are not so visually immersed in the project but also not too heavily attached or committed to design they have been working on as less time has been invested in it. This also allows the team to make changes and adaptations quickly to props and sets that have been made simple and quickly.

Agile methods and other disciplines

It is the intention in this paper to show how this project and its design methodology can perhaps contribute new knowledge for both practice and pedagogy in this new and expanding area of Motion Graphics.

Because of the multi disciplinary approach to the project this could transfer to other practice based disciplines. One thing that appears to be common across many Art and Design teaching discipline is a students tendency to spend too much time focussing on research. Not starting to create prototypes and tests early enough in the design process. Often this early stage tends to focus on using the computer extensively, which may also be part of the problem as it is difficult to create something rough and approximate.

It is difficult with a computer to make something that is half realised. Drawing in a sketchbook can be much more approximate and be the seed of an idea. The act of drawing is less conscious and controlled. Whilst drawing other ideas and adaptations often come to mind leading on to other prototype plans.

When creating a line with a computer it is very definitely a firm visual line that in some ways is too strong a commitment too early. Perhaps this contributes to the students reliance on the computer at an early stage combined with their often computer based research which can often lack in primary research. The main reason seems to be a lack of agile thinking with a real need for a breadth of primary sources combined with a series if quick first stage prototypes. In some ways this relates to the act of drawing from observation where it is common to draw multiple lines before fully understanding how to draw a shape or outline. Trying to draw with one clean line

before the draughtsperson fully understands what they are doing can be a difficult strategy.

This method of working quickly and producing multiple prototypes can relate to reflective practice as highlighted by Donald Schoen in 1983. When drawing at early stage of a design process it is common to be reflecting in practice. Whilst drawing a line an artist is also evaluating its effectiveness sometimes stopping when they realise it is far from working or continuing when it is near enough and then starting another. This method has been used many times during the 1896 Olympics project initially evaluating sequences either in camera or watching puppet figures live on screen as they perform.

Speedy and Agile reflection in contemporary practice.

One of the significant factors of the new technology and digital cameras has been the increased ability to reflect in action compared to Muybridge and Marey's work in 1890s and Fritz Lang's work in the 1930s.They would have little guidance or feedback from their camera work until it had been processed. At best they would have had to wait a day to view the work they had produced. Yet in this project work could be reviewed live as it was being created and then immediately after replayed and analysed in great detail.

Multi disciplinary work and Agile thinking methods for other Art and Design disciplines.

This practice-based work has revealed a lot of surprises that are specific to Motion Graphic Design practice. The difficulty in evaluating the Photogram stills compared to when they move in a sequence could be distinct from other disciplines in this instance. But some of these discoveries can be transferred to other disciplines in particular Multidisciplinary practice specifically.

The Target method can be a very effective way of helping students or designers get down all their ideas on paper. But then be able to evaluate and place each concept or piece of research in one of the central circles of the target. Finding what is central to the project and what is on the fringes is ideal for the early stages of creative project management- being able to see "the wood for the trees" and giving focus to a project.

Agile Thinking from Bricolage has been a key methodology.

This can be applied to all stages of the design process, research, prototype creation, and idea generation and also to the timing of reflective analysis. Quickly making work and quickly or timely reflection.

The agile methodology has been crucial in developing a range of prototypes. The evidence from these projects tells us that prototypes need to start very early on in the creative design process. A core element of being able to seize opportunities is the need to be agile. Agile in two senses firstly not to become to immersed in any one way of working and secondly to keep looking for opportunities and new ways of working.

It seems there is a connection between simplicity and agile thinking. Certainly when agile thinking access's simple solutions the success rate is high.

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Like or dislike: Aesthetic judgements on textile patterns

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Abstract: *In different areas of handicraft and textile production, teachers, researchers, purchasers and others have to judge products based on different factors such as function, aesthetics, taste and so on. The whole process of designing – from ideas and visions to finished product – includes aesthetic judgements: In the first planning phase, several sketches are made that can later be changed, adjusted and further developed. When a product is finished, further judgements are needed: designers and artisans evaluate the result of their efforts, teachers judge the works of pupils or students and purchasers or consumers judge the suitability of the textile based on their particular needs. Because different persons make different choices when making or buying a textile product, it is interesting to study people's experiences of fabrics as well as their reasons for making certain aesthetic judgments. This article presents a study of judgments and values expressed when designed printed fabrics were displayed for designers, teachers of textile crafts, consumers and schoolchildren. The present study shows that subjects make their judgements on the basis of formal, functional, cultural and emotional contents. These aspects should therefore be in focus in design work and design education.*

Keywords: design, aesthetic judgement, structures of attention, emotion, textile pattern.

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Background

Design[1] deals with visual elements such as line, colour, texture, shape and form, etc. (Giard 1990; Skjeggestad 2001; Mörk 1994; Wong 1993). Giard (1990) compares these visual elements with the letters of written language, and claims that all designed objects make statements. But because visual language is poorly developed and understood, Giard states that designers should be aware that products only transmit their messages, and that the perception and impact of these messages constitute a neglected field in design. Thus, designers are probably more visually literate than are average users; if someone speaks a language unknown to you, you can hear but not understand him (Giard 1990, b6). Semiotic theory focuses on "product appearance" (Oehlke 1990). Here the appearance of a product refers not only to the gestalt and all the perceptible properties and elements of the product, but also to the "product concept" with reference to the idea, experience and values of the product (Oehlke 1990, e4). Product semantics looks at design as a kind of language, a form of communication, and this communication is largely based on aesthetic qualities. Buchanan (1989) talks about design as communication, but his argumentation has a rhetoric perspective. The designers communicate with their intended audience through objects. Buchanan divides design rhetoric into three elements that to some degree are all included in every design argument: logos, ethos and pathos. Buchanan's classification of design rhetoric is based on traditional rhetorical terminology. He calls logos technological reasoning, reasoning about composition, construction and material aimed at a user, and also reasoning based on the attitudes and values of potential users and the physical conditions of actual use. Ethos is the character of the design. The character can be connected to the designer or trademark, but also to traditional or contemporary style, etc. Buchanan calls the third element, pathos, emotion. It emanates from physical contact with objects or from active contemplation of objects before, during and after use. Buchanan says that pathos emotionally connects the object to the mind and is therefore a powerful and persuasive element of design rhetoric.

Aesthetic judgements are based on impressions given by our senses and filtered through our experience. In the current article, the intention is to focus on aesthetic experience and aesthetic judgements of objects such as printed textile patterns.

Categorical perception and aesthetic appreciation

The elementary perceptual principles mean that reality, as we perceive it, is divided up into distinct units. A technical term for this is categorical perception (Gärdenfors 2000, p.40; Harnad 1987; Klarén 2006, p.289). Spatial perception, basic perception of outlines, distinctive colour combinations, shape, balance, etc., are all based on categorical perception. Categorical perception is innate in some respects, but for the most part it is acquired early in life when the child starts to sort visual and other sensory impressions from the surrounding world.

In public discussions on the influence of taste and on teaching taste, however, more stable (categorical) perception and dynamic (e.g., cultural, emotional) perception are

[1] The process of design includes many intentions and a great deal of planning prior to production (Wiberg 1996), but in the present context, the concept of design is used in the simple sense of *giving form*: making decisions about size, shape, arrangement, material, fabrication technique, colour and finish that establish how an object is to be made (Buchanan 1989, p.109, Landqvist 1994; Lawson 2001).

often treated as thought they were in opposition to each other. In this article, it is argued that there is no contradiction; the two principles of perception are complementary. We can touch, feel, look at and use objects. We make spontaneous judgements based on our knowledge, experiences and demands. Judgements of this kind are connected to intuitive experience, which is an instant sense of truth, fact etc., irrespective of any rational reasoning (Gärdenfors 2005). Gärdenfors claims that intuitive experience is built on implicit knowledge.[2] However, because it is cognitive, based on experience but difficult to express explicitly, he says that it is possible to explicitly explain parts of our intuitive experience afterwards by reflection, even if he also questions whether this is always the right answer. If implicit knowledge is cognitive, this explains how a well-educated and experienced specialist can have a ”trained eye”: ”specialists combine information into larger meaningful structures, they are able to exclude irrelevant information and they rely on larger sets of mental models” (Gärdenfors 2005, p.80, my translation). The specialist therefore easily finds, rapidly combines and filters information so that intuitive ”truth” appears without him/her having to pay any attention to the underlying process. Klarén (2006) remarks that experience in different fields of activity develop structures of attention that result in conscious or unconscious attention towards special aspects of a phenomenon. Structures of attention concern all kinds of sensuous experience and all experiences in life. Arnheim (1974, p.48-51) points out, however, that there must be a structure in the outer world that can be attended to and connected with experience. It is not possible to see a pattern if there is no structure in the outer world that evokes such a pattern.

The emotional perspective is sometimes an intrinsic part of design work (Buchanan 1989; Desmet 2003; Farstad 2003, p.71 ff; Wong 2003, p.13). Designers often present their new collections on mood boards, which mediate the emotional expression of their ideas (Eckert et al. 2000, p.529). Emotional responses can inspire customers to select a special product, and more and more producers are encouraging designers to manipulate the emotional impact of their design (Desmet 2003).

Taste and culture

In the contemporary public discussion, the well-known 20th century phenomenon of Swedish Grace – with its characteristic features of simplicity, strictness, order and clarity – has been said to be the result of conscious indoctrination intended to reduce the taste of the Swedish nation to a uniform level; everything Swedish was to be made with the same good taste and the clean, functional line and light colour design was to become ”the right way” (Ahl & Olsson 2001; Rampell 2003). Bourdieu (1984) claims that this kind of indoctrination, or influence, is conceivable. He describes the structure of society as ”fields” in which a struggle for power moves individuals ahead. Knowledge and understanding of the rules are distributed to the individual through a given context of economical, cultural and social frames – the individual’s cultural capital. It is necessary to know the rules, or at least to have intuitive knowledge, a feeling for them. Individuals learn and feel what is proper, correct and right; what Bourdieu calls habitus. Bourdieu (1984) states that it is difficult to change the (power) position given on the social and cultural playground, and claims that aesthetics influences the individual’s feeling of social and cultural belonging; thus, taste is dependent on social class and

[2] Implicit knowledge is what Polanyi (1966) calls tacit knowledge.

education. Hence, different kinds of education give rise to different kinds of taste and feelings of belonging, and this, in turn, influences choice of friends and social intercourse. In this case, aesthetics is not related to categorical perception; it is not about basic perceptual categorization based on harmony, balance etc., but about form associated with social context and events.

How we perceive the outside world depends on basic perceptual principles, subjective experiences and cultural context. There are different opinions, as seen above, as to whether preferences for simple design depend on perceptive principals or are due to more or less controlled, cultural influences. One problem in the public discussion on "good form" and good design is the use of vague and shifting definitions of the notion aesthetic value. Another is confusion over the two different kinds of formal qualities: the elementary formal qualities that are dependent on basic perception and the qualities of form experience, the meaning of which arises in interaction with the surrounding world and culture. It is therefore interesting to study how people judge textile patterns. What are their reasons for choosing one pattern instead of another?

Aim

The aim has been to study judgements, notions and values in relation to designed textile patterns as expressed by schoolchildren, consumers, teachers of textile handicraft and designers.

Method and material

Seven textile patterns labelled A, B, C, D, E, F and G were presented to the subjects. The patterns were stripes printed with blue colour (NCS: 3065-R90B) on white cotton fabric. The choice of printing blue stripes should cause subjects to focus on the patterns and reduce the influence of colour preference on pattern judgement. Many experiments on colour preference have been conducted during the past century, and although most researchers have pointed out that the experiments differ in many ways, many results show a preference for the colour blue all over the world (Ball 1965; Eysenck 1941; Jacobsson 1990; Pastoureau 2001; Sivik 1989). The patterns were all stripes, systematically designed and developed to result in patterns of different complexity (figure 1).

The choice of using striped patterns in the research was made to avoid figurative and naturalistic patterns that could influence preferences. The research focused on characteristics of patterns, thus the sensory or sensuous qualities of texture in the fabrics were not included in the study.

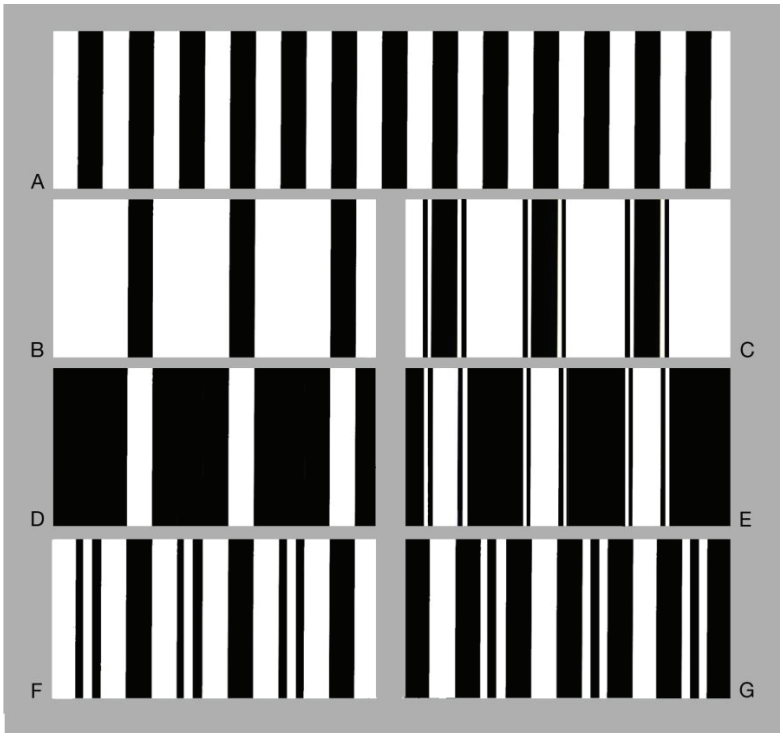

FIGURE 1. PATTERNS PRINTED ON CANVAS. ALL PATTERNS ARE DEVELOPED FROM PATTERN A, WHICH IS COMPOSED OF 10-MM-WIDE STRIPES IN BLUE AND WHITE.

Repertory Grid Method

A modified version of the Repertory Grid Method (Kelly 1955; Shaw & McKnight 1992) was used to study judgements, notions and values in relation to textile patterns and to analyse reasons for choices. The subjects were shown seven different textiles patterns, three at a time (triads). For each triad, the subjects were asked to choose one of the textile patterns, to reject another one and give reasons for their choices. No patterns were to be shown together more than once. Thus, each pattern was presented three times, but in different triad constellations. The subject's criteria of selection may be the same for all of the triads or different for different triads. When the subjects are asked to compare, they are helped to describe and justify chosen and rejected alternatives. The third alternative might be commented on for the purpose of comparing, but this was not required of the subject. Because the alternatives are repeated in a number of triads, all alternatives will normally be commented on.

Subjects

The subjects were from four different categories; Designers (n=10), teachers of textile handicrafts (n=15), Consumers (n=13) and Children (n=32), altogether 70 individuals. The ambition was to have a balanced mix of females and males and of individuals of all ages. However, in the category of teachers of textile handicrafts, this ambition was difficult to achieve, as this profession is female dominated. Thus, one

male was interviewed. The designer category consisted of educated and established designers with different specialities. Teachers and designers had higher education in colour and form and experience in designing different kinds of textile products.

The children were divided into two categories: Children age 15 years (n=12) and Children age 7- 12 (n=20). For the consumer group, the ambition was to find subjects with a capacity for verbal expression, and with an interest in textiles, but without a textile education. The subjects in this group were selected using snowball sampling, which means that during the interview period, names of other possible subjects to contact (Silverman 2000, p.159) were collected. Hence in the consumer and children groups, subjects had no professional education in design or textile, but varying experiences as consumers of textiles.

Interviews in the Repertory Grid Method

The printed fabrics were cut into 40x60 cm pieces and fastened onto neutral grey cardboards with pins in three corners of the fabrics. This allowed subjects who wanted to assess the fabric's quality to do so in the unpinned corner. The grey cardboard framed the fabric 40 mm all around. The triads were presented in different rooms to different subject groups, on tables or floors, a little aslant on the same white ground and white background and with the same lamp directed at the triads. In order to give all subjects the same impression of colour, a halogen lamp with a white spectral light was used. The subject sat or stood in front of the triad at a distance of about 1.5 metres. The interviews were tape-recorded. Afterwards, the interviews were transcribed verbatim and analysed using the computer programme Maxqda; a programme made for qualitative analyses of textual data. The subjects' descriptions and explanations were sorted and organized into different categories during this analysis.

Result

The subjects were asked to choose one of the textiles, to reject another one and to justify their choices. Some of the 70 subjects (45) had favourites among the striped patterns and always chose that pattern when it appeared in a triad. Others (50) had anti-favourites that were always rejected when displayed.

An analysis of the subjects' reasons for their choices and rejections, i.e. the judgements and notions they experienced when looking at the designed printed patterns, was made by coding the material to form categories (Silverman 2000). Four justification categories could be observed: (1) Formal content: Colour and pattern composition, including simple or complex expressions (2) Functional content: ideas related to products (3) Cultural content: Cultural and social associations and (4) Emotional content: feelings and emotional associations (figure 2).

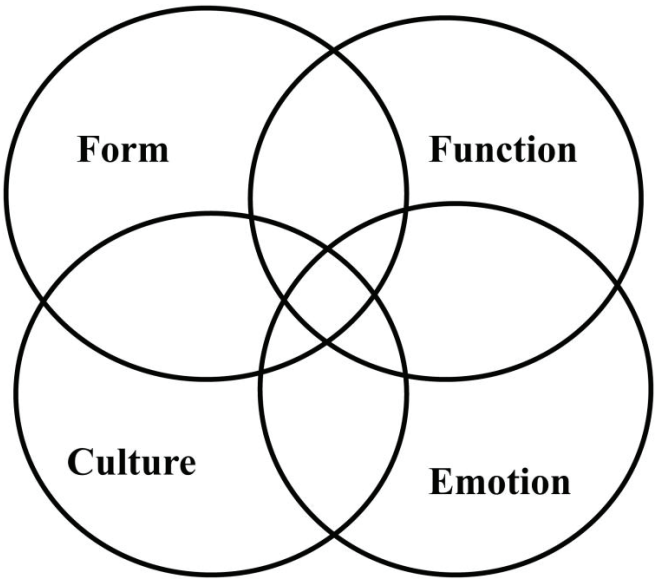

FIGURE 2. SUBJECTS MADE THEIR JUDGEMENTS OF THE TEXTILE PATTERNS BASED ON FORMAL, FUNCTIONAL, CULTURAL AND EMOTIONAL CONTENT. (MODEL BY SIRI HOMLONG)

Formal content

The colour design resulted in relatively great light contrast between the stripes. The choice of colour also meant that colour preferences could influence the choices. Those who liked blue very much preferred the bluest variation of the patterns or the bluest pattern. Others found the pattern too dark when the blue colour was dominant, and expressed the impression of the fabric as heavier or thicker due to the colour. One subject rejected pattern A, saying that she found it messy and dull. She added that "It has a lot to do with the colours: If it was black and white I may have made another choice" (consumer). Many of the subjects in the designer group had considerable experience of textile pattern design in industrial production. Most of the designers, in some triads, related their choices to the market value of the fabrics. One of the designers stated that "/.../the Swedish people love blue. If you want to be commercial you have to use blue". Some subjects in the designer and teacher group presented ideas about how one could develop some of the patterns, but they had nothing against choosing a pattern even if they would have given it a better design. Talking generally about pattern when rejecting pattern A, one female designer meant that there had to be something more in a stripe than just two colours and stripes of the same width. One designer preferred pattern G to the reversed coloured pattern F: "(F) feels a bit boring. It feels too Gustavian, I think. The other one is a little…a little more unexpected. G is a little more unexpected". One consumer also said that she had this distinction in mind when she made her choices: "…the first you think of is that it should be something you like, then you have to think of something else that is a bit conspicuous". This consumer seemed to first make an intuitive choice, then corrected herself by looking for "something special" in the design.

Simplicity, also described as clean or pure, was something that many adults regarded as preferable. Among the younger children (age 7-12), however, many preferred more complex patterns and found the simplest patterns boring, but even adults could find the simplest patterns relatively uninteresting.

The more complex patterns (F and G) were chosen by fewest informants and were also most often rejected. However, no children age 7-12 are found among the 27 subjects who always rejected these patterns.

Functional content

Many subjects, even the younger children, had ideas about objects the patterned fabrics could be used for: clothes, interiors such as pillows, curtains, beddings and also wall hangings. Some subjects always had this in mind when they made their choices, but the professionals reflected more than the others on the function of the material or pattern in relation to proposed objects:

> If there is as much printed on the fabric as there is on D, I really don't think it would be so comfortable to sleep on. But a tablecloth or some kind of home furnishing textile which you could…you don't have to have so much in direct contact with the skin and so, I could image….Yes, if I should try something really smashing maybe I could also use it to make a pair of trousers or something like that. And aprons too, and things like…Handbag, perhaps… (teacher).

Later on, the subject touched the fabric and found that it was usable as chair cover. Reflecting on function, one designer discussed the patterns as combined with other objects:

> And if you imagine (it) in this field of application (as a) curtain, or if you imagine (it) as tablecloth – Now you are going to lay a table and then …the tablecloth (she sighs) has to be nice, but still it has to be kept in the background of the plates, then I think that C is preferable, seeing that F then feels too conspicuous (designer).

The reason for this result is probably that professionals are more used to making these kinds of considerations. They may also have focused on the patterns as such as suitable patterns for objects, independent of textile material or technique. Another designer discussed during the whole interview how the patterns he had chosen would complement each other in a collection. With regard to possible functions of the fabrics in practical life, many of the designers and teachers also presented ideas for improving the patterns, the colour design and the textile materials of the fabrics. Their implicit knowledge influenced their judgements, but they also knew how to improve the pattern or fabric quality for better usability. In this case, the displayed pattern was viewed as a design proposal.

The younger children (age 7-12) more often used function as a reason for their judgements.

Cultural content and Emotional content

Choices made based on culture and emotions were often integrated and difficult to separate, both in the analysis and in subjects' reflections. Therefore, these two disparate phenomena will be integrated. Cultural associations were related to traditional styles and special objects such as the Finish flag, awnings and traditional bolsters. General associations also occurred such as summertime, marine style, the Swedish west coast, Greece and café. As mentioned above, reasons for judgements

were often integrated, deriving from more than one category, as in some of the following examples: One consumer always preferred pattern C because of its simplicity, and it gave him "really (a) summer feeling". Many adults associated patterns F and G with domestic handicrafts: "I choose that one, I don't know why, I get a sort of handicraft feeling from those (with) different (stripes) - that when the stripes are different widths - but that's how I feel" (consumer). Associations with well-known trademarks such as IKEA, Polarn&Pyret, Gudrun Sjödén, Marimekko, etc. also occurred, mainly in the adults' remarks.

Subjects made associations to different products, personal memories or were influenced by the direct context of the patterns when looking at the triad. Their associations could be negative or positive. One teacher reported that as a child she had wallpaper in her bedroom similar to pattern B/D. She could not neglect her negative associations to the pattern and always rejected it when displayed. One boy (age 10) chose pattern A because he had a similar fabric on a sofa at home. These reasons are examples of individual cultural and emotional experiences that influenced the judgments. Sometimes subjects who had made the same choice appeared to have completely different justifications for their choices. Their reasons were dependent on different cultural or artistic focal points and disparate individual experiences. This was probably the case for two distinguished designers: one of them found that pattern D was connected to "Swedish cultural heritage", the other regarded D (and pattern A) as "ageless and /--/ not at figurative, so to speak". One of the youngest children made the same association to ski tracks as did one of the oldest designers as well as a female consumer, but with different patterns and with different reactions: The girl chose pattern B because "it looks like…ski tracks…/…/. I like skiing very much" (age 9). The designer rejected pattern F and said that even if she like skiing very much, she thought the pattern looked too much like ski tracks. The female consumer rejected pattern G because it remained her that she should go out skiing, and obviously this was nothing she was looking forward to.

Many subjects, even the younger children, seemed to be conscious of their own taste. In both the children and adult groups, subjects justified their choices by saying that the pattern was/was not to their taste, or they described their overall taste during the interview session. Most of the designers also referred to their personal taste when explaining their choices, but it is obvious that skill and professional experience influence judgements.

Conclusion

Categorical perception gives a basic structure and order to the outer world (Gärdenfors 2000; Harnard 1987; Klarén 2006). In interaction with the surrounding world, the individual acquires dynamic, coherent and significant patterns of perceptive experiences, some of them more important to the individual than others. Direct experience of the logic of the outer world contributes to development of structures of attention. Such adapted principles of perception – conscious or unconscious – cause us to attend to special aspects of the world. They are the basis of implicit knowledge and serve the same purpose for perception that a theoretical perspective does for scientific research. When the subjects in this study made judgements about the textile patterns, they did so using different structures of attention, based on individual implicit knowledge. They could even use different structures of attention during the same interview session. Some subjects' attention was directed towards the function of the

patterns: What could this pattern be used for? Others directed their attention towards form content, cultural content or emotional content, but judgements were often based on more than one of these categories. In the adult groups, curiosity quite often led to an analysis of the pattern. That this occurred in the professional groups is not remarkable. They are used to analysing the effect of composition of form elements. Consumers too wanted to find out how the form elements influenced their judgements – especially when changing the context (triad) in which a previously chosen/rejected pattern was displayed changed their judgement.

The design of the striped textile fabrics aroused different structures of attention. The subjects were asked to compare different patterns in each triad, and reasons for judgements based on form content were often connected to their own taste: they liked the bluer patterns, the simple/complex patterns, etc. All the striped patterns had a systematic and logical structure – a kind of distinct order that, according to Langer (1953) and Gombrich (1979), makes patterns easy to perceive. Many subjects, however, found that especially pattern A flickered. Pattern A was disturbing to perception and often rejected. Some of the designers knew from experience – from implicit knowledge – how they could avoid that kind of flickering in a pattern design, and could therefore be more positive to the pattern as such. One interesting observation was that the older children, already at the age of 15, judged the complex patterns more negatively than the younger children did and more like the adults did.

Some of the subjects always attended to the functions of the patterned fabrics. They found them usable for clothes, interior design, etc., and they sometimes had ideas about how they could use combinations of patterns towards these purposes. Some of the designers focused on how the patterns could be combined in a collection or on how colour choice could make the fabrics more marketable. The designers' remarks above are clearly connected to knowledge of habitus (Bourdieu 1984). The extent to which the other subjects' proposals were connected to habitus is not explicitly expressed in the interviews.

In the subjects' judgements based on cultural content, implicit knowledge was a clear factor of recognition of semiotic signs in the designed patterns. In the child groups, the semiotic content – "product appearance" (Oehlke 1990) – was not observed or understood. Obviously they did not have the kind of perceptual experience needed to notice the semiotic dimension of "appearance"; they lacked the structures of attention needed to recognize this dimension. At least they had no verbal notions to describe it. Giard (1990) claims that designers are more visually literate. In the current study, the designers were adaptors, not designers, and as "readers" of the design, they understood the semiotic signs. Most adult subjects understood these signs, however, although they were not professionals. With the exception of some of the 15-year-olds, the children did not connect the patterns to a specific design or cultural heritage.

Buchanan (1989) classifies communication into three rhetorical categories: logos, ethos and pathos which are all found in this study. As Buchanan claims, pathos (category of emotion) seemed to be a strong rhetorical element. It is notable that the designers let their good memories of objects from childhood guide their choice of patterns, teachers were guided by very negative emotions towards some patterns, and three subjects at different ages and from different groups formed emotional associations with skiing when judging the patterns.

The judgements were based on implicit knowledge of different kinds: direct experience of physical and practical conditions, "know-how", cultural and emotional experiences. Some designers wanted the designed printed patterns to be "something

special", and they knew from their education and professional experience how to make a pattern more conspicuous. The designers demonstrated their explicit or implicit knowledge of the conditions that must be included in habitus (Bourdieu 1984). Experience and awareness of habitus is part of the designer's profession. A statement by one female consumer indicated implicit knowledge concerning her own habitus: for some reason not trusting her first impression, she checked to see whether there was "something a bit conspicuous" in the pattern that allowed her to choose it. One female designer also made clear that her choice in some triads would be different if she made the choice as a professional or as a private person. One teacher was very surprised when she found that she loved a pattern which was not what she would describe as her "normal taste". These examples may illustrate the – more or less conscious – influence of habitus, the common rules of taste.

When individuals have different aims and experiences, they perceive the world differently. One person may ignore what another pays attention to. Awareness of aesthetic qualities is developed through experiences in life, and can therefore even be learned. The reasons why a pattern can be looked upon in different ways are manifold. Sensuous preferences are dependant on a number of mental dimensions. The dominant inner contexts of individuals, basic perceptual patterns of apprehension, direct experiences of the surrounding world, and influences from cultural context all give different and complex structures of attention. Different structures of attention lead to different perceptual choices and different judgements, notions and values concerning, for example, a designed printed pattern. The present study shows that subjects make their judgements on the basis of formal, functional, cultural and emotional contents. These aspects should therefore be in focus in design work and design education.

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Colour and Light in Design - Levels of experiencing colour and light

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Abstract: *In our designed culture, every environment, object and picture is analyzed from the viewpoint of colour and light. Colour and light play an important role in social life and culture. This paper springs from an epistemological project about concept formation in the field of colour and light. Based on own observations and scientific and scholarly references it presents a graphic model describing possible constituent relations between colour and light experiences. Design is the art of using knowledge – implicit or explicit – about how humans perceive, experience, and relate to the world around. In design all senses are involved, but when dealing with colour and light we can confine ourselves to vision; designers must understand the conditions of visual perception. Human experience of colour and light has many sources; the given cultural context (conventional meanings of colour and light), the direct experience of the world around (colour and light expressions) and the basic perceptual functions (formal aspects of colour and light). There is need for distinct concepts and concise approaches to understand coherence of aesthetic and functional expressions. Design education calls for coherent and well defined structures that can be used to describe connections and distinctions between experiences of different kinds.*

Keywords: Colour, Light, Experience, Perception, Concept

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Background

The aesthetics of colour and light play an important role in the fields of art, design and communication. Colour and light in built spaces influence our experiences and feelings, our comfort and physiological well-being. Colour and light have great impact on health and can promote visual clarity, functionality, orientation and sense of security.

When designing, colouring and illuminating objects and environment (or ourselves) a general experience of a rich and complex world around is not enough. To a designer it is also necessary to have a sound knowledge of what constitutes *how* we experience the world – both for the creative process and a critical distance. It is one thing to experience or intuitively imagine the "tone" of an object or a "mood" of a space; another thing is to be able to consciously reflect on the sources of such experiences. Professionals in the field of design must in one way or another find distinct concepts and concise approaches in order to understand coherence and causes of aesthetic expression. Such concepts and approaches are not easily found. The essence of our experiences and emotions might even be beyond the limits of (verbal) language. But, as Ludwig Wittgenstein has pointed out, even if we cannot explain them verbally they manifest themselves to the senses. They can be demonstrated and their cognitive and perceptual basis can be described (Wittgenstein 1992 p 64, 122).

Creativity requires conceptual means to consider conditions and nature of intuitions and experiences. And this is not only important for designers, artists and researchers. It is also highly important to technicians and politicians – and, actually, to all of us. We are all responsible for how the world is designed. In design all the senses are involved, but when dealing with colour and light we can confine ourselves to vision; designers must understand the conditions of visual perception.

Colour and light are only seldom integrated from the beginning in the design process in education. Traditionally colour and light in design and design education have been looked upon as something that is discussed when the design is finished; designed objects or designed spaces are thought to be 'coloured' and 'illuminated' afterwards. This educational choice – or lack of choice – is done in spite of the fact that appearance is basic in spatial design, and that colour and light are absolute conditions of appearance. This way of looking at colour and light as being subordinated and of minor importance is based on an insufficient understanding of human visual perception and on basic conceptual confusions.

Academic research about colour and light is split between several disciplines. There is also technological research and development of light sources, light fittings, dyes, paints etc. carried out by industry. This division between different institutions and organisations has lead to diverging research traditions and conceptual approaches.

Manufacturers and researchers often have difficulties understanding and forming opinions about each other's methods and results, although they are working with similar questions. One important aspect of this is the absence of common and generally accepted concepts. The confusion about the concept of *colour* is discussed in Green-Armytage (2006). The need for specifications of the concept of *light* is discussed in Liljefors (2006). In design education this incoherence of the field has resulted in confusion of ideas about the nature of colour and light.

Colour, light and space

We live in a spatial and continuously changing world. Our cognitive and perceptual systems derive their distinctive characters from this fact. Even if our perceptions are subjective, our basic spatial experiences are natural perceptual facts and functionally universal. All senses add to the experience of a spatial and changing world around, but the principal *spatial* sense is sight. Vision provides a coherent and continuous understanding of space. We always experience the surrounding world as three-dimensional: visual patterns that *can* be understood as spatial are given naturally such an interpretation in perception (Gregory 1966, pp 147).

Traditionally, research about colour has most often neglected the need of knowledge about spatial visual perception, and although colour and light are mentally inseparable in our experience of the world around, the complicated relation between colour and light experiences has not been given attention. Colour phenomena have usually been presented two-dimensionally and without intention to be spatially experienced.

Concepts describing colour and light as integrated in a spatial whole have to be based on coherent spatial experiences. Spatial perception demands spatial relations and directions, size gradients, enclosure, etc. David Prall (1936, p 39) says:

> You cannot make a spatial whole except with elements the very nature and being of which is spatial extension – – The elements must lie in an order native to their being, an order grasped by us as constituted by relation. We call structures intelligible (–) so far we find them capable of analysis into such elements so related.

Colours as such have no spatial extension. They have no formal structure except colour qualities related to other colour qualities, i.e. contrasts in lightness, whiteness, blackness, hue or chromaticness (this colour terminology refers to The Natural Colour System, NCS – The Swedish standard for colour notation). If focusing on colour in spatial context, colour and light theory is given theoretical connection to our intuitive understanding of the world around and can be part of a wider field of aesthetic research and education.

Colour, light and physics

In the field of colour and light, visual/perceptual phenomena too often are described and analysed with the use of physically based concepts. This can give the impression that physical measurements also measure what we see. But this impression is false and it is not only a question of simplification. Using physically based concepts to describe perception of colour and light may be both misleading and incorrect. This does not, however, mean that concepts referring to abstract but measurable structures of the physical world are not useful. But they are useful only as long as they are used to describe the material world. It is, for example, necessary for paint industries and light source industries to have instruments to control and maintain physical standards of their products.

We experience colours intuitively as properties belonging to the outer world. In the physical world – beyond the reach of the senses – the existence of colour and light can only be demonstrated indirectly by measuring spectral electromagnetic radiation with wavelengths between approximately 380 nm and 760 nm. The human eye responds to this radiation, but the rays themselves are not visible. Isaac Newton

remarks that " "the rays, to speak properly, are not coloured. In them there is nothing else than a certain power and disposition to stir up a sensation of this or that colour" (Newton 1704).

It is true that experience of colour and light is dependent on electromagnetic radiation but the colour of an object are only to a certain degree dependent on spectral distribution of the radiation that it reflects. The Norwegian neurophysiologist Arne Valberg states: "The reflection properties of surfaces relative to their surround are more important for colour vision than the actual spectral distribution reaching the eyes." (Valberg 2005, p 266). The American philosopher C.L. Hardin concludes that there is no "reason to think that there is a set of external physical properties that is the analogue of the (colours) that we experience" (Hardin 1993, p xii).

Colour, light and adaptation

The relationship between the physically measurable and vision is complicated. Our perceptual systems counterbalance physical changes in the world around. Our vision is based on a continuous adaptation, which strives to keep the colours of the surrounding world.

When perceiving colours, our vision does not register the absolute intensity or the absolute spectral distribution of radiation that reaches our retina. Instead *distinctions* and *relations* are registered. Hence our visual system is developed for a continuous spectrum of light and gradual changes between different illuminations. Under these circumstances we perceive colours as more or less constant if our visual system has had time to adapt to the specific light situation.

The mechanisms that make us perceive and determine the lightness of surfaces observed in different situations have been thoroughly considered by Alan Gilchrist et.al (1999). Gilchrist et al. state that it is not the luminance that determines the perceived lightness of a surface. Any luminance level can be perceived light or dark depending on context, and the surface that we perceive as white functions as an "anchor" for perceived lightness of all other surfaces seen simultaneously.

Most often our anchor for "white" is defined as the surface that has the highest luminance in the visual field – *Highest Luminance Rule.* This is, however, not true in all situations, since we also have a tendency to perceive the largest area in the field of vision as anchor for "white" – *Area rule.* As long as the lightest area also is the largest, the two rules coincide, but they come into conflict if the darker one also is the largest. Then we tend to perceive the largest area as white at the same time as the smaller and lighter area also is perceived as white - a paradox that is solved by perceiving the smaller area as luminous.

But even if we experience that an object has the same colour in different light we can at the same time perceive a slight tone of colour that reveals the character of *light*. All colours have at least a slight chomaticness and a hue. We never experience absolutely neutral – achromatic – colours (Fridell Anter and Klarén 2009). For nominally white surfaces this effect is more obvious than for nominally chromatic surfaces. We experience the surface as white but we understand at the same time that it is illuminated with a light of a special quality and intensity. This involves not only light coming directly from the light source, but also reflected light from surrounding surfaces. Reflection from chromatic surfaces in a room can give a hue to a nominally

neutral or slightly chromatic surface, which is especially evident in nominally neutral light surfaces (Billger 1999).

Klarén and Fridell Anter (2011) have shown that the "lightness anchor" also functions as a perceptual anchor for experience of hue. With an analogy from music theory white anchoring could be regarded as a "transposition" where the surface that is perceived as white is the "keynote" – or "keycolour" – for perception of both lightness and hue in a given light situation; the "keycolour" decides all relations between the colours in the field of vision.

The French philosopher Merleau-Ponty (2002, p 355) discusses how we experience the surrounding world in different ways depending on situation. He makes a distinction between two modes of attention: he talks about *the reflective attitude* and *living perception*. We use the reflected attitude when we attend to and consciously compare one colour to another. In living perception colours are manifested to us in the totality of spatial relations; it is the everyday way of attending to colours. Depending on modes of attention, a nominally white surface lit by 'warm' sunlight can be seen, with a reflective attitude, as slightly yellowish. With living perception, however, we may feel that *the same* surface is white; we experience intuitively that it also has – independent of the accidental yellowish light – a constant colour experienced beyond the perceived colour. One could call this colour *constancy colour* (Klarén 2012, p 24). Constancy colour refers to a natural perceptual 'skill'; we intuitively summarize the totality of perceived visual information in a given context.

We have a tendency to regard the constancy colour as the "proper" or "real" colour of the wall. Ewald Hering's concept *memory colour* (Gedächtnisfarbe) touches on this phenomenon, but confines it to expected colours in objects: "What the layman calls the real colour of an object is a colour of the object that has become fixed, as it were, in his memory; I should like to call it the memory colour of the object" (Hering 1920). Merleau-Ponty says that the "real" colour persists "not as a seen or thought-of quality, but through a non-sensory presence." (Merleau-Ponty 2002, p 356).

All these colour and light interactions are what makes us perceive space visually. Normally we have no difficulty in making distinctions between what is caused by the light and what by the qualities of surfaces. The logically distributed colour variations caused by light, reflections and shadings are to our intuition natural and indispensable spatial qualities.

There is a tight perceptual attunement between us and the world around. The experienced world is in ecological balance with the human environment, and the perceptual relation between the outer world and the human inner world is without hindrance.

In addition to the basic perceptual processes and the direct spatial understanding of the world around, human comprehensive experience of colour and light is also related to culture. Imaginations, conceptions and ideas *about* the world provide a context to our sensory experiences. The American philosopher Alva Noë (2004, p 1–3) remarks that adaptation is not limited to basic physiological reactions. It is both perceptual and cognitive and derives its origin from multiple sources, external as well as internal. Human experience of colour and light in the world around is related to the context as a *whole*. It is made up from interplay of the individual and the world on many levels. In this sense colour and light are *natural* but *non-physical*.

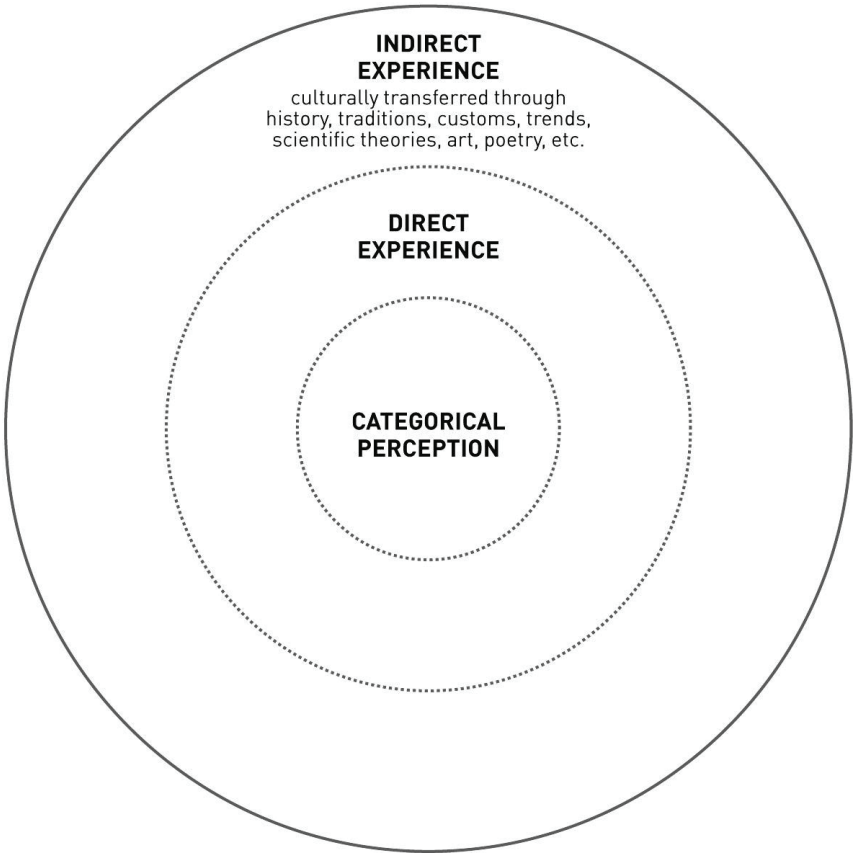

Figure 1. Experience levels (Model by Ulf Klarén)

Levels of experience

It is true that we *see* colour and light, but what we so vividly *experience* is a *coherent* world full of life and meanings. The human experience is multidimensional and dynamic. Its totality cannot be described easily. Just like all sensory experiences, colour and light are perceived and understood on different levels: from the basic that are common to all humans to the most rapidly changing cultural trends.

Figure 1 shows levels of experience - from experiences based on *categorical* – basic – *perception* (formal aspects of colour and light) through *direct experience* of the world around (colour and light expressions) to the *indirect experience* (conventional meanings of colour and light), imbedded in cultural expressions; history, traditions, customs, trends, scientific theories, art, poetry, etc.

Categorical perception

Categorical perception gives basic spatial and temporal structure to experience of the surrounding reality. It comprises the basic perception of colour, light and space, balance, verticality and horizontality, movement, etc.

We perceive the surrounding world (and ourselves) in time and space, as were it, without hindrance. The world appears as an *aesthetic surface* (Prall 1936). We perceive patterns of colours, shapes, sounds, scents, tastes and textures as part of a spatial context. The ultimate purpose of categorical perception is to build a comprehensive mental image of the human world: "A reality without well-defined borders is divided up into distinct units by our perceptual mechanism" (Gärdenfors 2000, p 20. Our transl.) . By natural selection man has been endowed with certain perceptual and cognitive tools for survival that are basically common to us all. Categorical perception is in some respects determined genetically, but for the most part acquired in early life.

Perceiving colour distinctions and colour similarities are basic to colour perception. If, for example, in a colour combination, the colours have the same whiteness, blackness, chromaticness, hue or lightness, we can sense that these colours have something in common. We are use to saying that colours in such colour combinations *fit together* or *harmonize* or that the colours of a painting or a room *hold together*. This experienced unity of colours, however, has nothing to do with preferences. It follows from the visual system itself: the ability to recognize colour distinctions and colour similarities is part of the categorical perception and is therefore predetermined. It is natural in the same sense as recognition of characteristic colour scales in perceptive colour systems.

Direct experience

By *direct experience* we gradually learn through living to understand the relations of colour and light to the world around. The direct experience is dynamic and simultaneous; perceptions, feelings and emotions form a coherent whole. Making use of natural perceptual abilities (the categorical perception) and interplaying with the physical world we develop perceptual "skills"; we acquire abilities to catch the spatial significance of colour and light in space. We also learn to recognize the perceptual qualities of materials, how they feel and how colour and light relate to them, etc. Patterns of sense-qualities always belong to functional situations in life, each one having a characteristic perceptual and emotional content; the light always

illuminates *something,* it is always *something* that has a colour, and a spatial situation always has a special atmosphere. Direct experience provides spatial understanding, meanings, and emotional content to the physical world around.

The German philosopher Gottlieb Baumgarten, originator of Aesthetics as a specific academic discipline, describes knowledge that implies a coherent intuitive understanding and is given to us directly by sense experiences. Baumgarten claims that aesthetic knowledge *constitutes* logically based knowledge, "that sensible cognition is the ground of distinct cognition; if the whole understanding is to be improved, aesthetics must come to the aid of logic" (Baumgarten 1983, p 80). The tacit meaning of the direct visual experience of colour and light, materials, textures and objects is an aspect of our aesthetic approach to the world.

Indirect experience

In the *outer* circle we find *indirect experience* - principles, concepts or models that help to understand or give perspective to experienced phenomena in the two inner circles. Being embedded in cultural expressions (history, traditions, customs, trends, scientific theories, art, poetry, etc.), indirect experience forms a cultural context to which all experiences of necessity are related. History, scientific theories and theoretical models provide a basis of explanation and analyses. Traditions and customs serve as guiding rules. Art and design, literature and poetry summarize common experiences: art and design with expressive or significant form, literature and poetry with verbal language. Thus indirect experience can convey meanings and feelings to phenomena based on direct experiences and categorical perception.

The indirect experiences can change and be reinterpreted, but can never totally be taken in or controlled by the individual. Indirect experiences are implicitly present in all perceptions. Abstract figures or words can be associated with symbolic meanings and scientific theories may refer to perceptual appearances. A colour combination, a specific light situation, a designed object or a spatial design may – as content of an associative symbol – be connected with special concepts or feelings. Associative symbols are basically social/cultural understandings. They are arbitrary and can be changed or replaced. The associative symbols may not be mistaken for the emotional content that has its origin in direct experience and the individual's perceptual interaction and interplay with the world around.

Being dependent on their origin the principles, models or concepts of the outer circle have indirect or direct relations to phenomena in the two inner circles: visual symbols and concepts used in perceptual colour or light theory refer *directly* to phenomena in the two inner circles, whereas concepts and symbols describing the outer world in abstract terms have *indirect* relations to them; thus words, figures and concepts based on physical analyses with quantitative measurements and instrumental methods have an indirect relation to perceptual phenomena.

The three experience levels are interdependent and implicitly present in all perceptions. A perceived distinction between a red colour and other colours is a basic – categorical – perception. The experience of the colour of a wall – whether in light or shadow – is a direct experience of the world around. The knowledge that red has a special position in a colour system, or that red surfaces absorb electromagnetic radiation in a special way, or that red houses may be of high social importance, is based on indirect experience.

Art and design have a special and complex relation to direct and indirect experience. On the one hand artistic works can serve as "models" or "examples" for how we may attend to light and colour in our direct approach to the world. On the other hand they are also, as appearances, direct experiences.

Experiencing colour and light in a living context always includes emotional and intuitive understanding; we experience spontaneously spatial relations and moods in a cultural context. This is how our overall perception normally works. In adopting an aesthetic attitude we consciously attend to this spontaneous process of understanding; perceiving aesthetic qualities in art and design – or in the world around – means that we open up for reflection on experiences us such.

The American philosopher Susanne Langer's aesthetic philosophy is a part of the epistemological tradition from Baumgarten. Connecting to Wittgenstein she asks, *how* do we give symbolic form to the tacit dimension of our direct experience? She claims that the emotional content we can experience in a piece of art or a designed object is

symbolic in a special way (Langer 1957, p 60); perceptual patterns of colour, light and form, abstracted from their normal context in life, can be used as symbols for *felt life* in pieces of art and in designed objects. Susanne Langer calls them *logical expressive* – or *articulated – symbols* (Langer 1953, p 31)

Wittgenstein (1993, p 19) says that feelings follow experience of a piece of music, just as they follow courses in life; a piece of music consists of a sequence of tones. It has a structural resemblance to courses in life – a rhythm, pauses and breaks, pitches, etc. – and thus they can be used as examples. The auditory structure in music is not a course of life, but felt life abstracted in a logical expressive symbol. The same is true for all sensory experiences.

The expressive symbols are what we may call the artistic or aesthetic dimension in pictures, in utility goods, in architecture; they can make us feel something *in* something or see something *as* something. Susanne Langer (1957, p 73) describes them as *objectification of feelings*. As logical expressive symbols, colour and light expressions in art and design can serve as *examples* of direct experiences that may promote new perceptual approaches the world.

The logical expressive symbols occur in the borderland between direct and indirect experience. What we are used to calling "expression" in an articulated object or space is perceived as a direct experience, but without being separated from its symbol. Encountering articulated patterns in a piece of art or a designed product we experience recognition. Susanne Langer says that "in one way, all good art is abstract, and in another way it is concrete" (Langer 1957, p 69). The aesthetic dimensions in art and design are, depending on aspect, both direct and indirect experiences.

Conclusion

In a sense colour and light are "always something else". They have many aspects and their relations to different levels of experience must always be considered. Our visual experience is not without structure or laws and there are certainly many concepts describing it. One could even say that there are too many – and disparate – concepts to be useful in communication. What is emphasized here, however, is the need for a coherent and well defined overall structure of content. Without a comprehensive structure of content it is not possible to see how different kinds of colour and light experiences – and colour and light concepts – are related to each other, or in what respect they refer to different aspects of reality. If colour phenomena are abstracted from their natural and simultaneous connections to light, spatial order and cultural context, the causal relations behind them become inconceivable and mystified.

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Mindfulness: The holy grail of design education?

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Abstract: *In the field of design education, the term 'mindfulness' has been criticised as a mystification of the creative process and derided as a 'holy grail' (Moore 2009). I will argue against this criticism, try to establish some general rules for the chaotic diversity of individual creativity and highlight the role of flow and mindfulness in connection with the creative act. These reflections are rooted in my own experiences teaching croquis drawing with a live model, as well as many years as a practicing artist and pedagogue. My main focus is on elucidating the relationship between context and mindfulness in a teaching situation. It is my hope that this presentation will contribute to a wider understanding of the act of drawing, including cognitive, psychological as well as philosophical aspects.*

Keywords: focused/non-focused attention, croquis drawing, overlearning, flow, mindfulness, distributed attention, ego-centred control.

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Introduction

How can we stimulate creativity in an educational context by using flow? The importance of mindfulness will be discussed here especially in relation to croquis drawing with a live model. Although this topic does not focus on the design process 'per se', can we find common ground between different working situations? Sketching out ideas in the germinal phase of the design process differs from croquis drawing in many ways. Both activities are nevertheless related to a part of the drawing process that particularly appeals to intuition, each accessing creativity in its own way in the sense that there are no right or wrong solutions. A characteristic aspect of this phase is the production of sketches in large numbers, executed extremely rapidly while the artist improvises. Improvisation requires a particular state of mind of concentrated attention that may be compared with mindfulness.

The concept of mindfulness has been discussed by leading psychologists, scientists, artists and spiritual masters, showing the diversity of fields in which mindfulness plays a role – from Thich Nhat Hanh's Buddhist meditation techniques to Jon Kabat-Zinn's clinical applications for therapeutic purposes (Boyce 2011). The Hungarian psychologist Mihaly Csikszentmihalyi has studied the importance of flow in many areas of daily life. His research focuses on creative individuals such as artists who are familiar with the phenomenon and make regular use of it. Csikszentmihalyi lists seven conditions that are necessary for achieving a state of flow:

- An activity involving such a large degree of concentration that nutritional needs and tiredness are forgotten.
- Ego-centred control of the process is replaced by a loss of self-awareness.
- Becoming one with the action.
- A clear goal, immediate feedback, and a sense of reward.
- A feeling of mastering the situation.
- The challenge at hand must be consistent with one's skills.
- A feeling that time has disappeared.

The terms *flow* and *mindfulness* are often used interchangeably, but are they actually synonymous or do they describe different things? Authors Nobo and Sachiko Komagata define mindfulness as 'a mental state of being aware of the outside and inside of oneself at present without judgment, i.e., with full acceptance.' Csikszentmihalyi's definition of flow is: 'The state in which people are so involved in an activity that nothing else seems to matter' and where 'the experience itself is so enjoyable that people will do it even at great cost, for the sheer sake of doing it' (Csikszentmihalyi 1991).

Are we talking about separate states or transitions between related psychological states? This issue was addressed by authors Nobo and Sachiko Komagata in an article comparing the experience of flow and mindfulness in relation to the concept of concentration. Their conclusion showed that our understanding of these terms is still evolving and that it is easier to regard them as a continuum of states rather than as discrete mental states. The reason for this is the paradoxical relationship by which these three states are linked. A high level of concentration, for example, may on the one hand contribute to bringing about a state of flow, while on the other leading to a loss of mindfulness. This, in turn, may contribute to openness towards receiving advice and feedback that would not be possible in a state of mindfulness in which the present circumstances must be accepted without judgment.

According to the two Japanese authors mentioned above, both states lead to an increased awareness of the moment, although mindfulness represents the highest level. The difference between the two states lies in their relationship to concentration and the field – or 'bandwidth' – of awareness. The duration of the state of flow depends on how long concentration can be sustained and requires loss of self-control as well total immersion in an activity, something that in itself will prevent mindfulness. The latter, however, is not compatible with the type of concentration found during flow. The field of awareness is narrower and more present in a state of flow than in a state of mindfulness, in which it is enhanced (Komagata 2010).

The mental state explored in this article, using croquis drawing as a basis, has nothing to do with religious practices or therapeutic treatment, but draws on Eastern meditation techniques in an attempt to increase the awareness of the present moment. Although the phenomenon of mindfulness is both difficult to describe and to convey in its entirety, it is a basic and spontaneous human experience that can be enjoyed by anyone, such as when learning to ride a bike, dance, play an instrument or draw croquis sketches.

Stimulating flow in an educational context

The experience of flow and mindfulness revolves around tacit knowledge about the creative process, i.e. experiences that are very difficult to put into words. The ability to enter into such an experience requires bringing one's entire personality into play. This means to access one's own 'spontaneous competence' (Wiese 1998) by relying on instant reaction, rather than to be bound by rules. Emotional identification with the subject, i.e. relinquishing control, is necessary to become one with the task. Questions such as how to take a chance on everything going well, how to get rid of one's anxiety, how to find the courage to throw oneself at the task, how to lower expectations or how to be unafraid of making mistakes and trust one's own feelings as a resource for action, are quite common. One answer to these questions is to banish all critical judgment in order to safeguard the development of this vulnerable process. The 'right' mental attitude involves the student's awareness of two different ways of thinking when processing visual information and of the functions of the two halves of our brain.

The experience of flow and mindfulness has among other things thrown light on the issue of how attention may be used in different ways during the learning process. The notion of 'overlearning' has been an important pedagogical concept in various educational approaches such as the Montessori system. It denotes

> … learning beyond what is necessary for immediate mastery of a task, for example continued drilling of a vocabulary list even after it can be performed flawlessly. Overlearning can provide superior learning, as the skill is preserved for longer than if overlearning had not taken place, or has been so well rehearsed that it has become automated (Store norske leksikon).

Automaticity as a consequence of overlearning is a particularly fascinating aspect of the learning process, as it frees attention for other tasks without sacrificing contact with the automated task(s).

> Automaticity is the ability to do things without occupying the mind with the low-level details required, allowing it to become an automatic response pattern or habit. It is usually the result of learning, repetition and practice. … After an activity

> is sufficiently practiced, it is possible to focus the mind on other activities or thoughts while undertaking an automaticized [sic] activity (Wikipedia).

Overlearning and automaticity are highly relevant concepts in connection with the process of learning how to draw, and can help us understand the role of attention during a state of mindfulness.

Mindfulness and drawing

The process of identification via aesthetic expression shares similarities with various meditation techniques in which posture and continuous attention to individual stable elements are of the essence. The actual focus of attention, however, is less important than its intensity. The former may vary greatly, ranging from visual stimuli to sounds, spaces or actions, depending on the meditative tradition in question. A crucial difference compared to traditional meditation techniques lies in the fact that the experience of flow is not explicitly formulated as a goal at the outset, but becomes a natural and spontaneous consequence of the necessary focus of attention throughout the act of drawing. Rather than a technique, it is more about an attitude that can help disengage routine thinking and thus allow one to be more present in registering the subject in the moment.

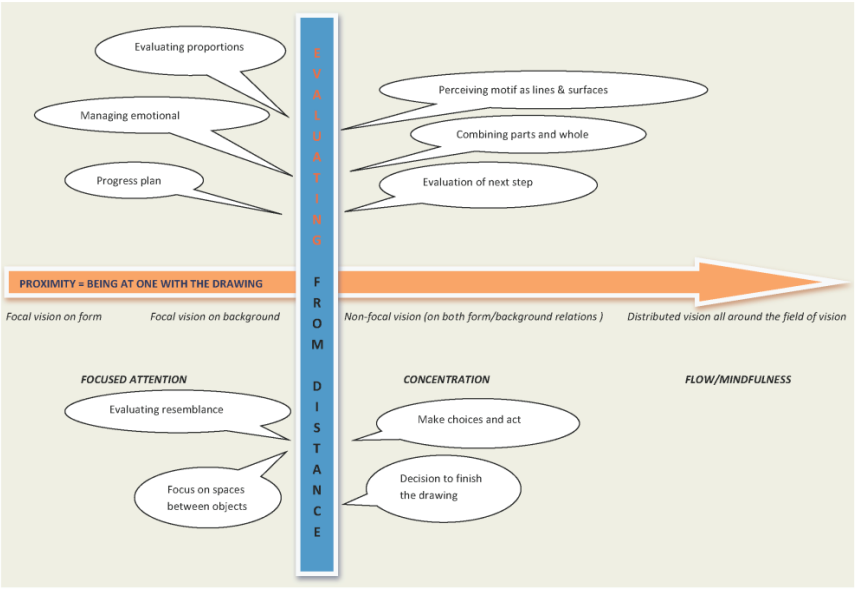


Figure 1: The diagram shows different levels of visual attention during the drawing process (horizontal axis) in interaction with assessments and strategies for action (vertical axis). Chr. Montarou, 2013.

As an artistic activity, one's posture can be informal and does not require any special positioning. An important similarity between meditation and drawing is control of attention. When drawing, visual attention must be fully focused on the act of drawing, and shapes, lines and colours must be seen precisely for what they are – disconnected from any meaning. Like an aesthetic experience, both situations require a sustained focus on the moment of perception. Such an approach can help bridge the

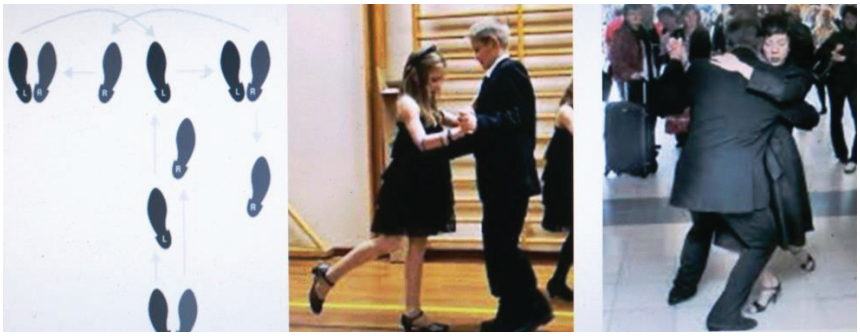
initially considerable gap between the intention of drawing and the subsequent physical act. The rational mind knows what to do, but the body does not follow suit. After some practice, the perceived distance almost disappears. At this point, body and mind have begun to integrate in a way that provides ideal conditions for engaging in the act of drawing. This state of mind can be described as expanded consciousness, not in a philosophical or religious sense, but in the sense that the relationship between body and mind is in a state of flow. The experience of this state as simultaneously mental and physical is of great importance for the creative process, opening up, as it does, for improvisation and free association.

The following quote by painter Paul Cézanne conveys the artist's ability to empathise by projecting him or herself onto the motif via focused visual attention. It may be seen as the result of the state of mindfulness Cézanne found himself in after painting for hours on end in the midst of the landscape he depicted: 'The landscape thinks itself in me, and I am its consciousness' (Sandqvist 1995).

A particular characteristic of this state of mind is that all sense of linear, chronometric time is erased. The artist seems to become one with time, 'fully present' in the situation while experiencing a sense of timelessness. This allows the body to play a different role in the process of perception: the anatomical, functional and rational body that creates meaning becomes less relevant. By partly 'turning off' the capacity for analytical thought, the brain ceases to perceive the body – as it usually does – as separate from its surroundings. Instead, the brain focuses on the actual and specific body intense concentrated on the act of drawing. Everything appears to take place simultaneously rather than as a series of events involving cause and effect. To a greater extent than otherwise, the body is experienced as being 'at one' with the surroundings and 'in flow' (Csikszentmihalyi 1991).

Achieving flow

The different stages of the drawing process resemble those described by both researchers on mindfulness and by the Chinese philosopher Zhuangzi (300 AD), who describes three different stages in the process of developing the basic experience of mindfulness (Billeter 2010).



From ego-centred conscious control to focused attention, i.e. losing oneself and becoming one with the surroundings. Energy flows freely without interference by the ego while dancing Tango.

I will argue that flow can be achieved by establishing the following conditions that help to usher students away from the control of ego-centred awareness and into flow and mindfulness:

- Control of attention during the drawing process.
- A feeling of mastering the task.
- Becoming one with the subject, i.e. loss of self-control during the process.

Facilitating flow in a teaching situation

The above description may give the impression that mindfulness is nothing more than an ego trip taking place in the individual mind. But the experience of mindfulness in an educational setting is not about one person separately interacting with his or her surroundings. Instead, it involves a group situation in which students, each with a unique set of expectations, interact by focusing on a common task. This places certain mental and physical demands on the participants, some of which may be addressed by a targeted use of educational resources. The rest is more a matter of organizing activities, techniques, materials and locations without any other clearly defined objectives than to be open and prepared to accept whatever might happen during a session.

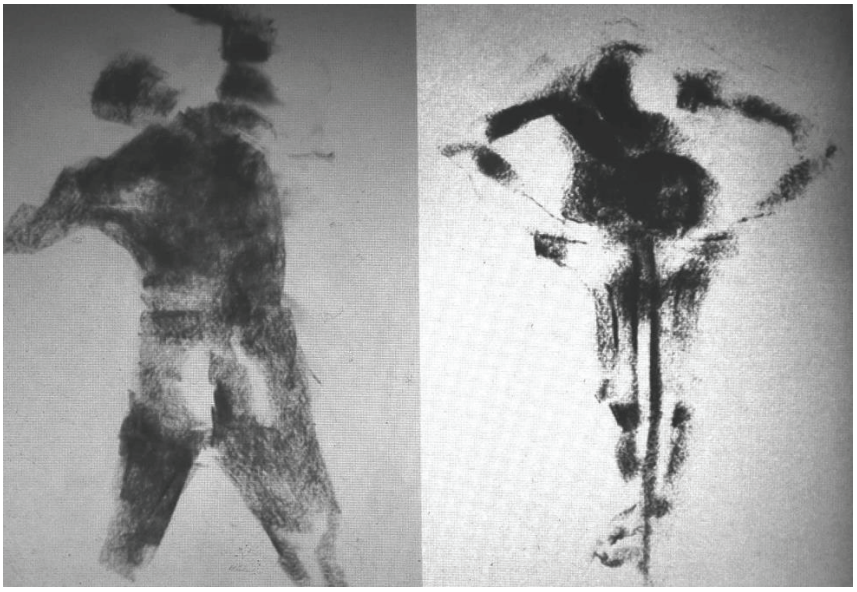
Students drawing in different positions and parts of the room during a fifteen-second sketch session with a nude model.

Nevertheless, before attempting an improvised session it is important to keep in mind the timing and sequence of the various progressive stages. Having practiced drawing regularly for several months, students have also tried their hand at sketch drawing based on magazines and movies. In addition, students experiment using various ink techniques. This allows them to become familiar with new techniques and exercise their visual imagination based on the application of these techniques. During their work, students are challenged to apply focused attention by using the methods discussed in this article.

Ultimately, it is a question of sharing one's own conviction with the students: every human being possesses creative powers that can be unleashed and cultivated. This requires trust in oneself and the ability to react spontaneously and creatively to visual stimuli.

In order to experience a sense of flow in drawing, it is necessary to perform this activity for its own sake, simply because it is a pleasure to draw. The atmosphere should be special, and there should be something magical about it. This can be reinforced by using certain habits and rituals, e.g. marking the threshold to a creative space, using music and establishing a repetitive structure of working periods and breaks. A safe situation can help some students dare give more of themselves and

achieve something beyond the ordinary. The artistic activity is based on imitation (mimicry) and allows the students' imagination and empathy to unfold. This entails above all the ability to identify with the artist in oneself. Through identification with the dynamic of the model's pose, experienced as lines and shapes in space, the student virtually becomes one with the model. This is brought about by a continuous and repeated drawing action that establishes similarities between the traces left by the student's hand movements and the motif. Students learn to trust their hands and discover that intuition frequently – but not always – can be counted on, and that emotional investment, hard work and diligence are indispensible.



Rendering the energy and dynamism of the model's pose by using lightning-quick sketch drawing. Student works.

One characteristic of a state of flow is that it provides self-esteem and thereby transcends the boundaries of the self. This means that we imagine ourselves to have qualities that we do not actually posses. In this way, the students can surprise themselves and perform better than if they had maintained a more 'realistic' sense of themselves. The students should be confident in their own abilities and hopefully not be concerned about the results, although in many cases the drawing skills of the individual student are not yet fully developed. The primary goal is to experiment with coincidence, setting aside any major expectations. Students attempt to master technique without defining advanced objectives such as rendering the energy and dynamism of the model's pose.

Determination and control of visual attention

The first step in learning to see is to understand the need to develop control of visual attention. This applies to both quality (intensity) and quantity (selectivity). Selectivity entails visual acuity – the ability to interpret a three-dimensional motif on a two-dimensional surface and transform aesthetic stimuli into a repertoire of visual elements such as lines, spacing, angles, proportions and symbols. In order to learn how

to control attention, it is important to provide clear 'guidelines' that tell the eye what to focus on, while at the same time judging what information should be suppressed as irrelevant. When using focal vision (narrow/analytical) in everyday perception, the shape of an object is identified in conceptual terms as a shape separate from a background. The creative challenge in the act of drawing is linked to the ability to register the relationship between shape and surroundings. This also involves attention to negative interstitial shapes that surround the motif and provide a new focus. This approach inhibits the usual tendency to focus on the main motif and instead fragments the scene into a puzzle of shapes that carry as little symbolic significance as possible. In this way, the artist can more easily break free from the presence of the concrete object and the power of perception that is governed by a conventional systematization of symbols.

By using non-focal vision (wide/synthetic), including both front and back (the main subject and its context), the draughtsman establishes a relationship between foreground and background and perceives the motif as a complete drawing. This type of vision requires clearing one's head of thoughts; the resulting 'mindful void' allows the artist to unconsciously scan the field of vision using distributed attention (Ehrenzweig 1974). Consciously shifting between focal and non-focal vision and thereby achieving transitions in the perception of a motif is a useful exercise for developing the experience of flow.

What about the intensity of visual attention during drawing? The level of intensity plays an important role in the drawing process, since it mobilises an overall state of alertness that allows the artist to address and respond to a stimulus, usually lasting anywhere from one second to 15 minutes; the 'creative instant' probably occurs during these short lapses of time. The path to achieving such an intense focus is an act of will that requires both a mental and a physical effort. Many students are unaccustomed to actually being *inside* the work and at first find this quite tiring.

Drawing is a psychomotor act that requires coordination of different mental processes and areas of experience. This includes, among other things, the students' need to extend their accustomed field of vision and to translate the entire gamut of their perception into visual language, emotional commitment and physical, muscular activity. All of this entails a more instantaneous collaboration among these areas than is required in most of the fragmented and specialised activities we engage in, and therefore demands a greater amount of energy than many of us are accustomed to. In addition to a short and intense focus of attention, the draughtsman has to be able to sustain his or her attention throughout the time needed to finish the drawing and learn to exclude distracting elements while working.

Combining time pressure and focus control

Conscious use of time pressure forces students to develop a spontaneity that reflects the model's body in the selected pose. The student needs to apply synthetic vision so as to capture a fleeting reality in mere seconds (10 to 15 sec.) and record it by using unconventional techniques and materials. Materials and untraditional tools are selected with a view to facilitating improvisation. Their use invites the student to think and act spontaneously rather than to stick to familiar rules and routines. In this way, representational schemata fall by the wayside and space is freed, allowing more original solutions to appear. These solutions, which the student had to find while engaged in an action, may have been inconceivable just moments earlier. As a consequence of time pressure, gestural rapidity helps the draughtsman remain fully

concentrated on the act of drawing so that all perception of time ceases. In other words, the artist is 'at one with his actions', disconnected for an instant from the perspective of past, present and future. The duality between body and mind that lies at the heart of the drawing process has been temporarily suspended, subsisting nevertheless in the constant alternation between proximity (being at one with the drawing) and distance (evaluating from a distance). Reducing the distance between intention and physical action may well be considered one of the most important objectives in the drawing process as far as mindfulness is concerned.

Students work using various ink techniques.

Overlearning

Before carrying out the act of drawing as a routine action (intuitive reflex), one has to learn by imitating: first drawing based on instruction, and then trying on one's own. When the stage dealing with focus of attention has been mastered (i.e. losing yourself and becoming one with the subject), consciousness can be freed for other purposes. Because the action has been partially integrated into the body, control is no longer needed to the same extent as before. This stage wipes out consciousness similar to falling asleep, and the act of drawing can occur 'automatically' but by no means in a mindless manner. As a transitional release, other parts of consciousness take over more complicated tasks like capturing and combining fragments of information from both past and present in new ways. Another form of visual concentration called non-focal vision or distributed attention is used to simultaneously process different sources of information by according each of them the same level of attention. This involves alternating between conscious and unconscious scanning of the flow of outer and inner stimuli.

Mastering the task and experiencing flow

From an ego-centric and rational, controlled state of mind, separated from an awareness of the body and surroundings, the creative process moves to the transitional state of becoming one with the motif and the surroundings through control of focused attention. Once the ego gives up its disturbing habit of constantly producing new ideas, the intensity of attention allows intuition to take over as a creative force and release the flow of mental energy that provides optimal conditions for action. The artist feels at the top of his form, wide awake and entirely present in the situation, mastering the task. This situation, which is experienced neither as a wholly mental nor as a wholly

physical state, breaks down routine rational thinking and allows access to body knowledge through a 'head over heels' process. This involves a new way of processing visual information by using non-focal vision to 'distribute' one's attention. In contrast to focal vision, in which a single source of information is processed at one and the same time, distributed attention compels the artist to 'scatter' his or her gaze across the scene and record more complex patterns of information. This also opens up for combining fragments of information from short and long time memory.

Interaction, feedback and reward

Proper feedback given at the right time can be enough to confirm an experience of flow, during which mental energy is released between the artist and his or her work. Confirmation of the newly created sketch gives students the feeling of being present and part of the here-and-now. In keeping with the students' realistic evaluation of their own skills, the drawing itself may not be exceptional, but the endorsement of an intuitive and spontaneous action represents such a strong and self-affirming reward, that it overshadows the actual result and reinforces the students' confidence in their own creative potential. According to Csikszentmihalyi, one of the conditions for achieving flow is a balance between challenge and perceived mastering ability; other conditions are clarity of objective and instant feedback.

During the break, students may receive further comments from both their fellow students and teachers, and look at the work of others. At the beginning of the next session, the student wishes to repeat the same positive experience but is unable to do so. The open attitude is gone and the drawing process is expected to achieve a specific goal: a replication of the previous session. The result is a feeling of boredom.

Students at work during a fifteen-second sketch drawing sessions with a nude model.

During the next break, students gain new insight into what their fellow students have achieved, while new comments are interpreted to assess where each student stands. They begin to worry about the next session, afraid that anxiousness will sabotage their work in case they do not 'get it'. Another review and a reminder to 'relax' with the assurance that a 'bad' drawing is as important as any other drawing, since the experience will benefit the student in preparing for the next session with a new round of drawings.

The longing to recapture the first experience of flow is the best motivation to try again, free of any distracting thoughts. As a result, mindfulness allows students to direct their attention, letting mental energy to flow between their own intent and the motif in question. Without any warning, a response to the challenge of producing a

croquis drawing suddenly emerges. It all happens within a few seconds. Eureka! A croquis drawing can capture the power and dynamics of the pose, the body's rhythmic movement, its proportion and balance.

In this way, the process can evolve, and lessons learned can be used in future interactions with the environment. The key to motivating an experience of flow is to foster a sense of self-development and discovery that allows the artist's mind to grow and develop levels of greater complexity (Csikszentmihalyi 1991). The greatest obstacle to creativity is often brought about by one's own thoughts and concerns.

Sound organisation as ritual

In addition to the participants (the personality of the model, the instructors and students), the particular space lends a distinct character to the situation, as does the location and position of the individual participants in the room – whether sitting or standing, body position plays a role in activating embodied knowledge. In addition to the primary visual focus and the way in which students are placed around the model, auditory stimuli (sounds, noise, music, etc.) registered during the drawing session affect the mind and can be used to stimulate the brain to concentrate on the task. I usually vary the register of sound from total silence – so that you can hear the sound of the drawing tools on paper – to jazz rhythms and classical music at various sound levels. This can help to structure attention and dispel distracting thoughts.

Time organisation as ritual

Work sessions with a model last for four hours and are divided into twenty-minute drawing intervals and ten-minute breaks. Like a ritual, this pattern repeats itself regularly and when the Do Not Disturb Sign is hung on the door ('do not disturb, we are drawing a model'), students are aware that an important event requiring quiet and concentration is about to take place in this room and within a given time period. This ritual has a positive effect on students, preparing them for the work that is about to be done.

Alternating between different states of mind

The physical act of drawing lines shifts the artist's focus away from the external referent (the model) towards the body's internal experience and accessing sensory-motor memory. As a consequence of having 'turned off' everyday consciousness by using the methods mentioned above, a 'stream of consciousness' emerges – a continuous stream of thoughts, images and associations. By entering into a state of mindfulness while at the same time sketching continuously, the artist can simultaneously observe their own thinking as both participant and spectator, witnessing the emergence of the subject on the drawing sheet. It is the paradoxical and concurrent experience of 'being' (by means of being aware of the outside and inside of oneself at present without judgment) and 'nothingness' (having thoughts without the presence of a thinker, i.e. absence of ego).

Saul Steinberg's drawing for the Oct. 18 1969 issue of the New Yorker illustrates human consciousness as a continuous stream of thoughts, images and associations. By assuming a state of mindfulness, the artist can experience an instant of being both a participant and an observer through the self's state of being.

This condition represents a higher level of consciousness in which the artist has moved beyond conventional aesthetic definitions of 'good' or 'bad', resulting in personal, original and creative work. The artist's range of attention is now far broader than in a state of flow, focused both on the act of drawing, the drawing itself and the motif in relationship to the surroundings. This does not imply a lack of sensibility, but only that parts of consciousness are now free for other purposes. This type of 'distributed attention' would not be possible in a state of flow, which requires full immersion in the motif and therefore a lack of mindfulness.

As a result of mindfulness, non-visual stimuli are registered as well. It is a blind process, in which the artist's perception of the motif depends on data provided by both short and long term memory. The constant movement of the drawing hand capturing the position of the model creates new analogue schemata that are registered in short term memory. In its interaction with the movement of the hand, the mind chooses among many different attempts and transfers the most appropriate model schema created by the hand gesture from one domain to another. Here, the artist must combine both what he or she sees on paper and registers by studying the model with what is invisible, but registered nonetheless. It is during this timeless instant that embodied experiences from long and short-term memory overlap to find the right identification with the model. Francesco Varela explains similar processes with his theory about 'enaction and emergence' – as autonomous events that occur in a state of mindfulness by means of a 'self-producing network of schemata' (Varela 1993). The interaction of schemata (stored body experiences) synthesises the flow of information based on structural analogy, regardless of the ego's conscious control, which among other things must be mitigated by 'clearing the mind of thoughts' as much as possible. This is an inspiring model for understanding the thought process that provides the basis for producing a drawing.

The experience of having a physical body allows the artist to recognise and identify with the model's pose without interference by the ego, and his or her knowledge of

drawing makes it possible to enhance this identification by transferring it analogically into lines, surfaces, light, shadow and rhythm. Although this stage requires discipline and perseverance, the drawing appears to come into existence by itself and without any effort.

The basis for this article

The above reflections are based on my own observations and experiences in teaching drawing, inspired by student's drawings, their behaviour during drawings sessions and their comments and reactions to fifteen-second croquis drawing of a nude model. These observations were made over a ten-year period with a large number of students, both men and women. How is it possible to measure the effect of mindfulness and flow on the drawings? I used the following evaluation method: as part of each drawing session, students selected three drawings among approximately 60 that typically were produced during the course of a session. In collaboration with each other, students evaluated the drawings according to the ability to render:

- The power and dynamics of the pose
- The body's rhythmic movement
- Proportion and balance

The selected drawings were proof that the students had experienced moments of flow and mindfulness during the process dependent on daily fitness level i.e. ability to concentrate on task. Their written evaluations of working with lightning-quick sketches also indicated that they felt time was flying by and that they were engaged in a challenging but exciting task.

Conclusion

The reflections presented in this article invite the reader to consider the importance of a state of mindfulness and flow during the creative process and aim to provide some 'inspirational tools' to discuss the subject and hopefully contribute to its wider acceptance in an educational context.

One of these tools consists of an analytic approach to the mental processes involved when producing a drawing. Another approach is to highlight the importance of the exchange taking place in the context of a teaching situation. A third approach focuses on the connection between mindfulness and creativity. The challenge in teaching drawing is to emphasise the essential role of the body in the process of perception. Since this applies equally to the field of design, the designer as a creator of conceptual sketches will benefit from opening up all the senses and focusing on the act of drawing in order to enter into the mind-body relationship referred to as mindfulness and flow. In this state, the creative process provides an opening whereby different levels of consciousness can combine to produce new insight.

Hopefully, these reflections will contribute to a clarification of the concepts of flow and mindfulness in relation to the drawing process and provide some new perspectives in terms of how the process may be approached and structured, as well as to the question of what should provide the basis for teaching drawing.

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‘What do you think the campus is telling you?’ Teaching-led research exploring campus design and perception.

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Abstract: *Learning to ‘read’ places is a fundamental skill for built environment designers. Although we may intuitively respond to different designed environments - the silencing effect of a church interior or the imposing scale of a grand estate, for example – the ability to understand how places are spatially and semiotically constructed (encoded) and interpreted by others (decoded) is an ongoing aspect of design education. In this paper, a teaching-led research project addressing such design literacy is presented. This project simultaneously introduces the concept of design interpretation to students whilst addressing the research question ‘how do different students read their own university campus?’ A cohort of first year architecture students were asked to voluntarily complete an online survey capturing their responses to a range of campus spaces, and the survey results were presented to the students in a follow-up lecture titled ‘Reading the Built Environment’. This exercise benefits students by informing them about the communicative power of architecture and landscape design, encouraging them to critically reflect on their own place perceptions, and engaging them in research methods. The research findings provide educators and University management with evidence suggesting how campus spaces can be designed and represented to be more welcoming to students.*

Keywords: design, teaching-led research, architecture, landscape, campus.

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> What student sensibility is there unresponsive to the beautiful nave where the daily chapel was held, the stately portico where the class would group itself to be photographed […]? And many an old grad has reflected […] that venerable walls and carved chimney pieces, picturesque gables and vaulted archways endure forever (Clauder and Wise, cited in Coulson et al 2011, p. vi)

In 1921, Clauder and Wise posed a rhetorical question which affirmed the power of university campus design to perpetuate a collective student sensibility of belonging, tradition, and reverence. Several decades on, we no longer assume that all places of higher education are the same, or that all students perceive a campus in the same way. How do today's diverse student population respond to different learning environments? Are university campuses intimidating, welcoming, easy to find and familiar, or inaccessible and alienating? If built environment design is about making a 'design statement' – what are our University campus' saying? And at another level, can the investigation of these issues teach design students to be critically aware of the semiotics of space?

In 2012 a teaching-led research project conducted at the University of Nottingham explored these questions. The project aimed to find out how design students 'read' their own campus environment, whilst simultaneously introducing those students to interpretation skills and awareness which are central to built environment design education. A cohort of first year architecture students were asked to voluntarily complete a survey capturing their responses to a range of spaces on three different campus' across their university. The results of this survey were presented to the same group of students as part of a follow-up lecture presentation which introduced the theory and application of semiotic analysis in design. The teaching outcomes of this project benefit students by informing them about the communicative power of architecture and landscape design, encouraging them to critically reflect on their own place perceptions, and exposing them to design research methods in an accessible and participatory way. The research findings provide educators, designers and University management with recommendations for how the campus can be designed and represented to be welcoming for all, thus addressing one means of widening participation in Higher Education (HE).

This paper is divided into four parts. 'Reading the Campus - Semiotics' summarises semiotic theory as it pertains to built environment design, and reviews existing literature to provide a semiotically informed analysis of campus design over time. This theoretical framework both underpins the research topic and represents a core element of the theory being taught to students. 'Accessing the campus' discusses widening participation in universities, noting the overall policy context and the potential influence of campus design on access to higher education. 'Researching perceptions of the campus' presents the research methodology and findings of the student survey. 'Teaching-led research on campus' concludes with a reflection on the research findings and the value and limitations of this pedagogical approach.

Reading the campus - Semiotics

Learning to 'read' designed landscapes and architecture is a fundamental skill for built environment designers. Semiology – the science of signs – is a structuralist interpretive method which has provided one means of literally applying design literacy, and has influenced built environment design and education since the 1970s (Hale 2000,

pp. 144 - 169). Semiotic analysis positions buildings and landscapes as culturally constructed 'texts' whose meanings can be read or deciphered according to underlying linguistic structures. It remains one of several methods which can be used to critically analyse how designed environments take on meaning, namely by "applying linguistic theory to objects […] as a system of signs, [isolating] the underlying sets of laws by which these signs are combined into meanings" (Eagleton, cited in Hale 2000, p. 132).

Although people may intuitively respond to different environments - the imposing scale of a palace gate or the vibrant ambience of a narrow cafe lined street, for example – the ability to understand how places are spatially and semiotically constructed or 'encoded' by designers and interpreted or 'decoded' by others is an acquired skill. Semiotic analysis demands critical thinking on the part of the student. It promotes an awareness of design beyond its technical or functional aspects, which is consistently part of the core set of attributes expected of University graduates in general and design graduates in particular.[1]

The university campus, as a spatial typology, provides fertile ground for sowing the seeds of semiotic analysis and critical interpretation to design students. As the opening description of Clauder and Wise illustrates, universities have long built campus' as physical embodiments signalling notions of learning and tradition. Their description, which moves beyond the functional aspects to instead evoke a nostalgic environment of beautiful, stately, venerable and picturesque settings, is consistent with more recent critical interpretations of campus architecture as "an architecture of ideology" (Coulson et al 2011, p. 1):

> Through its physical estate, a university can reinforce the high ideals of scholarship and institutional values to create a unique and defining sense of place […] the entire environment can be shaped into an expression of institutional identity and ambitions (Coulson et al 2011, p. vi)

The following review of the history of the campus design typologies reveals an evolution of building and landscape styles which have been explicitly designed to express values associated with higher education:

The first European institutions to form as 'universities' as we know them were not defined by a physical campus, instead conducting classes in existing spaces such as houses and churches. During the Middle ages some institutions began acquiring

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[1] For example, in the UK the Architects Registration Board (ARB), which is responsible for accrediting Architecture degree programs, stipulates that graduates should "develop a *conceptual and critical approach* to architectural design […and demonstrate the] ability to *evaluate evidence, arguments and assumptions* in order to make and present sound judgments within a structured discourse relating to architectural culture, theory and design" (ARB 2010, pp. 3 & 7 emphasis added). At an individual institutional level, University of Nottingham sets out 'critical thinking' as a core Nottingham Graduate attribute, noting "Across the range of disciplines at the University, there is a common interest in what constitutes a critical approach" (Nottingham University website 'Nottingham's Educational Values' 2012).

property (e.g. the University of Paris in the Latin Quarter) and by the time of the Renaissance universities "increasingly felt the desire for the prestige that accompanied owning purpose-built academic facilities" (Coulson et al 2011, p. 1). Such buildings "were physical manifestations of the omnipresence of the European university, a visible sign that the university had evolved from a loose association of scholars and masters into an institution" (Coulson et al 2011, pp. 2 – 4). Oxford and Cambridge epitomise this development, especially the residential college model (Coulson et al 2011, pp. 4 – 7). The monastic-like courtyard typology, where a series of residential and teaching buildings clustered around an enclosed, private and exclusive space, was cemented here.

When America established its own institutions of higher learning, it sought to break from the European cloister tradition and opted for "separate buildings sited in open landscape, approachable and accessible to the community" (Coulson et al 2011, p.8). Thomas Jefferson's 1822 plan for the University of Virginia combined the order and refinement of unified neo-classical pavilions with spacious open tree-lined lawns where the academic community could interact, physically opening up to the wider landscape and community. Later the ideas of landscape architect Fredric Law Olmsted emphasised the importance of edifying nature as an appropriate setting for learning. In Olmsted's designs, buildings set informally within picturesque park-like campus grounds were intended to positively influence the well being and moral character of society's future leaders (Coulson et al 2011, pp. 13 – 14).

New universities in 19th century Europe were characterised by the construction of urban buildings of grandiose ambition and stature. By combining historical architectural references and imposing large scale these "temples of learning" were buildings "loaded with symbolic capital" (Coulson et al 2011, pp. 17 - 19). Building new structures in neo-gothic or neo-classical style was one strategy used to intentionally construct an impression of age, permanence and tradition befitting "the immemorial longings of Academic generations" (West 1910, cited in Coulson et al 2011, p. 23).

When a dramatic global expansion of university enrolments occurred after World War Two, the character of university campus design changed with it. As well as addressing the practical need for space to accommodate the numbers of people accessing higher education, new spatial types reflected a more diverse, less elite institutional outlook. From individual Modernist buildings in glass and steel through to entire campus layouts modelled as new mini-cities, design reflected a progressive attitude as well as reflecting the dominant architectural theories and innovations of the era. Later, when postmodern ideas heralded a return to historicism in architecture, this was manifest in a reinterpretation of the scale and motifs of recognisable architectural styles from the past (Coulson et al 2011, pp. 32).

Most recently, the rise of the starchitect phenomenon and branding has seen universities commission iconic landmark buildings. Amid the perceived need to compete for students, many campus's now feature the "curves, jagged contours, blobs, bulges, high-tech materials and vivid colours" of contemporary headline-grabbing design (Coulson et al 2011, pp. 33 – 35). Such buildings can be considered an effective means of generating an awe-inspiring and "cutting edge" institutional image; alternatively they have been criticised as expensive, impractical architecture reflecting commercially motivated image-making (Coulson et al 2011, pp. 35).

This reading of campus design illustrates that the places where we teach and learn have evolved over time to include several different stylistic trends, from the introspective cloister, the imposing public building, the picturesque park, and the

Modern urban landscape. Regardless of typology or era, when interpreted semiotically they all share a common expressive function. It is within this context that today's students and prospective students encounter the campus environment, consciously or unconsciously decoding its mix of semiotic messages.

Accessing the campus

> Space, like language, is socially constructed; and like the syntax of language, the spatial arrangements of our buildings and communities reflect and reinforce the nature of gender, race, and class relations in society. The uses of both language and space contribute to the power of some groups over others and the maintenance of human inequality (Weisman, cited in Krusemark 2012, p. 27)

Inclusive education is concerned with "overcoming barriers to participation that may be experienced by any pupils" (Ainscow cited in Hockings 2010.). Could one such barrier may be the design of the campus itself and the messages it transmits? When writing in 1921 Clauder and Wise evoked a positive and uniformly collective student response to the campus environment and all it signifies – a sense of identification and belonging. However, contemporary theory espouses the view that the way in which the campus-as-text is read and identified with (or not) is dependent on the spatial literacy and subjective position of the student. Perceptions may vary depending on any number of personal factors such as economic background, gender or ethnicity. A university environment may appeal to one student but be perceived as alienating to another. In an age where equitable, non-discriminatory access to higher education is a legally recognised right, and when university policies actively seek to encourage under-represented socio-economic groups to enter the HE system, the way in which a campus may encourage or discourage identification with higher education is a significant issue.

Creating inclusive learning and teaching environments is a common goal within HE. Widening Participation is the term used to describe initiatives which address patterns of under-representation in HE. Particular under-represented groups are those from lower socio-economic groups or working class backgrounds, low participation neighbourhoods and families with no experience of HE (Higher Education Academy 2012). At the institutional level, efforts to widen participation include outreach programs in schools and local communities, admissions policies which consider an applicant's 'less advantaged family environment', and financial support such as scholarships and means-tested bursaries. Within the UK, where 2012 legislation has seen University fees increase several thousand pounds per year, efforts to ensure students are not excluded from HE due to financial disadvantage have taken on additional importance.[2]

Once gaining access to university, students from under-represented backgrounds may still face disadvantages. Targeted research investigating how students cope within

[2] For example, the University of Nottingham has a dedicated campaign, 'Nottingham Potential', offering a number of tailored services and financial assistance to support disadvantaged students to progress to the University. One aspect of the campaign included a high profile fundraising event, where the Vice Chancellor and other staff rode bicycles over 1,100 miles across the UK, raising awareness and almost £250,000 in donations and "breaking the cycle of disadvantage". See http://www.nottingham.ac.uk/supportus/currentfundingpriorities/theuniversityofnottinghamslifecycle/theuniversityofnottinghamslifecycle.aspx and http://www.nottingham.ac.uk/impactcampaign/campaignpriorities/NurturingTalent/NottinghamPotential/NottinghamPotential.aspx

specific disciplines have shown that coming from a non-academic background can negatively affect their progress. A 2009 study of Art and Design students in the UK found the "inaccessible language of Art theory" was a barrier akin to "learning a foreign language" which students from non-academic backgrounds found particularly challenging and alienating. Students cited in that study commented "I'm a Yorkshire lass … and I'm quite plain talking" and "They make everything confusing in big, fancy words" (Hudson 2009, pp. 108 – 109). In short, an understanding of student's different backgrounds is necessary if educators are to develop curricula and communications which allow their students to engage with the HE environment.

While strategic university policies, promotions and a variety of pegaogical techniques may communicate a message of openness and accessibility, the extent to which the design of the physical campus itself is considered as a positive form of communication is not as apparent. Existing research in the area of widening participation reveals a substantial body of work relating to policy, student experience and teaching methods which may enhance diversity and participation in the classroom (see Hockings 2010). Conversely, little research addresses how campus design may contribute to this process. As feminist theorist Stephanie Krusemark notes in her investigation of African American womens' experiences of HE, "non-white students still report experiences of a non-welcoming campus climate […] Yet the built campus environment has remained a silent element in all of their accounts and thus, rendered neutral […] the impact that the built campus environment can have on the physical and psychological experience of identity is an area of inquiry that has rarely been considered" (2012, p. 26 – 27). Krusemark's study reveals that, in the American context, campus design perpetuates a patriarchal, Eurocentric image of a white 'collegiate ideal' – one in which black females feel self-conscious, conspicuous, and inherently like they do not fully belong.

In the next section, the perceptions of a cohort of new architecture students are examined, to discover how their own campus appears to them and to suggest ways that they read the built environment.

Researching perceptions of the campus

> There are many benefits for students through participating in research and inquiry tasks, including positive student perceptions of the teaching and learning process and a deeper student engagement with coursework (Homewood et al 2011, p. 7).

As a pedagogical approach, research enhanced learning and teaching (RELT) asserts the importance of exposing students to, and engaging them in, various research activities throughout their education. RELT encompasses a spectrum of activities which provide students with different levels of engagement in the University's research culture, ranging from academics presenting their own research findings in lectures, through to students devising research questions, choosing and testing research methods, analysing data, and publishing and presenting results.

Students in the first semester of their architecture degree were chosen to participate in the campus research project. As such, a method which introduced the students to a research activity by acting as research participants – in other words by completing a survey – was considered appropriate to their limited level of experience. Students were then shown the results of the research – the data they had provided – in a follow up lecture. By asking students to give their own opinions of the campus environment, the activity encouraged students to reflect on their own first hand

experience or 'reading' of familiar designed spaces. It rendered somewhat challenging or abstract design theories (semiotics) accessible by relating these theories to an immediate real life example. Finally, it was hoped that this application of RELT would be more interactive and engaging than presenting research conducted without the direct input of the students. In their review of RELT, Homewood et al (2011, p. 6) encourage this form of "knowledge-producing" activities as they allow students to "engage in the process as participants in research and inquiry".

The survey design

The survey asked students to respond to six images of University of Nottingham campus environments (figures 1 – 6). These images were selected from the University's Image Bank which is used for branding and publications, and is thus an officially endorsed visual record of the Institution, an aspect of the research design that was pointed out to students in the post-survey lecture.

For each image, students were asked five questions, composed on a Likert scale:

- WELCOMING: How friendly or welcoming is this environment?

(ranging from 1/ very unwelcoming and unfriendly, 3/ neutral, through to 5/ very welcoming and friendly);

- EXCLUSIVE: How exclusive or inclusive is this environment?

(ranging from 1/ very exclusive and elitist, 3/ neutral, through to 5/ very inclusive and open to all);

- INTIMIDATING: How intimidating or accessible is this environment?

(ranging from 1/ very intimidating / feels very inaccessible, 3/ neutral, through to 5/ the opposite of intimidating / feels very accessible);

- EXPENSIVE: How expensive or affordable does this environment appear to you?

(ranging from 1/ very expensive / only for the wealthy, 3/ neutral, through to 5/ very affordable / not just for the wealthy);

- ACADEMIC: How much does this environment appear to be a place of academic learning?

(ranging from 1/ very academic / this is definitely a uni, 3/ neutral, through to 5/ not at all 'academic' / does not look like a uni)

Socio-demographic questions asked students about their educations and financial backgrounds, namely:

- FAMILIARITY: How much have time have you spent within university campus environments in the past?

(ranging from never through to very frequent)

- YOUR FAMILY BACKGROUND: What is your family's history of university education?

(ranging from being the first to attend in two generations through to parents being university staff)

- YOUR UNIVERSITY STATUS: How are you enrolled / funded at this university?

(ranging from full fee paying international students through to students with full scholarships)

This data was used to analyse possible correlations between students' place perceptions and their widening participation backgrounds.

Survey delivery, response rate and researcher response

The survey was initially delivered via Moodle, the online Learning Management System or Virtual Learning Environment (VLE). Advantages of using Moodle included:

- convenience (the ability to voluntarily participate in their own time and in private)
- control over who participates (only students enrolled in the targeted year one module were able to access the specific University of Nottingham Moodle page where the survey was uploaded for a restricted time period of 12 days)
- complete anonymity (submissions were not linked to student ID making tracing them impossible)
- introducing online learning to the students in a non threatening way (as new starters their familiarity with Moodle was limited; participating in an activity that was not linked to a compulsory or assessable task provided an opportunity to engage with the technology free from pressure)
- enabling staff to try the VLE method of delivery (Moodle was only introduced the University of Nottingham in 2012, meaning this was a new system for researchers to 'test out')
- the immediate digitisation and initial analysis of data (Moodle generated spreadsheets and graphs based on submissions ready for researcher use)
- environmental impact (saving paper)

In practice, however, Moodle suffered technical problems which significantly limited student participation. When very few responses were initially received students were reminded about the survey in their weekly lecture; several students then responded that they had attempted the survey only to receive error messages which prevented their electronic submission. IT staff attempted to solve the problem, and a second version of the survey was uploaded. Unfortunately this also resulted in the same problems and limited successful submissions – although this time students who encountered the problem proactively reported it. It was then decided to issue 50 hard copy take home surveys, of which over 25% were submitted.

The final overall response rate was low (22 participants, or 12% of potential respondents), either due to the problems with Moodle or other reasons; this has limited the reliability of the data collected. Nevertheless it was decided to proceed with analysing and presenting the data available, and that the limitations of relying on a small data sample were pointed out to students as part of the post-survey lecture presentation.

Survey Findings

The following description of each image – which formed part of the post-survey lecture content – outlines how each of these designed environments can be read as a form of communication. Each description is followed by a summary of the student's responses to the images. For this paper, only the welcoming / unwelcoming, inclusive / exclusive and intimidating / accessible questions will be reported.[3]

[3] As the focus of this paper is on the value of a RELT approach (not on the research findings per se) only a summary of the data and analysis is presented.

Figure 1. Survey 'Campus Image E' (University of Nottingham University Park campus, Trent Building). Source: University of Nottingham image bank, Lisa Gilligan-Lee, 2009.

CAMPUS IMAGE E - UNIVERSITY PARK CAMPUS, TRENT BUILDING

In the 1920s the University of Nottingham's University Park suburban campus was established, and the Trent Building was designed as its architectural centrepiece.[4] Philanthropist Jesse Boots envisaged this area of the campus as a "public park" with the Trent Building as a new "palace of education" gracing the shores of an ornamental lake in the Picturesque tradition (Fawcett and Jackson 1998, p. 4). The neo-classical structure remains one of the main iconic symbols of the University. In this image, the symmetrical order and scale of the building, and its impressive if potentially distancing landscape setting, present the most formal and palatial institutional edifice. Note a similar view of this building seen from behind a set of large gates was available but was considered too leading to be used for the survey.

This environment scored as being the most intimidating and unwelcoming of those pictured. Over 50% of respondents found this to be 'very' or 'a bit' intimidating and exclusive. However, feelings of this negative kind were not universal, with 15% ranking the pictured environment as 'very accessible', and it attracted a mix of responses about being 'welcoming'.

[4] This was known as the Civic College before becoming a University in 1948.

Figure 2. Survey 'Campus Image F' (University of Nottingham University Park campus, Portland Building). Source: University of Nottingham image bank, Lisa Gilligan-Lee, 2010.

CAMPUS IMAGE F – UNIVERSITY PARK CAMPUS, PORTLAND BUILDING

The Portland Building, like the Trent building discussed above, is situated on the main University Park campus, where during its establishment civic monuments in a "classical language" were "judiciously placed in an arcadian landscape" (Fawcett and Jackson, p. 5) along the lines of the Olmstedian model. Interestingly, by the 1950s this traditional style of campus planning, where campus life was detached from the modern urban street, was critiqued by some as being "isolationist" (Brett, cited in Fawcett and Jackson 1998, p 5). Despite this, students responded to the image of the Portland building with a mix of views ranging from somewhat unwelcoming to very welcoming in almost equal measure, suggesting it is perceived as being more inclusive than its generally 'unwelcoming' Trent building neighbour. Not one student surveyed found this environment 'very' unwelcoming or inaccessible, and over 50% found it to be somewhat or very inclusive. One interpretation of this finding may lie not in the semiotics of the architecture or the landscape design, but of its representation: In this photograph, two smiling students sit in casual repose in the foreground, and the camera angle positions the viewer at their level. Although the two spaces being depicted in figures 1 and 2 are similar, the way they are populated in the photograph (one empty, the other shown being used in an accessible and friendly context) appears to have influenced student responses.

Figure3. Survey 'Campus Image A' (University of Nottingham Sutton Bonnington campus main building). Source: University of Nottingham image bank, 2008.

CAMPUS IMAGE A – MAIN BUILDING, SUTTON BONNINGTON

The University features a number of other campus sites which also express the image of the institution. At Sutton Bonnington, a village ten miles south of the main Nottingham campus, an Agricultural College (established 1915) became part of the University in 1947. The main building on site is another neo-classical symmetrical building in a generous landscape setting in the college style.

Responses to the image of this environment displayed some contradictions. The majority of students described it as 'somewhat intimidating' (almost 50%) but almost the same number found it to be 'somewhat welcoming'. Despite being built as an agricultural college not a university per se, this environment received the highest number of respondents for 'very' or 'somewhat exclusive' (over 70%). Again the way the image is composed – at a distance and unpopulated – may contribute to these results.

Figure4. Survey 'Campus Image C' (University of Nottingham Sutton Bonnington campus Plant Sciences building). Source: University of Nottingham image bank, Martine Hamilton Knight Photography, 2009.

CAMPUS IMAGE C – NEW BUILDINGS, SUTTON BONNINGTON

The Sutton Bonnington has since been expanded with modern and contemporary additions, including some low and medium rise buildings such as the Plant and Crop Sciences building.

Responses to this building image were relatively neutral or moderate in all cases, with almost no students finding the image 'very' welcoming or unwelcoming, inclusive or exclusive. Given the modest, unassuming scale and materials, and the presence of people in this image, the fact that as many respondents found it 'somewhat' exclusive as they did 'somewhat inclusive' is an unexpected result. Compared to the other older Sutton Bonnington campus building (above) the image of this newer building was found to be more welcoming and inclusive. Nevertheless the overall impression is one of neutrality – this building appears to say little either way to attract or repel.

Figure 5. Survey 'Campus Image B' (University of Nottingham Jubilee campus phase 1 development, Computer Sciences and learning resource centre). Source: University of Nottingham image bank, 2008.

CAMPUS IMAGE B – PHASE 1 DEVELOPMENT, JUBILEE CAMPUS

Jubilee Park, established in the late 1990s and still under development, extends and reinterprets the 'buildings in a landscape' model established at University Park over 70 years earlier. This suburban campus, includes a lake and a series of iconic buildings by award winning architects such as Michael Hopkins. Environmental sustainability and performance is one key feature of the masterplan.

The image of the contemporary timber clad buildings situated by a modest lake received the most responses for the 'very inclusive' 'very welcoming' and 'very accessible' questions. Only a very small number of students ranked the environment below the neutral point (10% > 'somewhat unwelcoming'). The image of this environment which is at a human scale, and which is pictured with people using it, is unsurprisingly considered to be less intimidating than its stone clad traditional precursor, the Trent building. Based on this survey, it would seem that this is the kind of build environment most likely to attract students into HE, and to assist them to feel welcome and comfortable once they are here.

Figure 6. Survey 'Campus Image D' (University of Nottingham Jubilee campus, phase 2 development). Source: University of Nottingham image bank, Make Architects, 2009.

Campus image D – Phase 2 development, Jubilee campus

In 2009 Phase 2 of the Jubilee Campus was completed, adding several buildings featuring the "high-tech materials and vivid colours" of contemporary headline-grabbing design (Coulson et al 2011, pp. 33 – 35). The student survey image includes the sculptural Innovation Park building as well as the Administration and International Office buildings, and a freestanding landmark artwork 'Aspire'. These structures are the most overt example of built environment design which seeks to show the progressive, forward thinking and innovative ethos of the institution. It is more akin to a business park typology than the traditional arcadian University Park model.

Although it may have been designed to attract energetic and innovative minds, the survey results suggest this assemblage of colourful buildings is not one which students find welcoming. Almost half found it neither welcoming or unwelcoming. Less than 10% found it accessible or very accessible, and one respondent found it very intimidating. Half the respondents ranked it a 'a bit exclusive'. Again the way the image is composed – at a distance and unpopulated – may contribute to these results.

Finally, the question of how students' perceptions of the campus relate to their personal backgrounds remains to be explored further. Due to the smaller than anticipated number of survey responses, a deeper analysis of the data according to the socio-economic background of the respondents is difficult. Taking the 'family background' variable as an example, when the respondents from opposite ends of the educational spectrum are considered in isolation it appears that there is no causal relationship between family educational background and campus perception. When comparing two respondents who were the first to attend university in their families to two students whose parents worked at university, analysis revealed that all held very similar views. However without greater numbers these findings are not reliable.

Teaching-led research on campus

This project has tested a means of introducing research and theory to new design students in an accessible way. In summary, students learned that places are generally attributed with having meanings which can be encoded (by designers) and subjectively decoded (by users). Semiotics – the science of signs – is an area of knowledge concerned with understanding this encoding and decoding of meaning. When we look

at the built environment semiotically, different types of spaces – buildings, landscapes and their proportions, materials and other properties – carry with them certain effects or implied messages. These meanings may build up and be culturally transmitted over time, however they are not universally fixed or guaranteed, since they depend on cultural norms and on the subjective response of each person who encounters that space.

The results of the surveys completed by students showed a range of subjective place perceptions for each campus image under consideration, thereby demonstrating to the students how their own views of the same environments could differ. For example the Trent building, a traditional neo-classical campus building in an expansive landscape setting, was perceived as being unwelcoming or very unwelcoming to the majority of students and yet very welcoming to some others. The research findings illustrated patterns of shared meaning, as although no single image was 'read' in exactly the same way by every respondent, there were discernable trends: One building image was clearly the most welcoming (the Jubilee campus phase one – a contemporary design at human scale) and others tended to have a more neutral 'neither welcoming or unwelcoming' effect. In all cases extreme responses ('very' welcoming or 'very' unwelcoming) were less frequent than 'somewhat' or neither' responses. In future more contrasting examples of designed spaces could be chosen, for example images of highly recognisable types such as the gated medieval Oxbridge-style cloister compared to a new urban campus with cafes and plenty of student activity in view. However if taking this approach one message being conveyed by the project would be lost, namely that the one institution (in this case the University of Nottingham) can have more than one image, more than one architectural and landscape style, and hence communicate more than one message.

The research findings are not as comprehensive as had been hoped for due to the limited number of students who were able to complete the online survey. Further surveys are needed to gain a fuller understanding the campus' ability to attract or repel students, including those from widening participation backgrounds. It may be the case that some environments are more or less welcoming regardless of socio-economic factors. This study suggests that other factors, such as the composition of the image being used in the survey itself, not the designed environment being depicted in that image, plays a significant part. There is an apparent correlation between the *representation* of campus environments and the perception of how welcoming and friendly those depicted environments are to students, i.e. the photographic composition and presence of people in the image appears to have influenced the student's response. Additional questioning is, however, required to prove or disprove this interpretation.

Instead of seeing the lack of conclusive evidence as a failure on the part of the research exercise, these findings were used in the student lecture to highlight some of the problems and limitations facing research (and theory) of this kind. No attempt was made to fully untangle the complexities of reading the built environment; a definitive reading of the case study spaces was avoided, and a conclusive analysis of the survey results was not offered to the students. Rather, what was emphasised in the presentation, are the multiple subjective meanings of designed spaces, meanings which arise from a range of factors including the intent of the designer, the perceiver or 'reader', and the role of representation (in this case university marketing photography) in framing what we see and experience. The fact that all these processes dynamically interact and can change over time was also noted. By problematising the research

findings, students were exposed to a form of critique and discourse which is a part of all research enquiry and debate. In effect, as well as introducing the notion that designers should read places semiotically (a structuralist view), the post-structuralist critique of meaning and interpretation was also introduced[5]. As an early year one lecture, such theoretical terms as post-structuralism were not explicitly used. Nevertheless, the idea of meaning and the built environment was introduced and was followed up with the idea that many meanings, and different interpretations of those meanings, are possible.

One limitation of teaching-led research is that of confidentiality of the respondents. From a human ethics point of view, ensuring the anonymity of participants is necessary especially in light of the sensitive familial and financial information they provide. However this presents restrictions to both teaching and research outcomes. Having the ability to informally discuss why students had provided particular responses, either as part of the follow up lecture or in smaller discussion groups, would potentially increase their own understanding of the subjectivity of place perception and interpretation through interactive debate. Further probing of students reasons for their responses would also be very useful when interpreting the results of the research.

Despite its limitations as a means of collecting data in this instance, the teaching outcomes of this project benefit students by informing them about the communicative power of architecture and landscape design, encouraging them to critically reflect on their own place perceptions, and exposing them to design research methods in an accessible and participatory way.

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[5] For a discussion on this issue see Whyte 2006.

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The Intervention of Criticism into Practice

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Abstract: *The goal of the present essay is to show that a number of critiques, following in succession from the first efforts to professionalize design, played a key role in the formation of the discipline as we know it today. Such critiques of design, by countering established practices, created gaps in knowledge – created a discontinuity, the consequence of which was the creation of the possibility for a new way of working. What the discipline lacks today, then, is precisely such a critique of this sort: one that would oppose a situation in which design submits itself uncritically to market demands and accepts the universal relativism of social consensus. For the first time in the history of design, it seems that the professionalization of the discipline is increasingly determined by what is supposed to have chiefly produced it (as a side product during the industrial revolution and the division of labour). Similarly for the first time, we in the profession are indifferent to such a situation.*

Keywords: design, critique, emancipation, Anti-Design.

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Gaps in Knowledge

In his book, *What Is a Designer*, Norman Potter writes: "Design at its best has an honourable history; affirmative, questioning, socially and personally committed, seeking to bring things together in good sense. A very large area of this effort has degenerated into managerial eyewash." (Potter 2002, 162)

Potter's extremely critical, but very lucid statement cuts into the discipline of design, which over the course of the twentieth century had become lax, uncritical, self-sufficient, and complacent. It had lost that rebellious energy it received in its cradle from the two main critics of the nineteenth century's expanding industrialization – John Ruskin and William Morris. Similarly, it had lost the fervour of the avant-garde movements that had looked to design as the answer, as a tool for building a better tomorrow. Potter's critique of the spirit of the discipline seeks to reactivate the ability every designer possesses: the ability to make something. Here I am thinking of the knowledge, the potentiality, we have as designers. This potentiality, in Agamben's sense of the word (Agamben 1999, 177–184), allows us both theoretically and in practice to change our surroundings, to change our context, if we are unhappy with it. The decision as to whether we will realize this potentiality in practice, however, rests on the shoulders of those who have the knowledge, of those who can. In other words, designers. Simply put, every designer, every day, is confronted with the question: "You have the knowledge. So what will you do?" Not: "What can you do?" For the knowledge you have already puts you in a position of ability, a position of potentiality. The question "What could you do?" therefore becomes "What will you do?"

Reading Potter's critique, we must not overlook the underlying questions that present themselves to us: What is the origin of such a change? What has led to such a situation in design? Why is there so much resignation among designers? The answer, it seems, we know, for we hear it regularly from the lips of so many designers: we are merely one of the links in the chain, one station on the assembly line of production. But if we are precise, an extremely important one: design, after all, is that interdisciplinary practice that knows how to identify with the user, translate the desires of the client, and exploit current technological developments, and at the same time has the ability to create, in conjunction with this bundle of knowledge, a functional, aesthetically pleasing product that is, if possible, oriented toward sustainability. On the one hand, then, we are co-creators; on the other, merely cogs in a machine. Here it is important to stress that the process of design's depreciation (to the point of being merely one of the cogs) has been gradual. Throughout the formation and development of the discipline, numerous important figures in the field resisted industry's latent desire to reduce design to being just another activity in its service. Not least of all, design might be defined, from a narrow perspective, as a side product of the division of labour, as one of the consequences of industrialization. Many, however, disagreed with this description even at the start of the discipline, and many today also reject this statement. The leading figures of the future discipline placed design in a broader social context; they saw it as the element that builds our material culture and thus not only affects our everyday life but also, in practice, manifests our degree of development as a civilization. The fact is that the state of affairs Potter describes came about through a cluster of situations, forces, and changes in society. But this brings us to a much more important question suggested by Potter's critique, namely: What must the discipline of design do to excavate itself from the apathetic, toothless condition it finds itself in today?

In the present text I construct an answer to this question. I base it on a number of critiques that followed in succession from the first efforts to professionalize the discipline of design; here I am primarily looking for the impact of writings that left a detectable trace in the proverbially pragmatic practice of design. In my text I will show that, by countering established practices, the selected critiques created gaps in knowledge – created a discontinuity, the consequence of which was the creation of the possibility for a new way of working.

In the essay, "What Is Enlightenment?", the French philosopher Michel Foucault writes about critical reflection, saying: "It has to be conceived as an attitude, an ethos, a philosophical life in which the critique of what we are is at one and the same time the historical analysis of the limits that are imposed on us and an experiment with the possibility of going beyond them". (Foucault 1984) The search for limits and "the possibility of going beyond them" is common to the critical thinking of Ruskin, Morris, and Adolf Loos, as well as in the writings of the De Stijl movement and, especially, the Italian Anti-Design movement. The Anti-Design movement offered the last real critique in design, and that was over forty years ago. The discipline today, therefore, seems to lack any radical, critical attempt to affect the situation we are witnessing. It lacks a critique that would oppose a situation in which design submits itself uncritically to market demands and accepts the universal relativism of social consensus. For the first time in the history of design, it seems, the professionalization of the discipline is increasingly determined by what was supposed to have chiefly produced it (as a side product in the period of the industrial revolution and the division of labour). Similarly for the first time, we in the profession are indifferent to such a situation.

Frederic Jameson has written that, in modernism, we were still striving to create new worlds, while in postmodernism we are looking for "breaks". (Jameson 1991, ix) The condition for the very possibility of a break, however, is the creation of a certain distance toward what exists; the existence of a critique, therefore, is essential. This is what creates the possibility for a different way of working and the conditions for an event – the desired break. For the Slovene philosopher Rado Riha, two steps are necessary for us to be able to see revolution: "on the one hand, an act of unconditional resistance; on the other, the concrete demands of concrete struggles for emancipation". (Riha 2006, 46) The desire to see – "we want the thing we desire" (36) – is, for Riha, the condition for us to begin thinking about a rupture with the given situation. In light of Riha's thinking, we cannot avoid asking: What in fact do we desire to see in the field of design? What are the concrete demands of the concrete struggles for emancipation? In all of this, the greater part of the discipline does not in fact demand a rupture with the given situation. What is more, most designers have few doubts about the given situation. They accept it as a given, as something self-evident. The utopian striving for the construction of a new world has been replaced by a challenge in the form of market interest, the unending improvement of the existing world. As a result, in the deluge of all that is seemingly new, the task of defining the real problem (in the manner of Louis Sullivan) seems all the more difficult, if not impossible. But defining the impossible is, indeed, the goal of the task we face. In an age when everything seems possible, our aim is to find the point of impossibility. To put it another way, I will try to answer the question: What today is impossible in design?

Questioning the situation

All the selected critiques are marked by a concern about relationships between design and work and between design and production. They show us that, as early as the mid-nineteenth century, in the emerging discipline of design, Ruskin's critique opened a problem that to a considerable degree defined what design would become, even as it laid the groundwork for how design as a discipline would think. As is well-known, Ruskin, in his writings, demanded of us (and he himself also strived unconditionally for this) that we return to the threshold where we can make a new choice. The search for this threshold takes Ruskin to the Gothic, but we need to interpret this required return to the Gothic in the broadest possible way. The key to understanding Ruskin's turn to the Gothic lies in his attitude toward work. In the Gothic, he finds a Kantian "freedom of thought" (Kant 1784, 120) – the freedom to decide for oneself, which is manifested in the conception and production of a product. This is the freedom that technological reproduction removes from work and excludes from production. This is freedom of thought and expression as the main component of human creativity, which, in Ruskin's view, was last seen in the Gothic period, while all other modern-age production alternatives deprive us of our freedom of thought. Through his lucid recognition of the problem, Ruskin succeeded in raising a question that in fact remains relevant today. Just as Ruskin looked for freedom of thought in work, we too continue to ask ourselves how can a space be opened today where freedom is still possible. In the newly emerging profession of design, Ruskin implanted a need for the profession to continually question its own role and position in society. Here, however, we must also stress that Ruskin was not content merely with offering a critique: his writings provide us with a paradigm for thinking about an alternative to what exists.

If Ruskin offered us the paradigm, William Morris's key contribution to design is that he actually did conceive an alternative. He gave us one of the first utopian visions conceived and created by a designer. In doing so, he caused a rupture in the way the designer's role was considered and understood. For with Morris, the understanding of the designer's place in society is changed: the designer assumes a new role as a builder of society. The trace of Morris's influence comes fully to life in the first half of the twentieth century with the advent of modernism, for this is when design, through its desire to transform the world, actively enters the field of politics; this is a time when designers are filled with optimism, still believing they can build a better world. But there is a difference: if Morris believed that the answer for the future lay in the past, the modernists believed that the new world had not yet been constructed: it still had to be designed.

If Ruskin's and Morris's ideas were anachronistic in their day, Adolf Loos's thinking was, in its core, anticipatory. By proclaiming a culture that was no longer connected with ornament, he made decoration unnecessary. Here Loos saw a solution that was obvious: if you didn't see it, you had been blinded. Through his proclamation of the visible, Loos created a new beginning for work in architecture and design. The collapse of ornament as law occurred in these fields. Consequently, design in the twentieth century was based on a failure – a failure, that, as Loos shows us, turned out to be a success. The success is evident in that fact that we failed to create an ornament for the new century. In the twentieth century, this failure brought to the fore something that was *non-style*: namely, function. The failure of architects and designers at the turn of the twentieth century turned out, through Loos's proclamation, to be an event that

signified the key to change. A change that generated something new and, before that time, inconceivable. And thus what occurred was, in fact, a reversal. What was first considered something negative turned out to be, in retrospect, a positive alternative. It turned out to be an affirmative event that offered a new paradigm.

In design, however, another new paradigm was introduced with the ideas of the Dutch avant-garde movement De Stijl. Unlike everyone else I have mentioned, the De Stijl movement took the side of the machine. In doing so, it brought about a reassessment of values in design, as well as in the definition, understanding, and vocation of the designer. The members of De Stijl believed that by forming a demand for the universal they would finally make the problems of the community the main priority and that the machine was the tool that would allow us to do this. They based their theory on the understanding that everything we make is artificial. We take from the artificial and we are the product of the artificial. On this basis, the De Stijl members saw the key to the next stage of design as the removal of the dominance of the individual aspect. This assertion created a break in the discipline of design. As designers, architects, scientists, and artists, we are building our environment; consequently, as De Stijl reminded us, it was high time we began to build the environment in a way that met the needs of the community to which we all belonged – to build the environment so it would be functional and at the same time provide enough living space for all who live in this artificial world. Gerrit Rietveld concluded his essay "New Functionalism in Dutch Architecture" by saying: "The fact that in our better moments we are more comfortable sitting on a table than in a chair, or the fact that we don't need a house, table, or chair at all, means that the house of the future (the house for the new generation) cannot and must not aim to conform to the notion of 'living' that is now prevalent." (Rietveld 1932)

Given all that has been said, what happened with the most radical of these critiques – the Anti-Design movement? This movement saw the next stage of design as being the radical rejection of material production, as the desire to find a way of producing that would not be embedded in the market system. It saw the solution in the production of ideas. The inevitable question, then, is: How do you protect ideas from the market system? How do you keep ideas from becoming a commodity? Anti-Design's safeguard was the void – the user of the void. It was the individual's task to find their own particular answer to the existing void, to the existing neutral grid. It was the individual's task to create a new use. And it was the individual's task to become an active co-participant in the creative process and thus reject the role of consumer as defined by others. Only in this way – according to the Anti-Design movement – only when the individual is the one who freely decides, liberated from the bonds of place, work, and production, would we achieve an earthly paradise free from the pollution of design. (Ambasz 1972, 246–251)

The solution, then, lay in the individual's way of thinking – the only intangible thing that could not be converted by consumption into a useless fetishism. When we recognized this, we would recognize the aim of design, whose essence was not about creating products, but about creating new uses, encouraging potential new thinking.

From this perspective, despite all the examples discussed so far, Anti-Design placed its position toward design in the most radical light of all. Through its critique of design, architecture, and society as a whole, it sought a way to oppose the official culture in which we found ourselves. It sought an alternative, which it tried to construct on everything that was not the official culture. It sought a point of impossibility in an environment that, at first glance, seemed to be the given context (in Christopher

Alexander's sense of the term) – in other words, a plane that could not be attained but that had to be understood as well as possible and to which the form we controlled had to be adapted as successfully as possible. Twentieth-century design practice showed us that the environment, too, was simply the result of human labour – a result, in other words, that could be changed, corrected, and redefined. And it was with this goal that the Anti-Design movement entered design. Everything around us was artificially generated, from objects and cities all the way to the relationships between people and the things around them. Indeed, it was this particular relationship – between people and objects, between people and the city – that Anti-Design found to be most problematic. All the established relationships – whether moral, aesthetic, or religious – existed solely to take away our freedom. Under the pretence of cultural progress, they limited us, defined us, and at the same time reduced us to being a *creative* consumer. Thus it was all the more necessary to reduce the established degree of culture. Only a *lower* degree of culture would allow for a different kind of relationship, which, although still artificially created, would (as the Anti-Design movement understood it) be based on neutrality. Such neutralization would create a crisis of values – a crisis in the existing relationships – and from this crisis it would be possible to build a new (neutral) social system. The crisis would create a void, which every individual would be able to fill without any predetermined rules and relationships. For the Anti-Design movement, then, the object of design was the void, which was there to encourage the potential that was already there, with the goal of filling the given void. The Italian theorist, architect, and designer Andrea Branzi wrote: "The theory that the void provided the greatest degree of flexibility and liberty was a sort of *tabula rasa* our generation had made, or was trying to make, of all previous experiences, in an attempt to build a new foundation for design and architecture by putting them to a different, alternative use." (Branzi 1984, 80)

But in order to arrive at this, we had to reject everything that shapes our culture – from objects, architecture, and cities, right down to labour itself. With their rejection of labour, the members of the Anti-Design movement were inevitably speeding ahead. Superfluous human labour would sooner or later be replaced by the machine, which doesn't complain or set demands. The elimination of work seemed self-evident with the knowledge that this was precisely what, at the same time, allowed us to return to the development of the intellect. It allowed us to revive that freedom of thought to which design has been returning ever since Ruskin. It allowed us to reflect on a different notion of "living" – which is what Gerrit Rietveld advised us to do more than fifty years ago.

Even so, by the mid-1970s, the main figures in the Anti-Design movement had gradually resigned themselves to the fact that, in practice, design was obviously incapable of playing the revolutionary role they were advocating. Some of them stopped working in design and architecture altogether, while others continued to practice a purified modernism; a third group, however, in the late 1970s, presented their own unique continuation of the Anti-Design ideology. What they presented was the complete opposite of the modernist doctrine: namely, the postmodernist action known as Memphis. Its impact was most tangible in practice, since Memphis succeeded in shaking the modernist foundations of the design profession. Although Memphis was a well-considered action, the market nevertheless perverted its work, turning it (as Agamben would say) into a fetish, which it exploited for its own profit.

What is more, these postmodernist actions (of which the Anti-Design movement was a part) did not lead to a design rooted in the satisfaction of "pure needs", or

better, in the creation of "naked ideas" based on "mere thought" and manifested as a void; what these actions ultimately produced was the designer as author – an author whom capital turns into a status symbol. What happened, in other words, was everything that designers from Morris to Anti-Design had been fighting against in their writings. Design today, even more than in the past, accepts the role as one of the main catalysts of consumption; moreover, design today is openly considered to be the factor that creates that celebrated "added value" in a product. Thus it is designers who create – daily and uncritically – the artificially induced values of objects.

In this perspective, we can more easily understand the resignation expressed by the, in fact, still-working Italian industrial design Enzo Mari. In a lecture at Studio ArtAvangarde in Belgrade in the late 1980s, Mari acknowledged: "The utopia of industrial design has lost the battle. […] It lost the battle because it tried to realize utopia by means of the system of commerce. […] Just like other people, we too work on an assembly line. There is no other alternative." (Denegri 1990, 191–192)

But why, indeed, should we get tangled up in Anti-Design's "mere thought"? Why does their proposal sound too radical, too unrealistic for both the profession and the public? What happens is that designers and the public collide head-on with the difficulty of comprehending how a thought, an idea, can be something that actually exists. From the perspective of both the profession and the public, what is missing is the act, the processing, the execution of the idea as something real. Mere thinking remains something that is completely intangible and unfinished. Anti-Design's idea that the proffered void can be filled only by the individual collides with the entrenched understanding (by the profession and the public) that, if we design, then we are also making, creating, drawing up blueprints. In short, we are, in practice, producing the evidence of our own thought. The proffered void, the tabula rasa, is the polar opposite of what design was and still is, from the first whetstone to Ford's assembly line. The meaning of design lies in its materialization, its production. The result of the designer's thought has always been expressed in a form: the drawing, the blueprint, the product, the service – in that is something real and tangible. But, as the proponents of Anti-Design tell us very clearly, every object we produce, no matter how indispensable, is immediately absorbed in the cycle of consumption. Or as William Morris described this process as early as 1885, the logic of the market ("the profit-grinding system") means that we all participate in the production of waste, in the production of things that are completely unnecessary and in many cases unusable, and such labour, therefore, "is wasted on all hands". (Morris 1885) The question, therefore, is still relevant today: How do we design and at the same time remain outside the cycle of consumption? And even more crucially, of course: Can design that remains outside this cycle still be understood as design? Is this that point of impossibility we have been looking for?

This brings us back to the two questions from the introduction: In an age when everything seems possible, how can we find the point of impossibility? And, what in design is impossible?

The answer now seems plain as day; it has been hounding us from the start. The impossible thing for design is to escape its entrenchment (imprisonment) in the system of production. Industrialization created the basis for the professionalization of the discipline and subjugated it with the help of the market system. Industry and the market have together defined the position of the design profession. If design is not entrenched in a market production system (whether small-business or industrial), it seems we cannot even begin to speak of the discipline of design. As the Anti-Design movement tried to tell us, it doesn't have to be like this. While their proposal for the

elimination of cities, labour, production, and objects may sound too radical in practice, it also offers us an alternative that pushes us toward a new critique of the system – a new upheaval in our thinking about design – a design divorced from material realization. If we move away from the market production system, it may indeed be true that we cannot speak about the discipline as we know it today, but this does not mean we cannot speak about a design that sets this demand. But how, then, can we practice – how can we think about – a design that exists outside the system. How do we respond to this demand?

According to the Slovene philosopher Jelica Šumič Riha, we must distinguish between "two structurally different demands: *the demand* '*to have*' and *the demand* '*to be*'". In the demand "to have", we express our lack, and at the same time we address our demand to the Other as a whole. The demand "to be", however, "requires of the Other nothing that the Other would have and so could give us, nothing that would fall under the category of having, but only the fact that you are, that you exist; it demands a space where you can be, where you can exist". (Šumič Riha 2007, 90) If in the case of design the demand is "to have", then we must ask: To whom is this demand addressed? Who, for design, is the Other as a whole? Is it the market production system? This system will survive without design without any serious damage. Still, designers like hearing mantras such as: "Only one company can be the cheapest. All the others must use design." (Fitch 1998) The Croatian theorist Goroslav Keller, meanwhile, presents the other extreme, asking in his essay "Design for Export": "Can you imagine all the designers in the world going on strike for an indefinite period? How would you tell? And who would be hurt by it? (Cynics even wonder if this might not be good for society.)" (Keller 1976, 132–134) The successful sales of many poorly designed products speak in favour of Keller's statement. But if the market production system is not the Other we seek, then we must ask whether this Other might not be designers themselves, i.e. the design profession. Following Šumič Riha's argument, this is impossible, since "there is no demand that would not include an Other", even if this Other is, in fact, non-existent. (Šumič Riha 2007, 91) But the non-existent Other is typical of the present age. As Šumič Riha goes on to say: "The politics of emancipation in the era of the non-existent Other faces the task of converting the structural impossibility of the closure of capitalist discourse into a condition for the possibility of the productional new, a condition for the possibility of inventing a new social order." (94) Here she adds that, if you want to realize the impossible, it is not enough to simply make a statement while discovering that circumstances preclude the impossible. Rather, it is necessary "also to invent, to literally produce, create, the means for 'processing' this impossible". (95)

How do we apply this idea to design? How do we begin the impossible? How do we separate design from the existing system of industrialization so we can address our demand to the non-existent Other? Perhaps the answer is to stop worrying about the demand "to have" and focus on the demand "to be". Here the role of the Other, although impossible to avoid, is marginalized. The aim of the struggle also changes: with the demand "to be", what we demand is a space for existence. But here we at once encounter a problem: Does our demand for existence mean that in fact we are saying that, as an independent discipline, we do not exist? For most design theorists and practitioners there is probably no more heretical statement than the answer that now presents itself. Namely, the problem of design is that it does not exist as an independent discipline because it does not have its own space outside the system of production.

By stating this, however, we are in fact repeating the question posed by both Morris and the Anti-Design movement: How should design operate on the plane of the market? And transferring this onto the plane of our reflection: What would happen to design if the market (whether free or regulated by the state) did not exist? Would it find itself in the world of *Mad Max*? Or would it perhaps move toward the possibility of discovering a solution to the problem just posed: namely, *that design does not exist as an independent discipline because it does not have its own space outside the system of production*?

To help us more easily come to terms with this preposterous suggestion, we might turn to the theory of the "ignorant schoolmaster". As the French philosopher Jacques Rancière writes, we have two methods to choose from: the old method and the method of emancipation. (Rancière 1991, 18) In the old method, the schoolmaster tells us what we have to learn and how we have to understand it. Thus, some other person selects for us the things we are supposed to know, which we then master and, on the basis of what we have mastered, we appear to make progress. Our knowledge remains fragmentary, since we are always in the grip of somebody else who guides us, measuring out for us, dose by dose, the knowledge we still have to master. Once we have learned the measured dose of knowledge, we reach the stage when it can easily be forgotten. For in the old method, we forget in order not to burden our memory with things we don't need. And, according to Rancière, this is where we find "the genius of the explicators: they attach the creature they have rendered inferior with the strongest chains in the land of stultification – the child's consciousness of his own superiority." (22) This is the comfortable position of immaturity: the beaten path is much *easier* to walk, especially under someone else's guidance.

In the method of emancipation, we relate what we learn to everything else: "The student must see everything for himself, compare and compare, and always respond to a three-part question: What do you see? What do you think about it? What do you make of it? And so on, to infinity." (23)

Why do I find Rancière's universal doctrine an interesting basis for design? At present, design is completely entrenched in the old method. The production system and capital make our selections for us, taking on the role of schoolmaster, of the explicator. They measure out for us fragments of knowledge, while the whole, because of its apparent complexity, remains divided between numerous specialists, who each take care of their own little territories. Capital is similarly unequalled when it comes to convincing specialists that they are an irreplaceable, crucial element in the whole; consequently, every element in the system accepts the given situation without any major doubts (or even any sense of resignation). What is more, the system creates various apparent possibilities solely in order to satisfy our need for a choice and provide us with a false sense of authorship. It perverts creative decisions into a situation where we constantly choose among numerous possibilities that only appear to be different from one another. No matter what we choose, it will always be the same; no matter what we choose, the schoolmaster will always be right. The bonds the system creates handicap the potential of the discipline, inasmuch as the system adapts the greater part of design services to fit its own image. In fact, anything *inconsistent*, anything *disconcerting*, is adjusted to the world of the market from the start or integrated into it later (as a new trend).

The method of emancipation, by contrast, makes it possible for us to think about an alternative – an alternative in the discipline of design. To think about a design that will, as an independent discipline, satisfy the demand to be outside the market production

system – a design that will bring us back to recognizing the potential the discipline possesses. This is not, indeed, a question of whether we as a discipline *can* do this, but whether we as a discipline *will* do this. Ruskin, in fact, reminds us of this, when, in the introductory to *Seven Lamps of Architecture*, he relays the words of the artist William Mulready: "Know what you have to do, and do it." (Ruskin 1880, 1) If one of the designer's tasks is to "discover and assess" reality (as ICSID's definition of design puts it), then we must ask ourselves: Do we even see the reality in which design is entrenched? After all, in order to assess reality, we must first be able to see. To see what exists. In the case of design, what the designer sees is a certain discrepancy, a certain discomfort, a certain problem. All of which pushes us toward reflection. And only then, on the basis of both steps – to see something and to think about what is seen – do we come to the third part of Rancière's question: the step that enables us to make a decision. Or to put it another way, with the knowledge we possess, every individual is aware that they have the potential to do something or not to do something. Thus, each of us is faced, again and again, by the question: What will you do?

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Redesign of traditional Chinese umbrella

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Abstract: *The project is about the redesign of Chinese traditional umbrella, discussing the possibilities of the traditional umbrella coming back to people's daily life. The designer studies the characters of traditional umbrella, including its features, manufacturing processes, technical skills, materials, costs, and differences from the modern umbrella. On the basis of the studies, the designer tries to combine the traditional elements with the modern life style, revitalizing and inheriting traditional culture at the same time. The whole process consists of the design of umbrella, its packing and propaganda materials. With establishing the artistic conception of the project, it is the project that can enhance people's attention on traditional culture, arts and crafts.*

Keywords: redesign , traditional umbrella , modern daily life

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Introduction

The object being studied in this design case is the Chinese traditional umbrella. Through studying the characters, manufacturing crafts, processing, materials and costs of the umbrella, and analyzing the comparison between traditional and modern umbrellas, these traditional elements would be tried to be combined with modern life style and the merits of modern umbrella with the traditional one. The case discusses the way in which the traditional umbrella can be re-integrated into modern life and be given new vitality, inheriting the traditional crafts at the same time.

The traditional umbrella (*figure1*) is originated from China and were spread widely across Asia thousands of years ago. As a kind of rain gear, climatic conditions and output of bamboo, which is one of its main materials, affected a lot the development of traditional umbrella. Therefore, Jiangnan district, where rains a lot and is rich of bamboo output, became one of the main development areas of the umbrella. And even in many ancient literatures, the umbrella made in Jiangnan turned to one of the symbols of Jiangnan culture.

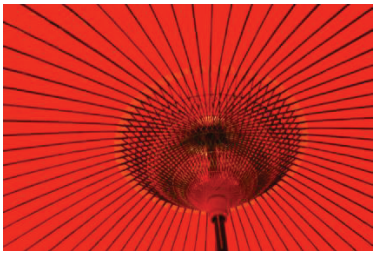


Figure 1 Traditional oil paper umbrella

Traditional umbrellas emphasize decorative and artistic quality and continue repeating classical paintings and traditional patterns on the umbrella. These patterns no longer fit modern aesthetics and daily life needs. The experience would be learnt from those similar redesign cases at home and abroad and the reasons for the success of modern umbrellas would also be analyzed so that proper design chance would be found and the final performance would be promoted by using design language in those success cases. In addition, elements and manufacture methods from other traditional crafts would be integrated into the umbrella design, making the final presentation more interesting. The desire of this project is to persuade more people use traditional umbrella again to relive their memories of childhood or to experience Jiangnan life style by using the redesign umbrella. Users of different ages will have various feelings and moods.

Redesigning work of traditional umbrella is to express and emphasize the characters of Chinese traditional umbrella and Chinese traditional culture. It is also part of social responsibilities of designers to inherit traditional culture and integrate it into modern culture. It is much significant that young designers should try to make more people pay attention to traditional culture and to make design and art a part of people's daily life.

Brief history and cultural meaning of traditional umbrella

HISTORY OF TRADITIONAL UMBRELLA

Umbrellas were invented thousands of years ago as a kind of people's daily necessaries. There are some different inferences about the origin of umbrella.

One saying is that lotus leaf is the prototype of umbrella since lotus leaf can be used to prevent people from rain and sunshine. Another one is that Luban (a famous Chinese artisan, born in A.C 507) was enlightened by his wife and made a small pavilion which is able to be carried around and this pavilion became the umbrella later.

In history, the very first thing being used to prevent people from rain and sunshine was a tool which couldn't be opened and closed and it is called "canopy".(figure2) It firstly appeared in the battle between Yellow Emperor and Chiyou. Yellow Emperor used the canopy to shield sunshine and sand so as to see the battle clearly and won the battle finally. And people thought the canopy blessed Yellow Emperor and brought him the victory. After that battle, the canopy was considered as the symbol of honors and rights. And the traditional umbrella is evolved from the canopy.

Figure 2 Traditional canopy

And there are some records about the emergency of the umbrella in many ancient books. In an old book written in Western Han Dynasty and in *Historical records*, there are records about it.

In the beginning, the surface of umbrella was made of cloth. Until Han Dynasty, after paper was invented, it became the new surface material. Since paper was easier to be made and its costs was lower, paper umbrella became popular after then. In Wei, Jin and Southern and Northern Dynasties, paper that was soaked with tung oil was used to be made the surface and this marked the invention of oil paper umbrella. The tung oil can protect paper from water and make paper more durable. This craftwork promoted the development of traditional umbrella. Until 70s in 20th century, traditional umbrellas withdrew from the stage of history gradually.

In addition, with the development of cotton, craftsmen drew the experience of oil paper umbrella, they also used cotton soaked with tung oil to make the surface. This oil cloth umbrella was very durable and could stand the sun exposure and storm combat. But it was very heavy and had few different patterns, so it was not as popular as oil paper umbrella. They were usually made in big size and used by street shops.

Another material, silk, was also used to make the umbrella. After Mid-Tang Dynasty, with the population of silk, silk-umbrellas went prevalent, too (*figure3*). In the classification of silk umbrella, those from West Lake in Hangzhou are excellent. Its ribs are made of bamboo and its surface is made of silk. The umbrella is small and flexible, has elegant style and puts emphasis on decorative qualities and comfortable handles. The lines of the whole form are smooth and the decoration of colored lines (*figure4*) and buckles are full of handmade texture. These details highlighted the fine crafts and the local characteristics of Jiangnan District.

According to different producers, the traditional umbrellas are divided into different kinds, such as umbrellas from Yunnan Province, Fujian Province and so on. There are various fairy tales and stories about the umbrellas.

Figure 3 Silk umbrella

Figure 4 Colored lines decoration

Structure and manufacture craftwork

The structure of the traditional umbrella involves (from top): the head, the upper umbrella nest, the upper ribs, the lower ribs, the lower nest, the umbrella stick, the spring leaf, and the handle. (*figure 5*)

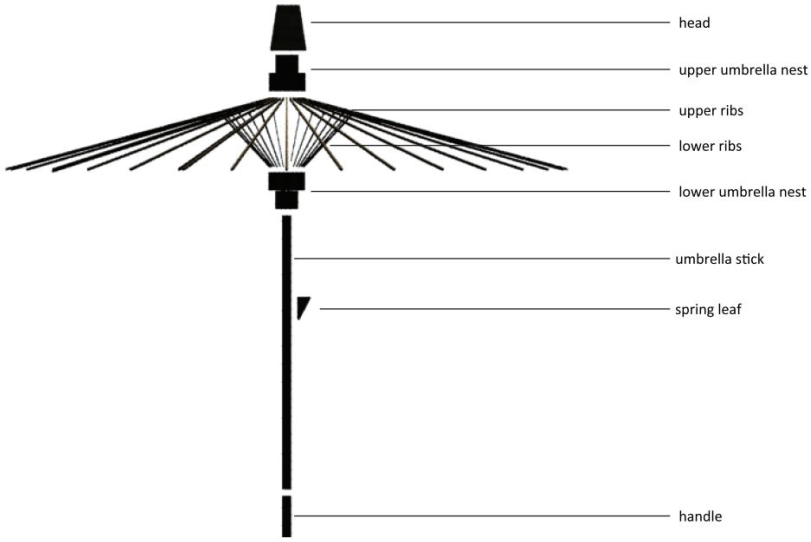
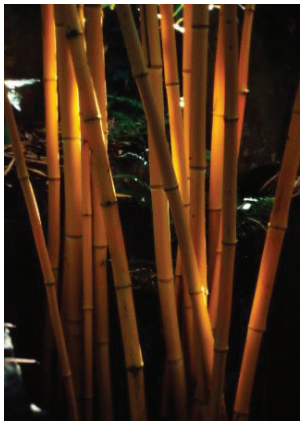


Figure 5 Structure of traditional umbrella

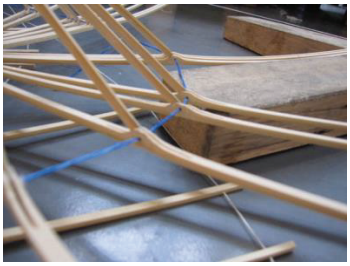
According to different geographical culture and habitats, oil paper umbrellas and silk umbrellas are made by different manufacture process, but generally, there are five steps in the process: choosing materials, making parts, assembling the components, pasting the surface skin and decorating.

Choosing materials is to select proper and qualified bamboos which should have enough length and strength. And the components are consist of two groups of ribs, two nests, a handle and a spring leaf. After connecting all of the parts by cotton strings (*figure6-c*), the structure is put into herbs to be steamed for about an hour so that it is not easy to be infested.



(a) Main material-bamboo

(b) Parts making (ribs, nests, sticks)

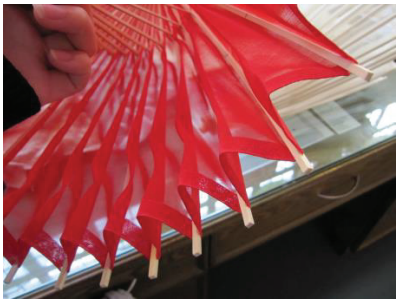


(c) Connecting ribs with cotton strings, which work as rotating shaft

(d) Twine the cotton string every distance

(e) Paste surface(silk) on the structure and paint

(f) Trim the brink of the umbrella



(g) Close the umbrella with surface inside

(h) Twine colored strings on ribs

Figure 6 The main process and some details of manufacturing

After the main structure is dry, craftsman will use cotton string to twine on the outer end of the upper ribs every equal distance (*figure6-d*), paste the surface on the ribs and paint patterns on it. The tung oil will then be brushed on the surface and the umbrella will not be folded and closed until the surface is dry. The surface is folded inside the structure and the whole shape becomes back to a part of the bamboo. In final process, craftsmen assemble the head and the handle and twine the colored string on the folding structure in particular ways. And this decoration is also used to the head and extends from the head to part of the surface. This decoration has great sense of rhythm and very colorful. After all these process, a traditional umbrella is almost ready.

Most of the traditional umbrellas are hand made and the whole process has dozens even more than one hundred steps. Nowadays, there are still some small workshops are making traditional umbrellas. The materials they use stick to the tradition to retain its ancient traditional charm. The tools used to manufacture also have a long history and qualities are seriously controlled. The patterns on surface are also refined and painted by professional painters. The themes are mainly from traditional Chinese paintings and folks. There are also themes about various traditional festivals and events.

Cultural meaning

Traditional umbrellas have a long history and in different ages and districts, the folks offered it various cultural meaning.

Seeing from the Traditional Chinese character of umbrella, "傘", contains five "人" which means people and this Chinese character means that the family can have a lot of sons and grandsons. This was considered good moral and symbolized "fullness" connotation of a beautiful descendents marriage. So in many parts of China, people use red umbrella in their marriage ceremony to express jubilant, elimination of disasters, and blessing for peace. In many minorities, people use umbrella as one of marriage dowries.

The umbrellas in circular shapes mean happiness, reunion, and peace in Chinese culture. The umbrella is a necessary for a long journey and giving umbrellas as gifts is a blessing to those who are going to travel. Derivative from this, people wish good luck to those who are going to Imperial Examination or to serve as official by gifting umbrellas.

And when watching from under the umbrella, the rounds shape of the umbrella makes people think of the vault of heaven. According to Traditional Chinese constellation, people use 28 ribs to make the main structure and the number is related to the number of constellation in the vault of heaven. This makes people imagine the mysterious power and let them feel more relied on the region. In a long time, the umbrella is not only a carrier of culture of people's Sung day psychological, but also a mold to express worships to gods. In much worship, people usually use umbrellas as main props in regional dance to show their respect.

Redesigning

Sources of inspiration and reference cases

In recent years, there are more and more redesign projects and more redesign methods are formed.

Some of the cases excavate characteristics of the materials and highlight the unique charm of the performance of the materials. The design keeps the traditional charming and modernizes it at the same time (*figure7, 8)*. Some of them change the original

structure and make it more reasonable. Some of them use the traditional craft in modern design and integrate the modern and traditional culture together from anther perspective (*figure9*). Other cases transplant different concepts from different design objects together and connect different things, which seem like unrelated with each other (*figure10*). The design can be very interesting.

Figure 7 Plastic structure with paper surface designed by PINWU, using new material for old craft to emphasize some character of the craft

Figure 8 Paper pasting chair designed by PINWU, using old manufacture process to make new things to preserve these processes

Figure 9 Transplant the structure of folding fan into light designed by Louie Rigano

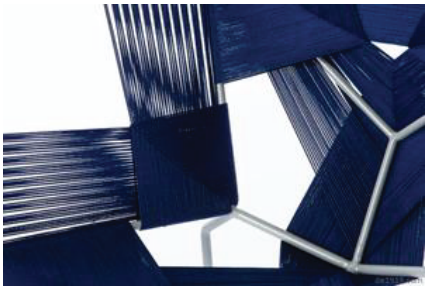


Figure 10 Connect embroidery with chair designed by TAREEF - new usage of old craft

Original ideas

In the phase of putting forward ideas, many possibilities and chances are thought about and the redesign methods mentioned before are referred .

1: introduce the structure of folding fan and the form of woven bamboo art into the design, change the structure of the umbrella and the way it opens and closes. This will also change the shape when the umbrella is closed.

2: restore the essence of the traditional umbrella only and simplify the form of the umbrella to most extend so as to emphasize the color, the smell, or the grain of the bamboo.

3: put emphasis on expressing traditional culture, especially Jiangnan culture. Change the patterns painted on the surface and let the form of the umbrella related to the patterns. The umbrella can create an atmosphere when man is using it.

4: use one of the materials which are used to make the umbrella, such as paper, to make the whole umbrella, so as to emphasize the characteristics of it. For example, use paper to make the whole umbrella.

5: the colored cotton strings twined in the umbrella is very unique and it will be used to weave the whole umbrella surface.

6: get idea from the habits when people are using umbrellas. When people are using long umbrellas, they are costumed to lean it on the wall. From this behavior, he shape of the handle and the head would be changed to make the umbrella easy to be leaned.

Development

After getting these possible ideas, these ideas were discussed by sketches and models in detail and these initial designs were determined.

Proposal one (*fiugure11*): simplify the structure of the umbrella to maximum extend, remove all the unnecessary parts, such as the string used to connect the ribs. This string also works as the shafts of the umbrella and we tried to substitute it with single shaft for each rib so as to simplify the whole form; change the shape of the main structure to emphasize the shape of "人" and the strength the structure has. And use transparent cover as new surface. The shape of the structure is the key point in this design.

Figure 11 Proposal 1: remove unnecessary parts and simplify the structure

Proposal two (*figure12*): aim at expressing the poetic atmosphere of Jiangnan culture, particularly with decoration on the surface. Use plum blossom as basic design element. Imagine the ribs as the plum branch and decorate the blossom on the surface. Then the handle will be made into organic forms to coordinate the decoration on the surface. When user stands under the umbrella, he will feel like standing under the plum tree. This umbrella builds a nature and full-of-flower atmosphere.

Figure 12 Proposal 2: make the umbrella a plum tree

Proposal three (*figure13*): use the craft of the colored strings to weave the whole surface. The weaving method is simply, full of rhythm, and has good visual effects. We tried to use this weaving method and to draw the experience of other traditional weaving crafts and substitute the paper surface with the woven surface. The umbrella seems like woven by colorful lines. This could be an interesting and beautiful design.

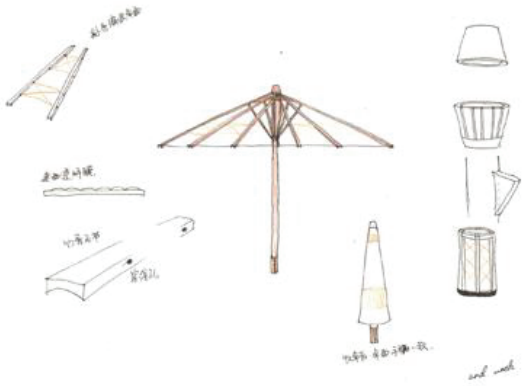


Figure 13 Proposal 3: weave the surface by referring colored strings twined on the ribs

Proposal four (*figure14)*: consider using habits as design entry. Change the shapes of the head and the handle so that the umbrella is easy to be leaned on the wall. This design could be very close to people and make user feel "warm" when using it.

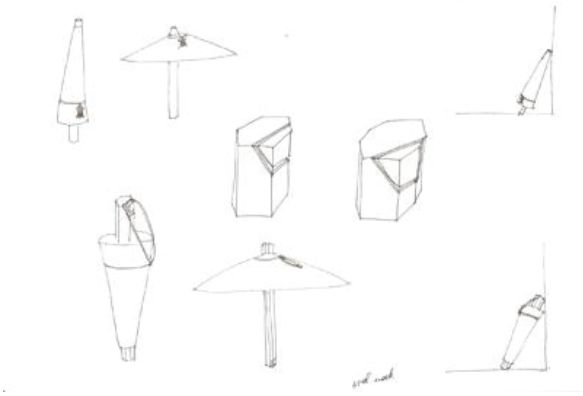


Figure 14 Proposal 4: make the umbrella easier to be leaned

After considering the production process we can achieve and the performance of the final design, and adjusted the four elementary designs. Because of limited production process, the first idea can't be achieved temporarily. As for other three ideas, the one which highlights the poetic atmosphere is the better. With these design were being developed, more information that were gotten from field surveys in Hangzhou were related to the design and four final design were organized (*figure15*). In the aspects of manufacturing, a lot of inspirations were picked up from some other traditional crafts and more modern design methods were used to express these traditional elements.

As for atmosphere, there are some vivid characters owned by all the cities in Jiangnan, which are modern and classic, leisure and busy. Plum flower and cloves represent the dialogue between modern and classic culture. We got atmosphere from poems to express the busyness, leisure and subtleties and gracefulness of Jiangnan.

The four umbrellas are four excerpts from a prose. The arrangement of the elements on the umbrellas presents the busyness, leisure, simplification and gracefulness of

cities in Jiangnan. The plum flower expresses the busyness and leisure of the cities. The cloves expresses the story in a modern poetry named "Lane in the Rain", in which the poet is looking for a lady with umbrella, looming in the lane.

The production process draws the experience of paper-cutting and embroidery. Hollow patterns can make special shadow and are very interesting.

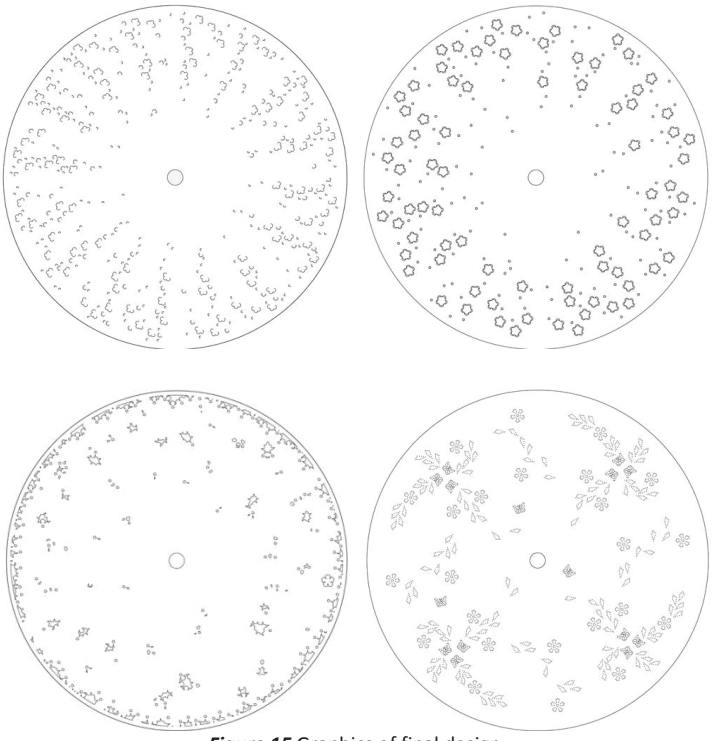


Figure 15 Graphics of final design

Figure 16 Final models of umbrellas

After fixing the final design, the umbrellas were named with the reference of some Tang poems and Song jambic verses, and a poem was written. The poem is used in the derivative products like poster and bookmarks.

Derivative products

Derivative products mainly include packages and bookmarks.

The package design(*figure17*) is also in simplified style. The package protects the body of the umbrella and the head and the handle are exposed outside. The main material is non-woven fabrics. There is another buckle with wooden button being used to fix the body of the umbrella, which can be fixed on the handle of the package when not being used. To distinguish the four packages, the same patterns as those on the umbrellas are made on the packages. And a logo is designed for the umbrella. The logo is evolved from the character "傘", which means umbrella. The logo and the poem are used to design the bookmarks (*figure18*).

Figure 17 *the packages and its patterns and use*

Figure 18 the logo and bookmarks

Further thinking

After the whole design, we reviewed the process and made some conclusions.: The meaning of the "Re-": Although because of limited manufacture skills and the performance of the final models, no changes were made about the structure of the umbrella. New design about the decorations changed the production process used on the surface material. The surface can now be made by machine instead of hands and improve the efficiency. But at the same time, the hand-made main structure is remained. the handmade texture was tried to be preserved when it was made mass

production and was kept modern and traditional at the same time.

The surface of the model is made of rice paper and it can't be used in practice. But the supplement for practical use was already taken into consideration. The material will be changed to the paper used in traditional umbrellas or to transparent materials used for modern umbrella or transparent materials used for architecture. The material that has the most approximate performance to the model will be tried and the method of decreasing the weight of the umbrella will be thought of. And two layers of surface maybe used so that the umbrella can shield the rain.

This umbrella case is just a beginning of redesign case serial. Some other traditional crafts, like paper folding fans, will be the design object of this subject later. More modern and interesting design methods will be used to wake up these traditional crafts. More good designs are expected. The aim of this serial project can let more people pay attention to those excellent traditional crafts.

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Counter-Design: Alternative Design and Research Methods

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Abstract: *Art is critical in its ability to propose an alternative to an accepted reality, and produces a counter-consciousness; a "negation of the realistic-conformist mind" [Marcuse, 1979, p 9] Communication design, is a formalized practice embedded in and serving conventional cultural production and capital. An alternative counter-design "…chooses instead to emphasize the need for a renewal of philosophical discourse and for social and political involvement as a way of bringing about structural changes in our society." [Lang, 2005, p. 46.] For communication design to dismiss its conventional service to capital is in itself a critical negation. Additionally, communication design's prescribed functions allow it to act as a Trojan Horse, imitating commercial work while surreptitiously engaging in critical practice. Its ubiquity and systematic conformity makes its counter a natural for challenging conventional consciousness. Can Counter-Design offer a model of design research as an agent for critical thinking and cultural agency? Can it engage design students in a critical process of investigation and analysis? Is this valuable for today's design student? I will show by way of theoretical models and some case studies how this methodology questions predominant roles of design and design pedagogy.*

Keywords: Design, Research, Experimental, Counter-Design.

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Introduction

Art is critical in its ability to propose an alternative to an accepted reality, and produces a counter-consciousness; a "negation of the realistic-conformist mind" (Marcuse 1979, p. 9).

Communication design is a formalized practice that is rational, pragmatic and oriented towards commercial objectives. It is embedded in and serves conventional cultural production and capital. For communication design to dismiss its traditional service to capital is in itself a critical negation. Its ubiquity and systematic conformity in cultural forms makes its counter a natural vehicle for challenging conventional consciousness.

An alternative model and practice, a counter-design "…chooses instead to emphasize the need for a renewal of philosophical discourse and for social and political involvement as a way of bringing about structural changes in our society" (Lang 2005, p. 46).

A case may be made for a model of communication counter-design as a critical practice, or trajectory, counter to the traditional models of design industry and, by consequence and to varying degrees, design education.

I propose that this model, by removing design and design research from the constraints of its typical marketing and commercial objectives, creates a critical practice of design that can engage students in deep critical and creative thinking and thus prepare them for the evolving practices of communication design. This model or method encourages unexpected solutions that circumvent common perceptions and expectations, and challenges students to find new languages and methods. It exposes students to another postulation of design practice: the use of the semantic tools of design and the writing of visual language to challenge our existing views of the world. The outcomes of this design practice are devoid of practical consequences and problem-solving artifacts and are nothing more (or less) than pure discourse. If design and design education are indeed concerned with the development of innovation and new methods, we might consider such an alternative—even *radical*—to explore the unknown in order to seek out new territories.

Central to this proposal is a model of counter-design and, with it, a bridging of some theories of art, design, and critical discourse. Framing what constitutes the basis of an argument for a practice of counter-design, I will briefly lay out some key principles:

- Communication Design: Conventions and Visual Language
- Art & Counter-Consciousness
- Counter-Design: Communication Design as Discourse

In addition, as an example of practice, I will present a short overview of my ongoing project "The Ad-Hoc Atlas." This project avoids the traditional goals and outcomes of graphic design practice, suggesting instead an endeavor that is entirely propositional, speculative, and transcendent in nature.

I will conclude with examples of student projects from my Advanced Graphic Design class at San Francisco State University that utilize the processes and outcomes of a counter-design practice.

Joshua Singer

Communication Design: Conventions and Visual Language

Figure 1. Times Square. Matt H Wade, 2009.

As Max Bruinsma states, "Our basic premise is that designers act as catalysts in this culture which 'writes' in images. By designing both the 'words' and what one could call by now a 'literature of visual language,' communication designers play a pivotal role in today's mediated cultures: they trigger viewers to become readers of visual messages." (Bruinsma 2005)

While going about the business of design,[1] writing the images that constitute culture, communication design creates the narratives of the everyday. In so doing, it tacitly or aggressively, directly or tangentially, serves dominant paradigms and plays a pivotal role in the construction of cultural consciousness. The business of communication design does not upend culture's normative conventions and desires, but rather plays to them in the interest of businesses messages and needs. Within this context, the primary context, is a communication design that continues and reifies the common narrative.

There are many forms of design that are presumed to simply educate or inform. One could say that these are not in the service of industry, consumption and capital. On the contrary, I would instead argue, that alternatively we could view these designs within the larger system of cultural production and consciousness, and as part of the "business" of design. Environmental and way-finding graphics that assist travelers in an airport, for example, facilitate the movement of individual consumers through the economic machine. Similarly, promotional materials for a non-profit art gallery, through messaging and visual language, reify the normative systems of patronage and commodity culture, both engaging and serving art collectors and funders.

The objectives of communication design are by and large deeply, and at least tacitly, engaged in the continuation of prevailing economic and cultural systems. Communication design writes visual language in a near seamless semiotic landscape that creates a stable perceptional environment, a dominant conventional consciousness, and a conformist mind.

[1] I am defining this term, the business of design, as the commercial and dominant practice of design engaged in the interests of industry (the production of goods and services), capital (the economy of economic exchange), and consumption (both economic and material).

Art & Counter-Consciousness

Figure 2. Archigram. Space Comics. http://rainbowguts.livejournal.com

It is not hard to argue, or simply imagine, that the consciousness of contemporary culture is in a dream state, absorbed by the apparitions constructed by design.

Marx states “The reform of consciousness consists solely in… the awakening of the world from its dream about itself” (Marx 1932, p. 226).

Marcuse proposes that art can remedy this dream state. He argues that art is critical in its ability to propose an alternative to an accepted reality, and that it thus produces a counter-consciousness. He states “The aesthetic form constitutes the autonomy of art vis á vis ‘the given.’ However, the dissociation does not produce ‘false consciousness’ or mere illusion but rather a counter-consciousness: negation of the realistic-conformist mind” (Marcuse 1979, p. 9). This counter-consciousness acts as an antidote to the perpetual and seamless dream state of a conventional culture and its representations.

In its dominant form, the business of communication design produces cultural consciousness and is an apparatus for the continuation of the prevailing realistic-conformist mind. We might also argue that it is the consumer/commercial/dominant culture that uses communication design as its handmaiden. Regardless of the causal relationship, what if communication design simply abandons its traditional territory? What if a method of communication design operates as a practice outside the bounds of commercial interest? What if this method writes visual language, explicitly and deliberately counter to the realist conformist mind? To dismiss its service in the production of capital and therefore of conventional cultural consciousness is in itself a critical negation. Its normative ubiquity and systematic conformity in cultural narratives make its position as counter a natural. Untethered by the demands of capital, it is free to operate as a critical apparatus and has the opportunity to exist as pure discourse.

Does this method then simply become art, or is it still design but in a transcendent practice? I am not sure, but would argue that we should consider the latter, due precisely to the cultural role of design. Unlike art, communication design is explicitly involved in constructing the dominant components of conventional consciousness and this positionality, this stance from within, makes its shift to the critical that much more distinctive. To reform or shift or shatter consciousness is best undertaken from within the forms that most resemble it. The cultural ubiquity of communication design gives it a unique ability to operate as a Trojan Horse, imitating or mirroring commercial work while surreptitiously negating it.

Joshua Singer

Counter-Design: Communication Design as Discourse

Figure 3. The Happy Island, Superstudio. http://collageandarchitecture.com/

Superstudio, an architectural firm working within the Radical Architecture movement of the late 1960s, coined the term "counter-design" as an alternative practice that "…chooses instead to emphasize the need for a renewal of philosophical discourse and for social and political involvement as a way of bringing about structural changes in our society" (Lang 2005, p. 46).

Superstudio has described its intent as conceptual postulation, rather than practical work on real or proposed structures or forms. This position is quite radical in relation to the conventional and pragmatic practices of architecture and design, for it postulates that architecture itself is nothing less than discourse.

Consider the description of an installation by Superstudio at the Museum of Modern Art in 1972:

"This is not a three-dimensional model of a reality which can be given concrete form by a mere transposition of scale, but the rendering visible of a critical attitude towards (or hope for) the activity of designing understood as philosophical speculation, as a means to knowledge, as critical existence" (Superstudio 1972, p. 2).

This statement eloquently illuminates the activity of counter-design as a negation of the conventional role of design. This is not an installation of a plan or model of a building in the real world, a construction of industry, but rather the "rendering… of a critical attitude."

There are of course many design methodologies that offer alternatives to the more common commercial practices of design. For example, Daniel Van Der Velden of the design research studio Metahaven articulates a method of speculative design in this manner: "When discussed from the point of view of critique, speculative design anticipates a reality, and uses that as a critical device" (Van Der Velden 2010).

Metahaven sees design and design research as "a tool used to inquire, to research, to anticipate…. [D]esign as an instrument to imagine" (Van Der Velden 2010). This approach attempts to redraw the territory of design to find a more adaptive and sustainable practice that can respond to a wider array of challenges in a more responsible manner. It proposes that design is essentially an instrument to imagine.

This speculative form of design supports, to some degree, a model of counter-design which renders critical attitudes rather than commercial artifacts. This somewhat

radical sounding position appears to exemplify a contemporary design practice that aims to transcend the strong bond between design and industry to find other, more critical and holistic, approaches. While critical and imaginative, this model of speculative design is, I would argue, primarily conformist. It does not negate the conforming role of design; it is ultimately rational, pragmatic and in the business of design. However enticing its label, speculative design still positions and justifies itself as a professional practice with tangible benefits for client work. I would therefore suggest that counter-design, with its reverence for design as purely philosophical discourse, has a more radical and transformative cultural role. It does not strive to amend or improve design or to amend or improve *by* design but rather to counter design's normative forces and effects.

If we were to conflate this model of counter-design with the counter-consciousness described by Marcuse, we might find a model for communication design as discourse. A model of communication counter-design, then, would offer a practice of critical discourse over the production of commercial artifact. This a model for the negation of the realistic-conformist mind, the creation of a counter-consciousness that can be considered a reasonable candidate for awakening the world from its dream about itself.

Communication Counter-Design in practice: The Ad-Hoc Atlas

Through my background in fine art and commercial design, I have developed an interest in the potential of a design paradigm outside of communication design's common practice. In conjunction with previous explorations and interest in urban geography, I have been developing design projects that visualize and map the construction of cultural paradigms in geographic space.

My current and ongoing project The Ad-Hoc Atlas is presented here as an example of a practice in communication counter-design and attempts to interrogate a "middle way" between art and design. The project avoids the conventional design outcomes of discrete ends and produces instead an unending series of prototypes. It postulates that design research and design practice might be entirely propositional, speculative, transcendent and ultimately discursive.

To borrow from Superstudio: In the Ad-Hoc Atlas, the rendering of the urban landscape is not "a mere transposition of scale, but the rendering visible of a critical attitude towards (or hope for) the activity of designing understood as philosophical speculation, as a means to knowledge, as critical existence" (Superstudio 1972, p. 2).

Specifically, this work explores the operations of graphic language, history, and systems in the construction of urban space ("space" in the big sense of the term, social and dialectic).

The Ad-Hoc Atlas is a compilation of historical and observational data in conjunction with inputs discovered through academic and field studies as part of the research process. The outcomes include three-dimensional digitally-constructed views containing layers of historical maps and geolocated tracks of personal and systemic flows, photo documentation of design artifacts, montage constructed narratives of aesthetic commentary, and auto-poetic annotations. The Atlas proposes these possible landscapes of graphic geographies as an (im)possible urban landscape.

Specifically, some of these outcomes include:

- A conceptual model of the subconscious psyche of the graphic city hacked from Freud's model of the human psyche. (Figure 4).

- A book of graphic montage and a poetic narrative of a city constructed by myth and desire. (Figure 5).
- A model of a 300 meter of the word “MODE-RNISM” that marks an historical buried stream in Montréal (Figure 6).
- A model of an Urban Prosthetic Semiospheric Metabolic Reader that towers one kilometer high over Berlin displaying the ubiquitous and varied vernacular graphic language of the city's streets (Figure 7).

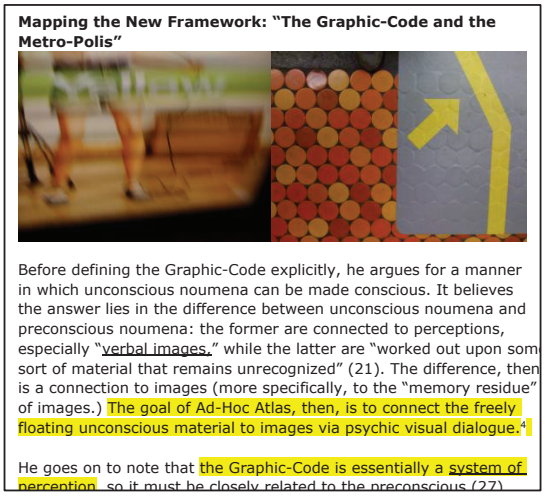

Figure 4. Ad-Hoc Atlas: Montréal, Joshua Singer.

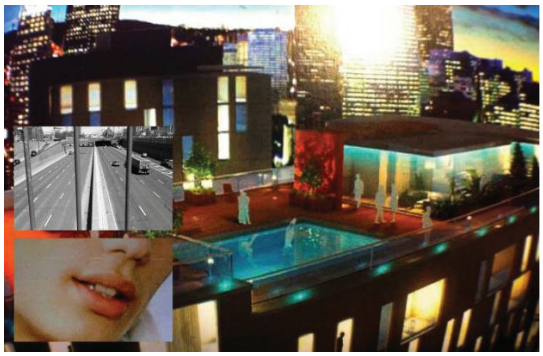

Figure 5. Ad-Hoc Atlas: Montréal, Joshua Singer.

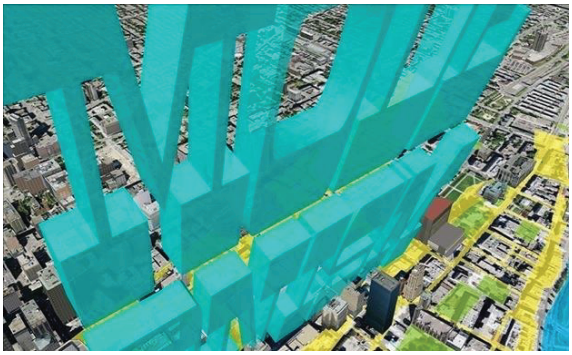

Figure 6. Ad-Hoc Atlas: Montréal, Joshua Singer.

Figure 7. Ad-Hoc Atlas: Berlin., Joshua Singer

Counter-Design as Pedagogy

The notion of communication counter-design raises significant issues, among them: What might we want to teach our students, our future communication designers?

Advertising collateral, packaging for consumer products, and corporate identity systems are the mainstay of many communication design programs, creating "sexy" portfolios for students who, understandably, are looking for well-paying employment in the industry after graduation.

Yet the rationale underlying these pragmatic outcomes is called into question as we witness the ongoing transition in the roles of the current and future designer. At this moment in history, nearly anyone with the requisite software can call themselves a designer regardless of their levels of skill and education. However, emerging views of the future of communication design point the way to a more broadly defined profession requiring the exercise of a more highly diverse skillset rooted in the practices of critical and creative thinking. Design thinking, design research, lateral thinking, divergent thinking, and design innovation – all call in to question traditional pedagogical models of design education and beseech inquiry into more diverse and creative approaches to the discipline of design.

I would propose, as others have, that there is a valuable place for a practice of communication design as experimentation, exploration and methodology. Framing this practice as a counter-design gives it some traction as well as a method for application

and outcomes. Counter-design as a methodology for design education can expand existing paradigms and offers methods of creativity and critical discourse while developing competencies that might better prepare students for a future in which adaptability, and creative and critical thinking, are prerequisites.

Examples of Student Work

I will now share some examples of student work from the Advanced Graphic Design class I teach at San Francisco State University in which a methodology of counter-design is applied. This work spans a number of semesters as part of a recurring class project in which students develop an Atlas of San Francisco: a collection of designs and documents that explore and visualize a system or systems and other invisible elements within the city.

At different times, this project has centered on historic buried watersheds, on unique attributes of neighborhoods, and on systems of communication. The recurring geographic component of the project facilitates both quantitative and qualitative research of varied forms including literature reviews, academic and field research, visual documentation, and data visualization.

The geographic theme also introduces theories and frameworks from disciplines outside of design studies and encourages students to think outside their normal modes of operation, expanding their perceptions in terms of the inputs that can be used to generate graphic works.

To this end, I assign James Corner's seminal essay *Terra Fluxus* to expose students to the conceptual basis underlying Landscape Urbanism. This approach frames the city as a landscape — a term usually reserved for the natural world — which behaves as an ecology of forces and agents, a metabolism, not merely a collection of forms

Terra Fluxus proposes a number of themes for the practice of Landscape Urbanism. Of particular relevance to our classwork, and to a method of counter-design, is The Imaginary. Corner states "Materiality, representation, and imagination are not separate worlds; …change through practices of place construction owes as much to the representational and symbolic realms as to material activities. And so it seems landscape urbanism is first and last an imaginative project, a speculative thickening of the world of possibilities" (Corner 2006, p. 32).

This formulation proposes that the investigation and construction of the urban landscape require of necessity a creative and imaginative trans-disciplinary practice in which imagination, a counter-consciousness, plays a key role.

This sets the stage for students to look for ways of viewing, perceiving, and visualizing the city that challenge conventional perceptions. It steers the students toward a research process of imaginative explorations and away from expected outcomes of historical overviews, inventories, and comparisons of form. This emphasis on imagination aligned with a systems view of city directs them, to varying degrees, to a critical stance.

Student Work: Islais Creek Phytoremediation

In the example of the student project “Islais Creek Phytoremediation,” students propose and visualize the clean-up of toxic pollution in the Islais Valley of San Francisco, a once vast and pristine estuary and marshland that is now paved over and heavily polluted by industrial toxins.

The group of students whose work is presented below began their research with an historical overview of the industrial legacy of the area and the deep and pervasive environmental damage to which the area has been subjected. They discovered that there was a wide array of chemical toxins remaining in the soil after years of unregulated industrial operations. Students researched the composition and hazards of these chemicals, their effects, and strategies for their removal. In researching remedies, students learned of the process of phytoremediation, a natural process by which specific plants are able to remove toxins.

Early studies by the group proposed and visualized utopian park-like landscapes. After critiques and suggestions to think outside of what might actually work, or what might be expected — encouragement not to concern themselves with being correct — they proposed a more aggressive and ultimately non human-centric solution. They pondered why a solution was obliged to serve human desires. Why not let nature have it all? Rather than control the solution, let the solution be its own force.

They ultimately posited a solution based on the use of plant species that are both phytoremediative and invasive. The students imagined and visualized a dystopian scenario through which these plants, after taking over the entire industrial region and its surrounding residential areas, transformed these areas into a geography of nature completely removed from humanity and human needs. What started as a reasonable and workable solution, phytoremediation, was then extended imaginatively to counter our preconceived notions and best practices. This extreme vision offers a counter to the given reality and allows us to see the world differently and to open the subject to discourse, rather than simply offer a solution to a problem.

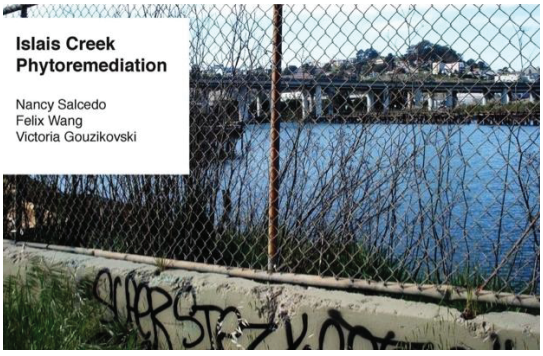

Figure 8. Islais Creek Phytoremdiation, Victoria Gouzikovski, Nancy Salcedo, Felix Wang 2010.

Figure 9. Islais Creek Phytoremdiation, Victoria Gouzikovski, Nancy Salcedo, Felix Wang 2010.

Figure 10. Islais Creek Phytoremdiation, Victoria Gouzikovski, Nancy Salcedo, Felix Wang 2010.

Figure 11. Islais Creek Phytoremdiation, Victoria Gouzikovski, Nancy Salcedo, Felix Wang 2010.

Figure 12. Islais Creek Phytoremdiation, Victoria Gouzikovski, Nancy Salcedo, Felix Wang 2010.

Figure 13. Islais Creek Phytoremdiation, Victoria Gouzikovski, Nancy Salcedo, Felix Wang 2010.

Figure 14. Islais Creek Phytoremdiation, Victoria Gouzikovski, Nancy Salcedo, Felix Wang 2010.

Student Work: Gnarchitecture

Inspired by the concept and model of a "Smart City," students were asked to create an atlas of San Francisco revealing flows of information beyond just the “smart” integration of digital information systems and infrastructure. Students were specifically invited to explore and visualize how a city is a network of language: How does information transfer across the urban landscape? What information is needed? How can information and/or its flows be visualized?

"Gnarchitecture" is a student-designed atlas of illegal skateboard locations across San Francisco, archived visually and geographically based on residual skid marks left by skateboards on the surrounding architectural elements. The student frequented and documented famous (and infamous) skateboarding locations throughout the city, focusing specifically on areas of historic importance, locations revealed by his research as strongly culturally relevant to the skateboarding community. Using the mobile/web app *Photosynth,* he created panoramic image spaces that could be navigated by the audience in order to view the residual markings. The ability to pan and zoom and the accompanying textual annotations permit the viewer to investigate these markings in great detail. Some of these virtual spaces included embedded historical images of magazine advertisements photographed at the location.

The student describes this atlas as a museum and database of skateboarding in San Francisco as it reacts to the city's architecture. It offers an alternative view of the urban landscape, the "city-as-skate-park." The student explicitly conceptualizes the documented markings as acts of "architectural scarification" upon the constructed landscape. He emphasizes that these marks are not forms, but rather artifacts of activity. He states: "Markings made by skateboards are, in their own way, marks of passage. These marks are evidence of hours upon hours of focus, repetition, and determination" (Martinez, 2012).

This project transforms our view of the urban landscape from one of purely geographic and architectural form into *both* an archive of activity through its marking *and* an alternate reality - the city as skate-park. In so doing, the work negates typical responses to what would conventionally be characterized as illegal acts of vandalism, defacement and destruction. Instead, it leads the viewer to consider the value and meaning of the activity and its subsequent marks in the urban landscape.

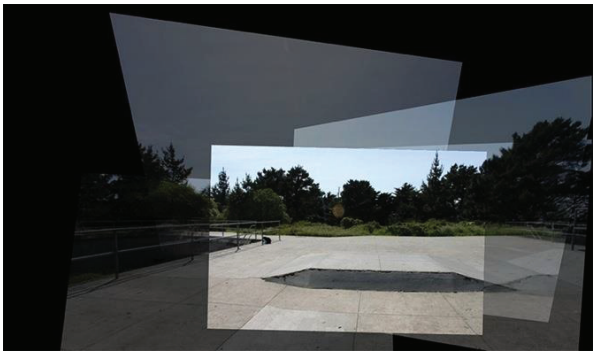

Figure 15. Gnarchitecture, Brian Martinez. 2012

Figure 16. Gnarchitecture, Brian Martinez. 2012

Figure 17. Gnarchitecture, Brian Martinez. 2012

Student Work: A Smell Map of San Francisco

In this second student project responding to the Smart City prompt, the student developed a smell map of San Francisco. She postulated that: "…smells could provide a parallel mode of understanding and representing the transmission of knowledge and information, which often passes from person to person in an almost viral capacity. The passage of ideas can be sporadic and spontaneous, processed as overlapping and simultaneous experience. …a city's smells, gathered in different neighborhoods, might represent a subliminal layer to the experience of a city, representing an underlying network of priorities, beliefs, and ideals" (Rogers 2012).

An exhaustive list of smells were recorded and categorized in a handful of San Francisco neighborhoods. Smells gathered in field research were distinguished by descriptions both rational (tires) and poetic (grandpa). These were then categorized into large groups: food, human-manufactured, natural human, industrial, and nature smells. Exploratory and quantitative research was conducted to map smells by location and diagram their interrelationships. Further experimental and qualitative research resulted in the creation of optical markers of smells in situ based on abstractions of cues from the visual environment.

The sophisticated and critical approach adopted by this student led to surprising results, ultimately challenging our view of the urban landscape and our common assumptions about the olfactory experience. The resulting atlas is simultaneously a record, an archive and an interpretive representation that ultimately renders olfactory

information as both communication *and* landscape. This unique alternative perspective on an urban landscape leads us to rethink our understanding of urban space by countering commonplace assumptions. This project eloquently demonstrates design research and design artifact as agents of discourse. There are no answers here, no solutions offered, but merely, and profoundly, counters to our given consciousness.

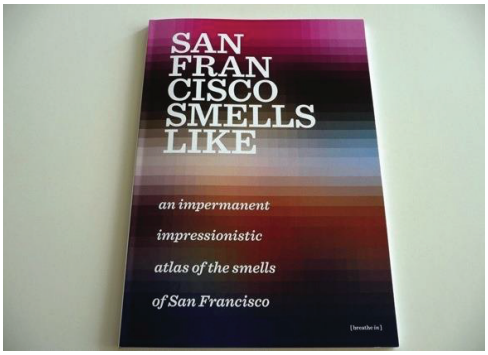

Figure 18. San Francisco Smells Like, Eva Rogers. 2012

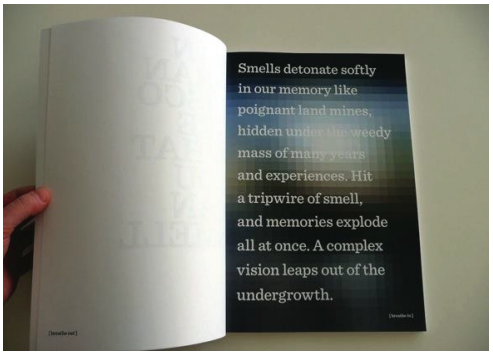

Figure 19. San Francisco Smells Like, Eva Rogers. 2012

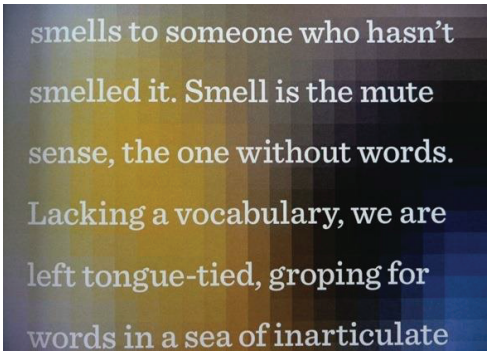

Figure 20. San Francisco Smells Like, Eva Rogers. 2012

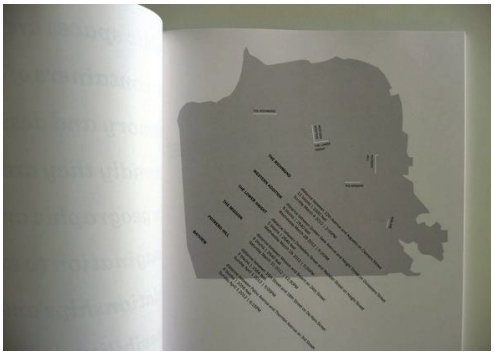

Figure 21. San Francisco Smells Like, Eva Rogers. 2012

Figure 22. San Francisco Smells Like, Eva Rogers. 2012

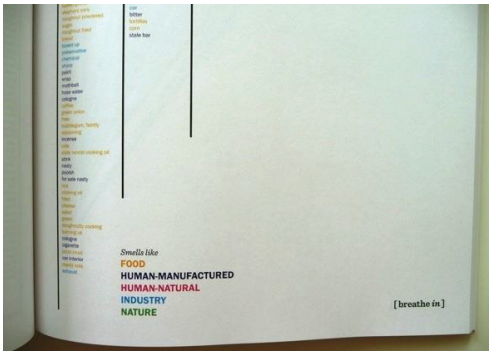

Figure 23. San Francisco Smells Like, Eva Rogers. 2012

Figure 24. San Francisco Smells Like, Eva Rogers. 2012

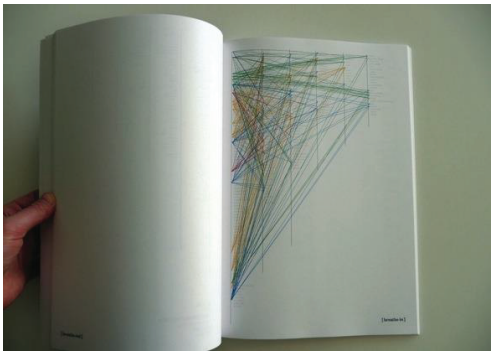

Figure 25. San Francisco Smells Like, Eva Rogers. 2012

Reflections

The above illustrations are just three examples from the many student projects executed for the Atlas assignment over multiple semesters. Overall, results varied widely. In instances when students were not provided prompts and/or specific encouragement to develop divergent scenarios, many if not most projects resulted in bland conventional outcomes (e.g., overviews, histories) or trite utopian scenarios.

For example, when asked to develop a future scenario for the San Francisco buried watershed, students transformed a decayed waterfront into a farmer's market, a project that did little more than require them to visualize space and signage for such a venture. Although well thought out and executed, the project did nothing more than mimic existing popular opinion and turn out attractive portfolio work. Ultimately, this project did little to develop and expand students' critical, divergent, and imaginative thinking skills. The results are emblematic of the kinds of conventional and un-critical design solutions students are easily drawn to in the absence of a more radical pedagogy.

The more imaginative risk taking projects, such as the examples discussed in this paper, encompassed the analytical, practical, ephemeral and poetic spheres and, in the spirit of counter-design, explicitly challenged conventional perceptions. These assignments prompted a rethinking of common perceptions and assumptions, resulting in demonstrations of design research and design artifacts that stand as agents of

discourse. Rather than designed to solve a problem, these works offered counters to our given consciousness. Students were challenged to use divergent thinking and, perhaps most importantly, their imaginations to solve design challenges.

No discussion of the benefits to students of using a model of counter-design in the graphic design classroom would be complete without a discussion of possible negatives. What does one do with such a practice in a pragmatic professional context? How does one justify to a client (and budget) the time spent exploring alternative and ultimately un-realistic scenarios? While one could make a long list of areas of the profession in which this method would not be useful (e.g., instructional graphics; way-finding signage), there is evidence that alternative scenarios and divergent thinking are indeed valuable to a pragmatic design practice. While analyzing this phenomenon is beyond the scope of this modest paper, Dunne and Raby's experimental work provides evidence that there is some real value to this sort of work.

Conclusion

In closing, if design and design education are concerned with the development of innovation and new methods, we might consider alternative—even *radical*—methods and practices of communication design. Counter-design offers one methodology for an experimental and exploratory practice outside the business of design. A model of counter-design can introduce methods that lead design and design research to unexpected solutions that circumvent common perceptions and expectations and challenge practitioners and students to find new languages and methods. In its pedagogical applications, this model can help students develop competencies that might better prepare for a future in which adaptability, creativity and divergent thinking are prerequisite. It can also benefit students by exposing them to an alternative postulation of design practice: the use of the semantic tools of design and the writing of visual language to challenge our existing views of the world.

As a model and method, counter-design offers an effective avenue for addressing critical thinking learning objectives. This approach supports and emphasizes divergent thinking and encourages outcomes beyond traditional approaches to graphic design education that typically steer students towards the sort of appropriate solutions seen within a commercial context. Removing design and design research from the constraints of the business of design, we free design itself to operate as a discursive practice. Counter-design can offer an alternative cognitive landscape, a fissure in the seamless narratives of the constructed world, while producing a counter-consciousness in which we experience the "awakening of the world from its dream about itself" (Marx 1932), thus enabling us to re-imagine the world.

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Applying Design to Learning: Cognitive Science Supports Visual Language Principles in the Design of Effective Reading Materials

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Abstract: *This experimental study examined whether formatting of textbook content influenced reader engagement, understanding or recall of topics. The 48-student population, ages 18-25, represented equal numbers of males| females with two levels of reader-ability, proficient and remedial. Four topics on nutrition were redesigned in grayscale to create three additional formats for each topic: original text with graphic mark-ups; chunked text; and visual language format, thereby producing 16 topic-format stimuli. After participants read four separate topics, each in a different format, they completed: a Personal Background Form; Multiple Choice Test; Prior Knowledge Form; written Survey; verbal responses to Open-ended Questions regarding formats read. This applied four conditions: Reading for Learning; Comprehension Test; Rank Survey; and Open-ended Questions, while incorporating three dependent variables - test scores, Likert scales and verbal responses. Quantitative and qualitative research methods found format statistically significant for influencing engagement, understanding and recall. Proficient and Remedial Male Readers' preferred visual-based formats yet tested highest on text with Graphic Mark-ups; Remedial Female Readers' preferred and tested highest on visual-based formats. Statistically significant data indicated all Reader Groups preferred visual-based formats for engagement, understanding and recall. While designing these formats, positive connectivity was found between cognitive science constructs and information design principles.*

Keywords: *Cognitive design, information design, reading, visual language*

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Introduction

Understanding the important role of learning in post-modern societies, opens the door to comprehend that students who learn less can suffer socially, economically, emotionally/psychologically and perhaps even physiologically. These affects, when shouldered by large numbers of individuals, can have a negative ripple effect throughout society that undermines the quality of life for all.

One of the most basic skills needed for learning is the ability to read. Statistics have shown that low-level reading ability inhibits learning, graduation from school, access to jobs, and is correlated with disorderly conduct (Bennett et al, p. 2443) increasing the probability of prison. According to Chall (1996, p. 165) "Reading is pervasive in its influence and its effects, and when people fail in reading; it becomes a personal tragedy as well as a societal problem" which only increases social inequities.

The need to address this topic is well documented. The following statistics, data and comments refer to the population in the USA. Stedman and Kaestle reported that "functional literacy tests suggest that 20 per cent of the adult population, or 30 million people, have serious difficulties with common reading tasks" (1987, p. 8). The National Center for Educational Statistics (NCES) reported on remedial education at degree-granting postsecondary institutions noting that in fall 2000, 11% of entering freshmen were "enrolled in one or more remedial reading, writing, or mathematics courses" (Parsad & Lewis 2003, p. iv). More recent studies have noted that many high school students cannot read above a fifth-grade level, and some cannot read much beyond a second-grade level (Archer, Gelason, & Vachon 2003, p. 89). In 2007, more than one-fourth of high school seniors scored below basic reading levels on the National Assessment of Educational Progress (NAEP).

In addition, a further reading gap exists within the mainstream of the educational system that includes a range of individuals who are not identified as special needs students or remedial readers, but whose difficulty with reading has not been sufficiently examined. For example, the 30-40 point difference on the NAEP in reading levels between "mainstream and minority [students] . . . has persisted with no significant change since 1970" (Labov 2003, p. 129). In addition, despite these serious concerns, "the field of reading," Labov noted, "has no present answer to the question of what to do about healthy children who do not learn to read" (p. 129). Without strong reading skills, other unclassified students (e.g., ADHD Students, Dyslexic Students, ESL Students, Lower SES Students, and Visual Learners) become marginalized from fully engaging in classroom topics (e.g., science, math, social studies). Neither do we know what to do with the growing population of healthy postsecondary "reluctant readers" and adult non-readers.

Design's role in redefining 'reading'

Perhaps one approach to understanding why some individuals have difficulty learning to read is to closely examine what is inferred when the word 'reading' is heard, voiced or viewed. In the genre of 'reading to learn', 'reading' infers the ability to interpret text into meaning from a 2D surface (e.g., paper, whiteboards, screens, billboards). Therefore, to clarify the topic being discussed, we need to acknowledge the importance of writing or saying 'reading text'. By inferring and thereby omitting the word 'text' after the word 'reading' implies that the only available form of reading to learn is through text-based formats. The definition of 'reading' in the 21st century needs to acknowledge all reading formats, not just text-based formats.

Research has shown that people have multiple ways of learning which leads one to logically postulate that perhaps multiple formats of reading are required for the learning process. This may be truer today than it was 50 years ago, before the age of technology, before the birth of our visual society. Publically acknowledging this presents challenges for schools and requires them to accept that the format itself has potential to hinder or assist readers in learning topic content. Current interventions focus on the readers and methodologies of instruction. Students who do not respond to standard linear text-based reading formats are segregated and isolated from mainstream text-based readers (Frey and Fisher 2004). Rarely has research focused on the format of the material itself. Instead, the focus includes teaching strategies such as decoding and whole language learning. Yet even with years of special training many students remain at low levels of reading comprehension.

To date, typical 2D reading formats have focused on the key elements of language (e.g., nouns, verbs, adjectives, sentence structure) with modest attention paid to the format of that content or the possible effect that design might have on students' overall ability to understand the content. Research across several disciplines and decades have repeatedly found a disparity between the needs of learners and the 2D materials used in classroom instruction. Information processing models and theories on working memory note that currently designed instructional materials which emphasize text over visual forms of information, present content in ways that create cognitive overload thereby lessening opportunities to learn (Sweller 1994; Bereiter & Scardamalia 1993). Research by cognitive psychologists on the topic of visual instructional methods, suggests the potential of visual-based materials increasing reading acquisition. These cognitive psychologists include: Holley and Dansereau (1984) who researched the effects of spatial elements on learning; Waddill, McDaniel and Einstein (1988) researched the inter-relationships of text and illustrations; Weidenmann (1989) studied the difference between effective and ineffective illustrations and; Winn (1997) examined the effective use of diagrams, charts and graphs in learning materials; Laura R. Novick et al., (2012) studied cognitive processing and comprehension based on line orientation in tree graphs (cladograms). In addition, information architects (Wurman 1994; Horn 1998; Lin 2007) have noted the potential format has for enhancing understanding and recall.

In order to meet this reading challenge, understanding two elements of learning procedure is critical: (1) teaching methodologies and (2) teaching materials. This study investigates the second element - teaching materials - specifically the formats that are used to present information in textbooks. This research was designed in order to determine whether the format of textbook content effects reader engagement, understanding or recall. The following questions formed the basis of this study:

- Are there significant effects on engagement, understanding, and/or recall when varied formats are applied to the design of textbook content?
- Does Reader Ability or Gender influence which format/s are more engaging, easier to understand, or facilitate recall?
- Does format effect Reader's test scores?

Research Methodology

In order to learn what formats best shape information content based on individual cognitive-learning needs, designing for effective user-centered transmission of

information may require restructuring topics and formats thus rethinking standard templates of information transfer. Knowledge from three fields was used to inform this 'rethinking' or development of format designs (stimuli) used in this research: Cognitive Science constructs (from both education and cognitive psychology), findings in the Neurosciences, and established principles from various disciplines within Graphic Design.

To investigate the above queries, the study incorporated a triangulation of research methods: participant Test performance, participant ranked Survey, and verbal responses to Open-ended Questions. Quantitative statistics were used to assess the Test and Survey results; qualitative methods were applied to open-ended Verbal Responses and observations. Therefore, the study included three dependent measures – Multiple Choice Test, Written Survey, and Open-ended Interview Questions.

Participants

Forty-eight postsecondary students, ages 18-25, representing an equal number of females and males from two groups of reader-ability, proficient and remedial, participated in this research. All Reader Groups include Proficient Female (PF) Readers, Proficient Male (PM) Readers, Remedial Female (RF) Readers, Remedial Male (RM) Readers, Proficient (P) Readers, Remedial (R) Readers, Female (F) Readers, and Male (M) Readers.

Twenty-four Proficient Readers were randomly selected from University of Wisconsin full-time student population who responded to one of the following: fliers, posters, signs, handouts, or word of mouth. They represented a variety of campus colleges and English was their primary language. The twenty-four Remedial Readers were students at a local technical college taking college preparatory remedial reading classes whose primary language was English, ages 18-25.

Research Design

The study was designed to examine how these populations read textbook content across four different design Formats. Once participants were identified using school ID's they were asked to read the Consent Form and sign if they wanted to participate in this study. Those who signed the Consent Form were given a Volunteer Packet coded by Set number and random ID Code.

VOLUNTEER PACKET

Section One | Four Stimuli. The study began with participants opening their Volunteer Packet to Section One which contained four stimuli covering the Topics of Energy, Vitamin D, Cravings and Food-borne Illness. Each participant viewed all four Topics only once with each Topic presented in a different Format. For example, some participants were shown the following combination: Energy Topic shown in original textbook copy (Text-only); Vitamin D Topic shown in original textbook copy with Graphic Mark-ups; Cravings Topic shown in traditional Chunked information style; and Food-borne Illness Topic shown in Visual Language design. The Test asked four questions about each stimulus totaling 16 questions incorporating four levels of difficulty. Twelve participants viewed the same Set of Topic-Format combinations. However, each participant viewed a randomly assigned Set in order to control Type I Error, thereby limiting the confounding variable of order-effect and strengthening internal validity of the study. When finished reading the stimuli, participants waited 10

seconds before turning to the next section. This allowed the brain to process the fourth stimulus before leaving Section One.

Section Two | Participant Background Form. This form served two purposes: (1) Questions were designed to identify past experiences that could have a potential influence on the outcome of the Multiple Choice Test, Survey and Open-ended verbal responses; and (2) filling in the Participant Background Form allowed for a span of time between reading the stimuli and taking the Multiple Choice Test. Information collected included: gender, age, year at postsecondary school, primary language, nutritional knowledge, science courses taken in high school and post-secondary school, source of nutrition knowledge, preferences when reading to learn, amount of visual art classes in high school, and intended postsecondary major. In addition to general information, these questions were included to provide insight into the participant's level of knowledge and interest in the Topic areas that might skew responses and contaminate the data.

Section Three | Multiple Choice Test. The 2-page test contained 16 questions incorporating four questions for each Topic. Each Topic contained a statement identifying a number, a word definition, an agent of change, and a general statement about the topic. Questions were developed for each of the Topics based on these four areas. The questions represented four levels of cognitive difficulty ranging from easy (Level 1) to most difficult (Level 4). Level 1 - Number Questions required recalling only one item from memory, the number itself (e.g., *"How many macronutrients contain energy?"*). Level 2 - Definitions were a well- defined word and its meaning which required a rote memorization skill that most postsecondary students are well-trained in (e.g., *"Nonfood items are called…?"*). Level 3 - General Statement Questions tend to be more obtuse and require more of an effort to recall (e.g., *"Cravings during pregnancy are mostly due to?"*). Level 4 - Cause and Effect Questions incorporate specific information with 2 actions to recall, a cause and an effect (e.g., *"Bacteria cause illness by..?"*). Presentation of Test questions had four randomized orders creating four Sets of Multiple Choice Tests for the 48 participants. Therefore, three participants in each of the four main Reader Groups (PF, PM, RF, RM) received tests from the same Topic/Format combination. However, each participant within that Set viewed the stimuli in a different sequence in order to limit the confounding variable of order effect.

Section Four | Prior Knowledge Form. Upon finishing the test, participants turned the page to complete a Prior Knowledge Form. They identified those Test questions that they knew the answers to prior to taking part in this study. The intent was to identify prior knowledge on any question in the Multiple Choice Test.

Section Five | Survey. Participants responded to seven Survey questions about the four Formats, using a 1-4 Likert scale. Copies of their Topic/Format combinations were placed in front of them on the table for use in responding to the questions. The majority of remedial readers preferred that the Survey questions be read to them. They then moved the four formats into rank order according to their responses to the question. Upon completing the Survey, participants were finished with the Packet.

Open-ended Questions. Participants were asked to verbally respond to seven Open-ended Questions based on the design Formats and Topics they read.

Query 1a) What made the first one [you chose] (Format A, B, C, or D) easiest for you to read?
1b) What made the last (Format chosen) the hardest to read?
Query 2a) What Format helped the most with finding specific information? Why?

2b) Which Format helped the least with finding specific information?
Were there any parts of the Format that hindered your efforts to find information?
Query 3a) Which Format was the easiest to understand? Why?
3b) Which Format was the most difficult to understand? Why?
Query 4a) Is there anything in the Formats that aided your understanding of the topic?
4b) Is there anything in the Formats that distracted you from understanding the topic?
Query 5a) Which Format or part(s) of Format aided recall during testing?
5b) Which Format did not assist recall during the test?
Query 6) Did Format influence your interest in the topic?
Query 7) If you could talk to textbook designers what would you suggest about textbook formats? How would you like to see textbooks designed?

Copies of their Topic/Format Set were once again placed in front of them for reference. The participant responded and then was encouraged to explain why s/he felt that way. Participants were audio-taped or responses were written by this researcher, depending on the preference of the participant. When finished with the Survey and Open-ended Verbal Responses the participant had completed the study.

Experimental stimuli

The stimuli content is from the textbook *Nutrition: ecology and behaviour* (Anderson, Wardlaw & Smith 2006). Four paragraphs were chosen representing four different Topics (Energy, Vitamin D, Cravings and Food-borne Illness). These Topics were chosen because they each contained a number to remember, a definition, an agent of change and its causal effect, and a general statement on the topic it was addressing. The formats are (see Table 1):

Table 1. Format names and descriptions.

Format A Text- only (See Figure 1)	**Format B** Graphic Mark-ups (See Figure 2)	**Format C** Chunked Text (See Figure 3)	**Format D** Visual Language (See Figure 4)
Original textbook format.	Adds graphic mark-ups to text (Italics, bold fonts, enlarged fonts, underlining, and highlights).	Reformatted content. Chunked information Apply Bullets, Tables, varied fonts, grids, tabbed columns. Some sentences.	Graphic fusion of words, images & symbols.
Text-based Formats		**Visual-based Formats**	

Passages from the book were chosen based on containing similar features in order to ensure topics were parallel and balanced in content. Features used to identify balanced content were: number of words, characters omitting spaces, characters including spaces, sentences, paragraphs, lines, numbers, locations mentioned, causal factors, dates/times used, and units to study for the Multiple Choice Testing condition.

Similarities that already existed among the topics selected are: a) they originated from the same textbook; b) were written to the same reading level; and c) covered approximately the same amount of visual space when in original text format. Both the Fogg and Smog Indexes indicate that passages within the book are written at the 18-19 year old reading level. Each Topic was redesigned in three different grayscale Formats containing the same information as the original paragraph using constructs from cognitive research and visual language principles.

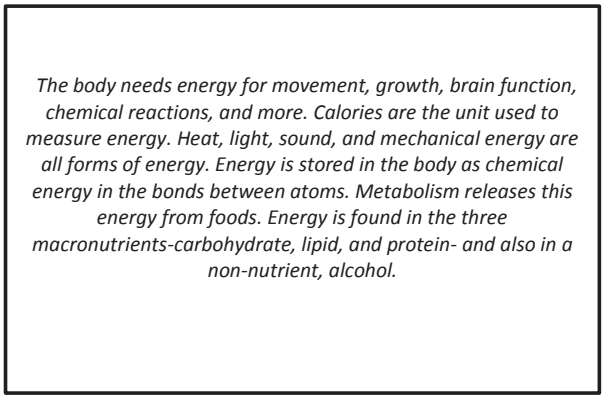

Figure 1. Energy topic in original Text- only | Format A.

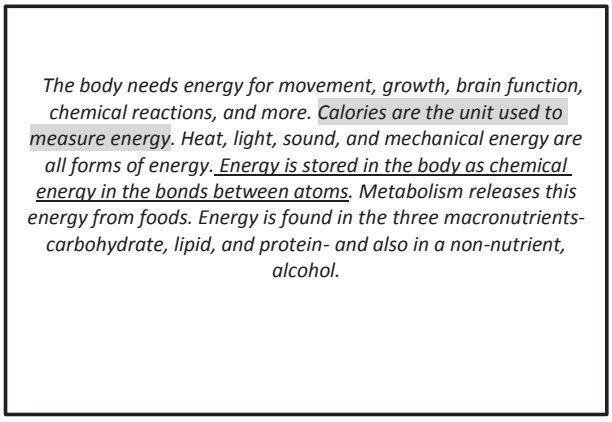

Figure 2. Energy topic in original text with Graphic Mark-ups| Format B.

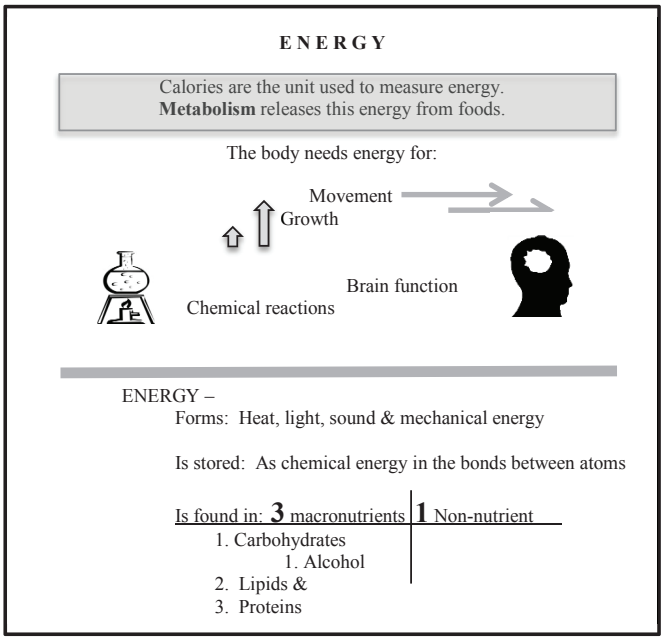

Figure 3. Energy topic in Chunked Format| C.

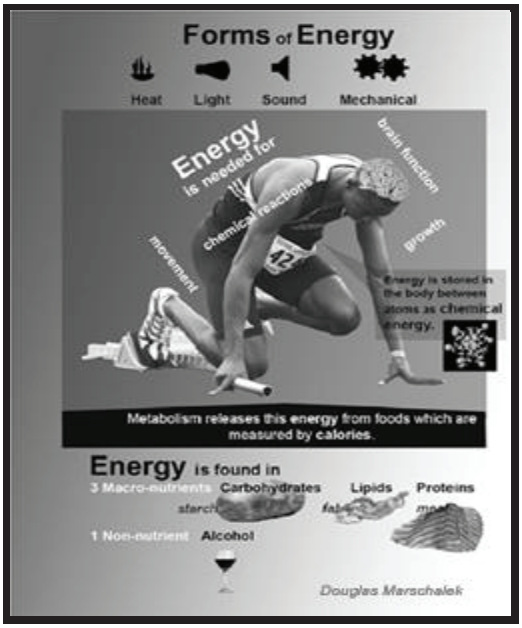

Figure 4. Energy topic in Visual Language | D. Source: Douglas G. Marschalek, Design Educator.

Table 2. Cognitive constructs with corresponding Visual Language Principles used to design Formats.

Cognitive Constructs	*Visual Language Principles*
Split Attention. Formats that force readers to visually seek, find and combine information requiring double processing interferes with learning core material (Sweller 1994).	Semantic Overlap uses specific visual language (VL) elements to "guide readers through the document and to cluster elements together" (Horn 1998, p. 186). This eliminates splitting the attention of readers.
Attentional Capacity is limited. Prolonging learner attention to identifying key elements and component processing of reading material can lead to poor reading habits (LaBerge & Samuels 1974).	Focusers are "Small, discrete visual elements used to organize smaller areas of the page…to attract readers attention…at a specific place, or to delineate a collection of objects or text (Horn, p. 185). This allows for more efficient learning during limited attention spans through guided episodes of designed focal areas.
Element Interactivity. Integrating various elements into instructional design that are not intrinsic to core content or when placed visually inconvenient can interfere with learning (Paas 1992).	Compositional Semantics focuses on using only pertinent words, images and symbols in visually tight construction units (Horn, p. 145). This helps eliminate extraneous or misplaced content, limiting element interactivity.
System Topology identifies components and labels them (Mayer & Gallini 1990).	Labeling integrates verbal and visual elements in order to distinguish terms parts and functions (Horn, p. 173).
Component Behavior identifies components and shows how they change, naming parts, steps and sequences (Mayer & Gallini 1990).	Transition Taxonomy. VL semantics use multiple taxonomies to identify transition (Horn, p. 153). These combined with labeling, identify component behavior.
Cognitive Overload occurs when short term memory can no longer process what it is seeing due to "disparate sources of information [being] physically integrated" (Sweller 1994, p. 204).	Information Design Principles organize designs to stay within memory limits (Horn, p. 237).
Schema Acquisition is a cognitive construct that states the brain organizes information according to meaning (Sweller 1994).	Semantic Fusion occurs when designers make "…meaning out of the tight integration of words, images and shapes…" (Horn, p. 97) through chunking and clustering information. This aids in building accurate schemas which increases the probability of understanding content.
Information Processing Models & Memory Systems are learning models that address and show that short term, working memory can process only limited amounts of information at one time (deKleer & Brown 1985).	Percept-Concept Integration. This principle includes and integrates percepts (objects shown as visual images) and concepts (mental ideas shown in text) into units easing comprehension, retention and retrieval (Horn, p. 95)
Theories of Expertise. Experts chunk information into meaningful units for ease of retrieval and to build new knowledge upon (Bereiter & Scardamalia 1993).	Chunked Information clusters words, images and shapes providing units of information based on perception principles and memory (Horn, p. 104 & 187).

Results

The variables of Topic, Set, Prior Knowledge, reading Preference, and Levels of question difficulty did not significantly influence test scores, therefore, it can be said that scores in this study are primarily a direct result of the reader's interaction with the Format. Based on these findings, further data analysis focused only on the Formats.

Data Analysis

Study design combined with selected queries determined the type of analyses for the research project. Identified queries indicated that both quantitative and qualitative analyses would be important for interpreting the data. Quantitative analysis was applied to data using software programs SPSS and Excel. Data was entered and analyzed for significant main effects and interactions. Post hoc tests analyzed significance between and within variables in pairwise comparisons and within three-way interactions of variables.

METHODS OF ANALYSIS

Data was collected from Multiple Choice Test scores and Survey responses. An analysis of variance (ANOVA) was run on all factors. The data from each of these factors was then analyzed separately using ANOVA's. These ANOVA looked at Between Summed Formats (Format A x B x C x D), and Between and Within Summed Reader Groups (Proficient and Remedial by Gender). Upon finding significance ($p \leq .05$), post hoc tests were applied that included Fisher's LSD and T-tests (F-tests) for statistically significant main effects and interactions. Spearman's rho test, designed to statistically analyze ranking data, was applied to Survey responses. Qualitative analysis was applied to data from the one-on-one interviews where participants verbally responded to Open-ended Questions. Analysis included descriptive research methods, identifying patterns, frequencies, averages, percentiles and relationship of responses compared to Multiple Choice answers and Survey responses. *All of the following data were found to be statistically significant* unless otherwise noted. Throughout this document when Reader Groups are listed and discussed, it is done so alphabetically and not by ability or gender.

MULTIPLE CHOICE TEST| Six variables were assessed using analysis of variance (ANOVA) in order to interpret the impact of Format design on test scores. The variables assessed were: Format design, Topic, Set, Level of Question Difficulty, Prior Knowledge of the question, and participants Preference of Reading Order for text and images. When participants had prior knowledge (PK) of certain questions, those responses were deleted from the data. With PK removed, test scores represented testing of 'new knowledge'. This helped level the playing field between proficient and remedial readers test scores. Formats for Gender were statistically significant at $p = .037$ (see Figure 5). This analysis reveals that Female Readers had higher test scores reading Visual Language Formats (D) while Male Readers scored higher on Text-only Formats (A) when reading new information.

Based on quantitative analysis of participants' test scores, there was no singular Format design that generated a universal increase of understanding or recall when reading material presented either known or new information.

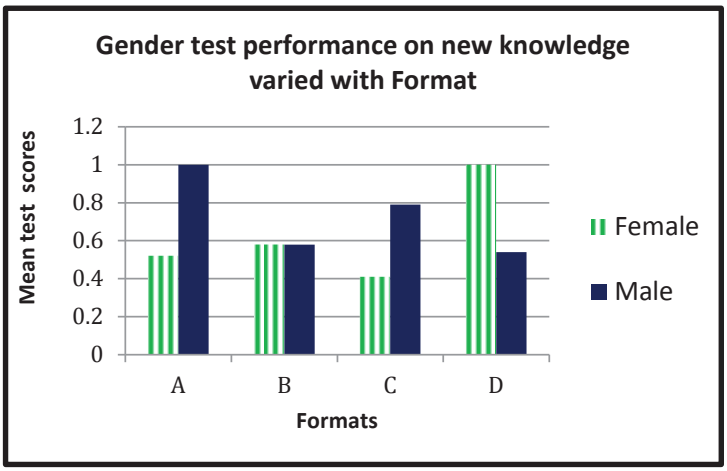

Figure 5. Female Readers scored significantly higher on Visual Language Formats (D) while Male Readers had higher test scores in Text-only Formats (A) when answering questions pertaining to new knowledge.

SURVEY DATA RESULTS | Participants responded to seven questions on the Survey form. Each question asked participants to rank Formats according to the question asked. The Survey tool used Likert scales for ranking responses using a four-point scale. (1 = lowest rank, 4 = highest rank.) Survey questions required participants to assess the Formats they had read in their Packets. Participants sorted their four Formats from:

1. Easiest to most difficult to read
2. Most to least informative
3. Most to least engaging
4. Most assisted to least assisted understanding
5. Most assisted to least assisted recall
6. Favorite to least favorite format for presenting information
7. Most to least favorite way they would like to see information in textbooks.

After the participant sorted their Formats in response to a question, the researcher recorded the ranked positions on the Survey form. Significant main effects for Formats were found for questions 1, 3, 4, 5, 6, and 7 ($p \leq .01$). Question 3 was significant on two levels 1) Format and 2) Format|Reader Ability|Gender. Significance was $p \leq .013$ for all main effects. The visual-based formats (Chunked and Visual Language) were found by both Reader Ability and Gender to be the easiest to read, most engaging, most helpful in understanding content, the easiest to recall, participants' favorite format, and the format they would like to see in textbooks (see Figure 6). In addition, Remedial Males ranked Visual language formats significantly more engaging than Proficient males (see Figure 7). Responses to Query 2 were not significant.

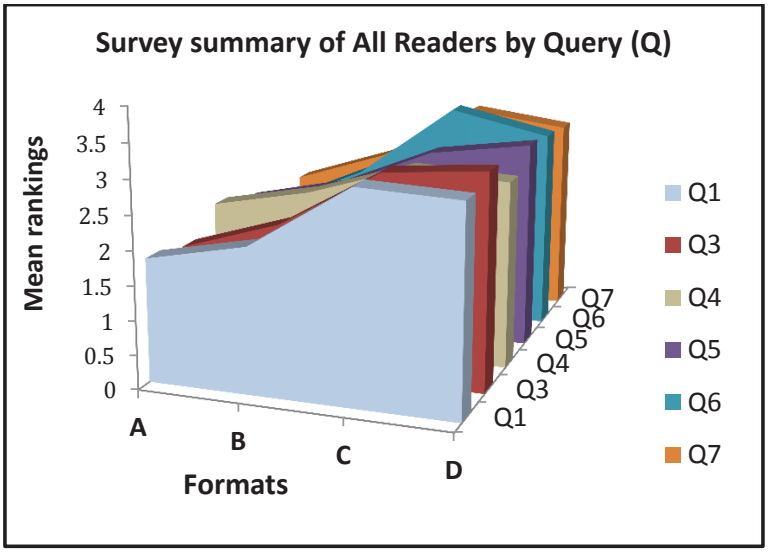

Figure 6. Visual-based formats - Chunked (C) and Visual Language (D) were found by All Readers to be the easiest to read [Q1], most helpful in understanding content [Q4], the easiest to recall [Q5], participants' favorite format[Q6], and the format they would like to see in textbooks[Q7]. Visual-based formats were also most engaging [Q2] for Female Readers and Remedial Male Readers but not Proficient Male Readers (see Figure 7).

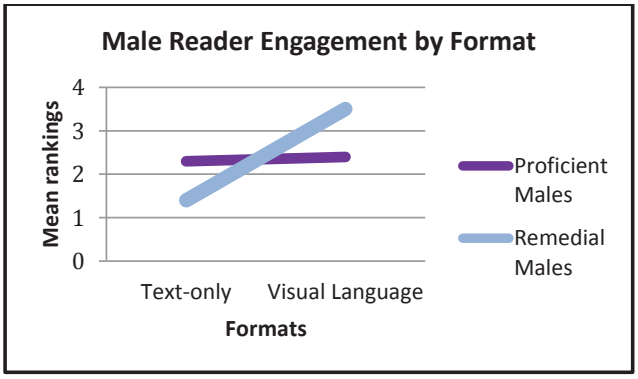

Figure 7. Remedial Male readers ranked format important to their level of engagement with content finding Visual Language formats significantly more engaging than Text-only formats. Proficient Male readers indicated that there was no singular format that was significant to their engagement.

OPEN-ENDED QUESTIONS. Analysis for this data used both inferential statistics and descriptive qualitative analysis pertaining to patterns, frequencies, averages, and relationships of responses. These questions were based on the Survey questions but addressed layout and design aspects of the formats, reader preference, readability, and clarity of content. Participants' answers were audio-recorded and transcribed. The purpose of including Open-ended Questions was to: 1) provide opportunity for participants to verbalize their thoughts; 2) discern participants' preference for, and

experiences with textbook content; and 3) aid in understanding participants previous responses to the Survey questions.

According to analysis, Ease of Reading, Understanding, and Recall were enhanced by visual-based formats|Chunked (C) and Visual Language (D) with $p \leq .001$ than by Text-only (A) formats across Reader Ability and Gender (see Figure 8).

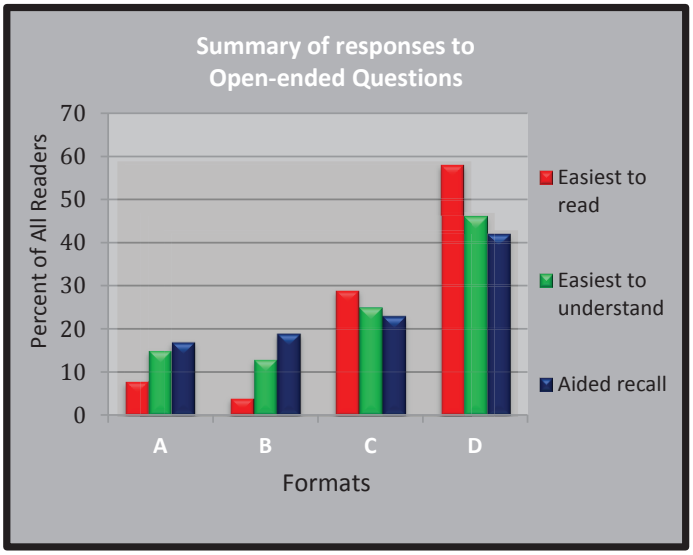

Figure 8. Ease of Reading, Understanding, and Recall were significantly enhanced by visual-based formats - Chunked (C) and Visual Language (D) than Text-only (A) formats across Reader Ability and Gender.

Based on these research findings, two significant issues emerged:

1) All four Reader Groups - Proficient Readers, Remedial Readers, Female and Male Readers – reported the best format for: engaging them in the topic; understanding the topic; and ease of recalling the information was visual-based formats.
2) All four Reader Groups agreed that the: least engaging format; most difficult to comprehend; and most difficult format to recall was a Text-only presentation of information.

Discussion

There is a growing body of evidence indicating that a close relationship exists between reading ability and topic comprehension, general grade-level abilities and school dropout rates. Currently, the bulk of reading materials are geared toward those students who learn best through reading text. The majority of reading materials in classrooms do not take into consideration many students who learn better through other reading styles. This study found that students across multiple learning styles and abilities are more engaged with, prefer to read, can understand and recall information easier with formats that use reformatted and cognitive-based visual language formats, than dominant text-based material. These findings coupled with aforementioned

theories and scientific observations of cognition point to the need for instructional content to be shaped by cognitive-based designs rather than traditional publication formats.

The data suggests that visual reading materials designed based on cognitive research could potentially engage more students in essential topics, assist in understanding and recall, encouraging positive learning results for a broad cross-section of students. Thus the format for presenting information could be as important to learning 'how to read' as current text-based intervention techniques. The need and importance for reading text-based material is important and whole-heartedly supported. However, text need not be the only format for presenting subjects such as science, technology, engineering, mathematics, or procedural knowledge. Text-training should not, and does not need to, infringe upon time needed to learn critical content. A broader range of formatted material is encouraged *in addition to text-based formats* in order to include a wider range of learners. Varied reading formats could provide more egalitarian ways of presenting information in a variety of learning environments (i.e., classrooms, training, on-line). In addition, different format designs may be necessary for new vs. prior known information.

On completion of this study, it became apparent that the Multiple Choice Test was biased toward text-based readers based on its traditional format and may have skewed the test results toward readers of text. In addition, there was the assumption that all participants would have similar cultural capital when it came to interpreting visual messages. Since the majority of such experience comes from the media (e.g., TV, computer games, video/movies, advertising, comics, graphic novels) and is readily available to participants in this study, assumptions were made that by some intuitive ability participants had acquired the skill of 'reading' visual language. This may be an inaccurate assumption. There were participants that did not automatically understand how to read the visual language format. They found it difficult to transition from reading text to reading a graphic form of information. A few readers noted being more comfortable obtaining information from text than from images and there were a couple Remedial readers who were not quite sure what they were supposed to do with visual language formats (e.g. what was the proper way to 'read' it). This lack of familiarity with visual reading may place individuals at an increasing disadvantage in this rapidly growing visual culture of the 21st century.

Certain questions arose during this study which merit consideration. How valid is the assumption that just because a participant likes a certain format, that they will be willing to spend more time with it and thereby increase probability of learning? Because a participant likes a format does not necessarily mean it's the best learning tool for them. What a participant 'likes' is part of the visceral or emotive response to their world, one that can gravitate toward comfort and security. Another concern was the high percentile responses by all Reader Groups to the visual-based formats. These unanticipated responses raise questions such as: Did participants want to please the researcher or do they really prefer visual-based formats? Did they answer according to what they thought was expected of them? Did they choose visual formats because of its novelty?

The fact that no singular Format generated a statistically significant dominance in comprehension or recall suggests that: 1] Both proficient and remedial post-secondary students have learned how to interpret text, to varying degrees, and 2] reading new, relatively unfamiliar visual-based formats generated similar test scores as text-based formats. This indicates that readers performed nearly as well, and sometimes

performed better on formats for which they had received modest to no training (visual-based formats) compared to the 12+ years of text training. This begs the question: If the same amount of time were spent on teaching with formats that are designed using cognitive science and visual language, would learning become more accessible to a wider range of students, resulting in a better educated population?

Conclusion

Findings in this study indicate a potential array of research that could be pursued, thus highlighting the need to replicate this research project in order to substantiate or refute its findings. Only with further research will definitive answers be determined as to the role of cognitive-based visual formats in the learning process.

The implications that format design could improve engagement, understanding and recall are pertinent to multiple fields. These findings, if substantiated by further research, could have a wide-ranging effect on Graphic Designers, Publishers, Businesses, Hospitals, Schools and other organizations.

GRAPHIC DESIGNERS

In order to design cognitive-based visual formats for learning, graphic designers would need to be trained in what constitutes cognitive-based information design (CID™). If CID™ formats offer a key to better understanding and recall of content presented, the demand for people trained in cognitive design methods could increase dramatically. In turn, this could create a new specialty path in the Graphic Design field.

EDUCATORS

Designing visual-based information based on cognitive constructs could provide educators valuable and effective learning tools. School leaders, be they teachers, administrators, or board members will need to be educated as to the benefits of CID™ formats. They will need to: a) be trained to recognize authentic CID™ formats in order to be wise consumers; b) learn how to create it for classroom and communication tasks; and c) learn compatible teaching methodologies in order to use them effectively.

STUDENTS

Starting with pre-school students and continuing through the educational systems, students could experience CID™ formats as an additional path to text-based reading in learning scholastic content. If a simple item such as format helps more students to understand content and remain mainstream students, it might also then have a role in improving school behavior, encouraging lower absenteeism and higher self-esteem by creating fewer marginalized students. Students who are Proficient Readers of text could use CID™ Formats to deepen their concepts of the topic being taught and/or use them as discussion and exploratory aids. Remedial Reading Students could have options to choose what type of format they learn from best. English Second Language (ESL) could use these visual-based formats to enhance vocabulary, grammar and engage in content discourse, which in turn aids in language acquisition and contextual understandings while building cultural capital.

PUBLISHERS

Could publishers see this as an opportunity to be the first source offering content designed based on scientific constructs thereby embracing the new science of reading? It would not require investment in new equipment, but investment in people trained to design for the cognitive process of learning.

ORGANIZATIONS

Any organization that needs to transmit information and perform training sessions could benefit from cognitive-based information design (CID™) formats – i.e., businesses, governments, hospitals, churches. These formats could have a positive effect on the rate of learning, interest in learning, engagement with and retention of topic information resulting in more effective training sessions. In addition, these formats have the potential to be affective across learning styles, across culture, across age groups.

These statements have been made based on statistical analysis of participants' performance (Test scores) and noted preferences (Survey and Open-ended Questions). However, it is important to bear in mind the small number of students (48) who participated in this study. Researching larger populations and iterations of this study could reveal further insights into the role formats have in the learning process.

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The four-second window: how the time constraint of working memory and other psychological principles determine the success of a graphic design.

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Abstract: *This article discusses universal psychological principles derived from cognitive psychology that are useful in creating an effective graphic design. The most important are: the strict constraints of working memory which persists about four seconds, the viewers' co-construction of perception and meaning based upon their prior relevant background knowledge including their knowledge of culturally constituted design conventions, especially those of genre. If the designer consciously exploits these cognitively and culturally constituted principles the result will be an effective graphic within a specific geographic and temporal context. Better designs are likely to result from familiarity with these principles.*

Keywords: working memory, co-construction of meaning, genre, context, inference, design conventions, background knowledge, graphic design, information design, data visualization.

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Are there universal principles that determine good graphics? If the question is taken to mean: "Is there a universal practical recipe for creating good graphics," the answer is "no" because of the cultural contingency of any given graphic with respect to any given audience. The visual form of an image is contingent upon its meaning as interpreted by an audience, as the great iconologists (Panofsky, Gombrich, Wind) have shown. Gombrich, especially, is a useful intellectual forebear of this paper, because of his profound connection with the findings of modern psychology. He rejected as groundless the idea that certain concrete design elements will appeal to all audiences in all times and places; the very form of the design element is never a brute given but a psychological construct—something co-constructed by viewers out of their prior knowledge and expectations. Gombrich made the point very succinctly in explaining the naiveté of the scientists who put a design into the Pioneer Spacecraft meant to communicate something about human civilization for the benefit of beings in outer space who would lack knowledge not only of the represented objects, but also of our conventions of representation (Gombrich 1982, pp. 150-151). For instance, the right side of the woman's face is narrower than her left. What sort of lopsided creature is that?

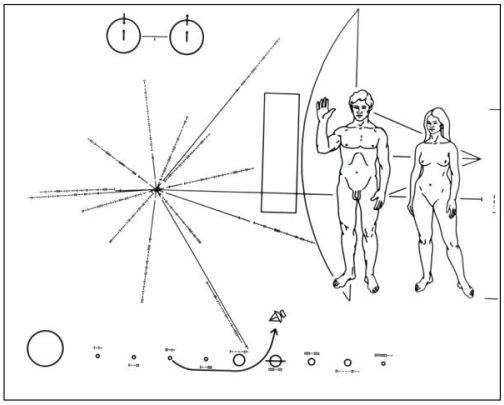

Figure 2. A golden plate with this design was included in the Pioneer 10 Spacecraft launched by NASA in 1972. Source: NASA.

But if the question is understood more modestly "Are there universal principles that determine good, culturally contingent graphics?" then recent cognitive psychology has much to tell us.

In describing how their work is produced and how it is communicated to the viewer, graphic design students and professionals use concrete categories such as form, shape, texture, color, etc. and other abstract categories such as beauty, aesthetics, pleasing, appropriate, etc. A "graphic design work"—"graphic" for short—is considered successful when it achieves its communication goal while achieving at the same time a certain aesthetic level. The beauty of the graphic and its functional effectiveness are two reasons for the success of its communication. While both are important, graphic design students are taught that communication is the number one goal. The main function of graphic design is to communicate, and we cannot escape the old dictum that form follows function. But besides the formal elements of layout, typography, color, etc., which are at the core of both teaching and practice, just what psychological principles enable a graphic to communicate successfully? Recent studies in cognitive

psychology indicate that there are indeed some universal principles involved in the perception of a graphic, and they remain the same regardless of styles or modes of design. They are always at work in successful, as well as unsuccessful communications. Moreover, the principles hold for both linguistic and visual experiences: for a book, a poster, a webpage, and whether "Swiss" typography, new wave design, or the latest flavor of visual style is used. Proper knowledge of these principles can help the designer to construct successful visual solutions.

In order to produce graphics that communicate successfully, the designer must realize that the process of communication is fundamentally a psychological process and that the formal aspects of communicative designs are dependent on these underlying psychological principles. These universal principles are neutral with regards to style or form, and they free the designer to select any preferred visual style, as long as the basic psychological requirements are met.

Working memory

In the dialogue between the graphic and the viewer, the most important psychological principle is the time limitation set by working memory, which lasts just a few seconds. "Working memory" is the name given by cognitivists to that short time span during which the human mind can put experiences together to form a meaning lodged in long-term memory. Understanding this very stringent bottleneck of the mind has been one of the greatest insights of psychology since the 1950s, when George A. Miller published his famous article: "The magical number seven, plus or minus two: some limits on our capacity for processing information." (Miller 1956) The current view sees the limitation as mainly a time constraint—a window of just three or four seconds. Within those first few seconds, if the viewer is not able to "construct" the various elements into a broader meaningful whole that is sent to long-term memory, then some of those elements will quickly drop from working memory, and little that is meaningful will survive.

Because of this limitation of working memory, insuring a very short processing time is critical to the designer. Within this window of time, a meaningful whole must emerge from the various elements. The viewer can repeat the process for various subgroups of elements, but in every case has to reach meaningful closure. A similar sub-process takes place in language, where the clause, which is now considered to be the primary unit of speech, is a universal feature of all languages. (Hirsch 1977, pp. 108-109)

In order for the viewer to be able to reach fast closure, within a few seconds, the designer has to make the elements of the graphic work quickly in concert. But this limitation need not apply to the whole graphic all at once. Just as a good book, or a beautiful speech can successfully communicate to the reader or listener by virtue of a succession of well-defined primary units like clauses and other subunits, a good overall graphic can be comprehended as a series of meaningful visual units that have reached "closure", each comprised of several smaller component elements.

Furthermore, in a visual work, the primary units may not necessarily be perceived in a fixed and specific sequence of time. For example, a good transportation map works well as a meaningful overall image, but its more practical use is in obtaining local, detailed step-by-step instructions related to some sub-portion of the whole: a specific route, a specific neighborhood. Because of the various settings and time frames in which graphics can be used in a practical way, individual graphic design problems require individual ad-hoc solutions. Thus, a theory of graphic design is not a fixed set of

universal formal principles, but instead it must rely on a set of underlying universal psychological principles—especially the universal limitation of human working memory.

Co-construction of meaning

Until the graphic is interpreted by the viewer, it really isn't a meaningful graphic at all: "The formal features of any design do not precede but follow the interpretation of that form." (E.D. Hirsch, Jr., pers. comm.) In the interpretation process, the viewer brings to bear a complex system of expectations comprised of past experiences. Hence, in addition to the time limitation imposed by working memory, a second universal psychological principle in any visual or linguistic communication is that of the co-production of meaning by the viewer. Modern psychology tells us that perceiving and remembering are both productive acts based on past experience—an important insight that psychology has reconfirmed many times since the path-breaking book by F. C. Bartlett: *Remembering: a study in experimental and social psychology (1932)*. Bartlett included the idea of the socially shared expectations as part of the remembered event. The art of creating an effective graphic involves the successful social prediction by the designer of the kind of response the typical viewer will probably construct. Just as memory is not the passive reproduction of past events, but rather an active productive process, the experience of the graphic is not a passive activity but a productive one based on relevant past experiences by the viewer.

The two principles of working memory and the collaborative co-construction of meaning are always interacting. In the communication, if the viewer is familiar with the subject matter, closure will occur much faster. Therefore it is important for the designer to include in the graphic the most appropriate and relevant information, instead of assuming that the viewer already has this information. The limitations of working memory can be reduced in large measure if the background knowledge brought in by the viewer is both highly familiar and relevant to the subject matter at hand.

Two maps from the US presidential election in 2008 illustrate the importance of background knowledge in the interpretation of a graphic. Someone not familiar with the electoral college system might be puzzled by the predominance of the red color in the map in Fig. 2, showing the counties that went Republican in an election that was actually won by Democrats (The New York Times 2008).

Figure 3. US Presidential Election 2008. The map shows counties won by McCain (red) and by Obama (blue). Source: The New York Times, 2012.

In the stylized map in Fig. 3, the states are sized according to the number of electoral votes for each state (Nagourney, Zeleny, et al. 2008). This more abstract map reflects the "winner take all" system of American elections, where a single extra vote at the state level means that all "votes" for that state go to the winner, and none go to the loser.

Figure 4. This map (cartogram) shows the states that each candidate won in 2008. States are sized proportionally to the number of electoral votes. Final count was: Obama 365; McCain 173. Source: The New York Times, 2012.

Design conventions

In this exchange between designer and viewer, design conventions play a critical role. Just as there exists a set of conventions in spoken and written languages, design has its own set of visual conventions. It's a mistake to assume that the viewer will be automatically familiar with the design conventions that the designer employs. But because all verbal and visual communication is based on prior agreement on a set of conventions, the effective designer has to work within the constraints of conventions that are familiar and in effect in a given cultural moment. A visual element that might mean one thing in Europe might mean something completely different in Australia. Sometimes this applies to basic categories which would seem at first to have a natural fixed meaning, for example: up is good, down is bad, the white color means life while the black color equals death, etc.

We learn from anthropology that while black may have a negative value and white a positive one in one tribe, the reverse may be the case in another tribe; and the same may hold for numerous design elements. No doubt some elements are trans-cultural: the female body, an infant's face, but the safest course is to assume that all design elements are dependent for their effectiveness on the culturally-constituted assumptions and expectations of the viewers.

Genre and context

As Bartlett pointed out, the act of remembering, as well as perceiving, is not a mere reproduction of a past experience, but rather a re-construction of the experience based on typical features of other events of the same type experienced over time. When looking at the front page of a newspaper for example, we prepare to read it based on how we read it in previous instances. We expect to see titles at the top with text immediately below them. We expect all columns of text under a title to belong to the same article, and so on. These expectations, if properly fulfilled, contribute to the re-

construction of the object "newspaper" as we know it. We recognize the object newspaper as belonging to a similar type, or "genre" as we have experienced it in the past. The recognition of genre takes place within the narrow window of working memory: three-four seconds, and the positive feedback of an object that matches our past experience of similar objects, lets us move forward to actually read the articles in the paper.

Imagine a situation in which the visual elements and the typographic conventions of titles, subtitles, etc., were to be disrupted or omitted. Imagine the articles having no titles. Looking at such object, the typical reader of The New York Times today would be puzzled and wonder if he were holding a real copy of the paper or a fake. He would not recognize the paper as he has come to expect it to look based on his prior experiences. The genre and type would not be determined within the four-second window and communication would be compromised. Genre and type are not absolutes though, but function within the social conventions of a given cultural time. This is the social dimension and perception pointed out by Bartlett: the viewer must share in the system of values and conventions within the specific historical context if he is to understand the specific genre and types presented to him at that given moment.


"All the News That's Fit to Print"

The New York Times

Late Edition

VOL. CLXI . No. 55,820 NEW YORK, TUESDAY, JULY 10, 2012 $2.50

Bank Scandal Turns Spotlight To Regulators

Widening Inquiry Into Interest-Rate Fixing

ROMNEY, AGAIN, OUTDOES OBAMA IN FUND-RAISING

$35 MILLION GAP IN JUNE

'Super PACs' Linked to Democrats Also Trail Rivals on Right

17 Years After Bosnia Massacre, a Painful Process Goes On

At Top School, Cheating Voids 70 Pupils' Tests

A Life-Death Predictor Adds to a Cancer's Strain

Figure 5. Front page of The New York Times. July 10, 2012. Detail. Source: The New York Times, 2012.

One of the first readers of The New York Times, which started publication on September 18, 1851, might be forgiven for feeling disoriented if he were to travel forward in time more than 150 years and be given a copy of the same paper from 2012. What would he make of the extensive use of relatively large titles, subtitles, and above all, color pictures? He would have been familiar with newspapers that densely pack the text, use minimal titles and display no pictures at all. The first issue of the paper, initially named New York Daily Times, employs just these graphic conventions, which were typical of newspaper publishing at the time of its debut in the middle of the 19th Century in America.


New-York Daily Times.

Figure 6. Front page of the New York Daily Times, later renamed The New York Times. First issue, September 18, 1851. Detail. Source: The New York Times, 2012.

The New York Times example demonstrates that one of the most important tasks for the designer is to make sure to include in the graphic those elements that help a viewer quickly place the object in the right context. This means allowing the viewer to immediately identify the correct genre or type. Only after the type or genre is identified, can the reader start making meaningful constructions and make sense of the whole. The designer needs not only to provide the elements necessary for correctly identifying the genre but he also must make sure to exclude those elements that might be misleading and steer the viewer in the wrong direction. Because visual elements and verbal text are not absolutes but can vary in the meaning they convey and they can be ambiguous, the designer must clear this ambiguity right from the start at the higher level of titles, subtitles, and large images. Good titles and other means of quick orientation as to type or genre, within the four-second window, are a must in any graphic that does not want to lose its reader, who will quickly move on unless his attention is drawn in effectively. Proper initial orientation is akin to the role played in a good map by the "You Are Here" mark. The mark quickly establishes the spatial relation of the viewer to its surroundings. In a graphic, the elements that properly identify the type or genre help the viewer to quickly place that graphic into the larger, correct social context. Once this contextualization takes place, the viewer can then process the secondary elements in the graphic much more quickly.

It should be noted that in specific instances, the designer might choose to mix-up genres intentionally, in order to create a sense of initial displacement in the viewer, only to reward him more emphatically later, when the true meaning of the graphic is grasped. And so he might elect to design an annual report that looks like a comic book, or a DVD package that looks and feels like a jewelry box. Here he might play with irony and visual puns, and use tongue-in-cheek devices aimed at particular audiences. He can do so thanks to the inherent ambiguity of language and visual expression. While this is obviously a fertile area of exploration for the designer, this paper focuses more on those means that the designer will explicitly make clear to his audience, in order to avoid as much ambiguity as possible. This approach should be the norm in the fields of information graphics and data visualization. Here clear and direct communication is the main goal. This field includes maps, diagrams, and the display of large and complex sets of information.

Inference and construction of meaning

Just like remembering and recall, perception is characterized by an act of construction in which the viewer brings to the interaction much more than is explicitly

given in the text or visual presentation. The viewer constructs a perceptual object that is much richer than the immediate physical stimulus of the graphic. A typical example of this constructive feature of perceiving is the act of looking at familiar two-dimensional objects. When a viewer looks straight at the facade of a building, he sees only that one side, but he nevertheless perceives a three-dimensional object with a definite solid character. He does so because he knows from experience that a building must have sides and a back in addition to the front. (Hirsch 1967, p. 132) The same thing happens in perception when a reader reads a text or experiences a visual representation. In both activities he has to construct stuff that is not explicitly given in the text or the graphic. He has to infer a lot of things in addition to what he actually sees, in order to make sense of it. We make references and put things into context all the time, and we do it without specific instructions because this process is inherent in language and perception since infancy.

So the first thing that needs to happen in the initial 3-4 seconds of the viewer's interaction with the graphic is a kind of "genre check", a self-posed question-and-answer that might yield a response similar to: "This is a building; it must have other sides." As mentioned, good titles, as well as other means of self-orientation, both typographical and pictorial, are therefore critical for paving the way to further exploration on the part of the viewer, otherwise he will be puzzled and discouraged from the very onset of the interaction.

The New York Times provides a good example where all the initial elements contribute to "getting off to a good start" by their expert arrangement and calibration. From the subtle typographic elegance and legibility of the typefaces, to the concise and no-nonsense style of the titles and subtitles, to the counterpoint usage of pictures, captions and other small details such as author bylines, and finally to the overall layout that reinforces the reader's expectation of consistency and habit, everything on the page contributes to an interactive experience that is immediately clear and fulfilling.

The annotation layer

It's seldom that graphics consist only of just text or just pictures, although the latter is more likely to need the former in more cases than the other way around. It's true that often "a picture is worth a thousand words", but it's also true that often a graphic that does not provide enough textual support runs the risk of being misunderstood and misinterpreted. In the powerful interplay between image and text that occurs in a graphic, this task of providing enough textual information is often neglected. In graphics, the addition of text to the visual elements can make the graphic truly informative. Amanda Cox, graphics editor of the New York Times, stresses the importance of the "annotation layer"—the written text—in successful data visualization. She states: "We learn by connecting to what we already know." (Cox 2012) She proves her point with a simple exercise performed on the front page of The New York Times (paper edition) in which she highlights things that she does not already know. The extent of "unknown" facts amounts for her to only about ten percent, every day during a typical week.

Based on this simple fact, most formal constructions, however sophisticated, must yield to the realization that a graphic is highly influenced by the relevant background knowledge of the viewer. New knowledge is best communicated by a graphic that combines new elements with past familiar elements. Brief notes, legends, captions, etc.

are therefore an excellent way of providing the viewer with general background knowledge upon which new knowledge can be built.

Figure 7. Front page of The New York Times, detail. The highlighting shows new knowledge acquired that day. Replica of original exercise presented by Amanda Cox. Source: Author, 2012.

This annotation technique can be seen to work effectively in a graphic about driving safety, published recently in The New York Times (Fairfield 2012), which depicts the decline in traffic fatalities in the US in recent decades (Fig. 7). In the graphic, a segmented line connects various dots representing the years from 1950 to 2011. Each dot's position is determined by the number of miles driven per capita in that year (x axis) and by the number of fatalities per 100,000 people in that year (y axis). The title of the piece: "Driving safety, in fits and starts" sets the tone for the other textual and visual elements.

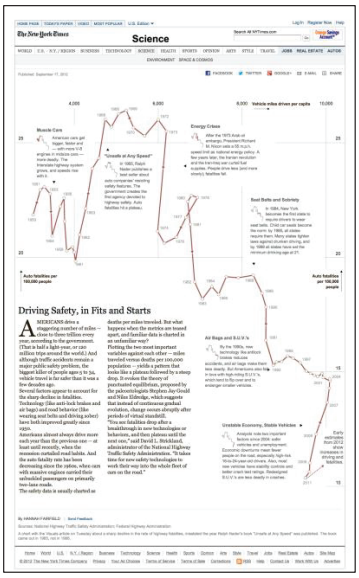

Figure 8. Driving safety, in fits and starts. The New York Times, September 17, 2012. Source: The New York Times, 2012.

Various sections of the line are described in detail with smaller chunks of text and smaller views of the described sections that function like a legend. The economy of means of this graph: clean lines and legible typography, combined with concise and clear text, make for a well-sequenced and informative piece. Despite the large amount and relative complexity of the data, the viewer is able to absorb the parts and quickly move from overview to detailed description. All visual and verbal elements provide for fast closure, despite the relatively long time commitment on the part of the viewer to read the graphic in its entirety.

Ad-Hoc design

Most graphics display aesthetic and communicative values for particular audiences at specific times, and so it should be stressed that every graphic is an ad-hoc construction, although this is not in contradiction to the general implications and validity of the psychological principles mentioned earlier.

In the making of a graphic, a failure to account for working memory, closure, co-construction of meaning, background knowledge, and shared conventions, often results in poor, uninformative pieces. Practical effects of this oversight are sometimes extreme simplification, overload of elements, lack of a specific sequence for reading the elements, or a false parallelism between simplicity of form and simplicity of communication and interpretation. This false parallelism shows up in a famous historical artifact: the 1972 New York subway map (Challand 2010), which displays a cheerful and yet impractical formal beauty (Fig. 8).

The map was much admired by fellow designers despite its failures as a practical way-finding tool for the average user of the subway. In this classic example, the arbitrary geometry of its square format actually works directly against the physical observations of the subway rider: he cannot easily match the stretched distances and

distorted proportions of the map with the reality and the precise topography of the city above the ground. Since 1979, the geometric map has been substituted with a more "topographic" map and has remained fundamentally unchanged since then (Fig. 9).

Figure 9. The New York Subway map designed by Massimo Vignelli in 1972. Source: Author, 2012.

Figure 10. The New York Subway map from 2012, based of the 1979 redesign by Michael Hertz. Source: MTA, New York City, 2012.

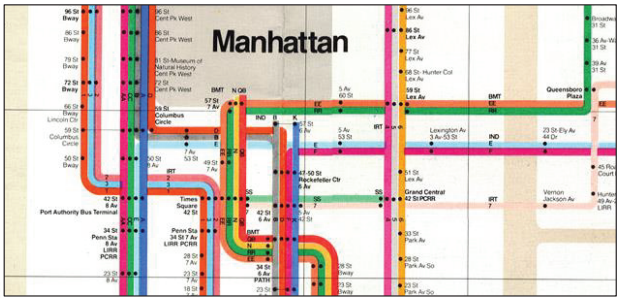

Figure 11. Detail of New York Subway map from 1972. Source: Author, 2012.

Figure 12. Detail of New York Subway map from 2012. Notice how, compared to this map, the 1972 map stretches the topography horizontally. The two details represent approximately the same geographic area. Source: MTA, New York City, 2012.

In another example related to transportation, an underground electronic board that displays train schedule information in the MUNI public transit system in San Francisco, is another stark example of lack of closure and disregard for the viewer's past knowledge and habits. In this board, a highly schematic map of the system offers very little useful information. Next to the map, a table of train arrival times seems at first glance to provide all the information that is needed. Alas, the list of trains and their letter symbols is statically sorted in alphabetical order, with constantly changing "times to arrival" information located next to each train (Fig. 12). A typical viewer might expect, based for instance on prior travel experiences (airports, train stations, etc.) that the train listed at the top would be the next train coming into the station. Such is the case with departure and arrival tables on display in airports around the world (Fig. 13). The uninformative alphabetical sorting, coupled with the vague "inbound" and "outbound" headers make for a very confusing graphic, especially for first-time users.

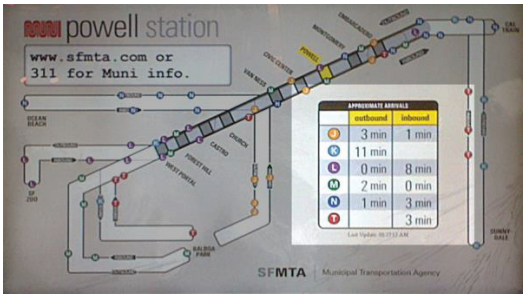

Figure 13. MUNI public transit system, San Francisco. This electronic board displays the map of the system and a table of "times to arrival" of trains. The detail with the alphabetically ordered table with arrival times has been highlighted for clarity. Source: Author, 2012.

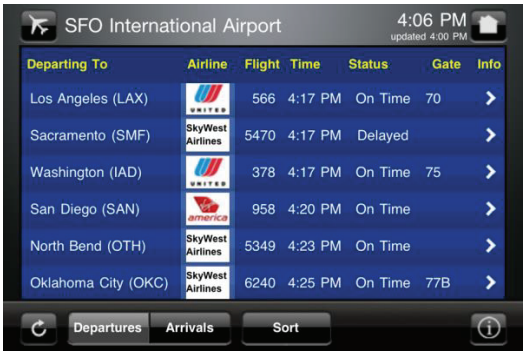

Figure 14. Departure table for flights leaving San Francisco International Airport. Screen shot from Airport Remote app for smart phone. Flight information is sorted by time, with the next flight at the top of the list. Source: Author, 2012.

An example of misguided parallelism between "geographic maps" and "abstract conceptual maps" can be seen in graphics that mimic traditional road maps for the purpose of highlighting the relationships between elements in an abstract system. However, while traditional maps bear a direct, natural connection to the physical objects that they represent: roads, cities, rivers, etc., in these diagrams the subject matter is often a set of abstract concepts that lack a given "natural arrangement". The "concept map", popularized by Joseph Novak and Bob Gowin in their book *Learning how to learn*, (Novak & Gowin 1984) claims to be analogous to a road map, but is in fact a visual abstraction that merely lists the items in the system and connects them with other items by means of more words or lines. In concept maps, the absolute limit of the number of items we can focus our attention on at any given time (Miller 1956), as well as the stringent time limitation of working memory, play against the purposed insights to be gained by the spatial arrangement. Instead of remembering and retrieving the concepts, the viewer tends to retain the purely visual abstract image, without retaining the concepts or the main content. The skeptical readers might want to test their retention rate after examining the following example, included in an article about the theory and construction of concept maps (Novak & Cañas 2008).

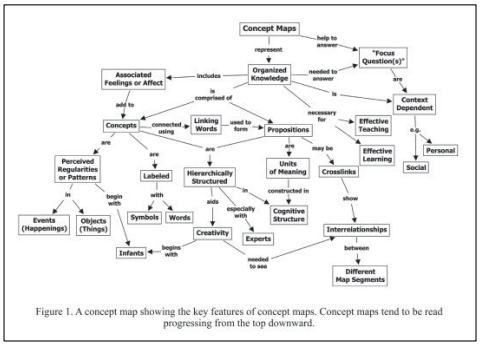

Figure 15. A "self-referential" concept map showing the key features of concept maps. Source: Novak & Gowin, 1984.

An illustration about the American Military strategy in Afghanistan pulls all the stops in the lack of concern about absolute quantitative limitations as well as working memory limitations of the viewer. This last example, first uncovered by NBC (Engel 2009) and republished by The New York Times (Bumiller 2010), demonstrates that sometimes verbal, written text by itself, could be much more effective than a confusing and cluttered image with no focus or meaningful sequence.

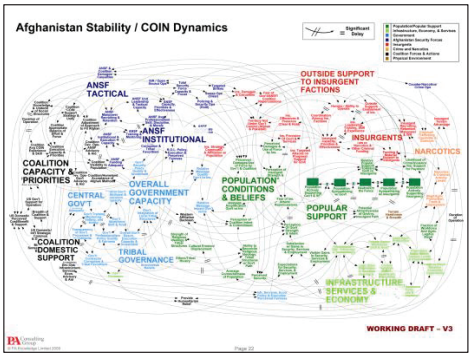

Figure 16. Diagram from "Dynamic planning for COIN in Afghanistan" an unclassified document from the Office of the Joint Chiefs of Staff, detailing the US counterinsurgency strategy in 2009. Presented as a projected PowerPoint slide. Source: PA Consulting Group, 2009.

The road map model is also on display in a recent typographic illustration from TIME magazine about the 2012 London Olympics (Cooke, Gibson, et al. 2012). In this example, there is no pretense of assigning specific meaning to the colorful lines containing the text. The lines are simply there to evoke the lines of the London underground subway map, provided that one has seen the original map before. Here, it's up to the endurance of the reader to try to read all the zigzagging text crammed inside the colored lines, without getting frustrated and ending up with a stiff neck.

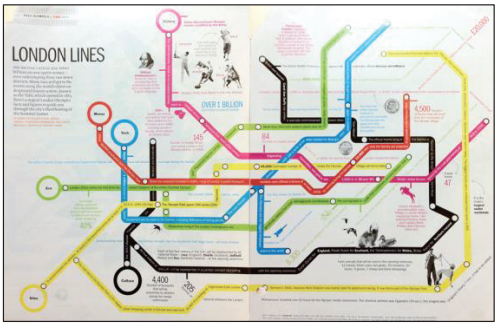

Figure 17. London lines. Article and infographic on the 2012 London Olympics. TIME magazine, July 30, 2012. Spread size: 16 x 10.5 inches. Source: Time magazine, 2012.

In the same issue of Time, another illustration on Olympic trivia (Adams, Cooke, et al. 2012), while still rather busy, manages to do a much better job at breaking down the information into smaller, finite chunks of text that can be read more easily and sequentially.

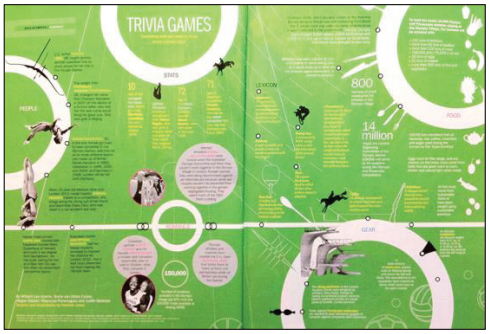

Figure 18. Trivia games. Article and graphic in TIME magazine, July 30, 2012. Spread size: 16 x 10.5 inches. Source: Time magazine, 2012.

Applying the theory to design practice

From the start, a successful graphic must communicate accurately to the viewer the genre to which it belongs. What is the type of graphic that we are looking at? If this question is not answered within the first four seconds of the interaction, the viewer will have trouble focusing his attention on the piece. Sometimes that window can be reopened and one will need to "restart", but more often than not he will get frustrated and he will refocus his attention on something else.

A look at two information design posters by students in my information design class, will help to clarify this principle. The first poster (poster #1) addresses the topic of team payrolls in Major League Baseball in the US. The second poster (poster #2) presents the topic of the world's tallest buildings.

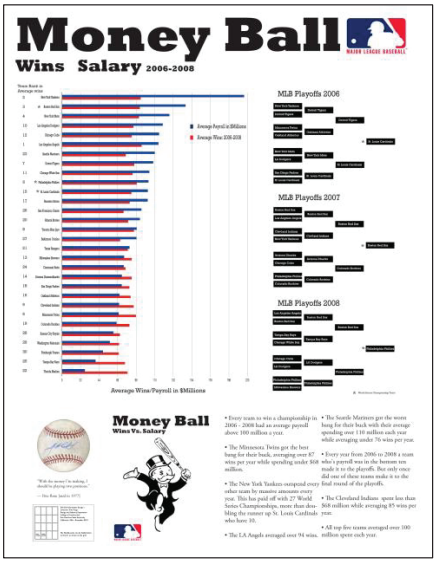

Figure 19. Student poster (#1) on the relationship between payroll and performance for teams in Major League Baseball from 2006 to 2008. Poster size: 34 x 44 inches. Source: Author, (student work: A.N.) 2010.

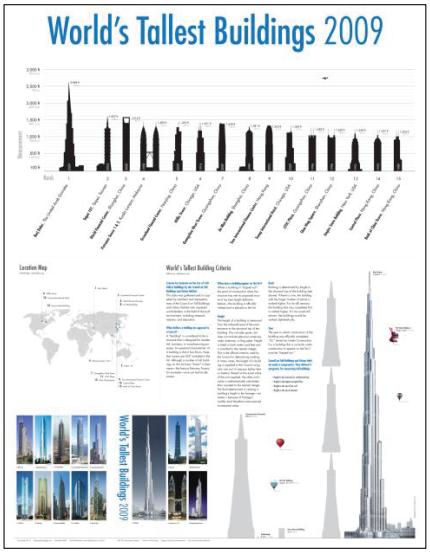

Figure 20. Student poster (#2) on the world's tallest buildings in 2009. Poster size: 34 x 44 inches. Source: Author, (student work: M.L.) 2010.

Poster #1, like poster #2, starts off with a big title of the top, but the title in poster #1 requires more background knowledge than the title in poster #2. "Money Ball" refers to the book and the movie by the same title, about the Oakland Athletics, a team that advances to the playoffs and almost to the World Series despite its very minimal

payroll budget. But the viewers who are not familiar with the book or the movie will not make that connection. The title in poster #2 means exactly what it says.

Whether the ambiguity of title #1 or the literal approach of title #2 is the better approach might depend entirely on the audience. If the audience for poster #1 is not familiar with the baseball world, then the title is already a stumbling block.

After the title, both posters present large graphics, one depicting relative salary and performance of baseball teams, from 2006 to 2008, the other showing the 15 tallest building in the world as of 2009. Poster #1 also includes playoff brackets from 2006 to 2008. More information such as pictures and text is included in the lower portion of both posters. As usual, in these examples the viewer needs to quickly assess the genre if his attention is to be retained long enough to proceed to the smaller, localized elements: images, text, maps, graphs, photos, and so on.

In examining the task, the viewer of poster #1 will be off to a very slow start, for the majority of the poster's layout consists of two separate and very "visually active" graphs, where only one provides direct relevant information about the topic. The bar chart, while exactly visualizing the data, disproportionately takes over the space while providing only limited information. The graphic brackets showing the playoff pairings and results also offer limited information regarding the main theme of payroll and performance. The bar chart on the left does include relevant data, but its visual display is too busy due to the vibrations of the colors used.

From this quick assessment, it seems clear that poster #1 struggles to get off the ground and requires repeated "restarts" of attention and focus on the part of the reader, making the interaction a laborious and unsatisfying process.

Poster #2 on the other hand, provides a series of well-defined areas within the layout. First comes the clear, descriptive title, next is the large graphic—a pictorial bar chart made with the skyscrapers—which gives detailed information about height, rank, etc., followed by the world map with the geographic location of the buildings. Next, the explanatory text on the criteria for measuring the buildings offers a short but detailed introduction to the material, then the diagram of the tallest building compared to another smaller well-known building provides a clear understanding of the huge scale involved, and finally the photographs of the buildings themselves provide the most direct visual presentation of the material.

In short, every element, but especially the title and the large graphic, all contribute to capturing the viewer's attention, and retaining it within those precious initial four seconds allowed by working memory. All the elements fulfill the expectations of the reader by adhering to visual schemes experienced earlier. The large graphic reads like a giant bar chart, the world map reads as a map, and the text is well arranged, with clear subtitles and concise paragraphs. The diagram with the stacked skyscrapers follows a familiar comparison device, and the familiar display of photos and captions complete this very informative piece.

Poster #2 then seems to satisfy the constraints of working memory by giving a quick snapshot of the topic, then by guiding the viewer through the smaller visual units.

Summary

This paper has focused on universal psychological principles that affect all graphics regardless of visual styles or modes of design. The specific visual examples that were chosen to explicate these principles represent a very narrow selection amongst the infinite variety of genres and media that could be analyzed. But this narrow choice

confirms the specificity of the methods employed in design and their ad-hoc nature, in contrast with the common underlying psychological principles that can be generalized to include a majority of visual examples.

Because of this ad-hoc nature, each graphic must be contingent upon the cultural environment in which it is created and presented. Each graphic must employ visual conventions that are accepted in that culture at any specific time. Each graphic must assume a certain amount of background knowledge on the part of the viewer, or conversely, it must work to compensate for a perceived lack of background knowledge. Erring on the side of the latter is generally a good, common sense design approach and also shows editorial respect for the reader.

The enormous variation of styles, modes of design, cultural contingencies, and viewer's background knowledge confirm that every graphic is an ad-hoc construction, each with its own specific visual style and mode of expression within the specific culture. In contrast to the extreme variability of visual formal aspects and the specificity of design methodologies, the main purpose of this paper has been to re-focus the attention of the designer on the more universal psychological principles that are at play, in a very general way, in all graphics, across multiple visual styles and multiple cultural visual conventions.

Further study is necessary in order to quantify the impact that a shift from focusing on the specific methods to focusing on general principles can have on the success of a graphic. In order to measure this success we can briefly borrow the definition of graphic "efficiency" from the late French cartographer Jacques Bertin:

> EFFICIENCY is defined by the following proposition: If, in order to obtain a correct and complete answer to a given question, all other things being equal, one construction requires a shorter observation time than another construction, we can say that it is more efficient for this question. (Bertin 1983, p. 139)

An experiment aimed at measuring this efficiency can be set up where the responses of the subjects—the "observation times"—are recorded for the purpose of determining the most "efficient" graphics. These will be those graphics that require "less observation time" for comprehension and therefore are more likely to survive the very stringent limitation of the working memory bottleneck.

The experiment, when well constructed in its method, should include all the variability of visual styles, modes of design, cultural conventions, background knowledge, etc. With these variables taken into account—the "all other things being equal" in Bertin's quote—the success of the graphic, its efficiency, can be measured by recording the length of the observation times required for quick closure.

Those graphics, or portions of those graphics whose required observation times match or fall within the time constraint of working memory, will prove to be successful, efficient graphics. In these graphics, meaningful information will survive the test of working memory and will be transferred to the more permanent storage of long-term memory.

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Rotational geometry as a teaching tool: applying the work of Giorgio Scarpa

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Abstract: *This paper focuses on a teaching unit in drawing for design that uses and applies Giorgio Scarpa's principles and methods in rotational geometry, as put forth in his book Modelli di Geometria Rotatoria, (Models of rotational geometry, 1978), and tests their validity through the construction of physical models built by the students. These models are derived from the sectioning of regular polyhedra such as the cube. The resulting modules can be re-configured into closed or open "chains" capable of folding back into their original minimal volume. This process has parallels in geometric folding, such as in linkages, origami, and polyhedra theory in general. This paper will introduce Scarpa's work to English-speaking specialists, and will illustrate how the subject can be made useful to design students.*

Keywords: rotational geometry, drawing, design, geometric folding, linkages, origami, polyhedra, chain.

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Genesis of form. Motion is at the root of all growth
—Paul Klee

Although rotational geometry is a difficult field of mathematics available only to specialists, the physical models that apply its principles are highly useful for courses in sketching and drawing. Students at San Francisco State University have found rotational geometry to be one of the most valuable segments of the drawing course, offering such remarks as: "I feel that this project used all of the skills that we learned in class, from drawing the basic shape in orthographic and isometric views to the cubic modules in the perspective." "This project challenged my design thinking by taking a 2D object and rendering it in a 3D environment." These were characteristic responses to the query: "Which class project did you find the most beneficial to your learning?"

The segment of the course is based on the writings of the Italian scholar Giorgio Scarpa (1938-2012). This paper will introduce his work to English-speaking educators, and will illustrate how the subject can be made useful to art and design students both in high school and at the college level.

Giorgio Scarpa taught Descriptive Geometry at the Istituto Statale d'Arte of Oristano and Faenza, Italy, and Theory of Perception at the Istituto Superiore Industrie Artistiche (ISIA) in Faenza. His book *Modelli di Geometria Rotatoria* (Scarpa, 1978), which was part of a design series edited by the late Italian designer Bruno Munari, is the basis of this study. This paper focuses on a teaching unit in drawing for design that uses and applies Scarpa's principles and methods, which were in turn inspired by the Bauhaus lectures of the painter Paul Klee and published after his death (Klee 1961, pp. 126-27). The unit tests the validity of the method through the construction of physical models built by the students. Through this process, students learn to apply a visual grammar based on rotational movements and folding which transforms two-dimensional shapes into three-dimensional solids. These solids are modules derived from the sectioning of regular polyhedra such as the cube. In theory, any regular solid can be used as the basis for the section. In this study only the cube is used, due to its simple and intuitive symmetry.

Drafting and Sketching for Design is a required course for all students entering the Design and Industry Department at San Francisco State University. In the class, all drawing is done by hand with drafting tools and free hand sketching. These students will become graphic designers, product designers, digital media designers, and creative professionals in general. The class covers orthographic projections, isometric projections, and perspective.

The unit called Cube Section begins with the simple problem: dissect a 4″ x 4″ x 4″ cube into two or three solid modules having identical surface area, volume, and shape. At a later time, the three-dimensional modules that will form the final cube will be connected with hinges. The connected modules can be arranged into open or closed chains. The modules may or may not fold back into a minimum volume depending on the type, location, and orientation of the hinges. The materials used in this process are pencil, paper and tape or glue. While the students are able to improve their manual skills through the use of these materials, the use of CAD and 3D printing at a later stage will allow for quick testing of the various configurations.

The process for the section that divides the cube into two modules will be called the "twin" section. The process that divides the cube into three modules will be called the "triplet" section.

A. Twin section

The process

Given a square 4˝ x 4˝ and its modular grid (Fig. 1), we draw a segmented line that divides the face of the cube into two separate parts. This line can be a 2-segment line, a 3-segment line, or more. In principle, any combination of segments can work, but in practice we keep the number of segments to a minimum to facilitate the actual construction of the cube. Additional constraints are: 1. Begin the line at the midpoint of the left edge of the square: point C in Fig. 1.1; 2. End the line at any point labeled C, D, or E on the right edge of the square; 3. The end point of any segment must not fall on the points shown as red dots in Fig. 1.4. This last constraint keeps to two the number of cross-sections that are needed to determine the distances from the points to the center of the cube.

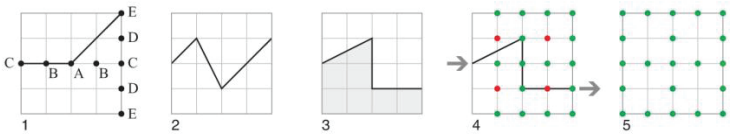

Figure 21. *The square is sectioned into two parts, starting at the mid-point on the left edge and ending at any point on the right edge, but avoiding "stops" on the four red dots.*

We then mirror the original square along its right edge as shown in Fig 2. The right edge is the axis of symmetry. Next we rotate the resulting pair of squares by 180 degrees. We label the points on the section and then we find the distances from those points to the center of the cube with the aid of separate cross-section drawings that are provided to the students. We add a top and a bottom square to complete the external surface of the two-module cube.

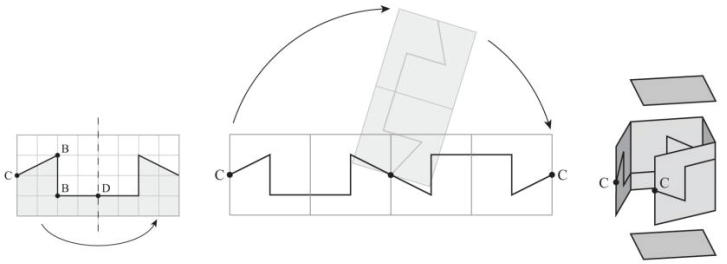

Figure 22. Mirroring and rotations of the basic square.

The external surface and the section along the four sides are now determined. The next step is to determine the internal surface of the modules by constructing a series of triangles whose bases are the segments on the faces and whose vertexes coincide with the center of the cube (Fig. 3). Each foldout shape is exactly half the external surface of the cube. Each segment along the section will be connected to the center of the cube

to determine the triangles needed for the foldout surface of the internal section. Z: center of cube. BB: base of one of the triangles (BBZ).

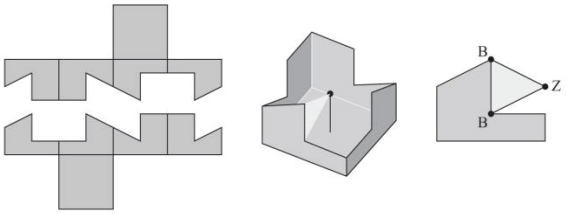

Figure 23. At left is the complete template for the outside of the cube.

With the aid of two cross sections, one along the median of the face of the cube, and the other along the diagonal of the face of the cube as shown in Fig. 4.2, we determine actual distances from any end-point of the segment on the face to the center of the cube.

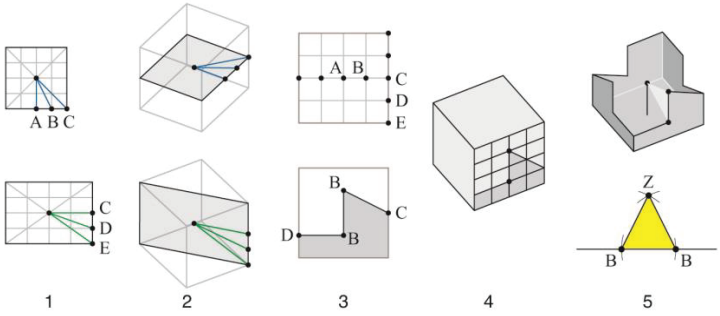

Figure 24. The triangles needed for the internal surfaces are constructed from a combination of external and internal lines.

We label the points on the face of the cube from A through E. In the example shown in Fig. 4.3, only points B, C, and D are used. The center of the cube is labeled Z. The two end points of each segment on the face are connected to the center point, forming unique triangles. In the example, two B points are connected to the center of the cube, as shown in Fig. 4.5. By constructing a series of adjacent triangles, we determine the internal surface of the sectioned cube. The resulting flat foldout shape will be folded into the appropriate configuration, matching the center and the segments along the faces. Thus, using ruler and compass, the internal surface of the modules is determined. When folded in 3D space, the surface shown in Fig. 5 will be a dihedral sequence formed by a combination of convex and concave shapes. As a rule, the complete foldout pattern of this internal surface cannot be obtained from a single sheet of paper without overlap. The vertexes of the internal surface, shown in yellow, will be matched to points on the external surface, shown in gray.

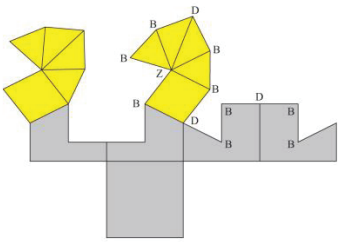

Figure 25. Foldout of internal and external surfaces combined.

When we complete the folding, the two modules are placed side by side to check that they have identical shapes. Both modules are “right-handed” (Fig. 6.6). Typically, a module will display a positive-negative configuration, where the “female” side of the module will fit the complementary “male” side of the other module (Fig. 6.5).

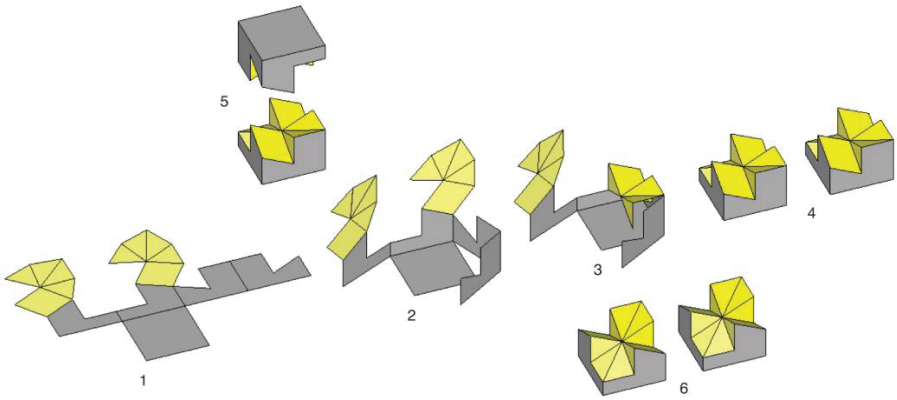

Figure 26. Folding sequence from flat polygon to completed solid.

In the drawing unit, the students also document the modules in a series of drawings, some of which are shown in Fig. 7. All the drawings are done by hand, but the examples shown below were drawn on the computer for ease of reproduction.

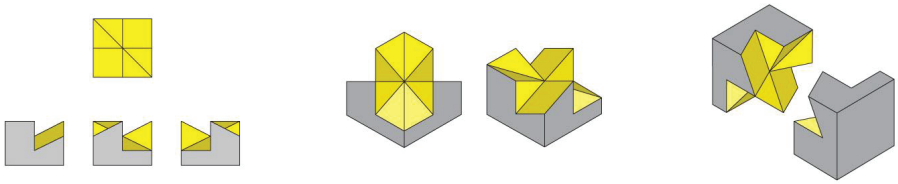

Figure 27. Orthographic and isometric views of the modules.

B. Triplet section

As Italian designer Bruno Munari noted, the close relationship of the cube with the square might appear at first to be counter to a section of the cube into three parts. However, he adds that a cube has six faces, which is divisible by three, and this suggests that such a solution is possible (Munari 1974, pp. 194-97).

In this process we will start with the same first step of sectioning the face of the square, but this time the final 3D configuration will yield three identical modules instead of two. The three modules can form the basis for further sectioning into six smaller modules that can be articulated into open or closed chains. These chains will include a series of modules connected together by hinges made with transparent tape or drafting tape.

Given a square 4˝ x 4˝ and its modular grid, we draw a segmented line that divides the face of the cube into two separate parts (Fig. 8). This is the same first step as in the twin section process (Fig. 1.1).

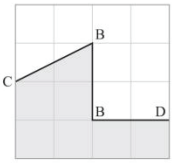

Figure 28. Two-part section.

Then we rotate one of the two resulting shapes by 180˚ with center in C so that the two shapes now share a boundary that is part of the edge of the square (Fig. 9). In addition to rotation, other operations such as translation movements along a straight line are possible in order to achieve the proper section. The students try various steps using tracing paper until a suitable configuration is found. The example shown is only one of many possible solutions.

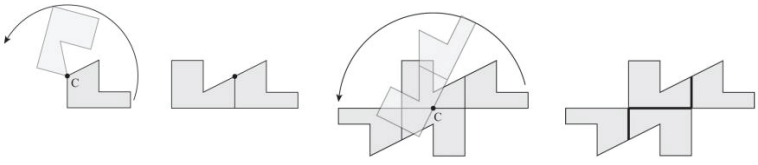

Figure 29. After one of the parts is rotated, the two shapes share one edge. The resulting shape is rotated by 180 degrees, resulting in the complete external surface of the module.

Another rotation of the new shape by 180˚ with center on another point C yields a total surface area of two squares. We then have four new parts, for a total of two squares that are arranged to share the whole or part of one of their original edges. It is a continuous four-part shape that occupies exactly one third of the external surface of the cube. The common boundaries shown as thick lines in Fig. 9 will be folded 90˚ in 3D space.

We repeat the process shown in Fig. 9 to obtain two additional shapes for a total of three identical shapes. We now have three shapes, made of four parts each, that comprise the full external surface of the cube (Fig. 10).

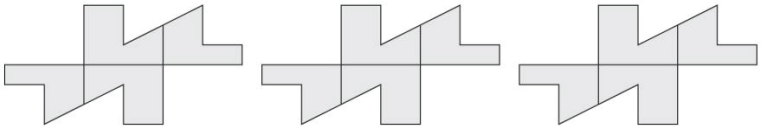

Figure 30. Complete external module.

With each shape, we fold and connect the parts along the shared boundaries and edges of the squares. The 90-degree folding will yield the three pieces of the puzzle, each exactly one third of the cubic space (Fig. 11). Each face is folded at 90 degrees. Three such modules will be fitted back together to form the cube.

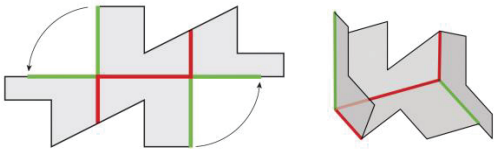

Figure 31. Folding the parts of a single module.

We now take the three identical modules forming the cube and we set them next to each other to make sure that they are identical in shape and orientation. The next step is to preserve the identity of the modules on the inside as it was on the outside. The triangular internal shapes of the modules need to be constructed in order to complete the full template.

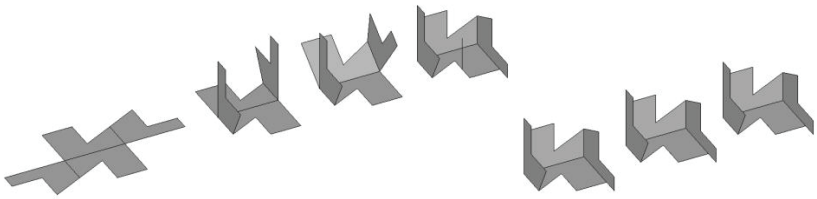

Figure 32. Folding of the single module and three modules side by side.

When constructing the three identical modules, we note that each face of the cube displays exactly the same original section or its mirror image, that each face has the same basic symmetry and spatial relationship with regards to the center of the cube;, and that the external surface of each module is exactly one third of the total external surface of the cube. Each segment that is part of the original section will form the base of a triangle where the two other sides are lines connecting it with the center of the cube (Fig. 13). The process for determining the internal surface is identical for both the twin and triplet sections.

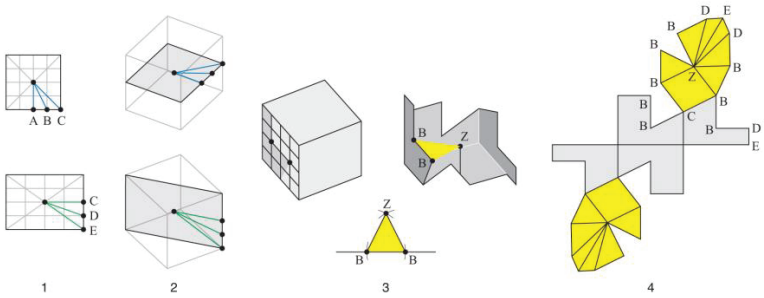

Figure 33. Construction of the internal triangles using the external line segments in combination with the lines provided by the cross-sections.

Sometimes two triangles will be combined into a diamond shape like the polygon BCBZ shown in Fig. 13.4 when the triangles happen to be coplanar in the final 3D model. The internal surface of each module will combine a series of triangles meeting at the center of the cube. Just as the external surface was the same for each of the three modules, the volume of each module is also the same.

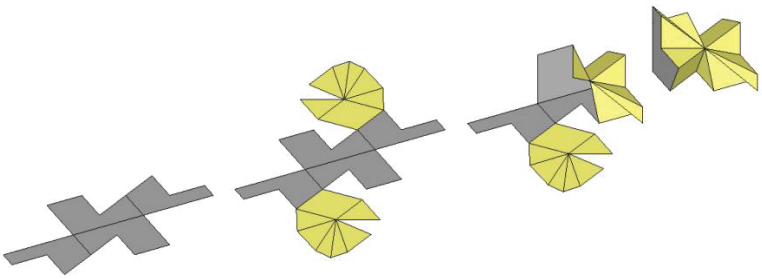

Figure 34. Folding sequence of one module.

Although advanced students would be able to determine the true dimensions of each triangle needed for the internal section by means of cross sections, this information is given to all students in the form of a “kit-of-parts” drawing where all needed lines have already been plotted. All students are required to build and test each surface needed for their cubes. The external surface is shown in gray and the internal surface is shown in yellow in the folding sequence depicted in Fig. 14.

To verify its exactness, a rough cube can now be constructed out of card stock and scotch tape. A second and more refined cube will be made with high quality cover stock and white glue. A color is used for the outside surface and a different color for the inside surface. All modules are identical and right-handed. A combination of blue and yellow board is used later in the six-module version of the cube shown in Fig. 15.

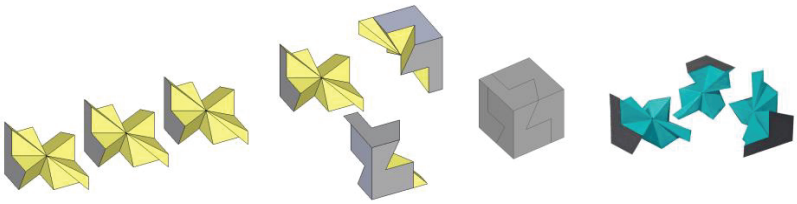

Figure 35. The three modules and the completed cube. Cube made with card stock and glue.

C. Hinges and rotations

In the three-module cube shown in Fig. 15, before they were hinged together, the modules were further sectioned in half (Fig. 16). This additional division can be helpful when the three finished modules cannot fit back together because of collisions due to "undercuts" present in the design of the section. In these cases, the additional division frees the parts and allows them to fit back together. When the one-third module is split in half, the resulting one-sixth modules are again identical to each other.

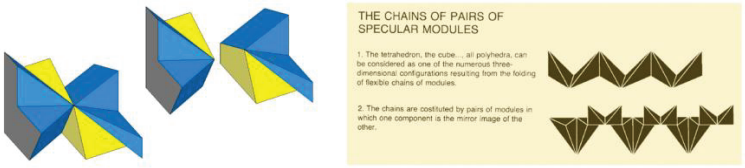

Figure 36. One-third module is split into two parts. At right: illustration from Modelli di Geometria Rotatoria.

The modular chains built by Scarpa are formed by pairs of mirrored modules hinged together along repeating axes, as seen on the right in Fig. 16, which shows an illustration from page 62 of his book (Scarpa 1978).

In the final examples shown in Fig. 19 and Fig. 20 it was possible to articulate the chain even though the modules are not mirrored. Rather, all the modules have exactly the same shape and orientation. The modules in this chain are analogous to two right hands: they can be moved one over the other and look exactly the same. The six modules, shown also in exploded view in Fig. 17, are then hinged together to form a cube.

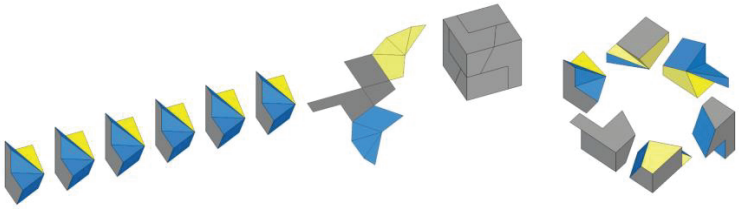

Figure 37. The new six modules, with the internal surface in yellow and the external surface in blue. At right is the exploded view of the six modules forming the cube.

The six modules will be hinged together along the cube's diagonals and other lines on the faces of the cube. The hinges are shown as thick black lines in the "x-ray" view on the left in Fig. 18. Four such groups are connected together in the "closed-chain" configuration used for the physical model seen in Fig. 19 and Fig. 20.

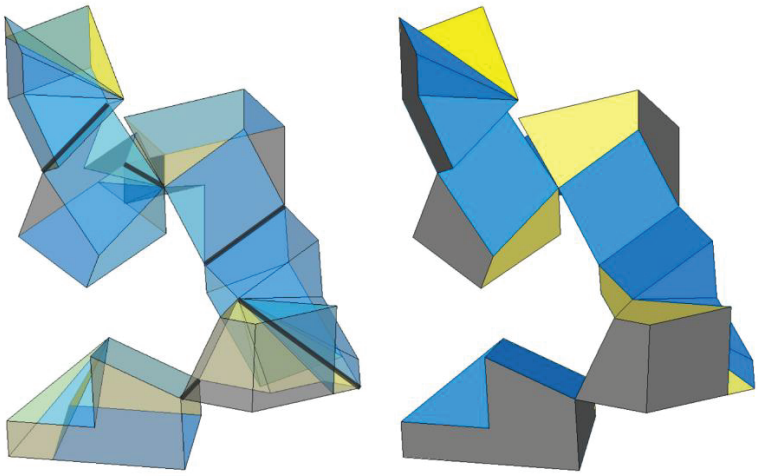

Figure 38. The six modules that will form a cube are hinged together along the thick black lines.

Configuration 1

A series of four cubes including a total of 24 modules was hinged together using a combination of hinge locations as shown in Fig. 18. In the configuration shown in Fig. 19 the selected placement of the hinges produced a closed chain where the modules cannot fold back into their minimal volume of 2 x 2 x 1 cubes. The minimal volume is not an absolute requirement and various configurations can be tested to achieve different results. This chain is composed of 24 identical modules. Each module occupies one-sixth of one cube. Four complete cubes compose the chain.

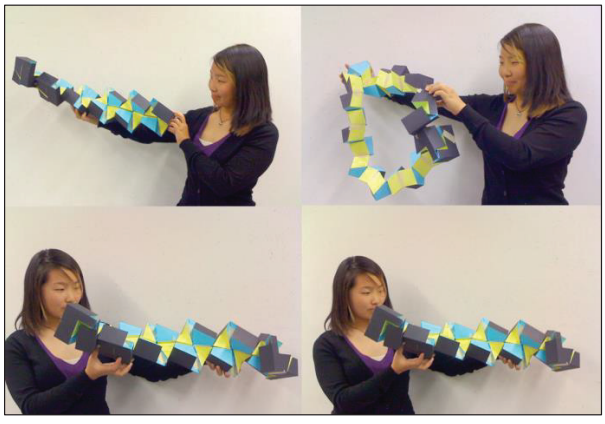

Figure 39. Twenty-four modules. This configuration does not fold back into a cubic shape.

Configuration 2

The next configuration allows the four cubes to fold back into their minimal volume of 2 x 2 x 1 cubes. The location and spatial orientation of the hinges needs to be formalized and mapped. We can expand this configuration into a larger volume composed of eight cubes, having 48 modules hinged together in a similar sequence. Physical models as well as computer simulations can be built to test 2 x 2 x 2 configurations.

The initial section of the square is complex enough that it makes it difficult for the modules to easily fold back together. Hand pressure is used to guide the modules together. With simpler designs it is possible to achieve the reassembling of the modules with little force. Simpler shapes are more “cooperative” in transmitting the pressure applied at one point of the chain to the other points along the chain. The same 24 modules seen in Fig. 19 were used to create the chain shown in Fig. 20, which collapses back into a 2 x 2 x 1 cubic space.

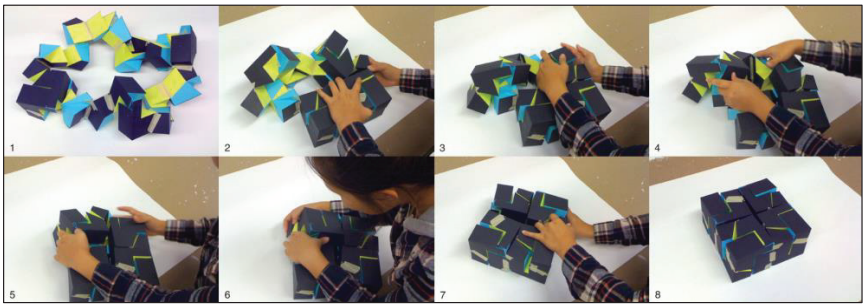

Figure 40. Twenty-four modules. This chain folds back into a minimum cubic space of 2x2x1.

Observations

Given a simple initial section on a face of a solid, it is possible to develop complex three-dimensional solids by rotating and folding the resulting parts. In principle, any initial section should work for the division of the cube in two or three modules, but is there a formal approach that can determine the degree of complexity of the final modules based on any initial section? In order to formalize the operation, collaboration is needed between designers, mathematicians, and engineers to tackle the theoretical aspects of the problem, however the modules can still be built without sophisticated mathematical knowledge. Finally, all regular solids and convex regular polyhedra should yield modular divisions of this kind.

The progression from a simple section of a square to a complex articulated modular chain presents a series of geometric transformations that can be appreciated on many levels: aesthetic, mathematical, and biological. Scarpa notes that the progressive division of solid forms into smaller and complementary modules might represent a valid model for biological systems. One such system of particular interest is the little known mechanism of protein folding and many believe that geometry may hold a key to understanding this process (Demaine & O’Rourke, 1997).

Pedagogical value

Drawing can be taught in many ways, this unit adds the discovery of form, space, and geometric transformations to the basic skills of learning to see and learning to draw. It strengthens the connection between nature and man-made by pointing to an essential aspect of life: movement. Scarpa points out the parallels between nature and rotational geometry. Mirroring, rotations, translations, folding, are all geometric movements. Straight lines and linear motion seem to be less frequent in nature than rotational motion: plants, planets, shells, dancing bees, to name a few, all move and grow along curved paths, sometimes spinning and turning around themselves.

Stimulated by works such as *On growth and form* by D'Arcy Wentworth Thompson (Thompson, 1942) artists and designers like Scarpa have had an opportunity to explore nature and geometry as two complementary domains. The painter Paul Klee, whose pedagogical writings constitute one of the early inspirations for Scarpa's work on geometry and topology, noted that: "The artist cannot do without his dialogue with nature, for he is a man, himself of nature, a piece of nature and within the space of nature (Klee 1970, p. 6)." Scarpa points out the difficulty in observing nature, which grows from the inside outwards, but we can only observe it from the outside and thus sometimes miss its internal generative processes.

The basic processes used to produce the 2- and 3-module configurations can be described as general processes, almost natural ones. Teaching the skill of drawing and learning how to see through these hands-on processes enrich the learning experience beyond formal technical instruction. They expose the students to a model of discovery and design process that can later be used in more applied design projects.

The unit thus focuses on non-applied problems, even if the design solutions that are generated by the general problems have very definite, physical shapes. The final models constructed by the students are the physical summary of the design process and function as the tangible products and outcome of the process itself.

Conclusion

This teaching unit, using the principles of Rotational Geometry, can be integrated into the art and design classes of high schools and art foundation courses of art colleges. Through the process of manipulating two-dimensional shapes and their transformations, students build three-dimensional modules and learn the intimate relationship between the two domains: 2D and 3D. This hands-on process returns many benefits, such as the ability to quickly visualize objects in three-dimensional space when the students move on to computer aided design processes that use AutoCAD and other 3D software. The unit includes elements of drawing, learning to see, transformations, and affords parallels with other disciplines such as mathematics, geometry, and biology. It represents a bridge between the aesthetic and the mathematical components of a geometry problem, its artistic and humanistic component, and its scientific component.

Acknowledgements: *Thanks to my former student Florence Gold Yuen at San Francisco State University for building the physical models shown in Fig. 19 and Fig. 20. The 3D illustrations shown in the article are based on those models.* ***Figures:*** *Source for all illustrations and photos included in the paper: Author 2012, except Fig. 16 (right): Source: Scarpa 1978, p. 62.*

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What does it mean to be a "materially attuned" practitioner?

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Abstract: *This paper reports on research in progress that explores the potential role the materiality of things plays as a tool for the critical understanding of the human relationship with man-made objects. The paper argues that many designers habitually engage with production and consumption of meanings more through the materiality of things than words and symbols. It proposes a hypothesis that materiality is a key to understanding the context, knowledge and information the man-made objects may "embody". Through the case study of an exhibition, the paper examines the ways in which this embodiment may be facilitated. Referring to Heidegger's notion of "thingness", it further explores the origin of the mediating, and the "engaging capacity" of objects. The paper draws on the more established analysis of the origin and the experience of the work of art, in its examination of the role that materiality plays in the production and consumption of meaning and in facilitating the experience through objects. While exploring the potential advantage of an anthropological approach to design, the paper suggests that an attunement to materiality and an active reflection on their observations enable the designers to have better insights into the workings of the human-object relationship.*

Keywords: Materiality, experiential knowledge, tacit knowledge, knowledge in design practice

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INTRODUCTION

This paper presents findings from on-going research, which investigates the role that the materiality of things plays in the production and consumption of objects in contemporary society, with a particular focus on design and applied art practices. Framing the theme in the context of design, the paper discusses the potential role the materiality of things plays as a tool for a critical investigation of our relationship with the man-made environment.

It has been observed that design practitioners typically, though not exclusively, work with information and knowledge that are manifested in material form. It can be said that this particular awareness of the material aspect of their surroundings permits designers and makers an insight into the meaning and the knowledge that the material things may embody. The research suggests that this awareness, a sensibility, potentially plays a key role in creating an engaging quality in the objects they design/make. Relating this "engaging quality of things" to Martin Heidegger's notion of *thingness*, the paper further explores the relationship between the *origin* of the object and the engaging capacity of the resulting work.

The paper explores the nature and the potential of an anthropological approach to design in an attempt to find the way to bring together the materiality and the meaning of things. It also examines the engaging capacity of material objects and how the act of making may contribute to its formation. Viewing design and applied art objects as "concrete expressions of material culture"(Boradkar 2010, p. 8), the research investigates how designers and makers alike essentially engage with the world, as well as facilitate experiences for their audience through materiality.

It has been observed that designers and applied artists who have a heightened awareness about "how things work" in material term interpret and deal with the agenda of contemporary culture and society in a way that is grounded in the lived experiences of material things. Jane Fulton Suri (2011) wrote, in her case studies of how designers reflect on and apply their observations of the everyday experience in the design process, the following:

> Whether creating products, apparel, services, or spaces, these designers display a particular sensitivity to the physical, metaphorical, and cultural values inherent in context, forms, and materials and how these are experienced. (2011, p. 31)

This sensibility constitutes reflective insights into the principles of things, material characteristics, etc., which are based on their experiential knowledge. It can be said that the designers who are equipped with such an attribute – an attunement to materiality – tacitly understand the principles of nature and human behaviours from the material aspect of their environment.

The paper proposes that the materiality of things is key to understanding the nature of tacit and experiential knowledge and how they manifest in material form. It includes an analysis of an exhibition *Thingness* (Richmond & Tsutsumi 2011), which was curated as an attempt to "unfold" the processes of production – of the meaning and experience – of design and applied art objects. Applied art objects and the makers of objects are also examined in this paper, as the paper considers how the familiarity to materials and making processes also affect the designer's understanding of "how things work". Through its exhibits and dialogues with the participating artists/designers, the exhibition became a tool for reflection, and demonstrated to its audience how the experience of the designers and makers could be conveyed through the experience of the resulting objects.

The author's ongoing research is concerned with the particular sensibility to the material aspect of the world – and its "thingly" nature as Heidegger (1978) put it – that designers and makers of objects are often observed to possess. It can be said that they are particularly attuned to the material aspect of the cultures around us. Nigel Cross wrote that:

> Designers are immersed in this material culture, and draw upon it as the primary source of their thinking. Designers have the ability both to 'read' and 'write' in this culture: they understand what messages objects communicate, and they can create new objects which embody new messages. (2006, p. 26)

The paper argues that this particular way of understanding the culture around us is potentially advantageous for design practitioners whose responsibility to understand and respond to the real-world agenda has become ever more critically important. In particular, the paper explores the methodology in which the two key themes – an attunement to materiality and the nature of the *thingness* – may be brought together. Although the ongoing research looks at the role of materiality in both design and applied art practices, this paper focuses more on its implications for the design practice.

The culture of design practice

If you were a practicing designer, it is likely that you would already "know" that the tools with which you deal with knowledge and information in your practice are not limited to a few types of media, such as materials, texts and images. It can be said that designers, to a considerable extent, engage with the "communicative property" of objects (McCracken 1988) in their practice. By observing the details of products, designers understand the maker/designer's intention, such as reconciliations between structure and cost, or the reason behind a particular feature the designer tried to emphasise, be it the process, technique or characteristics of the material used. In other words, most designers are able to *read* principles, in addition to technical and historical knowledge embodied in the objects, by observing their physical features. Dillon and Howe (2003) wrote of the notion of the "design object as narrative" and argued that the stories "enfolded" in the realization of design object are also the means of "unfolding" its full significance. As it has been observed in the studies of design practices, designers define their problems by trying to solve it (Cross 2007; Schön 1991; Lawson 2006). This process is all but linear as Jane Fulton Suri wrote in her documentation on how designers utilise their observational skills in the design process:

> Design and innovation are creative endeavors that defy entirely rational and linear processes. Human intelligence, skill, and leaps of imagination are required to grapple with multiple variables and uncertainties. (2011, p. 17)

As Cross (2006) argued, designers have a high level of cognitive abilities, which can respond to undefined issues and to a dynamic between people and things, and this dynamic between people and things, as Prasad Boradkar wrote, "configure each other"(2003, p. 9). To achieve coherence in the objects they produce, the designer needs to apply a principle, such as a narrative or geometry, to determine the perspective from which the designer comes to frame the formerly undefined design problems. Fulton Suri wrote:

> Perhaps, as makers themselves, they have a heightened appreciation for the kind of elements in the environment that they can manipulate and control: formal relationships between sensory qualities such as color, mass, layout, and texture, and dynamic qualities of feedback, rhythm, sequence, layering and logic. This reflects awareness of both *that* things are made and of *how* things are made, and of the choices and artistry that has gone into that making. (2011, p. 31)

It is possible to hypothesise here that many designers experience and interpret the world in a "materially attuned" way and recognise patterns that are manifested materially in the world around us. These observations suggest an interesting prospect that tacit and experiential knowledge are transmitted in a way that is particular to the design practice. It can be said that through materiality, designers are able to "unfold" the stories and conditions with which the objects came into their existence.

Objects mediate

In his *The Origin of the Works of Art*, Martin Heidegger questioned how materiality affords lived experience within objects: "How do matters stand with the work's thingly feature that is to guarantee its immediate actuality?" (1978, p. 125). This notion – an experience of a thing in an immediate and intuitive sense – which is variously named as the *presence*, *essence* (Heidegger 1967; 1978) and *aura* (Benjamin 1999), could be interpreted as the engaging quality of objects. As an experience, our encounter with material objects feels very immediate. As Bill Brown wrote in his essay "Thing Theory", "things seem to assert their presence and power" (2009, p. 140). What may be felt in this experience of the "encounter" is difficult to pin down, as Daniel Miller wrote that material objects escape intellectual scrutiny because the object

> …tends towards presentational form, which cannot be broken up as thought into grammatical sub-units, and as such they appear to have a particularly close relation to emotions, feelings and basic orientations to the world. (Miller 1987, p. 107)

In philosophy and other studies of material culture, it has been well articulated that material things (artefacts) mediate human psyche and the external world (Miller 1987; Verbeek 2010; McCracken 1988). *Things* mediate the relation between human beings and the *external* world in a material way, fulfilling their functions as material objects, and by this functioning shape human actions and experiences (Verbeek 2000, p. 11). Their transcendent capacity is manifested in "how everyday people use everyday objects to transcend their everyday experience and to connect and mediate… universal human experiences" (Geismar 2011, p. 213). Miller also wrote of the bridging roles material objects play on multiple levels for humans in perceiving the world:

> The artefact may perhaps best be understood as playing a series of bridging roles. It does not lend itself to the…analysis of symbolism which identified distinct abstract signifiers and concrete signifieds, since it simultaneously operates at both levels. (Miller 1987, p. 33)

To understand the design objects as cultural artefacts, it is necessary to extend the exploration into wider academic contexts. As Boradkar wrote:

> Design studies, which have traditionally regarded objects in formal rather than social terms, can benefit by expanding their discourse to include a more socially and culturally rooted understanding of objects. (2003, p. 3)

Although different disciplines employ their own subject-specific vocabulary, the existing studies on the nature of our experience with material things explored in other disciplines greatly benefit the study of design.

Design anthropology

So how useful is it for designers to be more attuned to the materiality of things in the context of design practice today? In recent years, there has been increasing interest in the process and the material aspects of the design practice. What has triggered this growing interest, and is there an advantage in better understanding these aspects? How important is it to cultivate such sensitivity to the materiality of things discussed above in the context of design and design education? The designer Sam Hecht (of Industrial Facility) spoke of the importance of knowing "how things work" in order for a designer to be critical of their subject:

> Many young designers have lost the ability to understand – or perhaps are not taught – why things are the way they are; but this ability to dismantle and analyse the parts of something is crucial. (Campbell 2010, p. 7)

The role and the meaning of design practice in society have evolved since the early 20th century, and today alternative roles and possibilities of design in society are sought and debated more actively than ever before. Designers' social responsibility and their awareness of it have become ever more critically important and relevant in today's context. Although the dominant idea of design as a vehicle for economic growth has always been questioned by some, propositions for change were not put into practice or seriously considered as real options until relatively recently. Doubts on the production-focused model were expressed in the example of Victor Papanek's *Design for the Real World*, which was written in the 1960s. Papanek observed:

> In this age of mass production when everything must be planned and designed, design has become the most powerful tool with which man shapes his tools and environments. …This demands greater understanding of the people by those who practice design and more insight into the design process by the public. (Papanek 1984, p. ix-x)

According to Papanek, at the time when the book was written, there was no single publication about the social responsibility of design practice. In the current design community, increased awareness of sustainability and ethical design is evident (Braungart & McDonough 2008; Fry 2009, 2011; Margolin 2002; Hinte 1997, 2004). However, the production-focused idea of design is still strong in the industry today. Historically, design thinking tends to separate the pragmatic and cultural problems as Victor Margolin (2002) reflected in his overview of the design culture in *The Politics of the Artificial*. He wrote that the design thinking at the end of the 20th century was only "grappling with ways to integrate pragmatic or operative concerns with semantic or symbolic ones" (Margolin 2002, p. 24).

Design as a discipline needs a more "anthropological" and context-based approach to facilitate the real needs-centred design solutions. In this model, the designer is to be more observant and responsive to what is going on around them such as the habits and customs of people, their cultures and environment. It demands more empathetic understanding of the people in context as well as the insight into the process of production and consumption. Fulton Suri observed that:

> …successful designer are keenly sensitive to particular aspects of what's going on around them, and these observations inform and inspire their work, often in subtle ways. … As businesses and organizations increasingly embrace design thinking and human-centered approaches, it feels important to understand more about how observation really works in design. (2011, p. 17)

A more sociological approach in which design practices are seen as observers of our cultures and societies has been advocated in the design culture today, evident in the publications such as *Design Anthropology* (Clarke 2011) and *Design Futures* (Fry 2009). Tony Fry wrote in *Design Futures* that design has to be "understood anthropologically. It names our ability to prefigure what we create before the act of creation, and as such, it defines one of the fundamental characteristics that makes us human" (Fry 2009, p. 2).

Design thinking is understood to be solution-focused, because often design problems are ill-defined and designers tend to define problems by trying to solve it (Cross 2007). This brings our attention closer to their thinking processes, where the practitioner's tacit and experiential knowledge manifests in their actions. It can be said that this process of framing an initially ill-defined problem is where the designer's observation and insights into "how things work" inform their decision-making. In this way, in the formulation of the "framing" element, the contextual knowledge and information may play a key role.

Rightness

Designers often mention that they make an intuitive judgement about an object, whether or not it feels "right", often without knowing explicitly the reasons for such judgements. This illustrates the notion of "design intuition" that Fulton Suri (2011) has proposed in her observation of how designers utilise their observational skills in the design process. The designer Michael Marriott wrote in the exhibition catalogue of the *Raw Craft* exhibition that – to him – *rightness* is:

> Something which is usually felt, rather than understood. It is something that might grow to be understood though, by relentlessly looking hard at objects, turning or rolling them over and taking them to pieces in reality, or in the mind. (Scholze et al. 2011, p. 6)

In his book *Thinking Architecture,* the Swiss architect Peter Zumthor explored the feeling of the *rightness* in the context of architecture. In his analysis of *rightness*, Zumthor attempted to figure out its origin, as well as what constitutes the particular atmosphere of a particular architectural space (2006a; 2006b). His observation covers a wide range of elements that make up our surroundings such as materials, sound, temperature, people, and compositions of all these put together. Zumthor wrote of the effect of combining the complex layers and web of elements listed above in the manner that he applies to his practice, in a pursuit of the *rightness*:

> I love placing materials, surfaces, and edges, shiny and mat, in the light of the sun, and generating deep solids and gradations of shading and darkness for the magic of light falling on things. Until everything is right. (Zumthor 2006b, p. 87)

He claims that humans are capable of making an intuitive judgement of a place very quickly:

> We perceive atmosphere through our emotional sensibility – a form of perception that works incredibly quickly, and which we humans evidently need to help us survive. … Something inside us tells us an enormous amount straight away. We are capable of immediate appreciation, of a spontaneous emotional response, of rejecting things in a flash. (Zumthor 2006a, p. 13)

The designer Jasper Morrison also observed how objects seemingly affect the atmosphere of the space around it: "it seemed to me that the change in atmosphere of a room when an object is added might be hard to measure, but that in some way it represented an invisible quality of the objects." He further noted that "an awareness of this might be an important factor in designing things" (Morrison 2002, p. 14).

Humans are by nature designed to constantly assess their immediate surroundings (Kahneman 2011). It can be said that some designers and artists possess a particular sensibility – naturally or cultivated – to their environment as Zumthor observed, and are highly capable of pattern recognition through the perception of material things.

The Thingness exhibition

In recent years, there has been increasing interest in the roles that the act of making and learning of skills play in our understanding of the world (Sennett 2009; Crawford 2011; Frayling 2011). Matthew Crawford, a philosopher and a motorcycle mechanic, wrote in *The Case for Working with your Hands* that he finds "manual work more engaging intellectually" (2010, p. 5). The way makers and designers engage with their surrounding culture through materiality – when combined with their skills or sensitivity to the physical/material world – enables them to produce objects of the familiar; a potential for bringing the world closer towards us.

In the above context, the *Thingness* exhibition seemed to be a timely theme. The exhibition was curated by two tutors who have been teaching on interdisciplinary design and applied art courses at undergraduate and postgraduate levels at Camberwell College of Arts in London. Their own interdisciplinary and intercultural background in craft, sculpture, product and furniture design led to an ongoing conversation between them on varying views on the relationship between ideas and material things in contemporary art and design practices. The idea for the exhibition came about when the two were discussing how best they could demonstrate to their students what they observed: the key role the materiality of things play in the transmission of embedded meanings and narratives in man-made objects; and how this transmission of meanings may differ from more typical symbol-based communication.

The curators observed that the learning of making skills plays a vital role in developing sensitivity to materiality. It appears to be the case that through acquiring the skill by doing, the maker becomes more aware of the "external physical world which is nevertheless in a more immediate relationship with the unconscious than the world of articulate symbolism" (Miller 1987, p. 103). They took particular note of learning and becoming accustomed to making skills often feel as if one were "living the knowledge", as Peter Dormer (1994) put it. This sense of "living the knowledge" is characteristic of experiential and tacit knowledge – the knowledge acquired by doing – and the "knowledge of familiarity" (Janik 1988). When the maker becomes at ease with his or her own skills, his/her mind focuses more on the act of making itself than the tool that is enabling it (Polanyi 2009), whereas the knowledge of familiarity is gained through senses that are grounded in experiencing sensations (Dormer 1994, p. 21).

Collectively, the exhibited objects in *Thingness* presented people's experiences, their histories, their connections to and interactions with the material world. In the exhibition, the objects were given a central role, which as a result enabled the audience to access to a certain degree the "humility of objects" (Miller 1987). In the *Thingness* book that accompanied the exhibition, the two authors questioned:

> Studies on what man-made objects do to humans have been conducted in many different academic subjects…What is evident in these studies is that, despite its seemingly definitive character, the very essence of objects evades linguistic articulation. How then can the "material articulation" work? (Richmond & Tsutsumi 2011, p. 3)

Figure 1 Michael Marriott "Mies Meets Marx" Thingness version (2011)

Figure 2 Neil Brownsword "SY series" (2001)

Figure 3 David Clarke "One Day My Plinth Will Come" (2009)

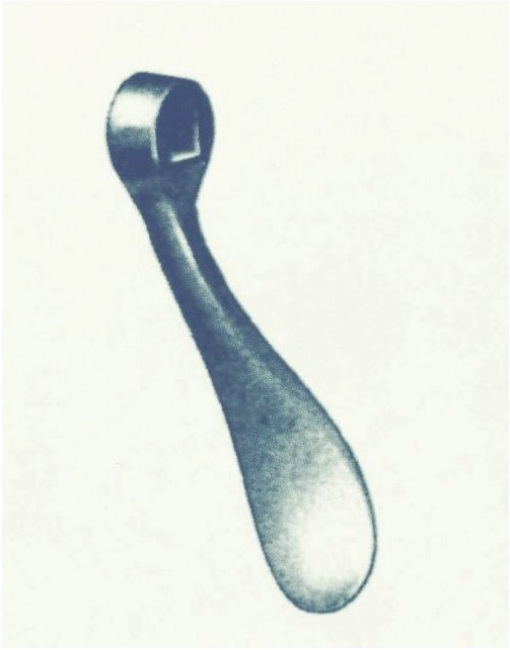

Figure 4 Still shot from Jasper Morrison "World Without Words" slide show

Figure 5 Gareth Neal "Block 2: Side Table" (2007)

The themes highlighted in the *Thingness* exhibition were informed by the curators' interest in some of the designers' notable *sensibility* to the materiality of things. Richmond and Tsutsumi observed that in the culture of designers and makers, "there appears to be a cyclical nature in this producing, and receiving from things" (Richmond & Tsutsumi 2011, p. 3).

The exhibition included the works of five artists/designers: Neil Brownsword (Figure 1); David Clarke (Figure 2); Michael Marriott (Figure 3); Jasper Morrison (Figure 4) and Gareth Neal (Figure 5). The works, in a variety of media (an installation of design objects of various origin; furniture; a group of small sculptural metal work; an installation of ceramics objects and a slideshow) were chosen for the characteristics and themes they appeared to share, enabling them to "speak" of the way the designers/makers engage with their cultures and environments through material characteristics of things. The exhibitors were also asked to answer this question: *What makes your objects speak?* The metal work artist David Clarke replied:

> For me the objects speak when we have a familiarity with them, we recognise them; my objects all have an element from the everyday. They trigger old stories, experiences and situations. For me there has to have an 'entry point' or a way to access the object visually something we can connect to… it reminds of something or other. Now we are talking! (Richmond & Tsutsumi 2011, p. 7)

For the *Thingness* exhibition, the designer Michael Marriott reproduced an edited version of his installation *Mies Meets Marx / MMM*, which was first held at The Geffrye Museum, London in 2002. The work consists of objects Marriott has designed, made, borrowed, bought and collected, all of which, as a collection, speak of Marriott's view and experience of what modern design is about, through their material presence

supplemented by the anecdotes that accompanied each exhibited object. Marriott wrote:

> If my objects speak, I think it is more likely a whisper or a hum. I aspire to make objects that have a feeling of familiarity, and are therefore quiet. On the whole I'm not so interested in objects that shout, it seems like there's too much shouting going on in this world. (Richmond & Tsutsumi 2011, p. 11)

Clarke and Marriott's commentaries suggest that the "sense of familiarity" – mentioned by both of them – plays a key role in evoking or facilitating the "unfolding" of the stories the objects potentially embody in the minds of the viewers. In the works of Gareth Neal and Neil Brownsword, the makers' "closeness" to the materials and processes used in the creation of their objects is reminiscent of the strong allure of their works. The strong physical presence of Neal's "Block 2: Side Table" derives from the characteristics of the timber (oak) that is visible in its volume and its crumbling edges, along with a physical trace of the labour – a repetitive action of the cutting of grooves. It was a result of the spontaneous idea that Neal had when he saw beauty in the pile of push sticks that was lying about in his workshop. He appropriately spotted the appealing quality in the now useless pile of push sticks that later formed the basis of the identity for the Block series. Neil Brownsword's *SY series* holds another layer: the history of a place, which is synonymous to the now declining ceramics industry in Stoke-on-Trent where the artist grew up and trained. The work *SY series* is an installation of a collection of ceramic pieces consisting of remnants of ceramics factory debris the artist had found and altered. The pieces in the installation are mostly abstract in form; however, all seem strangely familiar, as they still possess the charm of the objects that were once produced in those factories that decorated and served functions in many homes. David Whiting wrote of Brownsword's work:

> Rarely has the oozing, coagulating, brittle detritus of clay, re-formed and re-fired into another state of permanence, been so intelligently and eloquently expressed. Nor has the history of ceramic manufacture in one place been so elegiacally and poignantly recorded. (2008)

The designer Jasper Morrison often writes reflective and observant commentaries about everyday objects that embody his design principles and inspirations (Morrison 2006; Fukasawa & Morrison 2008). Morrison's slideshow *A World Without Words*, which was shown in the exhibition, consisted of collected images that, according to Morrison, "made an impression" (Morrison 2002, p. 74). The slideshow, Morrison has put together as an alternative to a lecture, consisted of a mixture of images that in a way *spoke* of principles in nature and the man-made world, as well as humour that "celebrates human inventiveness with materials and structures resulting in the utility of things" (Richmond & Tsutsumi 2011, p. 3).

The collection of works in the *Thingness* exhibition revealed a pattern, which is a combination between nature's principles that are manifested in the ways materials and structures work, and the variety of narratives that are communicated through them. As both Marriott and Morrison have explained, the kinds of objects they tend to respond to – which to some extent forms their design ideals – are "quiet" but have a lot to offer in a subtle but profound manner. Their observation suggests the characteristics of objects at work relating to Miller's observation of the quiet but striking capacities that engage with our psyche:

> That objects are important, not because they are evident and physically constrain or enable, but quite the opposite. It is often precisely because we do not see them. The less we are aware of them, the more powerfully they can determine our expectations, by setting the scene and ensuring appropriate behaviour. … They determine what takes place to the extent that we are unconscious of their capacity to do so. (Miller 2010, p. 50)

The exhibition *Thingness* presented different methods of telling the narrative, while demonstrating the exhibited works' striking capacity to engage with its viewers. Identifying this engaging capacity of material things with Heidegger's notion of *thingness*, as well as the origin of work of art, the paper further explores its source and workings.

Heidegger's thingness

The title of the exhibition *Thingness* refers to the term Heidegger used in his speculation on the nature of the thing in his book *What is a Thing*? (1967). Heidegger described *thingness* as "what makes the thing a thing … what conditions the thing" (1967, p. 8-9). It resonated with the *Thingness* exhibition curators' view on the mediating role that materiality plays in the human perception of the world, in the context of making and experiencing the world of man-made objects. The *Thingness* exhibition, and the dialogues with the participating designers/makers, explored and reflected on "how the making of an object affords it 'a voice'" (Richmond & Tsutsumi 2011, p. 3). The works in the *Thingness* presented the potential role that the "materiality" of objects plays in the experience of the maker of objects. How then can we talk about *thingness* in our own terms in the context of design? If we were to identify this "voice", or the "engaging capacity" of objects as it is interpreted in this paper, with the notions of the "essence" or the "presence" of things, we could then refer to many of the attempts that have been made to explicate the "essence" of art objects, in an effort to reveal its origin and the making as well as the workings of its effect, such as Benjamin's "aura" (1999), Heidegger's "thingness", the "essence" and "the actuality of the work" (1967; 1978).

The author's ongoing research focuses on the nature of this *engaging capacity* of things in relation to the objects' material being, in the hope of encouraging design practitioners to actively reflect on the production and consumption of the "essence" of things that are firmly anchored in the materiality of the objects they produce. The research suggests that the further understanding of how designers could possibly bring closer together the material aspect of the object they produce and its meaning is crucial to the development of works that facilitate a stronger bond between the object and the user. Verbeek and Kockelkoren advocated in *Eternally Yours: Visions on product endurance* for product longevity: "things should direct attention towards themselves instead of just being a material embodiment of meaning" (1997, p. 105). Their remarks resonate in the question Heidegger posed about the origin of "the self-evident" essence of the artwork in *The Origin of the Work of Art*:

> …even the much-vaunted aesthetic experience cannot get around the thingly aspect of the artwork. There is something stony in a work of architecture, wooden in a carving, colored in a painting, spoken in a linguistic work, sonorous in a musical composition. The thingly element is so irremovably present in the artwork that we are compelled rather to say conversely that the architectural work is in stone, the carving is in wood, the paining in color, the linguistic work in speech, the musical

> composition is in sound. …what is this self-evident thingly element in the work of art? (Heidegger 1978, p. 91)

This "self-evident thingly element" in the work of art, Heidegger proposed, is not just a list of material characteristics of object:

> …artwork is something else over and above the thingly element. This something else in the work constitutes its artistic nature. The artwork is, to be sure, a thing that is made, but it says something other than what the mere thing itself is… (Heidegger 1978, p. 91)

Zumthor also wrote of the "self-evident" qualities in buildings in relation to the beauty of things, as well as identified it with the origin of the presence of things:

> As long as I can remember, I have always experienced the beauty of an artifact, an object created by man as a special presence of form, a self-evident and self-confident hereness that is intrinsic to the object. (2006b, p. 75)

In *Thing Theory*, Bill Brown also discussed the nature of *thingness* and how things assert their presence in a very physical manner only when we encounter them in a bodily way, by quoting Leo Stein's words that "things are what we encounter, ideas are what we project" (Brown 2009, p. 140). Here another question arises: does Heidegger's speculation on *thingness* suggest a solution to reconcile the gap between the actual experience of things and their meaning? Is this a question that concerns the design practice? For us makers and designers, it is something we tacitly "know" – that this reconciliation is possible – from our experience in working with the very physicality of things while simultaneously working with more abstract thoughts, visions and principles.

Objects as Experience

The research points to the importance of the ability to attune to the material aspect of the work as physical manifestations of actions – the making and thinking of the designer/maker. In this way, the objects are not simply representative of something else. In contrast, John Dewey observed, in what he calls expressive objects, that:

> There are other meanings that present themselves directly as possessions of objects which are experienced. Here there is no need for a code or convention of interpretation; the meaning is as inherent in immediate experience... (Dewey 2005, p. 87)

These meanings, which make the experience of things appear so immediate, are perhaps close to Heidegger's notion of thingness. Here it can be suggested that the materiality of things affords the object to act as an agent that facilitates such an immediate and engaging experience. Heidegger argued that the origin of the artwork is the artist himself. In this way, material things could embody meanings and experiential knowledge, which can then be unfolded in the mind of the viewer. Heidegger wrote "…the work essentially unfolds as something in which truth is at work and because truth essentially unfolds only by installing itself within a particular being" (1978, p. 125).

This work-in-progress research suggests that there is an inherent link between the designer's intuitive understanding of the world – a cognitive ability – through the materiality of things, and the experience of objects. It also points towards the need for

further investigation into how principles and meanings could manifest in material objects, and how such a manifestation is linked with the act of thinking and making. Andrew Harrison, in his book *Making and Thinking*, advocated that human intellect and rationality can be witnessed as much in the human's trait as a tool-maker, as in the practice of speaking or writing: "the idea of a maker of things, a tool-user, plays at least as central a role as the idea of a talker or writer" (Harrison 1978, p. 3). As Heidegger (1976) wrote that thinking is *handiwork* "something like building a cabinet" and that it is as tactile as the actual work made, then can the opposite be said about making insofar that it plays a similar role in the act of thinking?

Conclusion

Heidegger argued that the origin of the artwork is the artist himself (1978). In this way, material things can embody meanings and experiential knowledge, which can be unfolded in the mind of the viewer. As Heidegger wrote, "…the work essentially unfolds as something in which truth is at work and because truth essentially unfolds only by installing itself within a particular being" (Heidegger 1978, p. 125).

This paper proposes that being "materially attuned" enables the designer to access tacit and experiential knowledge that is embodied and manifested in material things that afford the work a voice; an engaging quality. The sensitivity to the manifestations of the rules and actions in the man-made world is a vital trait for design practitioners; as it is often how the real problems and issues around the production and consumption of objects manifest in our lived environment.

Materiality tells us of the contexts of how things come into being, and lets us experience that context in a more immediate sense. With the aid of objects and contextual understanding of how things come to embody meanings and experiences – a theory of things – it may help us provide better insight into the nature of the human relationship to material things. The paper proposed that materiality beyond the terms of form, aesthetics and functionality must be taken into account in the context of design in order to have a better insight into contextual understanding of the subject as well as the human-object relationship. Boradkar wrote that "in order to design products that are meaningful to people it is pertinent to see them as culturally produced items rather than as expressions of form and function" (2006, p. 12). If we look at man-made objects as a material manifestation of culture and human conditions, an unfolding of the "making of" could become a vital learning tool. From this perspective, paying close attention to the materiality of things has the potential to facilitate context-based learning.

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Listening design: a new methodology for design and innovation processes

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Abstract: *The aim of the paper is to describe a design methodology in the area of innovation design highlighting the importance of sharing strategies, methods and listening practices to be implemented at specific stages in the project's development. The ability of creative systems to generate product or process innovation and to integrate creativity and know-how in the products is the necessary condition to promote design activities and the following competitive dynamics able to meet the needs of the ever-changing world of consumption. The presence of universities, defined as "engines of innovation" (Florida et al. 2002), in complex production territories can establish close links between local development and intellectual capital and generate innovation processes. The interaction of and exchange between different competencies (universities, enterprises, institutions, users) makes up the environment where to formulate, share, design and test the demand for research-led innovation. Starting from the Design Thinking approach, the paper puts forward a methodology for the development of activities that may generate innovation, giving a crucial role to the "open listening" stage meant as the experimentation of an open, equal listening model provided with specific tools.*

Keywords: Innovation design, knowledge-intensive, creative ecosystem.

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Introduction

In the current economic framework, the crisis of production models has brought to light the need to implement design-led innovation processes to increase their competitiveness in the global system. A few years have passed since Richard Florida related the development of territories with the intellectual capital, namely the role of universities as innovation engines for local development. Universities, in collaboration with public and private bodies, are able to educate creative talents, trigger cultural contaminations and set up complex systems of relations between research and production.

Thanks to its intrinsic critical ability with respect to everyday objects and actions, design is able to feed radical innovations into the world of consumption and thus inform innovation strategies in different fields. Actions in the disciplinary area of design at various levels do not only direct the companies' demand for innovation and the manufacturing of new, material and immaterial products: they also spread values that affect lifestyles in the society. Movements like the Massive Change Network (M.C.N.) promoted by Bruce Mau tend to suggest the evolution of design into a discipline that is not only able to design objects, but also educate society to identify creative solutions that can have an impact on the future development of consumption, on the society and on the evolution of the world at large.

The aim of the M.C.N., whose programme reads "It's not about the world of design. It's about design of the world", is to investigate and implement the potential of design in improving the wellbeing of humanity. Design is able to lead towards new economic perspectives, where a crucial role is played by the human and relational capital. We are living in the age of "cognitive surplus", where design, viewed as *an emerging, vital force, able to collect a de-localised, fragmented knowledge and aggregate it into something big and new* (Shirky 2010), has the opportunity to catch and exploit the new connection potential, and to devise new models for innovation through complex, diffuse actions.

A design project aims to construct creative ecosystems and, not only does it *investigate our global abilities, it also develops an informed outlook on our limitations (…) reflecting on the utopian and dystopian capacities of the emerging world, where even nature is no longer safe from our manipulation capacity* (Mau 2012*)*.

By now design is able to affect and transform every aspect of everyday life – a potential of which the public is gradually becoming aware.

Several sectors are leaving behind the idea that design is a mere device linked to consumption practices and a "formal way" to construct marketing-driven, attractive objects. This interpretation, which limits design to the world of objects, has been overcome by an idea of design as a "style of thought" rather than as a mere tool to make objects more attractive, developing usage modes that improve peoples' lives and design choices connected to marketing strategies.

In this line of thought Tim Brown describes the diffuse action of design through the *Design Thinking* method, which draws on Roger Martin's theory of "integrative thinking", characterised by the ability to exploit "opposing ideas" and "opposing limits" to devise new solutions able to balance attractiveness with people's actual needs, and technical feasibility with economic value.

Based on the approach of Design Thinking, the present research develops a methodology to devise design processes able to generate innovation, identifying

specific stages in which to experiment with a model of open, equal listening and to use specific tools.
The collaboration between the IDEAS Department of the Second University of Naples and the enterprises operating in Campania in the knowledge-intensive fashion- and design-oriented sectors, is the environment in which to experiment with innovation-led design processes. Based on these premises the *IXDI – Ideology for design and innovation Lab* set up by the IDEAS Department with API – Association of SMEs in the province of Naples, experiments with a Listening Design creative model aiming at supporting, exchanging and promoting shared innovation processes. The Lab's specific goal is the construction of an ecosystem attracting different competences to develop projects in collaboration with the enterprises, which are involved in defining the "demand for innovation" that is at the source of the whole design process. The crucial element generating the need to implement the method consists in contrasting the deep-rooted resistance of enterprises and the market to invest in innovation-intensive projects.

Creative and methodological approaches to guide innovation processes

Numerous works in the literature describe methodologies aiming at organising the design and process stages involved in generating innovation. These include the *Design Thinking* approach – the methodology that has generated most of the often contrasting reflections on the role of design in innovation processes.

The *Design Thinking* approach is based on a social creative process that can generate a diffuse participation in the design process by using individual abilities to construct new visions interpreting the social and economic transformations of contemporary society and to enable enterprises to introduce process and product innovations.
Design Thinking views design as a strategic tool for change. Its purpose is to solve different problems, such as the analysis of climate change, the setting out of new norms for education, the management of public health or safety - applications which provide a new context for design, providing it with an ethical and social role that extends its field of action from commodities to behaviours.
As well as the creative process, the present research analyses the role of the designer, who can bring together social, economic and productive aspects in setting up innovation processes, and the role of users, who contribute to the project with their own competencies. The main drive for the creative process is a view of the person as a subject able to bring together technology and economy and to produce innovation.
There is no general agreement over the effectiveness of the method. There are no doubts, however, about the crucial role the *Design Thinking* approach plays in spreading certain research areas of design, like humanistic and social design, where the subjects involved in the creative process are able to bring to the surface a demand for innovation and to take part in the creative process as a group related to a specific need of change.
Helen Walter, innovation and design manager of the Bloomberg Business Week until 2010, claims that *Design Thinking* is a fundamental tool for the creative industries where relational and communication dynamics make the sharing of complex, diverse knowledge more effective.
Conversely, while recognising the role of the *Design Thinking* approach in the development of innovation dynamics, Bruce Nussbaum believes that the method has

not brought about any real change in the shift from creative theory to the application stage in industrial processes. *"But in order to appeal to the business culture of process, it was denuded of the mess, the conflict, failure, emotions, and looping circularity that is part and parcel of the creative process."* (Nussbaum, B. 2011).

The importance of sharing know-how is recognised, however, in a design area where the interaction between different disciplines generates innovative solutions to meet the demand of consumers, who are more and more actively involved in the creative process. The interaction thus produces a social phenomenon based on the spreading of individual abilities by their sharing with the community, which generates what is described as Creative Intelligence or CQ (Nussbaum, B. 2011).

> I am defining Creative Intelligence as the ability to frame problems in new ways and to make original solutions. You can have a low or high ability to frame and solve problems, but these two capacities are key and they can be learned. I place CQ within the intellectual space of gaming, scenario planning, systems thinking and, of course, design thinking. It is a sociological approach in which creativity emerges from group activity, not a psychological approach of development stages and individual genius" (Nussbaum, B. 2011).

With regard to these aspects, it is useful to analyse the potential created by the sharing of knowledge that develops in collaborative communities, where the user plays a key role in generating innovation: user-to-user cooperation and user-to-communities interaction take place thanks to open source software that is accessible to all users. Von Hippel highlights the existence of numerous communities of innovation of lead users, in which selective access makes it possible to analyse the users' specific needs and outline scenarios for the creation of new products.
Unlike Eric Von Hippel's theory of Open Innovation, which analyses the user's creative participation modes imagining a virtual space where to find needs, insights and ideas, Tim Brown devises a creative methodology through which individuals can take part in the creative process and use their own capacities even when designers are not involved. This method, which apparently excludes design from creative processes, in fact strengthens the discipline if it is meant as a science whose purpose is to organise and improve the creative activities of individuals. The primary aim of design actions is not consumption, but exploring the participatory potential of the community, who view *human needs as the starting point, the prototype and vehicle for progress* (Brown 2009). With respect to this, there are several experiences concerning "creative communities", "production collectivism" and "associations of interest" for generative exchange, design experiments to solve social problems, which have turned collaboration into an art or a job requiring people's ability to comprehend and respond to the others emotionally in order to act together (Sennet 2012).
The interaction between creative communities and real needs, between people and objects, makes it possible to transform a passive activity – between product and consumer – into a collaboration between and among several subjects, a meaningful, productive experience leading to common, shared results. The relationship between an object and a person is brought forward, as it also includes the design and manufacturing stages of a commodity, thus extending its experienced lifecycle and increasing its affective value.

The evolution of design-oriented methodologies investigating design and creativity clearly shows that the design process to follow has changed dramatically, while the steps needed to develop innovation processes have become more complex and of an

indefinite number, and are not consequential. Therefore they are considered as a set of creative possibilities rather than a pre-set sequence of stages.
Three macro areas can be identified that investigate ways to achieve innovation processes, namely the methodologies aiming at developing *creative processes*, *design processes* and *optimisation processes*.

The first macro area, *creative processes*, refers to those methods describing the process by which to give life to an idea, e.g. E. De Bono's theory on "lateral thinking"1.

The second macro area, *design processes*, concerns design-driven innovations, which entail not only the realisation of an idea, but also experimenting and prototyping to achieve the end product, according to the methodology described in B. Munari's text "Da cosa nasce cosa"2.
Finally, the third macro area, *optimisation processes*, regards the methodologies aiming at solving particular design and process problems that tend to analyse specific stages in a company's development with a view to optimising its results. One example is the Life Cycle Assessment method assesses the environmental and potential effects of a product, a process or activity by analysing the life cycle and functional units making up the material or immaterial product.
These three areas, which over their development have taken different – sometimes parallel, cross-cutting or overlapping – ways, are currently hybridised by means of methodologies that bring together creative elements and technical data, and that are supported by accessible, complex tools able to spread "production collectivism". These methods merging creativity, design and innovation are defined as tools for *design-oriented innovation*.

Creativity is a crucial feature of design and innovation, and is meant as an aptitude for the creative organisation of thinking and *the ability to see new, original contexts which are difficult to infer through logics alone* (Pfenninger, Skubik 2001), and can hardly be entrapped in static methodologies envisaging univocal solutions to problems.
Today the awareness has been reached that methodologies are able to extend the perimeter around a problem (Brown 2009) by analysing several elements that increase the possibilities of finding innovative solutions. This awareness is in line with J.P. Guilford's theory of "divergent thinking" as the ability to produce a range of possible solutions to a given problem, namely for a problem that does not envisage one correct answer only. What changes in trying to obtain multiple interpretations is not the design method, but the competencies involved; *instead of solving the problem on one's own, in the case of a large project it will be necessary to increase the number of experts and*

[1] The theory of "lateral thinking", born out of the merging of three research areas (thinking, creative thinking and self-organised systems) within cognitive sciences, describes a non-linear, non-sequential and non-logical type of thinking opposed to "vertical thinking" which is characterised by a sequential, ordered trend instead. The Oxford English Dictionary describes it as follows: << the solving of problems by an indirect and creative approach, typically through viewing the problem in a new and unusual light >>. Through lateral thinking E. De Bono highlights the need to look for different approaches and a different way to look at things through a lateral gaze which may distort the conditions of reality in a creative way.

[2] Bruno Munari claims that "designing is easy when you know how to do it. Everything becomes easy when you know how to proceed to reach the solution of a problem". Starting from this idea he develops a methodology that deals with all the stages within a canonical design-driven project. In particular, B. Munari compares the development of a project to the preparation of a dish – green rice – observing that to create a good dish it is necessary to follow the recipe carefully. In design the recipe is the method, which starts from a definition of the "problem" and ends with its solution.

collaborators as well as to adapt the method to the new situation (Munari 1996). It's not surprising that the idea of "hybridisation of knowledge" is spreading within innovation design, based on the merging of multiple competencies collaborating in a multidisciplinary environment to identify innovative opportunities for businesses.
In order to produce innovation in the context of design disciplines it is of the utmost importance to identify professionals, institutions and companies willing to exchange competences, experimenting with new production systems in which each and every actor acts as a "fertiliser" of knowledge, sharing his or her expertise with all the members of the network. Such "fertilisation", viewed as the set of practices making it possible to increase productivity among several subjects, increases the awareness of the subjects involved in the system while multiplying the opportunities to create "diffuse" innovative projects, that is to say projects resulting from the combination of several production capacities. The spreading of competences and needs across a research group triggers a process of mutual growth leading to the creation of "total projects", which are generated and shared by all the members.

This scientific approach reflects Rullani's idea of innovation, which he describes in the text "*Innovare*": the progress producing innovation can only be achieved by spreading the spectrum of intelligence to the many cognitive subjects, belonging to different places and cultures, which contribute to creating proto-innovations on which innovations with latent qualities are constructed. This consideration encourages businesses to focus on a "knowledge-based economy" and to invest mainly in the relational and intellectual capital of the subjects involved in the design and production stages.

Listening design methodology

A creative and innovative design approach

Listening Design is an open, equal design methodology aiming at leading enterprises towards expressing the demand for innovation. Recent research in the field of design shows that innovation does no longer originate from individual subjects but from "dialogic collaborations" (Sennett, R. 2012) based on the ability to bring together several competences. The aim of the methodology is to set up a creative ecosystem including designers, researchers, companies, users and local resources in order to connect competences which may, together, produce innovation.

The practices and tools of Listening Design include 'collective' and 'connective' intelligence in all the stages of the innovation process to guarantee a rich and complex interaction.
Listening Design starts from the *Design Thinking* approach and identifies a variety of actions to implement open, careful and analytical practices.
This makes up the conditions to take the creative, productive and economic opportunities offered by the local ecosystems.
In order to involve a greater number of people around a piece of innovation the project must be transformed into an effective message. Telling a story is the most successful way to catch people's attention. To increase its effectiveness, this activity of storytelling – a consolidated practice of development in the *Design Thinking* approach – must adopt the technique of "dialogic exchange" introduced by Sennet, who stresses not only the importance of technique and of the gift of synthesis needed by someone who delivers a speech, but also the equally important skill of the listeners to "follow and

interpret in detail what the others say before responding, understanding the speaker's gestures and silent pauses alongside statements"(Sennet 2012, p. 25.). Silence sometimes hides undeclared intentions, which are not explicitly stated by the speaker: in this case a good listener – says Theodore Zeldin – can identify a common ground in what the speaker assumes rather than in what he or she actually says (Zeldin 1998, p. 87). This is the "dialogical principle" introduced by Michail Bachtin with reference to a type of communication that is not resolved in finding a common ground but in triggering a research process that introduces new discourses to be shared. Even more than generate invention and novelty, to innovate means being able to read, catch and bring to light competences.

There is a need to create a new model using the principle of empathy meant as the "ability to understand" (Mead, G.H. 1934) the other in an open, collaborative way, spreading culture and knowledge. "Empathy is the social glue that allows increasingly individualized and diverse populations to forge bonds of solidarity across broader domains so that society can cohere as a whole" (Rifkin, J. 2010).

To spread empathy it is necessary to listen carefully and to catch all the signals this listening provides us with. The next real innovation will lie in the ability of each and every one of us to listen and to collaborate "together".

Stages of the methodology

The Listening Design methodology is structured along different stages Open listening, Cross Research and Open Concept. Open listening is the listening stage, with specific actions and tools, and is the central element of the methodology.

It is crucial to identify the creative ecosystem which generates a framework of relations contributing to defining the information needed to construct the area in which the demand for innovation is shaped.

The main actors in the creative ecosystem are the researchers, designers and companies that are constantly involved in the innovation process, in which they play an active role; users, instead, only collaborate in a more random manner contributing their competences, aptitudes and interests to the project evolution. The approach is based on the participants' skills, which make up the immaterial creative tools. The system of tools includes both individual and collective creative skills as well as connections between "connective" and "collective" intelligences. Once the ecosystem has been set up and the instruments have been identified, the research group arranges workshops in which to host interactions and exchange of knowledge and expertise. The exchange between the subjects involved in the process is documented by short notes making up the Posting stage. These notes are supported by audiovisual materials that record the contents simplifying the traditional activity of reporting, with the aim of enhancing mutual understanding between and among all the members of the research group. The products resulting from the Posting stage are taken to the following analysis stage – Sharing and Fixing, which selects, mixes and re-generates data by means of the *Open Method of Coordination* approach.

The *Method of Coordination* aims at promoting mutual learning with the largest involvement of actors possible, and at giving fresh energy to an approach oriented to sharing common challenges. The activities focus on cross-cutting issues, establishing a horizontal coordination through inter-group meetings for an integration of competencies. The aims of the meetings are the following: promoting cohesion between and among actors, equality between sectors and specific competences and

equal opportunities for all through appropriate, accessible, adaptable and efficient systems of involvement in the creative process.

During the Sharing and Fixing stage evaluation criteria are devised to calculate the degree of effectiveness and efficacy of the meetings. These criteria aim at evaluating the impact of the themes discussed in the workshop meetings and, consequently, at defining their innovation potential. After being shared with all the research group members, these results contribute to the production of Listening Prototypes coming in the form of documents, maps, drawings and 3D prototypes, which are made available to the users for any additions.

The Open Listening methodology views the designer as an informed, careful and creative listener, who processes the assumptions described by the speaker and makes them explicit in new design visions, developing innovation.

The following stage of the creative process – Cross Research – brings together the scientific competences of different disciplines with those of the users, generating advanced visions which define the environment in which to develop the innovation process. The disciplines involved, such as design, technology, marketing and sociology, are fundamental to build the scenario. More disciplines are added to these depending on the type of project being developed. The contributions produced at this stage are collected in a document called Vision prototype, to be shared with the whole group so that everyone may be informed about the scenario in which the product of innovation will be integrated. The last stage aiming at the development of the concepts, Open Concept, is based on the principles of co-design with the users. After defining a number of Concepts, the group of designers, together with the firm, moves on to produce a synthesis of the proposals to reach a single solution in which to invest all the resources of the creative ecosystem. Unlike other methods, Listening Design does not use the fuzzy component in the first part of the process alone; on the contrary, it extends it to the whole process, stressing the importance of unexpected elements called "Noise" factors. In scientific and theoretic language Noise is defined as a perturbation of the normal trend of a phenomenon (Treccani.it) that produces unexpected effects.

All the stages of the methodology can be adapted to the changes generated by the *interfering factor*, "Noise", meant as un unexpected element that is able to affect the project's development. These variables act in an environment which is sensitive to intuition, called White Room, which is guided by the creativity generating variations within the Listening Design methodology. Figure 1 and 2.

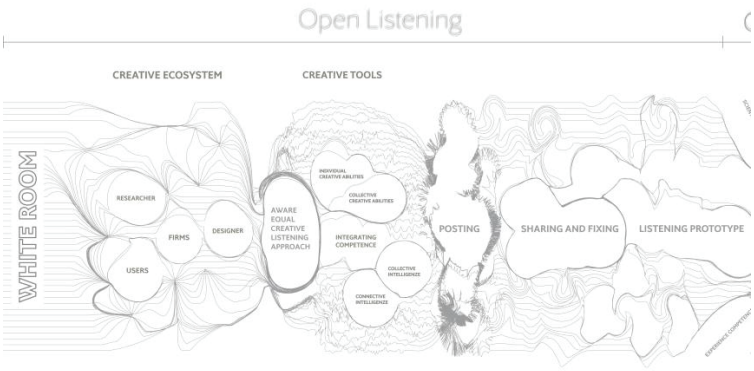

***Figure 1**. Listening Design Map: open listening, first phase of the methods.*

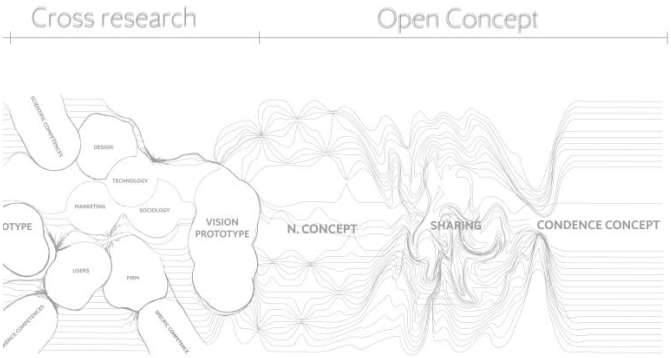

Figure 2. Listening Design Map: cross research and open concept, second and third phase of the methods.

Conclusion

The research explores new ways for the construction of a creative and innovative methodology with the aim of leading enterprises towards defining the demand for innovation and generating constant innovation processes through an open and equal listening process between the various actors involved.

The IDEAS Department of the Second University of Naples experiments with the methodology by developing innovation-led design processes with the aim of promoting the excellences of Campania and spread best practices in design-oriented production and design.

The testing of the model was started in collaboration with the API Association of Naples, that manages the network of local enterprises: they contributed to shaping the creative ecosystem by selecting companies in the agrifood, pottery, yacht design, fashion and product design sectors on the basis of qualitative criteria.

The activity resulted in the increase and empowering of the system's intelligence through a transfer of the idea of participation to the companies operating locally, which make up the texture of competences through which to test innovation products.

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Research informed design education – Design education informing research

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Versioning: full-scale prototyping as a prototype for design education?

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Abstract: This paper discusses the development of an emergency shelter that can be inexpensively mass-produced and rapidly deployed to disaster relief sites. A seeming simple project wrapped in multiple shrouds of complexity, the project demanded that we not only design an object, but also devise the process for its production, determine how it would be constructed and sourced, identify the most efficient assembly sequence, and outline a strategy for the shelters' distribution. The authors saw this project with its equal emphasis on design, assembly and production as the perfect opportunity to apply the concept of versioning, a strategy that borrows heavily from the disciplines of industrial and packaging design. Versioning utilizes digital tools to combine form finding, the assemblage of materials and the means of fabrication in a single feedback loop that informs multiple iterations. Similar to rapid prototyping, versioning moves the design process towards a system of vertical integration whereby the designers drive how space is both conceived and constructed. This paper discusses the methodology of versioning and positions it within the larger concept of design intelligence. It then looks at it's application to the design and fabrication of four generations of prototypes used to develop a flat pack emergency shelter. Finally, the authors speculate as to whether this methodology can be expanded into a pedagogical model for interdisciplinary design studios for architects and engineers focused on small, community-based, design-build projects.

Keywords: Collaboration, construction, design, design build, fabrication, pedagogy, public engagement

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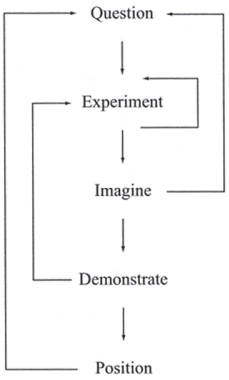

Figure 1. This diagram captures the non-linear process and feedback loop used by innovative designers who employ design intelligence. (Benjamin and Yang, 2006, p. 12).

Introduction

In 2009 the authors of this paper (an architect and a structural engineer) were presented with a grant-supported project to develop the prototype for an emergency shelter that could be mass-produced and rapidly deployed to disaster relief sites. We quickly found that this deceptively complex project presented several challenges: 1) The scale of the shelter was closer to product design than architectural design thus requiring a different way of thinking than the traditional design and delivery method; 2) Due to the emphasis on lightness and simple erection, conventional materials and methods of construction common to architecture and engineering were largely irrelevant; 3) Given the project's emphasis on large-scale production and rapid-deployment, aesthetics were secondary to the shelter's production, an efficient assembly sequence, and a strategy for the shelters' sourcing and distribution.

The authors saw an opportunity in this unique project to employ the strategy of versioning, a methodology that leverages technology to expand the possibilities of design through iterative prototyping and experimentation. As approximated in the diagram in Figure 1, our approach to the shelter's design was tested with successive prototypes, and each generation not only informed new prototypes but also clarified our research position. At the onset of the project we began prototyping in full-scale using real materials for the first time. Many of the materials used for prototyping were outside the normal palette used in architecture and shaped using digital tools which required a skill set we didn't possess. A considerable amount of our time was spent consulting with material engineers, product engineers, packaging designers and cowboys. At the outset of the project we realized that we were pushed well beyond our limits as architects and engineers, and this resulted in immeasurable growth as designers. This raised an obvious question: if versioning was a catalyst for design growth in our research pursuits on the emergency shelter, could a similar methodology be a pedagogical platform for interdisciplinary design education?

The context of versioning

Design intelligence

In the early 2000s discussions surrounding architecture began to subtly shift from what was being designed by 20th century vanguard architects towards how 21st century post-vanguard practices implemented their projects. Observing the shift at the time, Michael Speaks wrote, “If philosophy was the intellectual dominant of early 20th century vanguards and theory the intellectual dominant of the late 20th century vanguards, then intelligence has become the intellectual dominant of 21st century post-vanguards. While vanguard practices are reliant on ideas, theories and concepts, opportunities for innovation that cannot be predicted by any idea, theory or concept.” (Speaks, 2002).

The intelligence and innovation that differentiated the post-vanguards from the vanguards were not in the traditional realms of theory or concepts, but in the realm of materials and construction, realms that had been ceded by architects to specialists in separate fields. The depth of the problem was noted by Kieran and Timberlake who write, “The single most devastating consequence of modernism has been the embrace of a process that segregates designers from makers: the architect has been separated from the contractor, and the materials scientist has been isolated from the product engineer.” (Kieran and Timberlake, 2004). The post-vanguard practices engaged technology, specifically parametric modelling and digital fabrication, and used it to integrate design with construction, thus becoming active collaborators in the entire process of architectural realization.

The term that Speaks coined to characterize the operative attitude of this new crop of architects was design intelligence. Speaks writes, “Design practices with high design intelligence quotients are able to manipulate the problem given to search for opportunities that can be exploited, thus allowing for a greater degree of innovation. Such practices also view design as dynamic and non-linear, and not as a process with a beginning, middle and end. Accordingly, the relationship between thinking and doing becomes more and more blurred so that thinking becomes doing and doing becomes thinking, engendering highly collaborative, interactive forms of practice that are already changing the face of architecture” (Speaks, 2002).

From horizontal to vertical integration

The methodology that Speaks refers to, i.e. a non-linear process that incorporates testing to create a feedback loop, has long been the cornerstone of many design disciplines, particularly those that develop prototypes prior to high-yield production such as product design or packaging design. More recently, a shift by architects to a similar methodology has begun to drive innovation and, in turn, design intelligence. This methodology, called versioning by some, is enabled by the adoption of new technologies that are moving the discipline from pixel-based representation to vector-based prototypes. Coren Sharples of SHoP Architects writes, “Versioning can be seen as an attitude rather than an ideology. It allows architects to think or practice across multiple disciplines, freely borrowing tactics from film, food, finance, fashion, economics and politics for use in design, or reversing the model and using architectural theory to participate in other problem-solving fields.” She continues, “Versioning implies the shifting of design away from a system of horizontal integration (designers as simply the generators of representational form) towards a system of vertical

Figure 2. In January 2010 a 7.0 M_w earthquake devastated Haiti. Three years later many families still live in makeshift tents

integration (designers driving how space is conceived and constructed and what its effects are culturally)" (Sharples, 2002).

The authors saw the emergency shelter project as the perfect opportunity to test the concept of versioning as a design/fabrication methodology. If successful, the forces that shape the shelter, the assemblage of materials, and the means of fabrication would be joined in a single feedback loop that would inform multiple iterations. Our hope was that the design intelligence gained from our form of versioning would propel the project into unforeseen directions.

The context of the project

Sheltering with an extended purpose

National and international headlines regularly point to the alarming frequency of natural disasters. Even a cursory glance at statistics compiled by international agencies reveals the extreme costs in human life and the enormous social and economic toll of these disasters. Recent data indicate that of the 245 disasters reported in 2009, 224 were weather related accounting for 55 million people affected, 7000 killed, and US$15 billion in economic damages. Worse yet, the frequency of natural disasters spiked dramatically in the 20th century, a trend that is likely to continue (www.unisdr.org). When considering how designers may address this grim situation, a number of areas present themselves: housing, food and water supply, infrastructure, etc. The combined expertise on our team led us to focus our effort on what is commonly referred to as sheltering, that is providing basic shelter for persons displaced due to the loss of their permanent housing.

As context, disaster officials, such as the Federal Emergency Management Agency in the United States (FEMA), view post-disaster housing in three ways: sheltering, interim housing and permanent housing. Sheltering refers to basic protection employed for short periods of time until the disaster subsides and the displaced population can return to their permanent dwellings. Interim housing refers to situations where permanent dwellings have been destroyed or rendered uninhabitable by serious disasters thereby necessitating temporary structures for displaced populations to occupy for extended periods (generally up to 18 months). Permanent housing refers to long-term structures used as permanent residences following natural disasters; these may be habitable or repairable existing structures that displaced populations return to, or may be replacement housing intended to take the place of structures rendered permanently uninhabitable (FEMA, 2008).

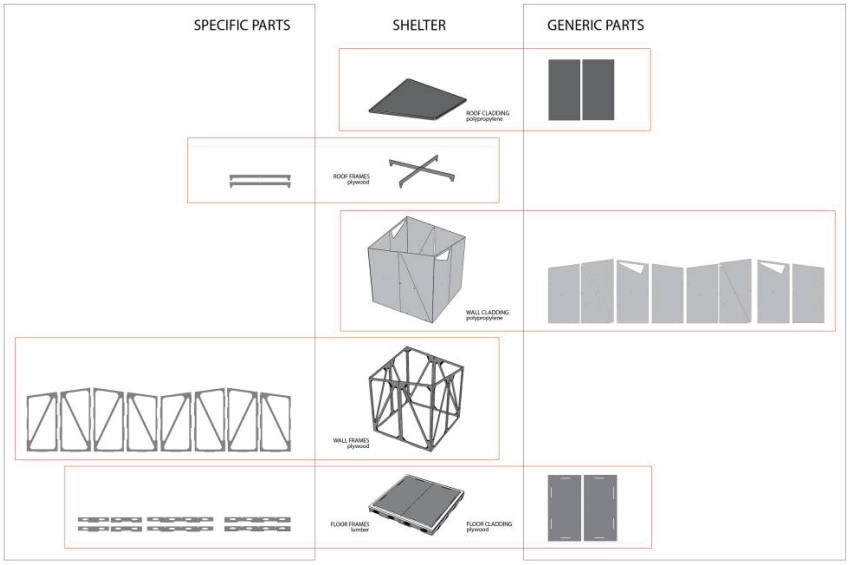

Figure 3. Our hybrid approach calls for a combination of specialized components of short-life materials (left), and generic components of durable materials (right).

Due to complex and overlapping factors, the line between these three types of housing is often indistinct. Major factors such as the severity of many disasters and the shortage of resources (funding, labor, materials, etc.) contribute to secondary factors such as extended clean-up periods and the inability to repair or replace existing housing stock. Consequently, sheltering constructed of temporary materials is soon pressed into service as interim housing inhabited for years not months, a period well beyond the length of its intended life. Worse yet, most sheltering, if forced to function as interim housing, reaches the end of its useful life before permanent housing can be provided (see Fig. 2). Although a greater challenge, we felt it was absolutely necessary to design a shelter that would address rather than ignore this troubling reality.

The project goals

The design team crafted the following set of six goals for the shelter design: efficiency, lightness, pack-ability, constructability, adaptability and re-usability. The first five address the short-term considerations of producing and providing a viable emergency shelter. The last goal, re-usability, was a response to the harsh reality of sheltering, namely that short-term shelters often become interim housing in settings where the resources to replace it with permanent housing are limited. In other words, unless temporary shelters can contribute to the future rebuilding effort in some measure, they are a solution of limited value.

Our design direction was to avoid highly specialized components of short-life materials where possible and include components of durable materials left in near-generic form. This hybrid approach called for a combination of short-life components that are easily recycled and more durable components that are easily repurposed as building materials for bona fide interim or replacement housing (see Fig. 3).

Figure 4. Version 1 (left) was built of composite material at half-scale; Version 2 (right) was explored at full-scale using wood products.

Versions of the shelter: prototyping at full-scale

Versions 1 & 2: Exploring materials and methods

Our initial version of the shelter was built at half-scale to study proportion, modularity and the viability of a composite material that had come to our attention. Sketches and a digital model were used to guide the construction of a prototype that explored the use of standardized composite elements configured into eight simple, diagonally-braced frame modules and joined together to at their edges to establish the body of the shelter (see Fig. 4, left). The frame, once established, could be clad with a range of materials; our initial test used inexpensive plastic sheeting. The composite material (which has not been extensively tested or used commercially) was selected for its potential as a strong and sustainable material with the promise of wide architectural application. Its matrix is comprised of polypropylene reclaimed from obsolete irrigation tubing used in agriculture and destined for the landfill. The fibers that lend the material its tensile strength are harvested from kenaf, an inexpensive and fast growing plant from the hemp family. Ultimately this material was determined to be too dense and heavy to meet our objectives of lightness and packability, but our testing added to the body of knowledge (design intelligence) on this interesting material that may eventually find its way into the architectural lexicon.

We began Prototype 2 with two major decisions informed by Prototype 1: we used lighter materials and tested our ideas at full-scale which we saw as the best way to gather valuable feedback regarding space, structure, materials, assembly, pack-ability and production. (see Fig. 4, right). Shifting our material choice away from the PP/kenaf composite to the use of plywood allowed us to work with a readily available material which had a similar strength profile but lighter weight. Since efficiency and constructability were two key project goals, the dimensional module of plywood in the US (48” x 96” x 0.625”) became a key formal and proportional determinant. Thus the shelter was designed as a roughly 96” x 96” x 96” spatial module, with the floor consisting of two 48” x 96” modules and each side panel (8 total) being a maximum size of 48” x 96”. To take advantage of digital design and fabrication capabilities, plywood panels were modelled using Rhinoceros software and cut using a computer numerically controlled (CNC) router with Rhinocam as the interface. The introduction of digital fabrication at this stage not only allowed our work to be more precise, it also allowed us to study possible high production methods that could be used to fabricate the

Figure 5. Versions 3 and 3x: simple to fabricate but difficult to build.

shelter components in bulk. Also tested in this prototype were floor designs that could also function as packing crates, friction joints requiring little or no hardware, and plastic or Tyvek sheeting used as cladding materials.

Version 3 & 3x: Optimizing the crate/floor and cladding

Our objectives for Prototypes 3 (single module) and 3x (double module) were to optimize the structural frame, explore cladding options and refine the design's details, especially those pertaining to the interlocking joints and the floor/crate clamshell. On the surface, the shelter's floor was the simplest component of the structure, but its dual role as floor and shipping crate made it a challenging design/fabrication problem. As a floor, it was required to meet live and dead load requirements. As a crate, it was required to accommodate stacking and lifting while also being able to resist torsion. Finally, it would need to meet these requirements while being light and efficient. Drawing on lessons from Prototypes 1 and 2, we added a substructure for stability and strength on Prototype 3, cut serrated edges using the CNC router to accommodate interlocking between top and bottom halves of the crate, and added holes to facilitate lifting, reduce weight and provide ventilation below the floor during use (see Fig. 5, right). On the topic of connections, full-scale prototyping and CNC technology allowed the team to refine the simplicity and effectiveness of the interlocking construction, thereby lowering the overall cost and weight of the shelter.

Having clad previous versions with plastic or Tyvek sheeting led to concerns about its durability and its contribution as bracing to the frame. On Prototype 3 we explored thin sheets of recycled corrugated polypropylene, a material that is light, strong, inexpensive and available in a range of translucencies.. Through prototyping we found that clear 4mm thick panels with scored openings for doors and windows worked well as wall cladding, while thicker panels of 6mm gray PP effectively braced the roof and reduced solar gain. The clear panels used for the walls transmitted ample, filtered daylight and the cavity construction provided a small amount of acoustic and thermal insulation.

Although the 4' x 8' material and spatial module worked nicely in terms of fabrication and construction, several nights spent in Prototype 3 (see Fig. 4, left) made it clear that a 56 square foot interior space was limiting. We modified it to become a double module (see Fig. 5, right), expanding the space to 112 square feet and calling the new generation Prototype 3x.

Figure 6. Version 5 of the shelter with optimized substructure and cladding.

Versions 4/4x & 5: Synthesis and further optimization

The design knowledge gained from the first three prototypes of the shelter led to sound approaches for several but not all aspects of design/fabrication. The modular plywood base performed well as a crate during shipping, as a floor during use, and as generic construction materials for use in future rebuilding efforts. The friction-fit connections, enabled by precise CNC fabrication, reduce reliance on hardware and tools, should be successful in simplifying field erection. The recycled corrugated polypropylene functions well as cladding since it is light, weather-resistant, inexpensive, durable and re-usable. The plywood superstructure used in Prototypes 2, 3 and 3x, however, was strong and durable to a fault; its lifespan would far exceed their use in a temporary structure. Since their specialized shape would most likely preclude their use in future rebuilding efforts, we determined that the wall frames should be built of lighter, less durable materials. The goal of the Prototypes 4 and 4x, then, was to focus on the optimization of the superstructure (wall frames and roof structure).

Even though packaging design had influenced our approach to the floor/shipping crate, we looked even more closely at the packaging industry for insight into mass-produced, yet stable structures with limited lifespans. We discovered paper-faced honeycomb panels used as dunnage products by the packing and shipping industry to protect and secure merchandise. These panels have some of the characteristics that attracted us to plywood: they are panelized, modular, and are routable using CNC

equipment. Their cross-sectional properties give the 48” x 96” panels a surprising strength-to-weight ratio, although panels are nearly twice as thick (1”) as their plywood counterparts. This additional thickness necessitated a slightly heavier crate, but this additional weight was offset by the lower weight of the paper panels and a more efficient lifespan use of material: the paper cuts easily resulting in a shorter routing schedule at the front end, and even though they have a shorter lifespan the panels are easily recycled at the back end.

Prototype 5 (see Fig. 6), particularly in terms of its roof form, structure and cladding, represented a significant departure from earlier prototypes (see Fig. 1). Abandoning the subtle hyperbolic paraboloid roof form, the team opted for a simple shed configuration that allowed the structure to consist of (4) 48” x 96” paperboard panels with notches that created simple connections to wall panels. Light and strong, the panels are easily lifted into place. Rather than use multiple sheets of polypropylene, Prototype 5 relies instead on a single UV-resistant polyethylene tarpaulin. When secured by its grommets to the wood base of the shelter, the one-piece tarp is very weather resistant and contributes to the overall stability of the structure.

The optimization that took place between Prototypes 3/3x and 4/4x resulted in greater material efficiency and reduced weight (see Fig. 6). The weight of a single shelter module was lowered from 395 pounds to 287 pounds, while the weight of a double shelter module was lowered from 794 pounds to 548 pounds. This was a savings of over 2 psf. Not only will the optimized design result in a lower material cost, it will significantly reduce the cost and effort of shipping. Most importantly, our material choices are better aligned with our expectations for each of the components: the base and cladding are durable materials capable of repurposing, while the superstructure is recyclable material with a temporary lifespan.

Unlike the grid shell which contributed considerable lateral stability to the shelter, the shed roof, though simple and light, provided little or no lateral bracing. To compensate for this instability, the walls of the shelter were "folded" or angled subtly relative to one another. Since the walls are connected using zip ties, joints between panels are "soft" and able to deviate from an in-plane orientation. The team found that a deviation of 6" sacrificed only a small area of interior space but resulted in a significantly stiffer structure when subject to lateral forces.

Conclusion: Research into Pedagogy

The motto at California Polytechnic State University where the author and his collaborators teach is "learn by doing". Whereas many universities and design programs follow this methodology, at Cal Poly this approach is considered dictum. That said, the curriculum in the architecture program typically reinforces the design process used by the architecture profession: ideas for a hypothetical project are generated and developed (to the appropriate level of the course) using scaled-down explorations, simulations or representations; these means of explorations are usually drawings and/or models in either a digital or analog medium.

Based on our experience conducting research on the emergency shelter project, namely the use of successive iterations of full-scale prototypes using actual building materials, we've concluded that our traditional approach to teaching places the emphasis on the surface of the design rather than it's substance. Although this paper discusses versioning within the context of a research project, the authors believe that a methodology that uses digital tools to compress design, testing, assembly and production into a single process has potential as a pedagogical approach in all design programs, but particularly those that espouse a "learn by doing" ethic. Although full-scale prototyping and testing have limitations, the spirit of versioning—a collaborative, open model of problem solving with more emphasis on technique and less on representation—could also help foster a climate of convergence between disciplines.

Within a design context learn by doing implies an exchange between an actual situation, not a simulation. David Benjamin and Soo-in Yang write of Flash Research, their approach to versioning used with students at Columbia University: "The test is the key. New and unproven claims, systems, and design need proof and evidence. New architectural propositions need to be explored though the assembly of physical materials. How will we know if it's possible to create a usable ten-foot structure out of one-quarter-inch plywood unless we build and test it?" (Benjamin and Yang, 2006).

As seen in the diagram in Figure 7, a methodology that embraces prototyping at full-scale encourages a feedback loop that informs multiple iterations and helps to propel the design idea. In the case of the emergency shelter, the project's complexity

did not allow the initial idea to fully integrate the assemblage of materials and the means of

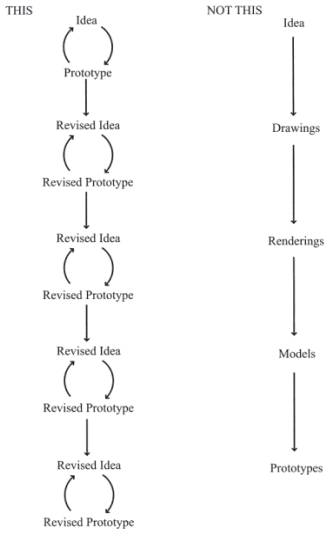

Figure 7. Diagrams which capture the spirit of versioning and a its potential as a revised model for design education (Benjamin and Yang, 2006, p. 15).

fabrication. These important forces, however, eventually shaped the project as they were encountered in successive prototypes and the body of knowledge surrounding the project, its design intelligence, grew. Although we have not had a chance to test versioning in a design studio we look forward to shifting the focus from "product" to "process" or as Coren Sharples suggests, to a hybrid domain: "Can the forces that make the object, both in the generation of the broad strokes and specific resolutions, combine with an intelligence of fabrication to become a 'process product'?" (Sharples, 2002)

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So what do Design students really think? Exploring perceptions of Learning Landscapes

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Abstract:This paper investigates learning environments from the view of the key users - students. Recent literature on designing Learning Landscapes indicates a near absence of the student voice, assuming that the majority of students are either uninterested or unable to express what they want or need, in a learning environment. The focus of this research is to reveal Architecture and Fashion Design students' perceptions of their learning environments. Furthermore, this study questions the appropriateness of usual design of learning spaces for Design students, or if the environment needs to be specifically catered for the learning of different disciplines of Design, such as Architecture and Fashion Design. Senior Architecture and Fashion Design students were invited to participate in a qualitative mixed method study, including investigation into existing literature, questionnaires, focus groups and spontaneous participatory research. Through the analysis of data it was found that students' perceptions validate discipline specific learning environments and contribute towards the development of a framework for the design of future Learning Landscapes, for Design education.

Keywords: Learning Landscapes, Students' Perceptions, Design, Architecture, Fashion, Studio

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Introduction

Students are the key users of educational facilities and yet students' perceptions and opinions on learning environments have been marginalised in existing literature. Learning Landscapes in Higher Education (Neary et al., 2010) provides insight into how the student's view is not as highly regarded as that of staff and facility managers. The term 'Learning Landscapes' refers to the refurbishment and reconstruction of universities on a multi dimensional level (Neary et al., 2010). Both students and academic staff argued that students find it difficult to articulate creatively what they want and that only a minority of students would be interested in discussing space and pedagogy (Neary et al., 2010).

The focus of this study is revealing Fashion Design and Architecture student's perceptions of their personal learning environment and the benefits those perceptions can have on the Learning Landscape. Furthermore, this study investigates whether being a Design student results in a generic learning space fit-out, or if the environment needs to be catered for specific disciplines of Design.

The research focussed on senior students enrolled in a Design degree at the Queensland University of Technology, Brisbane, Australia. To highlight how students' perceptions of Learning Landscapes can influence the future design and planning of educational facilities, two cohorts of design students were included in this study. Due to their training in spatial awareness and its relevance to the design of learning spaces, Architecture students were central to the research. The other group of students examined were from the creative discipline of Fashion design. The School of Design that this research has been conducted in has separate learning environments for the Architecture and Fashion Design students, as illustrated in the Figures 1a + 1b, and 2a + 2b.

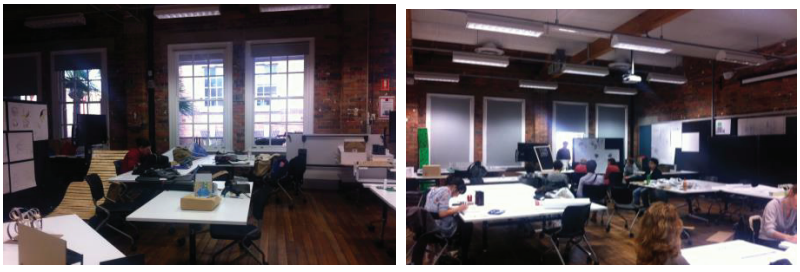


Figure 1a + 1b: Architecture studio learning environment. Source: Louise Barbour.

Figure 2a + b: Fashion Design studio learning environment. Source: Louise Barbour

Review of Existing Literature

Design Pedagogy

Design education can be traced back 200 years to 19th century Paris, at the Écoledes Beaux-Arts, School of Fine Arts (Glasser, 2000; Lackney, 1999). As those graduates who were trained under the Beaux-Arts system travelled overseas, the teaching methods were established and have subsequently been maintained in education institutions worldwide (Anthony, 1991). While Fashion, as a discipline of Design, has long been a tradition of art schools in Paris, London and New York, it has remained at the periphery of Australian academic activity. Not until 2002 did the first degree-level program in Fashion Design become available to students pursuing a tertiary fashion experience in Queensland (Vaughan, 2009). By contrast, in 2011 the Australian Institute of Architects recognised 22 Architecture Schools in Australia, New Zealand and Papua New Guinea as being accredited pathways to professional Architectural Registration (Australian Institute of Architects, 2011). Each of these tertiary institutions offers an Architectural curriculum with a growing level of consistency since the 1980's (Ostwald & Williams, 2008).

A longitudinal study by Kolb and Kolb (2005) found that creative students are more concentrated in the feeling-orientated learning space, while management students are thinking-orientated (Kolb& Kolb, 2005). This indicates there is a difference in the learning environments of Architecture and Fashion Design compared to that of Law, Business, and the Sciences. Architecture and Fashion Design share many pedagogical similarities, both relying on significant contact hours and resources in the design studio (Franz, 1990; Wolff, 2009).

The University of Oklahoma's Architecture school adopted a Steelcase LearnLab, an environment with innovative products, design applications and strategies to aid multi disciplinary teaching, while encouraging interaction between students and teachers. While Steelcase LearnLabs had been implemented in other higher education institutions, the Architectural School was aware that it was not a simple copy and paste application into the learning environment of design students as; 'they're a lot more hands-on and need more time in the classroom, their studios are usually four or five hours long' (Libby, 2011). In Australasia students typically have 18-hours a week of face to face contact, and it is not uncommon to find students working into the night or the next day (Ostwald & Williams, 2008; Wolff, 2009).

The Studio

A dominate attribute of Design pedagogy today, is the studio environment started in Paris at the Écoledes Beaux-Arts (Glasser, 2000; Lackney, 1999). The studio model affords the integration of the functional, the structural, the social, and the technical into the learning environment, while marginalising formal lectures (Kuhn, 2001; Stevens, 1998).

The studio has an aura of 'holiness' surrounding it, creating a fitting environment to study the 'magical quality' of Architecture (Lackney, 1999; Wolff, 2009). For Fashion Design students, the studio is referred to as a second home (Vaughan, 2009). Studios can appear neglected with material off-cuts, empty coffee cups and dishevelled furniture arrangements, but the space is actually expressing a model of creative learning worthy of informing the learning environments of other campus facilities (Lackney, 1999).

The flexible design of the physical environment of the studio supports flexibility in instructional strategies (Tanner, 2008). The physical make up of this represents a large space with high loft-like ceilings, folding partitions and moveable furniture which drives the organisation of the environment(RM Associates, 2005; Taylor, 2008; Wolff, 2009). There is no defined front and back to the space, causing a breakdown of hierarchal relationships that occur in traditional classroom settings (Libby, 2011).

A recent study by Ostwald and Williams (2008) indicates that Architecture academics in Australasia viewed the lack of quality studio, teaching and exhibition space as the second greatest resources challenge. This finding was followed with the third greatest resource challenge to the architectural education system - to be the growing demand for workshops and model making facilities (Ostwald & Williams, 2008). This study by Ostwald and Williams, validates the great importance that Architecture academics place on the physical learning environment. Students also respond to the studio environment, or lack of one; as timetabled access to studio leaves students with no space to work between classes resulting in their diminished sense of belonging (Ostwald & Williams, 2008).

Users' Perceptions

Existing research into users perceptions tend to allow academics to speak on behalf of the students (Clatworthy&Kooymans, 2001; Jessop et al., 2012). A recent publication by Jessop et al. (2012) highlights academic claims that students feel undervalued due to their scruffy learning environments. However when the students were questioned, they seemed less concerned; students ultimately viewed the facilities as a transient space, which they use for a specific purpose at a specific time, whereas academics considered the space to be a second home (Jessop et al., 2012).

A study conducted at the University of South Australia into academics and students perceptions of the effect of the physical environment, revealed that staff considered the design of the lecture theatre of higher importance than students (Clatworthy&Kooymans, 2001). Referring to Wilhelm (2010) and the concept that students recognise learning in the 'third space', it becomes understandable why students do not rate the physical lecture theatre highly, as a learning space. 'Third space' is a micro-environment of inspirational conversation supported by walkways and large ground planes (Watson, 2007). Kolb and Kolb (2005) argue that traditional school environments create a one-dimensional conversation with teachers talking at passively learning students. Authentic learning occurs when spaces encourage freeform talking, thinking and memorable experiences (Abdullah et al., 2011; Kolb & Kolb, 2005).

It can be concluded that students are not unaware of their needs because of a low rating of lecture theatre environments, but rather that they recognise the 'third space' as a more important learning environment. Neary et al. (2010) argue how academics suspect students of being unable to decipher the learning environment themselves; as a senior academic elaborated; 'Students seem to find it difficult to articulate what they want, they know what they do not like, but they find creative thinking about space very difficult' (Neary et al., 2010). Reference to 'students' is generalised and not discipline or curriculum orientated.

Recent research on the relevance of student's perceptions is a student stating that all students want is: 'good basic conditions in their teaching rooms, if we start talking about the relationship between space and pedagogy only a minority would be interest-ed' (Neary et al., 2010).The key here is to identify who the 'minority' of students are. As explored in the review of literature it is clear that Architecture students have a unique

pedagogical system and in addition to this, they are educated in spatial awareness. What then do these spatially educated students think of the provided learning environment and how can the space be better designed to facilitate the needs of the key users, students? Furthermore, Architecture and Fashion Design share an array of pedagogy similarities, but does this necessarily translate into the same user needs. Does being a Design student result in a generic learning space fit-out, or do these learning environments need to be catered for specific disciplines of Design?

Methodology

Context

This paper focuses on two differentdisciplines of Designwithin the Creative Industries Faculty at the Queensland University of Technology (QUT) - Architecture and Fashion Design. At QUT Architecture is a four-year undergraduate degree with the option of a fifth year masters degree to achieve a professionally accredited qualification. Cohort sizes range from approximately 250 students in first year, to 90 students in the Masters course. Entry to the Architecture course isgranted on the basis of competitive academic university rankings. Fashion Design is a three-year degree, with entry based on a competitive portfolio submission and interviewing process. These entry requirements result in a significantly smaller cohort for the Fashion discipline, with approximately only 25 students per year level. This study focuses on the students in the final year of study of both disciplines, to reflect a longer experience and interaction with campus facilities.

Data Collection and Analysis

A qualitative grounded theory approach was chosen to allow key themes, relationships and theory to emerge, and to reflect the existing perceptions of Learning Landscapes. The research was conducted in two stages. Firstly both Fashion Design and Architecture students were provided with a paper questionnaire during timetabled classes,early in the semester. The questionnaire required the students to identify their existing learning environments and their general impressions of on-campus learning. 60% of the students in Architecture and 80% of students in Fashion Design,responded. The second stage allowed students to participate in a focus group;to expand upon and specifically inform their opinions of the learning environment, of their particular discipline. The research team found the Architecture students to be vocal in describing issues about their learning environments in both the questionnaire and the focus group. By contrast the Fashion Design students showed resistance to participating in the focus group and the result from their questionnaires informed the research team that they were not as enthusiastic about actively voicing their opinions about their learning spaces, as the Architecture students. In response to this, Fashion Design students' perceptions were further sought through a form of participatory research, to gain student views in their own time, space and without the influence of the research team. This is illustrated in Figure 3. A pin board with prompt questions was installed within a Fashion Design learning environment. This method enabled Fashion Design students to express their specific views and thoughts indirectly to the research team. This method was more successful in gathering insight from the Fashion Design students, than the focus groups, which received little attention.

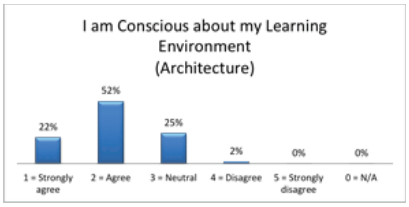
The questionnaires, focus group and participatory research data were coded and extrapolated using thematic analysis and grounded theory methodology. The use of the two differing approaches allowed the data to be analysed, compared and contrasted to enable five clearly identified themes to emerge, in addition to the known discipline curriculum and recognised learning environments. The themes of *studio culture*, *24-hour access*, *ownership of space*, *noise* and *facilities*were identified as reoccurring design students perceptions of learning environments.

Figure 3: Fashion student interacting with the participatory research method.
Source: Louise Barbour

Findings

Value of Student Perceptions

Design students revealed an interest in the on-campus learning environment. When asked to indicate their level of agreement with the statement 'I am conscious about my learning environment', over 75% of Fashion Design students surveyed either agreed or strongly agreed as shown in Figure 4a. Architecture students similarly resounded with over 70% of students surveyed agreeing or strongly agreeing as illustrated in Figure 4b. The high response of students being consciously aware of the physical space facilitating their learning, positions students to further inform their opinions and interactions with the space.



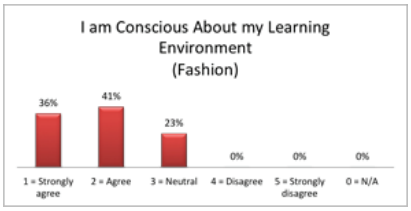


Figure 4a + 4b: Fashion Design and Architecture students indicate how conscious they are about their learning environment

The Learning Environment & Curriculum

Consultation with lecturers of both Architecture and Fashion Design revealed five core curriculum units in each of the disciplines to be:

- Design: Design studio unit;
- Practice: Professional practice, management, economics and law;
- Communication: Traditional and computer based presentation, and communication skills;
- History and Theory: History, theory and philosophy of the discipline;
- Garment Fabrication (Fashion only): Materials technology and garment construction;
- Technology (Architecture only): Materials technology, services and construction.

In order to position this study, students of Architecture and Fashion Design were asked to identify as many of the learning environments, which they currently experience during timetabled class or independent learning from the following:

- Lecture;
- Studio;
- Computer Laboratory;
- Seminar Room;
- Technology Enhanced Space;
- Other.

DESIGN LEARNINGwas indicated to be primarily undertaken in a studio environment by both Fashion and Architecture students. This confirms Lackney (1991) and Kuhn (2001) literature demonstrating the studio's dominance on the learning environment for design-based disciplines. Architecture students indicated that design learning also takes place in the lecture theatre and in informal social environments, including off-campus. 'Field trips… actually being exposed to the environment…studio is nice but after five years it… starts to wear on me.' This statement provides insight into why Architecture students nominated informal social learning environments as an important Learning Landscape for design studies. By contrast Fashion Design students identified the computer lab as a secondary design learning environment. Mention of 'home' as an environment to learn design was also addressed by Architecture and Fashion Design students, as an alternative to studio. The strong inclusion of the home as a place to learn should be further included in the acknowledgment of social learning environments.

PRACTICE LEARNINGwas strongly designated to be undertaken in the studio by Fashion Design students as shown in Figure 5a. Architecture students did not respond with one resounding environment, rather indicating the lecture theatre, studio, technology enhanced room and seminar room as the adopted learning environment for Practice learning, as illustrated in Figure 5b. The use of a multitude of different types of learning spaces rather just the studio was explained by Architecture students as 'being exposed to what goes on in an office is completely different to… the studio spaces'. An Architecture student reflected on how studio is not an authentic reflection of the architectural profession as 'all the main learning that you'd ever use is from working, actually having the experiences…'. Architecture students revealed that practice is not best learnt in a studio, but rather the allocation of different environments to support their learning of professional practice.

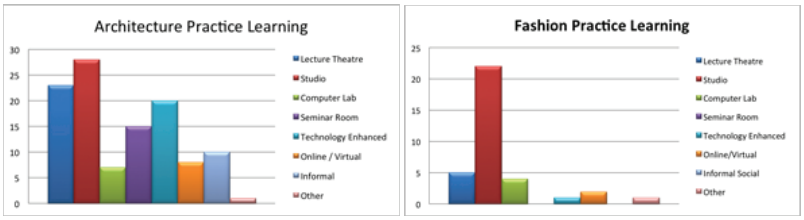


Figure 5a + 5b: Fashion and Architecture students indicate where practice learning typically takes place

COMMUNICATION LEARNING is primarily learnt in the studio for Fashion Design students, alongside the design curriculum. Architecture students also identified the studio as the primary place for communication learning, but in addition to this, the computer lab and informal social learning environments also appear to be supported. The use of informal social learning environments was described by Architecture students detailing communication as 'a very personal thing… everyone has a different method' and 'a personal exploration'. Architecture students therefore expressed the need for a multitude of environments to learn communication skills, not just one specific timetabled learning environment.

HISTORY AND THEORYis seen to be primarily learnt in a lecture theatre by both Architecture and Fashion Design students as illustrated in Figures 6a and 6b. Both disciplines indicated the dominance of the lecture theatre. Architecture students explained 'I can't really imagine learning history in another environment' and a Fashion Design student stated, 'that's what we are familiar with'. Discussion about the lecture theatre creating a more formal environment to learn history and theory was important to one student, as 'it needs to be formal to get the content across… but just the way we approach it… that could be different'. In addition to this, an Architecture student agreed that 'maybe they feel its (content is) less personally engaging and they (students) just want the content to be delivered at them'.

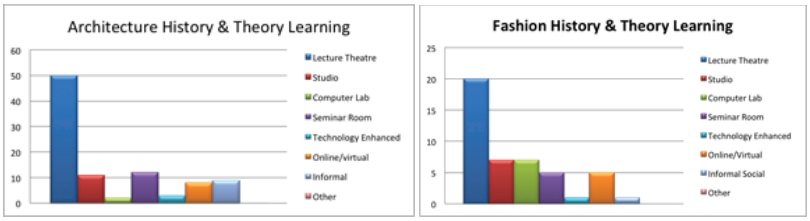


Figure 6a + 6b: Fashion and Architecture students indicate where history &theory learning typically takes place

Fashion Design'sGarment and Fabrication class is comparable to that of Technology in Architecture. The Fashion Design students indicated that learning takes place in the studio alongside design, as shown in Figure 7a. A Fashion Design student explained that it 'is best learnt in class with step by step tutorials, then individual experimentation.' This illustrates how the studio supports the students learning customs. Architecture students however, indicated a variety of learning environments for technology including the lecture theatre, studio, computer lab and informal social environments as shown in Figure 7b. An Architecture student explained that 'tech(nology) is not a subject that you can get inspired about…the social aspect is helpful because our tutor… gets us all into a group… he (is) the chairman of the forum'. An Architecture student proposed that technology be taught by 'looking at different building systems in real life buildings'. This provides insight into why Architecture students failed to identify one learning environment as the technology curriculum content calls on different life experiences.

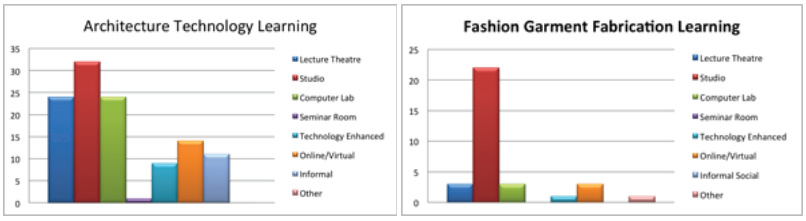


Figure 7a + 7b: Fashion and Architecture students indicate where technology/garment fabrication learning typically takes place

Discussion

Discipline Based Learning

Design students have provided insight into the need for discipline based learning environments. The differing student perspectives of each discipline reflect differentiation in curriculum and the need for specific learning environments to cater for such. Specifically, the learning of practice and technology/garment fabrication has been identified as requiring varying environments for Fashion Design and Architecture students. Although Fashion Design and Architecture students identified the studio as the favoured environment to learn design in, a Fashion Design student could not simply use an Architecture studio, as the tools, equipment and support are not appropriate. Whilst key differences in Design learning environments were identified through the

students' perspectives, there also emerged similarities in the need of lecture theatres to learn history and theory.

Emerging Themes

While the need for discipline based learning environments have been established, both Architecture and Fashion Design students' perceptions have revealed key themes specific to the school of design as a whole.

STUDIO CULTURE:Fashion Design students identified a strong sense of studio culture with 90% of students agreeing or strongly agreeing that the studio culture keeps them working on campus - refer to Figure 8a. A student explained that the 'fashion learning environment is supportive, fun, caring, encouraging and relaxed, which makes studio fun and engaging to learn in'. Another student resounded that the Fashion Design studio culture is 'the collective feel of the space. I really love being able to work with others as well as individually in the same space'. By contrast, less than half of the Architecture students suggested that the studio culture keeps them working on campus. Architecture students questioned the existence of studio culture, some even going so far as to claim that 'there is none'. Architecture students identified an important aspect of studio culture as having 'somewhere to stay… and keep going and keep working. Sometimes you are on a roll and you want to keep working … (but unfortunately) you're kicked out of the class and the next class comes in'. The desire to create a studio culture out of an environment where the students can 'stay on and work together' is directly relatable to the theme of ownership of learning environment.

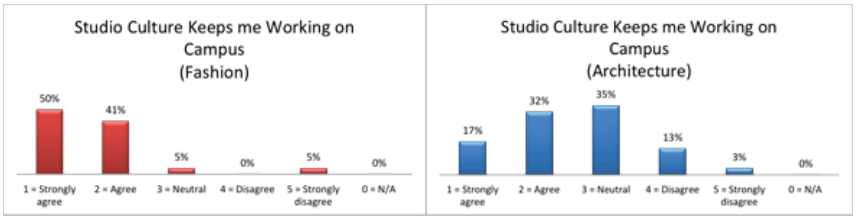


Figure 8a + 8b: Fashion and Architecture students indicate how studio culture affects their learning

OWNERSHIP OF SPACE:Extending the theme of studio culture, is the importance of ownership of space to Design students. A Fashion Design student suggested that: 'it is important (and) beneficial to have your own creative space…. you have the freedom to spread out, move around freely, not be disrupted by noise from others, and to be consistently surrounded by inspiration'. Within the Fashion Design studios, each student had access to a personal storage box and work space, including tools and furniture. By contrast, the Architecture studios provided no personal secure storage and the studios were shared by a variety of different year cohorts, at different times of the day. The difference in the studio environment and the lack of Architectural studio culture, resulted in students observing that some students: 'don't really use the whole two hours. They will just get in, talk to the tutor and (then leave)...they may as well go wherever (else) it's comfortable for them to further their study'. The lack of ownership resulted in one Architecture student feeling out of place: 'you notice it most when you go into studio… and there is another year in there…it really just feels like you are not meant to be there'. Architecture students proposed a solution to the apparent lack of

ownership by suggesting the provision of a learning environment that is similar to that of the existing Fashion Design studios: 'Masters students should have their own area where they (can) collaborate, and (they would) probably get to know everyone in (their) group a lot better, and feel integrated… if they had set areas for each level or Bachelor to Masters.'

24-HOUR ACCESS:'When inspiration strikes…it's nice to be able to schedule in your learning at odd hours or when it fits in with you. Because sometimes I'm just not in the right mind set to concentrate during my designated class slots'. Fashion Design students expressed the desire to have 24-hour access to learning spaces, and argued why this was crucial to their learning outcomes: 'it means that I can prevent myself from falling behind in classes'. Architecture students agreed that educational facilities should be accessible: 'for those who work from nine to five… they need access to the spaces and the tools'. The implications of having to earn an income during the day and going to the design studios after work resounded with a Fashion Design student: 'being able to access the studios at any time is integral to getting our collections finished'.

NOISE:Noise within the learning environments of Design students was revealed to have primarily a negative impact on the space. Over 45% of Fashion Design students surveyed indicated that noise deters them from learning on campus while 60% of Architecture students agreed with this - refer to Figure 9. Students believe that loud noise affects their ability to concentrate. A Fashion Design student stated: 'loud noise or other people talking, prevents me from being able to work or find the right mind set I need to get work done'. The type of noise was crucial to its impact: 'people talking about the weekend or just irrelevant stuff… that can get distracting. But if it's on task it's generally more bearable'. An Architecture student highlighted that students need to be mindful of the environment: 'I like listening to music when I study but I try not to affect other people, so when people do that to me, (it) bothers me'. Not all students were affected with noise if it was not discernible: 'I personally, like background noise, I like chatter and that's why I said I don't mind working at a café… You are not focusing on what one person's saying, there's so much chit-chat going on'.

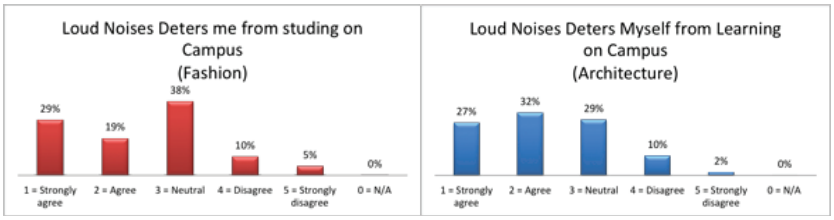


Figure 9a + 9b: Fashion and Architecture students indicate how loud noise affects their learning

FACILITIES: When asked if furniture improves the learning environment, both Design disciplines agreed that it does. The inclusion of large tables was indicated as essential to both Architectural and Fashion Design environments as: 'you can spread all your belongings and models'. Fashion Design students proposed the use of soft furnishing to benefit from more informal social learning environments. Architecture students also asked for social learning environments arguing for a: 'shared space where anyone can go at any time (with) a fridge and (a) kitchenette, decent bathroom facilities,(and) a couple of slat beds'. Architecture students were, however, more concerned with access

to facilities to aid their learning. Limited access to power points for laptop charging forced students to: 'always go to the edges of (the) studio' or ensure that students: 'manage battery life amongst the group'. In one case a senior Architecture student was unaware of the facilities they had access to: 'is there a toilet in studio? Because I didn't even know there was a toilet there'. Another student indicated reluctance to use facilities without prior consent: 'if you don't say "this is here for you to use" then I feel like (I am not) meant to be using this… (incase I am) going to get in trouble' To avoid reluctance to use facilities and to make facilities known, students recommended an orientation specifically for Design students to point out the facilities, even the seemingly obvious amenities.

Conclusion

The study reveals that Design students are consciously aware of and interested intheir learning environments. Through the exploration of students' views and perceptions of their personal Learning Landscapes, the need for discipline based learning spaces and five distinct themes for planning educational environments for Design students have emerged.

Although Fashion Design and Architecture are included in the same School of Design and have similar core subjects by descriptor, these disciplines require learning spaces specific to the learning curriculum of each discipline. There is no 'one learning environment fits all' solution for Design students or design curriculum, rather it is recommended that an investigation into what specific spaces the students require, when planning facilities. In response to each of the themes identified by Design students in relation to the overall faculty Learning Landscapes, the following points for consideration are proposed:

STUDIO CULTURE: Studio culture and its ability to support and engage students in their learning, is important. Studio culture is fostered through when students have somewhere to stay and work for a length of time, and which is not necessarily sharedor rotated with other students. Class size also has a significant impact on the development of studio culture.

OWNERSHIP OF SPACE: Directly related to studio culture, the ownership of space is important to students; it enables them to collaborate, be inspired, and feel integrated in the learning process. Students recommend having access to both faculty shared environments and discipline orientated learning spaces,specific toindividual year cohorts.

24-HOUR ACCESS: 24-hour access to educational facilities is a priority, as the nature of Design education does not necessarily result in productive work during timetabled classes. Income generatingor other external commitments may result in students needing to access tools and spaces at any time of the day or night.

NOISE CONTROL: Some students are deterred from working in on-campus facilities, because of noise. Their ability to focus on task is difficult if music and conversations in educational environments are discernable. However, if noise is not distinguishable and referred to as background noise,students areless concerned by this.

FACILITIES MANAGEMENT:Large tables and mobile furniture are seen to improve students' learning. An increase in the provision of informal learning spaces with soft furnishings and decent amenities is also desirable. Lack of knowledge about or access to facilities hinders the use and interaction students have with them.

While the results are limited to the experiences of students at one Australian university, this initial work provides the grounds for further research into the value of students' perceptions of learning environments. To make a full assessment of Design Learning Landscapes, exploration and review of students' perceptions of the other disciplines within the School of Design would be beneficial to future research in this area. Within the School of Design at QUT there are seven design disciplines. From this study we can see that although design disciplines have similar pedagogical approaches the actual need for the design of discipline specific learning environments is evident. However it is not known what the needs of each discipline currently are,specifically from the student's perspective.

To expand this study, future researchers should further investigate how the needs of students are being met within their current learning environments and what should be changed to improve these environments, and better address student needs. Another direction for this research could be to compare the findings with a similar study conducted at another institution, with the same disciplines of Architecture and Fashion Design, and taking into account student success and student numbers.

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Interdisciplinary Connections between Health Care and Design – a Case Study in a Psychogeriatric Ward in Norway

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Abstract: Interdisciplinary communication can contribute to the development of a sustainable environment. The promotion of interdisciplinary collaboration among specialists and with people in general is an objective in design education described in the second cycle of higher education in the Bologna process. This article introduces a case study of a creative process initiated to explore how the use of material and visual aesthetics contribute to create a health promoting environment. Health professionals were invited into a process of materializing suitable art objects for a geriatric ward in mental health care. A participatory design process illuminated different intentions from the participants and these influenced the creative process in the making of communicative forms with various shapes and surfaces. An analysis of the case was performed to disclose structures in the process and furthermore to synthesize the key findings into an expanded knowledge on intentionality in design. The key findings make relevant concepts for learning outcomes in product design education and are defined as the; pragmatic flexibility of an open conceptual form, the potentials of a skilled and emancipated view on materiality in interdisciplinary collaboration and the promotion of interdisciplinary collaboration through visual and tactile communication.

Keywords: interdisciplinary collaboration, sustainability, material communication, design education, microsociology

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Introduction – interdisciplinary dialogue

Research and development in design activities can contribute to the manifestation of productive interdisciplinary collaboration in which conflicting values emerge (Buur and Larsen 2010). Emphasis on the goal to reach pragmatic and satisfactory solutions is of great importance in such a complex situation. This can partly be attained through the activities illustrated by the notion of bounded rationality (Simon 1969).

Attaining skills to promote interdisciplinary collaboration by material communication is an aim (Corbett, 2005) in design education (Froukje Sleeswijk Visser 2007). Such communication skills and working contexts can reveal different views upon values and intentionality (Wahl and Baxter 2008) which are significant in the process of creating pragmatic solutions as well as salient experiences (Simon 1969). Wahl and Baxter (2008) have connected intentionality to how ideas are materialized and applied into the environment on to a social perspective. In such a view the specific intentionality will have excessive impact on design processes and the experiences of the outcomes. A conscious perspective on the existence of intentionality as an influencing factor in design processes and what it comprises is therefore essential to become aware of own orientation as part of a team and furthermore to alter established design processes and approaches within areas that require novel thinking such as sustainable design or processes with the aim to create new innovative products and experiences:

> Materially, the intentionality behind design, is expressed through the interactions and relationships formed by consumer products, transport systems, economies, systems of governance, settlement patterns, and resource and energy use, with the complexity of social and ecological processes (Wahl and Baxter 2008, p. 73).

This is a complex issue which motivates a further study of the concept of intentionality in light of different design perspectives. The materially dimension is described by Wahl and Baxter (2008) as systems and realization opportunities in societal macro perspectives. Smelser however promotes micro perspectivesas equally important as macro and global perspectives (Smelser 1997, p.5). We recognize that materiality in this view can represented through micro perspectives. This understanding of materiality underlines the potential impact of design processes and products and furthermore the importance of research within this specific area. Similarly Wahl and Baxter use a macro perspective when the immaterial design qualities are described:

"Immaterially, our organizing ideas, worldviews, and value systems express how we make sense of our experience of reality through meta-design" (Wahl and Baxter 2008, p. 74). They propose in that immaterially applied into design is a way to understand how values and systems represent different ontoepistemological assumptions that can change our experience of reality, and following the intentionality behind design. Wahl and Baxter states "This change in *why* we design things and processes in turn affects *what* and *how* we design" (2008, p. 72). Interdisciplinary dialogue and collaboration can in other words encourage researchers and practitioners towards solutions that reflect inter-subjectivity. The concept of inter-subjectivity can expand the knowledge about - and contribute to the creation of - new design approaches that are necessary in order to design new sustainable solutions. Inter-subjectivity as a facet of a design process can therefore be seen as an extension of the ideas of the design researcher Papanek who aimed for a more ethically, socially responsible and sustainable role of the designer-

values that could be further conveyed into industry by the designers practice (Papanek 1971). Many product design educations aim to link commercial aspects and experience value to sustainable and social concerns in their curriculum. This is done through a macro as well as micro perspective represented through the study of systemic and analytic approaches in one end and the emotional bond between a person and a product in relation to product replacement rate in the other.

Background – skills in material communication

Sustainable value creation in product design means to find sustainable solutions that take the fullest account of economic, social and ecological concerns in their development, implementation and realization (Melles, de Vere, and Misic 2011). Research in sustainable value creation can for example contribute to extended lifetime for products by exploration of people's feelings of attachment to products and related pattern of consumption (Gulden, Moestue, and Berg 2010). To ensure the social relevance in design practice such thinking should permeate all teaching and development projects in design. Interdisciplinary research approaches as described above can change and develop new creative processes specifically connected to materiality and linked methodology, in order to contribute with the development of new competence in product design with the aim of a future sustainable environment.

Skills of material communication also plays an important role in value creation (Marres, 2012). Findings and effects of this research can systematically be integrated into the teaching and learning in product design. Through teaching that is focused on product innovation, innovative processes and best practice, students can continually develop knowledge and skills in establishing a suitable balance between social factors, ecological concerns and economic value creation in their work.

The outset of the present study is based on the knowledge gap of intentionality as a facet in design (Wahl and Baxter 2008) in relation to product design education and the second cycle of learning outcomes in higher education as described in the Bologna process (Corbett, 2005). In these guidelines it is stated that there is a need for students to enhance their understanding of ethical concerns as well as to acquire skills to apply such dimensions in cross disciplinary processes in order to contribute to approaches of corporate social responsibility (Melles, de Vere, and Misic 2011; Curaj 2012). Although several case studies of cross disciplinary sort has been performed in health care settings (Topo and Iltanen-Tähkävuori 2010; Daykin et al. 2008; Lipe et al. 2012) there has been little focus on people that are admitted in mental health care with their experience of the near environment - their micro perspective. Based on this context we formulated the research question: How can one establish interdisciplinary connections between people in a mental health care ward through a participatory design process of making material based art objects in a perspective of intentionality (Wahl and Baxter 2008) on a micro level (Smelser 1997)? A relevant context for such a research approach was with employees at a mental health institution. A qualitative case study was found apt as a methodological approach for this research based on the nature of the research question (Yin 2009.) Methods for the case study were observation, participatory observation, focus group interviews, participatory design (Asaro 2000) and artistic research (Varto 2009).Variations of intentionality was studied through participatory design processes (Melles, de Vere, and Misic 2011) where the creation of art objects enabled a space for both exploration and analysis, an emerging research field in art and design (Mäkelä et al. 2011). The health professionals contributed with co-creation and

use of art objects for their institution. Aesthetical objects or components can influence a communication process significantly. We therefore chose to use aesthetic objects engendered by a material based art process as part of the research. Objects with intention to increase communication at the ward were made in collaboration with nurse researchers because of their experience with patients. The implications that the intervention of art objects had at the ward were explored. As basis of this exploration new objects were created assumed to have different or stronger influence on communication. The outcome of such a study can have relevance for future creation of physical artefacts for mental health care and for product design educations that aim for interdisciplinary skills.

Three of the art works from the hospital ward project were selected for an extended analysis for this study. They were selected because they represent a micro perspective of constraints and challenges, potentials and values as described by Wahl and Baxter (2008). The analysis of the case was performed by concept mapping (Maxwell 1996, p. 47) to disclose structures of significance in the process and furthermore to synthesize these key findings (Jørgensen 1992) into three concepts of intentionality in the making of a social sustainable environment. Some significant qualities of the connections between health care and material based art elicited by the interdisciplinary processes are described in the findings. These are further analysed and discussed in the final chapter in relation to the role and relevance of visual and material aesthetic knowledge in an interdisciplinary design process.

Figure 1: Hospital environment

Figure 2: *"Arctic Border, 2010" (Berg 2011): open form for communication at ward in mental health care.*

Figure 3: *"Lucid Moments": open form for tactile communication at ward in mental health care.*

Findings: a participatory process in materializing communicative objects

The interdisciplinary group that was set out to create art for the environment in the hospital ward consisted of psychologists, nurses, psychiatrists, aides, an occupational therapist and a physiotherapist. About 60 people were involved in the process, and the fifteen patients at the ward were offered to use the art in art dialogues (Ingeberg, Wikstrøm, and Berg 2012). The average age of the patients at the ward was 65 years.

The data in this study relate to the creative process with the health professionals and art objects in general. Several conceptual possibilities were presented to the health professionals in a participatory workshop and based on these discussions, further developed into 24 ceramic images and 24 ceramic art objects that were installed in the ward environment (Figure 1). Three of these forms were analysed in this study (Figure 2, 3 and 4).

Interdisciplinary collaboration through visual and tactile communication

Intentionality related to the creation of the work "Arctic Border" had several sides (Figure 2). The ceramic form was intended to stimulate communication in a psychogeriatric ward. One example that took place in the ceramic work shop that can serve as an illustration of the interdisciplinary process that we went through is; while discussing a function of one of the physical forms the nurses said: "because the object is meant to enable communication in a ward for mental health care there should be a physical edge, or a border in the rounded shape that could work as a limit to something or as a break of thoughts". The nurses explained that, for patients with a depression this may break a fixed state of mind or thinking pattern, a break that can be a door opener for dialogue. Furthermore the nurses pointed out the advantages with a "non-perfect" form, because it could possibly speak to those feeling down. The intention they said was that this could cause a form of identification.

Materially, the intentionality behind the design, was exemplified through the interactions and relationships formed by the creators of the objects. Two nurses took part in the in the creation process of the art pieces along with an artist. The physical environment at the ward made a part of the project intentions, as the art objects were to become communicative elements integrated in the hospital environment. Thus the physical environment was actively used in a professional mental health perspective. The nurses said that "The objects should stimulate emerging thoughts and ideas in order to stimulate the patients' phantasy". The nurse researchers explained that the practice of the staff could be changed by the materialized art objects because "The active use of environment in patient dialogues enhanced the nurses' communication skills".

Elderly patients with dementia were a part of the target group. These patients who have different mental conditions such as depression, anxiety and paranoia make a minority group within health care that gets little attention due to low status. Consequently the ward interior has to a little degree been designed to please or activate the patients. An intention to increase communication between the patients therefore emerged, which we did by placing of the art objects in the corridors where the patients lived. The project turned in other words towards the emphasis on the needs of the individuals' desire to touch and to be stimulated by touching the surfaces of the art objects.

A patient said after being presented with a non-figurative art object "I like non-figurative art because it reminds me of when I was a child looking at the changing formations of clouds". Thus based on this situation "Arctic Border" was made to stimulate the imagination and to contribute to an immaterial perspective of intentionality through providing an opportunity to play out personal values. The staff said: "The patients with reduced communicative skills touched and examined the forms in very different ways and based of this we could to some extent interpret their mood through their body language".

An emancipated view on materiality

Stages of intentions concerning the creation of «Lucid Moments» (Figure 3) were different from "Arctic Border" which was more planned. The shape of "Lucid Moments" was revealed through interdisciplinary communication in a ceramic studio. A slump of clay was cut off with a string and put away for later processing. This lump was discovered by one of the partaking nurses who thought of shape as apt for the purpose of this research. She said*: "*This is a good form for communication, it looks like a horse's head". Although it was explained that it was not one of the forms intended for the project, the nurse said that it comprised both figurative and sculptural qualities, as well to hold the potential of being covered with motifs on the surfaces. We therefore further develop the clay form with different intentions to communicate through unlike surfaces and colours. The intention for the presentation of the object was initially to mount it on a wall, maybe several in a row, and that it should be mounted with movable bracket on the wall, so that patients could move and change the position of it. A new solution emerged which was to present the objects by lowering them, and partly hiding them in marble sand. Then the objects would be even more flexible in use, possible to mix and match with each other, offer the potential to discover new, hidden and forgotten sides of the objects, an approach comparable to the reminiscence work done in the ward: To search the old memories and mix and match old thoughts, develop new conversations and new ideas.

The art objects lowered in sand was placed in the light therapy room to ease the availability for the patients to choose how to interact with the art in the ward environment. A certain amount of voluntariness or motivation was thus integrated in the presentation of the art works. Materially, the intentionality behind this installation was expressed through the users' possibility to interact with sand, hand and mind. The marble sand was used as an asset to evoke memories. The sand facilitated the flexibility of use as there were endless ways of composing the objects in the sand, as well as to what degree they should be hidden or visible in the sand. The tactile experience of letting sand flow between fingers was also a quality of intention in order to create dialogues. The complexity of therapeutic and diagnostic processes in mental health care was thus combined with the simplicity of direct, material presence, with the aim to create alternative door openers for communication. The therapist said: "Sometimes the patients started to talk about the art work in such way that it allowed us to develop the dialogue into more therapeutic conversations within the patients' private room". Immaterially, "Lucid Moments" this way contributed to peoples' ability to partake in interpersonal communication which could serve as a door opener. By creating the art object along with the values disclosed in the ward, existing practice and within the staff culture, the objects was in a way inscribed with these meanings into the existing system.

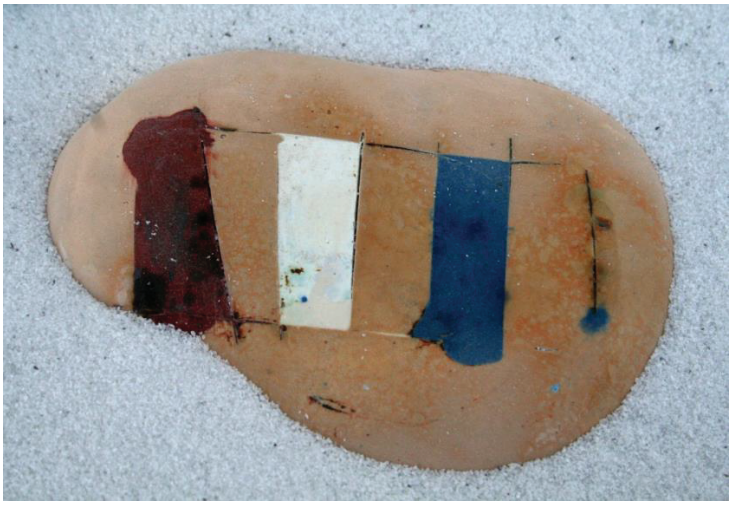

Figure 4: *Stones were used in the hospital based on the staffs' intentions.*

The pragmatic flexibility of an open conceptual form

Intentions of violence and injury could not be overlooked in a psychiatric ward. Some of the employees were worried that patients with acute psychiatric disorders could use art objects with the intent to threaten or hurt others. On the other hand, other nurses had different experiences and expressed that they had never experienced patients who had used art to exercise damage. They pointed out that if they really wanted to create harm they could use the available objects such as coffee cups, dishes and furniture. Moreover, they felt that available ceramic objects would not represent any risk since those who were in a critical state would usually be sheltered on separate rooms with special attention. In spite of these reflections, it was decided that the stones should not be used freely in the locked ward. They could however be placed in the lunch room for the personnel, to invite for any usage that the employees would want (Figure 4). Thus various intentions of the objects were transferred to the staff. This had consequences. A physiotherapist said; "One day the stones made me remember a situation from my physiotherapist education where a teacher asked us to use natural stones in the practice of physiotherapy". She was surprised by herself that this recollection of knowledge emerged so late in the research project and not immediately. Subsequently she brought the ceramic objects into a morning gym session with some patients because of the revitalised knowledge of practice. The elderly could choose a stone each during the gym session. Furthermore they were asked to describe why they chose the one they did. Even though few explanations were uttered in words, the physiotherapist together with a nurse emphasised on the interpretation of the mood of patients through their body language.

Materially, the intentionality behind the design was expressed by the recollection of forgotten professional knowledge retrieved through a new physical change of practice. The presence of available open art objects stimulated the inherent values in professional knowledge and memories. Furthermore the physical use of the stones in physiotherapy enabled the physiotherapist with a deeper understanding of the patients' state of mind through their body dialogue with art objects. The materiality of

the art objects invited patients to an open, imaginative approach of the undefined objects. One could say that the openness as an embodied function in the objects alone invited to new use. The use of the ward as an environment for art was in this case a practical solution and an example of how to use physical resources in an existing environment. The situation demonstrated an intentionality that opened up for people's ability to think and act based on their own thoughts which included possible new use of the environment in spite of established, formalized and routinized hospital procedures.

Immaterially, the new use of the art objects stimulated towards the recollection of forgotten ideas – a process similar to the reminiscence work with patients. The art objects challenged established habits by being open and available for any use, and stimulated towards personal initiatives by the staff. Several of the staff members had no specific intentions of how to use the art objects in the very beginning of the research project; they got the ideas after some days or weeks while interacting with the stones. This is an example of how the openness of the art objects stimulated the staff towards different or new actions. The intentionality that emerged through the new use of the stones was not based solely on personal initiatives but also because of an interactive process among the staff and patients which engendered several initiatives. Each approach was valid both for the staff and the patients as it elicited different types of communication and awareness to the environment. The presence of the art objects led to changes in one of the least dominant professional practices namely physiotherapy. In this case the art objects that were made available for new use enabled forces and professionals that were among the least dominant in the hospital system, to change and create practice, thus it contributed to an emancipatory process. The art objects demonstrated how latent possibilities could be brought to surface and how these could lead to new thoughts by the staff and subsequently result in changes in intentionality and practice at the ward.

OVE - an analytical tool

How does the term of intentionality embrace the sustainability perspective for design education in this case? An analysis of the case was performed by pattern matching (Maxwell 1996; Yin 2009) between the three variations of intentionality with a perspective of the material and immaterial characteristics on a micro level reflected in the products. Structures were disclosed in this process which serves as key findings synthesized into the analytical tool, the OVE-model (figure 5). OVE is an acronym for Open conceptual form, Visual and tactile communication and Emancipatory materiality. Design methodology was used as part of the research project in order to explore and enhance the internal consistence of the engendered analytical tool (Topo and Iltanen-Tähkävuori 2010; Buur and Larsen 2010). The aim with the development of such a tool was to validate key factors that can influence communication by the use of visual and material aesthetics in an interdisciplinary design process. The tool can therefore contribute to knowledge transfer between design education and interdisciplinary practice.

Throughout this study the concept of intentionality has been broken down and expressed through the creation of specific examples of material based art. The term of intentionality has been exemplified from the making of concepts to materialization and eventually the implementation of the art objects in a social setting, all contexts which enabled a new understanding of the concept of intentionality. Three concepts have been synthesized through pattern matching (Yin, 2009) from the empirical examples

shown. These are related to the expression of form, to the knowledge of materials and to the visual qualities of surfaces.

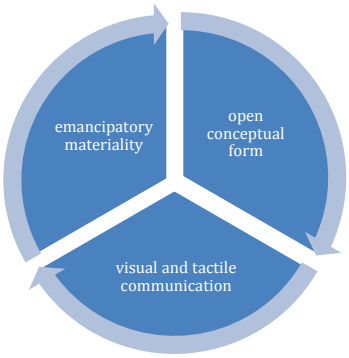

Figure 5: OVE –model: Three aspects of intentionality: open conceptual form, emanicaptory materiality and visual and tactile communication.

The pragmatic validity was explored through the analysis of student projects to establish the degree of coherence between the process that emerged by the characteristics of the research design and practice (Kvale and Enerstvedt). The relevance of such knowledge for students in product design is related to knowledge about materiality. Some product examples created by the design students at a master level which were analysed show open ended product through the characteristics of changing by the accumulation of traces of use (Figure 6) and products with flexible features (Figure 7). These examples connect to the understanding intentionality by the pragmatic flexibility of an open conceptual form. A student who was working with tactile guiding tiles for visually impaired people wrote in the report (Figure 8):

> Blind, visually impaired and sighted in the community have many similar needs. Tactile guiding tiles on walls represent an innovative mobility concept, which has both aesthetic and functional characteristics. The tiles create interactive communication, and are significant for all human sensations and urges towards engagement, activity, amazement, coping and stimulation of the human mind. Tactile products can also give great information, by making the curiosity help to inspire and motivate a greater understanding of visual impairment and touch, and encourage to learning and knowledge. Through this project there has been developed concepts based on my understanding and knowledge of fusing, based on dialogue with visually impaired people. I know how the composition of glass, metal, ceramic and organic materials have a consequence and lead to tiles that contributes to increased aesthetic value of the environment for everyone (Student report, Figure 8).

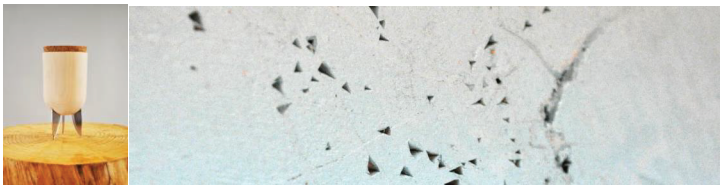

Figure 6: *Student work: Open ended design: cup with knife and traces of use.*

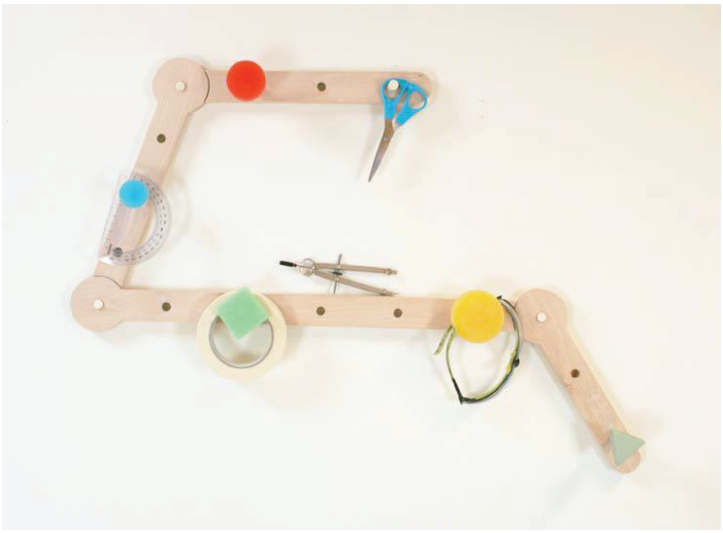

Figure 7: *Student work: Open ended design: "Hook"*

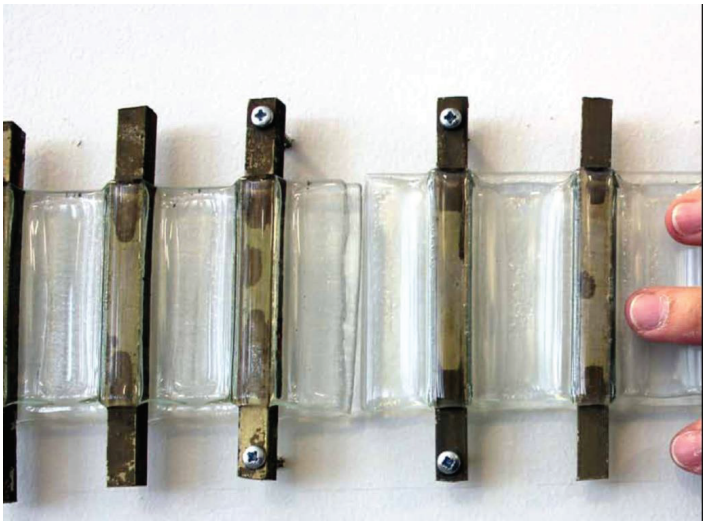

Figure 8: *Student work: Emancipatory materiality: tactile leading tiles.*

This student example contributed to the idea that it was relevant to define potentials with a skilled and emancipated view on materiality in interdisciplinary collaboration. Furthermore it served as an example of promotion of interdisciplinary collaboration in the making of visual and tactile communication. The interdisciplinary dialogues which were oriented about materiality and forms relate to similar collective creative processes in education (Seitamaa-Hakkarainen, and Hakkarainen 2004). The results of Seitamaa-Hakkarainen indicate that collaborative design processes exhibit three characteristic patterns with variable intensity: coordination, cooperation, and collaboration. These patterns were of essential importance to this study as well as to the student projects, in the participatory processes as well as in the involvement of people and material objects. In relation to the participatory dialogue, design competence can be a constructive and necessary part in collaborative research projects as described in the case of scripting patienthood through design of hospital clothing (Topo and Iltanen-Tähkävuori 2010) and in art dialogues in hospitals (Ingeberg, Wikstrøm, and Berg 2012). Likewise conflicting values in cross disciplinary dialogues can be stimulated to enable emancipatory processes towards innovative solutions (Buur and Larsen 2010) in which sustainable design processes rely on.

Conclusion - interdisciplinary connections

The study demonstrates intentionality in product design in relation to material knowledge and how established rules and habits in a material tradition are challenged by emancipatory processes and interdisciplinary collaboration. Three variations of intentionality based on material communication were disclosed and synthesized through this study (Jørgensen, 1992). These key concepts represents the pragmatic flexibility of an open conceptual form, the potentials of a skilled and emancipated view on materiality in interdisciplinary collaboration and the promotion of interdisciplinary collaboration through visual and tactile communication. These concepts can contribute to concretize abstract ideas and to facilitate a flow in collective creative processes by influencing the dialogue through a direct and specific response in the actual material during the process of making. In relation to the adjustment of product design education to the present society these above mentioned dimensions can make relevant learning outcomes in projects where the facilitation of interdisciplinary connections seem apt. Such learning outcomes are first of all linked to the attainment of knowledge concerning designing of pragmatic flexibility and open conceptual forms. Secondly they can serve to gain a general competence in how to define potentials with a skilled and emancipated view on materiality in interdisciplinary collaboration and thirdly to obtain skills to promote interdisciplinary collaboration through visual and tactile communication. By a focus on facets of material communication in design education the concepts of intentionality can become a part of learning outcome formulations in accordance with aims in the Bologna Process (Curaj 2012). This new pedagogical concept of intentionality in design education can lead to interdisciplinary connections and processes that acknowledge the need of more sustainable products and processes as well as the ability to create novel solutions in which sustainable design relies (Melles, de Vere, and Misic 2011; Wahl and Baxter 2008).

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Methodological Foundations of Design Pedagogy: The Scholarship of Teaching and Learning in Design

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Abstract: Design as a discipline has been discussing its body of knowledge from different perspectives. An area that will bring new insights to such discussion is a better understanding of how the knowledge in teaching has been constructed and expanded. Using Maryellen Weimer's perspective and classification scheme on the scholarship of teaching and learning (SoTL), this study aims to descriptively analyze the disciplinary pedagogy in design. The content of 174 pedagogical articles published from 1999 to 2010 in three design journals were analyzed. Findings show that in design, experience-based and research-based approaches to SoTL have almost equal significance. The plurality in SoTL approaches suggests that the definition of credible and high-quality SoTL studies in design as a discipline is yet to be discovered.

Keywords: scholarship of teaching and learning, design education, design knowledge.

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Pedagogical Knowledge in Design

Design scholars and practitioners have debated what design knowledge is and how it is generated or discovered for more than twenty years in efforts to codify design as a discipline (Carvalho, Dong, and Maton 2009; Friedman 2000; Love 2002; Poggenpohl 2009; Wang and Ilhan 2009). While some advocate practice-based knowledge development in design, others focus on scientific methods. This pluralistic approach to venues of design knowledge shows similarities to Boyer's (1997) theory of knowledge generation. According to Boyer (1997), within the context of American colleges and universities, knowledge development and exchange happens through four types of scholarship: scholarship of discovery, scholarship of integration, scholarship of application, and scholarship of teaching. This broad understanding of scholarship moves beyond an exclusive focus on traditional and narrowly defined *research* as the only legitimate avenue to new knowledge (Boyer 1997; Glassick, Huber, and Maeroff 1997). Boyer suggests that each type has unique characteristics that merit special analysis.

All four of Boyer's scholarship types — discovery, integration, application, and teaching — are included in the discussions about design knowledge. However, scholarship of teaching is one of the least studied areas of collective knowledge construction in design as a discipline. According to Boyer, "… teaching, at its best, shapes both research and practice" (Boyer 1997, p. 16) and thus, the scholarship of teaching and learning is significant for understanding the knowledge base of design.

The purpose of this study is to explore *the methods used in the construction and advancement of pedagogical knowledge in design*. A content analysis of pedagogical articles published from 1999 to 2010 in three principle design journals: Design Studies (DS), Journal of Architectural Education (JAE), and Journal of Interior Design (JID) offers preliminary clues. In this analysis, the contextual framework was built upon current literature in the Scholarship of Teaching and Learning (SoTL) — particularly that of Weimer (2006) — as well as the editorial approaches of the three design journals. The analysis of SoTL specific to design not only informs the disciplinary pedagogy but it also explains how design as a discipline is structured within educational settings. In what follows, we first share a brief overview of the literature on design as a discipline and SoTL that informed this study. The description of method, contextual framework, and our database is followed by research findings. Finally, we address the implications of these findings for design pedagogy and design as a discipline to define the nature of knowledge construction in SoTL specific to design.

Learning from the scholarship of teaching and learning

In the nearly twenty years that have passed since Boyer's (1997) initial report on higher education in the United States, the constructs of four scholarship types has been thoughtfully pursued, debated and expanded in most disciplines and forums of higher education. Scholars maintain that the construct of the scholarship of teaching was the least defined by Boyer and point out that it is not yet complete, clear or agreed upon (Braxton, Luckey, and Helland 2002; Huber and Hutchings 2005; Paulsen and Feldman 2006). Settling on or agreeing to a construct that integrates multiple perspectives of what Boyer called the archipelagos of academia may be impossible. Many believe that what constitutes scholarly teaching or scholarship of teaching is highly dependent on the characteristics of the disciplinary field of study (Healy 2000; Huber and Morreale 2002) and for the most part, any interest in scholarly work on teaching and learning has

been firmly tied in disciplinary focus. Others (e.g., Weimer 2006) challenge the idea of placing a disciplinary box around SoTL. There is much to be learned between disciplines about SoTL. Positioning SoTL only within a discipline narrows the potential audience; good work that transcends discipline specific considerations is not widely read and it follows that a good deal of time and effort is spent to discover basic method that has already been created or optimized by others (Weimer 2006).

Whether discipline specific or interdisciplinary, teaching as scholarship is about "…making a larger claim: that the scholarship of teaching and learning builds knowledge that others can use" (Huber and Hutchings 2005, p. 93). Publicly sharing the findings and rigorously reviewing the work is the responsibility of the academy. Others' use of the work for the further development of the subject, that is, knowledge generation, defines the roots of academic scholarship (Shulman 1999). It should be a priority of a discipline.

In *Enhancing Scholarly Work on Teaching and Learning*, Maryellen Weimer (2006) takes a comprehensive look at knowledge construction in pedagogical literature as it has been handled within and among diverse disciplines. Weimer posits that a number of key questions about the development of pedagogical literature can be explored by looking back at its history: Can such a survey inform us about the collective value of pedagogical scholarship in our disciplines? How have others approached it? Are some articles of higher quality than others? What are the gaps? Does this work shape the discipline and what does it tell us about how we move forward?

In her study, Weimer (2006) answers these questions from an interdisciplinary perspective. However, she also challenges others to undertake the retrospective analysis of disciplinary SoTL for the development of a pedagogical agenda to advance teaching. This is the impetus of this study.

In last thirty years, various design domains transformed from an occupation into a profession (Friedman 2000; Giard 1990). At the same time, codification of the body of knowledge that informs and guides these professions has resulted in a discipline that can be understood and studied on its own terms (Cross 2001). It is generally agreed that within this discipline, there are numerous design domains that are characterized by the act of creation through abductive reasoning (Blanco 1985; Cross 1990). While most scholars agree on the presence of this "creative act" as the core of design domains (Archer 1984; Wang and Ilhan 2009), other issues related to the construct of design as a discipline are still under debate; including the *knowledge* governing the discipline and its domains.[1]

Dinham (1989), Eastman, Newstetter, and McCracken (1999), Friedman (1997, 2000, 2003), Giard (1990), and Lee (2009) suggest that the difficulty in defining the knowledge base of design is rooted in educational traditions. Furthermore, compared to the fast-paced changes in the new century, design pedagogy does not keep up with the knowledge revolution (Eastman, Newstetter, and McCracken 1999; Friedman 2000). The education of new designers has long depended on trial and error or intuition rather than construction of a collective and shared knowledge of design pedagogy (Eastman, Newstetter, and McCracken 1999).

[1] In this paper, discipline is used as an umbrella term that covers multiple design domains (e.g. architecture, industrial design, or interior design).

Methodology

Looking at the journal articles is a widespread way of studying the developments within a discipline (e.g., Buboltz, Deemer, and Hoffmann 2010; Eby et al. 2005). To approach our study, we took a similar approach and used content analysis to take a look back at pedagogical articles published in three principle design journals; Design Studies (DS), Journal of Architectural Education (JAE), and Journal of Interior Design (JID).

Our approach was built on Krippendorff's (2004) model where content analysis of text is undertaken within a contextual framework. The contextual framework serves as a lens through which the data is analyzed, constructed and research questions are explored.

Contextual framework

Informed by Boyer's (1997) theory on the scholarship of teaching, the contextual framework for this research is built upon 1) Weimer's (2006) classification scheme for analyzing SOTL based studies, and 2) the editorial approaches of the three scholarly design journals reviewed in this study.

WEIMER'S TAXONOMY

Weimer (2006) is one of the first scholars[2] to make an extensive review of SoTL from a wide range of disciplines. Her aim was to understand the quality standards of SoTL studies based on the governing modes of knowledge construction. She reviewed articles, with pedagogical content, that were published in around a hundred discipline-based and cross-disciplinary journals and magazines for two years (the only design journal included in her study was the Journal of Architectural Education). Her reading of SoTL literature led her to suggest a taxonomy of methodological approaches to pedagogical scholarship, those most often seen in the broad view. Weimer's proposition for disciplinary review of SOTL provides a model for a collective review of pedagogical scholarship (Jones 2008; Powell 2006; Terosky 2007) and she challenges scholars to analyze their disciplines with the same critical eye.

According to Weimer (2006), pedagogical studies can be grouped under two main categories, wisdom-of-practice scholarship and research scholarship, and a third least applied but growing category, promising possibilities. Under each category, there are several types that further define the characteristics of the work.

The wisdom-of-practice category is associated with *experience.* It is characterized by intuition, practicality, and trial and error. While "knowledge in action" as defined by Schön (1995) is central to this category, it is also different from good teaching or scholarly teaching. Wisdom-of-practice requires "systematic review and reflective analysis" in order for one's experience to "… be made explicit and beneficially shared with others" (Weimer 2006, p. 40). Based on the content of her sample, the wisdom-of-practice category is subdivided into four types: personal accounts of change, recommended-practices reports, recommended-content reports, and personal narratives.

Different from the wisdom-of-practice, the research scholarship is defined by *objectivity* that is achieved through rigorous and systematic research protocols within

[2] Nelson (2003) made a similar analysis before but his review was not as broad as Weimer's and his taxonomy was not focused on knowledge construction.

the classroom. Here the researcher is the practitioner, the instructor. "… the empirical questions addressed are mostly pragmatic, applied, and often related directly to the instructional practice of the person asking the question" (Weimer 2006, p. 42). Based on the research method applied, there are three types of research scholarship: quantitative investigations, qualitative studies, and descriptive research.

The last category, promising possibilities, is a look into the future of SoTL based studies. While they are not widespread yet, Weimer observed an increased attention to this category that is defined by three types: hybrids (combining any of the previously reviewed types), innovative approaches (using a method that is creative), and unique formats (reporting the work in an uncommon form).

Editorial approaches

Generally, the dissemination of pedagogical scholarship is limited despite its potential value (Nelson 2003; Weimer 2006). In the fields of design, the dissemination narrows dramatically. As in many disciplines, there are few journals devoted solely to the literature of pedagogy. The available texts for this study were chosen as a convenience sample of well-known academic design journals published in English: *Design Studies* (DS), *Journal of Architectural Education* (JAE), and *Journal of Interior Design* (JID). Each of these journals targets a different disciplinary audience and scholarly approach. Therefore, the variety of work in these three journals is sufficient to frame initial questions on the state of design pedagogy.

Design Studies is the only journal among the three that has a true interdisciplinary approach. This journal includes the highest percentage of co-authored papers in our database.[3] DS welcomes studies from all around the world on every design domain including architecture, interior design, industrial design, engineering design, and systems design. The main focus of this journal is not design education or pedagogy; it is listed as one of the areas that they include: "The journal publishes new research and scholarship concerned with the process of designing, and in principles, procedures and techniques relevant to the practice and pedagogy of design" (DS 2012). DS is an important venue that informs the contemporary design research, practice and education.

The *Journal of Architectural Education* is the primary venue for research and commentary on architectural education. This journal is the oldest of the three and until very recently was published as a quarterly.[4] There is a wide variety in "type" of articles published in JAE. JAE welcomes articles on "Scholarship of Design, Design as Scholarship, Op Arch, Translations, Transactions, Interviews, and several form of review, from buildings + projects to books and symposia" (JAE 2012). Not all the articles published in this journal follow the conventional article format of DS and JID.

The *Journal of Interior Design*[5] was the first journal dedicated to issues related to the design of the interior environment from a scholarly perspective. Inquiry representing the entire spectrum of interior design theory, research, education, and practice is included in its contents. Interdisciplinary submissions are also encouraged from others interested in interior design.

[3] 65.4% of studies in DS are co-authored, whereas the percentage in JAE is 37.9% and in JID is 48.6%.
[4] In the autumn of 2009, JAE transitioned to a biannual publication.
[5] JID was previously published as Journal of Interior Design Education and Research.

Guiding research questions

While our main aim is to discuss "how pedagogical knowledge is constructed in design as a discipline," in order to answer this question, our analysis draws inferences in response to three questions:

- what can the theoretical framework set forth by SoTL tell us about design?
- what approaches to SoTL are found in design?
- what can the pedagogical articles tell us about the discipline of design?

The intent is not to extend the theory of learning or pedagogy but rather to consider what an analysis of these writings can suggest or contribute to the discussion of disciplinary pedagogy and design as a discipline. There are two types of data analysis that inform this discussion. The first, descriptive statistics, adds to the context of the study. While Weimer's (2006) analysis is qualitative without numeric conclusions, in this study the results from frequency and percentage distributions offer insight into emerging patterns of SoTL approaches that are found in design. Second a closer qualitative look at types of scholarship and pedagogical delivery contributes to the question of collective value of pedagogical scholarship in design.

Database

The research sample (n=174 articles) was drawn from possible 936 articles published from 1999 to 2010 by the three journals. Only pedagogical articles within each journal were considered for analysis. These articles were identified through a search for keywords in the body of each article: educat*, teach*, learn*, student, pedagog*, university, class* and course. An article had at least two of these keywords to meet the study criterion. Next all the articles were read in entirety to determine if their subject actually related to SoTL or not. The research team discussed perplexing articles in order to develop a consensus. The team was very inclusive in terms of the definition of SoTL. The main subject of the article is either on instructor's teaching or student's learning to be included in the database. Articles that meet keyword criteria but deal with tangential subjects, such as design education at K-12 level or current professional practices, were excluded from the sample. For instance, an article by Carvalho, Dong, and Maton (2009) included five of the searched keywords. The authors drew some conclusions that are applicable in design classrooms, for instance, "design pedagogy should allow students to reconfigure existing traditions and practices which take account of and build upon their profession's knowledge base whilst at the same time integrating their own positions" (Carvalho, Dong, and Maton 2009, p. 501). A closer reading of the article revealed that while there are limited pedagogical recommendations they do not contribute to the intent of the article. Therefore it was excluded from the database.

A codebook and code-sheet were developed prior to the in-depth coding of each article. A sample year — prior to 1999 — from each journal was selected and coded as a pilot study to test the validity of the codebook and to make the necessary changes in the coding scheme. As the analysis progressed Weimer's (2006) categories were refined to reflect the evidence emerging in the sample data. This customized Weimer's classification scheme to the disciplinary focus of the sample. There were three main changes to Weimer's taxonomy (Table 1). Because of the limited number of recommended-contents reports, we merged this type with recommended-practices reports and renamed it as *recommended instruction reports.* Within design literature, descriptive studies were limited; most of the time, the descriptions were supported by

other analysis methods. Therefore, we eliminated the descriptive studies type from the research scholarship category. Lastly, as the analysis progressed, we realized that the promising possibilities category is a main category in design. In this category, the studies are limited to mixed methods studies that Weimer (2006) calls hybrids. To reflect this character of pedagogical studies in design, the promising possibilities category was relabeled as *integrated approaches*. This category includes articles either blending the wisdom-of-practice scholarship and research scholarship or using both quantitative investigations and qualitative studies within a single study.

Table 1. The classification of pedagogical articles in design for this study.

Categories	Types	Definitions
Wisdom-of-practice	Personal Accounts of Change	Faculty reports their experience about a change in teaching, program, curriculum or policy.
	Recommended Instruction Reports	Faculty gives advice on instruction or pedagogical content.
	Personal Narrative	Faculty shares ideas, thoughts, experience related to teaching and/or learning.
Research scholarship	Quantitative Investigations	Articles that report research involving quantitative methods and/or statistical analysis.
	Qualitative Studies	Articles that share results from a qualitative study.
Integrated Approaches	Hybrid	Articles that either combine wisdom-of-practice and research scholarship categories or use mixed methods as their research approach.

The final code-sheet includes 11 variables, as reported in the findings section. Each article was coded twice, each time by a different coder. Disagreements between the coders were reviewed by a third person and discussed as a team.

Limitations

The current study is limited related to the sample size and the content of the database. Three journals yielding 174 articles are insufficient to holistically frame the SoTL specific to design. The current research needs to be understood as a preliminary study. The goal was to explore the potential of such studies. In order to frame a more precise picture of the field, further studies investigating a wider range of scholarly design journals is necessary.

Journals were viewed as data resources and not as design domains. However, as each editorial perspective represents a specific domain of design, the findings must not be misinterpreted as representing these domains. Different journals from the same domain might have different editorial approaches. Looking at one journal is not enough to understand that domain fully. Therefore, we only claim to make inferences about the journals included in our study.

Further, all three journals and all design domains are not equally represented in this study. The number of articles published each year in each journal is not equal. Two of the several design domains, architecture and interior design, include a larger proportion in our database. In order to address this limitation, we calculated weighted percentages whenever necessary in our descriptive statistics.

Findings

In order to analyze the collective value of pedagogical scholarship in design, the distribution of pedagogical articles among the journals is important. The numbers of pedagogical articles representing each journal in our database are consistent with the total number of articles published by the same journal (Table 2). More articles were published in JAE than the other two journals. Consequently, articles from JAE constitute the largest portion, 50% of the database. Articles from DS are 30% and articles from JID are 20% of the database. JID allocates more space for pedagogical articles (29% of the articles published are pedagogical) compared to the other two journals.

Table 2. Distribution of articles by journals.

Journal	Number of Pedagogical Articles (1999-2010)	Total Number of Articles Reviewed (1999-2010)	Percentage of Pedagogical Articles (1999-2010)
DS	52	362	14%
JAE	87	454	19%
JID	35	120	29%
	174	936	19%

The distribution of the articles on pedagogy published by the three journals as a whole does not significantly change within the time frame of the study. The trend line defines only a very slight increase from 1999 to 2010 in the total amount of pedagogical articles published (Figure 1). The largest number of pedagogical articles was published in year 2006, followed by a sharp decrease in 2008. There are not any overlapping trends between the changes in the number of pedagogical articles published by three journals. While the number of articles in DS and JID showed a very slight decrease, the number of articles from JAE has a slight increase within the past 12 years.

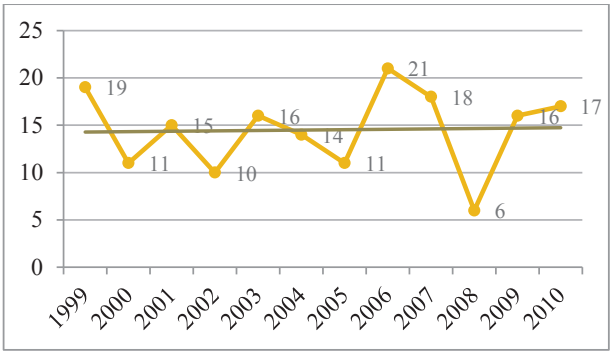

Figure 1. Trend line showing the change over time in the number of pedagogical articles published.

Grouping the articles into scholarship categories is helpful to look closely at the approach design scholars have taken in SoTL (Table 3). Nearly half of the articles reviewed (n=95) were devoted to wisdom-of-practice. This category was followed by research scholarship (34%) and integrated approaches (18%). The most subscribed type of scholarship within this sample of design literature is qualitative studies (n=38, 23%).

Table 3. Distribution of articles by the scholarship category and type.

Scholarship Category	Type of Scholarship	Frequency	Weighted Percentage (based on journals)	Frequency	Weighted Percentage (based on journals)
Wisdom-of-Practice	Personal Accounts of Change	49	22%	95	48%
	Recommended Instruction Reports	33	19%		
	Personal Narratives	13	7%		
Research Scholarship	Quantitative Investigations	16	11%	54	34%
	Qualitative Studies	38	23%		
Integrated Approaches	Hybrid	25	18%	25	18%

One of the most informative results from the database came out of the distribution of the scholarship category and type by journal (Figure 2). In DS, research scholarship constituted the largest proportion (n=31, 59%) of articles. In JAE and JID, research scholarship is replaced by wisdom-of-practice. Eighty percent (n=70) of the articles in JAE and 49% (n=17) articles in JID are from wisdom-of-practice scholarship category.

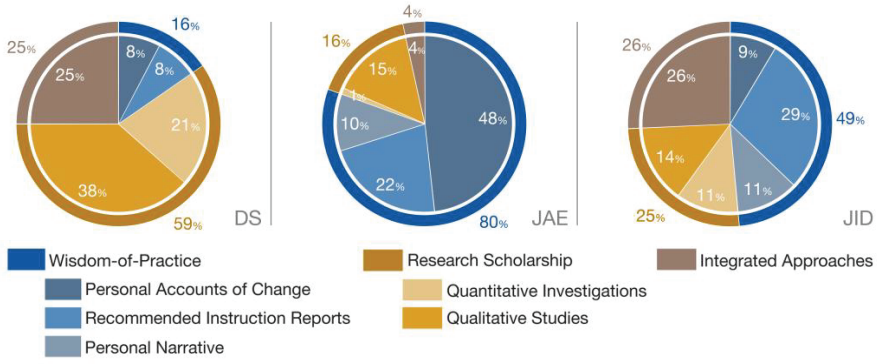

Figure 2. Distribution of scholarship categories and types by journal (outer rim represents scholarship categories, inner circles stand for types of scholarships).

The pie charts representing the types of scholarships in Figure 2 show a different character for each journal. In DS, qualitative studies has the largest proportion (n=20, 38%), whereas for JAE, articles based on personal accounts of change constitute 48% (n=42) of the total. The distribution of the type of scholarship for articles from JID has a more even character compared to DS and JAE. Recommended instruction reports ranked the most in JID with 29% (n=10).

At the next level of analysis, it is possible to draw inferences about the context of SoTL in design literature. Articles dealing with pedagogical issues in the studio represent the largest distribution (n=134, 74%) when the sample is analyzed by class type[6] (Table 4). 17% (n=26) of the articles do not focus on any specific class type. These

[6] Articles that involved any type of skill-based application were coded with the studio value.

articles discuss or narrate a general pedagogical issue. For example, Watson, Guerin, and Ginthner (2003) explain the importance of staying current on design practices for interior design educators. Design educators need to have a relationship with firms and practitioners in order to be informed about contemporary design practice. Watson, Guerin, and Ginthner's (2003) research enabled them to develop a handbook including information on how to research and analyze practitioners design process for design educators. While this article shares valuable information on how to develop curriculum in interior design, it does not focus on any specific class type or level.[7]

Table 4. Distribution of articles by class type.

Class Type	Frequency	Percentage	Weighted Percentage (based on journal)
Studio	134	77%	74%
Theory	14	8%	9%
General	26	15%	17%

In terms of articles' topics, 55% of the articles are SoTL specific; meaning, their main goal is to share either experience or research results on teaching or student learning. The rest of the articles (45%) do not seek pedagogical advancement as their main objective. Instead, these articles share findings about research with educational conclusions that have the potential to inform design pedagogy. Casakin and Goldschmidt's (1999) research on the impact of visual analogy on design process and Guerin and Thompson's (2004) critique about the interior design education are examples for the second group of SoTL based studies.

The content of articles show variety. Some scholars focus on a project, course, or an educational program and narrate their experience. In some cases, this narration is limited to the class schedule, description or the presentation of the course outcomes, e.g. student projects. In others, the experience is presented together with research conducted on the same subject within the classroom or studio. However, not all pedagogical studies in design occur in the classroom or studio. Scholars conduct studies on teaching and learning outside the classroom using methods such as protocol studies and surveys. These studies are conducted with or without students. There are also narrations of thoughts without any references to specific courses. There are studies reporting a non-pedagogical research conducted in a classroom or studio. Because of its context and research subjects, these studies include discussions and conclusions on design pedagogy.

The articles also vary in terms of the number of citations that are included in their bibliographies. The range is 0-74. Table 5 lists the average number of citations by journal and scholarship category/type. 174 articles included an average of 19 citations. While the average number of citations in the articles from DS and JID exceeds 19, the average number of citations in the articles from JAE is below the average. Boyer's (1997) study on American higher education was cited in three articles. Another study

[7] In addition to class type, the research team also coded level of delivery. Fifty-five percent (n=85) of the articles were involved with pedagogical issues at the undergraduate level. Forty-nine articles (25%) do not specify the level of delivery that the authors addressed. Eleven percent of articles (n=21) report an educational environment in which undergraduate and graduate students attended the same studio/course.

from Boyer and Mitgang (1996) that analyzes architectural education was referred 12 times.

Table 5. Distribution of the average number of citations by scholarship categories and types.

Scholarship Category	Type of Scholarship	DS	JAE	JID	Total	
Wisdom-of-Practice	Personal Accounts of Change	21	6	29	9	11
	Recommended Instruction Reports	27	13	19	16	
	Personal Narratives	-	1	13	5	
Research Scholarship	Quantitative Investigations	32	6	30	30	30
	Qualitative Studies	31	28	32	30	
Integrated Approaches	Hybrid	24	13	36	27	27
All Scholarship Categories		29	11	27	19	

Discussion

The data suggests that the theoretical framework set forth by SoTL can be used to explore design as a discipline as well as challenge our thinking about design. The analysis of 12 years of pedagogical articles shows that while SoTL based studies do exist within design, the percentage of pedagogical articles is low. If the assumption is that all four scholarship types defined by Boyer contribute to knowledge generation, an expectation that 25% of scholarship within a discipline is devoted to teaching and learning is reasonable. In this study, only 19% of all the articles published were devoted to design pedagogy. While it is generally acknowledged that SoTL is not widely pursued, neglected no matter what the discipline is (Boyer 1997; Huber and Hutchings 2005; Shulman 1999; Weimer 2006), this can be revealing in light of our understanding of the teaching of design knowledge.

When one reflects on design as predominantly studio-based curriculums, teaching lends itself well to the pursuit of scholarship. If the hours devoted by design faculty to teaching are considered, either in the preparation and delivery of lectures or in the review and critique of studio projects, pedagogy remains relatively untapped among the contributors to DS, JAE, and JID. Further, if one presumes that a large number of current faculty were trained in the tradition of doing rather than knowing, reporting on teaching rather than empirical research seems natural. Is it possible that because SoTL is typically viewed suspiciously in the academy, design scholars overlook it?

In the academic environment contribution to scholarship is a key to success (Boyer 1997; Glassick, Huber, and Maeroff 1997; Huber and Hutchings 2005). While this is often measured in terms of numbers of publications, it is not necessarily true that all academic writings in design disseminate new knowledge. To the contrary, within this sample, the scholars who share new knowledge through SoTL work are not extensive. 49% of the articles' authors narrated their course/studio experience or rendered their general ideas on pedagogy without sharing new knowledge on the topic. While these articles have been deemed of interest to the respective journals, there is an important point to highlight in this respect. Studies from other disciplines, which have a longer appreciation to SoTL, prove that SoTL work can produce new knowledge and extend the disciplinary body of knowledge (Healy 2000, Huber and Hutchings 2005; Huber and

Morreale 2002). Does this approach of reporting only what we do again reflect the trade traditions of our domains? How much greater is the potential for this reporting, if it is held in an analytical light to search for new ideas?

A closer reading of these experience-based articles, reveals some key points. Most experience-based articles in this sample do not adhere to a systematic method of reporting nor situate their study in an existing body of literature. Further, these articles often fail to offer a reflection or analysis on the experience, i.e. they report "this is what I did" rather than "this is what I discovered." Experience-based articles include an average of 11 citations, whereas this number is 28.5 for research-based (the combination of research scholarship and integrated approaches) articles. In the whole database, only three citations are given to Boyer's (1997) study. Even these three do not use the extensive SoTL literature as a resource to guide their pedagogical research. Instead, 45% share a study that is based on other issues — such as analogy and design thinking — and report on pedagogy as a secondary issue. In overall, the citations are mostly on design education.

A closer look at the distribution among categories and types of scholarships published in design journals reveals information about what is viewed as reasonable or important scholarship by each journal in this study. The analysis of the same variables in each journal also shows that the discipline of design does not have agreed upon sense of credibility and quality for articles in SOTL. Figure 3 depicts the differences of the editorial approaches of each journal with another way of categorizing the scholarship categories. Here, the types of scholarships under wisdom-of-practice category are named with experience-based studies as these articles always share an experience or an idea. On the other hand, both the research scholarship and integrated approaches categories include some type of empirical investigation and can be grouped under research-based studies. From this perspective, in DS, research-based articles were published more frequently, whereas in JAE, experience-based articles appear more often. In JID, the two approaches are balanced. Furthermore, the expectations for the same category differ from journal to journal. For example, the average number of citations in the experience-based articles from DS and JID (the average number of citations are 24 and 20, respectively) is higher than the ones from JAE (the average number of citation is 7). The distribution of the types of scholarships (Figure 2) also illustrates difference in research traditions among the authors of each journal. These findings highlight that there is need to strengthen criteria for credibility and quality of pedagogical studies in general and within each represented design domain. This challenges the scholars to debate the body of knowledge within design from a slightly different perspective. While there is potential for further discussion about the perception of *credibility* and *quality* in SoTL based studies in general, the distribution of scholarship categories in this sample points to credibility and quality issues in design pedagogical articles as well. The variety of SoTL research in this sample follows Weimer's (2006) thinking that there is no evidence of definitive assessment criteria for credible pedagogical scholarship at large.

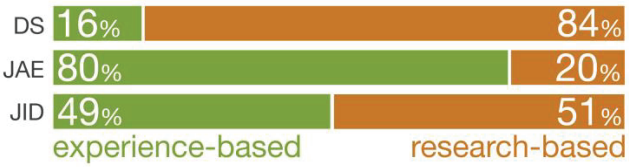

Figure 3. The distribution of experience-based and research-based articles in each journal.

Our findings also show that craft versus knowledge is a tension point in the pedagogical scholarship (Figure 4). While 52% of the studies are research-based in design; an almost equally important percentage is experience-based. This distribution does begin to frame a picture of how we approach pedagogical scholarship in design. In design pedagogy at large 'what we do' and 'what we know' appears to have equal value.

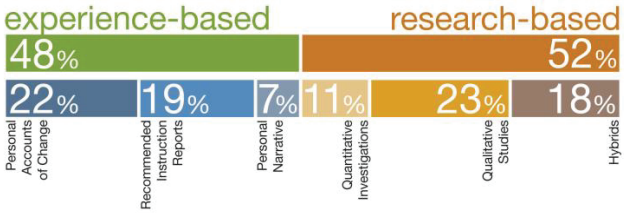

Figure 4. The distribution of experience-based and research-based articles.

In addition to the distribution of articles among experience-based and research-based approaches, the distributions of the class type and level of delivery support this claim. The development of design as a discipline requires attention to design theory and knowledge (Friedman 2003; Poggenpohl 2009). One might expect to see an equal focus on teaching and theory courses as there is on studio in design education. However, among 174 articles, 74% focuses on the studio. Only 9% of the articles deal with a pedagogical issue on theory. Further, 55% percent of the articles focus on undergraduate coursework. While this demonstrates a response to Boyer's challenge to improve undergraduate education, the attention to graduate education is limited to 20%.

These findings suggest that SoTL does not shape the discipline but instead that traditions of the field shape SoTL of design. This is worth a second look. Boyer (1997, p. 16) suggested that "teaching at its best, shapes both research and practice." What is the impact on a profession if it's traditions shape teaching? This question resonates as well in the broader discussion as the field at large seeks to codify and generate knowledge. Are we a field of craft or knowledge? How does this situate the profession in the knowledge driven world economy? Acknowledging the limitations of this preliminary study, the findings nevertheless suggest that careful thought should be turned toward both the way we teach and what we teach. Further, questions should be pursued in relation to current practice in the 21st century.

Finally, the study revealed one unique characteristic of design. That is the equal appreciation of experience and research in our current literature. A high number of extant articles report an integrated approach in pursuing the studies reported among

the three journals. Weimer (2006) did not include this category in her broader study of multiple disciplines. Our findings suggest that in the discipline of design, a significant percentage of articles use an integrated method in pursuing research questions related to SoTL. This finding should be pursued further in future studies. An integrative approach to research studies is consistent with the notion of the iterative design process and design thinking.

Conclusions

The aim of this study was to test Dr. Weimer's taxonomy in the context of design. It demonstrates that this sample of SoTL literature could be tested as Weimer suggests. This study is important because it is the first to review published pedagogical scholarship in design seriously. It offers a foundation for the ongoing development of thinking in this area. The timing of this survey is significant as well. As the debates on design knowledge and the development of design as a discipline has been heating up so should the debates about the way we educate of new generations of design practitioners. Such a subject requires us to first look back in order to plan the future. The retrospective analysis showed that there is no agreed way of knowledge construction in design pedagogy. Experience-based and research-based studies are almost equally significant. This is a starting point for conceptualizing questions that could enhance the credibility, quality, and the viability of SoTL for scholars and professors of design. As such it offers two contributions. The first is to contribute to the discourse on teaching as credible scholarship for design educators. The second is to suggest a way to expand debate of design as a discipline.

We offer a framework that begins to respond to the nuances of the disciplinary pedagogy, although we acknowledge that further refinement is in order. As well, there are clues that further study of the SoTL of design as a discipline and of each design domain will yield valuable information. For example, the qualities of wisdom-of-practice writings, which incorporate personal narratives, do not represent a fully accepted methodology among the academic community (Weimer 2006). Nevertheless, these writings are a significant part of the findings in this study. Are there questions about quality and utility that can be posed to enhance or advance this approach? On the other hand, can the normative view that pedagogical research should embrace normative methods be challenged, particularly in the discipline of design? Or should we take the interdisciplinary discussions around design as the basis and concentrate on generating pedagogical knowledge through integrated approaches to define our disciplinary boundaries? At the end, we have more work to do in order to answer the important questions located within the intersection of SoTL and design as a discipline.

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Examining the Textile Design Creative Practice Research-Teaching Nexus

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Abstract: Due to the nature of higher education (HE) in the United Kingdom (UK) educators often operate under pressure. This can be connected to requirements to undertake research and produce outputs, linked to funding awarded to HE institutions (HEIs). Approaches to research that utilise professional and or creative practice are adopted and formulated, prompting use of terms such as 'practice-led' and 'practice-based'. Variation in opinion exists regarding research and creative practice by academic staff and within HEIs. The positive impact that educator research and or creative practice bring to the educational environment, learning and teaching has been recognised. Textile design exists on the periphery of academic discourse regarding design research and education. This paper contributes to literature relating to these disciplines. The focus is on examination of textile designer educator engagement with research and creative practice. Investigation is carried out to ascertain if and how research informs textile design education. The positive impact that operating in the educational environment can have upon undertaking research is described. The paper concludes with discussion surrounding the key findings and proposes considerations for enhancement of the textile design research-teaching nexus and visibility of textile design research to the wider community.

Keywords: textile design research, higher education, creative practice, designer educator.

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Research Context

In the UK, responding to changes in HE policy, while potentially of long-term benefit increases pressure placed upon educators operating in the system. Previous research discovered:

> Full-time and part-time teachers, including teacher-practitioners in Higher Education already work under considerable pressure including the need to undertake scholarly work which sustains and enhances their teaching practice and subject knowledge…there are additional pressures to engage in research that brings funding (and prestige) to institutions, teaching responsibilities that involve planning, preparation and assessment, and numerous administrative tasks. (Leith & McInnes 2010, p. 65)

In addition, requirements to obtain teaching qualifications, participate in quality assurance activities and respond to a more diverse, fee paying student population impact upon the educator role.

The Research Assessment Exercise (RAE) and Research Excellence Framework (REF) place emphasis on staff employed by HEIs to gain funding, carry out research and create outputs with impact. Success in these exercises equates to enhanced reputation and financial gain for HEIs, as the distribution of public funds by the HE funding bodies is based on the quality of research undertaken. For the purposes of the REF (2011, p. 48), research is defined as "…a process of investigation leading to new insights effectively shared." Included in this, is work directly pertinent to "…the needs of commerce, industry, and to the public and voluntary sectors; scholarship; the invention and generation of ideas, images, performances, artefacts including design, where these lead to new or substantially improved insights…" (REF 2011, p. 48). For the Arts and Humanities Research Council (AHRC) (2012) art, design or architecture professional and or creative practice can be integrated into a project if made explicit, termed *practice-led* research. Essential to the AHRC (2012, p. 71) is "…documentation of the research process, as well as some form of textual analysis or explanation to support its position and as a record of critical reflection."

Smith & Dean (2011, p. 5) cite 'practice-led research' and other associated terms such as 'practice-based research' and 'practice as research'. The terms are used to argue that "…creative work in itself is a form of research and generates detectable research outputs…" and "…to suggest that creative practice – the training and specialised knowledge that creative practitioners have and the processes they engage in when they are making…can lead to specialised research insights which can then be generalised and written up as research." (Smith & Dean 2011, p. 5) Candy (2006, p. 1) differentiates, with *practice-based* research a "…creative artefact is the *basis* of the contribution to knowledge…" whereas *practice-led* "…*leads* primarily to new understandings about practice…". *Practice-led* research is viewed as the singular pathway for the dual identities of educator and creative practitioner to be reconciled, requiring an approach to research that 'does not undermine' creative practitioner identity (Rust et *al* 2007).

The emphasis on research has led to examination of the *research-teaching nexus*. In HE creative industries studies that examine the nexus, the close alignment of research to creative practice is evident. The Supporting New Academic Staff (SNAS) (2007b) workshop examined links between educator research or role as creative practitioner and teaching. Wareham (2008, p. 1) describes activities that go "…beyond what may

normally be thought of as 'research' in institutions of higher education…" to reflect "…the links between academic research, creative processes and professional activities." It is evident that there is "…considerable divergence of views about creative work and research not only within universities, but also amongst academics…" (Smith & Dean 2011, p. 16).

Educators' research has been found to impact positively on the learning and teaching environment. This can be through student exposure to an educator's current research or by the student learning to be a researcher (Jenkins et *al* 2007). Research impacts on teaching through the general development of the curriculum, the creation of new courses, modules and materials, as well as alternating thinking and the level of ambition of courses (SNAS 2007a; Rust et *al* 2007). The link between teaching, learning and research is iterative, as "…curricular developments will also prompt new areas of exploration for research." (SNAS 2007a, p. 8) Educators recognise positive aspects of formalising research in art and design, with support and legitimacy for new work, resource access and freedom to create work removed from market demands (Wareham & Trowler 2007)

Looking Out examined the role of teacher-practitioners, individuals working in the creative and cultural industries who contribute to the learning experience of students (Clews & Mallinder 2010). Teacher-practitioners positively impact upon student learning as they influence pedagogy and curriculum development, enhance student learning and acquisition of employer relevant skills (Clews 2010). In fashion and textiles, teacher-practitioners connect industry and education, facilitate transference of industry relevant skills, communicate design methods and provide direction to viable design solutions for students (Leith & McInnes 2010). The positive impact that teaching has on teacher-practitioners is realised as a co-learning experience, learning can also occur through articulation of own practice to others (Clews 2010). Varying concepts exist regarding the way teachers approach their teaching, a community of practice dimension is evident when learning is viewed '…as engaging with a practice, by exemplars, stories, narrative and through experience' (Drew 2004: 11). Five categories of variation in relationships between creative practice and teaching are evident, from the perspective of educators who are also creative practitioners (Shreeve 2010). These relationships can be complex; when segregation exists negative experiences impact upon creative practitioner identity and can result in individuals leaving academia (Shreeve 2011).

Textile Design Content and Rationale

Textile design HE in the UK has been intrinsically linked to industry, which occupies "…an important position in the supply of domestic industries as diverse as home furnishings and fashion to industrial areas such as automotive and medical." (Studd 2002, p. 37) Bye (2010, p. 207) claims that textile design "…has not been a visible part of the discourse of design as a discipline or design research." This is attributed to the prominence of tacit knowledge resulting in "…a considerably less active role in the pertinent debates of design research…" (Igoe 2010, p. 5). In addition, opportunities for dissemination of research to the textile design research community are minimal. Published since 2003, *Textile: The Journal of Cloth and Culture* "…focuses on issues of materiality, and cultural and historical studies and therefore is not well placed to kindle the discourse on textiles as a design discipline." (Igoe 2010, p. 2) Recently formed, the *Journal for Research in Textiles and Textile Design* selects papers that examine approaches, contexts and outcomes surrounding textiles and textile design. Outside the

UK, journals that publish textile research exist, however these tend to be technical and scientific in nature. Bye (2010, p. 210) analysed the content of articles from clothing and textiles journals to discover "…limited visibility of design research." In addition, journals with a general interest in design research have minimal textile content (Bye 2010). A similar situation exists with the small number of conferences, which focus on textile design and the minimal amount of textile-based contributions made to conferences, which target a range of disciplines.

Therefore, there is a scarcity of literature relating to contemporary textile design education, the role of educators, approaches to research and creative practice and limited insight into the textile design research-teaching nexus. The primary intention of the research project to which this paper disseminates an aspect, was to investigate the role of the textile designer educator in the UK HE system. The term *designer educator* was adopted, as existing terms did not depict accurately the role at the centre of the investigation. Designer educator describes individuals who engage in their own creative design practice and work in design education. The focus on this type of individual ensures engagement with textile design practice and education. This paper examines designer educator approaches to research and creative practice. Investigation centres on if and how educator engagement in these activities informs teaching and therefore textile design HE. Discussion takes places surrounding the ways in which textile design education informs educator research and creative practice. Although this paper focuses on textile design HE in the UK and contributes to understanding in this field, it is anticipated that the findings, discussion and conclusions will be of relevance to other disciplines.

Researching the Designer Educator

The methodology used to undertake the research reported in this paper included a self-case study into the author's evolving role as a designer and educator, a UK wide survey of educators employed in the HE textiles sector and seven case studies with textile designer educators. The designer educator self-case study covered a three-year period. This method was deemed appropriate as it offered "…a strategy for doing research which involves an empirical investigation of a particular contemporary phenomenon within its real life context using multiple sources of evidence." (Robson 2001, p. 5) Evidence included photographs, sketchbooks, designs, textile samples, products, diagrams and an activity log. Reflection was vital throughout the self-case study, whether 'reflection-in-action' while carrying out activities, or retrospectively after an experience or event had taken place, 'reflection-on-action' (Schön 1987). From the self-case study key themes emerged relating to the designer educator role, research and creative practice.

To increase understanding surrounding the emergent themes it was necessary to gain further insight into the phenomenon at the centre of the investigation from the perspective of others. An online survey was undertaken, primarily as a means to locate individuals operating in roles comparable to the author and to gain broader insight into the textile designer educator role, research and creative practice. 81 respondents completed the survey; analysis of data was primarily statistical. Certain responses were analysed to ascertain who out of the respondents could be classified as designer educators, this totalled 58 individuals; from this group requests to participate in the case studies were sent. Seven cases studies were carried out.

The aim of the case studies was to increase understanding regarding the research themes. Differing from the self-case study, which provided in-depth insight into a developing situation, over a period of time, the case studies were an opportunity to gain insight at a certain point in time. Qualitative semi-structured interviews were the main method used. Content analysis was applied to interview data; initial categories were formed from the questions, with others devised and amended in relation to the responses contained within the interview transcripts. Analysis of case study data prompted further reflection on and comparison with the self-case study and survey findings. The purpose was "…to discover similarities and/or differences by the use of comparison and contrast…to form categories, establish boundaries, find inconsistencies, discover patterns and connections..." (Gray & Malins 2004, p. 133) In this paper case study participants' survey responses are abstracted and discussed to contextualise this sample within the wider context provided by the survey responses, comparison is also made with the self-case study.

Designer Educator Educational Employment

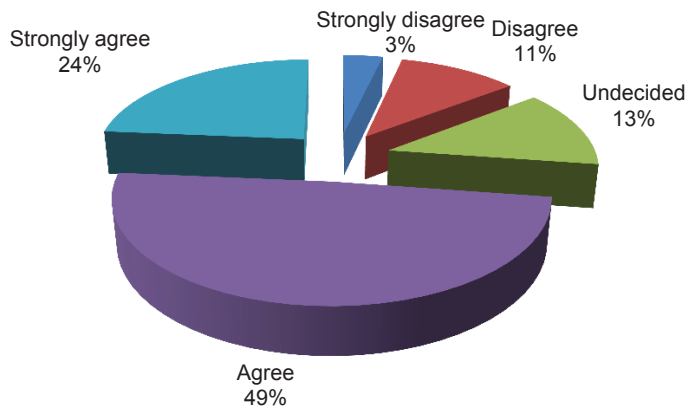
The survey respondents were employed at 36 different HEIs. Four of the case study participants worked part-time, they were employed at Leeds College of Art, Chelsea College of Art and Design, Nottingham Trent University and Bath Spa University. A further two case study participants were employed on a full-time basis at Buckingham Chilterns University College and University of Wales Institute Cardiff. Two HEIs, Robert Gordon University and The Glasgow School of Art (GSA) employed one of the case study participants. The author's educational employment changed during the self-case study; initially employment was on a visiting basis at GSA and occasionally at the Royal College of Art and Central Saint Martins College of Art and Design. This changed to part-time permanent contracted employment as a Lecturer at GSA. Of the survey respondents, 55% were employed in educational employment in full-time positions, 35% on a part-time basis and 10% in a visiting capacity.

Research Activity

All but one of the case study participants described themselves as research active, respondent 1 was the exception. Throughout the self-case study the author was an active researcher. 74% of the designer educator survey respondents considered themselves to be research active. However, analysis of data related to function of educational employment shows that only 66% of designer educator survey respondents functioned in positions involving research, as 62% held teaching & research positions and 4% were research only. From the case studies, respondent 1 worked in a teaching only capacity, whereas the other participants all functioned in teaching & research positions. During the self-case study when working as a visiting lecturer the author's function of educational employment was teaching only, this changed to teaching & research when contracted to part-time employment.

Research Activity and Creative Practice

To ascertain connections between textile designer educator research and creative practice, the survey requested selection of a graded response to the statement 'My research involves my creative practice'. 49% of respondents agreed and a further 24% strongly agreed with the fact that their research involved their creative practice (figure 1).

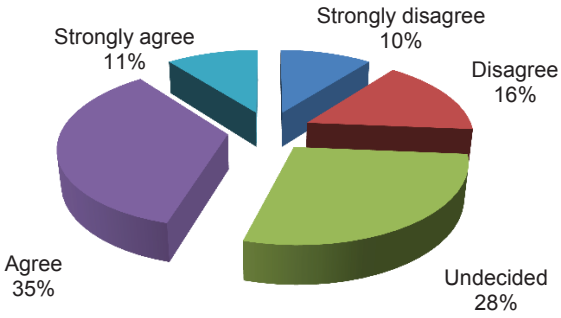


Strongly disagree		Disagree		Undecided		Agree		Strongly agree		TOTAL	
No. of responses	%	No. of responses	%	No. of responses	%	No. of responses	%	No. of responses	%	No. of responses	%
2	3%	6	11%	7	13%	27	49%	13	24%	55	100%

Figure 1. Designer Educator Survey Responses to 'My research involves my creative practice?'.

14% stated that their research did not involve their creative practice (11% selected *disagree* and 3% *strongly disagree*) and 13% were *undecided*. Case study participants held the same opinion as the majority of survey respondents, as they all selected either *agree* or *strongly agree* regarding the extent to which their research involved their creative practice.

To gain further insight into the extent to which textile designer educators viewed creative practice as similar to or differing from research, the survey asked for responses to the statement 'My creative practice is the same as my research' (figure 2).



Strongly disagree		Disagree		Undecided		Agree		Strongly agree		TOTAL	
No. of responses	%	No. of responses	%	No. of responses	%	No. of responses	%	No. of responses	%	No. of responses	%
6	10%	9	16%	16	28%	20	35%	6	11%	57	100%

Figure 2. Designer Educator Survey Responses to 'My creative practice is the same as my research?'.

Almost half (46%) of the survey respondents viewed their creative practice as the same as or similar to their research, as 11% selected *strongly agree* and 35% *agree*. 28% were *undecided* indicating ambiguity in opinion or belief that their research involved aspects of creative practice and other activities. 26% of designer educator survey respondents viewed creative practice as different from research, as 16% selected *disagree* and 10% *strongly disagree*. The case study participants survey responses also indicated variation. Case study respondents 1 and 6 selected the *disagree* option. This is because operating in a teaching only position, respondent 1 undertook creative practice but not research; this involved the design and production of textiles and collections of textile accessories for a range of different clients. Respondent 6 undertook both research and creative practice, however these activities differed. Research was described as a written activity due to the necessity to publish aspects of doctoral research through conference papers and journal articles. Creative practice involved working freelance, designing collections of trend-based fashion textiles, exhibited and sold at trade shows. Respondent 6 described future creative practice as the creation of 'one-off pieces' for gallery-based exhibition.

Respondent 5 selected the *strongly disagree* option when responding to the statement 'My research is the same as my creative practice'. For respondent 5 creative practice undertaken for research purposes was described as 'art practice', considered necessary due to the constraints imposed when working for a commercial design context which was seen to limit creativity. Commercial design practice involved the production of designs on a freelance basis for tableware, textiles and giftware markets

(respondent 5). Themes examined through research may overlap with aspects of commercial design practice, however the art-based practice was used as a research method to carry out investigation into aspects of digital technology utilisation. Dissemination of research tended to be via exhibitions, conference papers and journal articles. Respondent 5 explained, "…more of the research is writing rather than making…it's constantly a battle to keep the visual…[component] going."

For respondent 3, creative practice was only undertaken for research purposes, with questions formed and investigated through creative activity and outcomes disseminated through exhibitions, conferences and journal articles. In this example of creative practice activity, 'clients' are not involved; instead work tends to be produced in response to 'events' taking place (respondent 3). Respondent 3 selected *undecided* in response to the statement 'My research is the same as my creative practice'.

During the self-case study, own design practice was used to investigate utilisation of digital design and printing technology for textile design creation. This formed part of a method used in a research project, which investigated the designer educator role. In this context creative practice involved the design and production of interior textiles (figure 3) and textile-based products, for example soft furnishings and lighting (figure 4).

Figure 3. Line 04, digital print with reactive dyes onto cotton twill.

Figure 4. Line 01 and Line 06 Lampshades, digital print with reactive dyes onto cotton twill.

Textiles and products were exhibited and sold on a yearly basis at 100% Design, London. Feedback gained from architects, interior designers, retailers and other visitors to the show informed subsequent design development. Each phase of design activity included periods of reflection, planning, investigation, production, exhibition, feedback and analysis, resembling the action research process. As design practice was used as a method as part of a project using other investigative methods, aspects of the research have been disseminated at conferences and through journal articles.

Respondents 4, 2 and 7 all agreed that their creative practice was to some degree the same as their research; respondent 4 selected the *strongly agree* option. Respondents 4 and 7 both described situations whereby they and their employer HEI viewed creative practice as research. For respondent 4 this involved the design and production of wallpaper, exhibited at trade shows and through galleries. The production of commission-based textiles for public and corporate interiors and the creation of textile artefacts contributed to research for respondent 7. These designer educators both authored books relating to textile practice. Respondent 2 also authored a book, described as an educational book and "…a series of tutorials…". This respondent described own creative practice as a means to develop and display skill. In addition to creative practice activity informing the content of the authored book,

designs produced were sold at trade shows. Future work resulting from creative practice was to feature as part of a group gallery exhibition.

Research Informing Textile Design Education

The high percentage (74%) of research active respondents and the fact that the majority of research undertaken involves creative practice (figure 1) indicates the importance of engagement in research and research, which involves creative practice, from the designer educator perspective. This view was also asserted by a survey respondent "…I believe my research and my creative practice within industry is of value to students." (no. 160353) Respondent 4 believed that it would be possible to "…stop being an educator…" however if this individual "…stopped being a designer, the educator [role] would suffer." Case study respondent 2 described herself as "…a very active designer…" and felt that due to demand in recent years from her educator role, her design practice was currently most important. Respondent 3 stated that practice as both a designer researcher and educator was 'absolutely vital'. At the beginning of the self-case study, the author began teaching digital design and textile printing technologies. Previous and developing understanding gained though own design practice and research, influenced and informed the approach taken to and content of teaching. Continued engagement in design activity enhanced understanding of methods and processes, the discipline and wider fields, industry, professional and contemporary practice.

Contextual Awareness

Respondent 6 described passionately the necessity to "…go out and see…things", included within this was work by other creative practitioners, trends, visual references and techniques considered innovative, viewed for creative practice purposes and believed to permeate teaching. When visiting and exhibiting at trade shows, information collected is shared with students and other HE staff (respondent 4). During the self-case study references discovered through exhibiting at, or visiting trade shows, other exhibitions and viewing secondary sources (i.e. books, magazines, postcards, promotional material and websites) relating to a range of subjects (i.e. the work of other practitioners and companies, materials, techniques and processes) for the purposes of own design practice, have been referred to when teaching, and communicated to colleagues when relevant.

Skill Advancement

For respondent 7 continued creative practice enhanced, challenged and developed skill, which fed into teaching, as did the 'diversity of work' undertaken. Designer educator skill development relating to digital technology utilisation directly impacted upon teaching practice and therefore student learning. For example, the skills gained by respondent 2 through individual use of CAD software, informed the tutorials written; the discovery of new techniques through own creative practice prompted the creation of new tutorials. This linkage was also expressed by a respondent to the survey (no. 154637) "…practice research into CAD processes results in the production of new teaching methods and filters through to the student experience." As with the situation encountered during the self-case study, case study respondents 2 and 6 described own creative practice as necessary when teaching digital technology. The release of new versions of CAD software and improvements with peripheral devices and output

technologies required educators to update skills and understanding to ensure that teaching remains relevant to the wider practice context. A survey respondent further reinforced this, “Standards with software and hardware evolve constantly and there will always be a need to put into practice new developments with technology. I believe you need to practice what you teach.” (no. 159445) Undertaking own creative practice using digital technology was found to enhance educators’ confidence (respondent 2) and necessary “…to be one step ahead of…students…” (respondent 6).

During the self-case study the Centre for Advanced Textiles (CAT) at GSA was regularly used to digitally print designs onto fabric. While this facility offers its own bureau service, on occasion the author would run the machines, print and finish fabric. Observation of bureau service activities, communicating with the Centre’s staff and having hands on access to the technology, increased understanding and awareness of future potential utilisation. The insights gained were communicated to students through workshops, handouts, group and individual tutorials and the development of an online learning resource, formed with other staff.

Experiential Realisation

Continuation of creative practice for respondent 7 was described as advantageous in terms of expanding own approaches to addressing issues and problems. Reflection on own experiences when difficulties were encountered and overcome influenced guidance given to students (respondent 7). Engagement in research-based creative practice enhanced ‘empathy’ towards students working through the design process due to similarities in experiences encountered (respondent 3). During the self-case study, own experiences were recalled to assist students in overcoming difficulties and to offer suggestions towards the realisation of their ideas. Respondents 3, 4 and 8 also believed that their experience as creative practitioners supported students to realise their ideas. This was described as an ability to “…visualise the end of the line…” and involved showing and explaining to students “…potentially where something could end up” (respondent 4).

Entrepreneurship and Networking

Respondents 1 and 7 believed that insights gained through working as a designer in industry and operating in a self-employed capacity also informed their teaching. The different situations encountered through the author’s design practice were communicated to final year students. This included describing examples of alternative working procedures, such as undertaking commissioned work involving exclusivity agreements, working for an agent on a predetermined percentage cut of the income gained, establishing royalty agreements and working out trade and retail prices. Awareness of the necessity for graduates to possess certain business skills and entrepreneurial abilities increased through developments in own practice, which then influenced curriculum content.

For respondent 3, disseminating outputs from research, whether through exhibitions, written text or conference presentation to peer review audiences is “…an important part of being an academic…”. Designer educators successful participation in exhibitions and dissemination of work through other platforms benefited HEIs employing these individuals. This potentially enhances the individual’s and HEIs reputation with outputs submitted to research assessment exercises. Through exhibiting at trade shows during the self-case study, contacts were made with a wide range of individuals. While the majority of contacts gained directly benefited the

author's design practice, others were potentially viable as contacts for industry-based student projects and student work placements.

Textile Design Education Informing Research

The positive impact that designer educators' research involving creative practice and creative practice activity brings to the educational environment has been evidenced. From the designer educator perspective, operating in the textile design HE environment can also inform research and creative practice, in addition to learning and teaching. Case study participants described communicating with students as 'very inspiring', 'refreshing' and a 'two-way process' (respondents 6 and 7). Respondent 2 found that suggestions made to aid the development of student work, promoted interesting discussion, which could act as a catalyst for the generation of further ideas. For two of the case study participants (respondents 1 and 4) communicating with students in the educational environment provided a necessary contrast to working independently in their studios, which was described as isolating.

Broadening Insight

Interaction with students updates designer educator understanding, assisting the maintenance of visual literacy relevant to the student cohort (respondents 5 and 7). This is seen as broadening considerations and described as a 'vibrancy', which might influence a designer educator's own practice (respondents 5 and 7). Students produced 'fascinating contextual research' that respondent 3 did not have time to discover. Ideas suggested but not adopted by students were recorded and considered by respondent 6 when returning to own creative practice. During the self-case study, viewing visual references of innovative contemporary practice, unique utilisation of technique, process and material by students broadened the author's insight of practice, although this did not necessarily feed directly into own creative practice activity.

Investigation and Experimentation

Although designer educators supported students with the realisation of their ideas relevant to industry, the removal of commercialised constraints from the 'consumer design world' permitted students the freedom to experiment and expand their ideas; the extent of this was interesting from the designer educator perspective (respondent 1). The depth of exploration that students could undertake due to studying in HE, in certain instances was found to be exemplary (respondent 3). Observing student innovation through experimentation with technique or technical process can trigger ideas to be used in own creative practice (respondent 5) and provide opportunities for co-learning experiences (respondent 6).

Learning Opportunities

Respondents 2 and 6 recognised that learning took place when working in the educational environment, particularly through observation of discoveries made by students when working with CAD and digital technologies. For the author, informal learning took place when students asked questions and the author had to then seek out possible answers. Respondent 4 learnt to use digital printing technology due to educational employment, as no other member of staff knew how to use the technology. This respondent now uses these technologies as an aspect of own design practice. Demonstration of CAD software and digital technologies to students provided

opportunities to update the author's understanding. During the self-case study staff development software training workshops, copyright and intellectual property seminars and professional practice lectures organised at the employer HEI benefited varying aspects of creative practice activity.

Collegiate Support

Respondent 2 described assistance provided by technical support staff at the employer HEI as necessary to enhance technology utilisation, improvements made impacted upon own teaching and creative practice. Examples were also evident where designer educators worked with technical support staff to develop new processes, which were taught to students and used in own designer educator creative practice (respondent 6). Throughout the self-case study, working in the educational environment provided opportunities to learn with and from colleagues. Through communicating with colleagues at CAT the author gained expert advice in terms of working with the digital textile printing process, highly relevant to own research and creative practice. Respondents 2, 3 and 5 interacted with other colleagues through involvement with various research groups and projects at their employer HEIs. Depending on the focus of the group or project these research environments exist as discursive and supportive communities for research involving creative practice.

Access to Resources and Equipment

Case study respondents accessed computers, CAD software, digital textile and analogue printing facilities for research and creative practice at employer HEIs (respondents 3, 5 and 6). Respondent 7 had CAD software purchased by an employer HEI on the computer based in this individual's studio. During the self-case study, resources such as the library, fabric store, dye lab and print room were used for creative practice purposes. CAT was regularly used for sampling and production; the author provided files on disk and would later collect and pay for the finished printed fabric. When pushed to meet specific deadlines, access to and own use of the facility was possible outside of normal working hours.

Funding and Time

Some of the case study participants received funding from employer HEIs for varying activities which could be seen to support research and creative practice. For example, respondent 4 acquired funding to exhibit at trade shows with selected graduates from the same institution. This respondent was permitted to take time out from teaching during term time to participate in exhibitions. Funding had been provided to respondent 2 to undertake and produce tutorials for use in a forthcoming book. The author acquired funding to attend and present at conferences and benefited from reduced fabric printing costs at CAT.

Discussions and Conclusions

In HE in the UK educators are required to undertake research, gain funding and produce outputs with impact. It is evident from the survey and case study results, which focus on textile design HE in the UK that variation exists regarding the extent to which research and creative practice are similar or different. In some of the case study examples the prominence of writing to disseminate research through more traditional forms of output such as journal articles is evident. In examples of textile designer

educator practice-led research, art-based approaches are adopted for research purposes. A shift appeared evident regarding the nature of textile creative practice. Case study respondents 4 and 6 appeared to be changing from working on a freelance basis and selling textiles at trade shows to the creation of textiles for inclusion in gallery-based exhibitions. While not fully conclusive, further research could be undertaken to examine if the nature of textile designer educator creative practice is changing due to the research agenda. The approach taken during the self-case study utilised design practice as a method, which involved producing commercially viable products; the boundaries imposed due to working in this context were deemed necessary to the textile designer researcher position.

Respondents also described 'practice as research' approaches. Case study participants who adopted this approach also authored books, which could be deemed as scholarship and potentially contribute as research output. To enhance the current situation regarding the lack of visibility of textile design research and variation in approaches to research and creative practice, the author proposes further discussion surrounding the nature of textile design research and research involving creative practice, between individuals, HEIs and the wider research and design communities. Networks could be formed between HEIs with symposium, conferences and exhibitions held to disseminate examples of textile design research and methodology. These networks could be utilised to form a series of travelling exhibitions whereby research undertaken at a range of HEIs travels to different locations. An online community and exhibition space could provide a forum for virtual dissemination opportunities and an interface to record textile design research activity.

Existing literature highlights the benefits of educator research to the educational environment. Investigation into the role of teacher-practitioners indicates positive influences that the creative activity of these individuals has on learning and teaching. The findings of this research, focusing specifically on textile design education, support these existing studies. This paper has described various means by which designer educator research and creative practice informs textile design education. It would appear that for educators involved with teaching digital technologies, the necessity to engage in creative practice activity as a means to ensure that understanding and skills remain current is paramount. Understanding gained through designer educator research and creative practice is transferred to students related to contextualisation, advancing skills and assisting with resolving ideas. In addition, designer educator insight regarding professional and entrepreneurial aptitudes informs teaching and curriculum content. In the current economic climate this impact is particularly important and asserts the benefits of designer educator activity that incorporates operating in a 'real world' practice context.

HEIs benefit from the creation of quality research outputs resulting from designer educator research and creative practice. Existing literature described the learning and teaching environment as positively impacting upon educators' research and teacher-practitioners' creative practice. This positive impact is also evident from the textile designer educator perspective. Educational employment can provide support for participation in dissemination activities and access to resources and equipment. Textile designer educators learn though communicating with students and working with colleagues.

Due to the evident positive connections it is important that the role of research and creative practice to learning, teaching and HEIs, and the influence of designer educators operating in the educational environment to research and creative practice is

recognised and supported. Individuals and HEIs need to consider ways in which designer educators can engage in research and creative practice activity. Further development of centres, projects and groups that are supportive environments for educator research and creative practice, would assist. Research projects involving both educators and students would enhance the textile design research-teaching nexus. The case studies highlighted that learning and development opportunities, which benefit students, also benefit staff and vice versa. The textile design HE environment could be organised and operate as a site for further co-learning experiences. Equipment and resources in HEIs could be directed to extend utilisation by designer educators for own research and creative practice activity.

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Undergraduate Design Studio Task to Internalize Learner Locus of Control

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Abstract: Designers intentionally influence events and outcomes, making an internal locus of control (LOC) desirable for them to have. Recently, engineering programs have provided more opportunities for design in their undergraduate programs than in the past, but these do not attend to learners' LOC. Because undergraduate learners with a high external LOC can enter these programs, it makes sense to attempt instructional interventions that could help these learners to internalize their LOC. Here, an intervention for internalizing LOC was piloted using a design task in an undergraduate engineering design studio. This was an innovative application of educational psychology constructs to engineering design education, previously two mutually exclusive domains. Although the study was small in size, measures showed a consistent trend: subjects with an external LOC prior to the design task shifted toward an internal LOC, while subjects with an internal LOC prior to treatment retained an internal LOC.

Keywords: Attribution, collaboration, design study, beliefs, classroom research, internal locus of control, external locus of control

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Introduction

ABET, formerly known as the Accreditation Board for Engineering and Technology, implemented its Engineering Criteria 2000 standards (EC2000) in 1996 as a response to professional concern with competencies of engineering program graduates. The EC2000 emphasized eleven program outcomes in engineering, including design, problem formulation and solving, and the impact of engineering within an actual context.

Most of these outcomes improved as a result, with the largest difference between 1994 and 2004 graduates being an "awareness of societal and global issues that can affect (or be affected by) engineering decisions," (Latucca, Terenzini, and Volkwein 2006, 9). On the other hand, these authors also found that "…barely half of the employers give an adequate rating to new graduates' understanding of the organizational, cultural, and environmental contexts and constraints of their work. Additionally, graduates' skills in this area, according to their employers, appear to have declined somewhat over the past decade," (Latucca, Terenzini, and Volkwein 2006, 12).

Thus (because awareness of a situation does not imply deeper interpretation), one's disregard or ignorance still can be anticipated with respect to the systems, cultures, and environment inherent to that situation of which one is aware. What this tendency to leave awareness undeveloped indicates is the default to an external locus of control (i.e., belief that one has little influence regarding events in which one participates, and that forces beyond one's control have greater influence), such that one's efforts at apprehending a situation's context are constrained by one's belief regarding limitations of conscious influence on that situation. As a result, what could have been design becomes chance instead. As Friedman (1997, 57) posits:

> Entirely distinct from the issue of many forms of articulation and role of intuition, it is possible for a designer to stumble upon the design of an artifact or muddle through to a solution without conscious effort. Without conscious problem solving, however, including the proper use of intuition, we are not talking about design but evolution.

With regard to other factors that might affect these beliefs, the authors also considered self-efficacy (i.e., degree of confidence in one's ability to perform a task), but dismissed that for two reasons. First, locus of control is apparently more fundamental than self-efficacy, in that it is easy to construct a situation where one has a high internal locus of control and low self-efficacy for a task, but difficult to imagine the reverse where a high external locus of control coincides with high self-efficacy (e.g., the statement that, "Even though this future event is out of my control, I am confident that I can be successful," is nonsensical). That indicates internal locus of control as of primary interest, perhaps providing a foundation for self-efficacy.

Next, there is the task-specific nature of self-efficacy. According to Bandura (2006, 311):

> Constructing scales to assess self-regulatory efficacy requires preliminary work *to identify the forms the challenges and impediments take.* People are asked in open-ended interviews and pilot questionnaires to describe the things that make it hard for them to perform the required activities *regularly*. [emphasis added]

However, the regularity of well-defined familiar tasks does not hold sway in design education. Sense-making in design processes is an iterative sequence connecting

divergent processes that are inclusionary (with regard to ideation and conceptualization) to convergent processes that are exclusionary (Bánáthy 1996) such as: problem setting, stakeholder need finding, ideation, analysis, synthesis, evaluation, iteration, prototyping, user testing, critique, and reflection. The result is that designing, teaching of design, and learning to design require continual self-monitoring and process modification in the face of the ambiguity (Cox, Harrison, and Hoadley 2009) that is inherent in the designer's everyday expectation of encountering wicked problems (Rittel and Webber 1973). Those encounters need to be resolved through iterative conversation with other designers and users (Schön 1992), and reflection by the design learner on his or her expanding catalog of experience. Banning (2003), furthermore, shows that a tolerance for ambiguity is directly related to the LOC internality.

This way of learning is a challenge for beginning design learners who, without prior experience for doing so, need to assume responsibility for their own interpretations of the problems and solutions related to situations with which they are confronted. In short, the challenge is one of exercising an internal locus of control (Rotter, 1966). And if that internal locus of control (LOC) is not already available to an individual entering a design intensive engineering degree program, then there is the additional challenge of nurturing that LOC through instructional intervention.

Research Question and Hypothesis

The research question is one of the effect from a short intensive design activity, framed as a team-based design task, on the LOC of an individual participating in the task (as part of a team having similar LOCs) when the task encourages behavior consistent with an internal LOC. The investigators hypothesized that individual LOC can be modified to be more internal by participation in such a design task.

In addition, the design task differed from LOC modification vehicles in previous studies because it simulated urgency to act and minimized consequences from error, quite a departure from the methods of some previous studies (e.g., Noel, Forsyth, and Kelley 1987; Perry and Penner 1990) dealing as they did with videos of actual and simulated academic successes described by spokespersons whose circumstances were made to appear just like those of the audience. For this current study, subjects were to act on behalf of other human beings in harm's way (the population of Haiti displaced by a massive earthquake at the same time as the design studio course was beginning). Design learners as experimental subjects were anticipated to initiate and pursue design activities in the manner of individuals with an internal LOC because, given the apparent urgency of these conditions, to remain inactive was the only alternative that would not be acceptable. This was reinforced by demonstrating that almost nothing subjects could propose would make the situation worse for the people of Haiti (i.e., minimal consequence from error).

To summarize, the dependent variable was LOC and its a priori condition was non-assignable in that all subjects entered the study with a developed LOC, whether relatively internal or external. The independent variables might best be labeled as a combination of: reduction of risk to subjects from error; and heightened urgency with regard to the imminent peril still to be faced by those fellow human beings already in a difficult situation (not only from the effects of an earthquake, but also from the annual rainy season due to begin, and the hurricane season after that). With regard to these variables, researchers chose a sequence for the experimental design as follows: pre-

test for individual LOC; design task as treatment; post-test of individual LOC; and delayed measure of individual LOC to check for change in any effect.

Whether or not to block subjects into teams by LOC level was influenced by previous studies (e.g., Grimes, Millea, and Woodruff 2004) wherein subjects with external LOCs worked well together, as did those with internal LOCs, but the combination of external and internal LOCs in those studies was not as productive as either of the homogeneous groups. There was no corresponding argument for randomization or other heterogeneous assignment by LOC orientations, as that might have introduced an undesirable reinforcement of existing LOC orientations if subjects with internal LOCs dominated the mixed groups. In order to maximize the probability of educational benefit to subjects as learners in the course, blocking as homogeneous groups for teams was chosen.

Method

The physical location for this experiment was a technical university in the north of Sweden that was not involved in ABET's initiative and did not typically provide design studios in its architectural engineering degree program, and so was not influenced by that effort to implement design. It was also therefore reasonable to regard the architectural engineering students who participated in this study as beginning design learners, even though they were mostly upperclassmen completing their undergraduate coursework.

The subjects were all students taking an eight-week long course as a requirement for their degree program. Initially, N = 13, composed of 5 male and 8 female subjects; the data for two of these, one male and one female, were later removed from the study (as indicated in the Data Analysis section below), and a second female did not appear in class the day of the design task, making the actual N = 10.

Pre-test

The researchers first administered Rotter's Internal-External Scale (Rotter 1966 as detailed in Lefcourt 1991); 23 dichotomous forced choice yes-or-no items, lower total scores indicating more internal LOC) to all subjects at a class meeting prior to that when the design task took place. Lefcourt (1991, 421) reports the range for Rotter instrument normative data from low ($\overline{x}$ = 8.2, sd = 4.0 for males and $\overline{x}$ = 8.5, sd = 3.9 for females in a combined N of 4433 males and females) to high ($\overline{x}$ = 11.6, sd = 3.3 for an n of 146 males, and $\overline{x}$ = 12.6, sd = 3.7 for an n of 260 females, implying $\overline{X}$ = 12.2 for the combined N of 406 males and females). For this current study, male subjects' data (n = 4, $\overline{x}$ = 9.50, sd = 2.08), female subjects' data (n = 6, $\overline{x}$ = 10.50, sd = 4.32), and all subjects' data (N = 10, $\overline{X}$ = 10.10, SD = 3.48) were comparable with those previously reported, keeping in mind the smaller sample size.

The researchers made a median split (Median = 9.50) to block subjects as two teams. One team's members had high individual external LOC (four members, plus another two whose data could not be counted as described previously). The other team's members had high individual internal LOC (six members, plus another one whose data could not be counted as described previously).

Design Task

Once teams were assigned, the design task was administered during the next class meeting (3 hours long, two days after the pre-test): deploying 1000 steel 20-foot

shipping containers assumed to have arrived in Haiti and meant to provide temporary shelter for cooperative survival among the internally displaced persons following the January 2010 earthquake and immediately preceding the annual rainy season and hurricane season. Framing the design task in this way, researchers made use of an authentic disaster wherein the health, safety, and welfare of real people were demonstrably in jeopardy.

Teams were isolated from one another while they formulated responses to the task and manufactured artifacts as representations of their responses. With 30 minutes left in the class meeting, each team then made a presentation of its response to the task to the other team.

Post-test

Immediately after these presentations, researchers administered Duttweiler's (1984) Internal Control Index (28 items, 5 point Likert scale response anchored by "RARELY" and "USUALLY," higher total scores indicating more internal LOC) to all subjects. Duttweiler (1984, 217) reported that her instrument had a moderate negative Pearson product-moment correlation with a portion of the Rotter items (r = -.385, and a negative correlation is to be expected since her instrument scores higher for internality, rather than lower as Rotter's does). Duttweiler based her correlation on 11 items from Rotter's instrument, these being suggested by Mirels (1970) as representing one of two factors in Rotter's instrument.

This raises the issue of why Rotter's instrument was not used again, because doing so might have simplified the comparison between pre-test and post-test data. Johnson (1986, 3), indicates that repeated use of a single instrument tends to shift responses toward the internal all by itself, in part leading subjects to pursue social desirability by answering some of the same items differently from the first encounter. Based on the observation of continual subject effort to please the researchers (who were also the graders for the course), the researchers decided the threat of this occurrence from instrument reuse outweighed the simplicity of direct comparison.

Duttweiler (1984, 212) reported normative data for a sample in the age range of the subjects who volunteered for this current study, being 21-30, and taken from a larger sample of 684 subjects (N = 313, $\overline{X}$ = 108.1, SD = 12.1). For the sample used in this current study, subjects' data (N = 10, $\overline{X}$ = 101.20, SD = 8.88) were comparable to those previously reported, again other than with respect to sample size.

Delayed Measure

For a final data collection in order to identify LOC variability over time as well as to gain insights by comparison to the previous LOC measures, researchers administered the Adult Nowicki-Strickland Locus of Control Scale (Nowicki and Duke 1974 as detailed in Lefcourt 1991): 40 items, dichotomous forced choice yes-or-no items, lower total scores indicating more internal LOC) to all subjects one month after the design task. Lefcourt (1991) reports a correlation ranging between .44 and .68 with the Rotter instrument.

The normative data (N = 156, $\overline{X}$ = 9.1, SD = 5.6) provided in Lefcourt (1991, 432) were obtained from a sample of university students. For the sample used in this current study, subjects' data (N = 10, $\overline{X}$ = 9.40, SD = 4.27) were comparable to those previously reported.

Data Analysis

There are questions about the advisability of resorting to each of the instruments previously described, and these are laid out in Lefcourt (1991) and Schepers (2005). This current study used Rotter's Internal-External Scale (Rotter 1966 as detailed in Lefcourt 1991, 420-425) because no clearly superior instrument for quantifying individual LOC has been developed since that one (Duttweiler 1984, 211) or effectively employed as often in other domains outside educational psychology (e.g., in business school research). Lefcourt concedes:

> Though there are methodological problems inherent in Rotter's I-E Scale, it has proven useful as a probing device. That is, if one wants to insert a general measure to ascertain the likelihood that perceived control plays some role in the prediction of some kinds of behavior, Rotter's I-E may still prove useful (1991, 422).

But then, Rotter's instrument was never intended to be fine grained (Rotter 1990), and the continuum from internal LOC as measured by achievement motivation to external LOC as measured by a drive to conform or surrender control might just not be all that particulate, and might instead require effects of large magnitude in order to justify a claim. As a consequence, Rotter's instrument does not present consistent results when subjected to factor analysis. Dixon, McKee, and McRae (1976) found two factors (and three for the Nowicki-Strickland instrument), Marsh and Richards (1987) suggest five or six, and so on. The point is: for the scope of this current study those limitations are satisfactory. Likewise, with respect to Duttweiler's (1984) attempt to refine and supersede Rotter, the resulting instrument was probably more than adequate for the researchers' purposes here as an initial investigative foray.

With regard to the relationship of Rotter's instrument with other instruments used in this current study to measure LOC, Beretvas, Suizzo, Durham, and Yarnell (2007) ran a reliability generalization study on previous uses of the Rotter and Nowicki-Strickland instruments, and found the internal consistency of both to be adequate. Goodman and Waters (1987) report moderate correlation between the Rotter and Nowicki-Strickland instruments and marginally acceptable internal consistencies for all three instruments used in this current study. Finally, the Duttweiler instrument was chosen because it also has been shown to correlate moderately with the Rotter instrument (Duttweiler 1984: Meyers and Wong 1988).

Analysis Procedures

As previously stated, the dependent variable was LOC, and in order to make comparisons between the data collected with one instrument and that gleaned from another, it was necessary to normalize the scales. After that, repeated measures t-tests were run to compare individual LOCs in the pre-test condition (Rotter's instrument) with those in the post-test condition (Duttweiler's instrument). Repeated measures t-tests were also run to compare individual LOCs in the pre-test condition with those in the delayed measure condition, administered one month after the design task. A one-tailed test ($\alpha = .10$) was used in all comparisons because only an increase in internal LOC was predicted.

When imputing data for missing responses, the researchers adopted what they felt would be the most conservative approach of substituting the value that would minimize desired results. For pre-tests that would be a value indicating highest internal

LOC, and for post-tests that would be a value indicating highest external LOC. Imputation had no impact on the overall results.

Results

It would be questionable to claim statistical significance based on the sample size, so all that can be reported here are trends. However, these trends are consistent, both in direction and magnitude (for a qualitatively oriented analysis involving observation of these students and their orientations to learning during the design task, albeit not directly related to locus of control, see Holmqvist, Wenngren, Cox, Ericson, and Bergström, 2011).

For all subjects (N = 10), there was a difference between the pre-test mean ($\overline{X}$ = 0.44, SD = 0.15) and the post-test mean ($\overline{X}$ = 0.35, SD = 0.08), t(9) = 1.74, p = .058, one-tailed, d = .82. Note that a decrease in the mean value indicates an increase in internality of LOC orientation, and this convention applies to all results reported here.

There was also a difference between the pre-test mean ($\overline{X}$ = 0.44, SD = 0.15) and the delayed measure mean ($\overline{X}$ = 0.24, SD = 0.11), t(9) = 4.25, p = .001, one-tailed, d > 1.00. Finally, there was a difference between the post-test mean ($\overline{X}$ = 0.35, SD = 0.08) and the delayed measure mean ($\overline{X}$ = 0.24, SD = 0.11), t(9) = 4.29, p = .001, one-tailed, d > 1.00.

Discussion and Conclusions

The research question addressed the effect of a team-based design task on the LOC of an individual participating in the task (as part of a team having similar LOCs) when the task encourages behavior consistent with an internal LOC. Although no strong evidence of previous research connecting LOC with design education was discovered during a literature search, the current study claims that a design task requiring the implementation of design processes has benefits with regard to design learners' personal development that have gone previously uninvestigated.

Other studies have found that locus of control can be made to shift toward the internal (e.g., Duke, Johnson, and Nowicki 1977 and Lynch, Ogg, and Christiansen 1975, both cited in Lefcourt 1982, 159). Kirkpatrick, Stant, Downes, and Gaither (2008) cite previous work (not including their own, which had both a similar premise and similar results to those cited), where subjects' LOCs were intentionally internalized (i.e., shifted in the internal direction: LOC being a continuum, there is no boundary that one crosses from external to internal, but instead more or less of one or the other). Following this internalization, subjects' academic achievement also improved.

The researchers hypothesized (as an alternative to the null hypothesis) that a design learner's LOC could be modified to become more internal by participation in a design studio task. Results from a pre-test, a post-test and a delayed measure indicated that this alternative hypothesis could not be rejected for either external or internal LOC teams without further investigation. The authors attribute these results to the nature of the design task that simulated urgency for learners to act, and minimized consequences from learner error.

Although three internal LOC team members regressed a small amount toward external for the post-test (i.e., their post-test scores were higher than their pre-test scores, but not altogether more external than internal because their percentage score remained below .50, in the lower half of the continuum from internal to external), they

then went on to score lower on the delayed measure than on the pre-test. While all members of the external LOC team scored lower on the post-test than on the pre-test, only one of them had a higher score on the delayed measure than on the post-test (albeit a very slight increase and well below .50)

The difficulty with the independent variables (labeled as: a combination of reduction of risk to subjects from error; and a heightened urgency with regard to the imminent peril of other human beings) is that they were treated inseparably. It is not known from the data collected here which of those had the greater effect on the results. Clearly, further research is indicated.

In answering the research question, the effect of the design task as purposeful modification toward an internal LOC does seem possible in the short term, and at the expenditure of comparatively little effort, but its robustness and longevity are still debatable. That is, does the LOC that subjects bring to an experiment such as this one tend to reassert itself over time?

The best practices for inducing and reinforcing such a modification are as yet hypothetical. The design task used for the current study likely has been beneficial to the design learners who participated as subjects by helping them to develop coping strategies for persistence and academic achievement. But it is even more generally beneficial to educational research because it identifies an existing research gap and links the educational practices of design with educational psychology theories in an original manner.

Turning to immediately practicable venues, what has not been discussed in detail here but certainly must be clear to even a casual observer is the great investment of time and effort already being expended by university faculties in constructing and implementing introductory design courses. What this study initiates is a promising direction of investigation for that audience. One prominent example is that of the School of Engineering Design, Technology, and Professional Programs in the College of Engineering at the Pennsylvania State University (abbreviated as SEDTAPP, they maintain a website at http://www.sedtapp.psu.edu/index.php). Their faculty promote first-year engagement in specially designed seminars familiarizing new students with both the rigors of college level academic pursuits and the fulfilment from performing research as engineers seeking to promote a high standard of living for all individuals in a sustainable manner (possibly heading off another approaching disaster involving the carrying capacity of the planet).

In addition, this school provides an entry level engineering design course required for many of the college's major programs. How to overcome the fear of being wrong that impedes students' embrace of design as an iterative process, both in this course and in the previously mentioned seminars, has long been an issue for this school's faculty. It is likely that discussion of framing design tasks such as the one in this study would lead to innovative ways of dealing with that trepidation.

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From teaching sustainable product design to teaching sustainable behaviour design

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Abstract: Traditionally, sustainable product design research and education has been focused on manufacturing and end-of-life aspects With a new found focus on the use stage, as in the research area of Design for Sustainable Behaviour (DfSB), a better understanding of how a focus on behavioural aspects can reduce life cycle impacts has emerged. Preliminary findings from on-going DfSB research were used as basis for the development of a method to guide designers in selecting promising design principles that can contribute to change user behaviour into more environmentally friendly patterns. This method is presented, and experiences with using the booklet in a sustainable product design course are shared. The paper reflects on how students cope with this research-based approach, and how research has benefited from this course.

Keywords: Design for sustainable behaviour, sustainable product design education.

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Introduction

In recent years sustainable product design research and education has seen an evolution from applying ecodesign guidelines targeted mostly at redesigning products, to more sophisticated levels of incorporating sustainability principles in product design. This has been fuelled by progressing insights on the complexity of the ever broadening topic, as the field has expanded in scope from a product to a systems perspective, from an environmental to a sustainability context, and from a concept development to technology transfer and commercialization perspective (Boks and McAloone, 2009). Research focusing on the use phase of products has throughout these transitions mostly focused on technological solutions to achieve resource use (mostly energy use) efficiency. But more recently research has suggested that through better understanding user behaviour, and applying that knowledge in design solutions that may make users behave in environmentally preferred ways, significant additional energy consumption reduction may be achieved. Design researchers increasingly understand their role in investigating such opportunities to influence users to alter their behaviour into more sustainable behaviour and consumption patterns (Tromp et al., 2011). As a result, we can now observe a young area of research emerging, referred to as Design for Sustainable Behaviour (DfSB) aiming at exploring design strategies for reducing behaviour-related environmental impacts of product and systems as well as more general applications to persuade users into more socially desirable behavioural patterns (Lockton et al., 2010). DfSB research incorporates insights from scientific fields including social psychology, persuasive technology, sustainable consumption, stakeholder analysis and interaction design. The current state of the art is one of exploring case studies, identifying design principles and developing guidelines to choose appropriate principles for specific design challenges.

The authors are part of a research group that has adopted Design for Sustainable Behaviour as a key research area. One of the on-going PhD projects aims at providing designers with a means to make informed decisions about which design principles to apply. In the first stages of this project, preliminary guidelines for selecting principles have been proposed (Zachrisson and Boks, 2012). These guidelines propose a way of translating information about human behaviour and insight from social psychology literature to recommendations for design principles. However, these preliminary guidelines have been derived from literature and theory, and have not yet extensively been tested in practical design projects.

Embedding Design for Sustainable Behaviour in education

Although education in sustainable product design has been done in many ways, most approaches found in design or engineering design curricula worldwide have a number of commonalities. From a traditionally very material and end-of-life focused teaching subject, the subject is, at least in literature, increasingly understood to relate to all aspects of regular product design and development. This includes the additional integration of sustainability criteria, with the aim of teaching students how to balance between possibly conflicting economic, environmental and social/ethical criteria, and how to exploit potential synergies. In practice, the integration of sustainability concerns in design and engineering education has been characterised as little and slow (Lozano, 2010, Quist et al., 2006, Velazquez et al., 2005, Boks and Diehl, 2006) a symptom of which may be the observation that the subject can be characterised as imprinted by a rather material and engineering focus. Although this may be improving, teaching

sustainable design with a focus on the use phase, including behavioural issues, have only received limited attention in literature so far. Loughborough University, one of the leading universities researching this topic, reported on the development of the website design-behaviour.co.uk as an inspiration tool for design students and designers (Lilley and Lofthouse, 2009). These authors have also reported on a pilot to develop teaching material for ethical thinking to support design for sustainable behaviour (Lilley and Lofthouse, 2010). They report mainly on how to include ethics, and pointing out challenges for educators in terms of providing students to use arguments and reasoning in the many cases where metrics and absolute answers are not available. They suggest using a checklist for students to evaluate design consequences, but do not discuss experiences with teaching a design methodology targeted at finding behaviour-changing solutions.

As DFSB is a focal research area at NTNU's Department of Product Design (IPD), and the focus of three doctoral research projects since 2008, the sustainable product design course taught in the spring semesters of 2011 and 2012 has endeavoured just this: choosing DFSB as the main coat hanger for structuring these courses. In semester-long assignments, students were challenged to identify potentially unsustainable practices and behaviour and use these as a point of departure for analysing attitudes, norms, habits and situational context related to (unsustainable) user practices such as (dish)washing, food wasting, temperature control, et cetera. As (re)designing behaviour instead of (just) (re)designing products requires a much broader perspective, the course has focused on analysis, and linking this to conceptualisation, rather than on detailed design. This meant that students needed to be newly introduced to not only research methods, but to a research and analysis attitude as well.

This paper aims to report on our experiences in doing so, by introducing our teaching methods and the guide used in our course. It is attempted to uncover advantages and disadvantages of the chosen teaching strategy. In order to do so, the paper is structured as follows. First a brief introduction in the underlying teaching philosophy is provided, i.e. the teachers' conviction of how sustainable product design in general should be addressed in an educational context, regardless of the choice of teaching format. This section also introduces how sustainable product design has been taught at IPD before the introduction of DfSB in education to facilitate reflection. These two introductions are then used to explain how DFSB has gradually gained a more important focus in our teaching, up until the 2012 spring semester where it has become the main focus. A discussion about our experiences from both a research-based education, and an education-based research perspective follows, before we highlight our most important conclusions.

Teaching philosophy

Instead of teaching students that sustainable product design is a morally superior trade of design, using pictures of retreating glaciers and lone ice bears on miniature ice growlers, sustainable product can also be taught as being really not that different from regular product design. Essentially, it considers all factors that are relevant for the conceptualization and development of products and services. It addresses hereby the complete life cycle and all relevant stakeholders that will, during the life cycle, interact with the product or service. Of course, individuals may have, and contexts may dictate different ideas about what is relevant. Within the context of sustainable product design, relevant aspects are generally understood to be of a functional, economic,

environmental, social and/or ethical nature. Sustainable product design education should therefore be taught holistically rather than 'merely' developing concepts for environmentally superior products. Such a holistic perspective can be achieved by challenging students to genuinely consider all relevant design parameters on an equal basis, including aspects of an economical, aesthetical, ergonomic, convenience, and sustainable nature. Doing so allows the identification of design dilemmas when searching for opportunities to avoid avoidable impacts on the environment, and an understanding of how environmentally preferred design solutions affect other relevant design parameters, allowing realistic solutions. In practice, this approach boils down to students becoming able to reason like *"Is it worth to sacrifice aesthetics for environmental impact if that means to abandon a 'nice looking' coating? But what if a nicer look will increase the products' life time, reducing the need for replacement? But would a company be interested in selling a product with longer life time and thus lowering sales? Or would that improve the company's image with increased sales as a result?"*

To become able to make such dilemmas as explicit and solvable as possible requires that students can use appropriate methods for quantitatively and qualitatively measuring and assessing individual design parameters, as well as evaluation methods that can make trade-offs visible (and thus decisions possible) between parameters that are usually measured in completely different dimensions such as exemplified above. This often means that students need to develop their own methods as these are not readily available, which requires the very holistic perspective that students are to acquire.

This teaching philosophy has been the basis for a series of sustainable product courses which have been taught at IPD since the 2007 spring semester, though with an increasing role for the use phase. These courses take place in the 6th semester of the 5 year Masters programme in Industrial Design. These courses typically host 25 IPD design students and 15 other students, mostly from NTNU's Industrial Ecology international master program or exchange students with various backgrounds. The course formats are briefly elaborated on the in the next subparagraph.

Course formats in teaching Sustainable Product Design at IPD (2007-2010)

Over the years, the course has experimented with different course set-ups and focal perspectives. Earlier on, courses were mainly inspired by more traditional ecodesign approaches, based on product comparison and redesign. In 2009 and 2010, partly inspired by how sustainable design had been taught at the Technical University Denmark, the main course deliverables included a product analysis report and a playable board game inspired by eco-design methodology. The purpose of the game was to educate a chosen audience, for example a group of product developers in a company; on aspects of sustainability, on a general level or in the context of a certain product (Boks and McAloone, 2009b). Compared to a standard report assignment based on evaluating existing and redesigning new solutions with environmentally superior characteristics, it was found that for the best students, the eco-game exercise strengthened a vital competence of being able to mediate and communicate about the topic at hand, and that the format supported the aim of taking a beyond-product perspective. The game exercise was very effective in exposing students' lack of knowledge and understanding, but a negative aspect was that the exercise invited for a focus on aesthetic appeal and game experience rather than a focus on the core of the

exercise (i.e. being able to absorb and communicate knowledge about the life-cycle perspective of products in their product system).

Since 2007, student assignments have become gradually more extensive and have been showing a greater variety of tools and methods used. Earlier assignments were principally based on straightforward benchmarking of products, identifying stages in the life cycle and components in the product with potential for improvement, combining good solutions in the product analysed, and using creativity to develop alternative product concepts with superior environmental improvement. In the 2009 and 2010 courses, more attention was given to the additional evaluation of non-technical/physical aspects. Groups mostly used their own 'expert evaluation', giving their own opinion on aspects such as aesthetics, functionality, cost of ownership and user friendliness (instead of attempting to measure these in some way, apart from environmental impact, which was mostly done with Eco-it software). Commonly, groups used 1-5 scales to grade the various aspects, and used a similar weighting scheme to arrive at final scores for each product analysed.

Though insightful for students in terms of understanding the broad spectrum of variables to be considered in good product design, students seldom showed initiative to exploit such matrices to formulate explicit design dilemmas. Experience tells that they need to be explicitly challenged to identify the single or combined product features or design solutions that cause a product to score well on one aspect, and worse on another, and to formulate this as a dilemma to be solved. And even then, most groups did not succeed in doing this. That said, many did arrive at interesting redesigned or sometimes even novel product concepts, opening up for a discussion to what extent creativity and gut feeling can replace prior analysis. However, the teaching philosophy for this course has remained with the assumption that both gut feeling and analysis work synergistically, and that students are served with gaining experience of context and user analysis before entering ideation phases; partly also because the focus in many courses is in fact on ideation rather than analysis.

Embedding Design for Sustainable Behaviour in education

The 2011 edition of the course embraced "design for sustainable behaviour" as an additional explicit component of the course. This provided us with an opportunity to use student assignments as a way to test preliminary research results in practical projects covering several different practices, providing the opportunity to do both research-based education and education-based research. Students were challenged to identify potentially unsustainable practices and behaviour and use these as a point of departure in their projects. To give the students an understanding of the reasons for why behaviour change can be relevant form an environmental perspective and an overview over the insight that the research had brought forward, a number of lectures on DfSB were given in the beginning of the course.

As a result of this substantial focus on user behaviour, in the 2011 course all groups did investigate the behaviour of the users and some of the groups even applied a well justified triangulation of different methods. However, analysing the reports from the project it became apparent that most of the groups ended up with a more traditional redesign project and not particularly focused on behaviour change. Even though some groups did identify behavioural problems, their process and solutions focused on reducing environmental impact from a technical point of view rather than making users

behave more sustainably. Moreover, whenever students did try to affect user behaviour, their choices of behaviour changing design principles did not always appear to result from conscious deliberation and evaluation.

Course format additions for 2012

Based on 2011 experiences and the increased focus on DfSB research at IPD, it was decided to increase focus on behaviour change even further in the 2012 course. Several of the lectures during the first weeks centred on what DfSB is, and on choosing and using user-centred methods such as surveys, interviews, probes, observations and focus groups in design projects, as previous experience told that students are relatively unfamiliar with using these methods appropriately. Also, the use of personas as a way to integrate and communicate research data was focused on. It was decided to develop and print a first version of the mentioned booklet guide and recommend the students to use it, in order to strengthen the DfSB focus in the course and help the students to structure their behaviour changing design projects. The structure of the assignments was aligned with the approach in the booklet to facilitate the students understanding and progress.

Figure 1 shows the development in the course format, showing the main deliverables required and the main methods applied, over time.

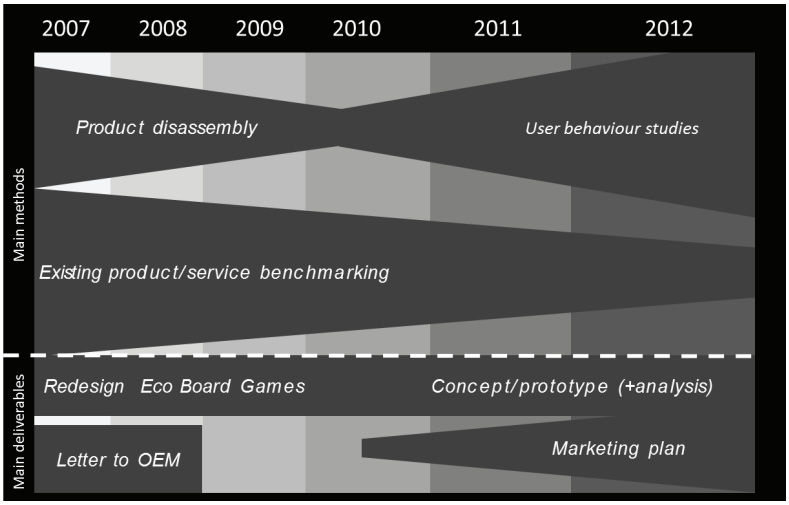

Figure 1. Course overview 2007-2012 with main methods and deliverables

Booklet: Principles of Design for Sustainable Behaviour

The booklet (Figure 2) is based on a PhD project at IPD which aims at developing a guide to help design practitioners identify the most promising design principles to people use their products in a way resulting in the least environmental impact. The theoretical basis for the guide is built upon a combination of insight from social psychology regarding the main factors affecting our behaviour, and strategies for behaviour changing design, from design research. The booklet is meant to communicate the results of this research in a form that is suitable for use in a design project. A major emphasis is put on helping designers to translate their understanding of the user and the context into an appropriate selection of design principles.

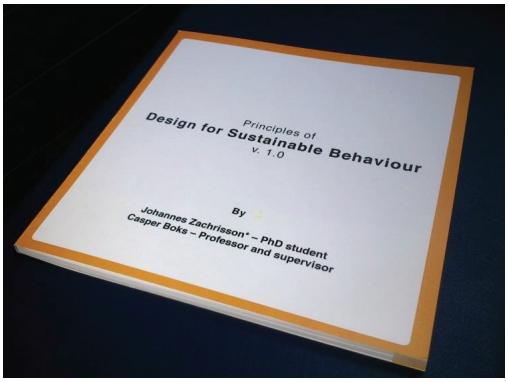

Figure 2. Booklet on Principles of Design for Sustainable Behaviour

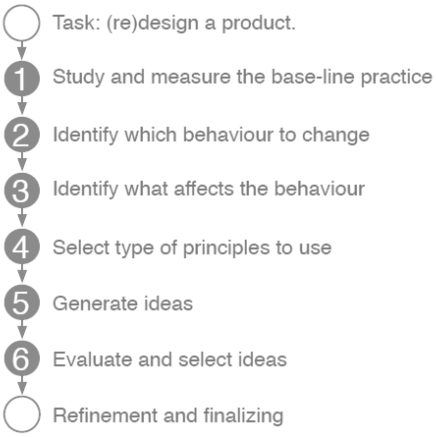

Figure 3.Design process as suggested in the booklet

The structure of the booklet is built around a suggested design process (Figure 3), with descriptions of the purpose and activities for each step, and with the help of appropriate examples. Although the figure illustrates a linear process, the sequence, number of iterations, or even in- or exclusion of steps may depend on the project and the preferences of the designer. The steps proposed in the booklet are as follows:

STEP 1: STUDY AND MEASURE THE BASE-LINE PRACTICE

This step explains how to choose the right methods to gather the most relevant information for a specific project, and why that is an important decision. There are numerous different methods and tools to gather information about the user and the usage situation, and which tools are most suitable for a particular project depends on a number of factors, such as the time and resources available, the competence available in the team, the accessibility of the target group, the goal of the research, etc. Although methods useful for a DFSB oriented project are similar to those commonly used in 'regular' user-centred design projects, the methods described in the booklet require some specific information about what goes on in the mind of the user, what goes on around the user and what the user actually does, which is described in more detail in steps 2 and 3. There may also be things the user does or that affect behaviour, which

the user is unaware of. To investigate this it is necessary to combine methods or use methods that investigate both aspects, such as applied ethnography or contextual enquiry. This step also highlights the importance of researching previous, similar studies, as user research can be expensive and time consuming, and provides some resources to assist in this process.

STEP 2: IDENTIFY WHICH BEHAVIOUR IS TO BE CHANGED

Once the information about the user and the context has been gathered, one needs to determine which behaviours to change or maintain. As the goal is to use design to reduce avoidable environmental consequences related to behaviour, it is valuable to identify those behaviours that both cause significant environmental impact and are possible to affect through design. The larger the potential impact reduction and the easier it is to affect it through design, the easier it will be to achieve environmental benefit. A natural starting point can be to identify the behaviours that have the largest total impact on the environment. Ideally this should be quantified, for instance through multiplying the energy consumption caused by the behaviour with the duration of the consumption. If quantification is problematic, it may be possible to consider the effects relative to each other more qualitatively. The interesting element is to identify how much energy could be saved with a different behavioural while still achieving the goal. It is important to consider the entire practice, as there might be low hanging fruit also outside the core behaviour. If it has been possible to calculate the actual impact of the behaviours, this information can be used after the project to estimate the achieved improvements and thereby the successfulness of the behaviour changes.

STEP 3: IDENTIFY WHAT AFFECTS THE BEHAVIOUR

When trying to change the behaviour of people and how they use products, it is necessary to realize that behaviour can be affected by a number of different factors and often a combination of several. The information gathered during the user studies can be analysed to identify the most important factors for your target group, by identifying the main reasons for why they behave the way they do. One way of understanding and structuring the factors is by dividing them into four different groups:

- What the user wants: What does the user intend to do? What does the user believe are the consequences of the behaviour? What is the attitude of the user towards these consequences? For instance the environmental impact, the effect is has on other people, the cost, etc.
- The influence of the surroundings: Which constraints are caused by the context around the use of the product? Do the surroundings make certain behaviour easier or more difficult to do? Does the product itself direct the user towards certain behaviour? Are there elements in the surroundings that affect the behaviour of the user and the interaction with the product?
- The habits: Are there things the user does without necessarily being aware of it? These can either be simple, stand-alone actions or routines consisting of sequences of several actions.
- What the user thinks is right or wrong: Which values does the user have, and which ones are most important? What does the user think is morally right or wrong to do? Is the user affected by any cultural or community values that may prescribe or forbid certain behaviours?

These insights are based on exploring behavioural psychology models such as the CADM model (Klöckner and Blöbaum, 2010, Zachrisson and Boks, 2012). This structure will form the basis for the selection of design principles in step 4.

The factors in these four groups may all affect the behaviour of the user in different ways and may be of importance for how a product should be designed in order to realise the affect that the designer is striving for. It is also possible that the users will have to be divided into groups according to which factors are most important for them or differences in the factors, such as different attitudes towards the consequences. The booklet suggests that one way of doing this can be by making personas representing the different user groups. Though there are other ways to do this, using personas is explicitly suggested to the students as they are relatively familiar with using this technique and it proved indeed to be a kind of 'anchor' to them in an otherwise very novel and at times confusing process.

STEP 4: SELECT TYPE OF PRINCIPLES TO USE

In this fourth step it is explained how there are numerous design principles that are directed towards behaviour change, but that some design principles likely will work better for certain users and in certain situations, than for/in others. To identify which principles may be more likely than others to be successful in a specific project, this section of the booklet includes a guide intended to help identify the most promising types of design principles according to the result of the analysis in step 3. For this it makes use of a landscape that allows sorting design principles based on two parameters: the degree of control that a product allows the user to have over his or her behaviour, and degree of subtlety or obtrusiveness that is designed into the solution (Figure 4). Our research (Zachrisson and Boks, 2011, Zachrisson and Boks, 2012) revealed these two dimensions as important ways to distinguish between design principles, although recent unpublished research has revealed a substantial amount of additional dimensions that may assist distinguishing between and selecting design principles.

The guide continues with an elaborate discussion on which level of control and obtrusiveness may be appropriate based on the results of the analysis in step 3. It uses simple diagrams to illustrate how this choice can be made. One of those diagrams is depicted in Figure 5; it is used to explain that habits are routine behaviours that are performed more or less automatic, and that because of this, the user is not always aware of the behaviour and it is therefore not necessarily in line with what the user wants, what the user thinks is right or what it is easiest to do. To change a habit, the user should be made aware of the habitual behaviour and be motivated change it. Once the behaviour is no longer automatic, it may be changed according to what the user wants or the influence of the surroundings.

Once the designer has decided which principles to use, the same control-obtrusiveness landscape as depicted in Figure 4 can be used to summarize the results, in order to get an overview, communicate them and include them in the design process. Figure 6 shows how, based on user research done in previous steps, it can be visualised what solutions on a certain part of the landscape may be most appropriate for affecting the behaviour of the identified personas.

Figure 4: Control-Obtrusiveness landscape

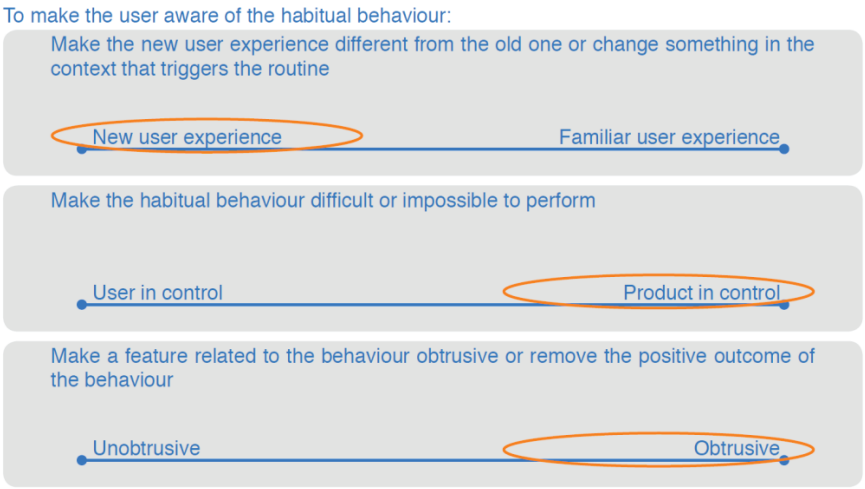

Figure 5: Example of diagram explaining how to use the landscape

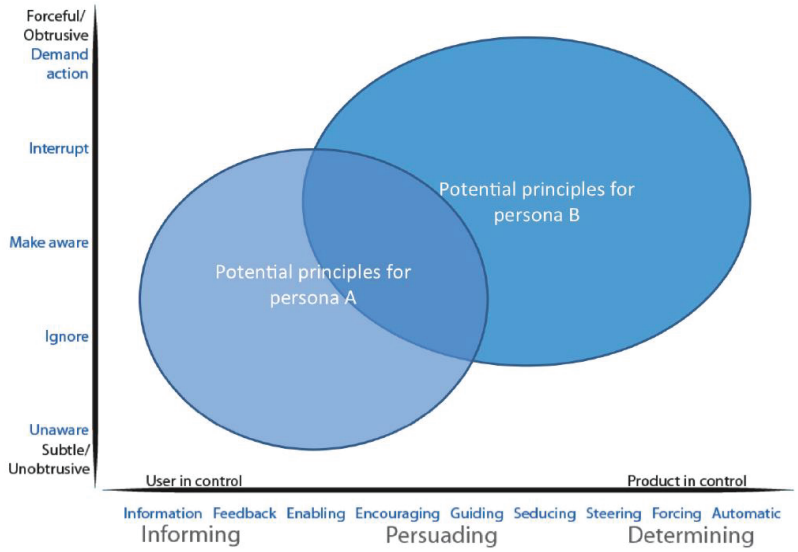

Figure 6: *Placing personas on the obtrusiveness-control landscape*

STEP 5: GENERATE IDEAS

Once the requirements for the new design have been identified, idea generation follows. This creative problem solving step is basically the same as in any other design process; commonly used methods include brainstorming, creative workshops, Forced Functions, etc. The purpose is to figure out how the product could be designed to fulfil all requirements, both regarding behaviour change and other requirements the design project might have such as price, durability, aesthetics, ergonomics etc. Whether the idea generation should focus on the identified areas in the landscape, allowing for a focused idea generation process, or whether a more general idea generation process should be the basis for selecting appropriate ideas that fit to the identified areas, is left up to the preferences of the individual designer. We have found that students typically choose the latter way: they do not let themselves be restricted by the confines of the identified search area; they rather select relevant ideas from a broader search.

STEP 6: EVALUATE AND SELECT IDEAS

After ideas have been generated, it is often a challenge to evaluate the ideas in a structured way and actually identify which ideas are most promising. In a regular design project, this is often solved by an assessing how ideas will fulfil a list of requirements, typically formulated as 'musts, should and coulds'. The same can be done regarding the requirements derived from the desired behaviour change, but to make sure that the ideas actually solve the original challenges it might be useful to evaluate based on the personas and the guide, rather than merely the requirements or design dilemmas derived from these. Once the most promising ideas have been selected a regular user centred design process can be followed, which usually includes concept development, prototype building, user testing and final detailing. The booklet explains how designers should be aware that it can be problematic to test whether changes in behaviour are actually accomplished in a traditional user test and might require more longitudinal testing outside a laboratory context.

Experiences with the booklet in the 2012 course

With the introduction of the booklet as the main guide for the course assignment, and with the different assignments for the interim reports scheduled in accordance with the steps in the booklet, the focus of the course per 2012 became strongly directed towards DfSB. Here, we would like to discuss our experiences with integrating DFSB in teaching sustainable product design from two perspectives: a research-based education, and an education-based research level.

Research-based education (general course) level

The transition from a traditionally focused ecodesign project to a sustainable behaviour focused project description allows for a number of reflections. The main issue to discuss is whether the new course outline has met the learning objectives, and proved to be good vehicle for the teaching philosophy.

With the new starting point now having explicitly become 'practices' and 'behaviours', students over time shifted from analysing "cookers, toasters and kettles" to topics such as ambient temperatures while sleeping (finding solutions for reducing energy consumption for heating sleeping rooms), laundry practices (avoiding washing clothes that do not need washing), dishwashing practices and preventing food waste, neither of which take a clear product-level starting point. A consequence of taking a starting point in behaviour has been that less attention for product level environmental analysis, such as through disassembly and benchmarking, has been paid. This is partly a logical consequence of a behaviour focus, and partly also because of time restrictions as user research is time consuming.

An important observation has been that the students, by taking a starting point in behaviour rather than products, clearly acquired a broader perspective, both in terms of stakeholders to analyse, and in terms of solutions considered. The broader perspective also allowed for a broader spectrum of dilemmas to be identified. This can be illustrated by the fact that several groups selected and developed services, product-service systems or integrated solutions as the most promising solution to change behaviour. Figure 7 shows an example of such a solution where an app was designed to interact with an electronic device controlling a heater via Bluetooth: the persona for which this solution was developed cannot be bothered to adjust sleeping room temperature to low, healthy levels, but since the smart phone is used as alarm clock, the app can be left with the responsibility to take care of this task, providing a win-win situation for the user.

Another improvement is that in order to identify the main reasons why people do not behave sustainably, the groups used a broader variety of investigative tools than in 2011, and were more skilled in doing so, probably thanks to the lecture-based tutorials (although most groups still benefit considerably from a thorough teacher check for ambiguity and logic in the questions to be asked). In addition to surveys and interviews, frequent use was made of diary probes, photo probes, story-telling, user observation through shadowing, and focus groups. In addition, some groups were proactive in developing customised approaches to measure factors like temperatures and cleanliness.

Figure 7: Example of a product-service based solution developed by one of the student groups

Although many groups gathered useful amounts of empirical data through these methods, meaningful quantification of characteristics of products and behaviour, in a way that allows for making dilemmas explicit, remains challenging for students. Still many groups succeeded in explicating dilemmas in more qualitative or intuitive ways. The majority of groups chose to follow the approach suggested by the booklet, and translated the gathered empirical data into personas that were subsequently placed in the landscape (see example in Figure 8).

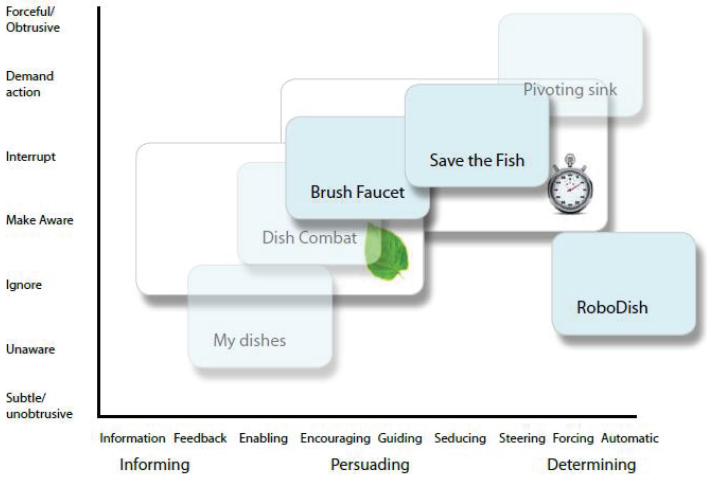

Figure 8: Personas on landscape from student assignment

This helped the students to translate the empirical data, through explicating design dilemmas, into a design brief and a list of requirements for solutions that were most likely to change the chosen target behaviours. After this, the projects became typical design projects, with ideation, concept generation, and subsequent concept testing. They were also challenged to develop a marketing plan, requiring them to think how their final concept should be promoted in order to actually be used by the target persona.

Education based research (or booklet development) level

The purpose of the research project discussed above is to develop a tool to help design practitioners apply insight from the field of DfSB in their projects. To achieve this, it is not only necessary to extract the relevant information from the DfSB research, but alto so present it in an easily comprehensible way that supports the way designers

work. Although the design students may not be considered fully trained designers, they have undergone several years of training to gain the perspectives and ways of working of design practitioners. From a research perspective, experiences from developing the booklet and monitoring the students' experiences were of a great value. When developing the booklet and planning how the approach should be communicated to the students, the necessity of explaining DfSB in the context of a design process became clear. The main reason for this is that the behaviour perspective requires slightly different focus in several of the separate steps in a traditional user centred design process. Not only when the desired behaviour is identified and the appropriate design principles to achieve this are selected, but also when determining the user research methods to apply and the user data is analysed. In the booklet this was presented as a stepwise approach, which the students seemed to find useful. However, during the project, it became apparent that the description in the booklet contained too much text and possibly too much detail. The students found it at times uninspiring, unnecessarily complex and therefore difficult to include in their projects. This experience may be expected to have an even greater consequence for design practitioners than for the students, as they often will have less time and focus available to make the effort, and thus have less motivation. After all, the students were forced to apply the method in the booklet or give good reasons not to, whereas design practitioners will choose their tools and methods rather freely. Consequently, the experiences from the course will have direct consequences for the next version of the tool, which should still explain the process and the connection to a traditional user centred approach, but in a less dictating and more inspirational way. An important development will probably be to expand the amount of dimensions that describes the different properties of the potential design principles, and rather allow the designers to select the once they believe are most relevant for the particular project.

Conclusion

Using a behaviour-focused approach, we feel we have succeeded in teaching a course that has, more than before, contributed to students taking a holistic perspective on how to reduce environmental impacts related to consumer practices. This is in line with our teaching philosophy. Students seem also to have become more experienced in using user-centred research methods that they will benefit from in other design projects as well. In that sense, the course has now moved on from being a specific sustainable product design course, to a more regular design course where sustainability criteria are addressed in an intertwined way (Lozano, 2010); instead of teaching sustainable design, we are rather teaching how to study user behaviour from a holistic perspective, and how to do research in the first place. The strong link with an on-going PhD research project ensured research-based education offering state-of-the-art insights to students, which has repaid the project with important understanding on how insights from behavioural psychology can be conveyed to design practitioners.

It turns out that for bachelor level students it is a challenge simultaneously cope with both 1) a behavioural (rather than product) focus and 2) a research and analysis (rather than just ideation) focus, in combination with 3) the sustainability context which also requires new tools and ways of thinking to learn, and 4) an open problem formulation. Students feel on thin ice for a while and may resort to approaches they are familiar with, but challenging them to use unfamiliar research methods and focus on extensive written justification of their design decisions provides many with a new-

found appreciation for research and analysis as a complementary activity in the design process. It should be noted that students who participate in this course are generally very good students as the high school grade point average needed to successfully apply to the Industrial Design program at NTNU is among the highest in Norway across all studies (one in six applicants is admitted). Therefore the relative success of this course may not be copied automatically to other bachelor level curricula.

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The role of identity development in design problem-based learning: essential challenges in sustainable design learning

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Abstract: This study focuses on challenges students face in learning through problem-based activities, in UK higher education in design for sustainability. Social theories of learning indicate the highly significant but possibly problematic nature of such social contexts for learning, a view underlined by psychological perspectives on potentially significant aspects of the learning process. In particular, the relevant development of identity is considered to play a centrally important role in learning, including in building expertise in tackling complex design problems. A key aspect of identity theory concerns the properties of self-evaluation during meaningful activities, and this suggests an important emphasis in examining the ability of specific educational programmes to enable successful independent learning. Investigating the role of identity, in relation to success in learning through design project work, is potentially of central importance in increasing the relevance and effectiveness of design education programmes. This paper presents the results of a study focusing on problem-based learning during the final project component of an undergraduate taught design module. Working with small tutorial groups during classroom-based activities, their developing responses to externally set design briefs were investigated primarily through the analysis of tutorial discussions relating to the production of project work.

Keywords: Design for sustainability, self-evaluation, problem-based learning.

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Designing sustainably

Learning to design

While the activity of designing may be complex even within the scope of contemporary industrial design, it is identifiable through some core kinds of activities. In very general terms these are exemplified by approaches that meet the sorts of complex challenges that Rittel & Webber (1973) termed *wicked problems*, lacking determinate solutions, compounded by questions of equity, and typically only soluble through a practice-oriented, discursive process in which realistic judgements are formed. Their conclusion that *formulating* a design problem is the central challenge, is also acknowledged by Lawson (2006) for whom this is a foundational component of the design process. Formulating the problem centres on the distinctive *framing* designers bring to design situations, a concept Schön (1983) used to draw attention to the ways in which we *construct* problems in order to solve them, based on a complex array of salient features from personal and professional experience. For practitioners in various relevant fields, he suggested, "Their frames determine their strategies of attention and thereby set the directions in which they will try to change the situation, the values that will shape their practice." (Schön 1983 p. 309). Moreover, rather than attempting to understand complex situations at the outset, designers take a *solution-focused* approach, a strategy whose significance grows with design experience (Cross 2007). It involves partly subjective design *moves* such as the use of *primary generators*, framing devices which impose often personally-valued, simplifying aims that address design situations at a workable level of complexity (Lawson 2006; Darke 1984). Reflecting on such activities, strategies and design roles, is a basis for designers to develop their practices, partly generating what Lawson terms *guiding principles*; evolving sets of particular design practice values or contextual philosophical frameworks. This suggests something of the richness of learning processes embedded in practice contexts, through which relatively general understandings of design practice are constructed and reconstructed toward more appropriate designing. Such processes of reflection must be compatible with the diversity of practice performances through which they develop, and in this respect a degree of indeterminacy may be seen to be part of the usefulness of the concept of reflection to practice learning theory (Boud 2010).

In this way the efficacy of real-world approaches to the resolution of design problems, will reflect the quality of their evolution in the course of practice. This is the central challenge of design teaching and learning, to support the development of informed and responsive ways of confronting design problems. This formative process on the one hand entails clarity among principles for appropriate designing, and on the other meets with the kind of open-endedness Asch (1987) recognised in the development of valued understandings of social contexts: "society cannot import these categories into the individual. These are properties of individuals whose capacity to grasp the structure of social relations permits them to sense requirements." (p. 357). The desired end points are reflective processes capable of overcoming practitioners' often weak ability to represent and so to understand aspects of their own practice reality (Argyris and Schön 1974). Design learning is necessarily embedded in live practices, within which the continual development of more general principles of action occurs through such contextual reflection. The intended outcome is a learning process equal to problems that are complex, ill-structured, and which bridge multiple domains of learning about the world and one's design role within it.

Design for sustainability

Such processes of learning are deeply embedded in the challenge of sustainability. Learning has increasingly come to be seen as the core driver of sustainability, as is noted by Sterling (2004), who observes that, "Essentially sustainability … is an emergent quality arising from sets of relationships in a system" (p. 55). This systemic view evokes an extensive learning process aimed at developing a capacity for coherent relational perspectives on a design problem. Among the design literature it recalls, for example, Archer's (1984) account of industrial design as an "art of reconciliation," (p. 60), at the start of which the identification of a systemic imbalance creates a design need. Bridging possible solutions that satisfy different problem domains, and confronting challenges ranging from conflicting values to technological hurdles, ultimately a creative leap is unavoidable: the designer must move beyond existing boundaries to personal perspectives by drawing on "rich, wide and fruitful experience ... as well as the capacity for flexibility and fantasy in thought." (p. 77).

In teaching practice the need for the development of design skills gives rise to the sort of partly open learning framework advocated by Cruickshank & Fenner (2012) who advocate sustainable skills development as a break with conventionally narrow role perspectives. Here learners pursue key themes in sustainability by expanding the scope of practices through diverse engagements with complex social and economic concerns. An opportunity to develop a fuller toolkit of abilities and approaches, this creates "an holistic approach to delivering a new way of thinking" (p. 261). And this also illuminates teaching and learning as design challenges in their own right, involving the formation of new relationships among a wide array of materials, situations and concerns across the learning context – an extensive and effective engagement involving key aspects of the design situation.

So while frames may develop through conventional design learning processes and associated ways of seeing, for example as illustrated by Schön and Wiggins (1992), promoting sustainability in designing requires more than simply a constructivist view on teaching and learning, foregrounding the learner's active development of understandings and capacity to make sense of problematic situations. It entails more purposive support for learners aimed at confronting the challenges of sustainability. What is required is an inclusive perspective on learning that more comprehensively bridges the learner and whole learning context; a position that tends toward that which Sterling (2004) advocates, *connecting* sustainably circumscribed behavior and attitudinal change with a more open educational emphasis on individual development and personal understanding. It calls for learning designs that embody key sustainability perspectives and principles, which have come to characterise a distinctive area of designing.

Design for sustainability is, in essence, a response to the call to action of the Brundtland Report (WCED 1987), building from the idea that, "Humanity has the ability to make development sustainable to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs" (unpaged). Brundtland questioned the prevailing view that: "human activities and their effects were neatly compartmentalized within nations, within sectors (energy, agriculture, trade), and within broad areas of concern (environment, economics, social). These compartments have begun to dissolve." (unpaged). These were recognised as *Interlocking Crises*, a dissolving of conceptional boundaries which is now widely conceived in terms of a *triple bottom line*, entailing the purposeful convergence of *socio-centric*, *eco-centric*, and *techno-economic* concerns (Dodds and Venables

2005). The intersection of these issues has become the focus for activities aimed at the making of a sustainable world.

A serious engagement with these core areas of concern leads inevitably to a number of key commitments to a more equitable world. These seem gradually to be gaining a foothold in the strategic aims of higher educational institutions, such that in studying institutional models of education for sustainability, Ryan (2012) was able to focus on three key strategic commitments, drawn from the UNESCO *Decade of Education for Sustainable Development* initiative (2005-2014), which were found to be evident across the programmes studied. These are: A *Global Futures Perspective* promoting global equity and social justice; a *Systems Orientation* emphasising relational learning across disciplines, human and natural systems; and an *Integrative Educational Ethos* which aims to support learning across and throughout lifespans (p. 5). This offers at least some evidence that foundational principles of sustainable development may be beginning to drive a more coherent, systemic understanding and implementation of teaching strategies across educational contexts.

Summary

Design learning is deeply rooted in the problem of complexity, most clearly seen in relation to design for sustainability. Recognition of a need and direction for systemic change, draws on a designer's capacity to come to terms with a range of significant perspectives on a problem, appreciating interactions between important elements which may appear bounded by multiple problem domains. A concomitant need is for a learning process capable of improving the quality of engagements across this process, bridging problem domains and related areas of expertise, and aligning development of the learner with the wider need for sustainable development. A sustained reflective process of reconciliation, may then lead to a productive convergence of the three key spheres of sustainability. Viewing practice reflection as central to this process, underlines that this ability must be developed in the context of relevant practices.

Learning through design practice

A commitment to enabling ongoing reflective development implies a focus on learning within realistic design practice situations. The relevance of *situated learning* perspectives to the development of competence in designing has previously been acknowledged, for example by Lawson and Dorst (2009). This emphasis in teaching and learning partly originated as the broad perspective on practice learning of Lave and Wenger (1991), and is relevant in particular to the project element of the sustainable design module investigated in the present study. It places an emphasis on the idea that "learning is an integral part of generative social practice in the lived-in world." (p. 35), better accommodating the complex relational reality of practice learning processes. Without precluding formally structured learning, this perspective enables a more complete connection to practice, better aligned with reflective learning. It contends with the development of *identity* as a core element of the learning experience, as the learner becomes increasingly engaged in relevant communities of learning. Rather than emphasising more established elements of expertise or relatively static perspectives on roles within communities, this allows a subtler view on the development of the learner's relationships among key communities, which contribute to the emergence of expertise.

Theories of identity are an important theme in the literature of social psychology, highlighting significant facets of a process of identity development. This illuminates a core pathway toward competence: while in some sense our identities are multiform and fragmentary, there is also a distinct need for coherence, supported by core roles and 'autobiographical' narratives that enable an individual to function effectively (Hogg and Vaughan 2011). This development of expertise through individual reflection, emphasizes the role of *reflexivity*, whereby processes of discovery are evaluated in part through self-narratives (Steier 1991). Such a search for coherent narration applies equally in the formation of core identities in the context of learning in design situations.

Given the need to develop the ability for successful reflection in design learning, the present study focuses on the way in which individuals reflect on their own identities in learning to design. Such *self-evaluation* is also the focus of an account by Sedikides & Gregg (2003) who tackle relevant *self-motives*, describing various common characteristics which tend to reduce the effectiveness of self-evaluation. This indicates various ways in which the capacity to develop effective practice may be confounded by intrinsic human self-motives.

Self-enhancement is a dominant self-motive, capable of raising one's level of *self-esteem*, however such an affective change is not straightforwardly beneficial. Sedikides and Gregg (2003) draw attention to the significance of both quality and level of self-esteem. At the same time, students' ability to appropriately moderate self-motives may be showing a general decline, with rising levels of low quality self-esteem found among undergraduate students over recent generations. This rise is identified in an extensive study by Twenge et al. (2012), who describe a corresponding loss in *community feeling*, which they define with Kasser and Ryan (1996) as "helpfulness and wanting 'to improve the world through activism and generativity' " (p. 1046). They discuss notable correlates including a marked decline in ecological conscience, and a loss of interest in developing personally meaningful philosophies. Such fundamental challenges faced in the reflective development of design expertise, highlight how gaining appropriately from available learning resources and distinctive perspectives on design situations may depend to a significant extent on the efficacy of self-evaluation.

Study of undergraduate problem-based learning

Study context

The focal study context is a taught undergraduate sustainable design module, with a specified aim to "enable industrial design students to become aware of the range of issues concerning sustainable development that could relate to their designing and to develop understanding of sustainable design strategies that they can employ in future projects." The content includes both core principles, and a range of sustainable design tools offering systematic approaches to assessing aspects of the sustainability of design ideas, among which students have some flexibility to select appropriate support in developing their own sustainable product concepts.

During the second semester of the module, students undertake a creative sustainable design project, equivalent to the conceptual design phase of an industrial design process. They begin by selecting from a small number of real design briefs proposed by external organisations, and their responses to these briefs develop over the next several weeks, starting during a number of structured group activities designed to support early idea generation in the context of further instruction, group

and individual support related to the module learning objectives and the briefs themselves. Subsequently they move to more individual idea development, reflected in logbook work and ultimately in presentation display designs explaining the developed ideas. These are assessed at the end of the project.

Students must work with various recently encountered module materials during the project phase, taking account of different sustainability considerations while developing their creative design ideas. This is a challenge for which accessing support from others and in particular the module tutors can be valuable. Of particular value is a series of tutorials, scheduled for all students over a number of weeks during the process of developing their design ideas. Held with small groups of students tackling the same design brief, these allow each in turn to present their ideas to a module tutor in the presence of their peers, and to gain feedback on their progress and an opportunity to discuss possible ways forward.

The project phase of the module may usefully be framed as an instance of *problem-based learning*. It "begins when students are confronted with an open-ended, ill-structured, authentic (real-world) problem and work in teams to identify learning needs and develop a viable solution, with instructors acting as facilitators rather than primary sources of information" (Prince and Felder 2006, p. 128). In this study, the conceptual design phase and problem focus exemplify this flexibility, inviting innovative approaches and access to any resources that are of use. The present study differs in a lesser emphasis on the teamwork component: there is an initial team work element during the brainstorming phase, but subsequently any such interaction is incidental. However, learners do confront a specific complex problem, that directs and structures the process of learning, and which in this case takes the form of a real-world design brief. It implies an emphasis on the process of inquiry involved in the generation of design ideas, rather than the design outcome, here particularly reflected not just in the series of tutorials but also in the use of student design development logbooks. Moreover, the process stresses individually-directed reflective learning, in problem-solving approaches in which narrative modes of deliberation, developed through design experiences, are expected to be significant (Jonassen 2011).

Methodology

Two groups, one of five, and one of six students, were observed during the tutorial phase toward the end of the project. Groups were selected to represent students tackling two different but similarly challenging design briefs, with students grouped according to the brief they had chosen. The tutorial discussions were primarily captured through audio recordings, and an approach involving thematic coding was used to analyse this naturalistic observational data. The coding scheme was developed partly inductively from the data, and partly informed by an initial theoretical perspective emphasising the properties of self-evaluation. This took three broad categories of self-enhancement suggested by Sedikides & Gregg (2003), termed the *self-enhancing triad*, and originating in a range of research into the psychology of self and identity. These three are the *above average effect*, *illusions of control*, and *unrealistic optimism,* which are defined fairly openly using examples from everyday conduct. Through analysis of the data they were translated to the contextual coding categories in Table 1. For each category a positive and negative form was derived, in order to recognise instances both of self-enhancement and of its opposite. So, for example, items scored under *AAE+* represent instances of the *above average effect*, whereas *AAE-* indicates evidence to the contrary.

Table 1. Overview of the coding structure.

Above average effect (AAE is an assumption that one has greater competence than relevant others.)	***AAE+***	• focusing on own ideas or approach, at the expense of receptiveness to alternative perspectives; • reluctance to explicate design ideas at tutorial (a key development opportunity).
	AAE-	• acknowledging limitations in understanding or design ability, by explicating rather than selling work, and listening with the intention to learn.
Illusions of control (IoC assume that one has more influence over outcomes than real constraints allow.)	***IoC+***	• not attempting to understand module requirements; • insufficient attention to lecture and workshop materials; • lack of clear integration of the above in development of ideas.
	IoC-	• acknowledging (desirable) limits to one's control over outcomes, by attending to module requirements, materials and feedback, and carefully developing arguments for approaches/ideas accordingly.
Unrealistic optimism (UO is an assumption that one will tend to be more successful than relevant others.)	***UO+***	• limited range of design ideas; • focusing on particular aspects of idea development, at the expense of more rounded development; • limited use of sketching or a range of media to develop ideas; • drawing on limited resources to develop work; • limited or late logbook work; • not attending one or more tutorials.
	UO-	• evidence of more extensive and timely development work, showing a realistic sense of the design challenge.

Some elements in this structure broadly coincide with features of the project marking scheme, however the two structures are not coextensive, and the three self-enhancement categories define a distinct process-oriented perspective on successful design learning. The emphasis on some of the more clearly observable features of the situation, is not an attempt to reduce reflective development to these components, but it allows an appropriately structured and contextualised view on the process in which these tutorial interactions occur. Such activities may contribute to the reframing of design situations and underpin the progressive reflective development of expertise in design for sustainability.

The tutorial data was coded across the two student groups, according to the coding structure in Table 1. Students were rated as to whether they exhibited all or only some of the defined self-enhancement characteristics (SE+), and similarly whether they also showed all or some of the contrary characteristics (SE-). So, for example, "Full" in relation to SE+, indicates that instances of AAE+, IoC+ and UO+ were all found to occur in the data for this student.

Results and analysis

In most cases, students were seen to undertake all or most of their design development work in the concluding weeks of the module, during the series of module tutorials. This made it possible to gain an impression of the pattern of productivity in each case, and in particular it was clear that students had potential access to significant and timely feedback on the development of their ideas through engaging with the tutorials.

The results for the final tutorial in the series are summarised in Table 2, which shows the occurrence of the self-enhancement properties for each student as full, partial or null. Having completed this coding, final project grades were obtained for these students, which are summarised relative to the average across the two groups studied (above average is shown as '+' and below average as '-'). In this way overall design project performance is indicated relative only to those students in the study, compensating for any effects of group selection in terms of self-enhancement or overall designing ability.

Table 2. Results for the final tutorial.

Student	SE+	SE-	Grade
1	Full	Part	-
2	Part	Part	+
3	Part	Part	-
4	*(non-attend)*		+
5	*(non-attend)*		-
6	Full	None	-
7	Part	Full	+
8	Part	Part	-
9	*(non-attend)*		-
10	Part	Part	+
11	Part	Full	+

For the four students for whom there was a clear propensity either for self-enhancement, or for the opposite tendency, this appears to be reflected in the final module grades. The two showing a tendency toward self-enhancement achieved a below average final grade, while the two showing the opposite inclination achieved an above average final grade. Among the students showing a relative balance of each, and also those who did not attend the final tutorial, a mixture of above and below average grades are seen.

Discussion and conclusions

The results indicate that students self-enhance in ways consistent with the *self-enhancing triad*, and that this impacts on the grades they ultimately achieve in the module. Although the student group is small, the pattern of achievement is unambiguous for those students for whom a clear tendency was seen. A lesser tendency to self-enhancement is aligned with greater success in the sustainable design project. That students self-enhance in this way in the context of tutorial discussions, also underlines the importance of this barrier to their learning to develop more

effective design ideas in projects involving collaborative work and the negotiation of developing ideas among problem stakeholders.

With further analysis of the study data, it may be possible to discern an inclination in one or other direction for more of the students in the study, which may again be reflected in their final grades. There are additional relevant features of self-evaluation which might be borne in mind. This is highlighted, for example, in a relevant working paper by Grow (2010) encountered some time after the analysis of data discussed above. Grow's online paper is a work in progress covering some reflections on his experience of teaching in a higher education context. Although he does not advance a framework for an investigation or present specific findings, his paper raises a particular concern with errors of attribution in students' evaluation of their learning successes and failures. Tackling this barrier to effective engagement with learning experiences, which the author terms *toxic self-esteem*, is suggested to be an important potential basis for supporting more effective student learning. A similar error of self-evaluation is also identified as a distinct category by Sedikides & Gregg (2003), and is termed a *self-serving bias in attribution*:

> people manifest a *self-serving bias* when they explain the origin of events in which they personally had a hand or a stake ... Specifically, they attribute *positive* outcomes *internally* to themselves, but *negative* outcomes *externally* to others (or to circumstance), thus making it possible to claim credit for successes, but to disclaim responsibility for failures. (p. 112)

This, along with other analytic categories they offer, might contribute to a refined coding structure. Whether such additional refinements will prove useful in understanding and supporting student learning in the context of the present study is not yet clear. The present analytic approach offers a broadly useful means to investigate the role of self-enhancement, using aspects of the design process which are quite readily observed during the process of design development.

Design for sustainability, which addresses the complex reconciliation of socio-centric, eco-centric and techno-economic issues, is particularly sensitive to the nature of a designer's engagement with the design situation. If successful, the designer may come to thoroughly appreciate alternative problem framings. Experience gained in successfully reframing design situations, can be expected to contribute to the effectiveness of processes of learning which comprise the lifelong reflective development of design expertise. A developing ability to moderate self-motives and so to self-evaluate effectively appears central to this.

Future work

This study has indicated essential barriers to successful design for sustainability, highlighting specific features of a problem-based learning situation that may be addressed in a teaching intervention. The study results show that this is of concern during key design negotiations (the tutorial discussions), which provides a suitable focus in developing a module support to reduce students' tendency to unhelpful self-enhancement and increase their ability to reframe design situations toward more sustainable solutions. The next study phase will involve implementing a learning support directed at the focal phase of the learning situation.

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Designing teaching—teaching designing: teacher's guidance in a virtual design studio

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Abstract: This study examined pedagogical aspects of virtual designing. It focused on how an industrial design teacher organized a plastic product design course and how the teacher guided student teams' design processes in a virtual design studio. The model of Learning by Collaborative Designing was used as a pedagogical and analytical framework. The study employed qualitative content analysis of the teacher's notes posted to the Moodle database. The results indicated that teaching exhibited three characteristic emphases: problem driven, solution driven and procedural driven. The main part of the teacher's notes was solution driven statements, including new information, design ideas and evaluating design. The results of the study demonstrate the link between the model of Learning by Collaborative Designing and the three teaching approaches.

Keywords: Collaborative design, computer supported design, design education, design process, industrial design.

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Introduction

In design education, virtual learning environments have been widely used (Maher, Simoff and Cicognani 2000; Wang 2009), and learning to use modern digital design tools is argued to be crucial within design practice (Al-Doy and Evans 2011; Yang, You and Chen 2005). Further, the virtual learning environment offers opportunities for design students to participate in multidisciplinary collaborative projects and thus provides them with experiences of global professional practices (Karakaya and Şenyapılı 2008).

"Virtual learning environment" refers to an asynchronous web-based environment that provides tools for sharing conceptual and visual design ideas as well as a medium for collaborative construction of the design object (McCormick 2004; Karakaya and Şenyapılı 2008). A typical virtual learning environment provides tools for computer-mediated communications (e.g., e-mail, chat, and threaded discussion forum) and tools for course administration. Further, a virtual design studio (VDS) may consist of more sophisticated digital design tools supporting various virtual representations, 3-D modelling and rapid-prototyping (Evans et al. 2005; Oxman 2008).

Researchers and educators have addressed the need to integrate digital design in design education, and pedagogical aspects of virtual designing have received more emphasis (e.g., Kvan 2001; Oxman 2008; Wang 2009). Yet many studies of virtual designing in design education focus on technological issues (e.g., Al-Doy and Evans 2011; Charlesworth 2007) or on collaborative issues (e.g., Karakaya and Şenyapılı 2008). Hence we suggest that further research is required to better understand pedagogical aspects related on virtual designing in the higher educational context.

In this study, we investigate the industrial design teacher's orchestration in a VDS setting, and we explore the nature of teaching by analysing what kind of guidance the teacher provided during the virtual design process. "Orchestration" refers to the planning, management and guidance of designing (see Littleton, Scanlon and Sharples 2012). In the following, we will briefly review the characteristics of design knowledge and teaching. Finally, the implications of our results for virtual designing in educational settings will be discussed.

Characteristics of design knowing and teaching

Designing is considered to be a complex and iterative problem solving process; i.e., design solutions emerge gradually as a process of structuring and restructuring the problem, defining and redefining constraints of designing, and generating and testing design solutions (Cross 2006; Goel 1995). In the other words, designing is seen to move back and forth between a "problem space" and a "solution space" (Dorst and Cross 2001; Goel 1995).

A design space forms the external frame to designing, but the set of possible acts is usually so wide that the designer is able to study only a part of the design space within a realistic time. By paying attention to constraints, the designer can ensure that the design will achieve the required as well as the most desirable properties. Knowledge related to external constraints defines relations between the product to be designed and its environment and conditions (Goel 1995; Visser 2006). Research findings on expertise in design (Cross 2004) indicate that novices tend to generate problem solutions without engaging in extensive problem structuring and analysing external design constraints whereas experts focus on analysing and structuring the problem and design constraints before proposing solutions.

Kruger and Cross (2006) have identified four cognitive strategies employed by the designers they investigated: problem driven, solution driven, information driven and knowledge driven design strategies. Problem driven designers focus on defining the problem and using information that is strictly needed to solve the problem whereas solution driven designers focus on generating solutions. Information driven designers focus on gathering information from external sources, and develop a solution on the basis of that information. Knowledge driven designers focus on developing a solution on the basis of their prior knowledge. Their protocol study of nine industrial designers revealed that most of these designers employed either a problem driven or a solution driven design strategy, and further, a problem driven strategy tended to produce the best results according to the assessed quality aspects. Furthermore, Sagun and Demirkan (2009) found that in a design studio setting, the critiques of the collaborators referred more to the solution space than to the problem space.

For several decades, it has been common to develop theoretical models of design processes in order to understand professional design activity and thereby to improve it. The idea of design as an iterative (i.e., spiral and cyclic) process has been used to illustrate how various activities in design fit together. According to Visser (2009), there are significant similarities as well as differences between the design activities implemented in various situations. The process-related activities consist of organization of the design process (time scale, individual versus collective design) and tools in use. Visser (2009) emphasized that the way designers organize their on-going design task influences their activity. The organization of one's work is a kind of tool which structures and guides design activity.

Hutchins (1995) has stated that communication among individuals in a socially distributed system is always conducted in terms of a set of mediating artefacts. In the collaborative design process, the mediating artefacts can be divided into procedural artefacts and design artefacts (Perry and Sanderson 1998; see also Visser 2006). The former artefacts are related to structuring and organizing the collaborative design process whereas the latter are related to designing the product itself. Design artefacts vary from material to digital representations (Charlesworth 2007; Pei, Campbell and Evans 2010). During design education, it is important that students have possibilities to use digital tools and to simulate collaborative professional design practices (Cardella, Atman and Adams 2006; Chen and You 2010; Karakaya and Şenyapılı 2008). Concurrently, it is crucial for design educators to focus on the pedagogical approaches to providing guidance and facilitating collaborative designing in the VDS setting.

The pedagogical models that have been widely adopted in design education are studio-based teaching (Schön 1987; Waks 2001), problem-based learning (Eilouti 2007), and project-based learning (Lee 2009). Further, many educators have stated that collaborative inquiry-based teaching and learning, particularly when supported with technology, appears to be one of the most promising ways to achieve the desired changes in teaching and learning practices (Dillenbourg, Järvelä and Fischer 2009; Littleton, Scanlon and Sharples 2012).

The idea behind collaborative designing, as considered here, derives from the model of Learning by Collaborative Designing (LCD; see Figure 1) developed by the present authors (Seitamaa-Hakkarainen, Lahti and Hakkarainen 2005; Seitamaa-Hakkarainen, Viilo and Hakkarainen 2010). LCD is a pedagogical model that has been developed to guide and facilitate students' collaborative design processes in technology-enhanced learning. The model emphasizes open-ended design tasks and collaborative interaction within and between teams; between students and the

teacher. In a design course, students are concerned with the usefulness, adequacy, improvability, and developmental potential of design ideas (Seitamaa-Hakkarainen, Viilo and Hakkarainen 2010) and develop knowledge and skills to model, design and construct ideas into physical artefacts (Al-Doy and Evans 2011).

Aims and objectives of the study

The overall aim of the study was to examine the pedagogical aspects of virtual designing; we wished to investigate the teacher's orchestration of design learning. In order to get an overview of the teacher's contributions in a VDS setting, the first objective was to examine the nature of communication in VDS. The research question was the following:

- How was the communication of the teacher and of students linked in VDS?

The second objective of the study was to analyse teaching in VDS. The second and third research questions of the study were as follows:

- What kind of guidance, based on the model of LCD, was provided by the teacher during the virtual design process?
- What was the distribution between the three teaching approaches (i.e., problem driven, solution driven and procedural driven guidance)?

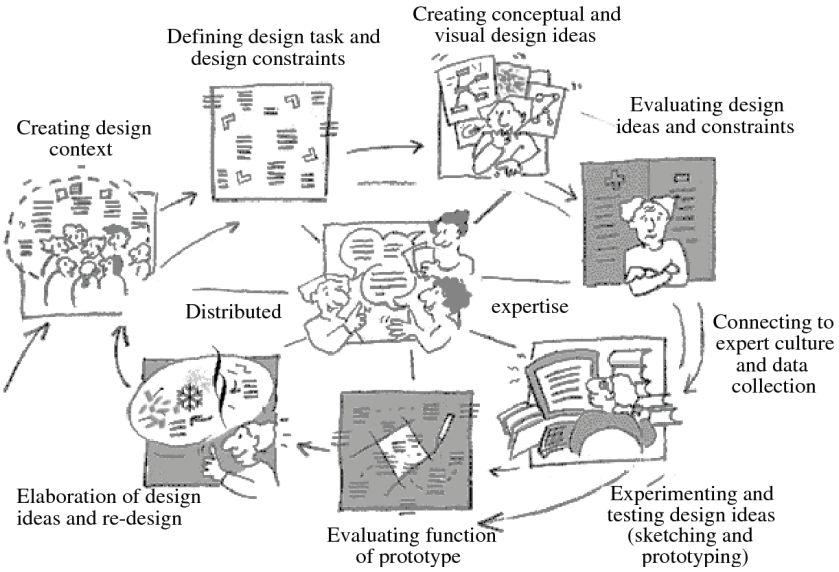

Figure 1. The model of Learning by Collaborative Designing (LCD).

Method

Setting and participants

The research setting was provided by the Development Project for Plastic Product Design whose general aim was to develop virtual learning materials and to develop a basic course of plastic product design for industrial design students. The participants of the study consisted of a responsible teacher from the University of Art and Design in Helsinki (now, Aalto University), 4 tutors and 53 students from four Finnish Universities. The teacher had twenty years experience of industrial design specializing plastic products, but did not have extensive teaching experience.

The students participated in the course at their respective institutes: the University of Art and Design in Helsinki (17 students), the University of Lapland (18 students), Tampere University of Technology (4 students) and Lahti University of Applied Sciences (14 students). The main part of the students was specializing industrial design. There were 17 design teams. The teams were composed of three or four students each and the students on the same team were geographically separated. Each team received the assignment presented in Figure 2.

The course relied on the Moodle-environment that provided tools for asynchronous communication. In addition, the design teams aimed to meet virtually every week. They were instructed to use TeamSpeak and eBeam Interactive during these virtual meetings. After the meeting, the content of the discussion and decisions were saved into a weekly report and the sketches in the eBeam scrapbook were saved into the Moodle-environment. It was also possible to use other communication channels if the progress of the design process was reported on the Moodle-environment. The whole project from the first virtual meeting to the exhibition took about 20 weeks, but the most effective virtual collaboration occurred during the first 13 weeks. The model of LCD was introduced to the teacher, tutors and students at the beginning of the course.

Assignment:
The assignment is to design a plastic product for the Design Forum Shop (http://www.designforum.fi/shop). The design team discusses products as well as brainstorms ideas to improve them. We'll come to hear the Design Forum representative's presentation about the concept of the shop. But we can already realize typical customers who are looking for something surprising and beautiful, something like a typical gift which is easy to carry with you in a suitcase or a small bag. A product's size at its largest is the size of two fists. In addition it's required that the product is built from three parts, which are connected to one another. The product is to be mass-producible, and production costs ought to be realistic. Printing or painting may be possible to use but may escalate costs.

Assignment hand-in form:
The product is returned in a 1:1 ratio prototype, where the finishing is done as well as one A-1 sized presentation rendering (poster). Prototype parts can be produced using a 3-D printer at a later date, following further instructions, but fine-tuning is to be completed independently.

Exhibition:
We will organize Design Forum Finland's exhibition, where the presentation rendering as well as the prototype will be available for audience and their feedback.

Figure 2. The assignment.

Data analysis

The following results are based on a qualitative content analysis of the teacher's asynchronous communication, as recorded in the database of Moodle. The Moodle database was used as a window to observe teaching in VDS, but it should be noted that lectures with PowerPoint-presentations and virtual learning material (http://www.muovimuotoilu.fi) were excluded from the data. Firstly, the investigators analysed communication links and teaching activities in VDS. The notes created by the teacher were segmented into statements representing separate meanings. Secondly, the codes were merged into three code families in order to examine teaching approaches. The analysis was conducted by ATLAS/ti computer program.

The macro unit of analysis was a note. Following the procedure of content analysis (Chi 1997), the notes (f=225) created by the teacher were coded according to scheme that emerged through the interaction with the data. The first category consisted of the following starting-points of communication: 1) pre-work, 2) document, 3) question, and 4) activity. The second category, receiver of note, comprised the following aspects: 1) to all, 2) to team, and 3) to individual student. Each note was considered to represent just one subcategory within these two categories. These subcategories were easily identified in the notes or in the communication threads.

Further a second level of analysis was conducted. The micro unit of analysis was a statement. Following the procedure of content analysis (Chi 1997), the notes (f=225) were segmented into statements (f=559). We employed a theory and data-driven analysis inspired by our previous studies (cf. Seitamaa-Hakkarainen, Lahti and Hakkarainen 2005). The analysis consisted of following categories 1) design context, 2) design challenge, 3) new information, 4) design idea, 5) evaluating design, and 6) organizing process. The subcategories evaluating design consisted of the following: 1) evaluating idea, 2) evaluating document, and 3) evaluating process. Each statement was considered to represent just one subcategory in terms of its dominant content. The subcategories and examples of the statements are described in Table 1.

Table 1. The classification schema.

Teacher's statements	The model of LCD	Three teaching approaches
Requirements related to design task	Design context	Problem driven guidance
Constraints related to selected concept		
Sub-problems related to design	Design challenge	
Sub-problems related to usability		
Sub-problems related to manufacture		
Info related to plastic	New information	Solution driven guidance
Info related to modelling		
Ideas related to design	Design idea	
Ideas related to usability		
Ideas related to manufacture		
Evaluating idea	Evaluating design	
Evaluating document		
Evaluating process		
Use of VDS	Organizing process	Procedural driven guidance
Announcements		
Instructions related to reporting		
Division of labour		

Results

Communication links

In the Moodle-environment, the discourse was structured by threads. To better understand the nature of communication, we identified both the aspects that promoted communication and the receivers of the notes. The entire database consisted of 225 notes posted by the industrial design teacher. From the database analysed, the researchers identified four starting-points for communication. Teacher participation was the most active around documents (f=117; 52%) created by students. About 28% (f=62) of the teacher's notes were preparation for working in the design course. In addition, both the students' questions (f=25; 11%) and their activity (f=21; 9%) generated the teacher's responses.

The further analysis indicated that approximately 37% (f=84) of the teacher's notes were posted to all students; 52% (f=117) of the notes were written to the design team; and only 11% (f=24) of the notes were sent to individual student. Figure 3 presents the distribution of the communication links. The results indicated that the communication was concentrated around the documents produced by the teams.

TEACHER-TO-ALL COMMUNICATION

Communication between the teacher and the students was very structured. The teacher organized spaces for documents and discussion. There were six subject-areas in the Moodle: 1) a questionnaire for background information, 2) design tasks, 3) materials, 4) local discussions, 5) team discussions, and 6) links. The teacher sent notes and material to all these subject-areas.

The analysis indicated that as much as 74% (f=62) of the notes directed to whole class represented preparation for working in the design course. These notes contained course material, schedules, the use of VDS (e.g., Moodle, eBeam scrapbook, TeamSpeak) and announcements for all participants. For example, the teacher gave instructions for the use of the Moodle-environment: "The assignment is returned to this discussion thread in a PDF format. Each group opens up a new discussion thread and begins with their document. The teacher comments on the document."

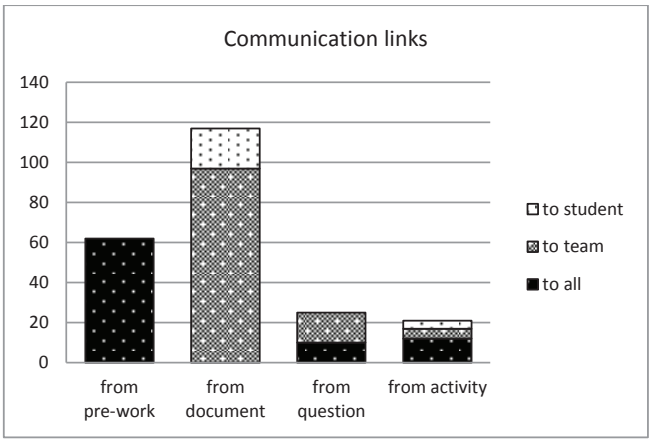

Figure 3. The distribution of the communication links in the Moodle-environment.

Although the teacher gave detailed instructions for the use of discussion-areas in order to get systematic structure for communication, many messages and documents were saved incorrectly by the students. There was lack of clarity with several headings and communication threads. For this reason, it was difficult to follow some continuity episodes within the design teams. In addition to pre-work, the teacher responded to students' activity and questions. It depended on the nature of the student's question whether the answer was addressed to all, to the team or to the one student. The following answer deals with the question of the design task: "I confirm Oscar's interpretation. The primary components of the product are plastic, and there needs to be as many as there are group mates. It can also have metal or even some simple electronic component. I don't however recommend designing a complex system like that of a cell phone."

The analysis indicated that the teacher reacted to students' activity by sending clarifications and reminders through the Moodle-environment. The following note represents clarification of the subtask, and it is addressed to all students: "Wikipedia-article has been left unclear. The purpose is to write a short article about the information gathered during the process. The information is directly tied to your product or at least the information is found during the process. These articles will be linked on the Muovimuotoilu.fi website in order to benefit all those who are designing plastic products. The idea is that the source of the information is mentioned."

TEACHER-TO-TEAM COMMUNICATION

The analysis indicated that the communication was centred on the design documents presented by the teams. About 83% (f=97) of the team level notes were linked to the documents. All the teams had to return six documents into Moodle-environment: 1) selection of the product to be designed, 2) working plan, 3) background study, 4) concept plan, 5) article to Wikipedia, and 6) presentation rendering. Figure 4 shows Team 10's document concerning the selected product. The teacher's feedback to Team 10 is presented on the next page.

Product:
Ice cube-dispenser, with whose help we can separate ice cubes from their container without using our bare hands. This new one-handed mechanism is made from three parts: ice cube mold, hand part, where the mold is placed as well as a handle part, which is used to determine the amount of ice.

Environment:
The target environment is primarily the home and kitchen.

Reasoning:
We selected precisely this product, because it does not exist yet and we believe it to be needed. An ice cube dispenser combines ergonomics, aesthetics, ease of use as well as ease of repair. Its operation consists of a simple technical action and as such the product is suitable for practically everybody. The dispenser provides a working solution to the unpleasant effect of handling ice cubes; we avoid the freezing of fingers as well as we can better control the amount of ice cubes as well as avoid mistakenly dropping them onto the floor. The product is cost-effective to produce and all of its components can be made of plastic.

Figure 4. Team 10's document of product selection.

> Ice cube dispenser is a difficult assignment, but it fits the subject. It does contain moving parts, mechanics as well as ergonomics. The form of the document and its presentation were good.

The analysis revealed that the teacher wrote 15 responses to teams' questions. For example, Team 10 presented a question concerning suitable materials for their design and got the following answer from the teacher: "What comes to mind is polythene-based foam plastic or EVA (Ethyl Vinyl Acetate), which has soft qualities as well." In addition, a couple of notes (f=5) focused on a team's activity. The notes in relation to deadlines were typical in this category: "Apparently some of the groups did not notice that, deadline has passed. It was yesterday. We tried to make it clear and hoped that the return date would be taken seriously. The course's task is broad and if you don't get working on it quickly, it will end up unfinished by the deadline. It is essential to have time to do the products planning in detail."

TEACHER-TO-STUDENT COMMUNICATION

A minor part of communication was directed to an individual student. Teacher-to-student communication represented only 11% (f=24) of all communication; this result reveals that the teacher did not contact to every single student through Moodle. The teacher did, however, comment on all student-level documents (f=20) which were saved into Moodle. The students were guided to design individually a part of the team's plastic product, but all students did not return their detailed designs into Moodle on time. Figure 5 presents a sketch produced by a student in Team 1 and the final construction of the toothbrush and rack. The teacher's feedback on the sketch is presented below.

Figure 5. Toothbrush and rack.

> The shape of the brush is beautiful. How well does it sit on your hand? The brush is manufactured using co-injection moulding. In order to keep the brush on the rack you need to extrude toe hard part and after that add some softness. You need to be able to do both. So, what is the form of the hard part without the soft?

There was no pre-work or questions in student level, but some notes (f=4) were classified activity-based. The following excerpt shows how the teacher pushed the students to keep up with the schedule: “Thanks to those, who returned their part of the design according to the schedule. A large portion of students didn't. This is a critical phase because the final modelling shouldn't be started before the product’s construction and functionality has been finalized. The feedback is meant to ensure, that the product can be produced and assembled. Teacher and tutors will today go through the parts' designs and the feedback, so answer this message and tell me when we'll see your sketch.”

Teaching approaches

The Moodle database contained 559 teacher’s statements related to the model of LCD (see Figure 6). The teacher’s statements consisted of various categories of the design inquiry phases. The analysis indicated that 9% (f=52) of the statements defined the design context. In the design challenge notes (11%; f=61), the teacher defined sub-problems which are to be solved. These two inquiry phases were defined to be the core of the problem driven guidance. The teacher developed the problem into three sub-problem areas: 1) design, 2) usability, and 3) materials and techniques for making the product.

The analysis indicated that as much as 4% (f=24) of the statements produced by the teacher represented new information; 6% (f=32) of the statements represented design ideas; and 44% (f=248) of the statements focused on evaluating design. These three inquiry phases were defined to be the core of the solution driven guidance. New information was mainly related either to plastics or to modelling techniques. In accordance with sub-problems, design ideas were related to design, usability and manufacture. Through evaluation statements the teacher assessed whether the design process was progressing in the desired direction, how the documents met the standards and how students' design ideas fulfilled the requirements.

The problem driven and solution driven statements focused on the design itself whereas the rest of the statements (25%; f=142) focused on organizing the design process. This phase was related to the procedural driven guidance. Procedural statements helped students to orient to the design process (e.g., the use of the VDS, announcements of lectures, instructions related to reporting, division of labour).

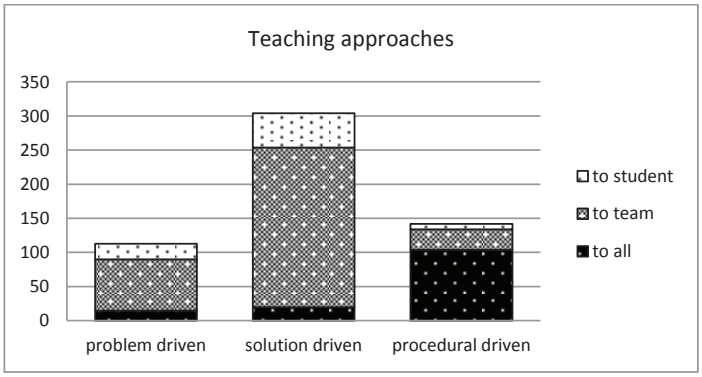

Figure 6. The distribution of the three teaching approaches.

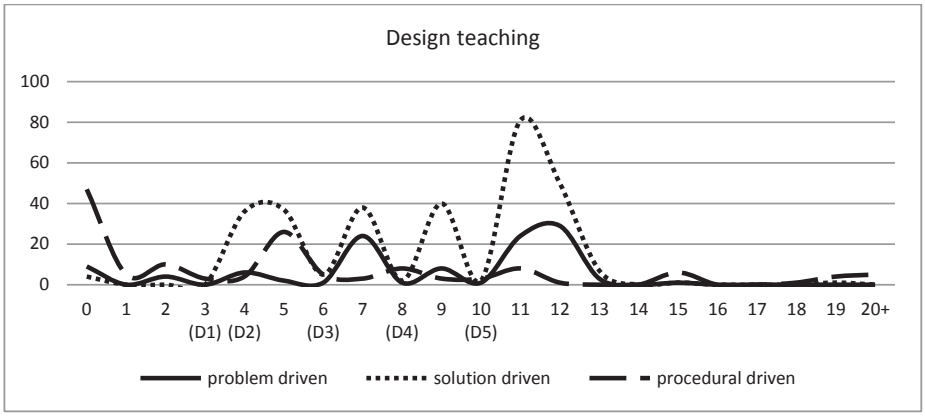

Figure 7. Design teaching during the 20-week period. Note: D1) selection of the product; D2) working plan; D3) background study; D4) concept plan; and D5) detailed plan for own part.

Figure 6 presents the distribution of the three teaching approaches. The teacher appeared to emphasize solution driven guidance (54%; f=304). The rest of the statements divided quite equally according to problem driven guidance (20%; f=113) and procedural driven guidance (25%; f=142).

A second level analysis involved a question whether there were any differences between the problem driven, solution driven and procedural driven guidance during the 20-week period of virtual designing. The analysis indicated that the teacher's participation increased after the documents were saved into Moodle-environment (see Figure 7).

PROBLEM DRIVEN GUIDANCE

The design task was a general and vague description of the desired product, giving only partial information about the customer, the purpose of the product and resources. Thus, it did not completely specify all the requirements, guidelines or desires for the product. The teacher facilitated students' understanding of the constraints and provided opportunities for them to extend and share their understanding. The main part of the problem driven statements (66%; f=75) was addressed to the teams. As the previous analysis indicated, the communication was centred on the design documents presented by the teams. The most central document in the problem driven guidance was the third subtask. During this background study the students had to find out, for example, where the product would be used, who would be the particular user this product, how it would be used, what the specific requirements for the product are, and what the expected production volume would be.

The previous document held communication together and facilitated a problem driven approach in both the students' and the teacher's point of view. In this approach, the teacher guided students in constructing a coherent design context by specifying requirements and constraints related to the design task or to the selected concept. In addition, the teacher guided the student teams away from problematic directions, permitting more manageable problems to arise.

Table 2. Three examples of the statements belonging to the problem driven guidance.

To all	To team	To student
The start point for the product is up to the design team. The product can be aimed at improving everyday life (can opener, key holder, cleaning tool, etc.) house appliance (clock, picture frame) or even an interesting accessory as long as during the assignment you mention the overall size, the amount of parts and material. Statement 3:101 - Code: [LCD context - Family: Problem driven]	*A series of 5000 seems on the small size. So the final product would be reasonably priced, we need to have the design- and production costs to spread over a large quantity. Usually this type of product are aimed at the global market where selling a million copies is possible.* 1:270 - Code: [LCD context - Family: Problem driven]	*This object could not be done with a simple mould, what kind of mould you have been thought about?* 2:163 - Code: [LCD challenge - Family: Problem driven]

Table 2 shows three examples of the statements belonging to the problem driven guidance. The first one defines the design context, and it is addressed to all students; the middle one is a feedback of the team's background study; and the last one is a design challenge based on the students' detailed design.

Solution driven guidance

The problem driven guidance focused on the question of what the problem is whereas the solution driven guidance pursued possible solutions for the problems. The analysis indicated that the teacher had three qualitatively different ways of supporting solution driven guidance. The teacher appeared to emphasize evaluating designs instead of sharing new information or creating new design ideas. It should be noted, however, that lectures with PowerPoint presentations and virtual learning material were important sources of new information, but they were excluded from the data.

The solution driven guidance was the most active at the team level. About 77% (f=234) of the solution driven statements was addressed to the teams. There were three team-level documents that especially facilitated solution driven guidance. The evaluation of the designs started after the teams returned the first document (i.e., selection of the product to be designed) into the Moodle-environment. Later on, a team-level document (i.e., the concept plan) and a student-level document (i.e., detailed design of one's own part) served as devices for design communication. Table 3 shows examples of how these documents promoted both new design ideas and evaluation of the students' ideas. In addition, new information of plastics and modelling supported students' problem solving process.

Further analysis indicated that the teacher appeared to evaluate students' documents and representational skills slightly more often than their real design ideas. Roughly 46% (f=114) of the evaluation statements related to the documents; for example: "Cross-sections are a great way to show the structural details, the dimensions well presented." Almost as many of the statements (42%; f=105) related to the design ideas, for example: "An accessory out of plastic is a difficult task. However, it fits as a Design Forum product." In addition, in some of the evaluation statements (12%; f=29) the teacher commented on whether the design process was progressing in the desired direction on time, for example: "If I understand correctly, then the product's prototype is still under discussion. So, it is not clear if it is an electronic device or not."

Table 3. Three examples of the statements belonging to the solution driven guidance.

To all	To team	To student
The innermost parts need to have a 0.2-0.4mm gap, so that the parts fit together. 1:383 - Code: [LCD info - Family: Solution driven]	*Could the same function work without moving parts, for example. By changing the shape of the base?* 1:339 - Code: [LCD idea - Family: Solution driven]	*The product's shape and structure looks to be different from the other groups?* 2:104 - Code: [LCD evaluating - Family: Solution driven]

PROCEDURAL DRIVEN GUIDANCE

Procedural driven guidance differed from the other ones. It was mainly addressed to the whole class (73%; f=104), not to the certain team or student. A typical statement to the whole class dealt with the use of the VDS, forthcoming virtual lectures or reporting requirements. At the team-level, the central document was a working plan which was intended to include a division of labour and responsibilities, a detailed working schedule and a plan for knowledge acquisition. With the help of this document, the teacher had the possibility of making recommendations to the teams. Table 4 presents examples of how the teacher organized the process at the three levels.

At the end of the course, each team succeeded in getting their prototype and presentation rendering ready for the exhibition. The final presentation in the University of Art and Design and the opening of the exhibition in Design Forum was the only situation where the students from the four different universities met each other face-to-face.

Table 4. Three examples of the statements belonging to the procedural driven guidance.

To all	To team	To student
In order to balance the poster print load we divide printing to three places: *Groups 1-6* *University of Art and Design* *Groups 7-12* *Lahti University of Applied Sciences* *Groups 13-17* *University of Lapland* 1:460 - Code: [LCD organizing - Family: Procedural driven]	*It would be great if you could already divide areas of responsibility, so that everyone could focus on their own area of expertise and nothing would be forgotten. Of course weekly we go into more detail on who does what.* 1:520 - Code: [LCD organizing - Family: Procedural driven]	*A final notice to those, who still haven't replied to the background multiple choice questions and free-form presentation. We're using this information for the breaking down into groups, so get your answers done and in by today.* 1:417 - Code: [LCD organizing - Family: Procedural driven]

Discussion and Conclusion

Recent studies (Al-Doy and Evans 2011; Chen and You 2010) have shown both the opportunities and the obstacles related to the digital tools and virtual designing. The need to integrate digital design tools and real collaborative projects to design education has been emphasized. Yet the pedagogical aspects of virtual designing have not been studied intensively in the higher educational context. The present study offered a unique opportunity to observe a design course in which 17 teams of industrial design students solved a complex design task entirely virtually. The aim of the study was to analyse the teacher's work and orchestration in VDS, in particular.

Traditionally teachers work as leaders and organizers of the collaborative design project. Virtual teaching requires a great deal of time to prepare course materials, to organize the learning setting and to communicate with the students. In the present case, the organization of the whole project setting was very challenging because of the large numbers of the participating design students that were geographically separated and their collaboration being conducted entirely virtually.

The results indicated that collaborative design was mediated by various design representations, such as plans, visualizations and 3D models. Mediating artefacts allowed the teacher and students to interact with one another through the object itself, as collaborating participants' activities were mediated and made visible through them. This is an essential feature of virtual designing where the participants do not meet face-to-face. According to Henderson (1999), visual representations work as boundary objects, by holding communication together and facilitating distributed cognition in design community. This point applies to the present case; the design teams' various documents contained the hints of knowledge that the teacher had to bring to the VDS. The result revealed that the teacher's contributions were extensively built around the design documents. Problem driven guidance was related to the background study documents, whereas solution driven guidance was based on the concept plans and on the detailed design documents. The procedural driven guidance was mainly supported by the working plan documents. It should be emphasized, however, that these three teaching approaches occurred simultaneously during the design process. This is an important point when designing process is seen as the co-evolution of problem and solution spaces (see Dorst and Cross 2001).

The virtual collaboration between design students has been studied more than virtual collaboration between a teacher and students. Sagun and Demirkan's (2009) study indicated that the critiques from both the instructors and the other students were more focused on the solution space than the problem space or representation. Likewise, in the present study, the teacher appeared to emphasize solution driven guidance. Further, Cardella, Atman and Adams (2006) suggest that student designers should be encouraged to develop their representation skills and to use more representational activities. In the present case, the qualitative content analysis of the teacher's notes revealed that the evaluation of the documents and students' representational skills had a central role; the students got plenty of feedback about how their documents met the standards and how to improve their representations. In some cases, the teacher recommended hand-drawn sketching and real muck-ups in parallel with computer-aided design and modelling. Despite rapidly developing design technology, material representation, such as hand-drawn sketches and real prototypes continue to have a place in exploration and idea generation within the design process.

To conclude, the teacher is needed to structure and orchestrate the collaborative efforts and provide guidance for design learning. In the present educational setting, the teacher was able to follow only the teams' documents, not the entire design process in progress. Thus, the students had to take responsibility for their learning—determine what it is that they do not understand and how to proceed with the task. This required a shift from teacher-centred to learner-centred learning and from individual learning to group learning. Nonetheless, the teacher's guidance was needed to expand the progressive, design inquiry. According to our study, the model of LCD can be used to provide guidelines for teaching. The teacher can use the model for creating a design project's infrastructure by considering the role of design documents and models of interaction that facilitate collaborative designing. The teacher and students together can also use the model for reflection on the design process; they can reflect and evaluate how collaborative design processes have proceeded, how problem driven and solution driven strategies are employed and how the process has been organized together.

The format of the virtual studio teaching permits a variety of interactions and methods to be employed. However, it is not easy to implement sophisticated pedagogical ideas in technology-mediated collaboration (Kali, Goodyear and Markauskaite 2011). The design teachers have to find a balance between prepared structures and improvisational activities in VDSs (cf. Sawyer 2011). It is essential not to use a VDS only for transmitting knowledge to students, but also for facilitating students' engagement in collaborative designing.

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Design Knowledge from Practice(s)

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Abstract: The main premise of this paper is to centralize the experiential mode as a fundamental to Design Research whether by practice–based or by practice-led knowledge. This paper will map the process of different 'knowings' of practice, how they manifest themselves into critical knowledge for Design. Through this researcher's engagement with the experiential, came an understanding that could not otherwise have surfaced without the practice–based inquiry and methodologies. 'Practice' is a central imperative of Design, yet the nature of these activities we call 'practices' is never the less complex in its critical edification and defining how it contributes and shapes 'culture building' (Scrivener 2008). To advance research the knowing needs to have 'impact of consequence' (Biggs 2006). While the research needs to 'change the knowledge' (McAllister 2006) of the subject domain, it also often changes the nature of the 'practice'. Making sense of how 'knowing practice' can add to research of / for / by Design education and therefore locating practice in the institute needs to be relevant to the contemporaneous Design Research

Keywords: practice-based, practice-led, experiential practices, research practice, design education

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This paper aims to question and debate what is 'practice' and how the activities that make up a practice can and should contribute to the gaining of critical research outcomes. Using this researcher as case study the paper will unpack the practices that have surfaced and how they are relevant to research. Experiential practices established the need to know techniques and processes, subjects and themes, historical and contemporaneous societal content and contexts. While at the same time, outputs and outcomes need to be tested for their appropriateness in answering the critical question. This process found that outcomes had to be made because they did not exist. Philosophical conclusions and new knowledge therefore could not have resulted in any other critical way. No one element of the research question was in itself a contribution to knowledge; instead the 'package' or conglomeration was deemed a contribution to the domain and to new or 'changed knowledge'. (McAllister 2009) The rigorous critical evaluation for the experiential researcher often means there is not one imperial view but a series of shifts and understandings that move beyond the initial inquiry by use of different practices, research praxis and methodologies.

At the core of the research has been the practice-based methodology. Yet this word 'practice' has multiple and layered connotations. This paper will tease out the meaning and significance of 'practice' for Design Research education from its intuitive, individual, introspective meaning to that of practices utilized that meet outside dissemination and critical elevation of the research.

'Practice makes perfect'

The notion that the more one does something, the better the 'thing', and the practitioner becomes. For many a practitioner, this is a core rationale that is akin to that of the individual's interest in making, in materiality, in the merging of substance and process, in craftsmanship and in the proficiency of a technique. 'Makers establish their positions through making ….. across a set of creative systems' (Cohn 2012 p 38) The strong 'dialogue between maker and object; an interdependency between process and intention which is linked by skill', has unique imperatives for the art / designer practitioner. (Harrod 1997 p351) The result is one of 'expert' but this accolade, while laudable, does not necessarily mean it equates to critical research, yet, never the less is the central requisite of practice-based research.

Often makers are cited as not critical thinkers, this is borne out of reluctances in the past for makers to textualize the thinking, often with the belief that text or articulation can not do better to communicate what the intuitive made object can. Makers are thinkers and are engaged in 'art as thoughtful workmanship' (Edwards 1997 p349) But thoughtful workmanship in itself is not necessarily critical thinking; the maker is challenged to find methods for articulation and textual communication that brings the introspective personal knowledge to the fore . The knowledge of the experiential, sampling, honed making skills is 'about provoking change and iterative imaginative steps forward'. (Sevaldson 2010 p20). What is emerging with significances is the connection between the art (design) inquiry methodologies to that of research building. 'I.e. a new actor that has appeared on the stage – a practitioner who reflects upon her / his own practice'. (Makélá / Nimkulral 2011 p2) Art and Design practices have unique insights that need to have critical reflection to locate and contribute to critical research. 'The exploration of knowledge partly through making artefacts has brought a new dimension to design research as the practitioner informs the nature of the researcher role, not only creates an artefact but also documents, contextualises

and interprets the artefacts as well as the process of making them'. (Schön 2011 p1) The artist limited to their own practice without contextual referencing and relevance misses the premise of doctorial research that needs the research 'to change, inform and have impact of consequence'. (Biggs 2006)

Scrivener cautions that, the making methodology 'does not necessarily demonstrate knowledge, ideas and intentions'. (2002) This is not to say practice is not valid, instead the practice has to determine why and what of its nature makes it valid critical knowledge. Stockerson states 'experiential knowledge, thinking and knowing are at the heart of design, (2009). While this maybe universally accepted as a prerequisite of design, we have to make explicit our intentions. 'Knowledge production in practice has far greater potential than being a curious sidetrack in academic research'. (Sevaldson 2010 p30) According to Dorst, the practitioner's expertise pertinent for design research is borne out of 'gathering of inspiration, building up a stock of useful or admired precedents and self education, to stay abreast of the ever changing field'. (2009) Yet for this expertise to have benefit to research, it must have rigorous critical evaluation as to their relevance appropriateness. This researcher would argue that the defence and justification of such practices had to be used as the philosophical critical question could not be answered by any other means. Fleishman terms 'creative discover' as demonstrative of the relationship between these creative processes and the knowledge gained. 'This concept underlines the importance of the two-fold process of making and reflecting and the knowledge that this process might be able to reveal'. (Fleishman 2009 p.3) This design strategy makes a valid contribution to 'research building'.

This researcher's method of inquiry of practice-based questioned the fundamental definition of what constitutes a pair through shoe-derived forms created by textiles processes. The shoe motif complimented the research of visual surfaces made or exploited in Venice, paired with the painted object, by Carpaccio's of 'Two Venetian Women' (circa 1495) which depicts a pair of 'chopines' shoes. The 'language' of a pair questioned shoe-derived forms as a vehicle for narrating philosophical preponderances of a pair. The outcomes found components of the binary pair are not passive equality of replication; instead these binary forces are indicative of design processes between the intuitive maker and that of critical thinking outcomes. The affinity of the experiential methodology harnesses the activity as opposed to predicting the activity to establish results. When design is paired with practice based research criteria there is a negotiation as to what these matrix actually are and what identifying traits they should communicate. Practice based research or interdisciplinarity increasingly needs 'the ability to communicate and get into dialogue with ….other knowledge producers, in ones own, as well as other disciplines and fields'. (Dunin-Woyseth / Nilsson 2012 p9) The shoe motif becomes artefact, visual communicator, narrator, and protagonist. The research necessitates crossing into Material Culture, Venetian Art History, and Culture Studies of Venice. There was a need to understand the notion of artefacts collected, horded, social codifier, metaphor, fetishism / gender signifier. The making of artefact contextualized research in the applied arts, craft debates and narrative for sculpture / installation and audience engagement. One could argue, such breadth of terrains studied, only brings together already known knowledge yet the outcomes resulting from the subjects linked together in the common goal of establishing new insights or 'changed knowledge' that contribute to the field.

Morphing Practices

The immersion in a rigorous research process is not always truly contextualized or acknowledged until there is time to reflect on what is a research continuum. A continuum that is not an even paced trajectory, but a sequential if not a consequential response. The progression of research morphs the process(s) often into other practices. What arises out of the practice based experience is the 'label' of that of 'practitioner'. While suggestive of having a practice (or practices) without saying what the practice is, does not perturb as the practices (or the expertise in given fields) is now multi faceted. The core visual applied arts practice has morphed into a teaching practice, to that of educational researcher. Scrivener acknowledges that there is now an education culture / research culture / design culture resulting in the triangulated roles of designer, researcher and education. (2008) These practices now straddle the practice-based to that of practice-led. For the maker / researcher what surfaces, is to question what happens the making practice as the research practice does not necessarily now need to be make in order to resolve a question.

While not predicted, prescribed or preordained, research does not come to an end, as Le Feurve has said 'grammatically artwork becomes a comma rather than a full stop'(2005) This is equally relevant to that of a research practice. The research can often move into other domains, with emphasizes on different modes of practices. The starting point was practice-based, the experiential mode alongside a developing critical reflective practice. For many makers, the process of making does not want to dissect or be interrupted by other modes of critical documentation, articulation and textualization. Yet while often problematic for the maker; like any other practice, research needs to be practiced, 'which like any skills, have to be learned by doing the task in practical situations under supervision'. (Phillips / Pugh 2005 pp20-22) Often the starting stance of research takes the view that the making process and its artefact outcomes are in themselves justification, that 'the artwork itself is knowledge', (Scrivener 2002) but now this researcher's experiential understanding is that the made artefact do not have inherent knowledge. 'Objects alone cannot embody knowledge because they need to be interpreted in order to communicate knowledge'. (Biggs 2002 p23-24) The making process and the made object need other critical means by which to reflect, interpret and communicate. One could argue that both these processes of reflexive and reflective are practice-based activities, on the other hand reflection could be argued as practice-led. While the nature of reflective and reflexive can be unpicked, they are imperatives in all design thinking. 'Design thinking is more or less the same in all cases,……(but) there is a huge variety in kinds of design reasoning'. (Dorst 2010 p138) While these issues may be pure semantics, they could not have surfaced without experiencing of and immersion in, the critical research process that propelled the investigation. It is in the 'reasoning' 'from different direction and confront, integrate and contextualizes this knowledge' (Stappers 2007) that arguably is of value for research.

By definition a PhD holder is a researcher and being research active is an imperative of that practice to create a continuum in the post doctorial space for research activities. The key 'discovery' is that the research practice has changed from practice-based to one that is ***led*** by the knowledge from having a visual arts practice, and from practicing research. 'Practice-led has been used by some authors in preference to the term practice-based, in order to acknowledge the change in emphasis from the production of original artifacts to the integration of artistic practice to the research practice'

(Lycouris 2011 pp 62-63). The research of this individual still has the shoe as the centrally object, but there is not the singular activity and exclusivity to make the non-existent pairs of shoes, instead the research has led the shoe motif into domains and territories of material culture; archiving, cataloguing, documentation collection, social record. One aspect of the developing research practice is in the study of a physical shoe collection from a closed Irish shoe shop has moved a central issue into other domains. The shoe stock was amassed over a time span of late 1950's to mid 1990's. Most are Irish made, a reminder of a once thriving indigenous manufacturing industry now extinct. The collection reflects the fashions, social norms of this rural Irish community. Therefore the research strategies have morphed into 'sub-clusters' of documentation, archiving and generation of a collection. This employs other taxonomies and epistemologies as the outcome is (hoped) to move into areas of social anthropology in an historical Irish context.

'Creative practice itself is developing towards transdisciplinarity and emerging as a confident research area. It also demonstrates development towards an increasing multiplicity'. (Sevaldson 2010 p15) The emerging of amalgamations of 'plinarities' will see the research added too, but also the trajectory allows research to relocate. The means by which this occurs is indicative of interdisciplinary strategies. What equally emerges is the emphasis of the educational value of practice-based methodologies; how they change, inform and determine research pathways, outcomes, clusters, audience, dissemination strategies, for the institute as a knowledge producer.

This morphing means the researcher, armed with a suite of 'knowings' adds to their experiential repertoire that simultaneously often moves into other subjects and methods. To be able to claim that this is pertinent to research as opposed to an 'interest', there needs, at all times rigorous defends as to their appropriateness to enable to answer the inquiry. The developing research trajectory must still have relevance. Caution has to be exercised in this transition or morphing, being cognisant of previously gained knowledge and experiences shifting and widening into other areas that have been less grounded in critical experience.

The Professional Practice

Love questions 'how professional practice can get fed back into research'. (2006). As Art and Design institutes locate themselves in the research university culture; this becomes a very pertinent question. On the flip slide of the question Phillips asks how is 'the relevance of research activities advocated by the university appropriate apprenticeship for a professional art practice'. (Phillips1998)

Indeed we should acknowledge that it has been in the practice-based methodology that there have been the widest debates in research strategies and changes over the last three decades. This in itself causes anxiety for academia by this shifting, highly interpretative area of research that breaks imperial views and certainties especially in the appropriate methods to communicate made outcomes. Practice-based methods allows for interdisciplinary / multidisciplinary or transdisaplinary in location to wider critical domains that will have impact on the research culture 'provoking change and iterative imaginative steps forward'. (Sevaldson 2010 p20)

Having said this, practice-based equally is seen as a 'weak link' because it has opened up the otherwise elite exclusivity of the traditional, formal imperial views of research. Practice-based can be seen as the 'rogues' of academia that are getting in the back door. Often the 'weak link' or the 'casualty' in utilizing this methodology is the

core professional practice. Successful professional practices are not necessarily that of research and do not in themselves create a base for a research practice. Hanrahan says 'art (design) practice and research practice are not the same'. (Colford 2005). The professional practice is more often than not led to critical research. For the designer this is often a clearer relationship than that of the artist. One of the dilemmas of the use of a professional practice (in this researcher's case that of an applied artist) is what happens to that core practice of making after a critical project / inquiry has been answered? A 'maker', often still has a need to make, to engage with an audience that now can split the once holistic reflexive / reflective art practice for research needs. The creative practice may exist as a parallel continuing professional activity alongside that of the predominate research practice. If the physically made outcomes are indicative of the research they can not be as 'natural drift' whereby there is a tendency for a designer / artist 'towards a certain way of working'. If the practice of making is to be critically used as research outcomes, it needs to be innovative, 'where change is becoming more rapid in pace, challenging the very core practice experience'. (Dorst 2009)

Knowledge of and experience born out of the professional situation can and should inform research. For many in the institute they were happy to keep their professional practices separate from the institute. This is changing, where by the distinct roles of the institutional profession and that of outside profession needs to become that of holistic research profile. The creation of a research culture by identifying prioritises and interests of staff needs to be driven / activated into a critical mass that not only reflect but innovate the landscape of our respected educational domains. The Design professional practices are varied from the individual experiential expertise crafting artist experience, to that of team /collaborative / consultancy context (that often exists with greater ease in design). It is the expertise of the professions that has in the past been of interest for the institute to inform teaching strategies. We are charged now as professional educators to be research active to critically view real world scenarios to create a culture of research. The visual creative profession is twined with that of educational profession morphing into that of the educator / researcher profession.

The Practice of Research

> 'Design is the key to research. Research has to be designed….. research is a design act. Considering design carefully (making theory from or even researching it) can reveal how better to act, do research – to design research'. (Glanville, 1999 p.90).

No matter of the successes of an individual's professional practice it is only of benefit to knowledge building when it adheres to the criteria of the research agenda. The practice of research is often a hard one for the successful practitioner with a rich professional experience. The practices of research shifts the experiential traditions from the 'insider', vocational, expert / master with connoisseurship of the field to that of critical, objective outsider role which, adjudication of these experiential practices to benefit critical research.

> 'Practice is an activity which can be employed in research, the method or methodology must always include an explicit understanding of how the practice

> contributes to the inquiry and research is distinguished from other forms of practice by that explicit understanding' (Rust et al., 2007: 11 p 21)

The fact there is a myriad of approaches to Design Research means we have to be more explicit and exact in defining the rich landscapes of design research and Design research practices. 'The aim is not to narrow down the field and arrive at a simplified consensus but to open up the field and give design researchers access to a rich repertoire of possible research perspectives' (Sevaldson 2010p9)

Practice-based inquiry emphasis the artefact as an outcome, equally the research in itself should be seen as a tangible crafted outcome. The research practice should dove-tail with other practices. 'We can argue that research is also an artefact, look at research as a craft. This perspective might be useful to keep in mind when attempting to bridge the gap between theorizing and practising and when looking at research as a skill and practice'. (Booth, Colomb & Williams 2008) What is clear is that research like anything needs to be practiced and exercised and that it takes skill and know-how to exact it. The language used in the aforementioned quote seems even more nuanced to this researcher as an applied artist (in Design) of the crafting / making experience. Understanding research as a skill to be practiced and perfected allows for the different activities to be underpinned by a commonality that sees these activities as mutually in need of each other. The reflexive / reflective making of practice-based often needs the 'entanglement of processes' to make sense of how best these activities inform, influence and infuse each other. (Farher 2009)

The experiential often takes on the introspective nature of the researcher as author, practitioner and maker, whereby this complex process while legitimate, needs rigorous defending and understanding by the institute how this can be supported and found pertinent for Research. The imperative lies with 'practice as a theory building activity' (Sevaldson 2010 p14) to articulate, (by various means and methods), argue / debate / defend and rationalize the personal and therefore subjective, to be comparable with that of objective formal discourse.

Horváth sees design research as a 'conduit' 'between "basic" research and practical application' that involves, design context, design inclusive and practice based methods. (2007) Formal research often is for a limited peer group, the use of practice(s) means this interdisciplinary approach widens the critical audience base. This in itself can be problematic for critical appraisal as design and practice–based methodologies often are seen as 'magpie' taking and dipping into critical domains. This is a fundamental debate how we gain knowledge, how it is disseminated back into the educational institute must be a key consequence of research and have ''impact of consequence'. (Biggs 2006) The outcome should not be seen as a definitive end of the inquiry, instead it should be part of a continuum in the culture of research building, an area that design has much to contribute.

Practice for / in the Institute

The morphing of practices is a difficult one to navigate in the institute, as quickly one can be faced with criticism of knowing things only superficially with no right to claim the accolade of the connoisseur of the knowledge. This can be one of down sides of the philosophical practice–based route. Having once proved and argued that the work has to be made because it did not exist, leading to answering the question in this

way, the making process may not be justifiable as it may merely be perceived as a continuing professional practice or seen as new art production.. Yet if the research's aim is one of 'enhancement of perspectives' as opposed to 'a quest for certainty' (Baron / Eisner 1997 p95) we can see the potential that the experiential / making practice can have insights, inform and contribute to research building. Brown sees potential of the critical and practical 'reasoning' brought to bare on research of the 'complexities, irrationalities and absurdities'. (2000)

Practice methodologies can have valid contributions to research and a core means to gain knowledge. 'This unique core of design research is found in Research by Design, where the design researcher is also a practitioner ……combined with a reflexive mode of inquiry that helps make design knowledge explicit'. (Sevaldson 2010 p9) The resulting change in the nature of the practitioner see the practice used for research, in turn whereby the research informs and shapes the professional practice(s).

The shifting polemics in Design, constantly questions what is 'Design', an adjective and a verb, it sometimes moves uneasily through the institute never quite being about to stay in any one location or take root. Design outcomes of productive activity can often be confused with critical design research. Productive activity may be an institute's priorities and interests but are not necessarily or automatically driven activities of a research collective / cluster.

More and more the researcher has to question the relevance of their research to the institute. PhD research's main aim is to gain and disseminate 'new' knowledge that has to have impact and create a continuum for research building. The contemporary institute context demands research is relevant with increasing pressure to gain funding. 'Agendas for research development are often shaped by political and economic forces external (to that of) art and design institute'. (2012 Remaking Conference) This alignment with funding agencies and industry is more sympathetic to the collaborative projects of a cluster. Research interests therefore have to be driven and orchestrated for them to be a 'cluster' that in turn is more receptive to building a research culture. The smaller institute of specialist subject domains like an art and design college often lags behind this university made model of research. Yet there are opportunities for the small institutes to exploit its uniqueness and take ownership of the niche knowledge's and methodological approaches to creative thinking. 'Competences being negotiated will be operative and useful as a pedagogical tool in research education…as well as in dialogues between research professionals and practice professionals'. (Dunin-Woyseth & Nilsson 2012 p9). For the individual researcher such as often found in the fine art / applied art areas, Visual Culture and Art History, the critical question and research activities are measured against the need for this activity to be done because it is contributing to knowledge production, still has to be driven and have clear intention and location in a clustered critical mass.

'The communication of the research is more than learning to gain knowledge but also a contribution to teaching and the imparting of knowledge'. (McAllister 2009) The institute as a collective has to drive how best to communicate the changing landscapes of practice based core activities. While many sectors of research are creative in their thinking, art and design are unique in their communicating by visual means and visual outcomes. Equally the applied artist / designer with a focus on the materiality and of the making process, should see this as knowledge that has to be taught, learnt, experienced, understood as being of critical value to forming research. We need to see what we do as valid and relevant and true to our domains. McGuirk cautions 'scholastic disposition that undermines the embodiment, situations and

practical aspects of art and design production'. (2011) The driving of research activities into research clusters is now the aim of art and design institutes with agendas to create, change socialite and influence and innovate culture.

Conclusion

The practice of art and design and the practices inherit in these fields of study allows for Design's re invention; not merely to solve problems, fixing things that have been already created. But to see the interdisciplinary nature of creative thinking overlaps into other domains as contemporary pre-requisite of Design at large, but as Research as a whole. Design and the breadth it encompass is charged with envisaging new research strategies and outcomes, drawing from and driven to what it is to newly think, understand and shape culture.

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Building appetites: the design of locative media apps for learning the networked city

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Abstract: Recent years have seen the rapid growth of mobile communication and more recently smart phones and apps. But how might we approach 'learning the networking city'? In this paper we reflect on the negotiation of a mobile app for cultural mapping of the networked city developed as part of a large design research project into social media and the city. The negotiation took place as part of an international master's level class of students of urbanism, architecture and design. The app called Streetscape was developed and trialled as part of a large funded research project into social media and the city. Drawing on research on mobile design, sociocultural learning theory and assemblage theory we describe the process and outcomes of the students' strategies for redesigning a cultural mapping tool. In summary, we found that the app stimulated learning in three broad ways: 1) as a device for ways of looking at the city, but also for exploring the city, 2) as a means to thinking about design potentials for design intervention, and 3) as offering ideas about alternative and future ways of reading and mapping the city.

Keywords: apps, mobile learning, cultural mapping, urbanism, assemblage, sociocultural, networking city

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Introduction

Much of the now expansive literature on e-learning refers to students' engagement and participation in using, making and sharing learning resources, including their own productions. In contrast to studies of 'K-12' learning, little of this literature covers the domains of architecture, urbanism and design education at tertiary level. In addition, in e-learning research there is still scant attention to the *design* levels and specifics of digital learning tools, environments, platforms and processes. So too might it be argued that what is often overlooked is the nature of emergent, dynamic and unscripted designs for learning and learning designs that digital technologies may offer.

Scholars in the learning sciences and 'instructional' designers might quibble with such generalisations. Yet, designers and design researchers seldom find their notions and practices of design in educational arenas. Less common still is it to see design practice and modes of design knowing and communicating linked to how learning is itself composed, co-structured and, ultimately, enacted.

Apps and appetites

If learning environments and new mobile tools and devices – and increasingly smartphone apps – are not discussed and framed in terms of how they are designed how they are to be used educationally may be problematic. We may hold ourselves to principles of the dialogical in learning (Bakhtin 1981) that are geared towards learing as a dynamic activity centred on mediated meaning making that is located in sociocultural contexts of communication. Even then, though careful to engage learners in the transformative nature and character of pedagogical events and wider knowledge building between tools signs and mediations (Vygotsky 1981), appetites for computationally mediated learning may not necessariy be healthy ones. Added to this is the commercial offering of more and more mobile applications. This covers formal professional and educational settings along with playful, popular cultural and self-motivated selections.

In this paper we offer reflections on a heuristic design education project into learning about the networked city in the domain of Urbanism through two related activities in a master's level course. First, students familiarised themselves with a mobile phone app developed for locative cultural mapping. Second, they took up an open ended brief to develop potential additions and transformations to the app. We discuss these two activities in terms of building critical and analytical approaches to 'learning the city'. We take up the affordances of the networking city, such as GPS locations, situated written annotations, user-generated thematic tags and location linked images. In this sense our work into providing students with an open ended brief into mobile app development aligns with that of Drew (2011) into non-hierarchical approaches to design learning via co-design thinking.

In the context of learning in a design school, these activities are to do with building appetites for design and learning. But what are these appetites? They are ones that are concerned with means to map the city culturally. Appetite is also about engaging our graduate students in seeing, accessing and critiquing tools we have developed within our own research into the dynamics of inquiring into the networked city. They were asked to take their own university and studio based course into the street. Via co-creative production this was then expanded to their own reflections on how locative digital media tools may be redesigned. This is possible because they themselves have been and are on the move, in the city and via mobile technologies that demand their

participative enactment in shaping and making meaning. These experiences and designs were also critiqued by their peers and the course teachers and an external evaluator.

Urbanism and cultural mapping

Overall, our concern, educationally and in design research terms, has been to assist our students in facing the complex weave of systems and settings that today constitute urban life. As students of urban studies - and as young adults who have 'grown up digital' and are themselves active users of mobile and ubiquitous technologies - they encounter city spaces that are infused with data and multiple sites of connection and sources of knowledge that are situated in the physical world as well as in electronic networks. A related contemporary pedagogy of the networked city now entails pervasive computing, data flows and mobile behaviours. This involves what elsewhere in the learning sciences concerned with 'digital literacies' is a matter of enabling and enacting competencies that occur in situ and online. In such a pedagogy together with our students we investigate how to not only read but importantly also 'write' the city.

We have approached this by referring to an emerging domain within Urbanism we have labelled 'cultural mapping' (Morrison et al. 2012). We understand cultural mapping as an approach for learning the city through the mobilization of the affordances and resources of networking technologies and through networking with the city by way of reading, annotating and reflecting upon its shifting sociomaterial environments. The cultural dimensions of the mapping cover activities that are performative, creative, emergent and experimental. This contrasts with more technocratic, hierarchical and teleological cartographies.

Main questions

Below, we address three core questions: How might the design of a locative media application be geared towards understanding the city as a learning context for cultural mapping? What might students generate in an open ended design task geared to promote dialogue in the field between activities of annotation and reflection? What are the implications of taking up the city as a learning context for cultural mapping via locative applications? In the next section we present two aspects: sociocultural approaches to learning and design and cultural mapping centring on the notions of assemblage.

Contexts

Sociocultural learning and mobile design

The shift towards mobile learning and the city demands curriculum design and micro level activities that encourage the generation of mediated communication by active participants who are now also on the move in a variety of urban settings with mobile communication tools and devices. These are wirelessly accessed tools that influence shared mediated meaning making as the interplay between tools, signs, and historical and cultural dimensions of our interactions (e.g. Vygotsky 1962, Vygotsky 1978). A sociocultural perspective on learning centres on developmental aspects that occur between cultural and socially mediated action in contemporary and legacacy contexts (Wertsch 1998). Today his mediated meaning making is itself multimodal, and significantly now also location based. There is an additional level to this complex and

dynamic communication of the mobile networked city that takes places in the rush and lulls of the modern metropolis. This is that we simultaneously need to look reflexively and critically at the situated knowledge (Brown et al. 1989).

Elsewhere place specific computing (Messeter 2009) has now been better connected to locative media (e.g. de Souza e Silva and Frith 2012) so that it is possible to see these as part of an emerging mobile, locative and distributed cognition. Such cognition depends hugely on good designing (e.g. Nova and Girardin 2009) and on seeing design as part of not only ubiquitous computing but in the context of relations between the network city and instances of ubiquitous learning (Cope and Kalantzis 2009). It is important that this is understood as occurring at a communication design level and one that is geared towards the further development and facilitation of communicative design literacies. These are competencies already addressed in digital literacy studies in terms of learning practice and learners' every day lives (Lankshear and Knobel 2007). They further relates to the shared shaping of semiotic resources for learning (Prior and Hengst 2010) as well as multimodal media, tools and contexts (Morrison 2010). However, the developmental design literacies that are central to design education do not apppear in this body of work on schools, workplaces and increasingly learning across sites. Yet in a school of design it is possible to investigate these dynamics in a pedagogy of production that engages our students in speculating about such a multimodal and mobile rhetoric and using their various compositional competencies to project it to one another.

There now exists research into mobile learning that provides educators with insights into the changing modes and media of learning, such as the use of SMS, photo and micro-blogging and other social media tools that allow for aggregation, annotation and sharing of learners' own productions. Learners' understanding crosses locations and activities, often moving beyond and between the home and school, among peer groups and within 'virtual' spaces (Carpenter 2012). This is learning in progress that cannot always be seen by the teacher; it may be filled with students' own production of texts in a mix of media and mediations (Buckingham 2003). In the design school this may be extended from traditional studio settings to ones that move outwards into the external world, spannng from embedded practices to modes of knowing, and emergent skills and experiences of making to interpretation and analysis (e.g. Koskinen et al. 2011).

Assemblage

Alongside such emergent electronic literacies, the application of digital tools in understanding and analysing the city has moved from a focus on the mediated city and its related spaces and architectures (McQuire 2008) to urban settings that are 'sentient' (Shepard 2011). The networked city then is filled with a mix of tracking tools, mobile masts, and smartphones that help generate our 'net locality' (Gordon and de Souza e Silva 2011). In trying to unpack these sensing and increasingly sensory environments and the processes and activities of designing for networking the city, we find the notion of assemblage to be useful.

According to McFarlane (2010), assemblage may be used to refer to the spatial grammar of urban learning that also relates to resources and empirical domains by which urbanism is realised. He writes (McFarlane 2010: 1) that assemblage emphasizes '… the labour through which knowledge, resources, material and histories become aligned and contested: it connotes the processural, generative and practice-based nature of urban learning, as well as its unequal, contested and potentially transformative character.' In our experience, the notion is also helpful for unpacking

the complexity of systems and interactions inherent in the networked city. McFarlane has also developed the concept urban learning assemblages. His work inspiring and appropriate in connecting assemblage, urbanism and learning yet it lacks two further key aspects. These are a clearer formulation of learning approaches and perspectives that cohere with this view and an activity centred view on the enactment of such an urbanism. This is what we now turn to concerning the experimental course in which we positioned assemblage in the context of an emergent ecology of designing and of learning in Urbanism.

Course settings

The mapping

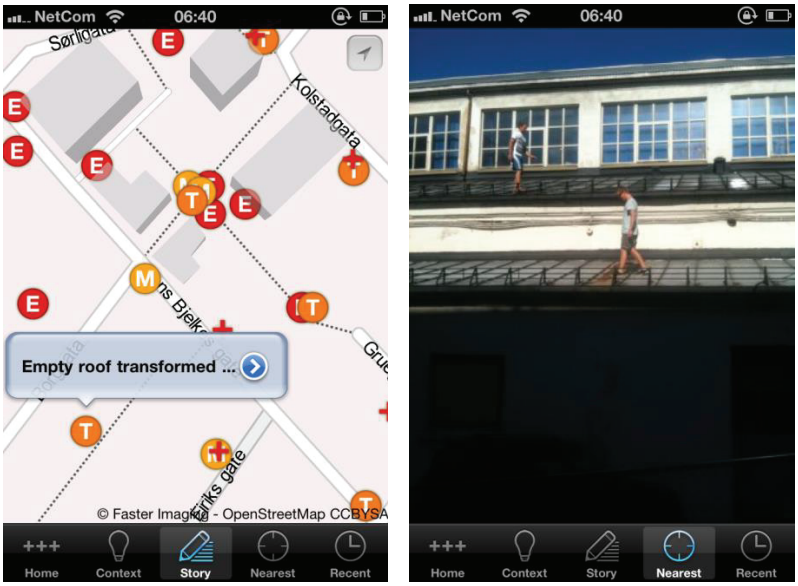

Figure 1. Two screen grabs from the Streetscape app, showing the four categories and an entry named (left), with its image content (right).

Streetscape was developed as a part of the YOUrban project into social media, the city and performativity. In designing it we transposed a paper-based and experimental mapping methodology of Urban Gallery (made by Raoul Bunschoten and chora, 2001) into a GPS-based application and mapping tool for the iPhone (Morrison et al. 2012). The tool makes for an explorative approach to ways of reading and annotating urban features that are everyday and mundane, complex and ambiguous. Following the Urban Gallery paper based tool, in the app mapping in the field is characterized by activities of observing (random) points of interest (POIs) according to four designated perspectives: Erasure, Transformation, Origination and Migration. Annotation is conducted by way of users' photo documentation, short written texts / statements and labels, using the touch based functionality of the iPhone. The perspectives function as a constraint, in effect a heuristic, in facing the complexity of the actual city and its changing character as one engages in it on site and through movement. On the

smartphone this translates into an interface between the four 'views' and the locative links that one then 'maps' productively 'out in the street' by way of annotating what one encounters, sees, senses and interprets.

In design education work prior to this course we involved over 60 master's students in using and testing the app in a selected inner city area (Hemmersam et al. 2012). However, we wanted to see if this could be taken a step further, in a production-driven design process with 8 master's students on an elective course in Urbanism. The group was comprised of four men and four women, arranged with one man and one woman in each pair in the final project work. Half of the group were international students. The students had backgrounds from interaction design, urbanism, and architecture. The course ran one day a week over 12 weeks (6 ECTS), and the work reported here is that presented in the last week.

While the scattering of POIs in the *Streetscape* app asked students to visit and fill out the four categories did promote movement into unknown streets or familiar corners and parks, we felt a need to take the students closer into the design processes and in their own right. As researchers and teachers we too were involved in learning the networking city through developing the app and including it in our own pedagogies and use.

We encouraged the group to first become familiar with our own designs to date and read our research papers on them, including reflections on other students' uses of the app. However, we wanted to give them space to more openly take up the app to consider additional options, abductive directions the app might take in its redesign and how they might be able to project some of their own expertise as users of social media into a more open-ended design process. This led to the development of an open ended design brief that was geared towards pair work and to mixing students from different contexts and countries.

Projects

In the following we present the four student projects in which they devised their own 'readings' of the app, and presented their own extensions of its aims. We include screengrabs from their projects (written submissions) that are made on the basis of their joint presentations to the whole class as part of a public crit.

1. FINAL REPORT: ANDREA ROMA & TAIRA SEDINI

After testing *Streetscape* Andrea Roma and Taira Sedini concluded that app seemed to be a useful tool, but that it needed a more specific aim to make the mapping activites even more interesting. Their overall impression was that the app gives the users 'the possibility to observe the city in a different way', and that 'places that you are used to walk through every day can become something completely new and actually interesting, getting details or further information about space'.

Figure 1. Example of one of fellow student testers' use of the given categories.

Related to their own project, these students claimed that whenever 'a deep analysis on different layers of urban space' is needed, 'this app can be used to obtain a rapid and focused thematic map'. For their project they gathered together 6 groups of fellow students (most of them foreign exchange students like themselves) and asked them to explore the app, with the assignment of visiting a given area (just around AHO), instead of specific random points, as in the *Urban Gallery* method. The intention was both to have those students explore an area that they presumably knew well from before, and also to give them the option of making their own route through the area (see Figure 1). On the application's map this would be reflected as a track of points of interest, and this their test student group found interesting. The test group was given the option of adding labels in addition to using the 4 main perspectives prescribed in the app. They were also given the option of adding comments which would allow for more specific kinds of thematic mapping (reflecting their own interests) or creating mapping tasks in the field and while on the move.

Figure 2. Users inputs arranged in a mosaic.

Looking more closely at the report it now appears that these two students must have given their 6 groups the task of highlighting a specific issue when conducting mapping according to each of the 4 perspectives. They also used the labels to direct the mapping activities of each of the 6 groups in more specific ways (see Figure 2): on the perspective origination the test groups were asked to look at the issues of waste, on the perspective of transformation issues of public space, on the perspective of migration issues of 'things on the move', and the perspective of erasure issues of paths.

On the basis of all of the 6 groups' mapping activities, representing 6 specific paths around the designated area, the two students in charge of this experiment put together all 6 groups' various annotations on each of the 4 given perspectives for purposes of comparison (see Figure 3). They asked: To what extent did the 6 different groups map much of the same features for each of the perspectives or did they focus on completely different issues? And how did the overall pattern (based on all of the 6 groups) stand out in comparison with that of each of the 6 groups?

Given the fact that each of the 6 groups were asked to map more specific issues or themes under each of the four main perspectives, the results from the mapping activities, when compared across all of the 6 groups (but staying within each of the 4 perspectives), seem very similar or focused. Roma and Sedini did not say this explicitly, but this 'alikeness' could be said to confirm their own hypotheses that the *Streetscape* app opens out for more specific thematic programming through the use of labels. As such, *Streetscape* may be additionally programmed for a great variety of thematic mapping activities.

2. EVALUATING STREETSCAPE: INGER THERESE MØGLESTUE AND MARTIN MONRAD ANDERSEN

Møgelstue and Andersen explained their intention to test and explore *Streetscape* as a general urban mapping tool for surveying a specific area in which one is to make a concrete design. Here *Streetscape* was to be used as a unbiased tool for exploring an area, hopefully in a manner that would result in unexpected observations. They wanted to use the app to reveal 'spatial configurations and urban situations that would suggest a site or a programmatic foundation to be used for further design work'.

In trialling *Streetscape* this pair defined a specific test area in the capital city (Oslo) and made more specific rules both for conducting the mapping and analysis of collected mapping material afterwards (see Figure 3). The analysis was to function as a kind of knowledge foundation for sketching out a project or design idea (or what they, in accordance with Bunschoten's Urban Gallery method, called a mini-scenario): Approach A, B and C. After testing all of the 3 approaches, the pair made a revised framework (see Figure 4) for carrying out a more specific case study, consisting of 3 defined phases: 1) the collection of 100

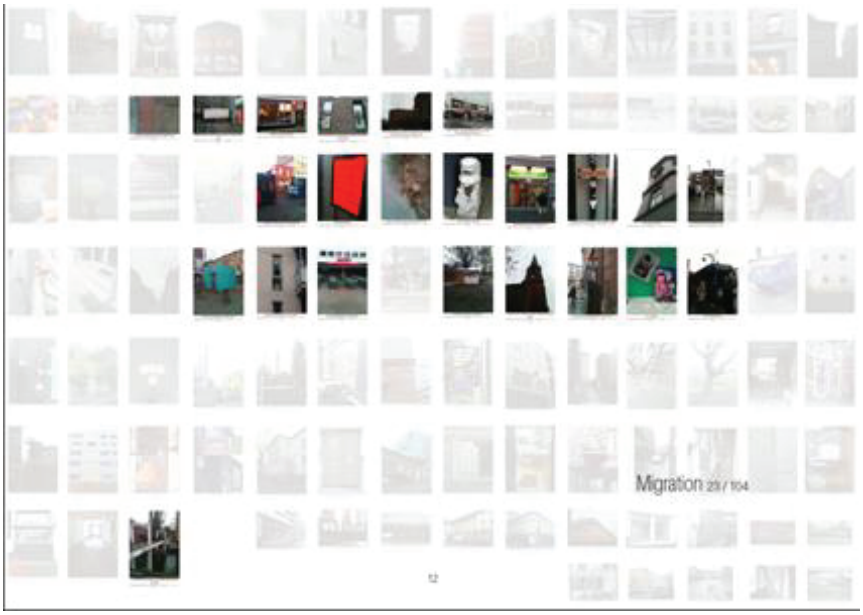

Figure 3. Selection of users' mapping of the category' migration' with the other 3 categories greyed out.

Figure 4. Student generated phases and contrasting mapping across the categories (not visble in the pre-given app).

photos/annotations (using all 4 perspectives) and then organizing them into thematic categories; 2) analysis in order to find a main kind of 'thematic tendency' (represented by 10 photos); 3) further analysis of the 10 photos/annotations for the purpose of choosing 1 specific

Figure 5. Student suggestions and prompts for material waiting to be 'transformed'.

photo/annotation which most characteristically could be said to represent the chosen thematic tendency. The final photo would make

for the actual site for a further design task (related to the chosen theme; see Figure 5). After mapping in the field according to the specific rules they had set out, the students ended up with Transformation as the most apparent thematic tendency in their study area. Within this perspective, based on a close reading of a selection of samples, they found that the most common type of transformation was of a

programmatic kind. They also found that Transformation, as an issue of process and change, reflected different time spans, i.e. are ongoing, more or less finished, etc. In concluding, they found that actual mapping activities and the analysis it allowed for worked well and generally as planned. In addition to a few technical improvements they recommended developing an improved wiki platform for analysis.

3. TESTING STREETSCAPE – GOING GLOBAL: SANTIAGO JIMÉNEZ AND HELERI NÖMMIK

This pair set out to test *Streetscape* in different cities around the world, both in their own home countries and elsewhere. They contacted architecture students in 5 different cities: Milan in Italy, Melbourne in

Figure 6. Example of student mappings in Mexico, shown as numbered POIs and as six individual entries.

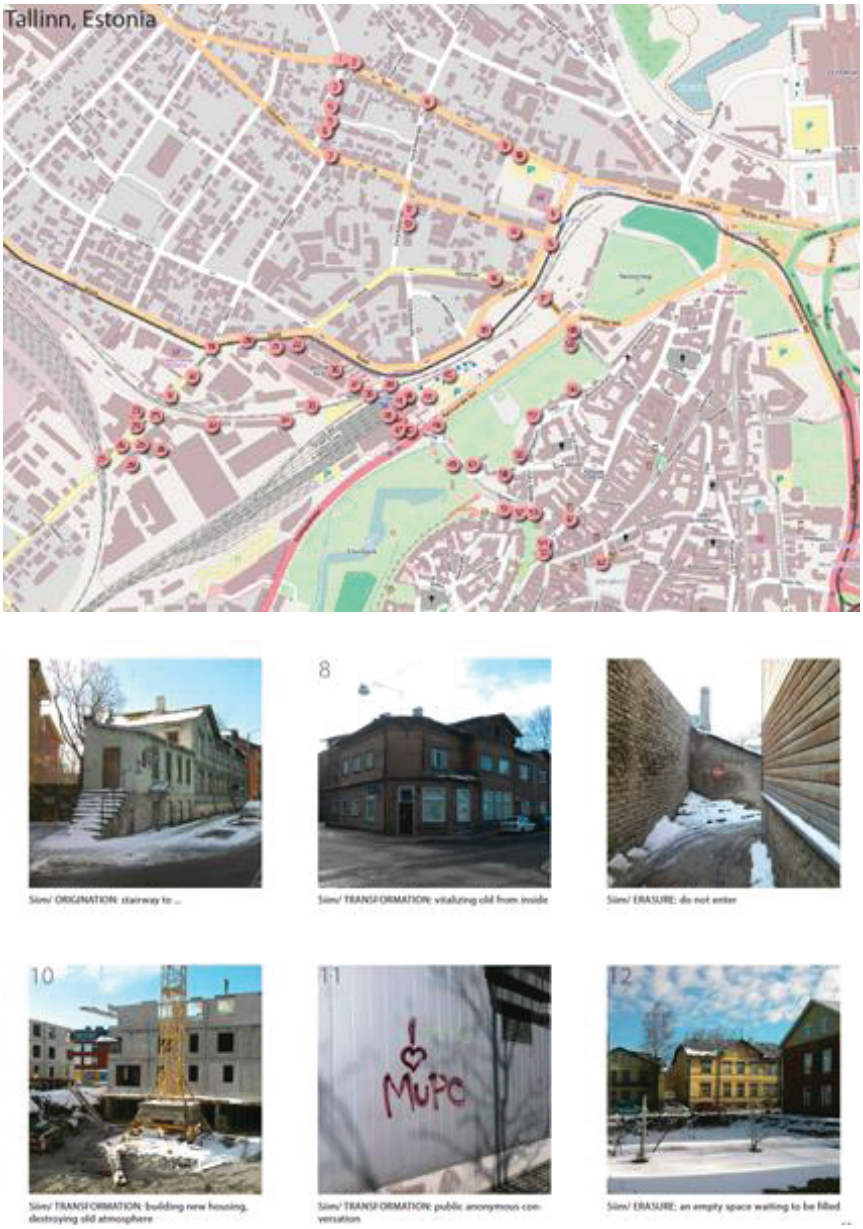

Figure 7. Example of student mappings in Estonia, shown as numbered POIs and as six individual entries.

Australia, Tallinn in Estonia, and México city and Naucalpan in México. They then asked these student to carry out mapping according to the principles of *Streetscape*

(though not using the actual app, but using an ordinary camera). These can be seen in selected screengrabs from their end of course presentation and report (see Figures 6 and 7).The overall intention behind situating *Streetscape* in these diverse locations was to explore if it could be used as a tool for students to communicate their respective urban environments to each other across the world. As a consequence, this would result in the creation of a database that could be used for future educational purposes.

In order to check the quality of the actual mapping conducted the two students in charge performed a reading of the samples taken from their respective cities of origin. The student from Tallinn made an interpretation of the samples from Mexico, and vice versa. Thereafter they 'cross-checked' each others' interpretations based on their own knowledge of their home cities. Each of them found that the other made an interpretation of their own city that was quite accurate. This indicated that the mapping material (consisting of pictures, textual annotations and chosen perspectives) was informative and had 'telling' and 'recognizable' qualities that travelled well across geographical and cultural boundaries.

This multi- and cross-sited view of the intentions behind *Streetscape* was a far reaching interpretation of the task. It served to stretch the notion of the cultural mapping built into the app to a more global scale where various participants looked into one another's mappings and perceptions of each others' and their own urban contexts.

4. FROM STREET TO RESEARCH: PEDER ESKILD AND HANNA PETERSSON

The overall focus in this project was to make a new web platform for *Streetscape* where mapping material could be stored and 'viewed, categorized, connected, grouped and extracted'. In short, this was an attempt to make the mapping material from *Streetscape* available for further analysis and research.

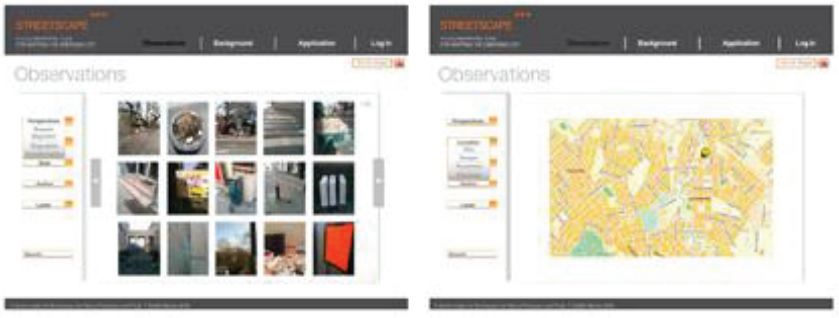

Figure 8. Proposed tart page showing most recent observations.

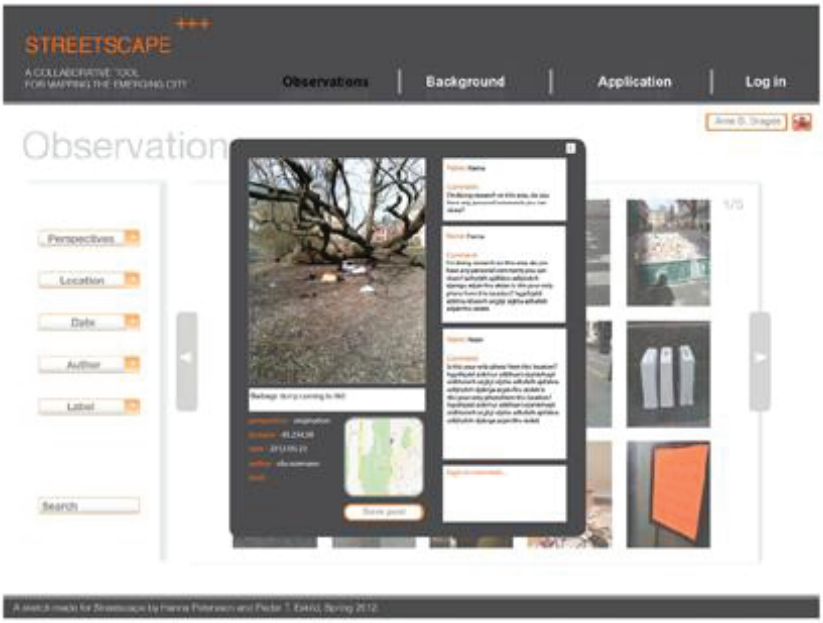

Figure 9. Pull out of selected item from Observations.

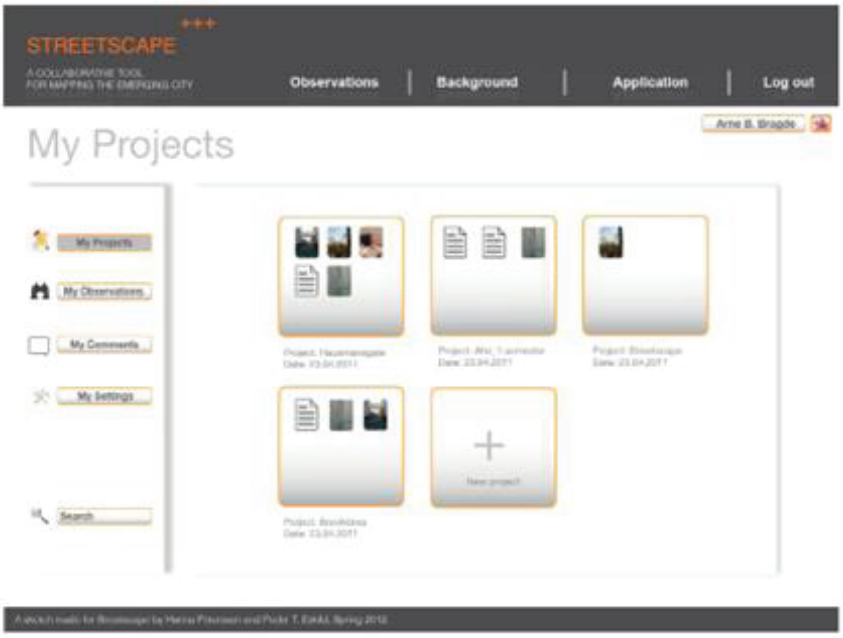

Figure 10. One's own page shows different items, adjustment possibilities and the potential to make new posts or changes.

Figure 11. Sggested connection between app and webpage (micking a wiki feature in the orginal app, but with suggested changes).

The two students worked out a scenario for an ideal new web platform (Figures 8-11). The platform would be based on a new start page containing the most recent mapping observations made with *Streetscape* and where users can log in to their own personal research domain. Users will have the option of making project folders (containing My projects) and keep track of their own research material. Furthermore people will have the option of organizing or re-organizing their mapping samples (or include samples from other users), according to categories they find fruitful for analysis or other kinds of use. (In the future more interactive functionalities for sharing of data, etc. could be included). The platform will also contain a comment function for all samples or observations, so that people can add comments to samples made by other *Streetscape* mappers.

By making a new web platform the mapping tool of *Streetscape* could be changed into a tool for research and reflection, in accordance with ways architects and planners most often organize their project and design work.

Reflections

Three reflections

In the context of 'learning for tomorrow', we now reconsider the three questions posed earlier. First we asked how the design of a locative media application might be geared towards understanding the city as a learning context for cultural mapping. From the students' work presented above on testing and suggestion for redesign of *Streetscape*, the city was approached as a context of learning through practices of cultural mapping in the field. The mapping is explorative and involves collaborative

interaction, both in terms of engagement in urban environments and through the use of a mobile app as a digital mapping tool. The actual app and the students' work indicates that the city is a highly interesting context for exploring issues related to both design for locative media and learning in urban contexts. This has given us interesting material for reflection on design strategies directed towards creating mobile mapping tools, as well as for reflection on the city as a specific context for both such designs and learning in general.

The features that makes the city an interesting 'learning environment' for the students have to do with issues of diversity and complexity. When moving around in a city one continuously encounters shifting urban features; no place is really exactly the same. *Streetscape* was deliberately designed as a mapping tool for engaging with all such aspects of urban multitude. This relates to issues of mobility, that the tool is to be used on the move and on different locations, and processes of engaging in shifting, but specific urban environments. Though mobile and digital, the tool spurs the mappers in the field to explore place specific qualities through creative close-readings and annotations.

As a locative media application *Streetscape* makes use of available digital affordances of the networking city online, such as GPS tracking and way finding. One could say that the networking city and the student projects - through use, the cultural mapping activities, those embedded in the app and the projected activities and articulations - are realised performatively. Thus the networking city, tailored through the app, then extended, makes for immanent meaning production in terms of explorative and creative readings of, and learning about, the city itself. *Streetscape* is both embedded in and makes for embedding into the networking city and students' design agency clearly elaborates on this.

Our second question was about what dimensions of 'composition' and learning might be highlighted and understood through the design and dialogical performative use of a locative media app for cultural mapping. In response we find that McFarlane's conceptualisation of urban learning as an assemblage has relevance for analysis of *Streetscape* and the associated student works (McFarlane 2011). Such an assemblage is constituted through interactions that emerge through processes of translation, coordination and dwelling.

Aspects of translation relate especially to the fact that the collection of place specific urban data, i.e. the actual annotating in the field, is co-constituted through creative readings according to the app's own prescription of perspectives (and/or of labels of one's own making). The perspectives function as intermediaries that facilitate urban learning and knowledge production through creative readings and collaborative interpretation in the field. Furthermore, the app allows for comparative learning on the move, for example in terms of content production and increased familiarity with the potentials of the app.

All such acts of translation are facilitated by the app's scripts for coordination. The prescription of random POIs (as in the original design and 'take me there' function are coordination devices that direct and facilitate both movement through the city and the actual mapping activities. When it comes to aspects of learning through dwelling, the app functions as a tool for coordinating and orchestrating specific forms of dwelling in various urban settings. These are forms that notably both allow for and spur acts of explorative and creative close readings of specific urban environments and features. Consequently, the main affordance of the app is to facilitate learning through specific procedures of relating to the urban world. These are initiated by students and by way

of them involving their peers as testers of their own projected designs. Design for learning and learning design are cross pollinated.

The third question we posed was to do with the implications of taking up the city as a learning context for cultural mapping via locative applications. Here we now see that the design and testing of *Streetscape* is the first step in a longer journey of exploring the potentials for digitally informed and networked based learning in urban settings. The potentials are as far-reaching as the challenges are complex. The potentials lie both in designing digital technologies for learning purposes as well as in conceptualising how urban environments, features and data can be creatively used in various (more or less targeted, more or less explorative) learning processes. The diversity and multitude of the city (manifest and visual as much of it is) makes it a fertile context for exploring new forms of learning – be that as formal knowledge building or as explorations in alternative urbanisms that may involve students as innovative design-users of mobile applications.

In summary, we found that *Streetscape* stimulated learning in three broad ways: 1) as a device for ways of looking at the city, but also for exploring the city; 2) as a means to thinking about potentials for design intervention, and 3) as offering ideas about alternative and future ways of reading and mapping the city. As a contribution to learning about the networked city our students were able to speculate about possible changes and offer projected changes to the given app, sometimes extending well beyond its original four inherited perspectives for urban cultural mapping.

Conclusions

Towards healthier appetites

We see these outcomes of the experimentation as a form of situated cognition concerning the network city itself. For our students this situated cognition is realised via the co-ordinated activities of understanding the co-design of a locative app, their responses to its collaborative use and their own co-creation of alternative learning futures. For the networked city as an emergent ecology in its own right, through such activities students are also able to see the net city as learning about itself through their innovation: their design interventions present new modes of reading and writing in location and via wireless devices.

In this regard, the students realised that the co-design behind this networking may be shaped by co-location, but that this may be extended beyond the pin-like character of POIs to ones that are connected across sites and contexts, near and far, similar and different. Here a dynamic performative engagement in the future networked city may be enabled via live-data feeds, divergent annotations and reflexive 'compositions' that come into being through co-design and co-articulation.

An ecology of design education

This echoes to some extent an ecological emergence of what Lash (2010) calls intensive cultures. In terms of cultural mapping, design and learning, these are cultural formations and actions that are organic and unfolding. In our view these are also themselves part of a wider 21st century literacy that is increasingly urban and technologised, yet locative and relational. These are appetites that span more than one course and need to add up to a design education that is truly nourishing and not simply a matter of unbridled consumption of the next and best next app.

Our students' engagement with their brief and with one another in using the given app and extending its potential into new activities and contexts shows come of the value of taking design education from the studio and into the street: as place, by way of students' own competencies with mobile tools, and via enactment. Overall we see this as part of an emergent ecology of design education. This is a design for education and an educational design. When intertwined, designing and learning are geared towards engagement, but by way of motivated connections and performative actions by students' and citizens' uses of social media in the city. Together they may be employed to refashion our notions, practices and appetites in what we have come to label in a more active formulation '*networking* the city'.

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The scholarship of teaching: threshold concepts and research informed design education

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Abstract: This paper considers the growing body of established scholarly research culture in the creative arts: which, it is argued, is in the process of 'catching up' with more established disciplines such as science, history and economics. This slow growth is linked to the need for practitioner-focused lecturers within the discipline, some of whom have little engagement with scholarly theory before entering the academy. The paper then goes onto consider the introduction of a particular theory - the threshold concept framework - to a cohort of industrial design staff at Coventry University and outlines some of the main impacts on both their continuing professional development and their teaching and learning practices. Specifically the main impacts have been an embedding of a threshold concept 'lens' through which the lecturers interviewed now see their teaching and learning practice, which has resulted in both changes in curriculum delivery, and an enhancement of publishing profiles.

Keywords: Research, design education, design curriculum

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Introduction

With its historically firm focus on practitioner expertise, scholarly research cultures within creative arts disciplines are not as well established when compared to more traditional subjects such as science, history and economics. This is reflected by the UK Research Exercise Framework (REF). When referring to the Art and Design unit of assessment (HEFCE 2012) the criteria acknowledges "the diversity and range of related methods of academic study and artistic practice, and therefore adopts an inclusive definition of its remit". This is coupled with a focus on practice: "Practice encompasses all disciplines within art and design, in which methods of making, representation, interrogation and interpretation are integral to their productions".

This recognises that creative arts practitioners are typically, first and foremost, employed for their creative, rather than scholarly writing, expertise.

This often means that staff are unfamiliar with scholarly writing and publishing processes, and in turn do not readily engage with theories which they can apply to their teaching and learning practices.

This paper discusses the impact of introducing one particular theory - the threshold concept framework - to industrial design staff as part of a longitudinal study carried out by the Centre for Product and Automotive Design (CEPAD) at Coventry University between 2005 and 2010.

CEPAD was funded as part of the HEFCE CETL[1] initiative, and as a result of the longitudinal study, *the toleration of design uncertainty* emerged as a first-year threshold concept, defined as "the moment when a student recognises that the uncertainty present when approaching a design brief is an essential, but at the same time routine, part of the design process". (Tovey et al, 2010)

As a result, the industrial design undergraduate curriculum was redesigned in order to offer safe spaces to students within which they could experience the intense uncertainty that is characteristic of the design process. This was facilitated by a re-thinking of the assessment process, which 'loaded' the marks towards the end of the academic year, allowing the students the opportunity to not worry about the marks, and thus learn from this, at the beginning of the year. (IBID)

As well as having an impact on the curriculum, the threshold concept theory also had an impact on the staff of the industrial design department, in that it allowed them to discuss and share their subject expertise with each other, and, for some, to view their subjects through a 'threshold concept lens'. This facilitated adjustments to teaching and learning practices and subsequently - through enhancing research profiles - impacted on continuing professional development.

This paper picks out several, previously unpublished, key points outlining the impact of linking theory to teaching practice, through focusing on four particular members of staff who have published papers using the threshold concept theory.

Creative arts staff and research culture

As has been argued elsewhere (Osmond 2011), there is a paucity of published educational research into the teaching and learning that underpins teaching within creative arts disciplines. The reasons for this are linked to the lack of established

[1] http://www.hefce.ac.uk/whatwedo/lt/enh/cetl/

research culture surrounding the creative arts, which historically were taught within independent art schools or, pre 1991 in the UK, in polytechnics (Bird 2000).

As such, the focus has always been on the practical in terms of employing creative arts staff who are practitioners first and foremost, rather than scholarly academics. Therefore, being practitioners, creative arts staff are - in comparison to more established disciplines such as science, history, and economics - much more likely to bring with them expertise in their *craft*, whether joining from a creative arts educational background, or from industry, rather than scholarly writing expertise.

This lack of scholarly writing expertise is compounded by a debate as to what exactly constitutes scholarly writing: as MacFarland (2011), bitingly suggests, it is to everyone's detriment that there is a division between scholarly research and pedagogic research:

> Subject-based research is serious, scholarly and well-respected stuff. It is published in prestigious subject-based journals. This kind of research is what counts in the assessment of research quality in countries like the UK, Australia and New Zealand. Then there is 'pedagogic' research. This is where academics from various disciplines do research about their own teaching, that of others or focus on the way students learn…But apparently, unlike subject-based research, 'pedagogic' research is not 'proper' research. It is not, therefore, any good for the purposes of research assessment.'

Further, this lack of a widely agreed framework for 'proper' research, especially within the creative arts, perhaps reflects its status as an "ill structured and undisciplined domain" (Joseph 2008) which privileges "wicked problems" (Buchanan 1992) at its heart, underpinned by teaching practices based on tacit knowledge.

There is too, within the creative arts, a suspicion that research itself may well kill the golden goose – in other words, that researching creativity will somehow dispel its 'magic'. (Doy 2008, Ritterman 2010)

The Centre of Excellence and Product Design

It was into this backdrop that the Centre of Excellence for Product and Automotive Design (CEPAD) first introduced the notion of threshold concepts as a research framework to industrial design staff in 2005. Threshold concepts are defined by Meyer and Land as:

> akin to a portal, opening up a new and previously inaccessible way of thinking about something [representing] a transformed way of understanding, or interpreting, or viewing something without which the learner cannot progress. (2003:1)

The aim of the research was to pinpoint those crucial transformative moments that industrial design students must experience in order to become critically minded, innovative practitioners.

Staff and threshold concepts

However the focus of this paper is the impact that the threshold concept theory had on particular members of staff in terms of their teaching and learning practices and continuing professional development.

The staff were involved in the longitudinal study from the very beginning, starting with attendance at a whole-staff meeting in early 2006. The outcomes from this are detailed in Osmond et al (2007), but in essence the meeting was characterised by staff enthusiasm to share knowledge about their subject. The initial discussion focused on the definition of 'spatial awareness' as this was seen as a crucial ability by staff for the students on the course, but despite extensive discussion it was not possible to define this and thus it was also not possible consider whether it could be a threshold concept. Despite this, several potential threshold concepts were identified, one of which – 'the confidence to challenge' (defined as the ability to inculcate design conventions and expand upon them using information from a variety of sources and experiences) was taken forward for investigation with students.

This meeting represented the beginnings of staff involvement with the threshold concept theory, and at a later meeting in March 2008, they were presented with the findings from the longitudinal study to date, which included data from student interviews showing that there was a level of uncertainty in terms of the 'confidence to challenge' being expressed. Again this meeting was characterised by a lively discussion of potential threshold concepts that students face throughout the course, including the notion of empathy (not just designing for themselves), professional development (increased confidence on return after work placement), and group work (allowing someone else's design to go forward). (Osmond et al 2010). What was apparent at this meeting was that the staff were now routinely engaging in framing student breakthrough moments in terms of threshold concepts.

This engagement by staff is reflected by Irvine and Carmichael (2009) who took part in a similar meeting:

> It is worth stating from the outset that we were pleasantly surprised by the extent to which the participants were willing to critically review their existing practice…these are accounts of concerned, reflective practitioners engaging with educational theory and practice in distinctive ways.

This level of engagement has continued with particular members of the original staff group and four lecturers were interviewed in late 2011 to identify the impact of the threshold concept theory both in terms of their teaching and learning practices and their continuing professional development.

Major Impacts

Framing understanding of the learning process

A major impact for most of the lecturers interviewed was that using the threshold concept theory allowed them to intellectually frame their understanding of the student learning process, with one lecturer linking the threshold concept framework with the notion of bricolage to produce a coalescence of understanding:

> For me conceptual thresholds are a little bit like bricolage in the sense that there are many of them and depending on the individual they may be different, so you can't teach to a formula because people have to discover what threshold concepts are relevant to their own learning. The collage that it creates will be very different depending on the individual.

For two of the lecturers, the theory enabled an articulation of what they instinctively 'knew':

> Before I wouldn't have put a title on it – you can tell when a student has achieved a certain level of ability or a certain way of critical thinking and at the time it would be just part and parcel of that student learning how to be a designer. I think having the framework is putting a title on some of the things that they are actually doing. You can happen across [threshold concepts] all the time and they seem to occur to different students at different times… I think you can see it in the level of confidence that they have.

Another lecturer also experienced a threshold concept moment of his own during his recently completed MA degree:

> I started to develop more of an interest in teaching design to students during [my MA] because when you are on the receiving end of it you think differently and you understand how long it takes to do things that you are asking the students to do.

The lecturers also began to identify threshold concepts, for example reflective sketchbooks were problematic for some students "because they can't deal with that whole idea of looking back". Also interesting were student difficulties with the difference between rendering and a piece of art:

> Trying to get the student to understand the difference –any good designer will tell you that they will spend three hours on a rendering and if they don't like it, it is screwed up and thrown in the bin. You often see the shock on [the students'] faces, but they need to realise that it is just a communication tool, it is not precious like the Mona Lisa!

This was an issue that had emerged during the longitudinal study, where students reported wasting hours on trying to produce a perfect render in their first year, but progressed to a much quicker sketch by the end of their second year.

Empathy

The recognition of threshold concept moments led to a more empathetic mode of teaching for one lecturer:

> In the past I would probably have thought 'oh this student probably just isn't a good designer' or 'they are just not getting it/don't draw very well'. I don't think that is true now: understanding that they will go through gateways at different levels helps you to have more empathy towards them and help them to play to their strengths. I think for me that is probably the most important.

This is echoed by Dewey, who, as far back as 1963, proposed that "The key element which facilitates the transition from a good education to a transformative one is empathy." Further, Ramsden (1992) suggests that interest in and empathy for students are necessary components of good teaching.

In addition, the notion of empathy as a threshold concept led to one lecturer to make the connection between design empathy and the concept of the 'other' (after Said 1991), taken from cultural studies. This link was used to present students with the concept of the 'other' during an ergonomics module with first year students which also used personas to encourage them to think 'outside themselves' (Osmond & Mackie 2012). This is felt to be important for design students as, typically, when they arrive,

they tend to want to design for themselves, and the concept of identifying with someone who is 'not them', is a difficult phase in their design identity development process. As this lecturer states:

> When they can think like an old lady trying get a bag onto a bus I think that is the breakthrough moment when they can achieve interesting design because it is that ability to think outside [of themselves]

This empathetic recognition of the different journeys that students undertake in their learning process is seen as student-centred teaching, a threshold concept in itself according to Blackie *et al* (2010):

> …we suggest that student-centred teaching is a threshold concept [and it] is not just a different style of teaching. It requires that the academic really understands and appreciates the need to pay attention to the students and their learning. It involves a shift from measuring one's success as a teacher by how much of the syllabus is successfully covered to measuring one's success by how much the students actually learn and with what depth of understanding.

Changing teaching practices

For two of the lecturers the identification of specific threshold concepts led towards a change in teaching practice. A Year 2 lecturer found that students were unused to defending their research process due to a focus on the formulaic 'presentation mode of assessment' typified by the standard 'pin up and leave' crit. This method of assessment meant that students did not need to defend their designs and thus demonstrate the journey from research to designed artefact.

> It is where they pass through this threshold as well - the idea that research is not just something where you do nice slides and put it on screen, and then do something completely different.

Meanwhile, for an MA lecturer, there was the recognition that some students had difficulty in thinking creatively when formulating their research proposal:

> I went through a systematic step-by-step delivery each week and at the end they got a mark and they were unhappy because they felt that 'I did everything you told me to do so I should understand, I should get it why have I not got 95%'. So clearly the threshold concept had not manifested itself in that module.

Both lecturers changed their teaching practices as a result. The Year 2 lecturer redesigned the assessment method for a year-long module. In essence, the assessment method – entitled the 'buddy system' (Osmond and Clough 2012) – is now much more closely aligned to the crits found in industry.

The focus is now extensively on the feedback element of the crit, rather than the final mark, and ensures that during each assessment session, the students are expected to demonstrate the link between their research and their final design by entering into a dialogue about their thinking processes. The lecturers, freed from taking notes by a system of student note-takers, can maintain eye contact and walk around the design: in other words, the lecturer and student enter into a professional dialogue about the work. Due to this change, the student focus on the 'mark' has lessened:

> Students are suddenly saying that the mark is less important now, because they are realising you know when something is a good piece of design - the whole thing is far far greater than the sum of the individual boxes you are ticking.

In the meantime, the MA lecturer moved towards a teaching model that emphasised conceptual thinking, rather than a linear step-by-step process (Bull 2013). Early indications are that the students are beginning to make connections between different ideas much more quickly and some have begun to experiment with this.

This change of focus which takes student understanding as the impetus to redesign teaching practice, is recognised by McLean (2009):

> Threshold concepts provide a lens through which teachers can view teaching in their discipline from a different perspective and, along with this, consider areas where their students 'get stuck' and why – areas that may emerge as threshold concepts… clarifying 'what' it is that students should learn and why it is important, where they effectively shift the focus from teaching to learning and from content to understanding.

Research profiles

Another big impact of the threshold concept theory has been on individual research profiles, with all the lecturers interviewed writing up pedagogic research framed by the theory for publication. Using the threshold concept to frame their research, carry it out, write it up and submit it for publication gave these lecturers the knowledge, skills and confidence to continue to publish. As one lecturer stated: "Threshold concepts allows people to write about their teaching and the theory allows it to be taken seriously".

For these lecturers – practitioners all – this change is important as previously engaging with theory and pedagogic research was felt to difficult enough due to the time pressures of teaching, and was, at best, perhaps perceived as just another 'demand' something echoed by D'Andrea *et al* (2000).

Also, engaging with the publication process was previously felt to be daunting, with one lecturer stating that he 'didn't see pedagogic research as being research for me' and another feeling that she was expected to 'simply know' how to research and publish: not only this, but also to demonstrate that she had done so in yearly appraisals. This hesitancy resonates in Stierer and Antoniou's work, when they found that HE lecturers often felt hesitant in carrying out pedagogic research as 'they lack confidence in their skills to cross-disciplinary boundaries and come out of their disciplinary comfort zone'. (Quoted in Brewer *et al* 2011) In addition, D'Andrea *et al* posit that those who *are* interested in pedagogic research can sometimes be isolated within their own department as 'the member of staff interested'.

To date then, three of the lecturers have inculcated the theory into their teaching and learning practices and have subsequently raised their research profile through publication. This focus on theory has continued with a newly appointed lecturer, arriving directly from industry, already on board with the theory, "recognising in his teaching that there are these kind of moments". This willingness to engage by a new lecturer is perhaps a reflection of a changing culture in which lecturers within the department are beginning to feel more comfortable in thinking about their teaching and learning practices in terms of theory. Therefore, in contrast to D'Andrea *et al*'s 'only member of staff interested', this engagement by a newly arrived lecturer signifies

that he is being brought into an existing culture of expectation in relation to pedagogic research, and thus evidencing an overall shift in departmental thinking.

To date, only one of the lecturers interviewed has not taken the theory fully on board, and this could be because, unlike the other three, she was not present at either the introductory session in 2006 or the follow-up in 2008. This appears to point to the importance of being part of the initial exchange of views, or the sharing that characterised both sessions, something that Skelton and Wisker comment upon:

> Striving for pedagogic excellence should be about learning and teaching development; sharing practice; promoting staff equality; and reuniting the separated research and teaching identities (Skelton, 2009; Wisker et al 2005: quoted in Skelton 2009).

Concerns

As outlined earlier in this paper, one of the immediate impacts of the presentation of the threshold concept theory to staff at two points during the longitudinal research process was how enthusiastic the staff were in talking about their subjects.

However there were concerns expressed about how to 'really' identify threshold concepts. As one lecturer stated, "everyone has a slightly different interpretation of what [a threshold concept] might be", and another was uncertain about "how accessible portals and thresholds are". This uncertainty is common in relation to threshold concepts, as the five characteristics defined by Meyer and Land are often seen as definitive. Therefore if a potential threshold concept does not fit all five characteristics, people sometimes struggle with identification:

> I am not sure about how much conviction or justification you would need to provide something that is justifiably a threshold concept - it is quite subjective in the sense of what is in and what is out - it feels like you can make a case for it but not necessarily one that I am 100% convinced about in my own mind.

But as Irvine and Carmichael point out, threshold concepts are "better thought of as pointers or framing devices or as evidence of their 'value-for-use' rather than as defining characteristics", or, for Meyer and Land as "ways of thinking and practising in a discipline".

Added to this uncertainty is the criticism that threshold concepts are 'just another theory': as one lecturer put it: "it feels like it is one of those things that I have come across: different theories that are descriptive but are not terribly useful in telling you what to do"

This is something that Glynis Cousin tackles in her keynote address at the *Threshold Concepts within the Disciplines Symposium* in 2006. Entitled 'Old Wine in New Bottles', Cousin acknowledges that the threshold concept framework can be seen as just another theory, but for her its importance is that it allows what she calls "transactional enquiry". In essence this is a move away from a teacher-centred/student-centred traditional binary opposition and towards a constructive, constantly shifting dialogue, between lecturers and students.

This is reflected by three of the lecturers, who despite their concerns, are still engaged with the threshold concept theory and continue to think about their teaching and learning practices through a threshold lens, constantly questioning and re-framing their understanding, whilst at the same time interacting and engaging with their students in order to improve their educational experience.

Conclusion

This paper has considered a lack of established scholarly research culture in the creative arts, which, it is argued, is linked to traditional practitioner-focused lecturers, some of whom have little engagement with scholarly theory before entering the academy.

The paper then goes onto consider the introduction of the threshold concept framework theory to a cohort of industrial design staff at Coventry University and outlines some of the main impacts on both their teaching and learning practices and continuing professional development.

Specifically the main impacts have been an embedding of a threshold concept 'lens' through which the lecturers interviewed see their teaching and learning practice: even though there were concerns expressed over precise understandings of the threshold concept theory, three of the lecturers are still iteratively engaging, thinking and pursuing their knowledge in this area. Other impacts were the subsequent development of a more empathetic teaching approach leading to changes in curriculum delivery, and the enhancement of individual research profiles.

This willingness to engage in theory was kick-started by CEPAD, which came into being as result of the HEFCE CETL initiative. That CEPAD has survived beyond the HEFCE funding stream (which ended in 2010), and that newly appointed lecturers are now buying into an expectation of pedagogic research, is a testament to Coventry University's willingness to perpetuate the nascent research culture that expanded during the five years of the project. As a result, two roles were subsequently consolidated – the Directorship of CEPAD and Director of Design pedagogy. More recent appointments include a research-active Dean, and a professor of design research. Therefore, there is a clear indication that such funding streams have a great deal to offer universities in this area.

As it is, the legacy of CEPAD is that it is constantly adding to the growing research culture within the creative arts, underpinned by publications such as *The Design Journal, Design Studies* and the *International Journal of Design*; the presence of the Design Research Society (DRS) and its bi-annual conference, and the (also bi-annual) DRS Cumulus conference which focuses exclusively on design pedagogy. This coupled with the recognition within the REF that practiced-based artefacts are as valuable as scholarly outputs, indicates that the creative arts are finally beginning to establish a research culture of its own.

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Exploring Real-life Settings: Integrating Research and Learning as Thinking-and-Doing in Design Studio Projects

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Abstract: This paper presents the activities of a multi-sectorial research project within a baccalaureate design studio, two seemingly diverse experiences that come together for a dynamic exploration of issues of accessibility for people with disabilities. Students collaborate with various stakeholders to develop design concepts for the scenario within a public space. They explore how multiple contexts including visual impairment, sensory, environmental, cultural and social issues of integration affect design responses within the environment. In this learning context, students are confronted with how the social construction of reality of the world we live in is not independent of real life settings, how actions play out socially and personally in co-operative inquiry (Berger & Luckmann 1966; Guba & Lincoln 1994; Heron & Reason 2001/2006) and how learning is informed using research alongside design thinking and doing, wherein the design studio in turn informs perspectives of both researchers and stakeholders. Collaborative and individual activities frame student understanding of diverse issues not normally understood in the design studio classroom, including the dynamic of the stakeholders and how priorities are framed within design intentions, project aesthetics, universal design issues, and social considerations such as inclusion and participation of users through their lived experiences in real time.

Keywords: participatory action research, social inclusion, co-operative inquiry, re-adaptation, integrated design studio, theory informed practice, project-based learning, problem-based learning, inquiry-based design

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Introduction

In this paper, we explore what happens when design studio concept building and design process problem-solving are juxtaposed against the real-life urban setting of a client-based scenario situated in a major research project of a "Living Lab". This particular form of learning combines both project-based and problem-based situated learning supported by the teacher who acts as a facilitator (Saven Baden & Major 2004; Vaikla Poldma 2003). Students are asked to design a commercial shopping complex interior, where they are confronted not only with the usual contexts and design issues they must learn, but also with understanding research and how this applies to their problem-solving situation. They must also consider issues concerning design, how to consider user activities as direct lived experiences, how they make sense of research findings and integrate them into their design thinking, and how they can develop design solutions with these considerations in mind. These experiences are learned in part, by understanding various contexts relative to the project and in part, on the ground in the real time, pragmatic situations with various stakeholders, users and the space itself. The scenario is situated in a real environmental setting of a commercial interior space that is part of what is known as the MALL Living Lab research project, a multi-sectoral project conceived with stakeholders and researchers/users within a commercial space that becomes both a virtual and real "living lab" environment for experimentation and research for professors, stakeholders, researchers, users and students.

Students who learn about designing space in this context of commercial public spaces such as shopping malls learn both about complexity of environments integrating people with and without disabilities, and how they arrive, spend time and use the space. This diversity of activities, services and the development of dynamic and innovative concepts requires that students are exposed to both theoretical ideas and pragmatic concepts about space, environments, client issues, and user needs, and these among multiple design criteria and design intentions (Malnar & Vodvarka 1992; Nelson & Stolterman 2003). When learning in this type of environment is done in a design studio setting, the client scenarios and project contexts are pragmatic in nature. While students engage in gathering information and design concept development as this usually happens within a design studio, they also learn to engage in theory-building through research applied to concepts of design intent, design process and design as a catalyst for design possibilities to serve a particular end (Nelson & Stolterman 2003).

The theoretical framework proposes that the nature of research informing design studio projects necessitates a project-based and problem-based approach, pragmatic yet reflective in nature. We examine this type of learning and how the project combines a particular research-practice approach that is innovative for student learning and that accounts for both theoretical/research issues and practical contexts. The design studio project and MALL Living Lab research project are presented and examples of one of the student projects are shown. The discussion provides perspectives on what happens when theory and practice come together and what results these generate. The conclusion proposes how these types of projects are useful to both inform student learning and inform the stakeholders of the value of design and why these practices are both innovative and necessary.

Theoretical Framework

Learning in the design studio is a place where knowledge builds from a particularly pragmatic approach of thinking-as-doing. Whether is it in industrial design, architecture, interior design or interaction design, designers solve problems and explore new design situations that take static ways of doing and change them by imagining new possibilities as a means to effect change (Nelson & Stolterman 2003). For students, this includes learning not only design principles, but also understanding these in the context of problem-situated and project-based situations and how people actually will use the spaces that they design for the activities and experiences that they wish to pursue. Confrontations with the social construction of reality are necessary to situate this learning in how things actually work in real world settings (Berger & Luckmann 1966). When learning about how to design in a design studio, students are confronted with design situations and design problems of varying degrees, and do not always understand these in terms of real-life settings and lived experiences of the users that they design for.

Problem-based and project-based learning in design

Dynamic scenario building in real-life settings can provide a catalyst for design concepts. For example, real-life settings can offer context through various learning activities that help to stimulate "thinking-and-doing" for students. This approach combines both project-based learning and problem-based learning, and the nuance here is one of context and subject. While there is some confusion (and merging) of these methods, there are specific nuances of each. This project includes qualities of both problem-based learning and project-based learning (Kolmos, Fink and Krogh 2004; Savin Baden & Major 2004). The design project/problem is situated in specific contexts whose catalysts are current evolving practices in both education and design. In essence, for students to make meaningful understanding of concepts that they learn in studio useful in their profession, they must understand theories of design juxtaposed against the realities that drive professional problem-solving. Situating research in design education and in problem-based learning is a way for students to confront issues, understand contexts. Teachers are facilitators of student learning, and components of this learning include meeting clients in a real-life setting scenario as a foundation to learn the design concepts that they explore. There are many characteristics of problem-based learning as explored by Saven Baden and Major (2004, 5):

> "…an integration of theory and practice,…a focus on processes, …and.. concepts …(such as) cased – based lectures ….where students meet with a client in some form of simulated format where free inquiry is allowed to take place…"

This requires that students be confronted with how the theory-informed concepts learned in the classroom can be understood, even applied, in practical situations, and what happens when design problems are explored in context and in consideration of evidence-based information. (Botti Salitsky 2009; Nussbaumer 2009).

The Studio project

In this particular design studio, the project-based component is the design problem – solving that happens using a practical situation of a proposed rebranding and renovation of an existing interior commercial shopping complex. This project is then situated within the contexts of several concepts promoting learning of complex issues for design problem-solving. These include understanding design problem solving as design intention and aesthetic intent, universal issues of access for people with disabilities, the branding and commercial viability of a shopping mall whose desire is to upgrade its retail presence and image, and understanding the existing issues of the space and what the mall owners wish to change, improve and develop for the space in the future. Students must understand both existing and past contexts, develop a clear picture of the issues at hand in terms of objectives and programming, understand the perspective of both clients, users and stakeholders in a service-oriented design approach (Nelson & Stolterman, 2003), and then conceive of the "not-yet-existing" with innovative concepts that respond to the contexts presented and examined.

The Research Component and the Living Lab

In the design studio, students are also exposed to the work of the innovative research Living Lab, known as the Rehabilitation Living Lab. The research project, *A Rehabilitation Living Lab: Creating Enabling Physical and Social Environments to Optimize Social Inclusion and Social Participation of Persons with Physical Disabilities,* is a multi-sectorial and multidisciplinary 4-year project (2011-2015) that groups together a major institutional rehabilitation centre and its satellite sites, universities, national, international, regional and community partners in various countries. With joint local government and institutional funding, this group is working hand in had with the shopping complex developer to initiate and develop technological and participatory/collaborative research programs with approximately 45 researchers. The executive team of 2 co-leaders and 8 co-principal researchers heads this group and organizes the overall structure of activities that occurs.

The concept of Living Lab is defined as follows :

> "…a user-centred, open-innovation ecosystem, often operating in a territorial context (e.g. city, agglomeration, region), integrating concurrent research and innovation processes within a public-private-people partnership." (retrieved 18.11.12 from http://en.wikipedia.org/wiki/Living_lab).

In this project, real-life settings interject with applied, basic and clinical research problems (Friedman 2003) all aimed at using technological innovation and investigating emerging practices for solving issues of access, of social inclusion and social participation. The Living Lab uses co-operative and constructivist forms of inquiry (Guba & Lincoln 1994; Heron & Reason 2001/2006) as a means of framing the various research perspectives encountered.

While the researchers and the projects are multiple, the involvement with the design studio was to engage students in the work relating specifically to way-finding and universal issues of access for people with disabilities. Students were exposed to

points of view from both professor researchers and design researchers, as well as users who have issues with access into the space of the living lab. Students were asked to consider potential concepts and ideas with technological and visual considerations such as way-finding tools and signage from a universal design perspective (Lidwell, Holden & Butler 2003).

The Project-based considerations: User needs versus stakeholder needs

Some of the issues we rarely consider when designing in the studio classroom learning environment, are the specific issues of importance to users and stakeholders and the contradictions that these may expose. First, users often have specific needs, while stakeholders have other specific needs, and these may (or may not) coincide. If we consider both users needs and stakeholder perspectives, we are confronted with several issues. For example, what is the perspective of the user as a person with or without disabilities – perhaps to access services or shop without feeling like a second-class citizen. Conversely, what is the stakeholder interest? For example, the developer usually has, as their fundamental interest, generating revenue. At first glance one objective may not seem to coincide with the other. These are diverse needs and are part of the complexity that students navigate when first understanding the design program requirements.

Secondly, and to add further confusion, these may be intertwined in contradictions of wants and needs. While the shopping complex is a place that is understood by some to be a destination – place of necessity (service), it is also a destination for shopping and for social get-togethers. People may want to go to the mall and meet a friend, have a coffee or just browse. Depending on the culture, some go to the mall to exercise, spend the day, or meet and greet new people as a way to socialize.

Yet in these contexts, sometimes design intention and marketing realities may seemingly be in contradiction with the needs of people with disabilities. For students to grasp these issues, problem-based learning situates unknown and complex contexts alongside project-based learning situations. In this type of design studio learning, students are exposed to the dynamic of people and their perspectives and teachers become facilitators of information and context, informing students about diverse perspectives and how these are reconciled with the intent of the designer. Currently, much of student learning focuses on the design intentions and less on issues of complex user dynamics. In this type of learning, the dynamics form the backdrop for the design studio intentions and aesthetic ideas that ensue.

The Pedagogical Approach: The teacher's studio perspective and the core objectives of the project

We turn now to understanding the perspective of the teacher, Michael Joannidis, also a professional designer. In addition to situating the student in a more realistic context, this design workshop aims primarily to introduce and promote the implementation of a project that takes into account multiple contextual variables and

working "in situ" with existing, physical conditions and real constraints. Encouraging students to design by means of actual problem-solving by responding to a specific mandate, and to adapt/develop a concept, is the vital component of the studio. These requirements are to help students understand their role as emergent designers in dealing with how they respond to specific needs, while understanding the critical link between research and design. They must also learn how to add research to the more fundamental design tools they have that include understanding and applying distinctly different problem-solving in two-dimensional planning, three-dimensional expression and illustrating the reality of the space they are designing. From the teacher's perspective this may mean, among other goals, the following:

> "The ultimate aim is to help the student realize that design and or the designer's intervention does not start and end with the concept. Understanding that the design process begins with the client, proceeds to respond/satisfy a mandate and concludes with the end-user."

The relationship and link between research & the design process

In this studio example, and as Michael suggests: " The primary objective is thus to obtain specific and relevant information related to the project - in the hopes of fuelling the student's creativity and ability to generate an ultimate concept by providing feasible possibilities to the client."

The different stages of collecting data for the project are explored. Through a series of work session and critiques, the teacher facilitates student acquisition of problem-solving skills such as applying research to the design problem. These are as follows:

- To establish the procedures, protocols and priorities.
- To help identify / organize a preliminary schedule of activities.
- Students are asked to produce programs that explicate the different requirements, identify the various phases of work.
- To articulate concerns, needs and / or specific criteria expressed by the client.
- To gather all relevant technical and regulatory.

The Student Work and Results

Through a series of group work exercises, critiques of progress and teacher facilitating project development, the students work in groups of 3-4 students. They examine site requirements, interview various stakeholders such as users, people with disabilities and mall owners representatives. Students construct models of the entire site to really understand the real space. Here in Figure 1 we see an example of a model built for the students as a study model, used to understand spatial issues and scale contexts:

Figure 1 Student working model

Figure 1 shows a latitudinal cross section of atrium and public circulatory spaces - with a custom key-feature element: a large architectural-scale fibre-optic custom luminaire, as a pivotal design feature, utilizing and exploiting the existing skylight conditions as backdrop & context in the main atrium of the interior space.

Once students understand all the parameters, contexts and issues relating to the design situation and problem, they produce final concepts. Here in Figures 2 and 3, we see part of a final design concept by a group of 4 students:

Figure 2 Student concept of interior public spaces

Figure 3 view of metro level towards street

Michael speaks to these situations thus:

> "Working with/from a specific mandate along with existing conditions helped to focus the students a lot better than other studios that I've initiated in the past, whereby projects where primarily hypothetical and or mainly conceptual."

Discussion

It is impossible to grasp the complexity of the design proposal visually in the scope of this paper. However, from the example shown, we can see the ways that students consider the space and develop solutions that are thoughtful, the end results responding to both issues of branding and issue of inclusion through the planning and applying of universal design concepts. From the earlier involvement of the research lab to the situating of the space itself as a place of exploration, students were exposed to a real-life setting as a lab for their study and design concept creation.

From one teachers' perspective, goals were achieved and solutions proposed were presented to the developer representative, who also gave feedback and who was impressed with the way that issues and contexts were aligned with potential and innovative ideas, such as technological tools for navigation and innovative concepts for lighting and signage as integrated elements of the space that both guide people with disabilities and make strong branding statements that provide a great place for shoppers to congregate.

Students were able to see results almost immediately and get feedback instantly - since the studio was structured as an actual industry design atelier/firm rather than an isolated/out of context academic classroom, students were able to get constructive feedback from both teacher as facilitator and client as developer, both acting in the scenario as they would in practice. The researchers both informed the learning through

interviews and onsite visits , where students could see the users in action, react to the real, lived experiences they saw, and then work in the studio to reflect on both user needs and their own designer intentions and actions in making design choices towards a finished design proposal.

Conclusion

As we have seen, student learning is engaged and innovative when students are confronted with complex situations that they can appropriate and devise design concepts. The situated contexts of both the real-life settings and the research project ass richness to the design studio. From the perspective of the research lab, researchers enjoyed the interaction with students and the stakeholders/developer was invited to the final design presentations, where critiques constructively added to student understanding of the relative success of proposed design solutions. The stakeholder/ developer representative was impressed with the design considerations and how students were able to integrate the ideas of universal access in terms of addressing in particular signage and navigation issues.

Solving complex problems in real-life scenario based settings; considering issues that are divergent and yet necessary to reconcile together. Students grasped how to integrate design intent and aesthetic with issues of user needs as a means of problem – solving and in compliment with service-based thinking and innovative design solutions. Problem-based learning and project – based situations integrated both theory and practice to generate innovative and new ideas as possibilities for both improving the space and its use and helping to rethink the value of diverse users and how they can help add value to designed environments.

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Notes:

1. Living Lab definition retrieved from http://en.wikipedia.org/wiki/Living_lab).
2. Research on the MALL as a Living Lab is graciously provided by the FRQ-S, Government of Québec, Canada. Principal researchers are Bonnie Swaine and Eva Kehayia. The Co-Principal researchers, from McGill University and Université de Montréal , include Sara Ahmed, Olga Overbury, Guylaine Le Dorze, Hélène Lefebvre, Philippe Archambault, Anouk Lamontagne, Joyce Fung and Tiiu Poldma.
3. Parts of this paper have also been published in several papers and at conferences, inc including an article by Kehayia, Swaine and Poldma the book edited by T. Poldma, Meanings of Design Spaces, New York: Fairchild Publications, 2013.

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A phenomenographic pilot study of students' conceptions of design research

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Abstract: In view of the current inadequacies of design research, a group of art and design researchers have urged for alternative research methodologies, which is challenged by opposing views that a formal research structure and a rigorous research should similarly be applied to design research. To address these divergent views, this paper aims to explore the potential use of formal research procedures in design research. This study uses the phenomenography method as the basis of its research design. Focusing on visual communication studies at undergraduate level, this paper is a documentation of the development and implementation of the formal research procedures on eighteen design research proposals. It shares the insight on how students experience, understand, perceive or conceptualize various aspects of design research. The findings have affirmed aspects of formal research procedures and represent a first step in explaining the different ways in which visual communication students conceive design research. The future aim of this research study is to better inform the application of theory to practice in design education.

Keywords: Phenomenography method, design research, formal research procedures.

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Introduction

There is consensus amongst educational researchers on the growing importance of research in higher education in the field of art and design (Mimoso 2011; Yee 2010). Yee (2010) states that the emergence of "a number of major international conferences dedicated to doctoral research reflects the growing interest in the nature of research and practice of the field" (Yee 2010, 2). The understanding and application of research theory, and research methods, have become essential elements in research-based design management universities (Kennedy 1997). This shift from an emphasis on training in traditional vocational courses to a focus on research being integral to the course, signalling a transformation in higher education in design. Furthermore, design practice has become more directed, in the sense that it now works from premise to conclusion, and seeks an understanding of research methodologies as the key component that allows creativity to flourish (Bennett 2006). For instance, Mottram (2007) says that explanations for creativity, and probably for other human functions, are starting to reflect behaviours that were once commonly known and understood as central to training artisans and designers. She observes that cognitive science now sees deliberate practice as one of the conditions for creative activity.

Concurrently, the challenge for design education is to move the teaching of practical design skills only to equipping a graduate with lifelong learning skills to succeed in the ever-evolving design industry. As Tim Brown (2012) said, "the world's problems have become more complex, the traditional design process has been challenged" (p. 18). Brown goes on to emphasis that designers need to learn scientific methodology because it enables designers "to ask more of the right questions, come up with better hypotheses, design effective experiments and most importantly, share our learning" (p. 20). Perhaps one possible way to enhance the design practice is to provide the know-how to conduct research with rigour, especially since "it is useful in developing higher-order skills of critical thinking, analysis and scientific inquiry" (Cross, Dorst, and Roozenburg 1992, p. 51). Furthermore, research plays an important role in art and design education, now that the number of students opting for courses in art and design research has grown considerably (Hockey and Allen-Collinson 2000; Newbury 1995; Yee 2010). Referring to art and design students, Newbury (1995) mentioned that "certainly in the United Kingdom . . . the number of research students registered for higher degrees has more than doubled in the last five years" (p. 53). Art and design departments have expanded rapidly in recent years (Newbury 1995), and knowledge and skills to conduct research have become necessary components in undergraduate and graduate programs (Bennett 2006). Besides being a positive addition to the design students' skill set, research also "enhances their physical output as it expands their creative freedom" (Bennett 2006, p. 13). As defined by Khoury and Khoury (2009), "research is an insightful method for the generation of meaningful design" (p. 837).

Above indicates that the knowledge and skills in research methods have become important in undergraduate studies, as research is a fundamental foundation block for designers aspiring to stand out in the competitive creative industry and/or to persist against the challenges of graduate study (Heller 1998). The review of knowledge and skills in research methods at the undergraduate level has uncovered four areas of concern: (a) lack of teaching of research methodology for design research, (b) lack of appropriate models of practice in research education, (c) very little or no written component for design research, and (d) lack of proper research infrastructure (Heller 1998; Hockey 2007; Khoury and Khoury 2009; Mimoso 2011; Newbury 1996; Siu 2007;

Tornello 2003; Strouse and Arnold 2009). In some ways, it might be worthwhile for educators to take a step back to understand the fundamental causes of all the above. One way is to observe the undergraduate students who have gone through a research method course and understand what are their conceptions of knowledge and skills in design research.

Considering the current inadequacies of design research, researchers such as Mimoso (2011), Siu (2007), and Yee (2010) have urged for alternative or new research methodologies for design research at the level of master's and doctoral studies. Another group of design researchers feel strongly that a formal research structure and a rigorous research process is important for conducting design research (Allison 1992; Archer 1995; Papastergiardis 2002). For example, Archer (1995) stated that the subject matter may range from anthropology to astrophysics, but what matters is that the research is conducted scientifically - defined as "to produce explanations that remain valid when tested in wider and wider fields of application, and which therefore offer some powers of prediction" (p. 6). Hence, this study aims to understand whether traditional research methods of inquiry are still appropriate or no longer relevant to this changing knowledge context of higher education?

Based on the opposing views of the design researchers on design research, the purpose of this paper is to explore the potential use of formal research procedures in design research. Formal research procedures refer to the conventional approaches currently undertaken when conducting research in academic disciplines such as science and the humanities. This study uses the phenomenography method as the basis of its research design (Hasselgren and Beach 1997). Focusing on visual communication studies at undergraduate level, this paper is a documentation of development and implementation of the formal research procedures on eighteen design research proposals. It shares the insight on how students experience, interpret, understand, apprehend, perceive or conceptualize various aspects of design research to capture the different ways in which design research is conceived by them. The study hypothesizes that the focus on original and rigorous methods of formal research procedures would offer an innovative insight to design education in relation to creative practice.

Methodology

This study adopted discursive phenomenography, a research method developed by Hasselgren and Beach (1997). A qualitative research design is chosen due to its naturalistic approach that respects the context of research, and phenomenography provides insights that cannot otherwise be derived. It emphasizes on "how things appear to people in their world and the way in which people explain to themselves and others what goes on around them" (Barnard, McCosker and Gerber 1999, p. 214). As Marton (1981) stated we cannot derive an understanding of what people think from what we know and what we can observe, Hasselgren and Beach (1997) based on Marton's observation (1994), described phenomenography as a research method designed to describe the qualitatively different ways in which people experienced, conceptualized, or understood an event, based on an analysis of accounts of experiences as they are formed in descriptions (p. 192).

Phenomenographic research was pioneered by Ference Marton, Lars-Öwe Dahlgren, Lennart Svensson and Roger Säljö in the early Seventies, and in 1981, Marton named the research phenomenography. According to Trigwell (2000), phenomenographic approach takes a second-order perspective, as the focus is on the

subjects' perceptions of a phenomenon and it aims to identify variation in experience of a phenomenon (p. 77). There are five context-types of phenomenogarphic research identified by Hasselgren and Beach (1997, p. 195): discursive, experimental, naturalistic, hermeneutic and phenomenological. The main thrust of discursive phenomenography is to understand the conception rather than to find causes on why some people think differently about the same phenomenon.

In the same vein, the purpose of the study is to understand the students' experience of design research and to understand the role of formal research procedures and design process in the activities of design research. Discursive phenomenography consists of five steps (see Figure 1): the first step, *conversation*, will involve raw data collection, which takes the form of students' descriptions of their experiences. Then the raw data will be *transcribed* and *compiled* into interviews reports, and lastly the reports will be *analysed* to produce *conceptions* (findings).

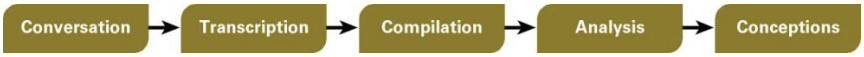

Figure 1. Steps when carrying out Discursive Phenomenography. Hasselgren and Beach 1997.

Sampling procedure

This phenomenographic study used purposive sampling as proposed by Marton and Booth (1997). Purposive sampling is the most common sampling technique in qualitative research and it is chosen because this study is examining a particular group of subjects, where the researcher is "working towards an articulation of the interviewee's reflections on experience that is as complete as possible" (Marton and Booth 1997, p. 130). Moreover, the sample chosen has to be appropriate to the purpose of the study. In this instance, the undergraduates working on their research proposals would have "knowledge and experience about particular focus of the research" (Connolly and Penn-Edwards 2005, p. 16) – which is the formal research procedure in this study.

The intended sample size was 20 Visual Communication module students from the Nanyang Technological University's School of Art, Design and Media, as a small sample size between ten and twelve was recommended for phenomenography research (Marton and Booth 1997). The samples were selected based on the following inclusion criteria: 1) Participants must be enrolled in the research method course – course code DD3012, and 2) they possess a Grade Point Average of 3.0 and above before they start their final year project. As phenomenographic research uses language as a means to represent experiences, therefore selected participants have to be able to articulate their thoughts well in order to represent information-rich cases despite the relatively small sample size. Due to the drop-out of two students from the research method course, the final sample size was 18 students. The final participants were Year 4 undergraduates in the BFA visual communication programme and their age range is between 21 to 26 years.

Implementation of research method course

The research method course is an introductory course that aims to fine-tune undergraduate students' research skills and work towards increasing their understanding of the style, form and discipline of art and design inquiry. The course outline includes 1) introduction to research, 2) selecting and defining a research topic,

3) reviewing the literature, 4) preparing and evaluating a research plan, 5) selecting a sample, 6) selecting instruments for data collection and analysis, and 7) writing a research proposal.

The learning outcome of the course is to provide students with a basic understanding of the different approaches to quantitative and qualitative research, such as survey and case study designs, including the steps necessary for appropriate analysis and interpretation of results. The research method course was conducted once a week over a duration of 14 weeks. The class consisted of lectures, professional case-studies, class work, homework, oral critiques and field trips.

Data collection

The data collection approach of the phenomenographic study involved in-depth interviews. The purpose of the interviews is to describe the meaning of the phenomenon for the participants who have experienced it (Creswell 2013, p. 161). All data collection was completed within three months. During the interviews, every effort was taken to ensure that the researcher "bracket" her own understanding of design research in order not to influence or direct the interview (Ashworth and Lucas 2000). "Bracket" is defined where the researcher needs to set aside her own assumptions in order to register the participant's own point of view (Ashworth 1996).

DATA COLLECTION APPROACH – FOCUS GROUP INTERVIEWS

The design research process, which included understanding, thinking, experiencing, and reflecting upon the research proposals, were gathered through in-depth interviews with the participants. The students were briefed about the purpose of the interview and were given the interview questions one week before the actual interview to provide them with more time to consider and respond to request for information. Thus, the participants can provide a deeper reflection on the discussed topic (Creswell 2013, p. 159).

The students were interviewed in groups of three and four participants, and there are a total of nine groups including one trial group. Due to the visual communication programme admitted more female students than male students, therefore the gender balance in the group were two to three female students to one male students. An open-ended questionnaire was used for the study because open-ended interviews provide the opportunity to probe for answers triggering the need for students to explain further or build on their responses. Interview questions were focused on both how students think and feel about their research process and design process, and act in relation to their experiences. Each interview last about 60 minutes and all the interviews were tape-recorded with the participants' permission and the recordings were then transcribed verbatim by a research assistant and verified by the researcher, complemented by observation notes. There were three interviews per group and the focused were on: Interview 1) research topic and direction, Interview 2) evidence of research (literary/visual) and exploration, and Interview 3) evidence of reflection.

Analytic

The study employed phenomenographic analysis to analyze the interview transcripts of the participants. Different from content analysis, the phenomenographic categories are not pre-determined and phenomenographic analysis may include the unexpected and not include the anticipated categories. Phenomenographic analysis

assists in determining where the change in conceptions has occurred and also allows for comparison in development and stages of development change (McManus 2009).

In this study, the analysis focused on "what" the students have experienced and "how" they have experienced the formal research procedures and the design process (Creswell 2013, p. 76 & 79). The aim is to provide a means of constructing rich, multifaceted representations of the variation regarding phenomena. The study recognises that a person may hold more than one conception of a given phenomenon, as elaborated by Marton (1992, p. 259), "certain things come to the fore whilst others recede to the ground". Therefore, during analysis, the individual participant was seen "as the bearers of different ways of experiencing a phenomenon, and as bearers of fragments of different ways of experiencing that phenomenon" (Marton and Booth, 1997, p. 114). However, the focus of this analysis is on the conceptions of the group instead of the individual participants, as the study seeks to identify the different was in which design research is experienced by the eighteen participants.

The eight-step analysis process was adopted from Creswell (2013), Dahlgren and Fallsberg (1991) and Mauleon and Ekman (2002):

The first step was data organization. Create and organize files for data.

The second step was familiarization. The interview transcripts were read a couple of times to ensure familiarity with the material and to make any corrections if required.

The third step was compilation. The responses of the participants were compiled under each question. Significant or unusual elements in their answers were highlighted.

The fourth step was condensation. A description was written for each answer, focusing on the important parts of the dialogue that corresponded to the study's purpose – personal experiences and the essence of the phenomenon were described through epoch. Statements were selected to provide a representative version of the qualitatively different ways in which formal research procedures and design process were thought of—in each written response.

The fifth step was grouping. Answers of the participants under similar themes were preliminarily classified or grouped together (significant statements) and put into categories (themes).

The sixth step was comparison. The categories were compared and analyzed. Sources of variation or agreement within statements selected in step 3 were identified—that is, fundamental characteristics were determined and the differences and similarities amongst them were noted.

The seventh step was naming. The categories were named based on the analysis – patterns in which formal research procedures were experienced, viewed, and described were identified.

The eighth step was contrasting comparisons. The categories were compared for differences and similarities between them. A description of the characteristics was included under each category.

Findings and Discussion

This section presents the findings from the participants' understanding and experiences of formal research procedures in design research. The study resulted in the identification of three conceptions defining the variation in the ways in which formal research procedures is understood: process conception, meaning conception and journey conception.

VARIATION 1: PROCESS CONCEPTION

In process conception, formal research procedure (FRP) is interpreted as a process of synthesizing separate elements so that problems are identified and questions are formed. The participants viewed FRP as a list of separate tasks, such as experiments, techniques, issues, problems, ideas or questions. The task may be conceived as, for example, identifying a research topic, narrowing it down to a feasible research problem, and then coming out with research questions. Or it may be seen as applying different techniques to creative practice and synthesizing new information. Generally, in process conception, the primary emphasis is on synthesis.

> "I like to based my projects on things that I personally feel strongly for and in this case… from the observation [it] kind of branch out to [screen culture]… me being curious about how this mobile technology has affected the way we socialize, behave and then it started from there, yeah…" – TT
>
> "my topic then was coffee drinking as a getaway for drinker… get away means or in my sense like sort of mental break free temporary… then I [started] looking into how local [drink coffee]…[I found out that they] have sort of stress level…, [and] at the same time… there was increasing trend of coffee drinking, so I thought there's a bit of relation [and] I decided to… [link] them up together… slowly channel it towards a artistic approach outcome." – IY
>
> "Beginning stage I went to look at broken object trying to see there is a value in keeping in this object but I realise it is lacking the human aspect that actually I want to try to portray as well. Then I'm afraid that broken object… people might not identify… in the end the aspect of scars became my focus because… it is a topic that people can relate to." – QY
>
> "I have to look at my objective first and then I have to relate what the solution help me to fulfil or obtainment of objective. Then from the solution that I have that I have to like analyse question that help me to improve on this solution that is how I came into my research question." – QI
>
> "the notion of thinking is very intangible… So, I need to… conduct experiments and focus group." – SL

VARIATION 2: MEANING CONCEPTION

In meaning conception, formal research procedure (FRP) can be perceived as a process of discovering, uncovering or creating underlying meanings. Emerging in the data of the review, the participants brought to light the ideas and explanations in the literature by uncovering the underlying meaning. The participants also used their own techniques to produce data, therefore FRP may also be described as a creative process, which meaning is being created, not discovered.

> "You go through your research process and …find solution to what you have research so that that design will be truthful to what you have research on." – HT
>
> "I see the need for it to be polish, so I plan to do it twice, do it once and then get it hammered and see what's wrong and doing it one more time cause my objective was to come out with something that's really visually stunning in a sense. Yeah." – AW
>
> "looking [into] people experience, feelings, attitude about things… will actually gives me a lot of confirmation what direction I'm heading towards… at the same time, I also came out with user generated images like through my experimentation… by showing that to people, will they actually have the same

thinking as me. If not, then, I probably have to sort of edit my visual style. So for me, it is really about…. the execution or the experimentation together with the research info to hand in hand." – IY

VARIATION 3: JOURNEY CONCEPTION

In journey conception, formal research procedure (FRP) is perceived as a personal journey of discovery, possibly leading to transformation. The activities in which the participant engage in, whether or not they appear to have a direct bearing, are viewed holistically as transforming theoretical and experiential understanding of the research interest topics.

"I was doing too much research so, I couldn't take it and so, I decided to do something totally different… I just went down to flea markets and just look at objects and just analyze object about what makes them special… either by colours and all that, then I realize that became a more fluid way of research for me…" – FH

"I think it's a… self experience like kind of things, because I have been following this venerable for quite some time and then, I thought his approach propagating Buddhism is different from the traditional kind. He instead of telling you… to follow… he ask you why are you doing this? So, you know that kind of thing inspires me too like sort of affirms me that you know I should follow his footsteps… his method" – BS

"I'm working with a therapist and I'm kind of giving her what she… not giving her what she wants but like she listing out what she desires to see my project but at the same time I'm directing it myself because it's my [final year project]. So I've to come to a compromise somehow… to see how much I should take in… everything she says and her decisions and how much I want myself to like implement my own decisions. So, for me, it's always like a pull and tuck thing." – SE

In identifying the relationships between different conceptions, "phenomenographers typically postulate a hierarchical relationship, with some categories being viewed as less complex, less well developed or less sophisticated than others" (Brew, 2001, p. 281). The participants in the current study were all undergraduate students therefore it is acceptable to designate some of their conceptions as less complex or less well developed, underscoring the idea that the logic of phenomenography does not dictate the necessity of hierarchical relationships between categories.

By demonstrating variation in how formal research procedures is experienced by the undergraduate students, the paper provides a basis for understanding various phenomena relating to formal research procedures in undergraduate education that have previously been insufficiently understood (Yeo, 2012). The variations in conceptions of formal research procedures may: 1) provide a means of understanding of how to conduct research in design, 2) be used as a channel for personal learning and form enquiries to conduct a more robust and rigorous research, and 3) boost students' capabilities to apply theories to their creative practice.

Conclusion

To get a nuanced understanding of students' conceptions of formal research procedures, we collected data via in-depth interviews with students who have taken a research method course. The purpose is to understand whether the traditional research methods of inquiry are still appropriate or no longer relevant to this changing knowledge context of higher education. Findings support that formal research

procedures continue to be relevant for design research and can offer an innovative insight to design education. For example, students are able to design a research proposal easily using the steps of formal research procedures, as most students have formed their research questions within six weeks of the procedures. Students have commented that the formal research procedures have guided their research process and prevented them from dealing with information overload. The formal research procedures have also brought them closer towards the path of an independent learner and thinker.

The limitations of this study are that the study is focused on using research proposal and not a full research project as research material. Further work is needed to establish if the variations are shared in a full research project. In addition, further study is needed to elucidate how reliable these variations are over time: whether the variations are likely to change from one research project to another; whether individuals choose a research topic because of the influence of their professor; or whether the participants have particular conceptions of research. A parallel study of the alternative research methodologies in design is needed to offer a better understanding of the strengths and weaknesses of formal research procedures is another possible area for future research. The findings reported in this paper, however, have thrown light on aspects of formal research procedures and represent a first step in explaining the different ways in which visual communication students conceive design research.

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Learning to See: Contribution to an Analysis of the Teaching of Free Hand Drawing by Kari Liv Brundin Torjussen at Oslo National College of Art and Design, 1947-1990

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Abstract: The National College of Art and Design (Norwegian abbreviation: SHKS) in Norway was established in 1818, as a school for educating craftsmen and artists. Until late 20th century, free hand drawing was its foundational subject. Today, this is no longer the case, and the recurrent questions are: Which competences do design students need in free hand drawing, how should this subject be taught, and what should the education curriculum comprise? This paper aims at clarifying the tradition in which free hand drawing is embedded. Asking what the institutional teaching of free hand drawing actually was, reveals that little information is available. This teaching has been demonstrative and oral, therefore, only scarce sources are available. The exception to the rule is Kari Liv Brundin Torjussen (1922-) who has left a personal archive of her teaching work. She taught free hand drawing in the first year design class at SHKS from 1947-1990. This paper represents an initial phase of a broader research project of the institutional history. It presents a brief biography of Kari and the beginning of an analysis of her teaching, based on interviews with her, statements from some of her students, institutional archival material, literature and her personal archive.

Keywords: Free hand drawing, teaching tradition, college level.

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Introduction

In 1818, the forerunner of the National College of Art and Design in Oslo (abbreviated SHKS from Norwegian: *Statens håndverks- og kunstindustriskole*) was established. Norway had an urgent need for educating local craftsmen and artists that should build the new nation. Free hand drawing was the foundational subject of the curriculum, and although the official names were shifting, the school for 150 years on, popularly was called "The Drawing School" (Norwegian: *Tegneskolen*). The European tradition of free hand drawing instructions were based on copying works of previous masters in two and three dimensions (Goldstein 1996: 11). This principle was furthered at SHKS. In the first regulation from 1822, the education plan had three levels, all based on drawing. The first, elementary level, dealt with copying images; the second level with drawing objects, models and casts, and the third level comprised drawing constructions and building details (Krogvig 1918, 36-37; Pedersen 1935: 28-29). In 1903, SHKS moved into a new, prominent building in Ullevålsveien 5. 100 years later, in 2003, the institution was dissolved and merged as two faculties into the National Academy of the Arts (abbreviated KHiO from Norwegian: *Kunsthøgskolen i Oslo*). Seven years later, in 2010, these faculties were moved to new localities and the old building was emptied. An archive was made (Liebold and Tronbøl 2012), and The Drawing School/SHKS had come to a close.

Today, free hand drawing in design education is marginalized, due to an expansion of new subjects, electronic media, and the Bologna process, demanding modulization of the teaching. "Drawing or not drawing that is the question!" sums up the frustration of a teacher who has taught free hand drawing to design students for 40 years (Refsum 2011). The recurrent questions asked are: Which competences do design students need in free hand drawing, what should the education curriculum comprise and how should this subject be taught?

A premise of this paper is that before starting to answer these questions, the tradition of free hand drawing ought to be clarified. What actually was the tradition of free hand drawing at The Drawing School/SHKS? In this author's opinion, the teachers identified themselves as artists, rather than pedagogues. In their leisure time, their ambition was to keep their studio work alive. The teaching was demonstrative and oral and each teacher had his or her methods and ways. Documentation of their teaching, writing text books or even memoirs were activities beyond their concern. In short, scarce sources are left. There are exceptions to the rule. Kari Liv Brundin Torjussen (1922-, abbreviated Kari in the following text) taught the first year free hand drawing class for designers at SHKS from 1947-1990, 43 years in all. When she started as an assistant to her former teacher, architect Johan von Hanno in 1947, she was the first woman employed as teacher in drawing at SHKS. According to Kari, the teaching of free hand drawing was almost the same in 1942 as 120 years before (Personal Archive vol. 2.1: 6). von Hanno introduced slight changes and represents another exception to the rule, since he published two text books. He was particularly concerned with bodily postures when drawing and he taught his pupils to observe. Kari furthered his methods. But in the 1950ies, inspired by contemporary American art and Bauhaus traditions (Droste 2009), she broke with the past and began to teach in accordance with the new ideas of the time, based on creativity and body movement.

The author of this paper was a pupil of Kari in 1979-80. Revisiting my old teacher, it became evident that Kari had kept her personal teaching material. Inspired by the interest this material might induce, she began a process of editing and organizing her

archive (Refsum 2012). In 2011, it was handed over to the library archive at KHiO, and from there to The Regional State Archives (Norwegian: *Statsarkivet*) in Oslo.

In 2018, The Drawing School/SHKS, now KHiO, will celebrate its 200 year anniversary. As part of moving on, the institution needs to understand its past. This paper represents the initial phase of a broader research project of the institutional history of SHKS. It briefly presents the beginning of an analysis of the teaching of Kari, based on private interviews with her, statements from some of her students, institutional archival material, literature and her personal archive. Firstly, the text treats the education she received at SHKS during the Second World War. Secondly, it presents Kari as teacher, her attitudes, working methods and obligation as employee. Thirdly, an evaluation of her teaching is begun, based on Kari's reflections and some of her students' statements. Finally, some reflections and suggestions for future research close the paper.

Education

Kari was born 12. July 1922 at Rælingen, a small place north of Oslo. Both her parents were teachers in the local primary school. Her paternal grandfather Johan Wilhelm Brundin (1867-1947) was a prominent gilder in Stockholm who was called to work on the National Theater in Oslo that opened 1899. Kari was a talented child and did well in school. In autumn 1939, 19 years old, she moved to Oslo to attend college. In the following spring, the Second World War reached Norway that was occupied by Germany. Still, Kari finished her college after three years and then wished to study art. Her parents rejected her decision. But a teacher in high school strongly had encouraged her to use her talents. Kari therefore, applied at SHKS in the Class for Painting. She was accepted and began her three year full time study in the autumn 1942, in a class of 10 pupils.

The education in painting had three levels, one for each year, which were called:

1) The school of beginning, 2) The professional school, and 3) The class of painters.

During the first year, all the new pupils in the school were taught the same three foundational subjects the whole year: geometrical drawing, ornament (colour), and free hand drawing I (first level). Her teacher in the latter was architect Johan von Hanno (1894-1952) who was employed as teacher in 1931 in the Class for Construction in the Evening school of SHKS, and from 1937 as teacher in free hand drawing I in the Day school (Annual Report 1931/32 and 1937/38). His brother, painter Carl von Hanno (1901-1953), taught free hand drawing II in the second year (NKL vol. 2: 49-50). This class was called the plaster class since the pupils were drawing plaster casts of classical sculptures. The second year also included teaching in ornament and painting. In the third year, the curriculum had two subjects only, painting and free hand drawing III that was drawing from the nude model, act. The teacher of painting was Wilhelm Krogh-Fladmark (1887-1980) who had his craft certificate of decoration and theater painting in 1909 and established his private company in 1910 (NKL vol. 2: 625). Free hand drawing III was given by the painter Karl Høgberg who was employed in 1944 (Annual Report 1944/45: 13).

During the 1930ies, Johan von Hanno developed a teaching system for his work at SHKS. He made posters and elementary models that the pupils should copy. In 1942, he published a textbook on his principles that should be used in the technical schools and at SHKS (von Hanno 1942). His main aim was to help the pupils train their ability to see and understand relations, lines and forms, and to draw them correctly (Norwegian:

"Undervisningen tilsikter å lære elevene å oppøve sitt øyemål og å øve evnen til en riktig oppfattelse av forhold, linjer og former og gjengi dette korrekt i tegning") (von Hanno 1947: 3).

Furthermore, his ambition was to induce a willingness to study among his pupils. He wished his pupils to concentrate in front of their motifs and to be aware of their perception, to observe. An important contribution to the teaching tradition in SHKS in free hand drawing was his concern of bodily posture and movement while drawing, figure 1.

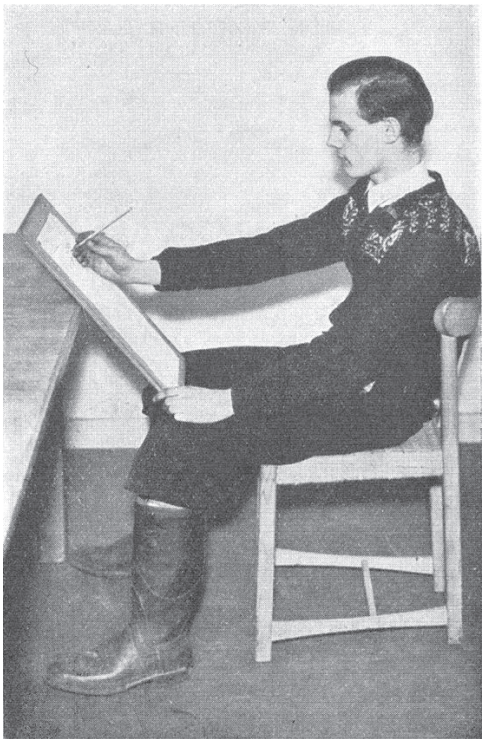


Figure 1. Correct drawing posture according to Johan von Hanno (von Hanno 1947: 17).

von Hanno held three foundational principles as teacher. Firstly, the pupil must understand himself and that which he experiences. Secondly, the pupil must be helped to reflect about what he sees. And thirdly, the teacher must observe how the pupil works (von Hanno 1947: 13-14). His foundational course had 19 exercises that should be treated within 60 hours. It started with horizontal and vertical lines, moved on to diagonals, figure 2, circle and eclipse, and more composed lines.

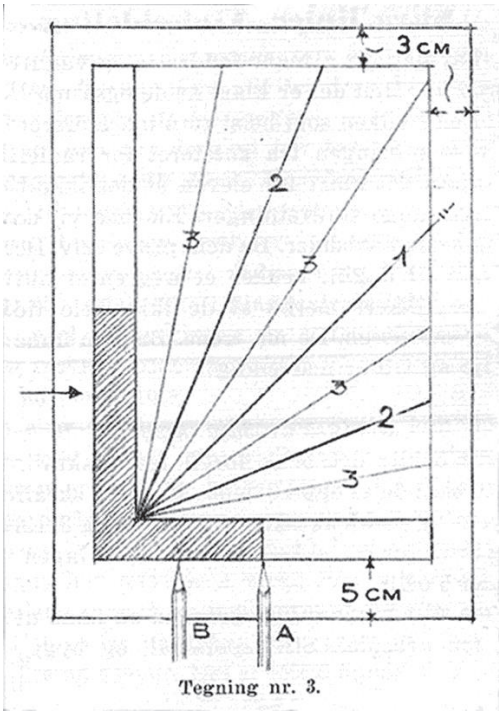


Figure 2. Illustration to 3rd level, diagonals (von Hanno 1947: 36).

In 1948, von Hanno published part two of his text book, treating three-dimensional form and perspective (von Hanno 1948). Accompanying the book, he had worked out blocks and geometrical models painted white. His main concern was to let the pupils study how forms change dependent on the view point, figure 3.

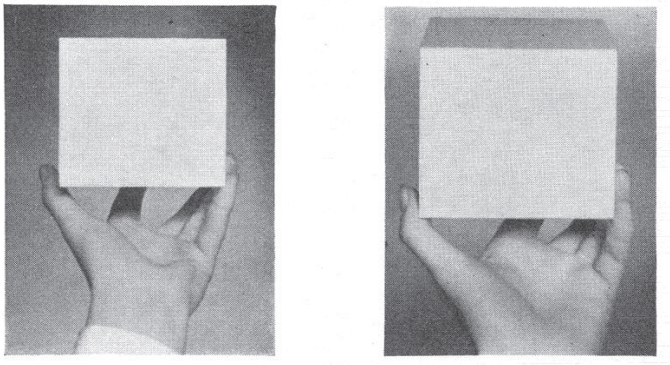


Figure 3. Observation of the cubicle (von Hanno 1948: 12).

von Hanno was explicit in his attitude towards his pupils. He recommended to give credit for everything that was worth it and otherwise help the pupils find the reason for

why they did not draw correctly (Norwegian quote: "Ros *det som er riktig, hjelp enhver til å finne* årsaken til feilene") (von Hanno 1947: 23).

Kari remembers her teacher as a warm pedagogue, but his teaching methods with posters and models to be copied, as intensely boring. But his interest in body posture she found positive (KT 7.12.2010). The milieu at SHKS, according to Kari, was rewarding (KT 1.3.2011). Although the war was raging, the school kept going (Prytz 1946: 8). She graduated on time in the spring 1945, as the war ended. The outspoken attitude towards the female students was that they should marry and establish beautiful homes (KT 21.9.2011).

Teaching

In 1944, the pupils at SHKS were offered a course in drawing pedagogy run by Rector Rolf Bull-Hansen at the Woodwork- and Drawing School at Notodden. Influenced by the psychologist Helga Eng (Eng 1929 and 1944), he had stopped using blocks in his drawing classes for children. Instead, he appealed to the fantasy world of the child (Personal Archive vol. 2.1: 5).

It became a central idea for Kari that children live through a development in which they draw and paint what they sense and feel, rather than what they observe – comparative to the cultural development of humans.

Leaving SHKS in 1945, Kari realized that she could not survive economically as an artist. She wished to be self reliant and applied at the pedagogical schools to continue her education. Due to her bad mark in German language – a subject she had boycotted during the war – she was not accepted. Instead, she intended to become a consultant of interiors and got work in a wallpaper shop. At the same time she attended a drawing course in the Evening school of SHKS for craftsmen (1946-47).

In 1947, her former teacher was allowed an assistant. She applied for the job and was employed 1. October 1947 in a preliminary assistant position, teaching free hand drawing first level in the Day school (Annual Report 1947/48: 17). Teaching the same level and subject, she advanced in several steps until full employment was reached in 1957 (Norwegian terms: 1949 *bistilling*, 1953 *midlertidig overlærerstilling*, 1957 *overlærer*) (Personal Archive vol. 2.1: 1).

Beside his engagement at SHKS, Johan von Hanno taught free hand drawing at the local technical school (Norwegian: *Oslo Yrkesskole*). Kari assisted him in this work for six years (1947-1953). To teach classes of 30 pupils, energetic boys 15-16 years of age, from different professions, was extremely challenging work. But the experience taught her how to keep discipline in a class (KT 7.12.10).

Kari followed the methods of von Hanno, using blocks and models (KT 7.12.10). She continued his ideas of motoric movement, especially the principle of using the whole arm while drawing.

Ragnhild Magnussen (1931-) who has been engaged at SHKS in various positions for her lifetime, started in the Class for Fashion in 1949, 18 years old. She was a pupil in the second class Kari taught, figure 4.

Figure 4. First year free hand drawing class 1949/50, Ragnhild Magnussen in front to the left, Kari no. three from the right, Roar Høyland, later rector, no. three from the right at the back (Kari's private photo).

Ragnhild recalls that although her teacher was young and friendly, she kept a distance and radiated knowledge, quality and authority. No doubt, the teacher was supreme. She vividly remembers how Kari – always elegantly dressed up – gently entered the classroom and gave her instructions. The pupils copied von Hanno's posters, one by one, at individual pace. Ragnhild explains how the pupils should train the hand to do exactly the right thing; all the muscles in the hand should obey the eye. They started with the horizontal lines, moved on to the verticals, and thereafter to the motoric exercises using the whole arm. When all the posters were done, the pupils could start drawing after small cast models at choice (RM 19.3.2012).

Ragnhild in particular remembers Kari's way of giving individual supervision. According to her, Kari entered quiet-mannered and sat down beside the pupil. Then there was a long silence. The pupils were eager and tense, waiting for their turn, and then there were some pleasant questions, starting with: do you think or do you mean? In that way, Kari made them see the forms in between the lines, and reflect about the form the eye could not see. From being self-conceited beginners, thinking that they knew it all, she gradually led them to new observations. She made them experience on their own and become aware of what there was to recognize. According to Ragnhild, Kari's teaching was a learning to *see* (RM 19.3.2012).

In 1951, Kari gave birth to her daughter. The father and husband, painter Kristian Torjussen, substituted as teacher during her short absence. He was employed on a regular basis in 1953 and the two could collaborate as colleagues. The following summer in 1952, a summer course of three weeks on visual training and design education was organized at SHKS. The initiator was head of the Class for Architecture

(Norwegian: *Bygningsklassen*) architect Arne Korsmo. He had invited his American colleagues and friends from the Institute of Design in Chicago, two of whom were former Bauhaus teachers. Teachers from all the schools of art and design in Scandinavia were participating and the event became a great success. Spontaneity, freedom and movement in free hand drawing were keywords for the teaching (Annual Report 1951/52), figure 5.

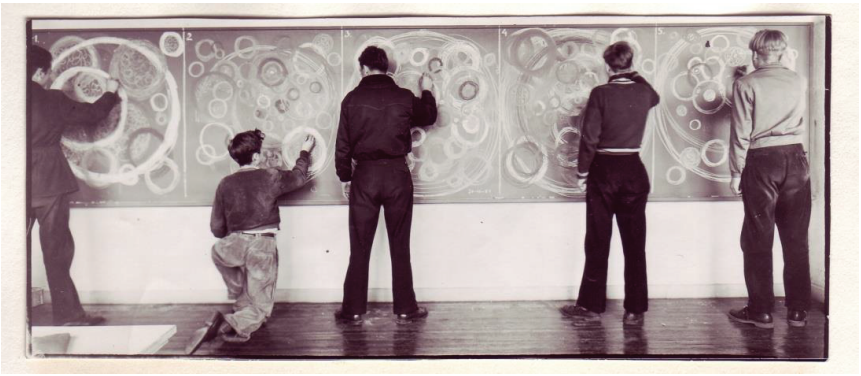


Figure 5. Participants drawing on the blackboard in the summer course in 1952 (Personal Archive vol. 2.2: 11).

The summer course was a huge inspiration for Kari. She regarded the work of the American painter Jackson Pollock (1912-1956) as the state of mind interpreted directly through movements onto the canvas (Personal Archive vol. 2.1: 4). In the discussion at SHKS after the course, the colleagues concluded that haptic feelings and playing were suppressed in Western culture (Personal Archive vol. 2.2: 3). Kari had taught for five years. After the summer course, she would no longer accept copying as the foundational teaching method in free hand drawing. Now, she was encouraged to break with tradition and teach in accordance with contemporary ideas of psychology, creativity and body movement. She developed a new teaching plan that built on and extended von Hannos motoric exercises; the pupils should draw in big formats and to music. They would also get free exercises to stimulate the use of their fantasy (Personal Archive vol. 2.1: 6-7). Kari recalls fairly wild experimenting in the following years; she was criticized by her colleagues, but had support from Rector Jakob Tostrup Prytz (1886-1962, Rector 1934-1956) (KT 7.12.10 and 1.3.2011).

In 1954, there were three teachers and 99 pupils in free hand drawing first level: Kari, Olav Mosebekk and Kristian Torjussen. The three worked together, inspiring each other. SHKS had seven departments and gradually the teachers began to specialize the teaching to suit the various professions (Personal Archive vol. 2.1: 7). Central in their teaching was the notion that the pupils should realize themselves; become acquainted with free hand drawing as a language with a logic that could be used for expressing themselves (Personal Archive vol. 2.2: 16-17).

After 10 years of teaching, in 1957, Kari was employed full time on a regular basis, her responsibilities still was free hand drawing first level. The following year, in 1958, she made her debut as artist in a Norwegian gallery (*Trondhjems Kunstforening*) (Personal Archive vol. 2.1: 1). As a mother and teacher, she again had to make a choice between art and pedagogy; and chose the latter, figure 6.

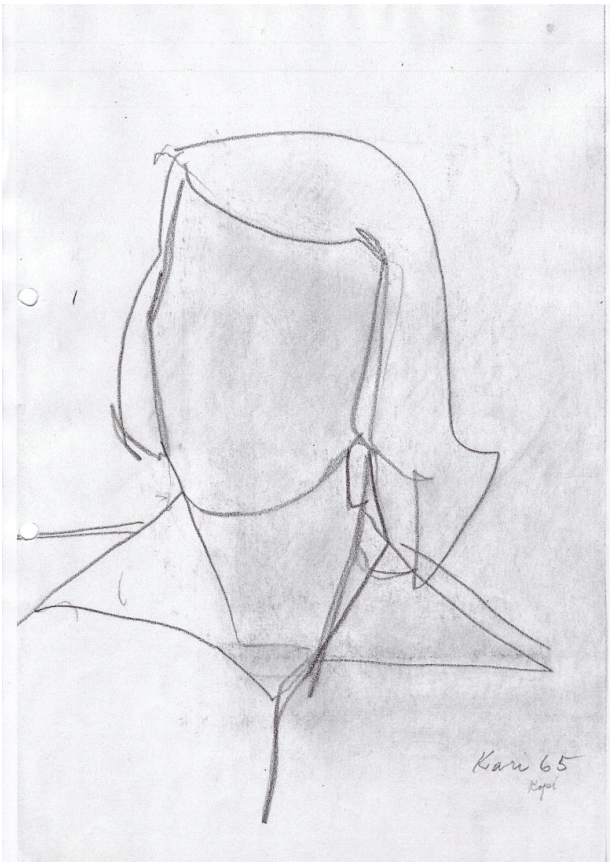


Figure 6. Self portrait 1965 (Personal Archive vol. 2, Images and drawings: 3).

Having tenure, Kari was relatively free to develop her personal teaching strategy and methods. For her, this challenge became a continuous task. She was responsible for two classes, the Class for Painting and the Class for Architecture. The teaching program for the latter class (1963 and 1967) was threefold: a) descriptive drawing, b) drawing technique, and c) fantasy drawing (Personal Archive vol. 2.3: 1 and 14). This basic structure she kept onto (Personal Archive vol. 2.4: 18).

The teaching started in the point. A point set into movement becomes a line; a line set into movement becomes a surface; a surface set into movement becomes a volume. Then there are shades and colours (Personal Archive vol. 2.4: 1-2 and 9). The perspective comes along with the transition from flatness to volume. Kari's Personal Archive volume two comprises overviews of the study programs for several classes and years. Central to all, is her concern for understanding three-dimensional form. Like von Hanno, she began with the cube, figure 7.

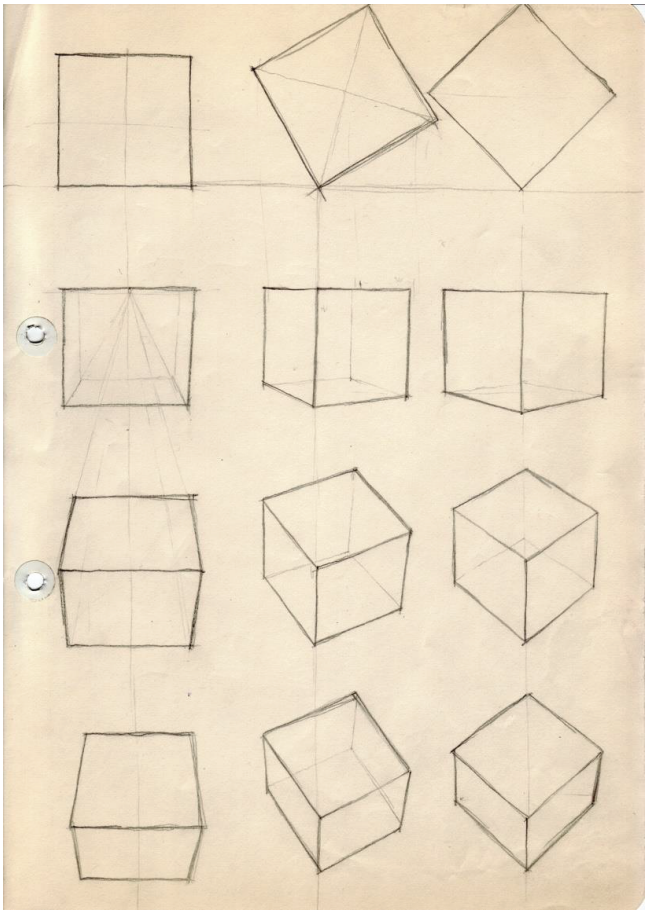


Figure 7. Sketch of the cubicle in perspective, undated (Personal Archive vol. 1f: 51).

Thereafter, the various geometrical forms were treated, figure 8.

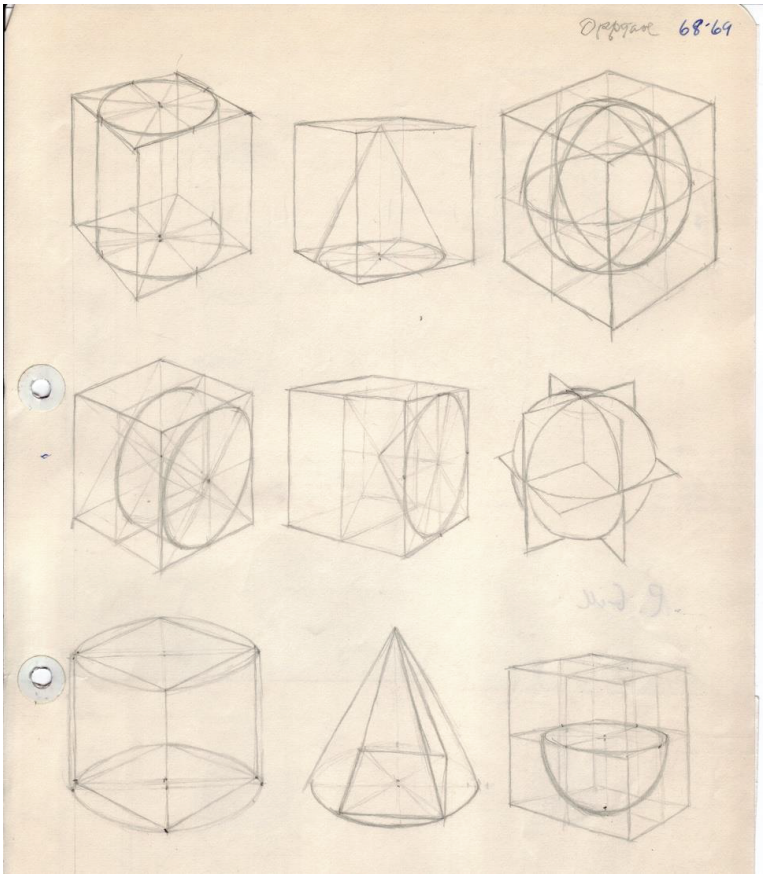


Figure 8. Sketch of geometrical forms within the cube, 1968/69 (Personal Archive vol. 1g: 5).

The premise in Kari's teaching is expressed in the statement: "Any object regardless of form, can be analyzed down to a combination of circular and rectangular forms" (Personal Archive vol. 1g: 7). In consequence, she taught her pupils to analyze form by descriptive lines, horizontally and vertically, figure 9.

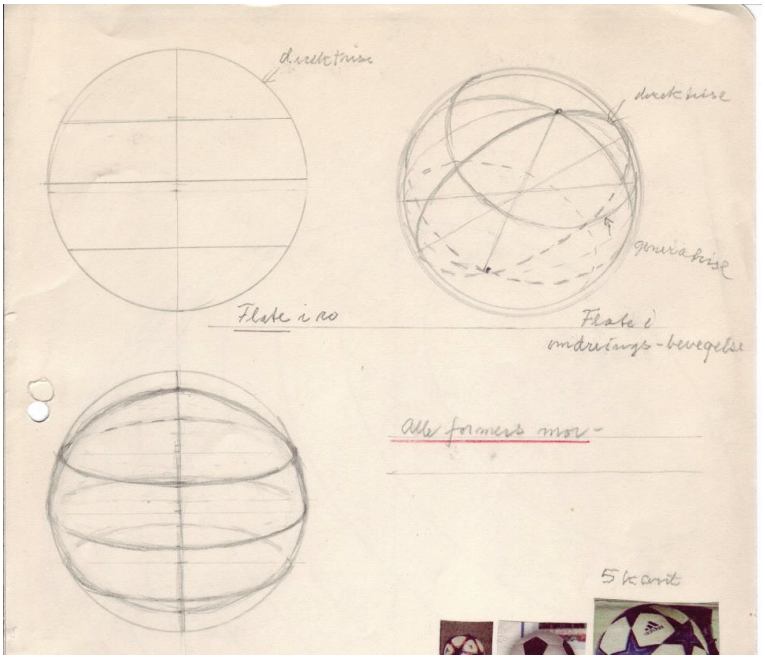


Figure 9. "The mother of all forms", the cube with contour lines (Personal Archive vol. 1e: 14).

Three elements underlie and characterize Kari's attitude in her work; first comes the principle of exact observation, next, the possibilities of the line, and then perception of nature (Personal Archive vol. 1t: 2-6), figure 10.

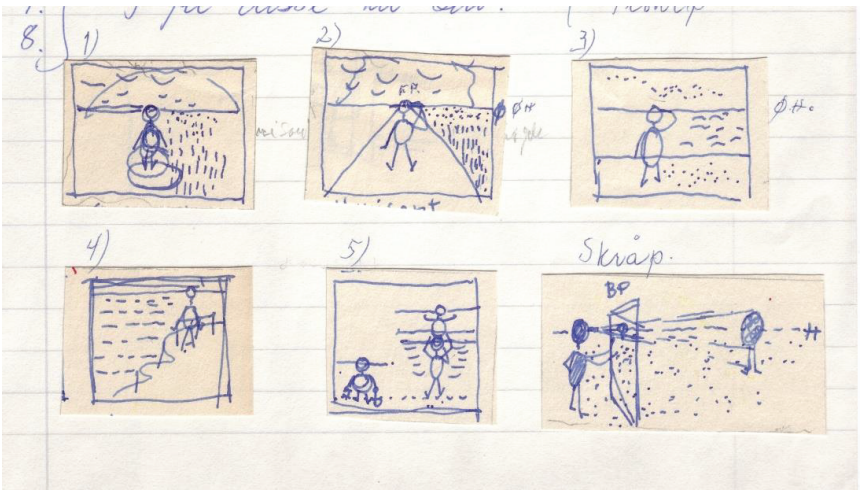


Figure 10. Summing up the free hand perspective in a landscape (Personal Archive vol. 2.6: 16).

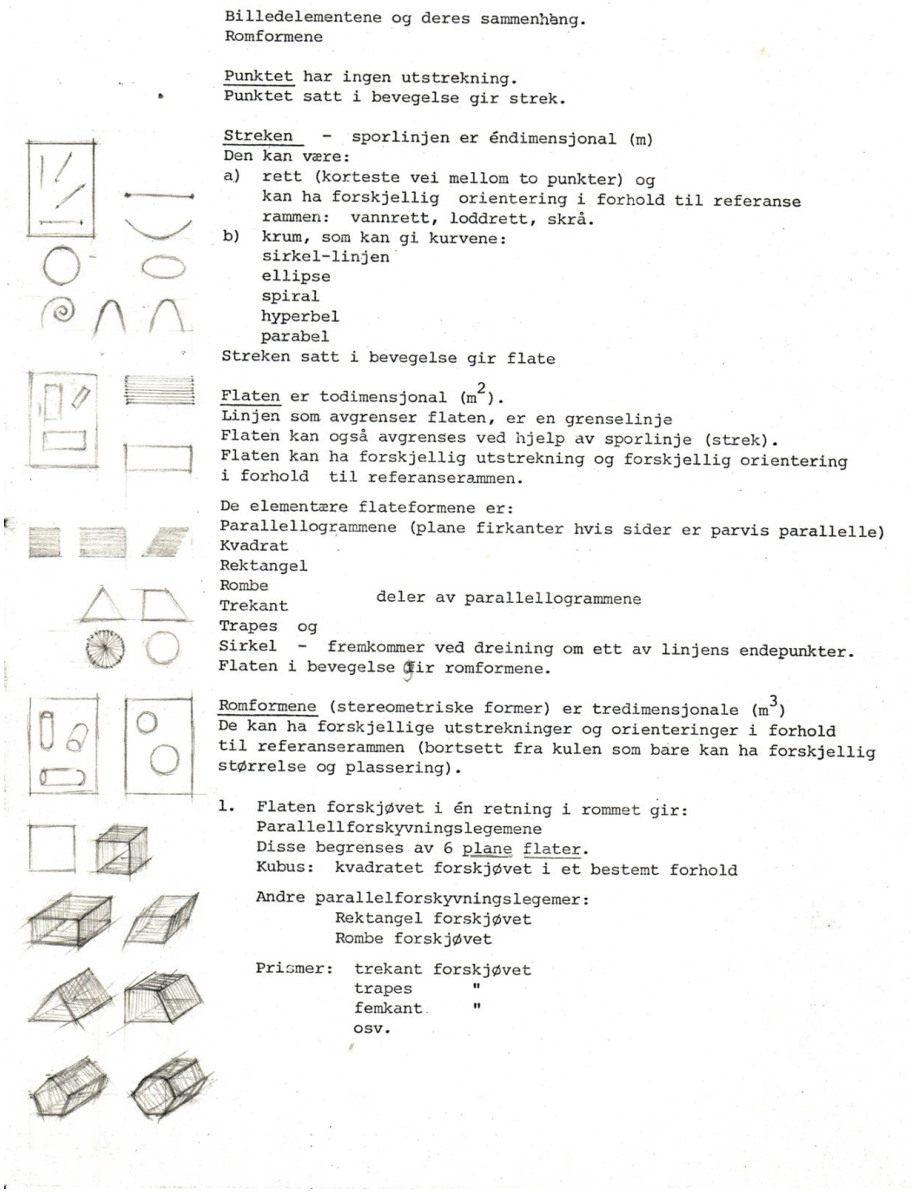
In 1965, the Class for Architecture broke away from SHKS, establishing a new school of architecture (Norwegian: *Statens arkitektskole i Oslo*, from 1970, *Arkitekthøgskolen i*

Oslo, AHO). It was a dissension about the qualifications of the applicants to SHKS that lay behind this decision. The architects required students with mathematical knowledge and college exam (Norwegian: *realgymnas*). Such a requirement the other teachers would not accept since many talented pupils were dyslectic (KT 7.12.2010). In consequence, there was a split. The new school stayed in the SHKS building until 1969, and Kari continued to teach free hand drawing as before. She developed a curriculum based on a more exact understanding of space and form than previously. Since, the class was big, she got an assistant, the drawing and graphic artist Ottar Helge Johannessen (1929-2010). His sketch from the period proves the difficulty of being female in a male dominated school, figure 11.

Figure 11. Drawing by Ottar Helge Johannessen, 1965-68 (Personal Archive vol. 2.3: 13).

When the architect school moved to its new localities in 1969, Kari was invited to come along. For a short period she did, but then decided to go back to SHKS.

In 1976, the ministry for teaching defined SHKS as a university college (Norwegian: *Kirke- og undervisningsdepartementet*). The teachers at SHKS regarded this as a degradation since the school represented the highest level of teaching in its fields. They wished the status to be an academic college (Norwegian: *vitenskapelig høgskole*). Then arose the question of research (Refsum 2004). As part of the process of getting acceptance for such a status, it was decided that the teachers could apply for research time. Kari was the first teacher to apply and had her sabbatical the autumn 1979. In her application, she accounts for her aim of developing a method for drawing that lies in between freehand drawing and geometrical construction. The outcome of the research should be visual, rather than written (Personal Archive vol. 2.1: 8), figure 12 and 13.



Billedelementene og deres sammenheng.
Romformene

Punktet har ingen utstrekning.
Punktet satt i bevegelse gir strek.

Streken - sporlinjen er éndimensjonal (m)
Den kan være:
a) rett (korteste vei mellom to punkter) og
kan ha forskjellig orientering i forhold til referanse
rammen: vannrett, loddrett, skrå.
b) krum, som kan gi kurvene:
sirkel-linjen
ellipse
spiral
hyperbel
parabel
Streken satt i bevegelse gir flate

Flaten er todimensjonal (m^2).
Linjen som avgrenser flaten, er en grenselinje
Flaten kan også avgrenses ved hjelp av sporlinje (strek).
Flaten kan ha forskjellig utstrekning og forskjellig orientering
i forhold til referanserammen.

De elementære flateformene er:
Parallellogrammene (plane firkanter hvis sider er parvis parallelle)
Kvadrat
Rektangel
Rombe
Trekant deler av parallellogrammene
Trapes og
Sirkel - fremkommer ved dreining om ett av linjens endepunkter.
Flaten i bevegelse gir romformene.

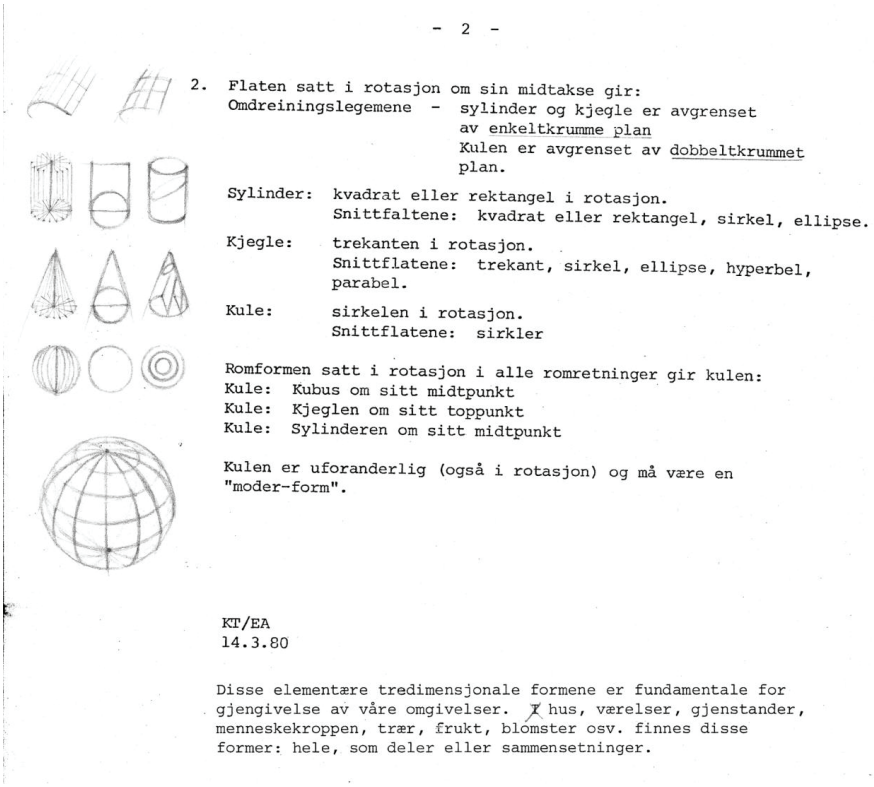
Romformene (stereometriske former) er tredimensjonale (m^3)
De kan ha forskjellige utstrekninger og orienteringer i forhold
til referanserammen (bortsett fra kulen som bare kan ha forskjellig
størrelse og plassering).

1. Flaten forskjøvet i én retning i rommet gir:
Parallellforskyvningslegemene
Disse begrenses av 6 plane flater.
Kubus: kvadratet forskjøvet i et bestemt forhold

Andre parallelforskyvningslegemer:
Rektangel forskjøvet
Rombe forskjøvet

Prismer: trekant forskjøvet
trapes "
femkant "
osv.

Figure 12. Overview of the connextion between image elements: Three-dimensional form (Personal Archive vol. 2.1: 18).



- 2 -

2. Flaten satt i rotasjon om sin midtakse gir:
Omdreiningslegemene - sylinder og kjegle er avgrenset av enkeltkrumme plan
Kulen er avgrenset av dobbeltkrummet plan.

Sylinder: kvadrat eller rektangel i rotasjon.
Snittfaltene: kvadrat eller rektangel, sirkel, ellipse.

Kjegle: trekanten i rotasjon.
Snittflatene: trekant, sirkel, ellipse, hyperbel, parabel.

Kule: sirkelen i rotasjon.
Snittflatene: sirkler

Romformen satt i rotasjon i alle romretninger gir kulen:
Kule: Kubus om sitt midtpunkt
Kule: Kjeglen om sitt toppunkt
Kule: Sylinderen om sitt midtpunkt

Kulen er uforanderlig (også i rotasjon) og må være en "moder-form".

KT/EA
14.3.80

Disse elementære tredimensjonale formene er fundamentale for gjengivelse av våre omgivelser. I hus, værelser, gjenstander, menneskekroppen, trær, frukt, blomster osv. finnes disse former: hele, som deler eller sammensetninger.

Figure 13. Overview of the connextion between image elements, continued (Personal Archive vol. 2.1: 19).

In 1968, Rector Håkon Stenstadvold (1912-1977, Rector 1964-77) requested Kari to arrange an institute of drawing (Norwegian: *Tegneinstitutt*) at SHKS, as a meeting place for the teachers in the foundational subjects: geometric drawing, form, colour, ornament and free hand drawing. The drawing institute became a rewarding forum. Here, the colleagues met weekly and discussed various questions and pedagogical challenges freely among peers. Kari functioned as secretary and for six years wrote reports about the discussions, now available in The Regional State Archives (KT 7.12.2012).

When SHKS in 1981 became an independent college, for the first time, a rector was to be elected. Kari got the majority of votes and became the first rector elected and the first female rector in the school's history. One requirement for establishing SHKS as an independent university college was to deliver complete plans of the teaching in the school. Such a claim was previously unheard of, but as rector, Kari handled the task. However, after two years of administration, she returned to the role as teacher. In 1990, she retired.

During her teaching years, Kari systematically collected examples of her pupils' work. When SHKS was to leave its location, this material was handed over to The Regional State Archives. Revisiting the archive in 2011, Kari explained that the examples withheld should exemplify the various states of problems treated in class. Her personal

archive consists of two main volumes. Volume one includes inspirational sources and references that may be categorized under five headings. 1. Nature, studies of: a) form, landscape, animals, plants, often details; b) natural elements: water, air/wind, light and solids; c) natural phenomena: wind and waves, light and reflections. 2. Fundamental drawing, Stone Age carvings and work of children. 3. Art historical material with emphasis on renaissance art and artists like: Rembrandt, Goya and Picasso. 4. Technology, constructions, technicalities and urban spaces. 5. Literature: a) art theoretical and historical material (Read 1951; Kandinskij; 1965); b) geometry and perspective (Norton 1964; Doblin 1979); c) perception and colour (Itten 1963; Arnheim 1967; Kepes 1969); and d) pedagogy (Edwards 1979; Klee1981).

Volume two deals with the concrete teaching, the curricula, exercises and tasks given, both her own and some of her colleagues'. All in all, there are five meter archived documents and drawings related to the work of Kari (Liebold et al. 2011).

Evaluation

Kari has taught nearly 1000 pupils/students through her 43 years as teacher. She continuously strived to rework her study plan and made changes. There were two main challenges, what to teach and how to teach it. She was well aware that free hand drawing might be taught in different ways (Eisner and Ecker 1966). Her list of literature shows how she was concerned about new entries and keept updated on contemporary movements and relevant research outcomes. She recommended handbooks for getting things right according to nature and vision (Jaxtheimer 1974).

The question she perpetuately asked herself was how she best could facilitate and guide the young students to find their personal vision in a complicated world (Personal Archive vol. 2.1: 7).

Asked in an interview what constitutes the good teacher, Kari responded that the most important thing is to understand what the students wish to achieve. The teacher has to create a safe haven of trust without anxiety, and stimulate each student at a pace that is fruitful for the individual (Grotmol 1989: 7).

Kari's teaching may tentatively be categorized in three phases: a) the assistant (1947-49/53), continuing the current tradition; b) the rebellion (1953 on), breaking with the past; and c) the matter-of-fact, pragmatist attitude (1960ies). She each year taught two classes in parallel, one of artist students, the other design students. In 1980, I remember her saying that there are two entrances to learn to draw free hand, one is to *feel* the way, the other to *think* it; the first applies to artists the other to designers. Teaching in accordance with both these approaches, was a challenge that perhaps explains the characteristics and quality of Kari's teaching method. She mixed observation and imagination. In addition, her interest in nature, history and psychology gave the flavour. Probably the matter-of-fact attitude stands out most clearly in retrospect. Two profiled Norwegian artists and a designer characterize her teaching. One says that Kari represented a precise and concrete drawing education, an analytic teaching that taught the student to see and analyze form and volume objectively (Bjørn Ransve 30.10.2011). The other that Kari taught the elementary drawing principles rigorously. Her teaching aimed at training the observation of the eye and provide knowledge about the abstraction that occur between the observation and the reproduction of it as sign symbols on the paper (Marianne Bratteli 24.9.2011). The designer says that Kari taught her to see lines and volume differently. To her, it was

revealing to watch a chair and then represent it trustfully in two dimensions on a paper (Birgitte Appelong 7.6.2012).

Kari's statement: "Any object regardless of form, can be analyzed down to a combination of circular and rectangular forms" (Personal Archive vol. 1g: 7), is normative and must be seen in relation to the positivist attitude of the time, and the interest among artists in mathematical structures in natural phenomena. She taught her students to inquire and to observe. Personally, I remember her refrain: "Let's go and take a look!" And I recall that the first time I was asked what I learnt at SHKS, I pondered for a while before answering: "I learn to *see*, to see my surroundings, the world, reality". Kari taught me to see objects like X-ray images, to analyze and clarify the contour lines of any form. In this way, her teaching in some ways was a forerunner to the electronic age. As in all teaching, one may ask if this method efficiently fulfilled its goal. Is the ability to abstract our environment down to two-dimensional form opening or restricting the students' future ability to use drawing as a communicative tool?

Reflections and Further Research

Today, Kari reflects on how to teach free hand drawing in an age of electronics. Even though the computer may make the drawing, the eye must be trained to do the right evaluations (Norwegian: "[…] på hvilken måte kan øyet trenes opp til de riktige vurderingene*? Hånden må i fremtiden også kunne mer enn å taste*.") (Torjussen 2004: 4), figure 14. New text books continually are published. Some presents the traditional basics (Rockman 2000), others are more specialized emphasizing aspects and attitudes that seem more relevant today (Gysin 2010; Klieber 2009). Free hand drawing is, however not an unambiguous term. In a recent doctoral work, the Danish teacher of the subject, Anette Højlund, underscores that drawing as a noun, referring to a) a practice, b) its outcome, the object, and c) that which happens in the gap between the practice of drawing and the realized drawing. Someone is drawing, something is drawn, and something appears while drawing. She writes: "Thus, a drawing is always an emergence of a conception, for the artist as well as for the person who sees the finished drawing" (Højlund 2011: 221). Traditionally, to draw is to represent something. According to Højlund, this attitude creates a dualism since the drawing itself is something different from that which is drawn. Regarding drawing as a creative process in which something emerges, allows the practice of drawing to become a tool for insight itself. Such an understanding may legitimize a renewed actuality of free hand drawing (Højlund 2011: 13-14).

Parallel to teaching students drawing skills they may need in their future careers, research concerning the past ought to be carried out. Little research is done on the design education at the highest level in Norway (Berre 2002). However, the archive left from SHKS, currently in The Regional State Archives, is quite substantial. It includes administrative documents, images, student work, Kari's Personal Archive and archival material from many other teachers. The library at KHiO keeps all the published and some unpublished material from SHKS (Aasen 1993), the annual reports, images, exhibition catalogues, and more. Old teachers are living sources to the past, remembering their own work, but also the teaching of their teachers. Many potential research possibilities lie in this material for understanding the teaching traditions of SHKS, free hand drawing in particular.

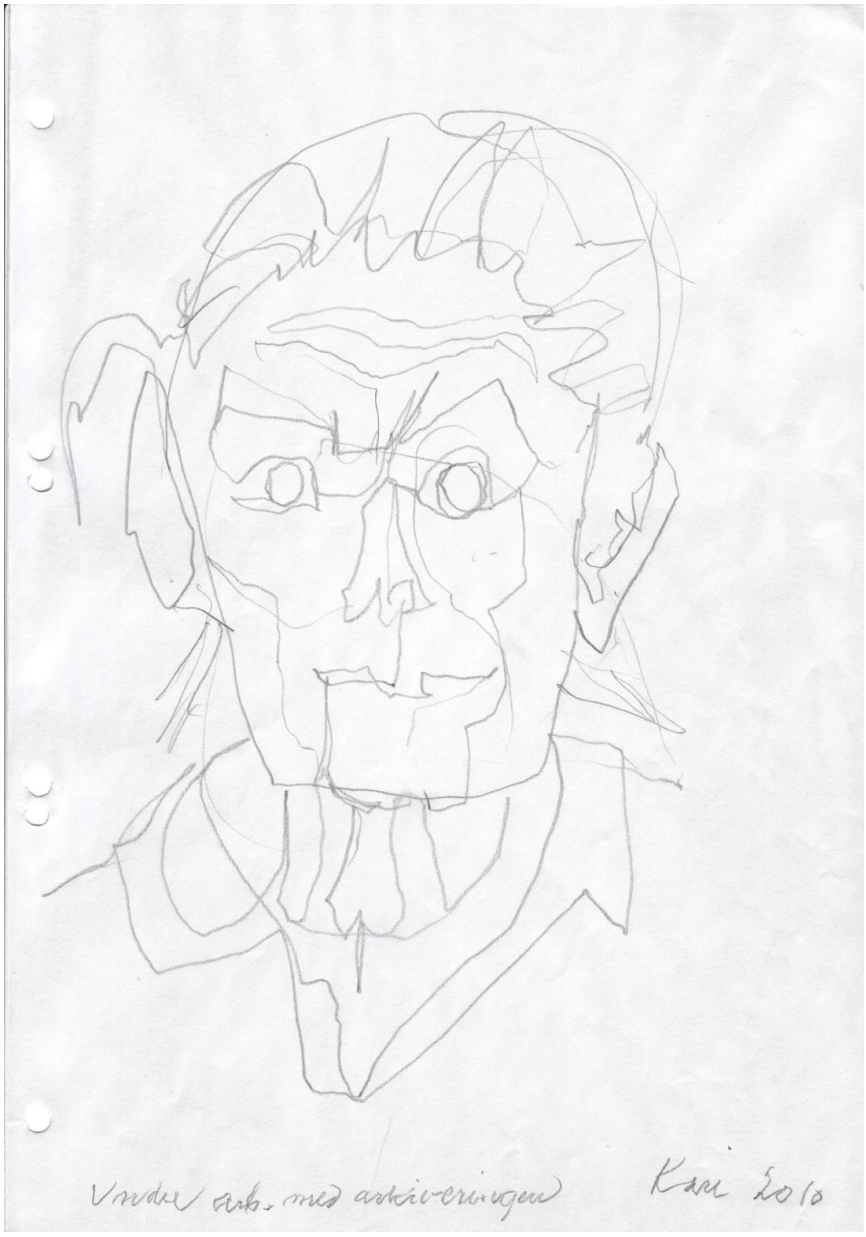


Figure 14. Self portrait, 2010 (Personal Archive vol. 2.12: 3).

This paper represents an initial step into an area that so far has received little attention and no research funding. Hopefully, opportunities for future research will arise. Personally, I am curious to know what they discussed in the Drawing institute. The reviews are well preserved in The Regional State Archives. More important might be to make comparisons with similar teaching traditions in other countries, particularly

in the Scandinavian and European, for instance in Germany, the Netherlands and the UK. One may ask whether the Norwegian approach was complementary, leading, following, or substantially different from the approaches elsewhere. Another topic of interest would be to look into the differences of teaching drawing for the art students versus design students. Finally, it might be exciting to explore whether the fundamental drawing teaching has left traceable impact on the mature artworks or design made by the former students.

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Designerly well-being: implications for pedagogy that develops design capability

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Abstract: The concept of "designerly well-being" identifies the value for individuals and society of the development of design capability inherent in all humans. This concept builds on ideas more generally of capability, well-being and democratic design. The paper explores pedagogic issues, particularly in relation to the development of an individual's understanding of themselves as a designer, how they engage effectively in the processes of designing and how they develop the confidence and confidence to positively exploit their own designerly capability in their personal life, social and community life or professional life. Key to this is the stance of the educator on the processes of designing. The paper will present research that make the case for an iterative, dynamic view of process, responsive to the changing demands within any design or design related task. This research illustrates the importance of recognising the preferred approaches to design activity of individuals and the importance of supporting individual preferences whilst building new strengths to establish a repertoire of design methods, processes, knowledge and skills. Achieving designerly well-being across society is ambitious. In considering pedagogic approaches that could support this ambition and drawing on research findings from projects with primary and secondary aged learners (ages 5-18), the relationship between individual approaches to designing and the way design challenges are presented structured will be explored.

Keywords: designerly well-being, design pedagogy, design education research.

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A NOTE TO AN INTERNATIONAL AUDIENCE OF DESIGN EDUCATORS.

While this paper is about design education, there is a need to understand the context in which this operates globally, within general education, where design is commonly included in Design and Technology Education or Technology Education. For this reason both Design and Technology and Technology education are drawn into the case presented through the paper. This is not to suggest that they are seen as interchangeable terms, but to recognise the reality of the strong links between them in general education.

Introduction

Historically and currently, design educators, design professionals and policy makers have made a case for the value and importance of design education. This can be seen in the British context from initiatives dating back to the industrial revolution right up to the present day where a major push is evident through groups such as the Associate Parliamentary Design and Innovation Group, the Design Council and the Design & Technology Association. But throughout this history there has been an ongoing tension between views on why design education is seen as important. At a simplistic level there is a dichotomy between those who see design education pointing towards the development of a capable and competent design profession and those who see it as the broader development of the designer in us all - of the development of potential design capability as part of the overall growth of rounded, capable human beings.

This overarching dichotomy has embedded within it further, more subtle, divisions. An argument might be made that 'professional' design education is the province of tertiary education and the 'human capability' model is the business of general education. On the face of it this has a certain logic, but in fact the split between what might be called the 'instrumental' and the 'liberal education' standpoints has dogged general education throughout history – providing a 'top down', assessment-led model of education that has seen schools providing a 'watered down' and stereotyped view of professional design education, in order to prepare the small percentage who choose to take this route into adulthood. In tertiary education it could be argued that the 'instrumental' view has also skewed design education towards a narrow vocationalism, preparing far more disciplinary designers than the world is ever go to manage to employ. Recent debates has seen a reaction against this with calls for more interdisciplinary approaches (Buchannan 2001) that enable design's broader contribution to what have been called Big Design ideas (for example addressing the need for clean water globally, or dignity in healthcare).

Threading through these arguments is a further subtlety – if design education is seen to be a good thing, and yet not everyone is going to become a professional designer, then what are the rest being educated for? An answer emerging ubiquitously is that the world would be a better place if everyone had a design 'literacy' (or sometimes design and technological or technological literacy) - an understanding of design that makes people critical consumers and users of the designed and made world. This sentiment can be seen in curriculum policy statements such as the following from 'Technology for all Americans' (ITEA 1996)

> Because of the power of today's technological processes, society and individuals need to decide what, how, and when to develop or use various technological systems. Since technological issues and problems have more than one viable solution, decision making should reflect the values of the people and help them

> reach their goals. Such decision making depends upon all citizens acquiring a base level of technological literacy - the ability to *use, manage, and understand* (my emphasis) technology. (ITEA 1996, p.6)

It is also echoed in the 'call' for papers for this current conference, where it is stated that

> To promote sustainability and meet global challenges for the future, professional designers are dependent on critical consumers and a design literate general public. For this purpose design education is important for all. (DRS // CUMULUS The 2nd International Conference for Design Education Researchers, Call for papers)

It would be difficult and indeed foolish to deny the importance of design (or technological) literacy, and in fact a strong case is made for the democratic value of this by Baynes (2005). However, there is a danger if this viewpoint is indicating the *total* value of design education to those that won't become professional designers, rather than just an important element of it. In this paper I present an argument for a 'capability' rather than 'literacy' view of design education that contributes to a concept of holistic "designerly well-being". I will then present pedagogic ideas and research that support the development of designerly well-being.

Capability, well-being and designerly well-being

Before going further, it will be helpful if I outline what I mean by "designerly well-being". The relationship between design and well-being is increasingly being explored to good effect through academic research and professional design, but the emphasis within this tends to be on effective ways for designers to engage in participatory design to produce products that support the well-being of others, for example who have a disability, or need health care (e.g. Larsson et al, 2005; Dilani, 2009) or on effective ways for designers to engage with models of sustainability in developing consumption-reduced models of well-being (Manzini, 2004). In both of these the emphasis is on what is produced in the name of well-being, not on the well-being of the 'designer'. I have presented elsewhere why I consider that it is important for the well-being of individuals and society to have design capability developed in all human beings. (Norman et al. 2010; Stables 2012). At an overarching level I am referring to enabling all humans to have the satisfaction, pride, confidence and competence to engage in designerly *thinking* and *action,* with criticality and capability, in their daily lives.

This vision builds on certain fundamental ideas, the first of which is the view of capability promoted by the economist Amartya Sen through his 'Capabilities Approach'. This presents a seemingly simplistic but profound view of capability as what a person *can be* (values and beliefs) and what a person *can do* (agency), and the freedom this enables. (Sen 1992). The second idea is a capability-based conception of well-being (as opposed to a 'desire' or 'happiness' based concept) developed by the philosopher Martha Nussbaum in conjunction with Sen (Nussbaum 2000, 2011). This view promotes the idea that well-being is based on achieving the 'functionings' or central human capabilities that present a spectrum of living, from bodily health and integrity to practical reason, imagination and thought, emotion, affiliation, play, and life itself.

The third idea is that all human beings are designers - that our design capability is one of the defining characteristics of being human. (Archer 1992; Baynes 2006; Black & Harrison 1985; Bronowski 1973; Csikszentmihalyi 1996; Nelson & Stolterman 2003). Enacting this capability in a way that draws on our beliefs and values, having a

sensibility to all that it means to be human, and that liberates with the impact of agency, might seem somewhat utopian. But my proposal is that this is the basis of designerly well-being. However, as with all utopias, designerly well-being needs to be nurtured. It is here that design education has an important role to play for all humans, not just those who choose to operate at a specialist, professional level.

Designerly well-being and democracy

If all humans have design potential, then the way that this potential is realised raises importance issues for democratic societies. Ken Baynes puts forward the idea that, just as Noam Chomsky talks of humans having a Language Acquisition Device, so too humans have a Design Acquisition Device that is a " 'wired-in' predisposition to explore and change their environment". (Baynes 2010, p 7). As with language he points out the importance of this device being supported and developed through education. He points out that

> although some of these young people will become professional designers … the large majority will be managers or citizens who have a range of design skills and ability to understand design and designing. They will be able to use these to enhance their personal lives and to improve their performance wherever their work brings them into contact with design. (Baynes 2010, p.18)

Presenting ideas from the 19th and early 20th century and drawing on the likes of Ruskin and Morris, he explores the relatively short history of a view of design as specialist professional activity and illustrates this view by modifying a quote from Eric Gill (1940) suggesting that "the designer is not a special kind of person: every person is a special kind of designer". (Baynes 2005 p.34)

He also identifies however, that the view of all humans as designers is a complex one and very much in conflict with a view of designers as specialists. He refers to the growth of literature from the 1970s that produced large amounts of publishing on the specialist fields of design that was not paralled by publishing on the role of humans as designers in a more general sense. His argument is that design criticism from that era was modelled on art criticism and celebrated the prowess of what he refers to as the 'hero-designer', that marginalised the important role of teams in the processes of design. In addition the products of the 'hero designers' were often celebrated before there was any real idea of how valued their products would be when seen in a social, economic or environmental sense. In discussing this idea he draws attention to the lack of recognition given to the user or consumer.

He also recounts a history that shows that the model of general education that emerged was one of the "watered down version of professional training". (Baynes 2010, p.28)

While Baynes is an advocate for developing the active capabilities of designing through imaging and modeling ideas, much of the focus he gives to the democracy of design is on the role all humans can play through their roles of consumers and users. He comments that, even today, design professionals are slow to develop ways in which consumers and users can engage directly in the creative, generative, modelling processes within design and highlights how the general public can be marginalized.

> design may be considered radical simply because it brings about fundamental changes in material culture. However, in the political sphere, there is the issue of

> power. Who has access to design skill? Who controls and benefits from it? (Baynes 2010 p. 55)

He also hints at the dangers of leaving all design entirely in the hands of professional designers because of the way that professional design is driven by market concerns. When considering environmental issues he points out "in fact, designers have made relatively little progress in being able to tackle these issues whenever they fall outside somebody else's commercial or political agenda." (Baynes 2010 p. 57)

This somewhat paternalistic view of the agency of design resting with professional designers has been voiced by others. Michael Shannon, making a case for public design education in 1990, raised the issue of disempowerment.

> No one *has* to discover or design any longer, and those who might be inclined to are discouraged by the high levels of specialized knowledge required. Many people feel isolated, unfulfilled, unable "to make a difference. (Shannon 1990, p.36)

Both Baynes and Shannon are presenting a perspective that runs counter to the notion of designerly well-being for all humans. Steve Keirl raises similar concerns about the general population being eliminated and alienated from design decisions and in doing so argues for a design education that highlights the importance of critique and of challenging what is happening in the name of progress. His view is that the only appropriate or "good" form of design education is one that is based around ethical practices that involves "critique" at the same time as "intention". He expresses particularly concern about uncritical design activity, highlighted by the following statement.

> Our capacity to design and make sets us apart from other species although our capacity to head into the future uncritically may, in another sense, not set us so far apart at all! (Keirl 1999. p 79)

What the arguments above highlight is the importance of design education to equip young people to be able to contribute in an informed and critical way to more a democratic view of design. This view echoes the Capabilities Approach to well-being put forward by both Sen and Nussbaum. In turn, this view is integral to a motivation and confidence to contribute actively and creatively to the processes of designing, either through generic everyday activity, or through more specialist design activity.

The importance of making

In parallel with exploring the need for developing a more reflective, critical dimension of designerly well-being there is also considerable importance in considering the more tangible, visceral dimensions that come through the act of making. I am not attempting here to reinforce an unhelpful dichotomy between 'doing' and thinking', but to maintain a balance in sharing dimensions that inform on the concept of designerly well-being. It is important to understand the ways in which making provides alternative ways of knowing, as (for example) has been made vividly clear by the fascinating ethnographic studies of craft apprentices by Trevor Marchand (2008). In observing the way learning and teaching takes place in three disparate settings (minaret builders in Yemen, mud masons in Mali and fine woodworkers in London), Marchand considers the nature and communication of *embodied knowledge* and the way this is negotiated, understood and learned through the practice of making.

> Knowledge is not confined to the sorts of concepts and logical propositions that are expressed in spoken language. … Knowledge necessarily extends to other domains including emotional, sensorial, spatial and somatic representations. Though these domains may be defined as faculties of knowledge 'beyond language', they are nevertheless learned, practised, expressed and communicated between actors, most evidently with the body. … contest[ing] standard divisions made between a 'knowing mind' and 'useful body', and direct[ing] researchers to assiduously heed actions as well as words. (Marchand 2008 p 257)

He also draws attention to the extent to which what is being learned goes beyond technical know how and skill, creating resonance with the Capabilities Approach to well-being as he describes the richness of the learning.

> These include technique, worldviews and a set of guiding principles for ethical judgement; and in some cases, training encompasses devotional religious practices, the performance of magic and correct enunciations of powerful benedictions. (Marchand 2008, p 250)

The explicit relationship between craft activity and well-being has seen increased interest in recent years and points to further valuable insights to designerly well-being. In a briefing note for the Crafts Council, and drawing on their recent report 'Making Value' (Schwarz and Yair 2010; Karen Yair 2011) highlights the breadth of ways in which craft practices and craft practitioners contribute to human well-being. Referring to case studies from the 'Making Value' report, Yair indicates a range of ways that practitioners have worked in community and education settings, demonstrating benefits to the well-being of people with disabilities and to those who feel socially excluded.

> Collectively, it seems that these distinctively craft based experiences encourage a sense of achievement and ownership. This, in turn, builds the confidence that strengthens social interaction and ultimately well-being: research suggests that social connectedness is perhaps the single most important factor in distinguishing happy people from those who are merely 'getting by'. (Yair 2011)

In addition she highlights the growth in social craft activities such as knitting circles and other craft related clubs and groups. Linked to this she identifies the work of Betsan Corkhill, a physiotherapist who has undertaken extensive research into the theraputic value of the craft of knitting in supporting well-being, for example in the management of pain, addiction and dementia. (Corkhill 2012)

In a schools learning context, the importance of hands-on learning, has been emphasised for more than a century through educational models such as 'sloyd'. There is a current growth in interest, as can be seen, for example, through Guy Claxton and Bill Lucas' recent report "Making it" (Claxton et al. 2012). In presenting a model of studio teaching, they draw on work such as Matthew Crawford's "The case for working with your hands" (Crawford 2010), and the pedagogies of MIT's Project Zero team, including 'studio habits of mind' (Hetland et al. 2007). Through research with teachers that focused on pedagogic 'dimensions' of studio teaching (such as creating authentic activities; organising space; making learning) they focus on building learning power in what they refer to as the 'four Rs': Resilience (emotional strength); Resourcefulness (cognitive capability); Reflection (strategic awareness); and Relating (social sophistication). Of particular interest in the context of designerly well-being, classroom

trials indicated the biggest change in learners was their independent decision-making and the confidence gained through managing their own learning. They also noted

> Our indicators of learning engagement include attentiveness, absorption, observable effort willingly given, indications of pride and the willingness to talk with animation about the learning taking place. (Claxton et al. 2012, p. 8)

Pedagogic ideas and issues

While there are some notable projects presenting models that support the concept of designerly well-being, there is also evidence of practice that is having quite the opposite effect. Over the last two years, England has seen a number of reports all expressing views on the importance of design education in schools and also highlighting the strengths and weaknesses of what is on offer, particularly through the school subject of Design and Technology (Ofsted 2011; Ofsted 2012; DfE, 2011; Miller 2011; Henley 2012; Design Commission 2011). A more detailed account of the issues raised across these reports appears elsewhere (Stables 2012) but the headlines indicate that there is general support for the contribution of Design and Technology. Where it is taught well it is a popular subject, teachers have high expectations of learners, present challenging and ambitious projects set in relevant contexts. Such teachers fascinate and intrigue learners, engendering 'palpable excitement' when learners are engaged in their work. However, this is only one side of the story and the 'flip side' indicates a subject that is too often formulaic, too narrowly focused, lacks challenge, spends too much time on worthless tasks and too often results in a string of unfinished projects. While there is clear evidence of the potential for the development of designerly well-being through teaching that is enlightening, inspiring, challenging and innovative and that sparks enthusiasm and passion, and develops competence, confidence and pride, what is clear is that new pedagogic models and ideas are needed. Lauren Resnick (1987), in articulating what she sees as the difference between 'in-school' learning and 'out of school' learning, identifies distinctive polarities, such as individual cognition versus socially shared cognition, symbol manipulation versus contextualised reasoning, generalised learning versus situation specific competence, that increasingly make 'in school' learning "coming to look increasingly isolated from the rest of what we do" (Resnick 1987, p. 15). These views from more than 25 years ago have resonance with the escalation of initiatives that provide learning opportunities beyond formal classrooms (and often celebrated through the likes of TED Talks, or raised through the concept of the 'flipped classroom') that are exciting, relevant, challenging, risky, socially engaged and motivating and that develop creativity, innovation, responsibility, confidence, competence. All of these can be seen to support the development of designerly well-being. The contrast between in and out of school learning caused me recently to draw the conclusion that

> In school we get to do the worthy but often un-inspirational stuff – that meets the needs of a curriculum full of content and monitored by an assessment regime that is stifling it. Out of school we get to do the inspirational, exciting, challenging stuff that (in my view) nurtures designerly well-being. (Stables 2012, p. 430).

But if this is (too often) the case, then what is to be done? While we may not have all the answers, there is a wealth of educational research to be drawn on the provide pointers to effective pedagogic approaches and I will turn now to some key

considerations, beliefs and ideas and the research undertaken at Goldsmiths in the Technology Education Research Unit, that has underpinned them.

Over the last 25 years we have undertaken a series of research projects that have explored ways of developing and assessing design and technological capability. Throughout these research projects, certain critical aspects of learning and teaching have been highlighted, all of which have some bearing on developing designerly well-being.

- Supporting design activity – views of process
- The centrality of imaging and modelling ideas
- The 'need to know' as the driver for learning
- Structuring activities – choreography not management
- The importance of authenticity

What follows is an articulation of these aspects and an account of related pedagogic issues and approaches the research provoked.

Supporting design activity - views of process

In the 1980s we undertook a research project, funded by the UK Department for Education, in which our brief was to assess the design and technological capability of a 2% sample of UK 15 year olds (10,000 learners). Our findings, based on the analysis of 20,000 short (90 minute) design activity portfolios, based on an authentic activity instrument created for the research (Kimbell et al 1991) highlighted the importance of performance and process in understanding this capability and resulted in us proposing and confirming an iterative model of process in which designing is seen as complex, non-linear, driven by an iteration of thought and action and a determination to take a hazy starting point of an idea and relentlessly pursue it through to a fully developed prototype or outcome. The model was articulated through the diagram shown as figure 1, below.

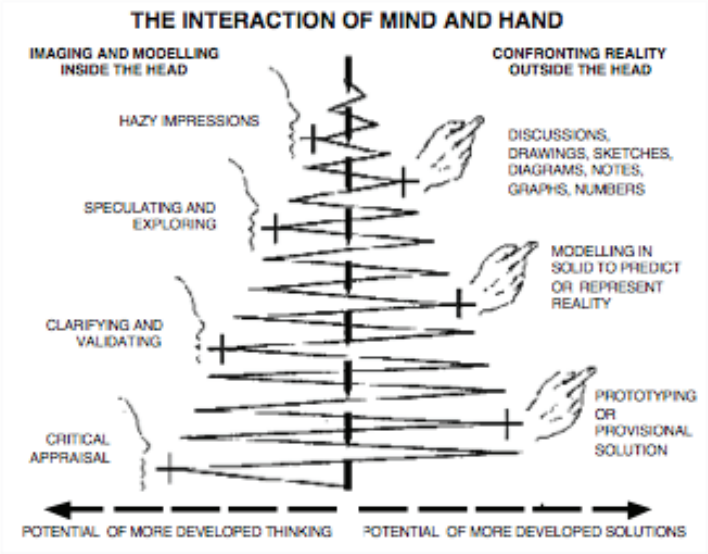

Figure 1. The APU Design & Technology model of process (Kelly et al. 1987)

This initial research allowed us to profile ways in which learners approached the processes of designing and to see how these approaches impacted on their performance. At a simplistic level, using the model in figure 1, we could identify learners whose approach had a 'reflective skew' or an 'active skew' and also where the approach showed a balance between action and reflection and, where this created good performance, that action and reflection were bound together by an iterative web of thought and action that supported strong growth of ideas. Delving deeper into these 'holistic' profiles indicated that, while there were aspects that characterised high or low level performance in design activities, there was no one way of being good or bad. There was no uniform process to be witnessed. This posed a dilemma for schools education at that time (and, to an extent, still today) as the orthodoxy was of a single, linear view of process (identify a problem; research; generate an idea; make it; evaluate it). Because of its perceived uniformity, this linear process supported the teacher in managing and assessing design work. The research team, however, became increasingly aware that the model we had created had resonance with research going on beyond the school context (e.g. Darke 1979; Buchanan 1995; Cross 1982; Lawson 1990; Jones 1980). Building from this first project, further research projects have added to our understandings of processes of designing such as individual preferences or 'designing styles' (Lawler 1999, 2006) and the ways these can be affected (for good or ill) by pedagogies adopted by the teacher.

The centrality of imaging and modelling ideas

If the process of designing is not governed by a pre-specified linear set of steps, then what is driving the process? The initial research indicated that the lynchpin was the growth of ideas and through more recent research involving analysis of a range of design portfolios submitted for GCSE (English national assessments at age 16) and the subsequent development of a six hour design activity undertaken by 350 learners, we

qualified this further as 'having', 'growing' and 'proving' ideas. (Kimbell et al. 2004) Having parallels with what Jane Darke referred to as the 'primary generator' (1979), our research through up a further challenge for pedagogic orthodoxy in schools – that having done some research, learners should put forward a series of ideas (often by drawing 4-6 boxes and putting one in each). We were looking throughout a total design activity for every small spark of a new idea (having) and then seeing what the learner did with each of these ideas (growing) and how they made decisions about their development (proving).

The 'need to know' as the driver for learning

Having an understanding of the role of ideas in driving the process of designing, we also needed to understand what was the drive for the learning taking place. Returning to the orthodoxy, teachers typically work out what they want to teach (that may or may not coincide with what learners want to learn) and structure a project where this teaching can be wrapped up in a palatable form. Our hypothesis from the early research was that any design challenge would allow learners to draw on what they already knew and could do and that, importantly, would also act as a catalyst for the 'need to know' new things. This meant that when looking to assess capability, we were more interested in whether the learner could identify what they needed to know and had an idea of how they could find out, that what they already knew. In more recent research (Kimbell et al. 2006) we actively sought data from learners (10 – 12 year olds) at the end of a design activity about what they had found easy, what they had found difficult, what they had learnt and what they wanted to get better at. Their responses gave insights into where learning and teaching knowledge, skills and understanding fitted in for the learners. Responses also indicated the extent to which they could begin to take responsibility for their own learning – to become what Glaser (1987) called " 'expert novices' who, although they may not possess sufficient background knowledge in a new field, know how to go about getting that knowledge." (1987 p.5)

Structuring activities – choreography not management

Having created a model to characterise the processes of designing, we also found that we had a provided ourselves with a framework for structuring activities that presented an alternative to the prescriptive, management focused, linear model. This framework has been important because much of our research has required us to structure short design activities (typically between 90 minutes and 2 days) in order to explore aspects of learners' performance. These short activities, and the portfolio structure that has characterised them, we came to term 'unpickled portfolios' (Stables & Kimbell 2000) to distinguish them from extended projects where learners are 'steeped' and 'infused' in a lengthy learning experience. In creating the framework we have been mindful to take our lead from the model – so the model anticipates that the process begins with that initial spark of an idea and that learners are then prompted through a series of active and reflective "sub tasks" designed to scaffold, in a responsive (rather than prescriptive) way, performance of design and development. We have taken the concept of choreography to describe this approach and to distinguish it from more prescriptive, linear, management models of designing.

To illustrate how tasks were structured in this way, the following is an illustrative sequence of events for a six hour task, starting after the design challenge has been presented.

- Put down first ideas
- Swap work with 2 team mates – for further development
- Review ideas and continue individually with early development using drawing and/or 3d 'sketch' modelling
- Pause and reflect on end user and context of use
- Continue development
- Record development photographically, and comment on progress and next steps
- Repeat development and recording at 45 minute intervals
- Swap work with team mates for 'critical friend' reviews
- Review comments
- Fast-forward development with an annotated sketch to show how a completed outcome would be.

Part of the framework for this task was created through the dynamic collection of work in a portfolio that was created by a customised unfolding booklet (figure 2) that allowed learners to keep sight of their total work as ideas progressed.

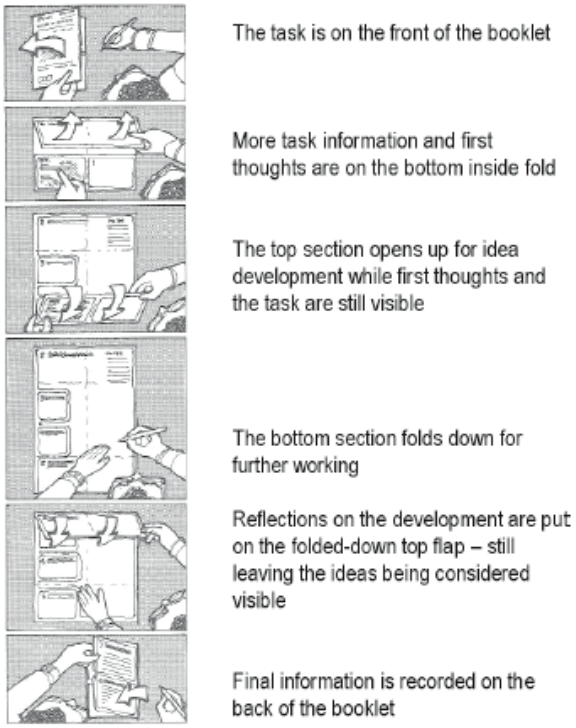

Figure 2 the unfolding booklet of the unpickled portfolio (Kimbell et al. 1991)

Throughout our research we have collected data on the response of both learners and teachers to the design activities we have used and consistently we have received positive responses to the value of the way the activities have been structured, including the way in which what might appear to be a straitjacket has been perceived as

liberating – supporting creativity and innovation. The structure seems to become invisible as the learners focus on the development of their ideas, rather than how to organise their work. In current research, the paper portfolio has been entirely replaced by a digital one, in which learners can draw on a range of text and imaging tools to develop their ideas, with all drawings, photos, videos, audio files, text files being seamlessly uploaded to a dedicated web space every 20 seconds. This shift to a digital portfolio has provided greater flexibility through the choice of reflection and documenting tools, supporting a broad range of learning styles and learners with special educational needs, while the active/reflective choreography of the original model remains in place. (Kimbell et al. 2009)

The importance of authenticity

The starting point for the original research in the 1980s was to assess design and technological capability by trying to understand what is actually going on during the performance of designing, rather than how well learners could jump through a set of hoops that had been pre-defined as a design process. Thus, from the outset, we were keen to attend to authenticity – both of the process and its dynamic documentation, as described so far, and also of the design challenges presented to the learners. In the initial research we needed draw learners quickly into both an understanding of what a design challenge is and the context in which we were setting a series of challenges – and we did this through presenting snapshots of scenarios, issues and fertile ground for finding design tasks through short videos. More recently we have presented design challenges supported with resources such as user profile cards, image banks and handling collections of 'inspirational' objects. The aim in all of this has been to present authentic challenges what we have referred to as 'context-rich tasks'. The breadth of learners we have worked with has involved us in writing stories for six year olds who were designing for someone that they missed, creating scenarios around transporting medicine in heat and across rough terrain as a preamble to design tasks with teenagers in South Africa and presenting user profiles of people taking regular medication to both primary and secondary aged learners to support them developing innovative solutions to a 'pill dispensing' challenge. In each case the aim has been to provide insight into the issues in a context along with motivating challenges and inspirational resources whilst leaving space for the learners to make the task their own. Feedback from teachers and learners has consistently been positive. In recent research we asked learners to give us specific feedback on what was inspiring them in the challenge they had been set. What was apparent was not just that the learners found all of the resources (design briefs, user profiles, inspiration objects etc) useful in various ways, but that they were able to make the tasks their own by the way the resources prompted them to draw on their own life experiences as well. This is captured in the following comment from the 'pill dispenser' challenge.

> The thing that inspired me was that my granddad takes lots of pills so if I could create one this maybe would help him take it and not forget in the evening or the morning, forget to take them which would be very vital to his health. He has been a big role model in me creating this product. (Stables 2010)

Where does this take us for designerly well-being?

The research we have undertaken has provided a range of pedagogic approaches that support the development of designerly well-being. However, these approaches

are likely to present challenges to teachers. They require a shift in understanding – of the nature of designing processes, of the value of a 'need to know' approach to learning, and of the importance of leaving space for the learner – in both the task and the process. Even if understanding shifts, the practicalities and challenges of managing more open, responsive and diverse approaches to designing and learning are considerable.

Ways of supporting learners to understand their own processes and, through metacognition, develop their own ways of bringing designerly thought and action to bear on challenges have become a cornerstone of our pedagogic approaches. While the insights we now hold have been derived empirically, seen more generically they are not unique within educational settings and have resonance with many learner-centred views of education. But even if adopted more broadly, would they, in themselves, develop designerly well-being?

In my view they provide a sound starting point, but aspects remain for further exploration and understanding. The following list begins to scratch the surface.

- How do we develop the combination of the capable designer and critical consumer– how do we develop what a person "can be" as effectively as what they "can do"?
- Do we understand enough about how to motivate learners and to deal with emotional challenge, such that they are willing to take risks, become confident and have faith in themselves as designers and as learners?
- If we can create "expert novices", how then do we provide the necessary support and guidance to manage and resource the consequent 'need to know'?
- What pedagogies within and beyond those in our research can we draw together and exploring to create a rich repertoire of tools for learning and teaching?
- Does the same value exist for exploring designerly well-being in professional design contexts?
- How will we know if achieving all of the above will impact on well-being in society?

The challenge is immense. Perhaps a start would be to understand better the emotional impact of design experience on learners. The story will continue.

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