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FORMULA FOR DESIGN

Key factors of designing 3D physical objects

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ABSTRACT

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Formula for design is a research for gathering information and insight on design, in order to search possibilities and means to evaluate designing and design outcome objectively. The research was done interviewing seven Finnish designers of different backgrounds and ages. The research used semi-structured format with preset questions as a basis for conversational interviews.

The research found successfully problematic phases in design processes. There could be pointed out factors for evaluating the design of three-dimensional physical objects. Such factors include defined functions, defined colours, chosen materials and finalised given form, among other factors. Besides focusing on such design details the research looks into design processes and design education and the impact they have in design output and designing as a profession.

Although the research did not set its target on 2D design nor digital forms of designing, the results and findings on designing and design processes do touch those subjects as well. The research findings can be used for evaluating key factors of design, design processes, design education and design-related consulting.

Keywords: Design, muotoilu, formgivning, formgebung, design thinking, service design, furniture design, product design, design quality, design education

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1. INTRODUCTION

Before there is an object, there is a process how that object or product was created. Natural objects form after some kind of an evolutive process. Human made objects are designed with a process faster than evolution. From the subjective viewpoint of the author, the work of a designer has altered greatly within the last decade. What once was a task for a skilled individual designer has evolved into team work actions labeled as *design thinking*, that could be described as asking input from the clients and making responsive actions according to the most popular answers. That process mimics evolution in its basic logic.

This thesis asks a group of diverse designers their views on current design world and its' processes compared to what are these designers' opinions on an ideal designing process. As a working hypothesis there is an assumption that the center focus of design education has shifted away from traditional form-giving design towards service design. The amount of relevant recent comparing design researches appears to be scarce, hence there are numerous open questions in the text.

Besides answering the research question, the research interviews managed to rise up numerous interesting related open questions during the process, revealing the participant designers having the spirit of true designerly way of thinking. The working hypothesis about the shift of design education focus shifting from form-giving design towards service design leads the research focus also towards the changes it may lead to, concerning designing as a profession. If iteration cycles are replacing the designing work of an individual designer, then how are and should the design efforts and design outcome evaluated.

Polls, queries, and customer researches can be presented as the basic tools of design thinking. This thesis asks the designers if that is considered as the optimal workflow of a design process. Does *design thinking* ensure the optimal results in an optimal timeframe? What are the key factors that pre-production design should be evaluated with? Continuous development by trial-and-error

-cycles can be based on user feedback or customer queries, but this thesis tries to research if iterative developing is the optimal formula for designing physical objects. Are there key factors of design that should be focused on when making and evaluating product design? If all the key factors of design were to be found, could these be evaluated intentionally thus defining the object in an optimal workflow and receiving optimal results. This thesis asks that from the designers – what are their key factors of design and whether they have a functional formula for designing. Those answers are then combined in order to find a common answer to the research question.

1.1 The contents of the chapters

Chapter two describes the basic fundamentals of design. Chapter three takes a brief look at the work of notable designers and their viewpoints at the craft of design and also the elements used in the evaluation of design in after-production phase.

Chapter four takes a closer look into design processes and design thinking. Chapter five describes the research question and the problematics of pre-production design evaluation. The chapter five also describes the research procedure and analysis methods used.

Chapter six describes the results of the research interviews. The seventh chapter provides the analysis of the combined research results as a conclusion. The eighth chapter opens up the author's view on the need for future research topics, the problematics of researching design and the chapter discusses briefly the possibilities of designing in the future.

2 DESIGN FRAMEWORK AND DESIGN AS A WORD

2.1 Design framework

A three-dimensional, touchable object may be a tool or utensil, a machine, a work of art, an object of desire, a collectable functional design item, a weapon, a piece of junk, a status symbol, or maybe just raw material waiting to be designed and manufactured. A person who is responsible for defining the three-dimensional haptic products so that they can be categorised and labeled with such definitions is called a designer. The evaluation of design can be seen as subjective and vague. Are there facts and objective values to evaluate the design process, designing as a work phase and a design as an end result? This research targets on charting the field of design, design principles, the evaluation of design and designers' and other stakeholders' roles in product development process.

The digital era has had an impact on human behaviour. Basic dualism is easily identified as digital versus analog - virtual versus real. Product designing has had its share of the change. Designing has become a general term that is used in many contexts. The work and results of designers of 3D physical objects are evaluated after the manufacturing with the same key factors as are the digital products – functionality, usability and visuality. Where the digital manufacturing phase is lighter the analog physical manufacturing should be evaluated before the production in order to avoid unnecessary costs due faulty design. So analog products with 3D haptic presence in physical form do hold all those factors of digital products and two dimensions and of virtual space, while having more key factors to be evaluated on.

Designing has been a target of change also by work process method changes. Some of the changes may be linked to digitalisation. Service design and design thinking are titles for development methods that are used in service and product development. Do those methods work both for analog and digital designing? Digitalisation-driven development of working processes in design field is an increasing part of changes in design-field in general, causing increasement of

participation with other stakeholders. Are the changes covering the analog and digital fields? The evolvement is eminent in digital side, but are there notable changes in the analog side? What are the influences of the change that may have had on the traditional designing?

Designing is a profession and therefore the revenue models for designing need to be considered as well. Designers' working methods have been accepted as innovative and creative in many different fields outside the traditional designing. After the initial designing phase, *design thinking doing* loops back to redefining designing again, that leads to an absurd phenomenon when the designing is set to work under those written-out process rules that all one needs to do for design results is to ask the clients and do something reactively and then ask the clients again for another feedback loop and follow this loop until money runs out or the start up company is bought by some faceless investor. The main open question about this is if product designing itself benefitted from design thinking methodology.

User interface design and other *2D digital fields of design* alter from traditional designing fields, such as furniture or boat designing. Haptical designing uses same approach as does sculptural art. A mass of an object is a very important thing that effects balance, friction, sound and resonance. There are objects that are touched more than looked at. The feel of an object on hand is a very important thing that has a large part on what is thought of the object's quality. Designing three-dimensional, touchable, traditional products as a profession may be under a threat. While designing has become a general term that is used in many contexts, the traditional royalty-based revenue model of independent designers seems to have become rare compared to tender agreements by design studios where the design work is billed as a delivered project.

One should ask how outsourced designing is evaluated and what is the actual role and purpose of a designer. Recently a common way for a company to evaluate a product or a service is Net Promoter Score survey (NPS) that is intended to meter customer loyalty. End users are asked in a survey whether they would recommend the product or service to their contacts. The result is a numeric

value that can be used as an indicator of a quality value that indicates customer loyalty. While the numeric and easy to meter value may deliver that, such simple numeric input does not give any indication to the reasons of possible failing quality, low customer loyalty or how the quality should be developed if the numeric value is too low (Reichheld, 2003).

2.2 Design as process and strategy

The Danish Design Centre (ddc.dk) made a four step model in 2001 to evaluate, rate and illustrate the use of design in companies (Figure 1). The first step of the ladder in their model is non-design. The second from none in the model is called design as a form-giving. The third is Design as a process, and the final, fourth ladder step is Design as a strategy. As such there are only three actual steps that consist design. The model does an effective visualisation suggesting that a company should climb the ladder higher to reach better results. The lowest actual step - Design as a form-giving is evaluated on the illustration as the least

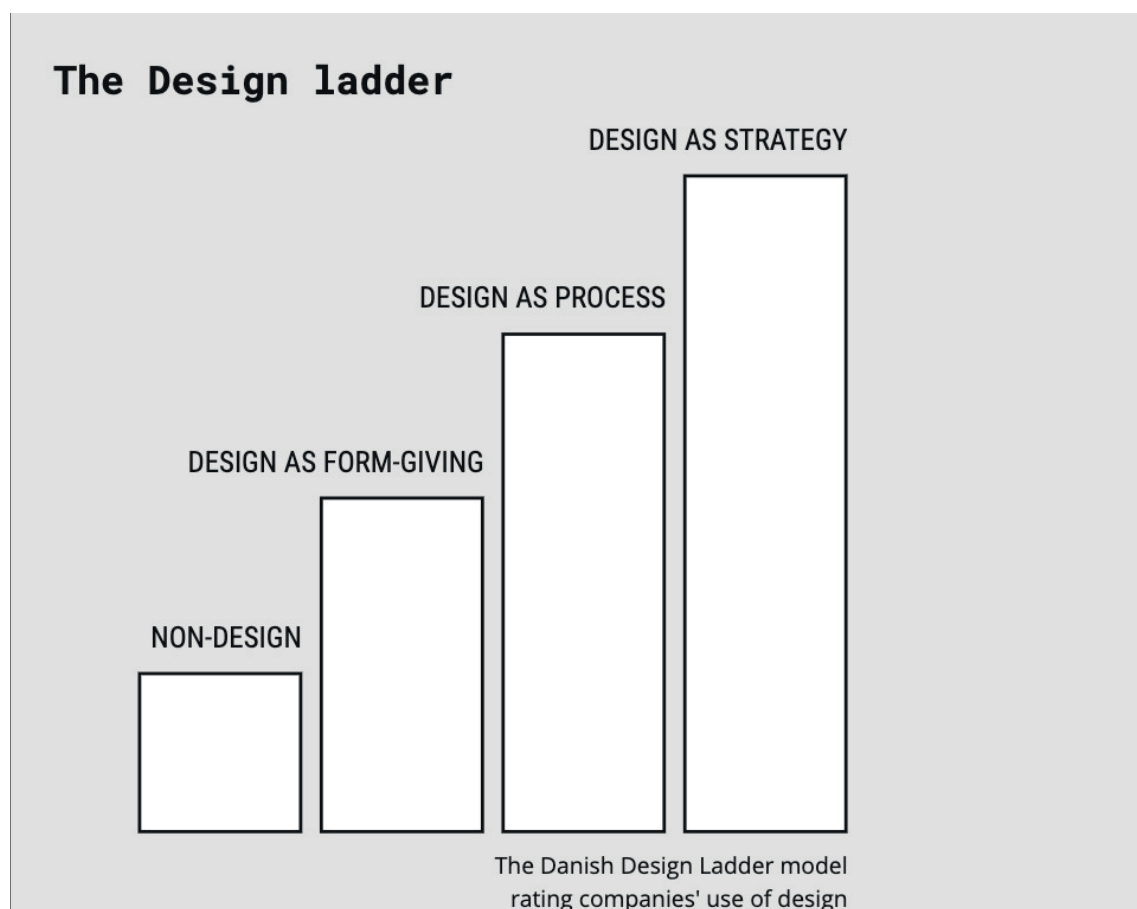


FIGURE 1, The Design Ladder (Danish Design Center, 2001)

effective step. The next one is called a process, illustrated as a better choice for a company to choose as its strategy. The fourth step is then the strategy. The first step was a concrete term compared to harder to define words of process and strategy. A company should always be aiming for high growth and success so the design ladder model suggests that a company should not focus on form-giving design, but rather processes and strategies when climbing design ladder higher up. A such interpretation of comprehension may not be common, but at the fast paced corporate world it may be possible. One should ask whether this kind of illustrative simplifying could be hazardous to design. Who are doing the designing when designers are busy creating strategies? The customers answering NPS surveys after purchase should not be given that much responsibility on design input. The design ladder, as it was intended, should encourage keeping designing in the company's processes and strategies. What the strategy is, or what the chosen process is at a given moment, may not be as important as it would be to keep design in the company's core functions. Strategy should be evaluated and redefined based on the evaluation. The processes in general should be evaluated and developed constantly in order to increase efficiency. The form-giving design can be taken in to company's processes and strategies. The form-giving design is a key factor when the use of design is evaluated. It is debatable which group of stake-holders has the most interest and something to gain from rating a companies by this four-step ladder model. Investors looking for long-lasting profitability on a stock market come to the author's mind.

The author has been a designer since 1990's. From a subjective viewpoint the ingredients of the actual work requirements, processes and methods have been largely the same up until 2010's. The last decade has seen a change in product development processes and designing in general. The role of an individual design expert has narrowed, while teamwork with participants with various backgrounds using iteration cycles as a method to refine the design little by little has increased as a working method. Iterative working methods as a quality improvement method first were used in engineering and manufacturing processes mainly with electronical designing and software designing. At first the change seemed subtle and of a positive progress while more stakeholders

were introduced in the design process. Relying on customers as a source for information has become a common thing. Designing has become teamwork. When an individual responsible designer alters to a group design process, that opens up questions.

- Who carries the burden of design responsibility?
- Who decides what is entered to production if there is uncertainty within the design team?
- What are the roles of the words strategy and design in the same sentence?

At the time of starting to write this thesis, the change in design processes seems to have developed into a direction where the actual designers may have become a rare species of soon to be extinct form of an ancient profession. This research and thesis hopefully proves the author's fears wrong.

Design is a vast subject. Everything that is made by humans could be categorised as been designed. In evaluating design there can be found categorisations that can help the evaluation. Whether the design is good or bad can be one categorising divider. How bad a design can be? How good a design can be? Probably there could be another possible iteration cycle on every object ever designed, yet just slightly improved. But how bad can a design be? Maybe if it is impossible to manufacture. At least the timing is off. That does not have to be a permanent fail as Konstantin Grcic points out.

When engineering concentrates on manufacturing methods dictating the way the product should be designed, because of a certain manufacturing machine just happens to be available, designing can wait for the right way to be invented to produce it. Technology makes it possible to make poetic design. Technology is now so invisible [...] It is possible to make a product without anything reminiscing traditional [...] like something magical. (Grcic, 2017).

So what are the factors to evaluate design on? Maybe one factor could be popularity. Apparently a large group likes that factor. Another factor could be credibility. The user must hold that factor a dear value. Longer maintenance and renewal cycles must be positive values. Profitability? At least the manufacturer must like this one. One factor could be efficiency. If understood in context this could be a

factor the whole planet appreciates. On the other hand that word could lead to another direction. A more clear factor could be sustainability. That is a positive factor and mandatory as a design key factor surely to be considered in. Let us look into what the design actually is. In a linear scale of product development, design is a process phase before there comes a ready product. Designing is work. How does physical and non-physical design processes differ from each other? What facts should be defined before the design can be called ready? What are the basic elements of a good design? That is a clearly subjective question, but what are the key elements of a design? What are the facts? What is on the designer's responsibility in designing work phase to actually accomplish? These are the open questions that this thesis circles around with.

Besides being optically visible, having a physically present object as a design target has an element of being haptical, touchable. Haptical designing uses same approach as does sculptural art. A mass of an object is a very important thing that effects balance, friction, sound and resonance. There are objects that are touched more than looked at. The feel of an object on hand is a very important factor that has a large part on how the object's quality and presence is observed. Fukusama, Papanek and Rams describe the basic approaches of hands on designing, by sculpting with guidance from the feel of hands without an aid from technology.

Your body is more honest than your mind (Fukusama, 2014).

Technology alone is not an answer. Technology can mess things up more.

(Papanek, 1992)

The first step in design is thinking, then to drawing board and then fast to three-dimensional hand-made models. The computer can not take away your thinking, you have to think and you have to tell the computer what it has to do. (Rams, 2013)

As Rams points out the computer technology may be of help, but not the primary tool in the process, a physical hand-made model will elevate the design process. As Jonathan Ive points out that as soon as there is an actual haptic object at hand, there is a remarkable shift of progress and focus in design process.

It creates a focus. It describes what we are trying to do. There is something very special about when you have an object with physical being. And when there is an object to touch, everything shifts. It's always been the case. And what's to shock me that I remain surprised and thrilled every time to get that first model. (Ive, 2014).

2.3 Design as a word

There is a noteworthy difference in terms within different languages on regarding design. Finnish word *muotoilu* (comes from the word *muoto* that accurately translates to English as a three-dimensional form), designing in Swedish *formgivning* and designing in German *Formgebung* all have a distinctive meaning that one gives a three dimensional shape or form to the object in question. The English word *design* without such restrictive definition has been used in many non-3D-contexts where usually the Finnish word *suunnitella* (to plan) or *kehittää* (to develop) would be more accurate translation than *muotoilla*, that has a 3D-meaning. The verb *muotoilla* (to design) and substantive noun *muotoilu* (a design) have been used commonly with translations of terms Design Thinking (*muotoiluajattelu*) and Service Design (*palvelumuotoilu*). The actual correct translated wording for Service Design would be *palvelukehitys*, while Design Thinking as a systematic tool for developing an abstract idea could be called in Finnish *ajattelunkehitys*. With this common language inaccuracy in mind the research question of this thesis has *3D physical traditional haptic objects* as target specification for the word design that actually intends to be an accurate translation to Finnish *muotoilu*, Swedish *formgivning* and German *Formgebung*.

The designing of 3D physical objects has all the elements and restrictions of *3D digital designing* and *2D graphic design* present. Three dimensions, gravity, friction and other physical elements are present. That makes the traditional designing, such as industrial design, furniture designing and physical product design more demanding in the need to think through and define various details.

This study does not concentrate on 2D design, graphic design or digital application design, although some principles are probably applicable on those as well. Furthermore this study does not concentrate on 3D digital designing, because the design work is remarkably different without restrictions of the analog world. Where the Finnish word *muotoilu* has been the used in discussions, the translation used in English later on is mainly Design, without the 3D physical object-definition.

3. RESEARCHED DESIGNING AND DESIGNERS

The designing has been claimed to be a difficult and foggy process to define. The researches have tried to grasp the essence of designing by a theory of designing being a method of defining the meaning and sense-making in the product development (Kettunen, 2013). One should question if the designers themselves see their profession as difficult, foggy and fluffy as the researchers seem to do.

Designing is a traditional profession, where the end-result is *the design*. Independent freelance-designers have traditionally made their living with royalties from the sold products afterwards. The amount of the royalty varies, and the reputation of the designer has a lot to do with it. In-house designers make their living with monthly salary usually without royalties. Design studios that use unnamed designers on their pay-roll sell their design services as an outsourced design-muscle for companies, most often without any royalty deals. Design studio's billing may be by the hour or a fixed amount of money, agreed on in a project tender offer. The most famous designers have usually been independent designers and working on royalty deals. That has a causal cycle, the named designer with many clients becomes more famous. The name gains reputation and help getting new clients. It can be assumed that multi-cliented experience also develops the designer's abilities to being a better designer.

Designing usually takes place before engineering and manufacturing in product development timeline. That order in timeline makes designing a future shaping function as Viktor Papanek describes it. *We try to predict what the future will be like. The future is the only place that nobody has ever been to. (Papanek, 1992).* The Manufacturing phase processes the earlier functions as designed. Designing should think through the whole product development process. Designing should also think through the whole product life-cycle and all the marketing and logistics. This thinking through and balancing possibilities guides designing process from integrated thinking (Figure 2) towards design thinking (Figure 3). Designing should make choices that are environmentally sustainable. Designing should think through and care for cultural and human values. *Design ... must directly relate*

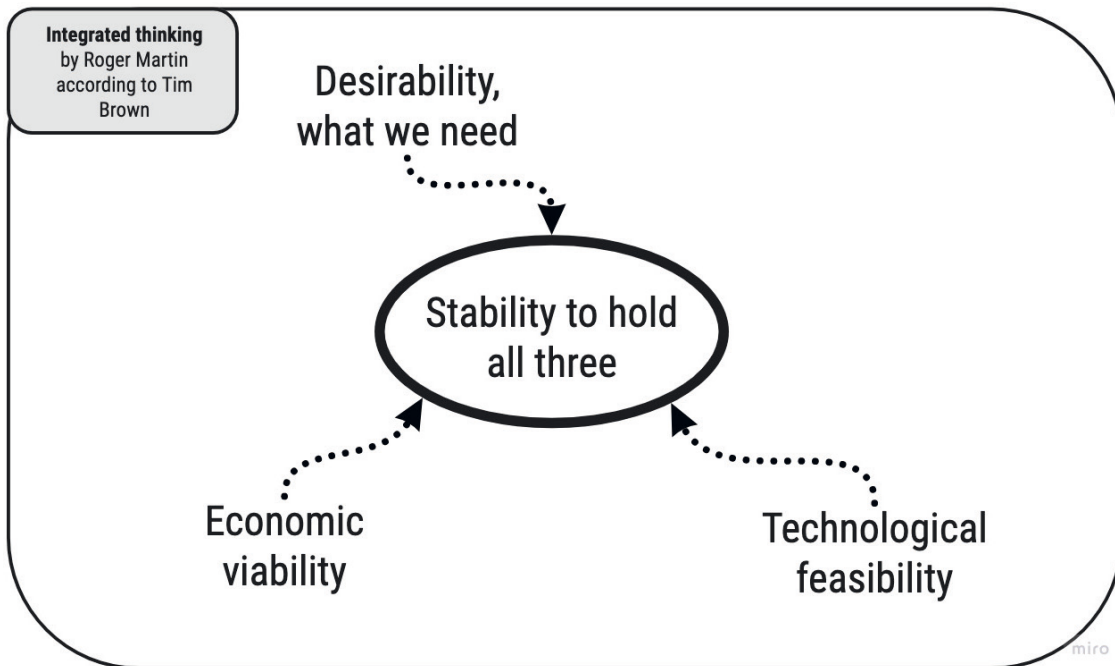


FIGURE 2, Integrated thinking (Tim Brown adapted from Roger Martin, 2009)

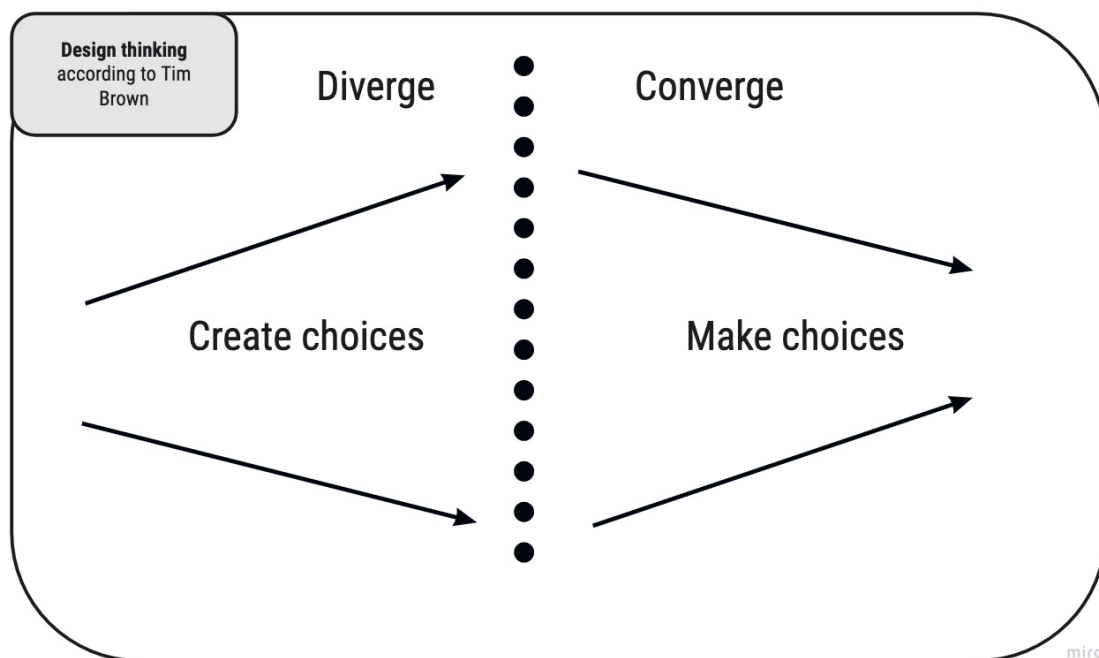


FIGURE 3: Design thinking (adapted from Brown 2009)

to people and people's needs (Papanek, 1992). Designing gives an identity to the object. Where the designing in Nordic languages thrives from three dimensions as described earlier, the *designing* as a word in English lacks that meaning and instead maintains a promise to think through drawing.

But why is it necessary for designers to draw at all? One obvious reason is that the end point of the design process usually requires a drawing, or a set of drawings,

that provide a model of the object - the building or the product - that is to be made by the builder or manufacturer. That is the designer's goal - to provide that model. If, given the brief for a new product, the designer could immediately make that final model, then there would really be no need for a design process at all - the designer would simply read the brief and then prepare the final drawings. (Cross, 1999).

As seen from the quote above, Cross has a viewpoint from two-dimensional angle on design. The modern methods with 3D CAD have bypassed that need. If the designer has achieved enough skills with 3D modeling, it is possible to skip a sketch on paper phase totally. A drawing is most likely needed for production, but the drawing can be generated from the 3D-model and not vice versa.

Design thinking method aims at activating participants inclusively into creating a lot of new ideas. Being innovative and creative is said to be in the center of design doing (Brown, 2009). Is creating a lot of ideas actually designing? Is designing inventing? Designing is said to be “intentionally defining a solution to a chosen or given problem” (Montero, 2015). That definition puts designing more akin to taking an idea and then defining a way to make that idea into reality. Does the idea need to come from the designer? What is the key input designer gives to the process? An idea may be already an existing one, and still the designer’s input may be crucial for the project and the company as Dieter Rams recalls the start of his career:

Design can help not only the world but the company to become successful [...] My first design thing after architecture was this Snowwhite's coffin, it was the first radio with a plexiglas cover, that was my start on this industrial design (Picture 1, Braun SK4, "Snowwhite's coffin", 1956). Braun brothers knew that the design of products had to be improved, because the outside of the radio was more technical than the inside. Braun brothers knew they need in-house stronger combination between engineering and design, and I got in. The beginning was improvised. It soon became clear that we needed decision only from models. You cannot get decision process only by discussion. You need the models. It gives you a chance to make clear what you want to do by three-dimensional models. (Rams, 2013)

For a talented designer, the personal designing process may be so natural and easy that the difficulty of designing could be belittled. The following quote could be read as an encouragement for everyone to become a top designer just by thinking like a consumer. The amount of talent and experience in designing probably makes designing seem easy as breathing for Jasper Morrison, as he has delivered high class design output with his subtle style and modest manner



PICTURE 1

for decades.

Take the attitude from personal experience. Design it in the way you would like it to be, as a consumer. I think that's a very important aspect to design, not to forget that we are ourselves consumers and we should be using these objects we design. [...] Very often the most pleasing designs are the ones where the thought has been most easily arrived at (Morrison, 2007).

Tim Brown illustrates the design thinking into two phases of creating more possible choices and limiting those possibilities by making choices (Figure 3). The first part could be seen as research. Designing is not the same as choosing the right outcome from a catalogue. Design does require intentional choices being made, in order to define the area of right choices and as a starting point to doing the designing. That leads to the outcome, the designer's vision of the optimal beauty and functionality. (Brown, 2009)

Designer believes on a vision of a product. Designer's task is to describe that vision so that the other stakeholders see that vision and believe in it enough to invest on the production. An idea of a product is not enough to call it a design. Raymond Loewy describes the target and the obstacles in the way from a vision

of an idea to a ready, finalised design.

Good design is a design that doesn't get obsolete. That stays classic. Secondly it should be humble, it should not jump at you, it should blend with surroundings. That's good design. Anything violent, brutal is cheap, vulgar. That's junk. Good design is simple. You look at it, you have the impression of great simplicity. The beauty of simplicity. If it looks gadgety and complicated - not good design. (Loewy, 1979).

A lot of designing is done with ruling out the possibilities. That is an effective process method of designing. Designer's most effective way to make a design decision is to decide when to refuse making the design at all. When a designer has set the limits to their personal moral code that refusal is logical and respectable.

I have refused to design two objects, one was a casket. Anything that has to do with death. Death doesn't scare me, I'm used to the idea. It bores me terribly. And the other one was a hand grenade for more killing power or more wounding power, it was the most shocking thing to ask me to design. I would never touch a thing like that. (Loewy, 1979).

Designer should be capable in describing the design to other stakeholders in the product development process. Knowing the engineering drawing methods and the ability to make drawings that are precisely detailed, eliminate the future need to request for explanations of the design purposes. An unnecessary asking for a design detail costs time on the budget. More importantly, an open question that goes to production on a false assumption, is a design quality risk at minimum. The need for the product must be real in order to achieve the level of good design. Dieter Rams has his priorities as a designer clear on philosophical level.

The basic thing to my philosophy is that come back to simple things. We don't need all unnecessary things, we have to concentrate basically on really the necessary things on products or on houses or whatever. And there is no change. There is no basic change. Still our main objectives to eliminate unnecessary things that necessary things come more into potent. Our daily products need to do what they do when needed, but to stay in the background when they are not needed. It's very simple, come back to simplicity. (Rams, 2013)

3.1 Evaluating design, post-production

When Raymond Loewy was asked about a perfect design, his answer without much of a hesitation was an egg. (Loewy, 1979). It is hard to find any design flaws on that form. As Loewy points out, a cube would not work. Nature has enough time to really iterate the design process to perfection. Us mortals do not

have that luxury.

There is an example against the design having the need of an unique idea. The designer designs a fork — that is hardly a new idea. But if the new design of an old idea such as a fork does not have the designer's personality present, the uniqueness is at stake. Jasper Morrison and Naoto Fukasawa presented an idea and curated an exhibition super-normal on ordinary objects that are so commonly used on every day life that the users do not notice them anymore. Those objects generally have not been designed by a designated designer. Anonymous designing does still fall into the category of designing, if it fulfills the requirements and given standards. Morrison points out having been concerned about the super-normal objects being superior in design quality compared to the designed objects by a famous designer. (Morrison, 2007).

My reaction against Memphis, at that time I had a feeling that Memphis and design in general had skipped a stage and designed things straight for museums and were missing out the actual consumer. So I wanted to get back to very ordinary atmosphere and ordinary pieces. (Morrison, 2007).

Dieter Rams's Ten thesis for good design (Rams,1995), a clear and logical top ten list of guidelines has gained popularity among designers for a long time. The list works as a list on design principles, but actually does not hand out very clear instructions on which are the key factors 3D haptic traditional products could be evaluated with. The end-user evaluates the design individually. The designed result as a ready product does have many other variables. A design can be perfect, but if the engineering, manufacturing production or even logistics fails, the end-user finds the product disappointing. Under the surface of the execution of an idea there may be underlying layers of meaning in the design. That is revealed in an interview with Apple Corporations former chief Steve Jobs in an interview where he was talking about the missing ingredients of the product of their biggest competitor. Jobs named those missing important things of design, none of which are easy to measure, meter or define:

- Taste.
- Original ideas and bringing culture into the products.

- **The spirit of enlightenment.**

The way the species grow that we take the best things and spread them around and then everybody grows up with better things and starts to understand the subtlety of these better things (Jobs, 1995)

Original ideas lead to a subject of whether copying is a form of flattering. Apple's products have been claimed as being copied by other companies. Jonathan Ive of Apple Corp. explains his personal feelings after copies of his designs entered the market.

I don't see it (a company copying Apple's design) as flattering at all. When you are doing something for the first time, you don't know if it's going to work. You spend seven or eight years working on something and then it's copied. I have to be honest, the first thing that comes to mind isn't "Oh, that was flattering". I think it's really straight forward, it really is theft. It's lazy and I don't think it's OK at all. (Ive, 2014)

Achille Castiglione points out a method of entering a personal touch of a designer into a design with a specific design element he calls a main design component. A such element that could be a form, a decorative element or a specific choosing of a material into the design.

The most important thing in design is the main design component... These are the principle characteristics. All objects have a main design component inside. Some solutions are a little stupid, others could be more effortless. (Castiglioni, 2000).

3.2 Functionality and beauty

Functionality is generally seen as a fundamental key element of a good design. There is a popular phrase about designing: "Form follows function", that dates back to 19th century architectural debate over then new sky-scrapers.

Form ever follows function [...] That is the law [...] we are on the high-road to a natural and satisfying art, an architecture that will soon become a fine art in the true, the best sense of the word, an art that will live because it will be of the people, for the people, and by the people. (Sullivan, 1896).

Besides functionality there is a different possibility to evaluate successful design. If a design is beautiful enough, it does not have to be even functional. A perfect example on that is Juicy Salif by Alessi, designed by Philippe Starck. A citrus squeezer that is commonly known as one of the most beautiful, yet disfunctional artefacts. There are obvious design flaws about it, the result is more likely to be appreciated as a sculpture than a kitchen tool. That has not diminished its iconic

value as a design object. A part of Alessi's 100 year celebration, the company has made a limited edition on bronze with the original sketch looks, the shape being probably even less useful as a citrus squeezer does not diminish the value of the object as a collectable design item.

Beauty of a form is an element of important design factor that may end up being considered as an extra layer on top of mechanical engineered solution. Beauty of a form should be seen and examined without such shallow vision. Precisely designed intelligent functional forms are more than top layer coatings, as Natasha Jen points out.

Everything has its form. How can anyone say that the objects don't have to be beautiful? Beauty is intelligence, beauty is precision, beauty is not decoration. (Jen, 2018)

3.3 Designer's responsibility

When Dieter Braun was asked if he tried to understand what the consumer likes, his answer was clear. *No. We all at Braun had the feeling that we want to make what we like. (Rams, 2013).* Besides the obvious product functionality and safety, designers are responsible for much of the new products being processed in a limited resources of this planet.

We have a responsibility to the world. This is not a choice, this is our job. Design works in a service for a better world. Design is by definition solving problems. There are a lot of problems for us designers to solve. We need to find the right ones. [...] It is time to stop hoping other people will start solving these problems. Or hope other people will let us solve them and just start solving them. You (designers) have more power than you think. (Montero, 2015).

Famous designers seem to be aware of their powerful role in the world. *We all as designers should have in our minds that we have to change the world. (Rams, 2013)* The planet, the world, is changing. The designers have a lot of power over how the world is changing. The powerful role does set as a heavy load of possible guilt on designers' shoulders if the actual need for new products and designs is unclear. *We should try to question our motives for designing (Morrison, 2007).* Environmental pollution may be more easily identified, but designers do feel the concern also for the visual taste for humans.

As designers we are responsible for our environment and filling it with amazing shapes and forms and surprising expressions of our genius doesn't make a very

good atmosphere and to me it is becoming a kind of visual pollution (Morrison, 2007).

3.4 Test of time

Some designs end up receiving a status of being classics. Good design should stand the test of time. A very good design may end up as a collectable item of desire. Collectability may not be an intrinsic value as such, but a collectable object has a longer life-cycle. Longer life-cycle reduces carbon footprints on sustainability calculations. Longer the life-cycle, better the design. At the time of the manufacturing, the prognosis for design life-cycle, not product durability, but design acceptance in future, may be difficult. Are there only subjective guesses on the test of time, before the time has actually passed? Designers do work on these issues with strong intention, as Naoto Fukasawa points out.

My products always fit the environment. They look familiar. My product is already in your mind, you just haven't seen it yet. [...] Aesthetics happen between objects [...] If the design doesn't fit inside the environment of need, there is no harmony. We really need to think harmonising the element to our environment. (Fukasawa, 2014).

4. DESIGN PROCESSES AND DESIGN THINKING

4.1 Examples of Design Processes

Design processes are different. This thesis does not focus on weighing different design processes, nor various Product development processes or Implementation processes of new products against one and another. That is still a sideline that must be looked briefly at a general level. An example of a general R&D Product development process from an idea to market shelf is described in the Figure 4. The example figure is a combination of the author's personal working history in medical appliance industry, furniture factories, technical component factories and process diagrams from design process literature. (Lempiäinen & Savolainen, 2003)

There are some key factors to point out from the figure 4.

- The linear usage of time from left to right, project phase starts after concept designing has delivered something valid as a starting point.
- Entering through cost phases or project gates require validation or approval

Research and Development, Product development process

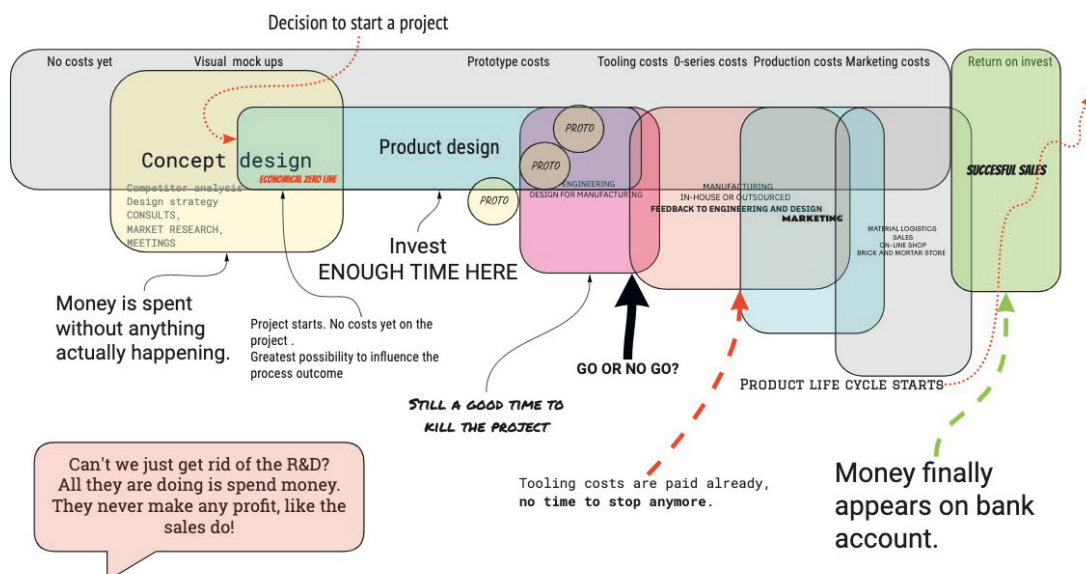


FIGURE 4. Example product development process

- Designing requires invested time before prototyping and tooling costs.
- The amount of costs pile up before first possibilities for return on invest
- Caution is needed about when the project can still be stopped without excessive costs
- Concept designing may happen before product designing
- Concept designing costs may not be earmarked on the starting project
- Prototyping may produce prototypes that do not push the project forward

This process may not be ideal, nor it may otherwise fit every product process, but that process can and have been used in medical devices, furniture making and sliding door mechanisms. As confirmed by the author's personal working history.

It is important to think the design process according to

- the company/Companies involved,
- the product/services
- whether some of the phases are outsourced
- if outsourced, the validation processes are very important

Change management should be handled very thoroughly already at prototyping phase. It is important to validate every prototype's faults and successful features and the need for changes. If a change is needed and documentation is left undone, the prototyping phase just spends time and money. 0-series (zero-series) is usually done after a succesful prototype with a real tool. That real tool may be a mold that lacks a final surface treatment until a validated result is received from the 0-series. Nevertheless the tooling costs are usually high and require cost analysis of the whole project. Prototypes are cheaper and the amount of different prototypes during design phase should not be limited with savings in mind.

Engineering phase may produce something that the design phase didn't intend

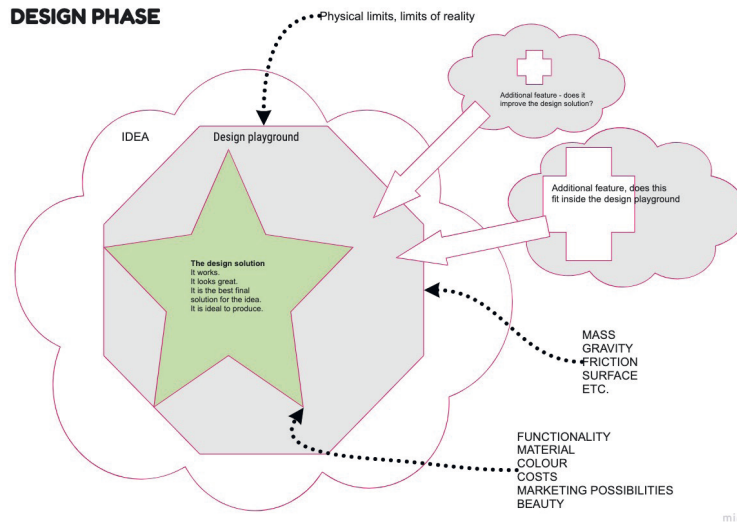


FIGURE 5, Design phase

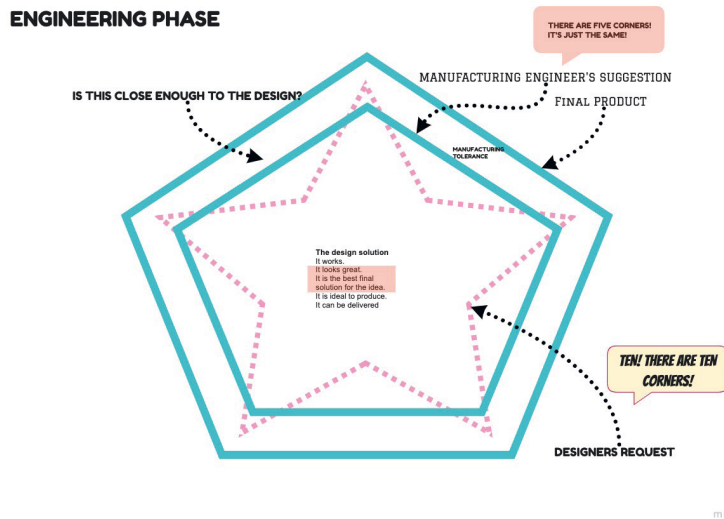


FIGURE 6, Engineering phase

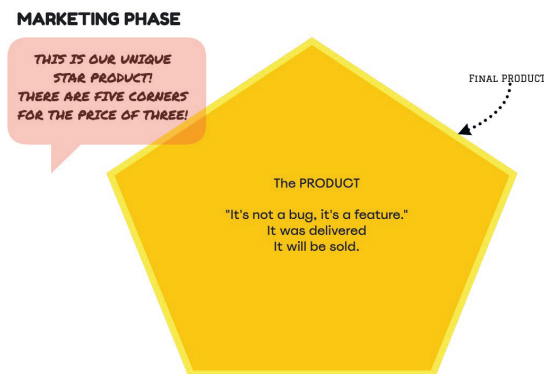


FIGURE 7, Marketing phase

(Figure 6). That doesn't mean that the project fails. Pricing or proper Marketing story can save a project (Figure 7). An example workflow from design to market is shown on Figures 5 and 6 to 7. A closer look at Figure 5 for design process. Design phase reveals one approach to designing. A designer has a vague idea. Then the physical limits of reality are defined within that idea. Then the designer sets up a design playground within those limits. And plays with the idea within those boundaries until a design solution is defined.

The design solution as described in Figure 5.

- it works
- it looks great
- it is the best final solution for the idea
- it is ideal to produce

Key factors on a design solution:

- functionality
- material
- colour
- cost estimate
- marketing possibilities as an idea
- beauty

Every additional feature should be considered with

- does it improve the design solution
- does it fit inside the design playground

Some of the physical limits listed on the Figure are:

- mass
- gravity
- friction
- surface

4.2 Design Thinking as a design process

Within the context of design there has been a lot of written text about design thinking. Recent researches or studies on traditional form-giving product design are scarce to find, but to compensate that, the older research material seem to be as relevant now as it has been when those were new. As such there should not be a reason to weigh designing and design thinking against one another, but that has been done. Tim Brown had personal experience of having his designs become obsolete when the technology in them became obsolete, so Brown put the new design thinking methods against traditional designing.

It occurred to me that maybe what passed for design wasn't all that important. Making things more attractive, making them a bit easier to use, making them more marketable. By focusing on a design, maybe just a single product, I was being incremental and not having much of an impact. This small view of design is a relatively recent phenomena, and in fact really emerged in the later half of the 20th century as design became a tool for consumerism [...] I'd like to suggest that if we take a different view of design and focus less on the object and more on the design thinking as an approach, that we actually might see the result in a bigger impact. (Brown, 2009)

Is making a bigger impact then such an important thing? Could it be that someone should watch over the little details? Those things that are in danger to be overlooked in crowded team workshops. Is putting design thinking against design really caring about design at all? Is the talk about improving design, when the talk is about design thinking? Would it be more correct to talk about improving thinking? Is design thinking actually just systematic thinking? Is the essential design thinking's promotional message Tim Brown talked about biased by frustration of a disappointed designer at a crossroads of technological disruptive evolution?

Somehow we went from systems thinkers who were reinventing the world, to a priesthood of folks in black turtlenecks and designer glasses working on small things. As our industrial society matured, so design became a profession and it focused on an ever smaller canvas until it came to stand for aesthetics, image and fashion. Perhaps design is getting big again. And that's happening through the application of design thinking to new kind of problems, to global warming, to education, healthcare, security, clean water, whatever. (Brown, 2009).

At some point the quest for better understanding designing and calling that design thinking (Cross, 1982) transformed into making a systematic behaviour

brand of *Design Thinking Methodology* that may even resemble a religious movement. There are designers like Natasha Jen, who challenge the movement.

Design thinking is bullshit. There is total lack of criticism on design thinking. Does design thinking work for the designers? Yes, it may. Prove it. Criticize it. (Jen, 2017)

Is design thinking the new dawn of enlightenment in product development? Or is it a translation of designerly ways to think explained better for a non-designer audience. Design thinking recodes designing into simple little steps of procedure that are easy to follow. Is that the reason for its popularity?

Design thinking and integrated thinking (Figure 2) combines desirability, viability and feasibility as holding these opposing constraints in our heads and create new ideas from them. The first step is that what is the question we are going to ask. How do we do more with less? Technology will continue to make disruptive break throughs that allow us to progress. Perhaps there are pathways to create new efficiencies, new productivities that are not based on brand new technologies (Brown, 2009, about design and healthcare). Design starts with humans. What people need? What makes life better? What makes life easy? What makes technology useful and usable and that is more than simply good ergonomics. (Brown, 2009).

The strict formatted step design thinking step by step approach apparently does reveal something about the designers' working ways, but can it be seen as a working tool for anyone and for designing anything? Besides the design thinking working ways the start and the end of design does need the actual designing still. As Natasha Jen asks, one should wonder is Design Thinking just a well-marketed presentation of design jargon package to increase sales of books and consulting services about itself?

It's terrifying that design is being presented as this kind of beast that you can let go and attack the world and then win everything. It doesn't treat design as a kind of thing that you develop. Development takes time. (Jen, 2018).

Natasha Jen's opinions reveal that some designers seem to be already on fight mode when the words design thinking or service thinking are even briefly mentioned. Maybe some indication for a motive of outrage can be found from how the terms are being marketed. Tim Brown opened up his presentation about design thinking at TED talk in a way that such outrage of design professional does seem justified.

Design is too important to be left to designers. Design may have its greatest im-

pact when it's taken out of the hands of designers and put into the hands of everyone. (Brown, 2009).

Tim Brown overlooks the professionals who see mastering their craft as a designer requiring talent, skill, education, experience and understanding to every visual, functional, physical, cultural and mental obstacle available. Out of the sudden comes the Design Thinking as a change of tide and all collapses with simple sentences - now everyone can be a designer. The reasons for designers' frustration seem justified. The outcome of the change is difficult to research as the change has been a rapid one, as Natasha Jen points out with Google word search analysis.

Around 2011 the Google Trends Search Term Interest Design Thinking started to rise. Spike at 2015, when IDEO put out on-line course. Marketing around design thinking started to bubble up. (Jen, 2018)

Design thinking process relies usually strongly on fast testing on multiple prototypes and developing the idea with iterative cycles on the feedback and learning from those prototypes. A healthcare queueing process prototype or a service design prototype with testing human feedback and behaviour will most certainly be effective and functional system. When we are talking about 3D haptic traditional physical products, the concept of prototyping does not have the same accelerating effect on project's lead time. The actual prototype may cost the same or even more than the actual final product. There usually are strict design gates to enter before the actual first prototype will be made. It has been pointed out in a previous research that there are several different design processes. (Kettunen, 2013) Design process on 3D haptic products differs to non-physical design process greatly. The only similarity may be that both of them are called design processes. In contrast with the Design Thinking procedure, Dieter Rams explained the short command chain in evaluating his designs in the sixties.

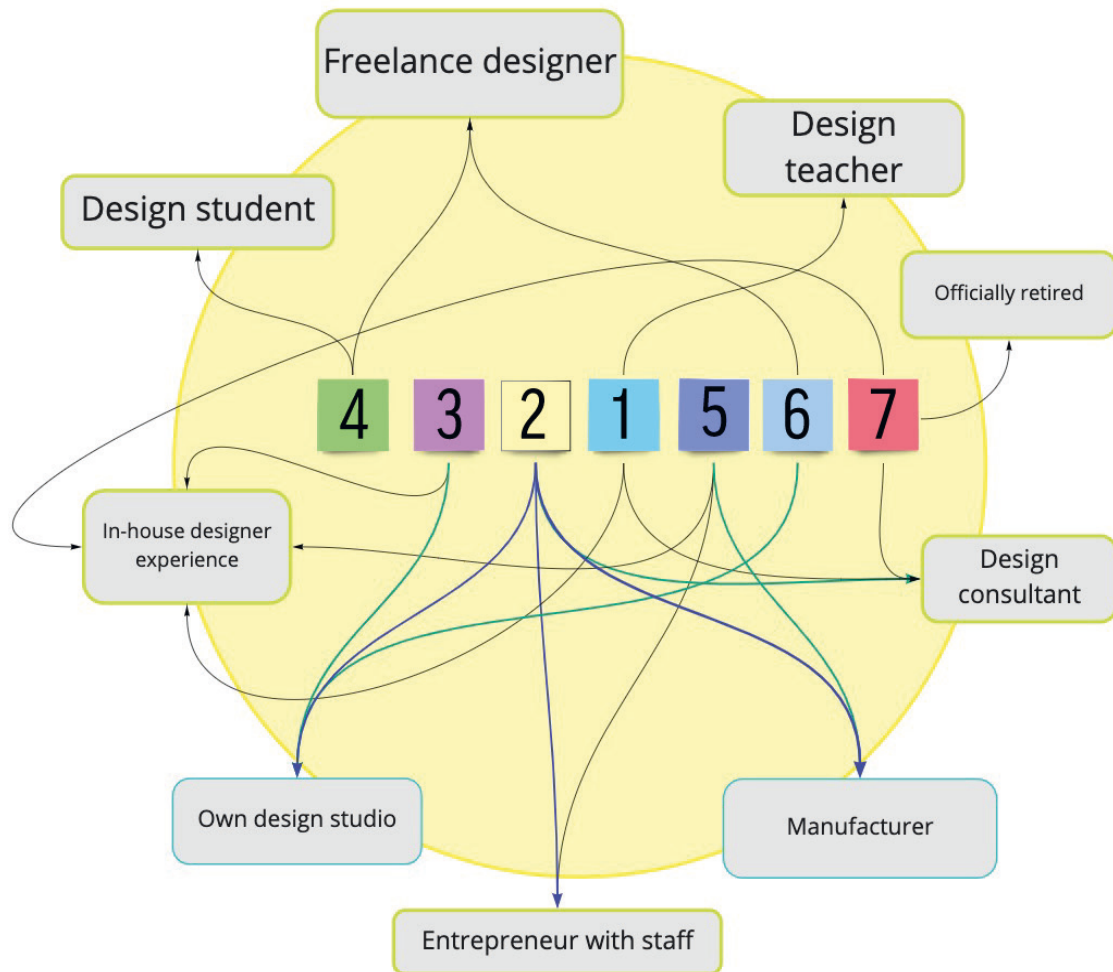
I was the only one in the sixties who as a designer reported directly to the chairman of the board. That was not normal at that time... I think it is necessary to have this close connection. (Rams, 2013)

5. RESEARCH OBJECTIVES AND PROCESS

5.1 Research question

How design and designing are evaluated? It is fairly logical and probably even easy to meter the design afterwards when the object or a product is ready. Popularity and profitability are easier to meter when there are sales figures and production expenses to weigh against each other. This thesis asks about the possibilities and problematics in evaluating the design in pre-production phase, when there is only the design, not yet an object. This research is searching for the key elements that need to be determined before a design can be evaluated as ready to be entered into production.

Interviewees in age order

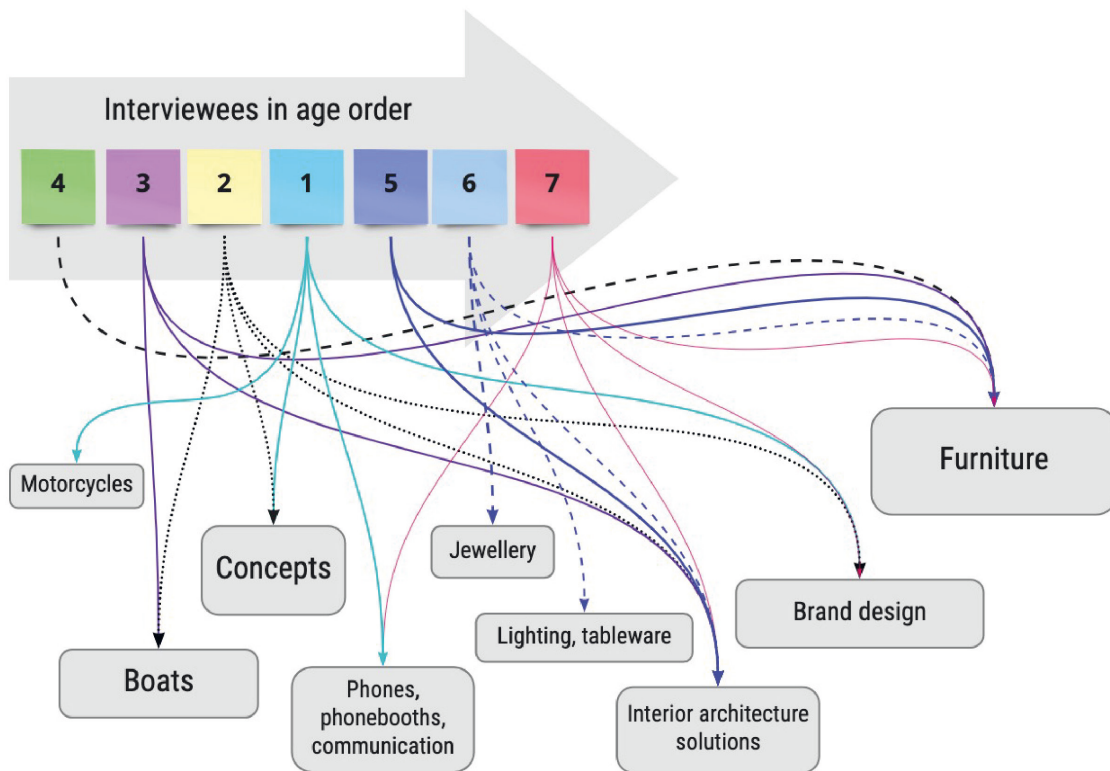


Ari Vanha-Majamaa, 2022

FIGURE 8, Interviewees, occupations

This ontological research took the approach to interview subjectively (by the author) selected seven talented and successful designers from Finland. The range of ages is 30 years, from a student to a pensioner. Both genders were represented, though the gender balance was not perfect. The professions and design target sectors were considered to select an evenly multifaceted group. (Figure 8, 9)

The interview process was done on the first half of 2022. The selected questions were used as a basis for free-flowing conversation that was being recorded with audio. Parts of some of the interviews were also recorded on video. The audio of the recordings was then transcribed and the given data was qualified on theme basis. Some interviewees were less talkative, but compensated the lesser talking with more drawings. All but one of the interviews were done face to face in live meetings, but the one interview seemingly did not suffer from being done over internet video conference. The results give out a seldom heard opinion on a delicate and difficult to define subject of design by a remarkably diverse and full



Ari Vanha-Majamaa 2022

FIGURE 9, Interviewees, objects

group of designers. The questions that were used to gently guide the interview can be found at the end of the thesis document. (Appendix 1)

5.2 Interviews with seven designers

The aim of the ontological research study is to define views on design process or processes, gather input and insight on design from experienced professional designers, design teachers and design students.

Open questions

- What are the key factors to consider for evaluating the design of 3D haptic traditional products?
- How is the design brief defined?
- How does the design process start?
- How a design process is planned to end?

STUDIES of the interviewees

Interviewees in age order

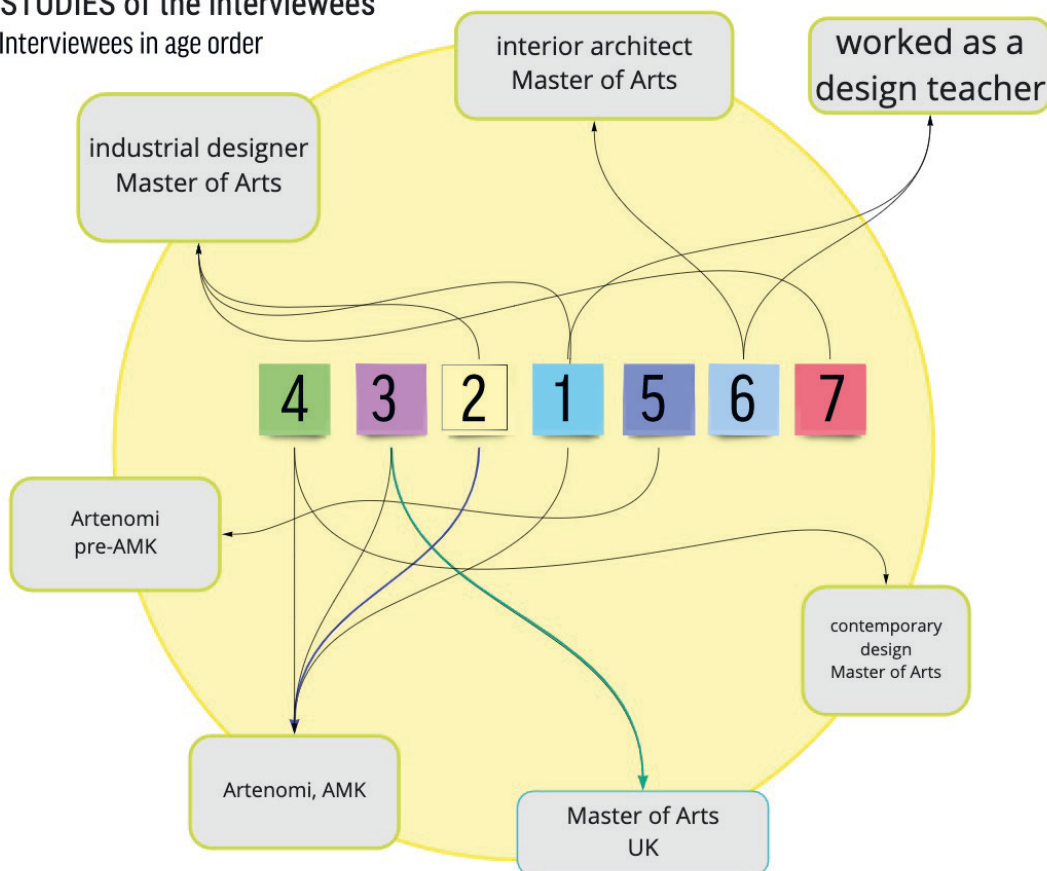


FIGURE 10, Interviewees, studies

Ari Vanha-Majamaa, 2022

- What is the criteria on which the decisions are based on?
- How does the trust in someone's abilities arise?
- How to trust a person's competences in evaluating design?
- Who are allowed to make design decisions?

The study consisted of semi-structured interviews with seven professional designers from Finland. Interview was chosen as an intimate and obvious research data collecting method as the author knew the interviewees from a professional design work history, or by being design alumni colleague. These seven interviewees were chosen with differing ages and professional histories. The interviews were recorded on audio and partly on video during the first half of 2022. Several drawings were made during the interviews. The author is personally very pleased that the seven interviewees all agreed to take part in the research. The author chose the seven interviewees with a criteria that each of the designers had shown remarkable talent as a designer and that had been established and proven to the author by some kind of a working history or a project together with the author. Having previous history with the interviewees helped mutual trust and confidence in the interview setup. That preset may open up a doubt of research being biased. Nevertheless the obvious benefit from the gained trust is that the interviewees could be chosen from highly talented and successful professionals. That approach was chosen to overcome the obstacle in design researches that Nigel Cross describes being common.

The reality of design practice seems to be that some individuals have outstanding design abilities. Highly creative or talented individuals become successful and highly regarded designers, with international reputations both within and beyond their professional peer groups. However, many studies of designer behaviour have been based on novices (usually students) or, at best, designers of relatively modest talents. This is because it is easier to obtain such people as subjects for study. (Cross, 2004)

At the very starting point of the first interview it becomes obvious that the interviewed designer has read and remembers Dieter Rams's Ten thesis for good design (Rams, 1995) by heart. Same happened repeatedly on later interviews. Dieter Rams gets been quoted several times during these interviews. Rams has written such popular top ten list of design thesis, that it is clear these seven interviewed

designers all respect them. Along with Dieter Rams there were numerous other famous designers who were mentioned and quoted correctly without any difficulties, as the quotes were checked afterwards using the audio recording. The interviewed designers know their craft and the theories behind it.

Some interviewees eagerly drew pictures, diagrams and figures while the conversation took place and that had diminishing effect on the amount of talking. After the first five interviews that took place quite close to each other, it became clear to the author that the chosen few simple questions generated easily a wide-spread conversation on design. There was no need to refine the question palette along the way, even though that had been the author's intention at the beginning. The questions in Appendix 1 were used for the interview basis. The interviewees gave remarkably positive feedback on the research question and the interview questions and they thanked for the opportunity to talk openly about current design world and especially its current shortcomings.

5.3 Procedure and analysis methods

The separate interviews lasted from an hour and a half to over four hours. The combined total length of the interviews exceeded twenty hours. Data analysis was done with thematic slices, as that creates intentional structure on the vast and easily straying subject of design. Thematic data analysis was done with subject and process approach following the same question order as a guideline.

Different design areas such as furniture, vehicles and jewellery do have significantly different processes in actual designing and also in the evaluating processes. The common to all key factors were picked from the common repetitive factors from varying design sectors. The results were drawn to diagram figures (Figures, 11 - 15) that are shown and explained in the chapters six and seven.

Specific attention and consecutive space was given for the answers on the last freeform question as a source for unbiased, deeper source of data feed. Interviewees all had insightful examples on design processes and the evaluation processes their designs had gone through.

6. RESEARCH RESULTS AND ADDITIONAL FINDINGS

At first the discussion over the research question started to define the basics of designing. The combined research results are seen on Figure 11. The figure resembles the integrated thinking figure of Martin adapted by Tim Brown (Figure 2). Their figure of balancing three elements of Economic viability, technological feasibility and desirability is seen here almost identical, but added with physical limits, required set standards, choice of material and the key factor that was seen as the most important by the interviewees - the user. As the interviews lasted there were more factors mentioned and those are gathered thematically in the following figures of beauty and quality. (Figures 11, 12)

Another figure of the result data is seen about the design management later on. (Figure 13) The importance of different factors against one and another can not be seen from these drawings, although these diagrams do open the multifaceted nature of designing as a work task. Additional set of figures better describing the key factors of designing are seen in Chapter 7 - Conclusions with key factors of design common to different design sectors of the designers involved in the research. The design sectors are listed earlier in Figure 9.

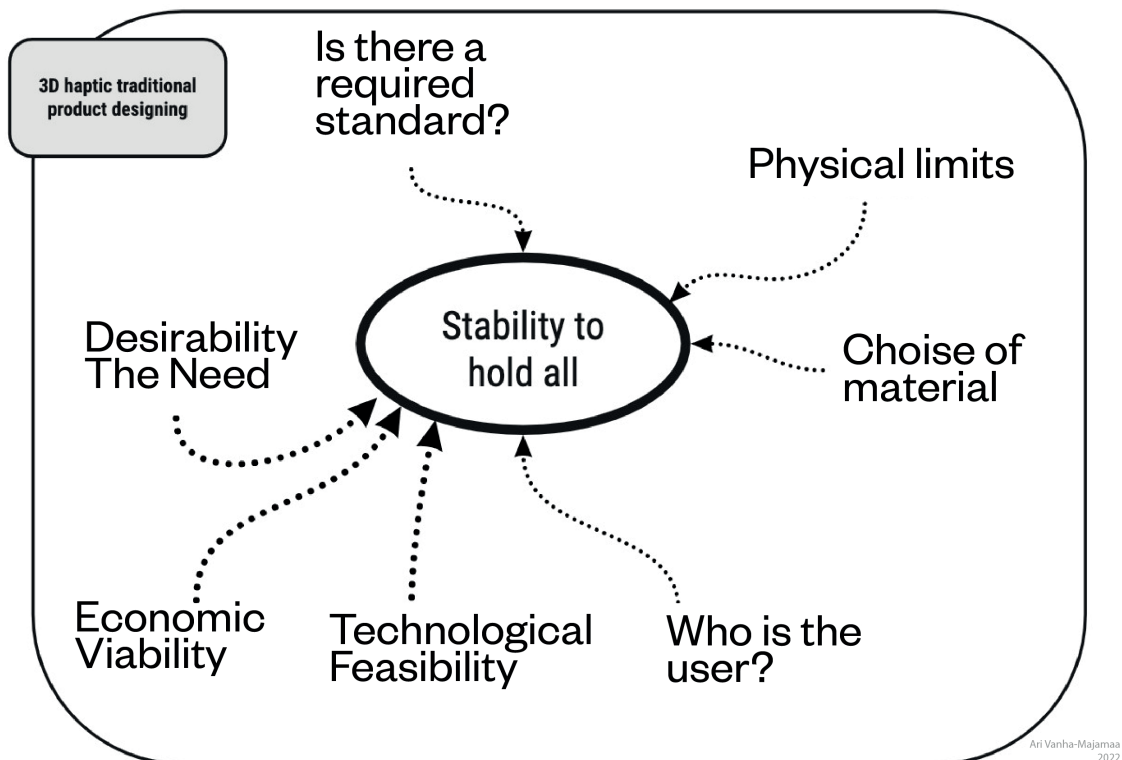


FIGURE 11, Designing, basics

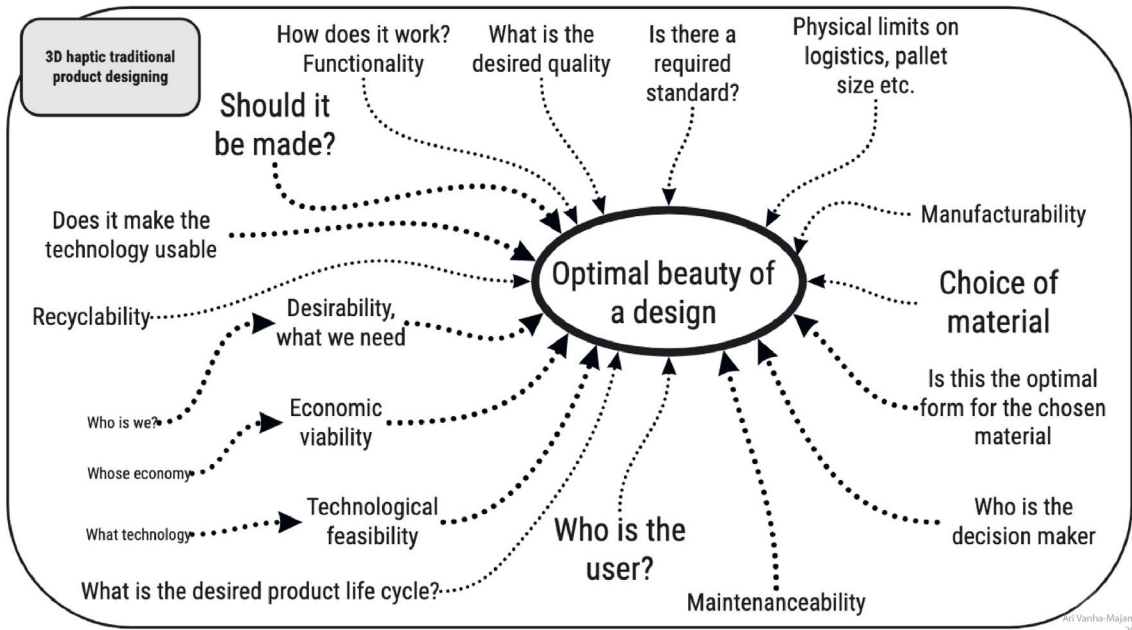


FIGURE 12, Optimal beauty of a design

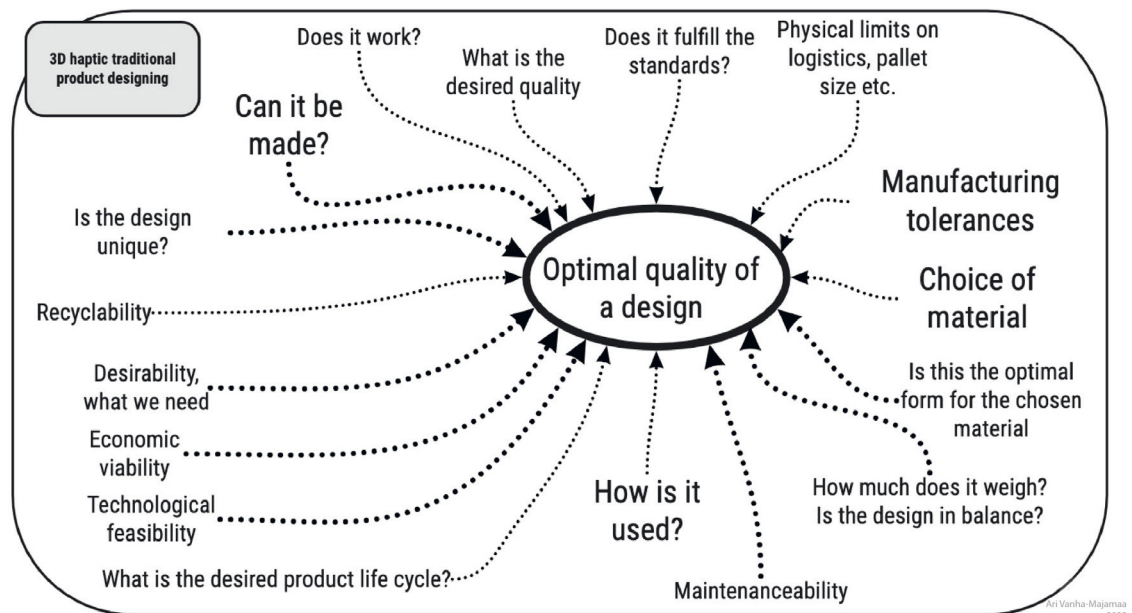


FIGURE 13, Optimal quality of design

6.1 Design Strategy versus Strategic Design

The first notion on the subject was to define what is the design the discussion was about. Some interviewees started to discuss that by defining and then eliminating some design definitions off the discussion. The defining discussions turned out to be resourceful, as an example there was a discussion about strategic design versus design strategy already on the first interview. By switching the order of

the two words the meaning of the phrase alters greatly.

Design strategy is easy to understand, but strategic design is a term that is vague. How can a company to outsource the thinking? (Interview 1).

It was pointed out as an interesting question whether companies were actually trying to outsource thinking when they asked for strategic design. Every designer does or should follow some kind of a strategy on their designing. An example of a design strategy was presented as to combine a movement of a human body with a furniture (Interview 4, Picture 2). About strategic designing it was noted that it is debatable if a designer, as an outsider provider, could be a designer of a company strategy. In chapter 8.3 there is a return to this thought with an example.

Industrial designers do service design, because there is more money in those projects. Companies buy service design and afterwards they do not know what they were buying nor do they know if they received it in the end. [...] After designing became consulting the timeline has decreased significantly from the actual industrial design projects. (Interview 1)



PICTURE 2, Hangaround, Isku Interior Oy (2017)

That previous quote from the first interview reveals the change that has happened in design work after service designing has been popularised. The modern design project for the designer can be facilitating a workshop for a group of key personnel of the client. The workshop generates as many ideas as the workshop possibly can produce and then the collective design process starts to roll. Another insight from the first interview took a focus on the quality of design.

The sales figures do not qualify for good design meter. The poor sales figures do have a lot of other explanations or reasons and the best selling design can be the designer's worst work. (Interview 1)

On the other hand that basic set up of a research construction can be seen as a source for deeper insight on the subject. The author's personal history with the interviewees certainly managed to open up the conversation to a relaxed casual chatting level and the interviewees talked about big complex questions and issues with ease. Additional findings beyond the initial research question are too interesting to be left out and these findings broaden up the view beyond the focus point on the key factors of design.

In the interviews there was said that the designers had been waiting for other stakeholders to participate better and more to design process. It was pointed out that because of the service designing has gained popularity the day is now at hand, when there are teams making the designing. The modern processes of designing help the dialogue, but do not make the need for designing or designers obsolete. In the interviews there were said to be clear indications that narrowing timeframe from designing increases risks that the outcome of a design process becoming more difficult to predict, and if predicting the outcome becomes difficult, that has a logic connection to difficulties in budgeting those processes and projects. A simple decision of approval may be the most difficult thing to do, if the design process has been created without clear authoritative responsibilities on making design decisions.

It was especially pointed out that if a company has outsourced its designing, the evaluating and approving the design outcome still requires knowledge, vision and understanding of designing, in spite of possibilities to follow the steps of design thinking. If there has evolved such situation that the decision maker's

identity is obscure or uncertain, the ending of a project is difficult for both the outsourced designer and the client company.

The outcome may end up as anything, as decisions may be done without designing, but by the authority ruling over. (Interview 2)

After the interview sessions, the designer from the sixth interview sent a text message with almost identical sentence about severe difficulties occurring if a capable design decision maker is obscure in the design process.

The interviews all started on pointing out the importance of the designer. The first thing on a design process is to find a designer. 71 % of the designers felt that designing for them is a profession of a calling. All of the interviewed designers felt that designing is natural thing to do for them. It was said that designers are self disciplined in the search for better design, better solution, shape and form.

An example on an additional finding beyond the interview questionnaire is the difficulty to find capable expertise for making a design decision that came up on interview number five. Who has enough knowledge to choose a fabric for renovation of chairs? If the client does not trust the outsourced furniture expert, who gets to make the final decision? Does the company hire an architect to make one simple detail decision, if there isn't anyone capable of making a ruling decision between two model chairs? Or does the company actually give the ruling power to their clients and let one hundred customers to sit on model chairs and vote between two chair options, because design thinking method suggests that kind of a procedure? A solution for such open questioning was waiting for an answer at the time of the interview without a clear schedule or a plan. How is the authorisation received to make a design decision? Deliciously hilarious open questions revealed on an apparent process failure in town-level public sector procedures of acquiring furniture maintenance services, there may be equally difficult times ahead if a decision maker remains unidentified. Seeing the humour in the process may take some time and distance to process.

The seventh interviewee talked about a design that was rejected by a company. So the product has never been made. To the designer there however is a definite finished design. The designer's work is done, it is finished. There remains an

affection to the design, even though the rest of the world may never see the actual product. The rejection may or may not depend on the quality of the design, but the designer knows that the design is finished and it can be evaluated as ready. Perhaps a different company will be responsible for manufacturing the design to a product. Another company may try to copy that design.

6.2 Designers on Service design and Design thinking

Since the first part of 2010's, the design thinking and service design have been entering into the design process and education of designing in general. The interviewees talked a lot about service designing and design thinking. Some of the interviewees do service designing, some teach also teach it. Only one of the seven designers had not been involved in any project declared as using service designing.

Service design encourages all the stakeholders taking part in finding a lot of ideas. According to the interviews the lack of ideas do not seem to be designers' concern. The execution of a selected idea to its final, optimal stage, is generally the designer's main concern. Some interviews were pleased with service design philosophy of making services better.

What is this service design about? Developing and defining services. If a new title makes the services we all use better and uses the word design (muotoilu) in its title, I can tolerate the faulty translation. (Interview 1).

In the first interview a reason for a career change was said to have happened because of designing had become actually consulting.

After designing turned more into being a consultant, I wasn't too interested in continuing that kind of work anymore, the opportunity to start as a teacher soon felt the right thing for me. Although I still do that consulting, as the University of applied science has many opportunities to participate in for example communal designing projects. I do a lot of that. (Interview 1).

In the first interview there was a discussion on Viktor Papanek who wished more people would participate in designing. (Papanek, 1992). The research interviews show the current design world at a time when it seems that Papanek's wish came true. Designing has become a common thing that seemingly everyone is capable of learning to do in a short afternoon course. Everyone participates

in design doing. Whether that is a good or lasting thing, remains to be seen. All levels of intended sarcasm from the interviews may not transfer through with a written text.

About Ideo and Tim Brown - I adore the fact that a consulting company has managed to conceptualise Design Thinking and Service Design and write books and sell a lot of them and to start a whole new line of science on it and in the end it is all about what the designers have always done. (Interview 1)

6.3 Design education

In questions about education there was a discussion about Nigel Cross's researches where Cross talked about a need for two levels of design education, calling for the rise for general design education to complement the existing specialist education (Cross, 1982). There is no apparent risk in providing general education about design for everyone. By a fair assumption general education on design for everyone would enrich cultural wellbeing in general. It was discussed that despite general rising in design awareness, designing as a profession does remain a discipline that requires special education. A design teacher revealed the problematic difference in length and status in design education between traditional designers and service designers.

One can call themselves a service designer after a two day course. In our school it takes a year to become a service designer. There is a definite difference to an industrial designer who studied design for several years. (Interview 1).

In English speaking context this hardly causes one to rise an eyebrow, but the context changes drastically when someone is using the Finnish word *muotoilija* instead of designer as a part of a title on a business card after a two day course.

After companies started to ask for service design courses the education for design students was altered. Currently every design student takes user-centered design course and service design course. (Interview 1).

Is there something more important removed out of the way? The education default length apparently stays unchanged. The new focus point in design education is seemingly on service design, but is there something important left out. The student of contemporary design confirms the hypothesis assumption saying that the product design would be the diminishing sector within design education.

Design thinking and service design seem to be the latest fashionable things right

now. Product design is closer to my interests, but that isn't taught as much as service design. Nobody asked us design students if we wanted this. (Interview 4).

6.4 Approaches on design

Interviews three and four both pointed out that solving a problem is a negative direction to look at designing from. The conversative interviews easily found examples of designs that apparently have gotten their inspiration without an existing problem. One way to look at designing from the positive side is to combine functionally unproblematic different elements together. Design thinking notably uses How might we -questioning, that rests on finding a correct question and then finding a solution to that question. A more playful approach might be to ask openly What if?

First and second interviewee mentioned differing opinions on having designer's personality to show in their designs. The first interviewee talked against personality and postmodern decorations in design. The second interviewee had a different approach. Personality in design allows the user to build a sentimental relation to the object. The user handles the object with more care and that leads to such objects having longer and thus more ecological life-cycle. Either opinion does have a pre-existing example in design world.

Discussions with quotes about letting or not-letting the designer's persona show handled Italian design coalition Memphis (founded by Ettore Sottsass, Memphis, was active during the 1980's and their design style was postmodern with lots of different colours and shapes that had seemingly nothing to do with the function of the object in question) against Super-normal by Morrison and Fukasawa. Trends and fashions vary along the years, so it would not be a miracle to see something like Memphis' postmodernism again as time goes by. After the original Memphis seized to exist at the end of the 1980's, the opinions against such playful and colorful design were openly told. *Cute is the enemy of beauty. Convenience is the enemy of excellence. Fashion is the enemy of integrity. (Papanek, 1992).*

With several designers there was a discussion about the personal input of a designer. The first interviewee said there does not have to have personality seen

in the final design, but the majority of the discussions did find the personality very important. The discussions used the examples of postmodern against super-normal designs as opposite examples. It was agreed that designing does not require a new idea, but it remained debatable if the end result of designing requires personality.

User experience and usability were discussed with notable interest in observing designs by other designers work. Some examples were particularly interesting. The end result of a good design may be philosophically very different to one and another. Usability can work well on logical and magical approach.

There are two kind of approaches to beautiful design. Apple and Bang & Olufsen are the perfect examples on them. Both of them use and create high quality of visual design. Apple does concentrate on easy and intuitive usability. Or at least they have done so in the past. Bang & Olufsen has equally visual design approach, but the usability is taken out from the user to almost magic level. The product may turn on when you walk past it. (Interview 7).

The discussion in the seventh interview took place in the central library Oodi in Helsinki, where there were automatic robots carrying the books around autonomically. The discussion touched the subject of usability and autonomous robotics, when using an object or product becomes too automatic, there is a feeling of presence of an artificial intelligence, resembling HAL 9000 from Stanley Kubrick's 2001: A Space Odyssey movie. How far should easy usability be designed? Is the product too easy to use, if it works autonomically as the Bang & Olufsen? If it is frightening to use the product, the user might not accept the design. There was a discussion that the functionality should be seen at a glance. It was mentioned that Raymond E. Loewy used an abbreviation MAYA to describe that same dilemma as his main design principle: "Most Advanced, Yet Acceptable". If the users are provided with too far out designs, those designs will not be popular. The designer should balance between advanced technological or visual output possibilities against the traditional cultural heritage the object may have, in order to have successful outcome as a design.

The second and the seventh interviews touched a subject of an unauthorised copying of a design or a stolen design. That aroused strong negative feelings even after a number of years after the incidents. The copies made of a ready

product and a copy of a design that hadn't yet made it to production. These incidents may hurt a company's economy and there certainly is a loss of money to be concerned about, but a designer who has had a design stolen is seemingly hurt by a different level. There are some designs that could have been created by different sources for instance if a new technique appears to the world, but designers who are certain their work has been wrongfully copied do not seem to forget nor forgive such an incident easily. A-company-that-makes-copies -is a brand that is hard to shake off from disappointed designer's memory.

The interviewed designers opened up the key factor question easily towards the processes that companies have. There rose up numerous examples on design processes and the procedures of evaluation gates and what may be ahead if a company has not set or defined clearly enough the processes of design evaluation correctly. That was stated for both the in-house designing and for out-sourced designing.

As to the question on how to evaluate the design of 3D haptic traditional product, there usually are preset steps and validation gates where the design is being approved. It can be a concept idea sketch or for example a visual model, but that is decided at the start of the design project. It is better to be involved as early in the process as possible. (Interview 1).

A company that buys designing should have skills and ability to evaluate what they are buying. If the company doesn't have that, the result will be the same that it has been for them before, they keep selling their previous narrow repertuare sector. (Interview 6).

If the company has design knowledge and vision, the results for buying designing have no limits. Then the buyer company knows what is needed and what kind of design provides more sales than previous products. (Interview 6).

7. CONCLUSION

A definite problem lies in the basic construction of this study — a designer interviews other designers. The interviewer/author tries to keep from letting the inner designer showing in the questions and the conclusion. Special attention was taken not to let the working hypothesis guide the discussion. That is a difficult task, so the reader should keep that in mind when the value of this report is weighed.

7.1 Design Management

The results show that the importance of functional Design Management cannot be over-estimated. Without functional design management, be it by a one capable design dictator, or a democratic group of designers following closely their preset design principles, there is little hope of reaching high-quality constant design outcome without functional design management. Modern design processes activate and call for a larger group of participants into designing. (Figure 14) A large group of individual opinions can make the ruling of various design decisions difficult. Is there a functional way to design in a democratic manner? There are examples where such process is functional. The reseach interviews indicate strongly that functional design process happens when the design decisions are

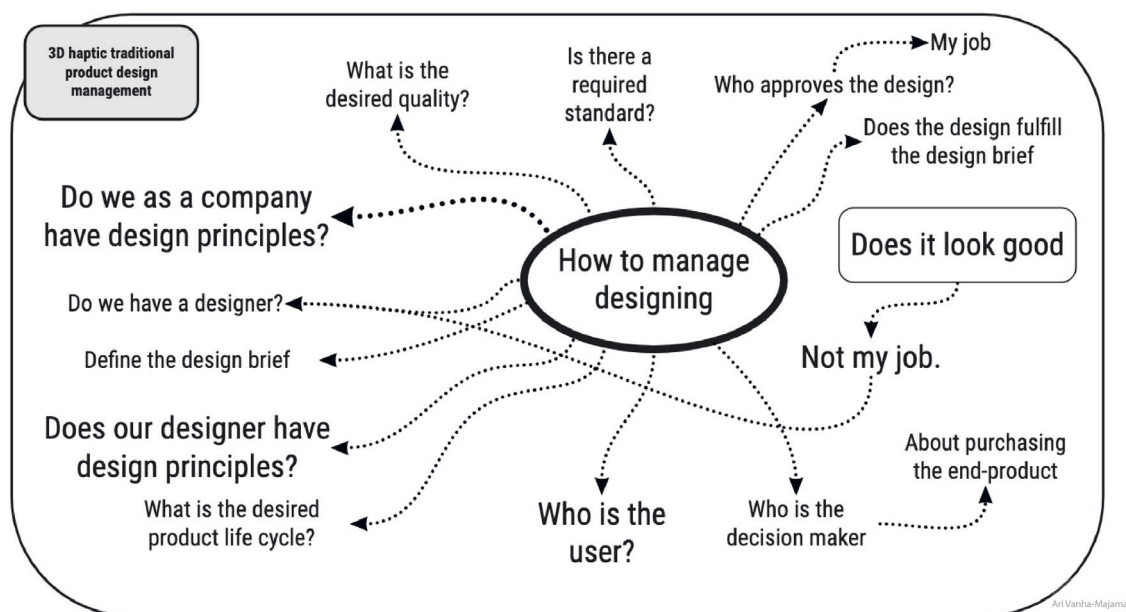


FIGURE 14, 3D haptic traditional product designing, design management

left for the designers to decide. Should one trust the customers on design decisions more than the designers? Functional proactive designing with customer input as a main source of information was not recommended by the interviewees. A recommendable main design strategy is to listen to the designer. Trust the designer. Someone has to make a design decision in the end anyway. The designer is hired to do just that. At best the design will have the designer's unique personal touch in it. The other option is that the design may have the personal touch of the average queue of a supermarket.

Design as an academic discipline does not have long history. Architecture has longer traditions. When an architect as a title of profession was used in software developing, there seems to be no actual case for a real concern. A software developer would probably not even try to act as a building professional. With a designer as a title of profession there seems to be much more possibilities to misunderstandings. A software designer might be promoted as a design director of a company without much of a debate over the person's competences. Possibly those competences might align easily with design thinking and service design — they are all called designing in the end. Iterative designing methods may lose the input of highly acclaimed designer in the process. On the question about who was the final decision-maker during his days at Braun, Dieter Rams declared he had the final say permit from the Braun brothers and later on from the chairman of the board.

As company becomes international, the marketing interference becomes stronger. Without the help of a lot of engineers or marketing figure, they knew I was always protected by the top management. That helps a lot. When I said this cannot be done, it's not Braun, they closed their mouths. (Rams, 2013).

On the last question the last interviewee answered about personal reason for designing. *There is that joy of completing something really well. (Interview 7)* Designers tend to hold quality and successful results on high value. One should wonder if anyone might be a better decision-maker than the designer on design decisions. Designing is natural thing to do for the designers. The first thing on a design process is to find a designer. When asked about advise on how to protect good design against marketing and other factors, Dieter Rams' answer does overlap

with this thesis' research question and the opinions of its seven interviewees.

You always have to fight, it's not easy life. It's a daily fight. Hopefully you have somebody on your side. The marketing people has the qualities of very much better to argument. It's sometimes difficult to win the battle with them, because they are trained to argument. We as designers are not so trained to play with arguments. Our arguments are the models as a reality we can show to the decision maker. The marketing people are playing mostly with their words. We should not forget that we have a chance, because we are the only ones who can show the things in three dimension. (Rams, 2013).

That opens a view to the awkward position the introvert designer is put into when the amount of stakeholders is increased in design process. A better speaker with faulty design suggestion may get their opinion heard and ruled over a better design but with weaker presentation. That result may resemble a situation described in a classic proverb "A camel is a horse designed by a committee" (Issigonis, undated). As designing has become a collaborative task, the motivation to participate design process without a revenue model may put freelance designers in a difficult situation. When design thinking brings co-operative teams in to the center of designing, who gets the credit for being the designer of the product? Previously freelance designer received a royalty check from the sales of the ready product. If the status of a responsible designer is unclear, the future of a revenue model built on royalties is looking challenged. Are we losing a traditional profession of designers who actually can design a 3D haptic traditional products? What is the future of design education? This research does not wipe away the worries described, nor it cannot be used as a reliable source for flawless data, as the subject is wide and ill-defined, just like also design briefs tend to be. Nevertheless this thesis does provide a view angle from the designers eyes. The future of designing and design education may not be as bright as the design thinking has been marketed, as Natasha Jen points out.

Design thinking is entering education system, from high-school to kindergarten. With a notion that kids really need to learn the method of design thinking in order to solve the world's very big problems [...] I find it extremely dangerous idea, not only to the world of design, but the idea of education itself [...] It is sort of like wanting to become an Olympic athlete without wanting to be trained. [...] Design thinking profoundly ignores the importance of artistry, of craftsmanship, of beauty, of art, of culture and all these things that actually elevate the quality of our life and the quality of our culture. (Jen, 2018)

7.2 Design principles

There are common design principles that may help as providing guidelines for designing. *Aesthetic things are perceived to be easier to use than ugly things (Lidwell et al., 2015).* A common list of design principles will help as a guideline, but it will not be enough for every occasion. Most successful companies have their own design principles. There are collections of different design principles easily available, such as *Design principles FTW*.

Balancing optimal outcome is what designing is all about. Fulfill the needs from the design brief. Apply your design principles to the design. Play with it until you find the optimal beauty of a design. When the design is finished? How about asking it from a focus group of customers? Maybe Steve Jobs might give insightful answers on that approach.

We have a lot of customers, and we have a lot of research into our installed base. We also watch our industry trends pretty carefully. But in the end, for something this complicated, it's really hard to design products by focus groups. A lot of times people don't know what they want until you show it to them. That's why a lot of people at Apple get paid a lot of money, because they're supposed to be on top of things. (Jobs, 1998).

There were several teams. On day-to-day-basis, my job wasn't to head any of them. We have really talented people to do that. (Jobs, 1998, when asked about on his role in the design of the product).

One of the most basic tasks in designing is to rule out options. That requires the personal taste and cultural sense of the designer. Whatever is the process, there remains the responsibility of a designer as Mike Montero reminds. Stopping a project before it is finished may not be a pleasant task. It may require strong will and thick skin.

*Who can pull a plug on something that sucks?
Designer. It is your job. (Montero, 2015).*

7.3 Formula for design

Design starts with the human in the center of focus and the environment surrounding the human and the thing that is the object designed to be. The human is the stable element in the equation on the formula for design. The medium that

will be filled by the future object, the design, remains as an empty void, until the design has been fulfillingly finished. Physical constants are basic restrictions that need to be considered in all form-giving designing on this planet. When designing the cultural targeting of the end-user should not be forgotten. With those starting points, the designing ends at a point when all elements of the design, the key factors, have been defined in a way that there is no possibilities of an error of the designers intent of the end result. The size, colour, material, form, functions and what can be altered by manufacturing needs without compromising the essential core of the design. That could be called a design tolerance. In a succesful design the unwanted manufacturing tolerance variates in a place where the user's eye does not meet that variation. Accomplishing such design tolerance handling in advance usually has economical advantages in production phase. Designers set their target at the optimal beauty of the design, knowing that usually there are compromises to be accepted during the design process. Formula for design depends on many things. Physical constants are set as basic restrictions. This research states that simplicity of the outcome should usually provide better design results than complexity. Faster and easier to produce and assemble may provide better results than slower and more difficult. Better maintainability is usually better, if not for the business for the manufacturer, but most certainly for maintenance service provider and the environment. It should be noted that the ease of manufacturing and the ease of maintainability may be colliding options.

The working hypothesis described in chapter 1 seems to be aligned with the results of this research, but the results of the described shift in design education towards service design should be researched better after some time has passed and these results could be examined better. Nevertheless in the seven interviews the shortened project time on design projects came up frequently. It is like the new design-branded group working methods suddenly would have taken away the need to spend any time to actually do the designing. Designers pointed out the risk of degrading quality when form-giving design is evaluated with focus groups and iteration cycles and designing is done with *deliver now and fix later* attitude. This working method that has been used in software designing

with apparent great results did not receive praises from the designers of this research. Being seemingly fast and agile during project schedules may end up producing sub-par design results.

All of the interviewees do have their own formulas for design and ways to evaluate when their work is done. The outcome is not what happened, it is what was designed. Human is at the centre of design process. The primary key factor is the designer. Without the intention of the designer the design does not happen. About the key factors there were naturally the answers of sustainable material usage, respecting human and animal rights, and respecting nature, climate and the planet, those prerequisites are noted and written as important basics, but they are closer to design principles than key factors of design. Nevertheless, if a design fails the planet, the design does fail. It was noted on every interview that the responsibility of a person who designs new products to this overused planet is huge.

Design principles do vary, but a good design should follow the current design principle. so if the common key elements are examined there can be found some mutual, common, key factors of design that can be set as the formula for design. If the design is left ambiguous, the manufacturing is forced to make guesses

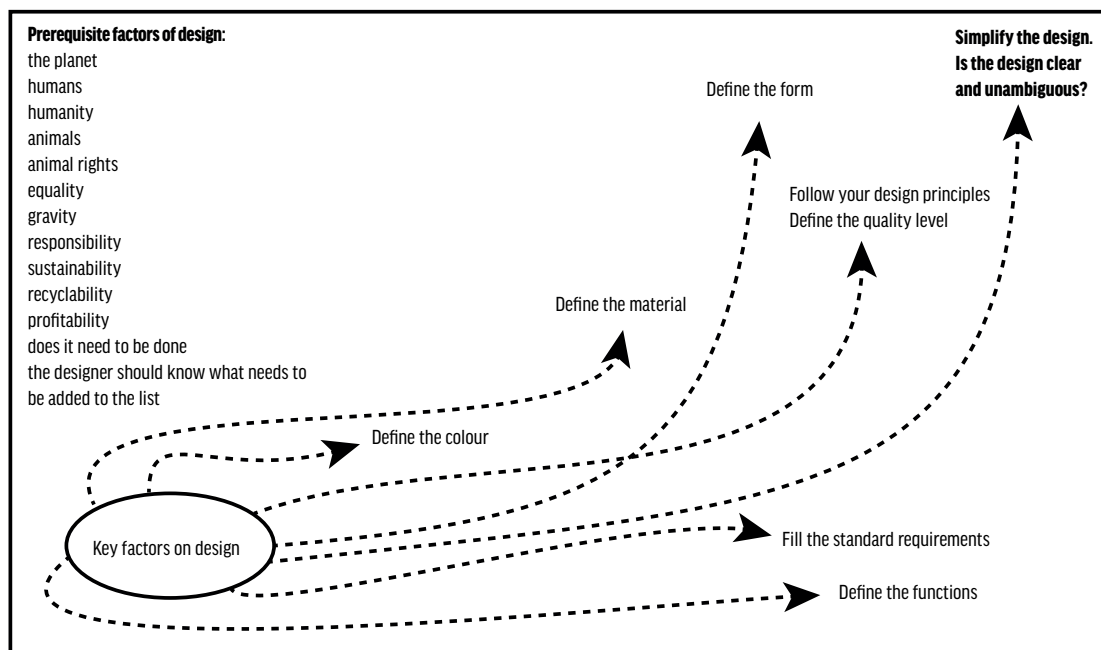


FIGURE 15, Formula for design, key factors

about the intent of the design. When designing is evaluated the unambiguity of the design is essential. The design needs to be presented in a manner that the design can be objectively evaluated. A simplified, clear design without errors of intent should be the end-result of a design process. Among other full list of design factors, (Figure 15) the most important key factors of design intention are:

- colour
- form
- material
- functions
- alignment of used design principles
- unambiguity

According to the majority of the participants of this research, the noted increase of using group working design methods, such as service designing, have made the need to find out objective key factors of design over subjective rulings by opinions and thus making it possible to intentionally evaluate design outcome in design processes. The result of this thesis may not be a definite universal right answer to what are the key factors to consider for when evaluating the process of designing and the design of 3D haptic traditional objects, but as a minimum the list of these key factors serve as a list of factors that need to be checked that are defined, when a design is considered as finished by the stakeholders of a design process.

8. DISCUSSION

This research has found out key factors of design and describes them as a formula for design, but also points out that there is a serious responsibility in designing in a similar vein as Nigel Cross pointed out.

In the face of the uncertainty of original design, there comes a time when the designer has to make a personal commitment. I think we have to acknowledge that design is risky - it is not comfortable, and it is not easy. (Cross, 1999)

The author respects all of the chosen interviewees for their professionalism and openness to discuss about issues that have not gained popularity in current corporate world. Under the well-behaving professional surface there is definitely underlying frustration against amateurs entering into the world of design, claiming that the design thinking or service design iteration process itself can make great design happening. Designing has been popularised in recent years in a manner that, although can be seen very positive and forward-going, does seem to cause some alarming observations from design professionals. When a type of expertise-requiring and time-consuming, not to mention costly, special profession finds itself being updated into a process for anyone to manage, should there be a question asked, if it is too good to be true? Two obvious downfalls come to the authors mind at first. Can a group of ordinary people, following design thinking methods surpass the design quality of a design professional doing the designing by oneself? The process may be sped up, but as a downfall it requires much more personnel. The process still requires experts, maybe a lot more. Efficiency seems not to be the reason to use design thinking in designing for an average team. A team of experts however may find themselves reaching new heights in design results and process fluency.

In order to have a deep dialogue, there's a need to have functional vocabulary. Design Thinking. Once you dig deeper, it's packed with jargons. Design thinking's language is problematic. Actually designers use very boring words. We are concerned about very, very boring things. Such as budget. Audience and Context. (Jen, 2018).

8.1 Inventing and designing

Seeing designing as a processing tool to create ideas and innovations is common

with design thinking method. Creating ideas and innovations is close to creating inventions, inventing. However there are differences between inventing and designing. Inventions can be patented, but the intellectual properties of designs can be protected with a design right protection. A same invention can be finalised to an object in many different ways. Originality of the idea is a different thing than a uniqueness of a design.

That is easily clarified by a common task industrial designers are given. There is a product, something is wrong with it — *please, design it better*. The idea of the product remains the same, but something in it needs the designer's input. The result should be a better product with the same idea. The result can be a new, unique design on the same old idea, or maybe lowered production costs due to better assemblability. Depending on who is the decision-maker of the product, the assemblability or servicability may be the key selling point of the product. The unique design may lie hidden under the surface.

Designing is not a synonym to inventing, but these two actions are close to each other. Designers are often the first ones to be called for duty to create something worth showing around with the newest material or technique, so it is easy to get those two things, designing and inventing, mixed up. Designing balances the need and the opportunity in the most effective way on the given material. Jasper Morrison describes the usage of material being one of the key elements of design. Konstantin Grcic talks about having had to wait with a design idea, longing for a suitable material.

Design is all about using materials to their best use in the most economic way (Morrison, 2007).

You may carry an idea around you for a long time but until there's a trigger to make an idea crystallize to something concrete (Grcic, 2017).

8.2 Designed quality

Intended quality level is one of the most important elements that the designer has to define. Too low quality betrays the customer's expectations. Too high quality may put the manufacturing company out of business because of too high

production costs. Too low quality may end up as a costly process also, due to reclamations and quarantee issues. The optimal quality level must be designed into the product and its manufacturing process. There is a definite difference with design quality, engineering quality and product quality. The end-user sees the product and buys it after evaluating the price and assumed level of product quality. A lot of things that effect on product quality may be out of reach for the designer to have control on. That should not be an excuse to overlook the things that are controllable for the designer. The desired level of quality must be designed, before it can be reached. The more the product is compatible with the user's expectations, the better. Intentional quality level is a fundamental design decision. That is a different thing than engineering quality. Designed level of quality is closer to marketing decisions. A vision and insight on the product portfolio is needed to make such an intentional quality decision. Engineering quality and manufacturing quality focus more on reproducibility with minimal variation. Designer can not leave reproducibility with minimal variation undesigned, as that is much easier and cost effective task to do in the design phase. If a product requires less tight manufacturing tolerances to be perfect, the easier it is to be produced and reproduced efficiently without variations.

Low quality can be dangerous. There are regulations on quality. The desired



PICTURE 3, Virén chair, Fortum Oyj (2022)

level of quality may not be the designer's choice to make. The desired quality level may be set by an outside source. The designer must know how the desired quality level can be achieved.

Consistency of product quality can be evaluated by examining product samples from the manufactured batch. When the product is under special regulations, there will be auditions held from an outside authority, such as FDA when medical devices are being made to USA market, in order to have a permit to sell the product. These auditions exceed the product sample examining level and reach all through the factory premises, production procedures, engineering documentation, testing methods, traceability of change management and even electric current stability from the wall sockets. Designing life-supporting anaesthesia machines or patient monitoring products can not be done with *deliver-first-and-fix-problems-later* iterative manner. (Source: Author's personal working history as documentation specialist in Datex-Ohmeda of Instrumentarium Corp. in 1995 - 2001)

With the latest 3D designing and 3D printing technologies available, there might come an idea that the quality can be reached nowadays easily and consistently. A printed part does however still consist of a real material, it shrinks and expands in temperature and humidity variations. When two surfaces meet, there is still friction. A modern manufacturing method does not make physical constants to disappear from the equation. All details should be taken in consideration and tested. As Jonathan Ive points out, that is not always the case.

I think we sense when there has been care taken with the product. Just in the same way we sense carelessness. Sadly most of our manufactured environment testifies to a degree of carelessness. It testifies to like get it built fast, make it cheap, make it look different. That sort of carelessness. It's one of those things we strive to do for humanity to conserve is to take care. (Ive, 2014)

8.3 Strategic design and Virén chair

The discussion with the first interviewee about strategic design being vague as a term found a perfect example a week after the interview had been held. Fortum Oyj launched a marketing campaign to promote their new plastic material. An additional discussion with the first interviewee took place at that point.

Fortum's product launch was named Circo, a recyclable plastic combined with cellulose fiber material was strategically designed to gain media attention using a connection to the 50th anniversary of Larre Virén's 10 000 m München olympic gold medal run. Lasse stumbled and fell during the race, but rose up, ran and won.

TBWA that has been known mainly as an advertising agency (they use nowadays the term creative agency) and a 3D printing service (they use the term design consultancy) called Maker3D designed a product for Fortum to link these ideas, plastic recycling and Lasse Virén rising up and continuing the race and winning, together.

The result is a chair that can be knocked over with the effect that the chair does not stay knocked over, but rises up on its own. Creating the link between the plastic and Lasse is designing a marketing concept, not product designing per se. Designing a chair is usually furniture designing, but creating that kind of an uprising chair remains as a mere an engineering task, because a well designed chair does not need such a function enough to justify the extra weight that is needed to balance the bounce back up. The result may be brilliant as a marketing campaign, but judging the chair on its own reveals its shortcomings easily. A chair should be designed difficult to knock over, and they usually are. A chair that bounces back up does not mean that the chair is stable on its traditional posture of use. Quite the opposite, as the extra weight at the bottom ring creates a tilting over tension by friction when the chair is moved by its backrest.

The chair in that project is a side-show gimmick at best. One might call it a chair yo-yo. Fortum tells on their website that a vast number of top engineers, physicists and researchers took part in the development of the chair. No designers were mentioned. To sum up all of that commerce, marketing, designing and engineering, that project is a perfect example of Strategic design. The designed end-product is not a chair rather than a marketing campaign for plastic material.

8.4 The future of design

The use of AI, artificial intelligence, in illustrative processes has taken a major

leap forward during this year. There are multiple AI-solutions such as Dall-E (openai.com) that make images out of key words or short text prompts, providing iterative process possibilities that resemble the process with iterative cycles of service designing. The use of AI in design processes might speed up the ideation phase in designing. The author finds it predictable that the next development leap in designing will be the usage of AI. Such development would rise up the need for better understanding evaluating processes and the key elements of design. If an intensive human touch will be decreasing from designing the need for evaluating the artificial intelligence design output systematically will be of utmost importance.

The probability of using AI in design would not surprise the author, but the gained efficiency and speed would not justify the absence of the joyful human touch of designing. Would there be any uplifting revelations of great designs, rather than an ever increasing work-load of fast produced AI-designs waiting to be iteratively curated by a design manager. What is the future we are designing for ourselves? Who or what does that in the future? The famous human designers have been looked upon with respect, as Nigel Cross points out.

Although everyone can design, designing is one of the highest forms of human intelligence (Cross, 1999).

One should ask if humankind could even respect the works of AI-designers and hold such AI-processed artefacts valuable or collectable. The author finds it debatable if the speed of designing should really be that important that the human touch in design were to be endangered. In a recent interview Sebastian Herkner spoke about the slowness on design and this quote shall be the ending thought on this thesis.

It's very important that the next generation, and all of us, need to learn the slowness on something. We need to be patient to get something. It takes years to really get a design done. We all need to learn the slowness of design. (Herkner, 2022).

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Picture 3, Fortum Oyj 2022. Promotion rendering image of Virén chair. Search date 22.11.2022. https://www.fortum.com/sites/default/files/styles/inline_grid_1x_wide/public/image-entity/viren_chair_standing_up_green.jpg?h=127267a3&itok=njEYIkNG

Figures:

Figure 1, The Design ladder, adapted from Danish Design Centre, <http://ddc.dk/>. Search date 22.11.2022. https://issuu.com/dansk_design_center/docs/design-ladder_en.

Figure 2, Integrated thinking, adapted from Roger Martin & Tim Brown 2009. TED. Search date 22.11.2022. <https://www.youtube.com/watch?v=aeAhH0uCvOc&t=588s>.

Figure 3, Design thinking, adapted from Tim Brown 2009. Filmed presentation, TED. Search date 22.11.2022. <https://www.youtube.com/watch?v=aeAhH0uCvOc&t=588s>.

APPENDIX 1

Interview questions

These following questions were used for the interview basis.

What are the key factors to consider for evaluating the design of 3D haptic traditional products?

Phase 1: Warm Up Questions

- 1. Please tell me a little bit about yourself.*
- 2. Please explain briefly your experience in design*
- 3. What is your current role within design?*

Phase 2: Design process and methods

- 4. Could you write or draw a scheme of the design process that you usually follow at your organisation?*
- 5. What is your role in the whole process? What is the design input you are asked for?*
- 6. What other people is usually involved in the design process?*
- 7. How much of the design work is group work? What happens prior your work? What happens after?*
- 8. Do you follow design thinking method? Do you hand over your work as ready or does it enter into an iteration cycle?*
- 9. Does the method stay the same or vary according to the project?*
- 10. How are the results of a design agreed on?*
- 11. If the designing is an outsourced task, how are the iterative design processes billed after the initial first designing has been done?*

Phase 3: Perceptions about designing

- 12. Why do you design?*
- 13. Could you do another line of work?*
- 14. What is the best thing in design?*

15. *What is the worst thing in design?*
16. *What would you change in design processes you are involved in?*

Phase 4: Wrap-up Questions

17. *How has the design world changed in during your career? Is there a rising trend towards something?*
18. *How do you feel about it?*
19. *Is there something else that you would like to add to the topic?*

Thank you.