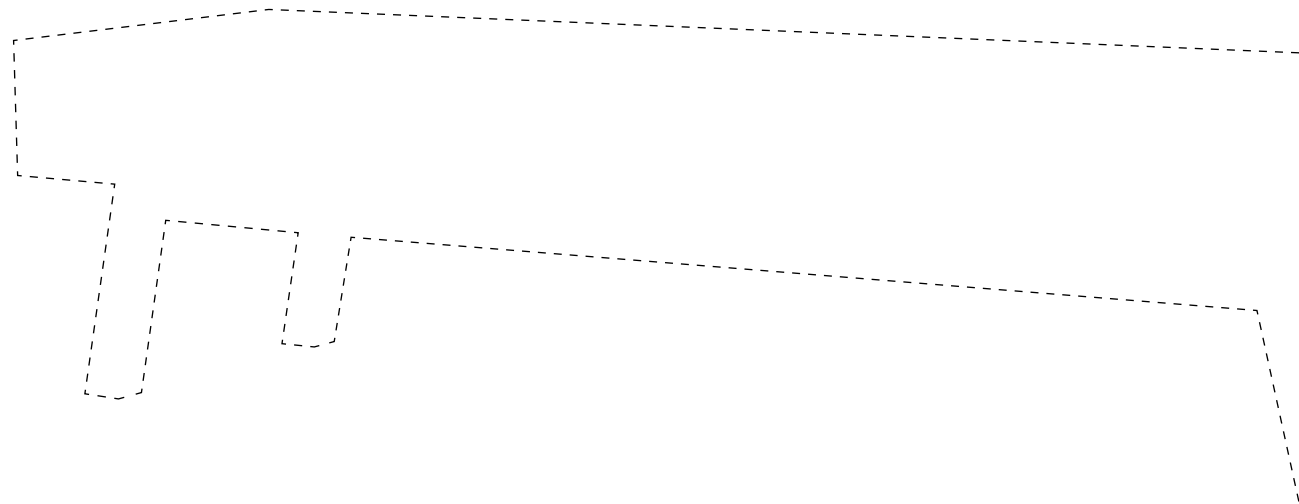


PDM 5900
JAKOB AGLÉN

**APTO
CUSTOMIZABLE
FURNITURE
SYSTEM**



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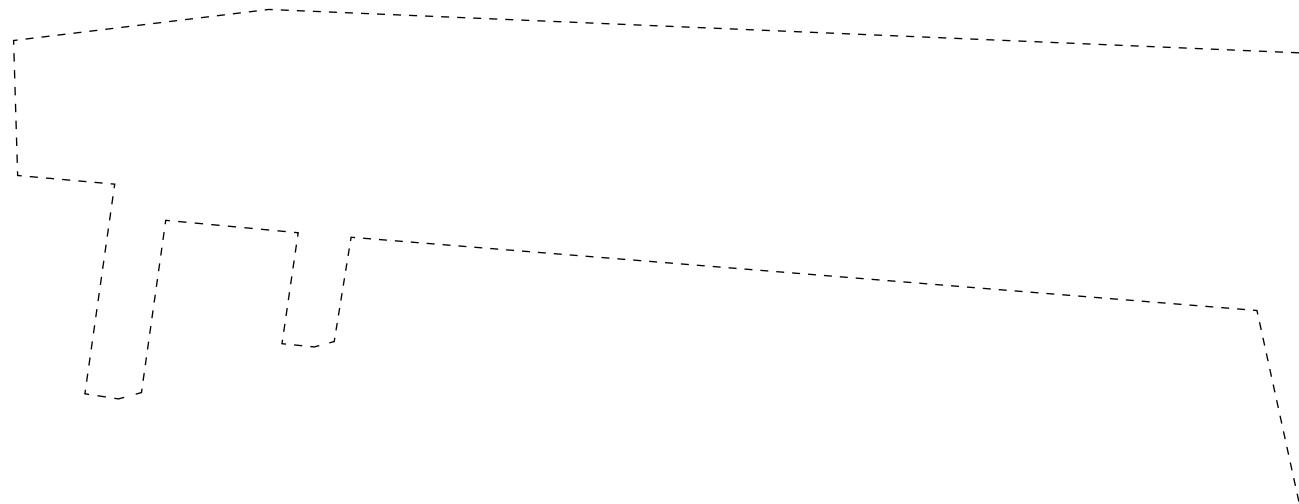
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APTO CUSTOMIZABLE FURNITURE SYSTEM.

A system attempting to merge the qualities of manual manufacture with the advantages of regular serial production.

Through a range of customizable options, prior production, ones Apto furniture can be anything from a table in the living room, a desk in the office or a dresser in the hallway, and with almost 40 billion different possible combinations, one should be able to make something to ones liking. Every furniture is made by hand and no single variation is made twice, guaranteeing that every Apto furniture is 100% unique.

The system strives to accommodate effortless, yet flexible user customization while ensuring a visually, constructionally and functionally reasonable product.



PDMK 5100

With global serial production offering ever cheaper production cost, local craftsmanship, time demanding and expensive, is having a hard time competing, the cost of local (Norwegian), manual labour being significantly higher, even compared with serial production at the same level of quality and finish. Thus traditional local crafts such as the shoemaker, tailor and the furniture carpenter slowly vanishes; as global franchises substitutes the local specialist and replacing substitutes repairing.

This reality became unpleasantly relevant during my internship at Nævdal A/S, a Bergen-based furniture carpenter run by the Nævdal family for over a century, as they now have to shut down production, 126 years old. What little might remain of their products and services will now be manufactured abroad.

Prior my internship I did a project, pdmk 5100 where I worked on a system to make handmade furniture more available and accessible to the customer. A more predictable system where the

product was already finished and the price was final, yet maintaining handmade aspects and being a unique, one-of-a-kind product.

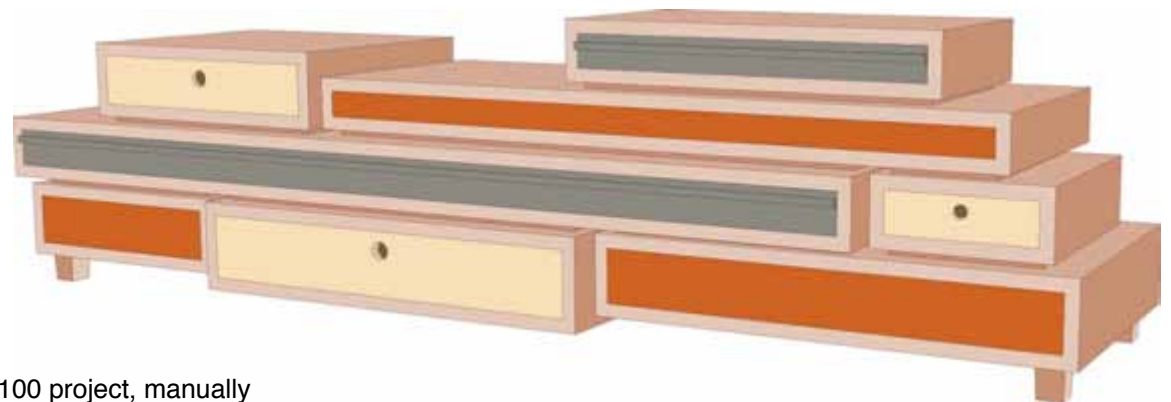
Nævdal already had a range of ready developed furniture, made per order, but most of these, had no determinable aspects exclusive to hand-manufacture and could just as well be done through regular serial production, at the same quality yet at a lower cost.

Based on this I wanted to make a product / product system, more predictable / determinable than the regular furniture carpenter assignment, where the customer

might only have a vague idea of what he/she wants, and perhaps a place to put it. (Gerke Evensen, managing director, Nævdal A/S) A system where the customer already from the start to some extent could see, touch and try the final product, as with ready-made, serial-produced furniture, yet maintaining the handmade, one-of-a-kind aspects exclusive in manual manufacture. Somehow, to get the best from both worlds, and provide both the customer with just a vague idea of what he/she wants, with a more defined/precise option, and also to lower the bar for customers looking at ready-made alternatives, to consider the

advantages and unique aspects that handmade furniture provides.

In pdmk 5100 this was done with a modular shelving / storage system, where all the modules were 'shuffled' and rearranged for each unit made. Thus ensuring each unit being unique, yet part of a recognizable system/brand. Though with each module made the same way, production time and cost would be kept down and. Thus the customer was offered a handmade, one-of-a-kind furniture, yet ready-made and with a fixed price. (ill. 2.1)



ill. 2.1 / the pdmk 5100 project, manually manufactured, with modular variations in each product.

PDM 5900

With offset in the pdmk 5100 problem, the research question for pdm 5900 became: How to combine aspects exclusive to manual manufacture in a small serial production, making custom, handmade furniture a more affordable, visible and accessible product.

Though the pdmk 5100 to an extent managed to bridge this gap between serial produced, ready-made furniture, and manual manufacture, there is still much to work with here as I wanted to take the concept further, thought with a different approach and direction.

First, though all the modules in the pdmk 5100 was 100% variable and not restrained to any kind of grid (other than straight angles), similar compositions can be done e.g. with the Montana system, serial produced, at a lower cost. And while the pdmk 5100 was intended to be a finished, fixed furniture, once produced, a similar Montana shelf could easily be rearranged and expanded any number of times. (This fixed / final solution can be justified if it supplies the system with aspects that e.g.



iii. 3.1 / different takes on the concept of storage.

Montana cannot offer, and with the pdmk 5100 this was only the case to some extent, as it would guarantee never to make the same unit twice, while anyone can make a Montana furniture identical with the next one.)

The greatest lack in the pdmk 5100 however, and one of the main reasons for customers to contact furniture carpenters in the first place is the aspect of user customization. This ranges from having a given system / framework the customer make choices within, or a 100% open system where the customer practically makes

every decision on his/her own. The latter of course gives an enormous flexibility only limited to the technical or physical capacity of the machinery or materials, while the former provides a more manageable range of choices to the customer. With the pdmk 5100 however, there was only the choice of whether one wanted the current version, or not. (The advantage of such a post-production purchase is of course the ability to see and test the final product before purchase, and this aspect should, to some extent, be preserved regardless of which system / framework I end up with.)

I decided to stay with a storage system / furniture also in pdm 5900, as the range of different functions and individual choice present in areas of storage, provide a natural premise for a user-customizable furniture, and is already a common occurrence in both serial produced, ready-made systems and custom made, manual manufacture. Also much of the reasoning and choices in pdmk 5100 was directly linked with the storage problem and to 'translate' this into another function / system would only unnecessarily complicate the task.

INTERVIEWS & MARKET RESEARCH

Revising pdmk 5100.

With the pdmk 5100 already at a presentable level and being so close to my current project and research question, I brought the report and some sketches from this project to different furniture retailers, carpenters, tutors, fellow students, laymen, etc. for feedback and proposals for my current

project. Based on this feedback I made modifications for the pdm 5900, and returned to some of the responders for further comments as the project developed.

Function.

Despite a general good response on on the graphical / visual dimensions and arrangement of the modules, several retailers commented on the actual function of each module. The thinnest

having an inner measure of 4,5cm, but a width of 120cm could store half a A1 poster, arguably not the most commonly stored article.

I was advised to start out with a desired storage function, and scale the module accordingly. (ill. 4.1) However my collaboration partner, Boris Praskac at Eske Interiør#Design warned me not to have the modules to function specific, but rather find a generic size to fit most functions, as people store different things, and formats

like CDs, DVDs, etc. eventually will become obsolete and be replaced by new formats with different dimensions.

Naturally, the aspect of user customization was mentioned here, and again the balance between a 100% flexible, yet less determinable system or a more fixed framework which the customer chooses within, was discussed.

DVDs HiFi remotes **books** boardgames
magazines framed pictures CDs video games
vases/glasses/etc. **newspapers**

Market potential / target group.

Meeting with Frank Nymand Olsen, Managing Director at Paustian, Oslo, pointed out that though the pdmk 5100 was a visually interesting product, it was certainly not “easy on the eye”, and the customer segment both able to afford it and willing to have it in their living room would be very narrow. Serving as much as sculpture as an actual functional product, much resembling the Droog design approach. Thus, if the goal is commercial success

more than design blog publicity, one might want to moderate the design some.

Again I was advised to begin with a precisely defined target group (young adults, 25-55, with good income, wanting something special / different) and develop the project with this in mind. There is of course also an important element of semiotics and sign value¹ here, and what the product communicates. (ill. 4.2)

Construction / manufacture.

Talking with Oslo based furniture carpenter Mikkel Hald, resolved some technical/structural elements. The board thickness, initially 6mm thick needed to be at least 10-12mm with the given dimensions. Doors/drawers extending outside the opening, covering parts of the board thickness, would however make the boards appear thinner, if desirable.

Simply gluing the boards together could give some weak joints in the end boards, that were only supported from one side. Enforcing these boards with Lamello or Domino joints, would strengthen the joints. Erik Marten Nilsen-Moe, at Fritz Hansens showroom, Sjølyst plass also mentioned that narrower

board widths would reduce the effect of wood movement across the grain. A base to support the furniture was also recommended, the original model simply resting on four feet connected directly to the bottom left and right modules. Oil would probably be the best choice of finish, despite the extra need for maintenance, as it brings more life and texture to the wood and as the end grain gets darker than the rest of the wood when oiled, emphasizing the end joints. The project was roughly estimated to cost 45.000,-, including materials and mva. With a production of 10 units, the cost could be reduced by approximately 10%. This being quite expensive, even for a handmade furniture, it can be difficult to justify if the user can't customize it him/herself.



ill. 4.2 / panton chair, gold and wegner's round chair. a contrast of products sign value and semiotics.

1 Baudrillard, J. (1972) *For a Critique of the Political Economy of the Sign*.

Montana.

To see what current serial produced, modular based storage alternatives on the market, can and cannot offer, I looked into various alternatives, like Vitsoe, Vita, IKEA and Montana. Montana stood out as not only one of the biggest suppliers on both the Norwegian and global market, but definitely also one of the companies who have taken the user customizable, modular based, storage furniture furthest. Having 42 basic units, available in 4 different depths and 46 different colors, with a variety of doors, drawers, feet, bases, etc. their system provides a variety of no less than 5 billion possible combinations.

However every single combination is confined within the same modular 5,7cm grid, regardless of where or when you buy one. Practical of course when one need to expand and combine the different modules, thought inevitably chained to the same global furniture franchise which makes a shelf in a hong kong apartment no different from one in a house in Bodø. (ill. 4.3)

A system with this much variation and so much choice left to the

customer also put a high demand on the retailer. Every montana sales person need to be schooled and regularly updated on the system in order to give the customer proper advise when making an arrangement, both with regards to construction, trends and economy. One of the biggest challenges with user customizable systems, according to managing director at Vitra Scandinavia, Loni Barsten, lies in finding suitable retailers.

Not being Montana.

With the Montana and similar systems so refined in terms of user customizable, modular based, furniture, one can at best manage a similar system, with no market foothold or established name, by going down the same direction. Thus looking at what Montana does not provide, despite or even because of it's size, seem a far better solution.

One thing to notice about the Montana system is, despite having guarantees on both color supplies, life expectancy and ethical production conditions, as anyone can buy any module anywhere in the world, there is no guarantee for your shelving system actually



ill. 4.3 / interior with montana shelving system.

being 100% unique. This will be far easier to execute and control with a pre-production customized system.

Further, any montana system consist of modules. Thus three modules sitting together pretending to be a shelf, will nevertheless be three modules sitting together, pretending to be a shelf. The homogeneous merge you get with the three modules put together in production, will be lost and where one separating wall would suffice you will have two outer walls pretending not to be there. (ill. 4.4)

T. Michael.

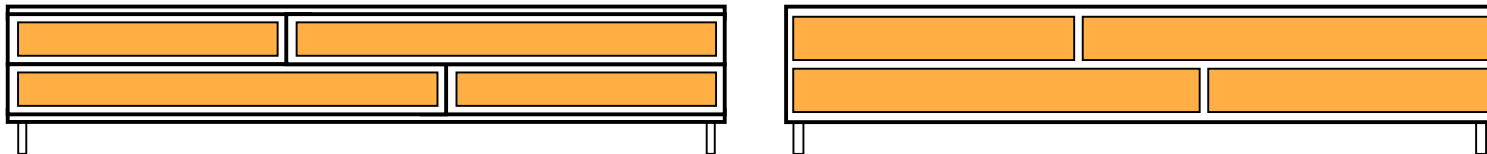
Tailors, though also a declining profession, have been doing pre-production, user customized manufacture for centuries, thus visiting one seemed a natural

approach to figure out how this could work in furniture carpentry.

Despite a narrow market, and competition even here, T. Michael have successfully established a bespoke tailoring shop in a city of roughly a quarter million people (Bergen), and have now expanded with an store in Oslo. Most of the tailoring done in Portugal (though largely by hand and on specific instructions from T. Michael), the Savile Row ideal of local craftsmanship and manufacture is somewhat dented, still the aspects of manual labour and a truly custom made product is preserved. More ready-made / off-the-rack garments are also for sale, though these can be modified and adjusted if necessary.

With a bespoke garment from scratch, a customer might come in knowing only she wants a suit. The

first clarification is then normally occasion; work, casual, party, etc. Then, based on the customers style, taste and measurements, a suit is designed and sent to Bergen (T. Michael) for a final review before it's sent to portugal for manufacture. Once the final garment returns, the customer tries it on and any further modifications is done locally. The customer might however return for adjustments as his/hers body eventually changes, making the relationship with the tailor a lasting commitment. Similar relationships can be found in funritrue carpentry as the customer return for mainanace or repair on furniture.



ill. 4.4 / the difference of furniture assembled by ready made modules compared with all modules being manufactured as one homogenous furniture.

Norwegian rain.

T.Michael together with creative director Alexander Helle and graphic design studio Grandpeople, have made a pre-fabricated line of raincoats. A raincoat designed to withstand Norwegian weather conditions, without compromising on style or finish.

Available in sizes from XS to XL and in three different colors, the raincoats also come in two different lengths (mid and full), and two different cuts (single and double breasted). This range of variation, though pre-fabricated, provides the customer a range of choice and customization otherwise reserved bespoke tailoring and a much higher price tag. (ill 4.5)

Another aspect of the Norwegian Rain raincoats is the possibility to actually try, see and touch the finished product and all variations before committing to a purchase. With traditional bespoke tailoring the client might commit to buying something as generic as (e.g.) 'a suit', without knowing how it will actually look, how much it will eventually cost or how long it will take to finish. Implementing this balance of predictability (of

both price and final result) and restraint (how much can be chosen/customized) will be crucial for my final furniture concept in order to successfully merge the best from serial production with manual manufacture.



ill. 4.5 / variations of the norwegian rain raincoat. (left) single breasted, mid length, chaircoal. (middle) single breasted, full length, mixed black. (right) double breasted, mid length, olive green.

Eames Plastic Chair system.

Such amount of pre-fabricated variation on a single product is also found in furniture industry. A more comprehensive example is the Plastic Chair system designed by Ray and Charles Eames in 1950 for the International Competition for Low-Cost Furniture Design. Each chair consisting of one of two single-moulded plastic seats (Side Chair and Armchair), available in 8 different colors. These can be attached to 7 different feet types, including a public bench version, rocking chair feet (only available with the Armchair mould), and wheels for office use. Further they come with none, full or half upholstery in 13 different fabrics (hopsacks). This should give a total of 2808 different variations. Finally a number of detachable cushions are also available, sold separate.

Plus another 105 versions if you take into account the DKR/DKX Wire Chair variations available. (iii. 4.6)

Despite this range of choice, Hanna Ekstrand at Vitra showroom, Oslo testifies that customers don't seem to have any problem making choices they are happy with. Making choices step, by step, rather than being presented with 3000 variations at once, of course makes a big difference; the biggest amount of variations at one time being the upholstery, that come in 13 different colors. However, she stress the importance of trained and dedicated sales persons and doubt the same range of choice would work in e.g. an IKEA situation with a lot more customers per available sales person. Also Vitra have been careful to remove any of the technical variations and choices

from the choosing process. E.g. all their upholstery have the same fabrics with the same durability and light resistance, thus the only choice left for the customer is what color he/she wants.

The place they most commonly experience some dilemma / hesitation is whether or not the customer want upholstery, as theres a price difference here of almost 2000,- (a 60-100% price increase, depending on the model), and aesthetic and economic values might compete. This aspect should definitely be considered in my final concept development, and to the extent possible choices with several variables should be avoided. (E.g. all colors should have the same price tag and all wood types be of approximately equal strength, durability, sustainability, etc.).



iii. 4.6 / variations of the eames plastiv char system. (left to right) DAR, DAX half upholstery, DAR full upholstery, DSW full upholstery, DSX, PSCC full upholstery, RAR.

The Paradox of Choice.

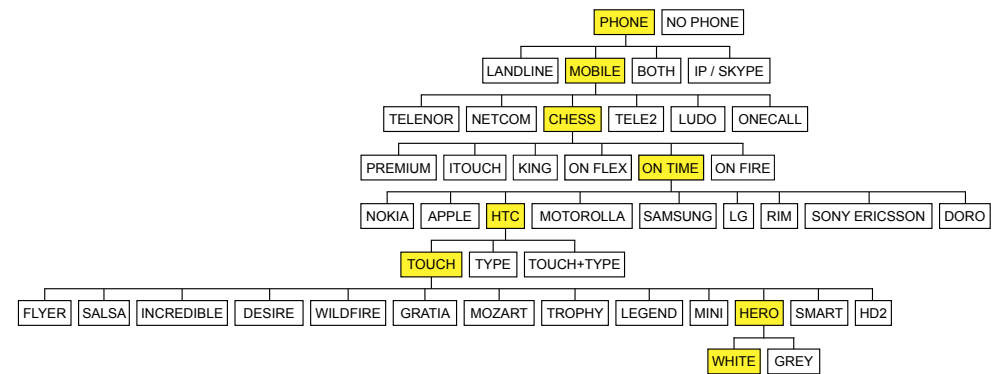
As represented by Montana and Eames, the aspect of choice is today a fundamental and almost mandatory part of our consumer society. Every product available from numerous manufacturers, every manufacturer with a range of different models, and every model in a range of different colors and features. (ill. 4.7) This is generally considered a good and liberating thing and Jean Baudrillard writes on the subject that “this availability of the object is the foundation of ‘personalization’: only if the buyer is offered a whole range of choices can he transcend the strict necessity of his purchase and commit himself personally to something beyond it.”²

Choice in its essence seem indisputably to be a good thing and ‘people keep expressing a desire for more choices’. However several studies show that presented with too many options, customers struggle with processing all the data and might even avoid buying the product all together^{3,4}. As Sheena Iyengar and Kanika Agrawal states in their article *A Better choosing experience*³: “There are neurological limits on humans’

ability to process information, and the task of having to choose is often experienced as suffering, not pleasure.”

In *the paradox of choice*⁴ Barry Schwartz elaborates on this subject, arguing that the more options we get, the better chance we have to make choices better suited our needs, yet the bigger the chance that we have not made the best decision. Thus, despite making a better choice with more options, our relative perception can be not to have made the perfect / right choice. (With 4 pair of jeans to choose from, one has a good chance to find the one best fitting oneself. With 20, the one you choose probably fit better than the best of the four, yet chances are statistically 19/20 that you’ve not made the best choice available.) Thus we make relatively better choices, yet feel less content with our decisions.

Several retailers I talked with stressed that one should not have to many different variations of a product. Boris Praskac at Eske Interiør claimed that while 3 different versions of the same product puts the customer in a dilemma, with 5 versions, the product would



ill. 4.7 / diagram mapping the range of choices related to purchasing a mobile phone.

simply sell less. While this don't seem to apply to the same extent in systems like Montana and the Eames plastic chair system, where one make choices step-by-step, within a modular system, Gry Winters at Montana Norge admits that the process of choosing and customizing a Montana system, can cause both frustration and debate, especially among couples trying to agree or compromise.

Montana, does however to a fair extent manage, with seven different shades of gray and a total of 5 billion possible product combinations, to make the process of choosing a fun and desirable

experience. In *A Better Choosing Experience*⁴ Sheena Iyengar and Kanika Agrawal defines four parameters to help the customer get a better experience when choosing. Comparing these with Montanas approach, might shed some light on their success, and provide some usefull information on how to make this work in the pdm 6100.

1. Cut their alternatives. “In the mid 1990s when Procter & Gamble Company winnowed its 26 varieties of Head & Shoulders anti-dandruff shampoo down to 15, eliminating the least popular, sales jumped by 10 percent”. Though

2 Baudrillard, J. (1996/2005) *The system of objects*.

3 Schwartz, B. (2004) *the Paradox of Choice*

4 Iyengar, S. Agrawal, K. (2010) *A Better Choosing Experience*.

the basic modules in the Montana system by now is pretty much fixed to 42 basic units, restrictions are made in what components can be inserted here, given functional reasoning (as a 35x35cm module comes with both doors and drawers, a 12.5x12.5cm, being significantly smaller, only comes in the open version). Further the color palette is being changed every 3-6 years, allowing Montana to remove unpopular colors from the array and add new ones as fashion change. (However, with a resupply guaranty on every color ever offered, you need not worry that your color will no longer be available in ten years) Though 46 colors might seem a lot to choose from, all 46 have been carefully selected to match each other, regardless of which two the customer chooses to pair.

2. Create confidence through recommendations. How do you give customers enough confidence to overcome the complexity of a large choice set? By turning to the people that already have that confidence: experts. This is already a vital part of the Montana retailing system, as every Montana retailer have to be schooled and regularly updated on the product to be

allowed to retail it. This is not only helpful, but strictly necessary, as the retailers don't sell a finished product, but parts of a whole system, and need to be able to give professional advice. Iyengar and Agrawal also makes a point of recommendations from other users. Thought Montana don't seem to have a system for communicating this (other than 'this color is very popular', etc.) such a system would almost be contradicting with the Montana statement of individual choice and unique self-expression.

3. Categorize their options. Best Cellars (Wine retailer) divides the vines into eight simple categories, such as fizzy, juicy and sweet. The novice has to deal with only eight units of information now, which can be managed fairly easy. Montana also goes to great extents to categorize, visualize and systemize their range of options. Their color palette have been similarly categorized into seven different 'families'. (natural, graphic, grace, excellence, friendly, authentic and attitude) There is also a remarkable coherence in the arrangement, both in the store, the catalogue, the webpage and the free CAD software provided the

customer, with the colors, modules and components always sorted and categorized in the same way.

4. Condition them for complexity. Consumers can handle a large number of options, if they start off in the shallows and then slowly move toward the deep, all the while building skill and nerve. Beginning with fewer options not only warms customers up, it helps them better figure out their own preferences, which in turn enhances their choosing experience. Vikky Eide, Sales Consultant at Montana Norge, explain that she never show the customer the entire module range to begin with, but rather start out with their desired functions or area to cover, and slowly work their way on from here. The entire system is drawn / planned in white / grayscale, and colors are added in the end. With every unit and every component available in every color / veneer (each unit being manufactured and colored, per order), the color selection can be done 100% regardless of the module composition made.

Though probably not developed with Iyengar and Agrawal's four parameters in mind, the Montana system corresponds remarkably

well with it, and might help explain partially why customers keep choosing Montana despite a relatively high price tag, and an virtually infinite amount of choice. Probably even, in many cases, because of this. The fact that a Montana system always can be altered, rearranged and supplemented, will also help lighten the decision, making it reversible. As the system I am developing probably will be a more permanent one, the advantages and downsides of this should be considered.

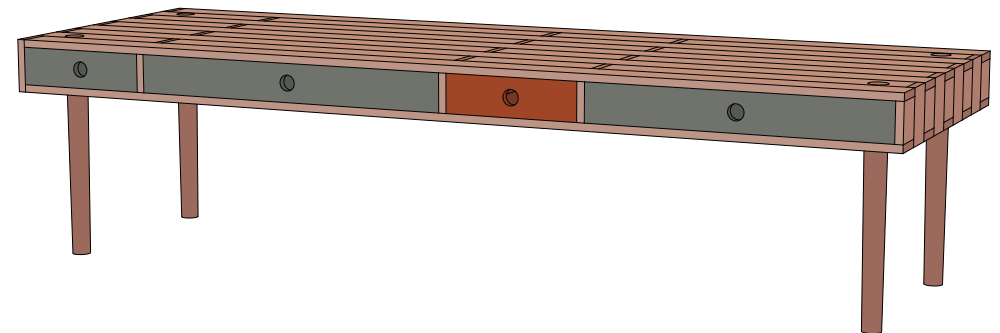
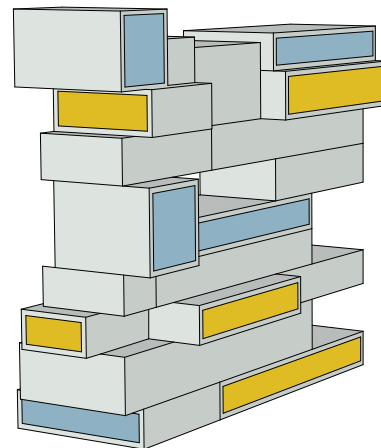
A PRE-PRODUCTION CUSTOMIZABLE FURNITURE SYSTEM

Pre-production modularity.

Based on a single module from the pdmk 5100, the pdm 5900 was developed as a more 'homogeneous' and complete furniture with all modules merged into one consistent construction. This to separate it from post-production modular systems like montana, where a similar consistent and 'homogeneous' finish is unobtainable. As three drawers are not simply three

modules stacked on top of each other, but rather three drawers inside a single cabinet. (ill. 4.4) This approach emphasize aspects of manual manufacture, in a way serial production will have difficulties imitating. The downside is of course that the end product, though fitted the client, cannot be modified, changed or expanded further, once it's been made. On the other hand it brings an element of a permanent, timeless and finished furniture, rather than one you simply change around every five years. This aspect of consistency and dedication would arguably generate a deeper attachment to the product over time. (ill 5.1)

Such a 'homogeneous', single-unit solution also proved far cheaper to manufacture, though without compromising on quality or finish. A rough estimate by furniture carpenter Mikkel Hald set the production cost of the pdmk 5100 to about 45.000,- while the homogeneous pdm 5900 was estimated to approximately 20.000,-. The pdm 5900 still being a unique, handmade furniture, only this time user customizable and more distinctly different any serial produced, modular based alternative.



ill. 5.1 / the project developing from a more reversible and rearrangeable modularity, to a more homogenous, complete and permanent construction.

Restrictions.

Trying to find a balance between giving the customer a system flexible enough to adjust to the individual needs yet with enough restrains to make choosing a manageable task and restrain the possibilities of making poor choices, an initial system was developed.

A fixed grid being one of the inevitable restraints of regular serial produced modular systems, I first strived to maintain a grid-less system, where every mm could be seamlessly adjusted to fit perfectly in any room and with any function. Inspired by bespoke tailoring a model was developed, where both ones body and (e.g.) living room

was measured and a furniture made specifically to match. Still restrained to an orthogonal 'box', for easier decision making and production, thought with a virtually infinite range of variations in height, length and depth. (ill. 5.2)

However, discussing this with both my collaboration partner, Boris Praskac and main tutor Einar Stoltenberg, we agreed that from a customer point of view, the system was still to open, and undefined. After all what separates this system from a regular custom furniture assignments is exactly the restrains and framework that allow the customer to make choices of his/her own and experience partaking in the design process, yet with enough restrains to

ensure sound decisions. So when the system / framework allows for the customer to suggest a 4 meter long, single compartment table, with 12mm boards and this isn't solid enough by any standard, it should not be an option.

This led to a solution much closer to the Eames Plastic Chair system, where the customer chooses step by step, within a system / framework with enough restrictions so that any possible combination is actually possible, yet with enough options and variations, to ensure the customer a unique choice, special for him/her. *Selection Chart* for the final system attached (attm. I).

An important point here, learned

from the Eames Plastic Chair research, is to try to avoid more than one variable for each choice. E.g. the five different feet types should cost roughly the same, to remove the dilemma of economy vs. aesthetics. If the various cost differences turn out to be small enough one could even consider a fixed price, regardless of compositions and choice. This would undoubtedly lighten the dilemma for the customer.

Despite a more fixed and restrained framework / system, the furniture is still made manually, and special requests and adjustments can easily be accommodated without any significant effect on the production flow.



ill. 5.2 / 'bespoke furniture' initial project based on a non-grid, seamless system, measured to fit the customer by the millimeter. 1/ the customer is presented with the system 2/ house call by carpenter or trained salesperson looking into use and context - measuring 3/ rough scale model based on customer specifications and measures - final adjustments 5/ furniture delivered.

Context.

Initially, to help develop the furniture, a more specific context was chosen. Discussing this with fellow student and BA Interior Architecture and Furniture Design, KHiO, Bente Evje, the living room proved an evident candidate. Being the hearth / center of most homes it is both a personal space for retreat and privacy, though at the same time as much a public space and a place where people are invited in. A room private / personal enough for meaningful objects and objects of affectional value, yet public enough to embody furniture with a certain statement / sign value¹. (iii. 5.3) The living room also being a place where people are 'willing to put money' (Matthew, M. sales / retail at Robert Tandberg), this would seem a good place for a personal, unique, yet expensive object.

However, as the project developed and the system / framework became more and more adaptive and customizable, it became evident not to tie it to a specific context, but rather make a framework flexible enough to accommodate nearly any thinkable context. This would also open up

the project toward the office / hotel / contract market. A substantial part of the furniture market, with according to Matthew Monachello at Robert Tandberg, a high end furniture store at Sjølyst plass, Oslo, contributes 12M of their 16M annual turnover. Consequently the initial decision of the 'living room table storage' was abandoned, as the furniture, according with context and function could just as well be a wall mounted chest-of-drawers in the hallway, an office work desk or a cabinet for the bedroom. A ready designed, yet customizable concept should also be a desirable product to architects / interior architects.

Alternative geometries.

Despite experimenting with various different geometries and form vernaculars, the project kept coming back to the initial orthogonal cuboid shape. For practical reasons, as the orthogonal shapes and straight angles are easier in production, especially with the degree of variations implied in this project. Also to make variations more comprehensible for the customer, with the basic shape staying unaltered, regardless of

P U B L I C

G A R D E N
P O R C H
H A L L W A Y
L I V I N G
R O O M
K I T C H E N
B A T H R O O M
B E D R O O M

P R I V A T E

iii. 5.3 / diagram describing the living rooms overlapping role as both a private, personal space and public area.

variations in dimensions. This strictly defined box / container shape also visualize / translate the fundamental storage function in a very distinct way, manifesting Sullivans principle of 'form ever follows function'⁵

Still, to break the perhaps to rigid, pragmatic and formal form vernacular of 'the box', a variety of feet of different form and material where added. Also the less 'orthodox' use of hi-macs in

various colors for drawers, doors, etc. should help soften the overall impression of the furniture.

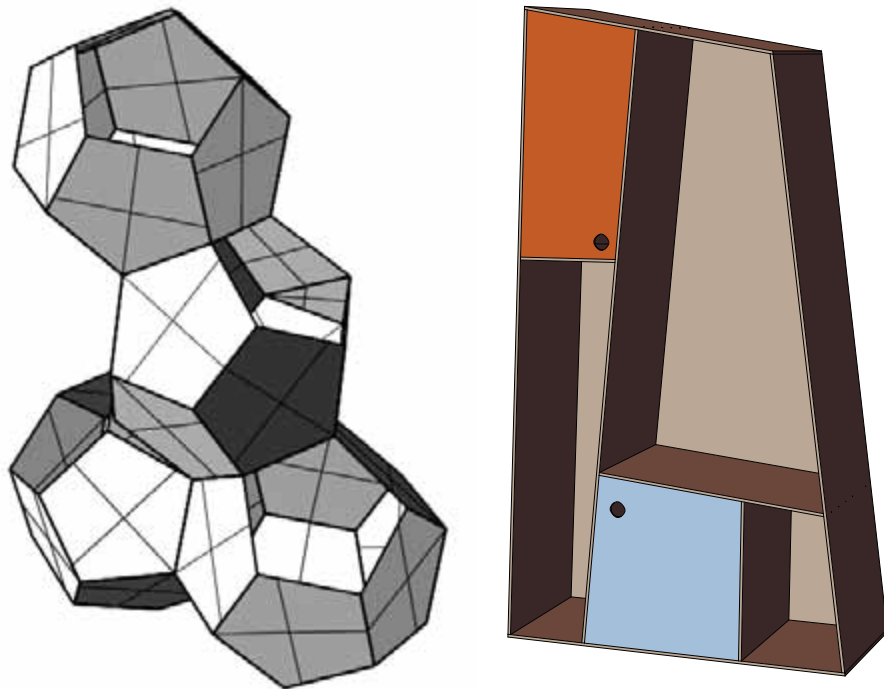
Of the other geometrical variations on a modular system tested, the dodecahedron proved one of the more promising alternatives. Assembled form 12 pentagonal faces in a sphere-like geometry, the dodecahedron provides a more spatial and three dimensional composition than the cubes / cuboids. From a more functional

view, however, dodecahedron modules does not provide a very reasonable storage room, with 12 different sides, all at different angles. Considering that the majority of objects typically stored in the living room (books, hifi-modules, CDs, DVDs, magazines, boardgames, etc.) are cuboids, it seem somewhat incoherent have storage modules of opposing geometry. As this logic applies to any non-cuboid geometry, cuboid modules on the other hand seem able also to contain non-cuboid objects, as a ball fit in a cube, but not vice-versa.

Some alternatives however, with nearly cuboid shape, seemed to work, to the extend that they where (nearly) cuboid. Though perhaps more visually appealing, discussing this with furniture carpenter Mikkel Hald, it turned out that irregular angles, being a manageable task in larger, identical, series, would greatly increase the complexity, time and cost in a production where every unit is variable. (ill. 5.4)

Initially made for manual manufacture by furniture carpenters, wood were of course evident as the primary material. With natural variations in each board, it also correspond well with the idea of each unit being unique and different every other. Different solutions with lacquered MDF / plywood was considered, but with manual manufacture and traditional woodworking as premise such compromises of price vs. integrity / quality, did not seem a reasonable alternative in a high-end, handcrafted furniture.

To supply a reasonable range of choice, a selection of different wood types with different visual qualities was needed. Though as with the Eames plastic chair system, I wanted to avoid technical and constructive distinctions influencing the customers choice, leaving him / her with only visual / aesthetic differences to consider. Learning from customers hesitations on upholstery for the eames chairs, based on considerable price differences here, price differences should be kept to a minimum within the range of wood types offered. Further,



ill. 5.4 / examples of attempts with alternative, non-cuboid geometries.

Materials.

5 Sullivan, L. (1896) *The Tall Office Building Artistically Considered*.

as the furniture is made locally, a locally produced, short travelled selection of wood, should at least be available, if not mandatory.

Solid surface material was chosen for drawers, doors, etc. These heavy, static, man-made composites makes a nice contrast to the natural, dynamic and softer wood, is almost as hard as stone, and with an even, smooth surface. Not lacquered but colored all the way through as part of the production process, and with virtually seamless joints when glued properly, it should withstand both wear and tear and closer inspection.

Solid surface materials can also be cut, sanded and worked with much like wood, in any wood workshop, requiring no additional machinery or tools, except a special two component glue.

Initially DuPont's Corian was chosen, however with only 18 solid colors and only available in 6, 12 and 19mm sheets, LG's Hi-Macs seemed a better option, with 35 different colors (4 translucent), available in 3, 6, 9 and 12mm. Both Materials being both fairly heavy and expensive, 3mm sheets should

help remove both weight and cost from a drawer construction. Though both weight and cost could be reduced by making the drawers in e.g. plywood and only have the visible fronts in Hi-Macs, this would be a shallow and superficial illusion, corresponding poorly with the integrity of a handmade, custom built, solid wood furniture. And with a total price of approximately 20.000,-, the cost saved on plywood drawers, should be relatively minuscule (with an estimated material cost of 480,- per Hi-Macs drawer⁶).

Branding.

With the intention of "making custom, handmade furniture a more affordable, visible and accessible product.", part of the aim was to reach outside the workshop and lower the bar for purchasing handmade, custom furniture. This, however should not happen at the expense of delivering a, high quality product, with a perception of exclusivity to it. Based on feedback from the second milestone presentation I decided the product / system should be available through high-end furniture stores (eventually perhaps also through



III. 5.5 / visual 'telltale'. bmw fin and ipod earphones.

dedicated showrooms), but also have a webpage where one can try the system and make ones own furniture, with no further commitments.

The price alone will of course generate a level of exclusiveness and value to the product, yet this should not prohibit anyone from wanting one, even if they never could afford one.

Some kind of 'red ribbon' or telltale of the underlying system, should

be implemented in the product and would add a nice dimension to the concept. Like the red ring on canon EF-lenses, the white iPod earphones or the 'fin' shaped BMW antenna, revealing a built-in GPS system. (III. 5.5) Especially with a product like this, where some of the most significant qualities (hand made, custom built, etc.) are no longer visible once the product is finished. Some 'token' telling that this is a one-of-a-kind, hand crafted product, made exclusively for the owner, by his/her instructions.

6 Given a cost of 3.600,- per 760mm x 3680mm (~300 dm²) sheet, and approximately 40 dm² spent per drawer.

APTO WHAT YOU WANT, IT IS.

The system.

All this considered, a furniture system to accommodate effortless, yet flexible user customization while ensuring a visually, constructionally and functionally reasonable product, was developed.

Starting by building the main body, or 'the box', the first choice is depth. Available with 7, 9, 11 and 13 boards (odd numbers to maintain symmetry), respectively 350, 450, 550 and 650mm, each board measuring 50mm. A fixed total length (1850mm), and a specified board width, helps narrowing the number of decisions

grain movement, which increases with board width, yet still be wide enough to ensure manageability and precision.

With manual production, further variations of both board width, number of boards, and total body length are available if requested, within what's constructionally reasonable, of course. This would inevitably cost extra, with the additional work required to modify the design, but, with manual production, not affect the production flow significantly.

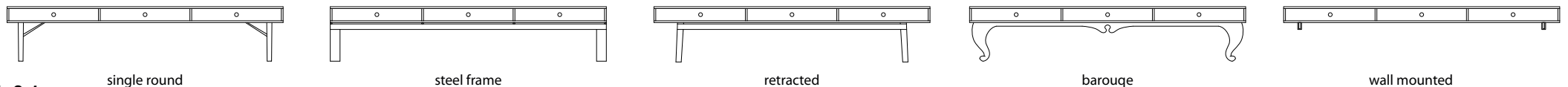
Next the body height is set, to *S*, *M* or *L*. 80, 160 and 325mm respectively. This should accommodate most storage functions, from papers, board games, magazines, etc. lying down, to upright books,

thirds or quarters gives a total of 10 possible compartmentalizations, but with a fixed total width (1850) only requires 6 different board lengths to accommodate. Testing with fifths, sixths, etc. only proved confusing and overwhelming in terms of options offered, as the number of different combinations grow exponentially with the number of compartments (2^{x-1}). However, there is also here the possibility of further variations 'off chart', if requested. Half is sorted under quarters and one big single compartment did not prove structurally reasonable, even with a horizontal dividers to make it more rigid (required where one compartment spans 2/3 or 3/4 of the body).

With 35 solid Hi-Macs colors and 11

Though some of the darker Hi-Macs colors, containing more natural pigments, are less resistant to wear and tear, the Hi-Macs modules will be sitting well protected within a wooden cabinet and this should not be an issue.

As the main body provides a wide range of choice and customization, it is still strongly embedded in a orthogonal, somewhat pragmatic 'box' shape and each furniture, despite being unique, will inevitably look like one another. This 'common denominator' is of course to some extent a good thing, but for a system advertising personalization and unique furniture, a more visible variation, other than just different colors, was necessary. Not wanting to break with the functional, practical



ill. 6.1

for the customer, and smoothens the production flow significantly, as a single board dimension, cut at 12 different lengths covers the entire material requirement for all the 120 different 'bodies' available. 50mm boards should help avoid cross

albums and vinyl records. With compartment sizes of 660mm (thirds) and 445mm (quarters), one should also be able to fit most hi fi components.

Dividing the compartments in

module types, each compartment can be fitted with up to 385 different modules, depending on height, etc. An large amount of options, but in a system where one is presented with the choices one at the time, it should be a manageable task.

and visual concept of the box / container, this was solved, much like with the eames plastic chair system, with a range of different feet, with clear visual distinctions both from the main body and each other. (ill. 6.1)

Each feet type available in three different heights provides further distinctions and makes it so the same 'body' can be both a sofa table in the living room, a chest of drawers in the hallway or a work desk in the office, with all practical and ergonomic aspects considered. (ill. 6.2)

Finally, the furniture can be done in a total of 5 different woods. Walnut, oak, birch, alder and beech. All hardwoods with good strength and structural abilities, and, with the exception of beech, relatively little temperature / moist movement. With similar structural abilities and a variety of colors and texture, the customer should be able to make an aesthetically choice, without having to worry about technical

differences. Requests for other wood types can of course be accommodated, without other variation in the price than what the cost of the wood dictate. Save for walnut, all five wood types are available locally in Norway.

All these variations combined should give a total of roughly 40 billion different combinations, with further possibilities of special, 'off-chart' adjustments. Then simply by keeping track of what has been made, one can guarantee never to make the same furniture twice, ensuring every customer a 100% unique, one-of-a-kind furniture.

Ideally, any Apto furniture within the constrains of the system, should cost the same, removing

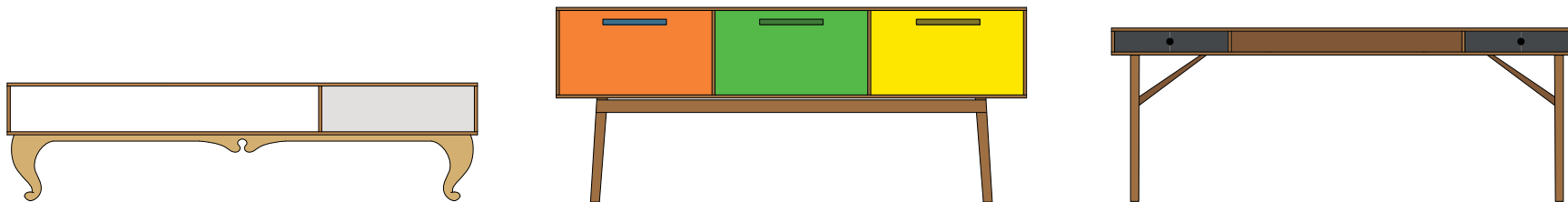
the element of economics from the decision process. Nevertheless a simple two-compartment, open, low height furniture will be less expensive to manufacture compared with four drawers, baroque feet and full height. However the price differences will be smaller than those encountered in the eames plastic chair system, and once you are paying 20-25.000,- for a furniture, an extra 500-1000 for an additional drawer becomes negligible.

Construction.

The method of 'braiding' the wood boards, using the positioning of the boards when joining them, rather than cutting/milling, was

developed from the pdmk 5100 project, giving an honest, visible and comprehensible construction and a nice visual play of the board lengths meeting the (darker) end wood. Also, such a complex 'braiding' of wood should be difficult if not impossible to properly mimic in mass production, providing an aesthetic evidence of manual craft.

With every second horizontal board, being cut into 2-4 compartments and wedged between two vertical boards, rather than spanning all the way across the 'box', resting on the vertical boards, the 'braiding' method will inevitably generate a weakened construction. However with every horizontal board being attached to two supporting boards on each side, strengthened with



ill. 6.2 / sofa table (M (160mm) body w/284mm feet), chest of drawers (L (325mm) body w/508mm feet), office desk (S (80mm) body w/ 700mm feet)

Lamello biscuits, the vertical walls working as supporting beams inside, the construction as total, with a 15mm board thickness, should be more than strong enough, for both storage, wear, and mischievous children. (ill. 6.3)

The feet, depending on type, will connect with the body at the 'beams' made by the vertical walls, improving the structural strength of the entire furniture.

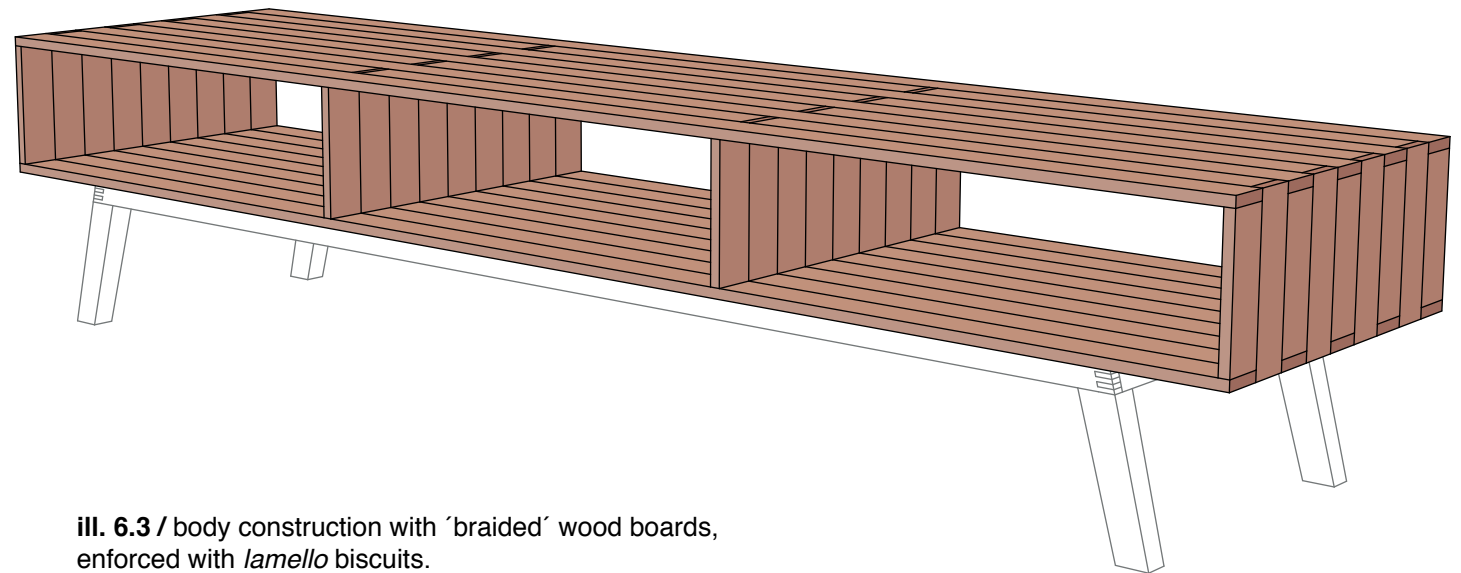
For drawers, flaps, doors, etc. lift, hinge and pull-out systems from Blüm is used. Being a well established supplier, with a wide range of functions and dimensions, Blüm seemed an obvious candidate. Commonly used by furniture carpenters, as their Tandembox pull-out system fully conceals the drawer runners, it should compliment drawers made entirely of Hi-Macs perfectly. Available overnight and in single quanta, from Gunnar Eklid A/S, a quick and reliable supply is ensured, and should the Apto system be sold abroad, Blüm is available all over the world.

Business model.

The most apparent way to get the Apto system on the market would be through high end furniture stores. Having developed the project in collaboration with several retailers (Eske, Montana, Vitra, Fritz Hansen, Tannum, Robert-Tandberg, Paustian), and with a final price tag of 20-25.000,- most of the potential customer body should be available here. (A possible opening to display the prototype at the Fritz Hansen showroom, Sjølyst Plass,

could be a welcoming opportunity to reach both target customers and retailers. Having collaborated closely with Boris Praskac at Eske Interiør#Design, there could be an opening here as well, as the store already mixes well established names and brands with input from local designers) With a few finished models in store to get the customers attention and samples of the different module variations and materials, to get a tactile, hands on experience with the range of choice available. A quick reference

chart enabling the sales person to give an instant price estimate of different variations, should also be supplied. However, to separate the seriously interested customers from the mere curious, an exact estimate of cost and production time will take a little more time and perhaps some consulting with the carpenter, requiring the customer either to come back later or give up some basic contact information (phone number or mail address). This model should also have the potential to trigger aspects of



ill. 6.3 / body construction with 'braided' wood boards, enforced with *lamello* biscuits.

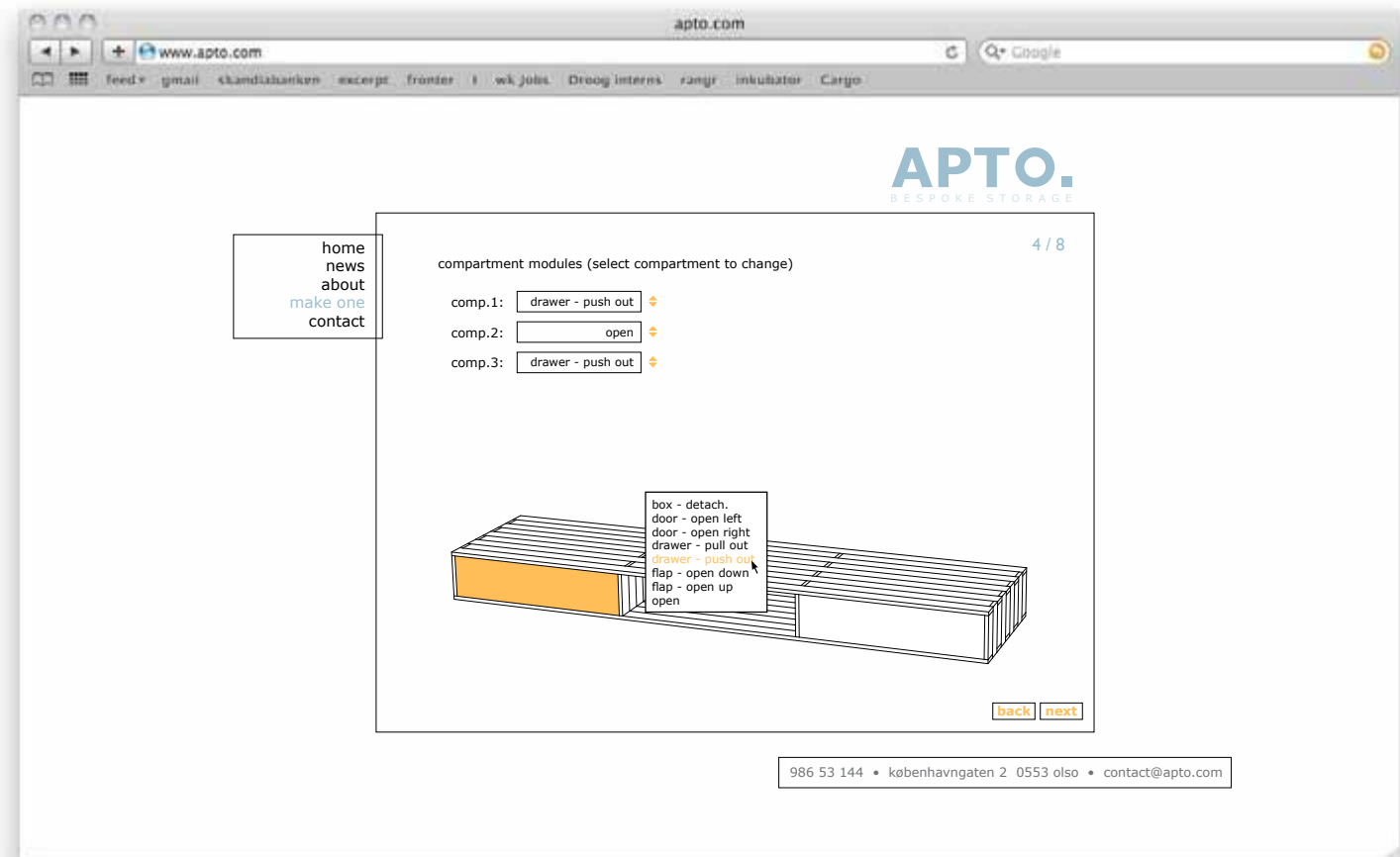
both commitment and reciprocity from Cialdinis six *Principles of Influence*⁷.

With local, established retailers selling furniture, and professional carpenters doing the manufacture, Apto only supplies the design / system, making start-up investment and risks relatively small. With every furniture made per demand, there is no risk of making more than have actually been sold. Should the concept catch on, one could always consider separate Apto showrooms / concept stores, cutting out the middleman, increasing the profit margin. Manufacturing could also be done by Apto owned workshops, though this would be difficult to combine with the idea of local manufacture. Also any legal obligations and responsibilities of maintenance, warranties and repair, would then rest directly on Apto.

With the intent of “a more (...) visible and accessible product”, an official webpage presenting the brand, product and system should be available. With a custom made furniture system, it would also be evident with a ‘make-your-own’ tool. (iii. 6.4) However there is a delicate balance here to avoid

diminishing the brand identity by making it into a internet toy associated with sneakers^{7,8} and t-shirts⁹. Though, with high-end brands such as Leica¹⁰, Vitsoe¹¹ and Montana¹² proving that it is possible to strike this balance between accessibility and exclusiveness, this should definitely be manageable, but also

an area to be cautious. E.g. one will request a price quote or contact a sales person. not able to actually place an order via the webpage tool, but rather



iii. 6.4 / apto webpage, with make-your-own tool.

6 Cialdini, R. B. (2001) *Influence: Science and Practice*.

7 nikeid.nike.com/nikeid/index.jsp (15.05.11)

8 www.converse.com/#/landing/create (15.05.11)

9 www.teejunction.com.au (15.05.11)

10 en.leica-camera.com/photography/m_system/leica_a_la_carte (15.05.11)

11 www.vitsoe.com/en/rw/shop/606/sketchtool (15.05.11)

12 www.montana.dk/Living/Design-facilities/Designed-by-You (15.05.11)

Brand.

This balance between exclusiveness and accessibility is reflected throughout the brand identity. With a short, unpretentious, 4 letters, 2 syllables name, easy to remember, pronounce and spell correctly (as opposed to names like Vitsø, Gieves & Hawkes, Hermes or Jaeger LeCoultre). There is however more substance to the name than just random, easy pronounceable letters, as the name means fit, adjust or accommodate in latin (and spanish). The name also associates with some of the creativity related with names like lego, duplo, ludo, etc.

This creativity and 'anything is possible' mentality is reflected in the brochure (**attm. II**), showing the actual furniture only as silhouettes and line drawings, and with an illusive, obscure language, leaving it to the imagination to manifest an actual product. As Apto only supplies the system, it's the customer who makes the final design.

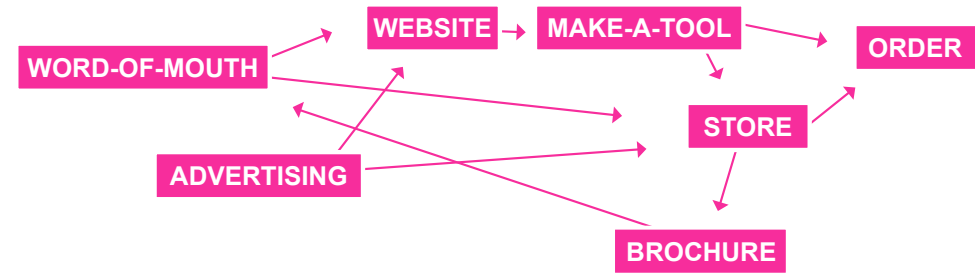
In addition to being visible through selected retailers and the webpage, advertisements in selected magazines and publications,

would also be a natural medium for brand attention, while tv, radio and internet advertising could possibly tip the scales too far towards 'accessible', harming the brand identity.

Though the wood - Hi-Macs combination, the 'braided' boards and the strictly orthogonal body by itself gives a strong, consistent brand identity, I wanted to implement some kind of signature 'trademark' feature like the white iPod earphones and the BMW GPS 'fin' (**ill. 5.5**), a telltale of both the user customized and hand crafted aspects, not immediately visible in the furniture. This was done with an engraving on the inside of one module/drawer/etc., saying who made it, for whom, and the date of manufacture. As discreet as a tailors signature inside a suit jacket, it's nevertheless there, and those who know, knows.

Ethics.

While local manufacture ensures a safe and well paid working environment for the craftsman, locally produced wood supplies a renewable, biodegradable and recyclable building material.



ill. 6.5 / diagram mapping different areas of customer relations and branding and their internal connections.

More important is perhaps the aspects of user-product attachment, aspects that can prevent replacing and make customers keep their products longer. Alone the fact that you have paid around 20.000,- for the furniture, should make one less likely just get rid of it after a few years, and if so rather sell it or give it away than simply throw it out. Each furniture being the only one of its kind, never to be produced again, should encourage one to repair a dent, rather than replacing the entire furniture. Most significant, though is perhaps what Dan Ariely in his book *the Upside of Irrationality*¹³ refer to as the IKEA effect. Basically it is a study that shows how we tend to overvalue and appreciate things that we make ourselves. He gives an

example of himself attached to an IKEA toy chest, after a few hours of assembly:

"I am quite sure it was not the highest-quality piece of furniture I could have purchased. nor had I designed anything, measured anything, cut wood or hammered any nails. but I suspect that the few hours I struggled with the toy chest brought us closer together. I felt more attached to it than any other piece of furniture in our house."¹³

He also applies this effect to customizable products even when the customer himself doesn't actually build the product, as long as there is some work / process of choosing and customizing and not simply a matter of selecting one of

13 Ariely, D. (2010) *The Upside of Irrationality - The Unexpected Benefit of Defying Logic at Work And at Home.*

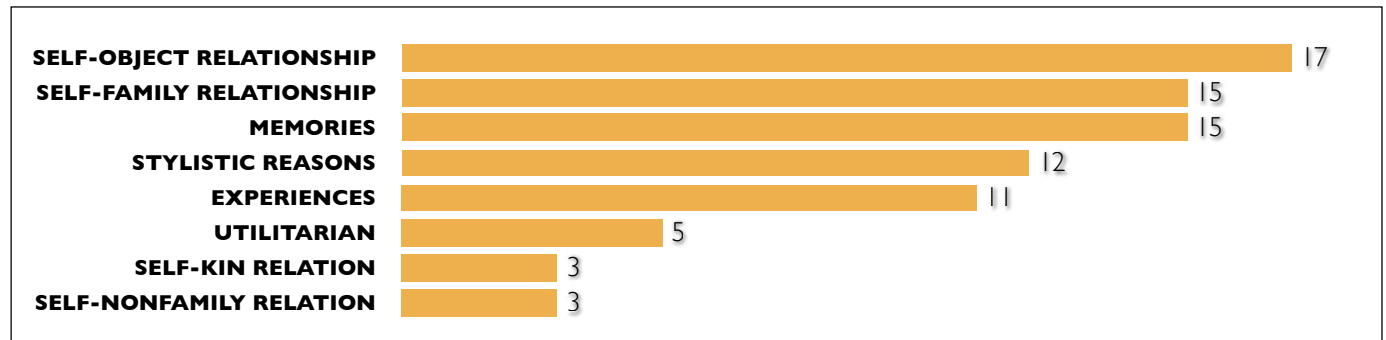
three finished products. With the actual craft done by a professional furniture carpenter, and the design choices made within the framework of the Apto system, the end product should also withstand closer inspection by a more objective observer. Thus with a one-of-a-kind, self-customized, handmade furniture, chances are the end product will be kept, cherished and maintained for decades.

Ideally, the furniture should even outlive it's first owner possibly being inherited by the next generation. Being the only furniture one of it's kind, 'made' by ones grandfather, should help increase the product-user attachment for later generations.

In a 1981 study by Mihaly Csikszentmihalyi and Eugene Rochberg-Halton, where people where asked about their most cherished objects, the importance of the relationship between the self and the object (e.g. made by oneself) was stressed in 17 percent of the cases, while 15 percent of the time, people stressed the relationship between the object and the respondents immediate family (e.g. made by family member). Other kin and nonfamily ties were

mentioned each about 3 percent of the time. (ill 6.6)

In this context, even Hi-Macs, a slowly decomposable and scarcely recyclable material is a justifiable alternative, as it is highly durable and wear resistant (positioned unexposed within the wooden cabinet), and valuable enough to be re-used when the furniture is finally disposed.



ill. 6.6 / diagram showing respondents reasons for product attachment in the Csikszentmihalyi / Rochberg-Halton study.

CONCLUSIONS

Product conclusion.

All considered the final product seem to correspond well with the intention of applying “aspects exclusive to manual manufacture in a small serial production”, both in details such as the ‘signature’ engraving inside the drawer and the ‘braided’ wood boards, and off course in a bigger scale with a pre-production, user customizable furniture system.

“Making custom handmade furniture a more affordable, visible and accessible product” have also been achieved, at least at a conceptual level, with a finished, tangible product sample out in the stores and with the opportunity to test the system and build one online.

The price have been reduced considerably since the pdmk 5100 (45-50.000,- compared with 20-25.000,-) and some compared with a similar furniture made custom by a furniture carpenter as a single order. 20.000,- is still a lot of money and this by itself will

inevitably make it less available and exclusive those who can afford it. However, with the customizable, unique and hand crafted qualities being visible, understandable and explained, customers who normally wouldn't pay 20.000 for a piece of furniture might recognize some values here that one can't get at IKEA.

Process conclusion.

With much of my research method / process having been interviews and feedback from retailers, carpenters, design professionals, etc., I have learned the value of

second opinions and ‘fresh eyes’. Especially people with different expertise and competences, not directly design related, can contribute with insight in areas oneself did not even consider.

My internship period at Nævdal A/S Møbelsnekkeri naturally proved useful in this project, not only in making the prototype, but also when collaborating with furniture carpenters and developing the project corresponding with the carpenters production facilities and abilities.

Looking into the customer choosing situation, choosing psychology and

how other customizable systems (Montana, Eames plastic armchair, etc.) presented their options was a very insightful and enriching experience. Despite my intentions, I never got to test the final system on actual, non-professional user, and I am certain some valuable input was lost because of this.

A lesson in planning and time management was, once again, learned, and will probably be well forgotten by the time of next deadline.



III. 6.7 / product model. medium body (160), 3 compartments, open + push-out drawers (nordic white), retracted feet (364mm)

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Fellow students

ATTACHMENTS

APTO SELECTION CHART

ATTM. I

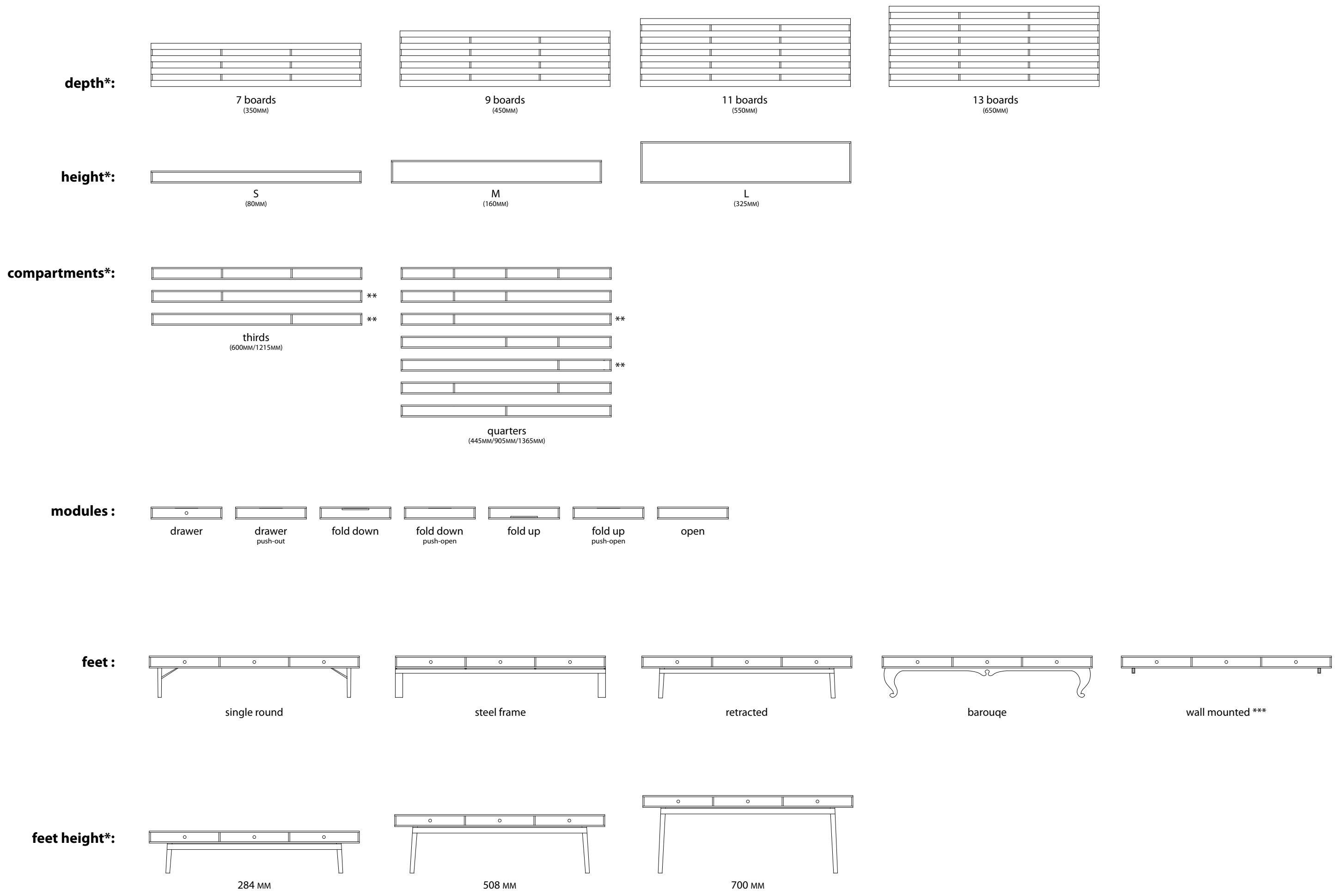
APTO BROCHURE

ATTM. II

PROGRESS PLAN

ATTM. III

APTO. SELECTION CHART



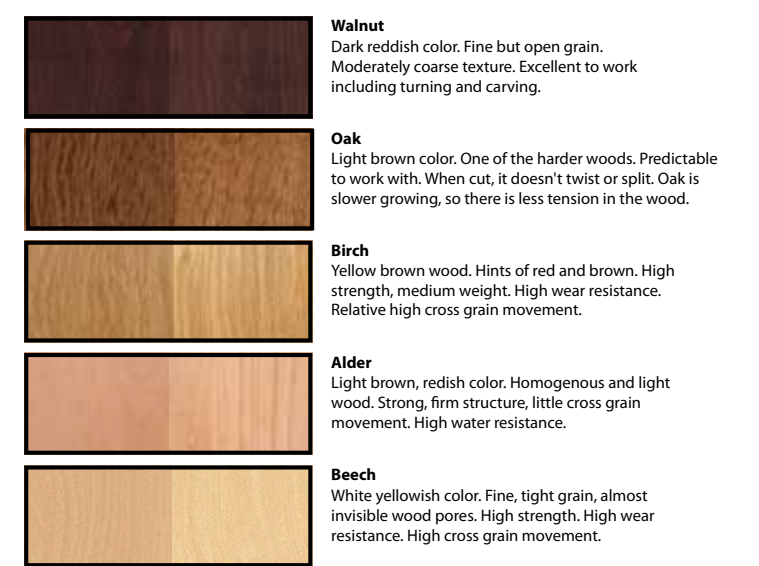
module colors :



lucent colors :



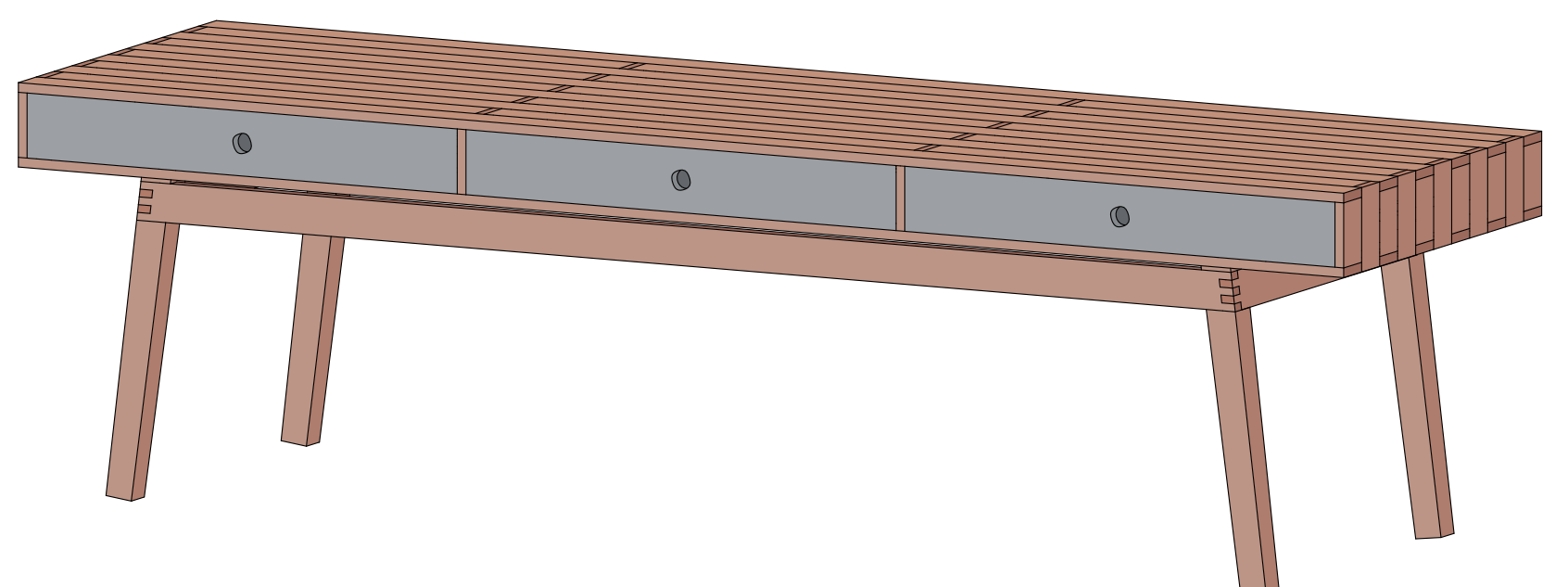
wood*:



total width: 1850 mm

* further variations available upon request
 ** require inner horizontal support wall
 *** require depth 495mm or less

illustration does not provide exact visualization of final product, contact us for product and material samples.



WHAT
YOU
WANT

IT
IS.

98 65 31 44
www.apto.com
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img. p. 4-5, *The Green Drawing Room at Buckingham Palace*, Derry Moore
img. p. 8-27, series *Gentlemen of Bacongo*, Daniele Tamagni
img. p. 30, *Title Unknown*, Author Unknown. Based on National Archives photo by Ollie Atkins.
img. p. 36-37, still from *Runaway*, Kanye West.

A grand, ornate ballroom with a red patterned carpet, gold-trimmed walls, and large crystal chandeliers. A doorway in the center leads to a stage with red curtains and two chairs. Two text boxes are overlaid on the image.

W E L
C O M E

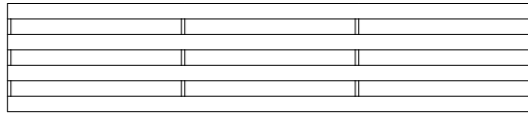
WELCOME TO THE BALL. WE DON'T CARE IF NOBODY LIKES YOU, YOUR CAR STINKS AND THE MILK IN YOUR FRIDGE JUST WENT SOUR. WE LOVE YOU REGARDLESS. WE DO.

I.

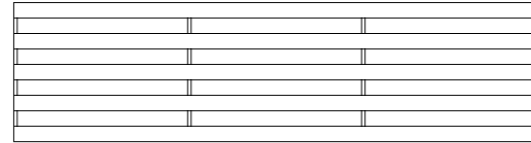
depth

9, 11, 13, 15 boards

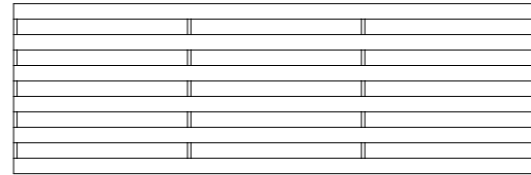
405MM - 675MM



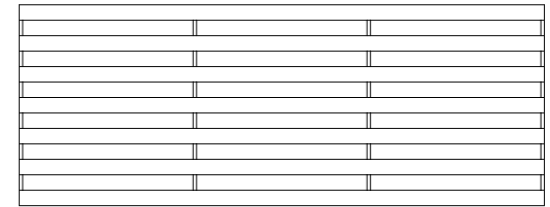
7 boards (350MM)



9 boards (450MM)



11 boards (550MM)



13 boards (650MM)

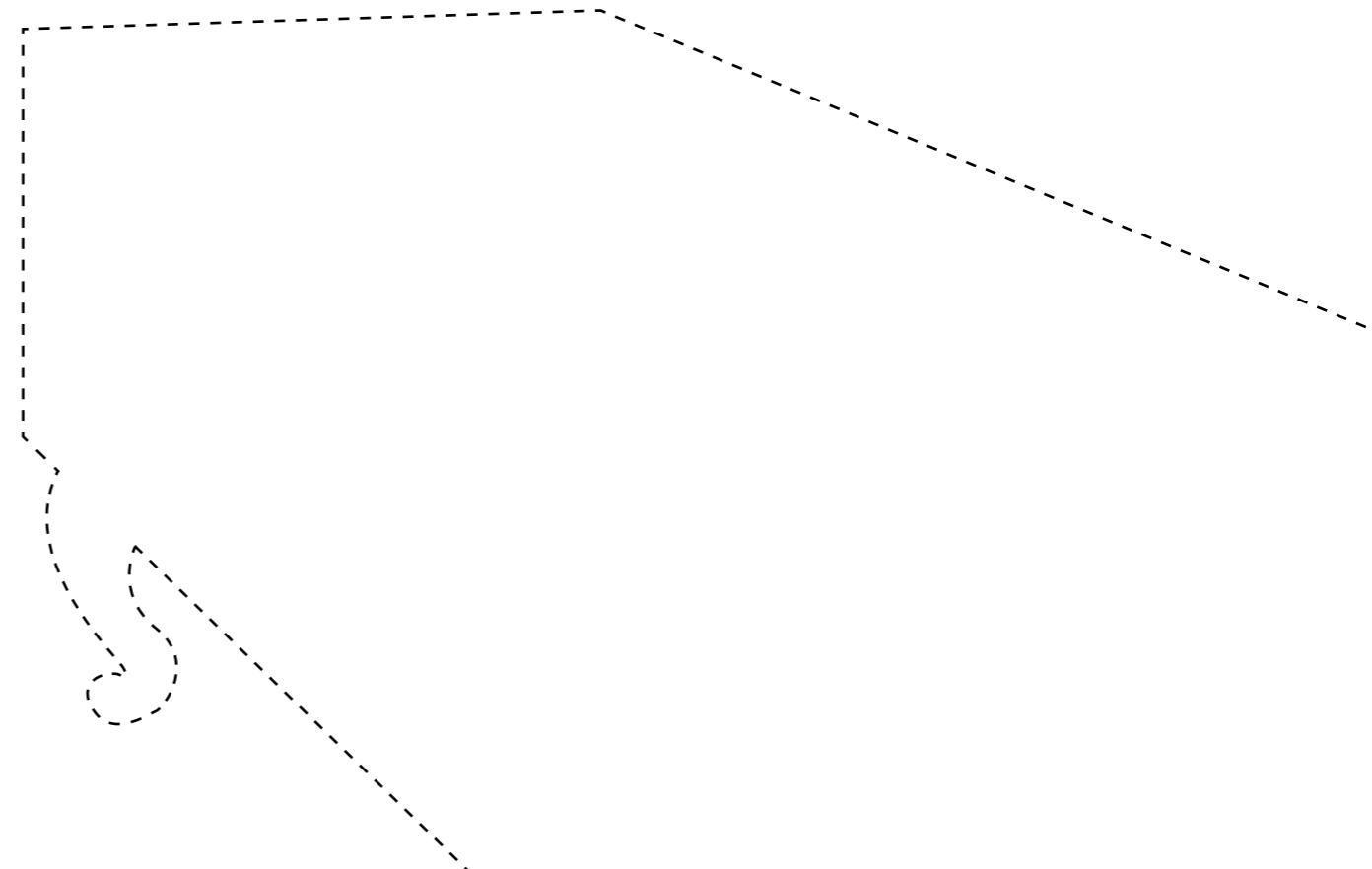
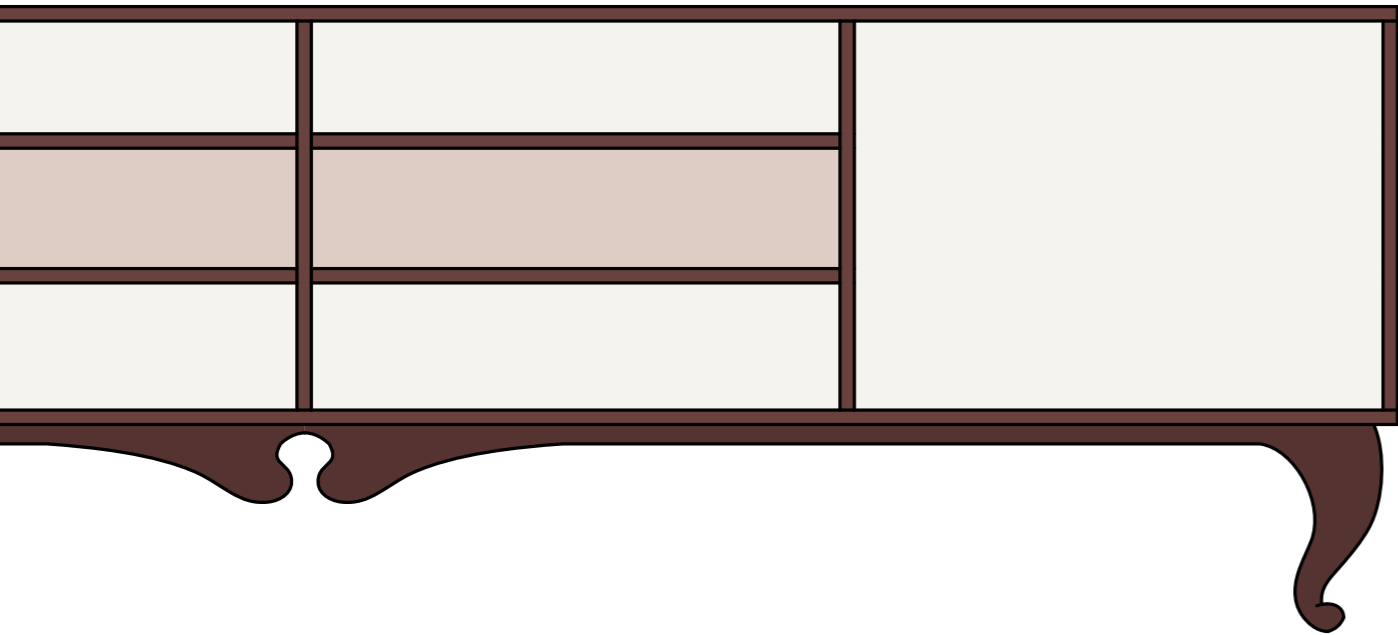


WHAT
YOU
WANT

WHAT YOU WANT,
IT IS.

APPROXIMATELY REGARDLESS OF WHATEVER YOU WANT,
THE APTO USER CUSTOMIZED FURNITURE SYSTEM NEAR-
LY GUARANTEE THAT WE CAN HELP YOU MAKE A PRODUCT
YOU LIKE. A LOT.

full height
eight compartments (custom)
doors + push-out drawers (white and almond)
baroque feet (short length)
merbau (custom)



II .

height
S, M, L

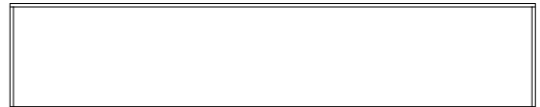
80MM - 325MM



S (80MM)



M (160MM)



L (325MM)

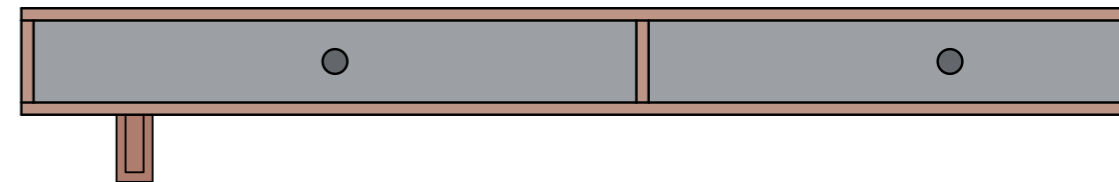
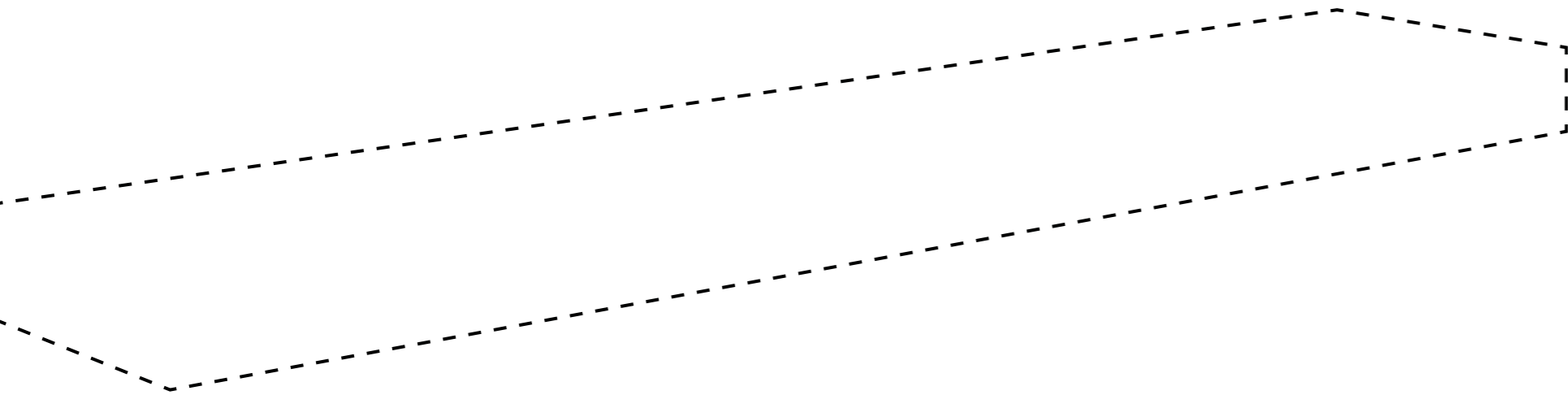
WHEREVER YOU DAMN WELL PLEASE.

WHEREVER YOU PUT YOUR APTO HANDMADE, CUSTOM FURNITURE, IT WILL MAKE WHEREVER LOOK AWESOME. PUT IT WHEREVER YOU LIKE, AND IT SHALL ADAPT. THIS IS THE WHOLE IDEA.



WHERE
EVER

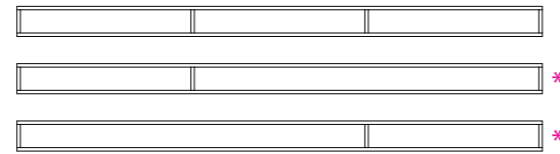
small height
three compartments
pull-out drawers (martha grey)
wall mounted
oak



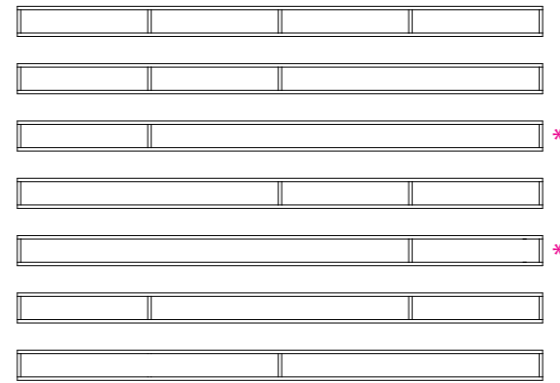
III .

compartments
quarter, thirds, custom

* require horizontal support wall



thirds



quarters

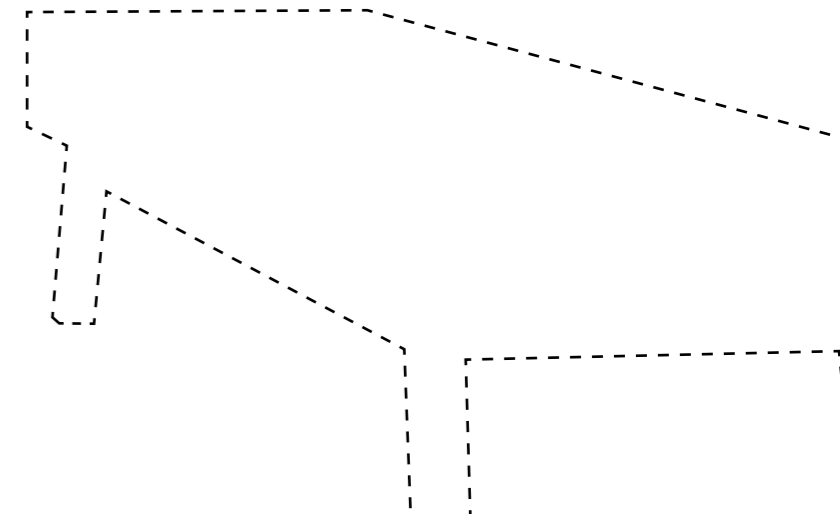
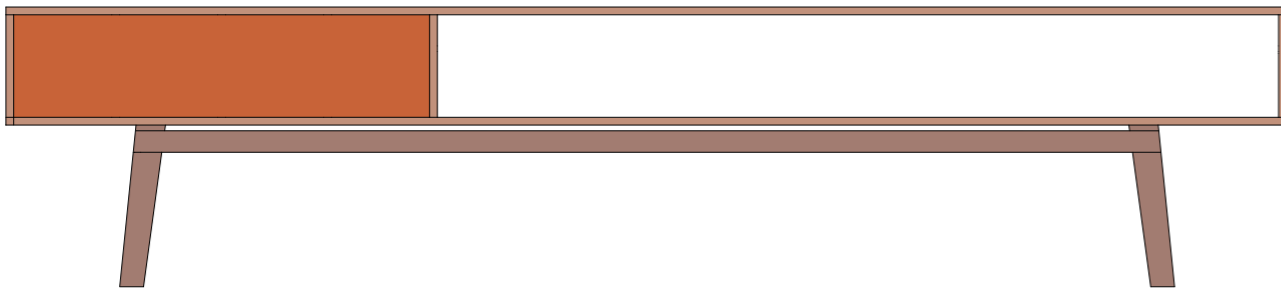
IF YOU DON'T LOVE IT,
NOR SHALL ANYONE ELSE.

WITH 39.164.686.488 DIFFERENT POSSIBLE COMBINATIONS, ALL HANDMADE, WE GUARANTEE NEVER TO MAKE THE SAME FURNITURE TWICE. THUS WHEN YOUR MORON NEIGHBOUR WANTS TO BUY EXACTLY THE SAME FURNITURE YOU JUST DID, HE CAN'T.



IF YOU
DON'T
LOVE

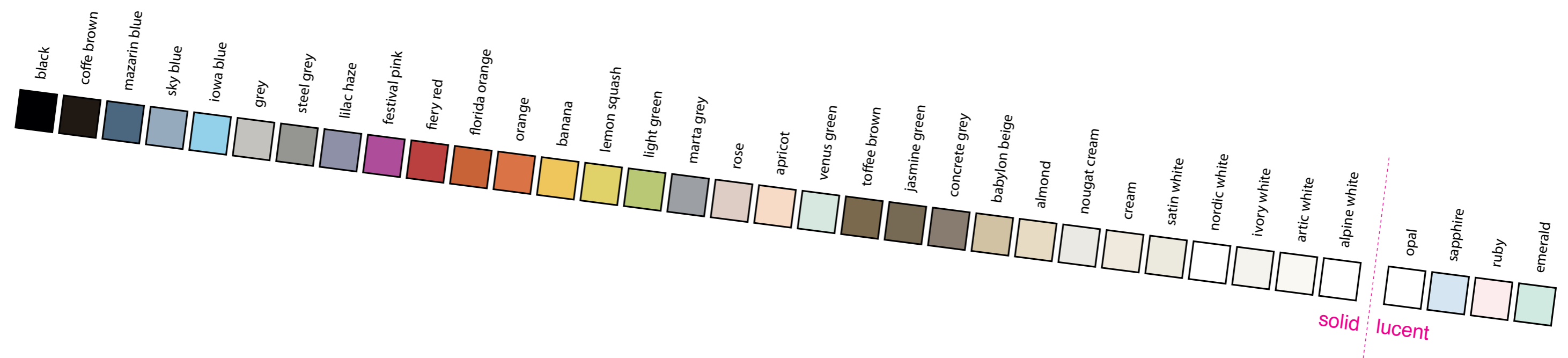
mid height
two compartments
push-out flap (florida orange)
retracted feet (short length)
alder



IV .

modules
drawer, flap, door, open

solid colors, lucent colors





I S
A W E
S O M E

IS AWESOME.

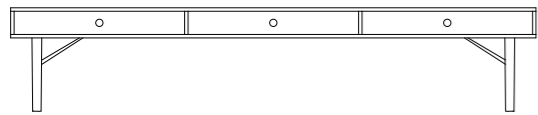
WE MADE OUR SYSTEM SO WICHEVER COMBINATION YOU CHOOSE, YOU CAN'T REALLY GO WRONG. IT STILL LOOKS GOOD, IT STILL WORKS, AND IT STILL CONJURE ENVY IN EVERY HUMAN SUBJECT ITS AWESOME. PERIOD.

V .

feet

round, steel, retracted, barouque, wall mounted*

*require depth of 450MM or less



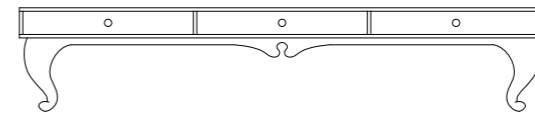
single round



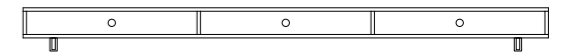
steel frame



retracted



barouqe



wall mounted *



W O O D
M E E T
H I - M A C S

SOLID WOOD. WARM, AWESOME, OLD AND LOTS OF SOUL, ALL THE WAY THROUGH. WITH NATURAL VARIATIONS IN EVERY PIECE OF WOOD, EVERY FURNITURE IS DIFFERENT, EVEN IF THEY WEREN'T.

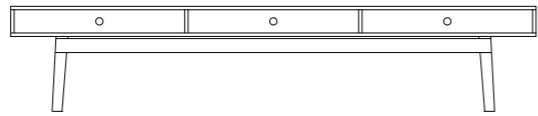
HI-MACS IS ALUMINIUM HYDROXIDE-ACRYLIC RESIN COMPOSITE. HI-TECH MATERIAL, HARD AS STONE (ALMOST), SMOOTH AS SOAP. IMPACT-, SCRATCH- AND WEAR-RESISTANT. ALSO AWESOME.

WE HAVE FOUR DIFFERENT WOOD TYPES AND 55 HI-MACS COLORS - 4 TRANSLUCENT. ENJOY.

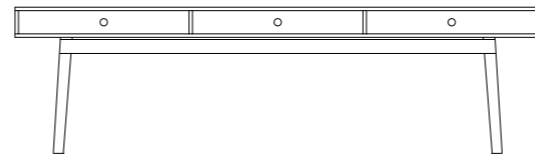
VI .

feet height
S, M, L

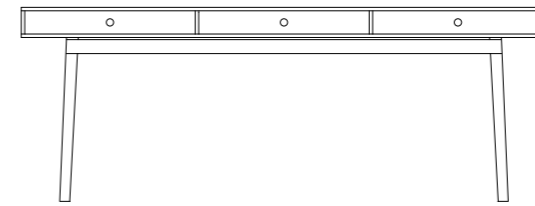
284MM - 594MM



364 MM



508 MM








674 MM

VII .

wood types

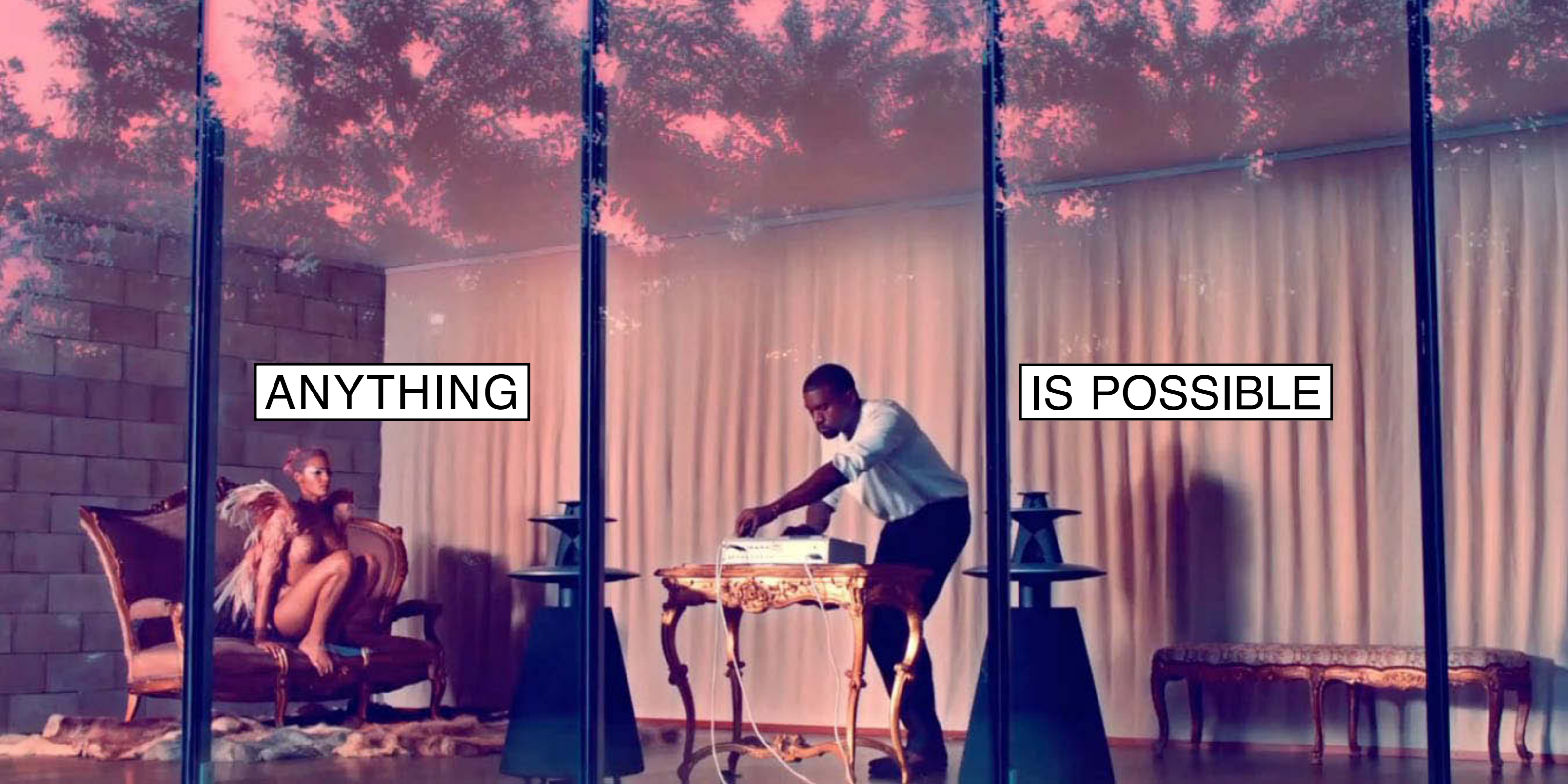
walnut, oak, birch, alder, beech

oiled, laquered, natural

walnut	oak	birch	alder	beech
				
Dark reddish color. Fine but open grain. Moderately coarse texture. Excellent to work including turning and carving.	Light brown color. One of the harder woods. Predictable to work with. When cut, it doesn't twist or split. Oak is slower growing, so there is less tension in the wood.	Yellow brown wood. Hints of red and brown. High strength, medium weight. High wear resistance. Relative high cross grain movement.	Light brown, reddish color. Homogenous and light wood. Strong, firm structure, little cross grain movement. High water resistance.	White yellowish color. Fine, tight grain, almost invisible wood pores. High strength. High wear resistance. High cross grain movement.

ANYTHING

IS POSSIBLE



**NOW
YOU
TRY.**

