

# THE NATURE AS AN INSPIRATION TO ENCOURAGE USERS TO EXTEND THE LIFE OF PACKAGING

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## **ABSTRACT**

Biomimicry depends on three key principles: nature as a model, nature as a goal and nature as a mentor. By studying nature, there may be several answers to challenges that have already been solved by nature. A growing challenge is that a lot of packaging gets produced and thrown every day. Few studies have emphasized on the structures and construction of nature as a source of inspiration in the design process taking the life cycle of packaging into account. Hence, the problem statement was as follows: How can fruit structures be used as an inspiration to encourage users to extend packaging into a long life product? The research methods consisted of a case study based on a survey, in-depth interviews and an idea workshop. The results of the survey identified some factors consumers emphasized when thinking of packaging, and acted as an input to the idea workshop. It was conducted an in-depth interview with the development manager at Lilleborg, a company that develops products for cleaning and personal hygiene. This collaboration gave a deeper understanding of the design process of packaging while also identifying important factors for packaging. The idea workshop used fruit as a source of inspiration and resulted in sketches of new ideas to the development of innovative packaging. The conclusion was that this study expanded the understanding of how students can use research methods and natural structures in biomimicry in their design education to develop long lasting packaging.

*Keywords: Product Design, biomimicry, packaging, sustainability, design process, Master students.*

## 1 INTRODUCTION: BIOMIMICRY AS INSPIRATION

Designers are always looking for solutions to people's innumerable challenges. There are several ways to be inspired by further developing existing or new inventions. It has become more and more popular to base design developments in biomimicry, which comes from a popular blog [1]. Biomimicry is a design tool to find a way to solve a human problem that nature has already solved. Biomimicry depends on three key principles: nature as a model, nature as a goal, and nature as a mentor [2]. This article will take inspiration from natural structures, exemplified with fruit, as a helping aid to develop packaging. Inspired by biomimicry, the study shows that inspiration from nature can be a useful tool in a design process [3]. Other aspects that are address in this article are to create value by extending the life of the packaging. Most of the packaging produced today have a given function, but when the contents is used, the packaging lose its usefulness and regarded as garbage [4]. The garbage problem is a challenge that has emerged in recent time, since many do not see as much value on reusing packaging because it may be associated with garbage. Previously, people were less prosperous and hence it was more useful to transform the little packaging that existed to get a new function [5]. In addition, some question reuse of packaging when one has the opportunity to recycle. On the other hand, studies show only 14% of all plastic packaging is recycled [6], and the rest ends up as a part of the garbage problem. From this background, the research question is as follows: How can fruit structures be used as an inspiration to encourage users to extend packaging into a long life product?

## 2 METHODS: CASE STUDY OF PACKAGING IN FOOD INDUSTRY

In this master project it was conducted a case study in a Norwegian context to obtain an approximation of the research question with various methods: survey, in-depth interviews, and idea workshop. The purpose of using case study was to achieve triangulation [8] around the research question, by gaining insights from consumers, designers, and manufacturers, and investigates the knowledge and awareness of packaging. The assumption behind the case study was: Structures and the build up of fruit can be

used as inspiration to develop packaging and simultaneously create an extended lifespan by using basic principles of biomimicry: nature as a model, nature as a goal, and nature as a mentor. It was conducted a survey [9] distributed via Facebook, but also through random selection. The random elections were students attending several disciplines on Oslo and Akershus University College, and were performed by gathering responses to surveys in paper format. This was done to reach out to even more consumers and to gain an insight into their perceptions of packaging and its usefulness. The survey consisted of questions where the respondent had to choose among a set of alternatives, but they could enter their own comments if none of the alternatives matched. Further, the result of the survey was developed into the idea workshop to obtain input on what factors some consumers emphasized regarding packaging. To obtain insight from a different perspective than from consumers, an in-depth interview was conducted [9] with the development manager at Lilleborg and normally works with packaging. The idea workshop is inspired by using biomimetic design in a product design course [10]. The purpose was to find out how structures and build up of fruit can be used to create creativity and inspiration to develop packaging. Idea workshop carried out by that three exotic fruits were divided crosswise in order to study the inside and outside of the fruit. The thought behind the idea workshop was to create various sketches of ideas and thoughts of packaging, but not directly provide one solution to how the final packaging should look like. The ideas were illustrated through simple hand sketches and 3D drawings to clarify the ideas that were created during the idea workshop.

### 3 RESULTS: A STUDENT APPROACH OF FOOD PACKAGING

#### 3.1 Survey: The value of packaging

The results of this survey shows that the majority would have reused packaging if it was given the opportunity for it, and there was a mixed response whether they threw away any or preserved packaging. The questions that were asked included: Why throw away the packaging? (Figure 1), what will it take you to keep the packaging? (Figure 2). Figure 1 and Figure 2 is a sample of the results that came forward using the survey. The proposed uses by participants on figure 2 were the opportunity to use in dishwashers, other uses than the original purpose, or the need for packaging. Responses from the survey helped shape, categorize various factors, and worked as input on the design of packaging. On the other hand it must consider that the survey had 55 respondents for inspiration to idea workshop. The results were used for further work as an approach to next methods.

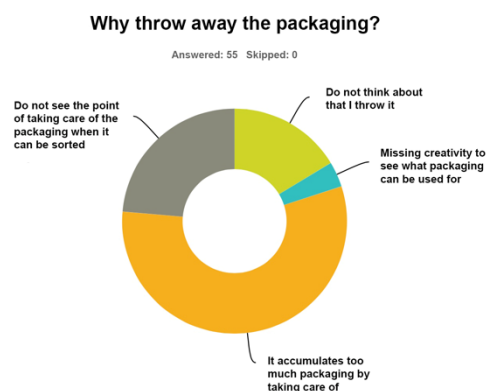


Figure 1. Why do you throw away the packaging?

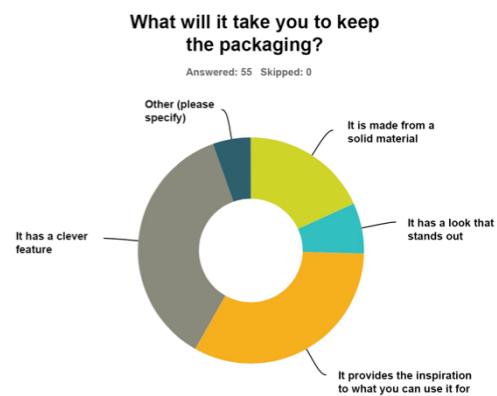


Figure 2. What will it take you to keep the packaging?

#### 3.2 In-depth interview to get insight into the industry

It was performed an in-depth interview [9] with the development manager in Lilleborg. She is responsible for a team of product developers who are responsible for Personal Care, Home Care and Oral Care, plus a group of graphic designers. The in-depth interview gave insights into the packaging industry, and how they think about their products. It also provided input that could be developed further in the packaging design process, based on the sketches that were developed. In beforehand, an interview template [11] was created to remember what should be addressed during the interview. The entire interview was recorded, but it taken notes long the way. After the interview, a visualization was

created to illustrate the main findings from the interview. The major factors and elements of the development of packaging were further used in the idea workshop, such as additional features and environments.

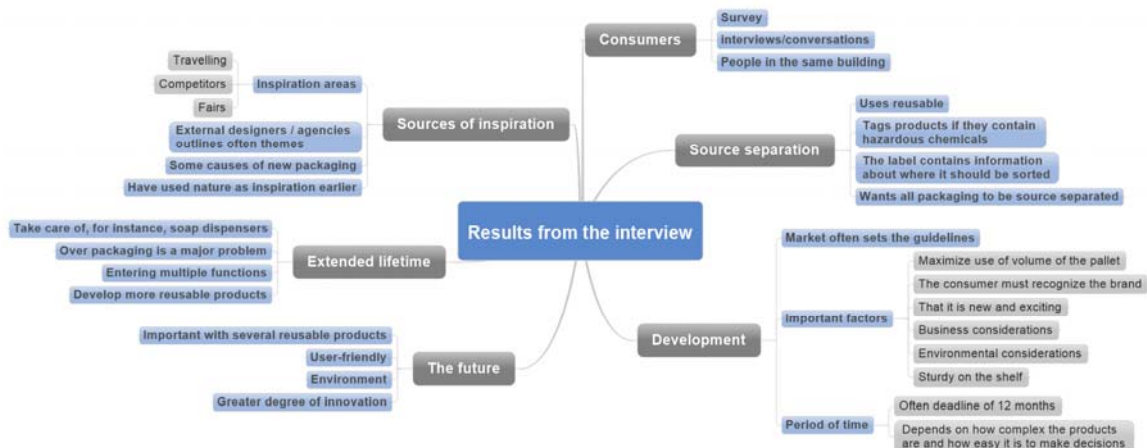


Figure 3. Visualization of an interview with the development manager at Lilleborg

### 3.3 Idea workshop based on survey and in-depth interview

The method was documented through photos, sketches and mind maps. Mind Maps [11] were as an aid in the development of blueprints. In addition, feedback from the survey was used for idea generation [11] for what consumers think about packaging. It was also taken into account the results of the in-depth interview in which some important factors and elements, as well as features and environment, the development of packaging, were identified. The fruit that was used in this study was pomegranate (Figure 4), Kiwano (Figure 5) and prickly pears (Figure 6). These were chosen because they are fruits that are likely to be less familiar than for example an apple or banana. In addition, the fruits are readily available in most grocery stores. The result was three different ideas inspiration was derived from the three different fruits. One can not see inside the pomegranate when standing in store. This means the buyer cannot be tempted to buy the fruit by seeing the inside, which could have been an incentive to purchase the fruit. The thought behind this idea is to be able to see the contents of the packaging. A transparent lid is added as an optional feature to clearly see the contents and what you buy, but it is also a lid that can be taken on and off repeatedly. This is in contrast to much of the packaging of, for instance, yogurt today [12] that is used only once because they do not have a solid enough lid (Figure 4). The structure of Kiwano's inside is layered and the seeds inside are protected by a film that must be broken to free the seed. The rationale behind this idea is a package, which can be stacked in layers on top of each other by a groove that can be turned to lock as an optional feature. The content of the package can be different as the packaging come in different sizes, but still stackable with each other. This enables the consumer to have more freedom to combine and stack containers as needed with new content (Figure 5). Prickly pears consists of many small seeds, but at the same time you had a sense that the content was juicy. The thought behind this idea is based on that one should ingest liquids while simultaneously ingesting solid foods. The packaging is a mixture of a bottle and box that is easy to carry with you on the go as a snack. The additional function allows combining parts on top of each other. This provides a solid construction and consequently the parts do not fall so easily apart when it is stored in a sack or bag (Figure 6). All three results are adopting the three basic principles of biomimicry. The pomegranate example has used nature as a mentor because it shows the content, which in principle is not what the exterior of a pomegranate does (Figures 4). The idea behind Kiwano uses nature as a mentor, as it utilizes the structure of the seeds by allowing the package to be flexible and stackable. In addition, using the nature as a model in that package serves as a film for the content (Figure 5). Prickly pears example uses nature as a model by using the process of ingesting liquids at the time of solid food. It also uses nature as a mentor by keeping content separated into separate chambers (Figure 6). All sketches are using nature as a goal by using sustainable materials

that were either energy-saving or recyclable. All sketches urges to save the environment by reusing the packaging by additional functions.

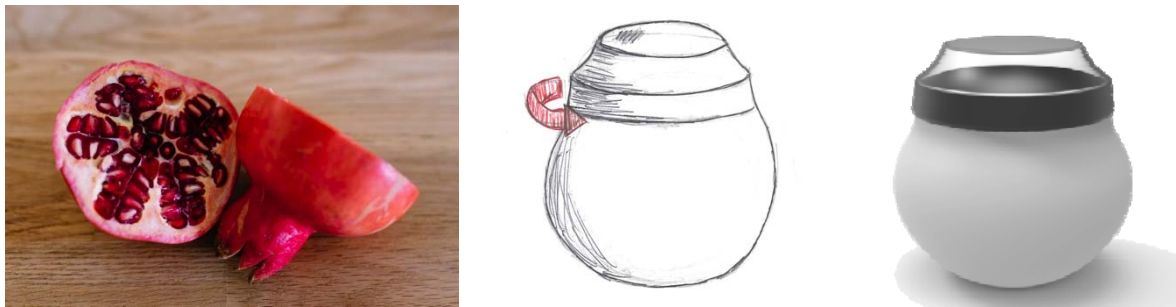


Figure 4. The idea from pomegranate. A transparent solid lid



Figure 5: The idea from Kiwano. Combination of different sizes

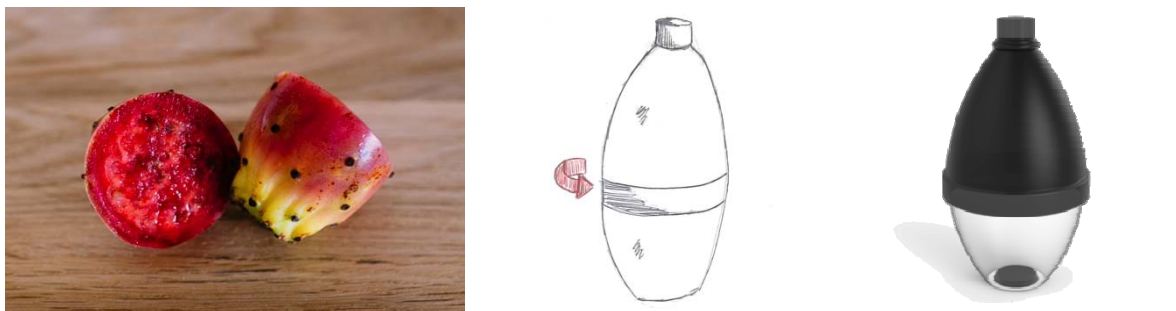


Figure 6: Idea from prickly pears. Bottle and box in one

## 4 DISCUSSION: THE PROFITS OF USING NATURE AS AN INSPIRATION

### 4.1 Nature as an source of inspiration

Designers have a long-time inspiration from nature to develop products and buildings [10, 13]. In a design education, one is usually free to choose influences. As it emerged from the idea workshop can structures and construction of fruit being used as inspiration in the creative phase of design development of packaging, and help to create ideas and thoughts, as other inspirations would not have given. Idea workshop was used as a creative method to quickly generate ideas [11] using sketches and mind maps [11]. Fruit has a natural form of packaging in that they have a shell that protects the contents, for instance oranges, pomegranate, bananas or kiwi. In turn, this can be linked to the idea that was inspired by pomegranate, whose content is protected by a kind of box (Figure 4). The box around protects the yogurt inside while the consumer can see the contents using the transparent lid. This is an example of using nature as a mentor in biomimicry. Form and aesthetics have also had an impact on the design of packaging through sensory input [14] and geometry. The fruits consisted of many geometric shapes that influenced the outcome of the sketches of the various packaging proposals. In addition, the different senses smell, taste and sight were used through idea-workshop in order to use different perspectives of creativity. The design is taken into account, so that the bag would have an attractive exterior using materials, function and form [15]. The different fruits facilitated very

diverse manifestations of creativity in the design process in idea-workshop. Some gave more inspiration than others because of its structure and appearance, while others were harder to create inspiration from. Therefore, it can be a great advantage to interact with other students or designers in an idea workshop so that you can play at and develop each other's ideas, thoughts and suggestions. In advance, it is hard to imagine what ideas fruit or nature can give, and it can get many different outcomes depending on where each designer gets their inspiration. The ideas and concepts can be developed indefinitely more iterations than it was done in the idea workshop. It is not possible to extend the life of all packaging because it is produced in huge quantities. Orkla alone produces around 19,800 tons of plastic per year [16]. Anyway, part of the packaging lifetime can be extended by adding some additional features, or use another sustainable material that allows the consumer to reuse the packaging after the original content is removed. Idea generation of extras functionality was done in idea-workshop, so it should encourage the consumer to extend the life of the packaging. It emerged in the interview with the development manager that Lilleborg has previously drawn inspiration from nature when they developed the Sterilan series. Lilleborg split the time into 8 different themes, where some of the themes took first place in nature. Just like most other companies and design agencies, they also need sources of inspiration for developing packaging. Usually they give the responsibility to external designers to determine the themes and influences, in and with the hiring designers when they develop new packaging.

#### **4.2 The importance of recycling**

Based on a survey done by 'As you sow', a non-profit organization, it emerged that only 14% of the plastic packaging were recycled in the United States [6]. There is no guarantee that the survey would have yielded the same results here in Norway, but anyway this is scary in that the use of plastic packaging is growing rapidly. It is therefore important that companies create sustainable packaging and encourage consumers to recycle the packaging after use. Lilleborg mainly plastic, corrugated cardboard, and cartons, which can go through energy and material recycling. They try as best as they can to inform consumers how their packaging must recycled, by applying the a label. There are several times I have thought; "How do I recycle this package?". By supplying this information consumers do not to end up in this situation. It is therefore important that product design students are taking sustainable choices during packaging development to ensure that most of the packaging is recycled. The survey that was performed in this study revealed that the majority recycled packaging, but chooses to dispose of the packaging since it accumulates so much by taking care of it. In order to tackle this challenge, the sketches have used the biomimicry principle the nature as a measure to make sure of sustainable material choices and facilitate for reuse. In addition, they have additional functionality whose purpose is to increase the life of the packaging and will reduce the risk of being thrown after use.

#### **4.3 Economy in the centre**

Norway is a country with much consumption, which greatly affects our view of the usefulness of packaging. Previously, one were better to reuse or redesign much of the packaging, and saw more value in not throwing the packaging away since they were not overburdened by packaging each day [5]. A significant factor that emerged during the in-depth interview is that economics is a determining factor when new packaging is developed and produced. Lilleborg has several competitors and it is important to stand out either by good visibility on store shelves or have an inviting look while the price is consistent with the product. An important factor that is helping to manage the economy is the optimization of the pallets, which gives a better volume utilization of pallets during transport [17]. The more products will fit on a pallet, the better utilization is obtained during transport and simultaneously saves the environment for more trucks on the roads. This is therefore important to consider when packaging will be developed, enabling both thinking the economy and environment.

One way to make consumers to reuse the packaging is, as the development manager in Lilleborg says, adding additional functionality. In the idea-workshop the major focus was that the packaging should give something more to the consumer, and therefore extras functionality were added. An example of this is the idea of Kiwano providing a bottle and box feature in one (Figure 6). Another example is the idea of prickly pears that provides a stacking feature and freedom to combine different sizes of packaging (Figure 5). In addition, it is important that manufacturers are getting better at producing more refill products, so that consumers can reuse plastic bottles. This is both economical for the

consumer and producer, while also respecting the environment. Are consumers really willing to pay for a more expensive packaging even though it is more durable and has a feature that adds up to reuse? It is therefore important that the function is related to the product, so it defends the price increase while providing a greater benefit for the consumer. Unless consumers see the value of keeping the packaging, it will continue in the same pattern where usable packaging is thrown every day. In the future, it is important to develop more refill products, while adding additional features that create a new value for the consumer. Refill products can be cheaper to produce, and in addition it is easier to recycle refill packaging since it takes up less space in the trash.

## 5 CONCLUSION: NATURE AS A TOOL TO INSPIRE DESIGN

This article shows how design students can use structures and construction of fruit in the design process as a source of inspiration to develop packaging through the use of Benyus' three basic principles of biomimicry: nature as a model, nature as a mentor and nature as a goal [2]. One can also extend the life of packaging by adding extra features to packaging. The result of this study shows that the idea workshop is a good method of rapid idea generation by using sketches and mind maps, and can serve as a starting point for further collaboration around the packaging design process. To create an attractive outer of the packaging product was it experimented with in this master project form and aesthetics through material selection, function and geometry. The sketches and ideas from the idea workshop should appeal to the consumer and extends the life of the package by giving new value after the original content is removed. The study shows that nature can be used as inspiration for facilitating creativity in the design process. This is also something professionals as Lilleborg have used previously. When one looks at how much packaging being produced today, it is important that consumers recycle and reuse. On the other hand, product design students also have a responsibility to consider conditions for sustainable packaging through recycling or reuse of choices made during the design process [4, 5]. Anyway, this responsibility must be evaluated against the economy, which is often a dominant prosecutor in the choices that are made during the packaging design process.

## REFERENCES

- [1] Maxwell K. *Biomimicry*, 2012. Available from: <http://www.macmillandictionary.com/buzzword/entries/biomimicry.html>.
- [2] Benyus JM. *Biomimicry : innovation inspired by nature. Reissue. ed.* New York: Perennial; 2002.
- [3] Kennedy S. *Biomimicry/Bimimetics : General principles and practical examples.* 2004.
- [4] Eriksen TH. *Sjøppel : avfall i en verden av bivirkninger [waste in a world of side effects]*. Oslo: Aschehoug; 2011.
- [5] Eriksen TH. *Innpakningens betydning [the package significance]*, 2005. Available from: <http://hyllanderiksen.net/Emballasje.html>.
- [6] MacKerran CB. *Waste and Opportunity 2015 : Environmental progress and challenges in food, beverage, and consumer goods packing.* 2015.
- [7] Lazar J, Feng JH, Hochheiser H. *Research methods in human-computer interaction.* Chichester: John Wiley; 2010.
- [8] Maxwell JA. *Qualitative research design : an interactive approach. 3rd ed. ed.* Los Angeles: Sage; 2013.
- [9] Ringdal K. *Enhet og mangfold : samfunnsvitenskapelig forskning og kvantitativ metode [social science research and quantitative methods]*. 3. utg. ed. Bergen: Fagbokforl.; 2013.
- [10] Hsiao H-CC, Wen-Chih. *Using biomimetic design in a product design course.* 2007.
- [11] Lerdahl E, Finne P. *Slagkraft : håndbok i idéutvikling [Impact force: handbook idea development]*. Oslo: Gyldendal akademisk; 2007.
- [12] Møller HS, Vibeke. *Forbrukerorientert emballasje : Emballasje og produkt [Consumer-oriented packaging: Packaging and product]*. 2012.
- [13] Hallgren L. *Santiago Calatrava*, 2007. Available from: [http://www.fec.unicamp.br/arqs/20090520015955-T2-ART\\_Calatrava.pdf](http://www.fec.unicamp.br/arqs/20090520015955-T2-ART_Calatrava.pdf)
- [14] Teigen KH. *Sansing [Sensing]*, 2009. Available from: <https://snl.no/sansing>
- [15] Michl JL, Jon. *Formgivning [design]*, 2012. Available from: <https://snl.no/formgivning>
- [16] Orkla. *Ansvar for miljøet [Environmental responsibility]*, 2012.
- [17] Lilleborg. *Miljøarbeid i Lilleborg [Environmental work in Lilleborg]*, 2010.