Nokia brand experience principles implementation in Nokia Mobile Networks' base station devices and new concept development

Lapin yliopisto, taiteiden tiedekunta

1. Työn nimi: Nokia brändin elämysperiaatteiden toteutuminen Nokia Mobile Networksin tuotteissa ja konseptisuunnittelussa
2. Tekijä: Hanna-Maria Viertola
3. Koulutusohjelma / oppiaine: Teollinen muotoilu
4. Työn laji: Pro gradu -tutkielma___ Laudaturtyö___
5. Sivumäärä / liitteiden määrä: 81
6. Vuosi: 2017

7. Tiivistelmä:

Laadullinen tutkimus on tehty Nokia Mobile Networksin pyynnöstä. Tutkimuksen tavoite on selvittää, noudattavatko Nokia Mobile Networksin tutkimukseen valitut tuotteet Nokia brändin suunnitteluohjeistusta sekä lisätä ymmärrystä teollisen muotoilun tilasta Nokia Mobile Networksissa. Toinen tutkimuksen tavoite on lisätä tietoa brändin suunnitteluohjeistuksen sekä brändin elämysperiaatteiden käyttämisestä konseptisuunnittelussa.

Kolme tutkimuskysymystä ohjasivat tutkimusta: 1. Sisältävätkö valitut Nokia Mobile Networksin tuotteet Nokian suunnitteluohjeistuksessa esiintyviä ohjeita. 2. Minkälaisia haasteita teollinen muotoilija kohtaa Nokia Mobile Networksin tuotesuunnitteluprosessin aikana? 3. Miten Nokian suunnitteluohjeita tulisi soveltaa konseptisuunnittelussa?

Teoreettinen viitekehys on rakennettu brändin suunnittelun ja tuotekehitysprosessin ympärille. Lisäksi brändin suunnitteluohjeistuksia on esitelty yleisesti. Tutkimus sisältää kaksi tapausta. Tapaus 1 pohtii, noudattavatko Nokia Mobile Networksin tutkimukseen valitut tuotteet Nokian suunnitteluohjeita. Toinen tapaus on produktiivinen prosessi, missä konseptin suunnitteluprosessi on dokumentoitu ja analysoitu. Tarkoitus on pohtia, miten Nokia brändin suunnitteluohjeita tulisi käyttää konseptisuunnitteluvaiheessa. Tutkimusmetodina on käytetty puolistrukturoitua haastattelua, joka on analysoitu teemoittelun avulla. Lisäksi tuotesemantiikka tutkimusmetodina on sovellettu.

Tutkimuksen tuloksia ovat 1) Nokian muotoiluohjeistusta ei ole kokonaisvaltaisesti noudatettu Nokia Mobile Networksin tuotteissa 2) Muotoilijat kohtaavat haasteita, jotka liittyvät prosesseihin sekä teknologiaan ja kustannuksiin 3) tuotekonseptissa on suurempi vapaus korostaa Nokian elämysperiaatteita konseptin käyttötarkoituksen mukaisesti.

8. Avainsanat: tuotekonsepti; brändi; suunnitteluohjeet; tuotekehitys; tietoliikennelaitteet

Suostun tutkielman luovuttamiseen kirjastossa käytettäväksi: _____
Suostun tutkielman luovuttamiseen Lapin maakuntakirjastossa käytettäväksi: _____

University of Lapland, Faculty of Art and Design

1. Name of the Pro gradu thesis: Nokia brand experience principles implementation in Nokia Mobile Networks' base station devices and new concept development
2. Writer: Hanna-Maria Viertola
3. Degree programme: Industrial design
4. Type of the work: Pro gradu thesis
5. Number of pages / number of enclosures: 81
6. Year: 2017

7. Summary:
This qualitative research is carried out for purposes of Nokia Mobile Networks' (MN) intent to create understanding about the current state of the industrial design within the Nokia MN products. Another research purpose is to add information in the field of industrial design and implementing brand design guidelines and brand experience principles in concept design.

Three research questions directed the work: 1. Do selected Nokia MN products incorporate the Nokia experience principles encouraged in Nokia Brand design guidelines? 2. Ware the challenges industrial design face in the product development process within Nokia MN? 3. How are Nokia experience principles to be applied in new concept design?

Theoretical framework is constructed around brand design and product development process (PDP). Additionally, design guidelines for brands are discussed. Two cases are presented and analyzed. Case 1 consists of Nokia brand experience principles' implementation in Nokia Mobile Networks' selected products. Case 2 is a productive part where the researcher has carried out a product concept design for Nokia Mobile Networks. Interview as research method is used. Additionally, product semantics as analysis method is implemented.

Main results drawn after the research are 1) Lack of Nokia experience principles' comprehensive implementation exist 2) Nokia MN industrial designers face challenges connected to processes and both technological and cost restrictions 3) At the stage of new concept design the industrial designer has freedom to emphasize the Nokia experience principles with accordance to the concept's purpose.

8. Keywords: concept design; brand; brand design guidelines; product development; mobile network devices

I allow the thesis' university library purposes: _____
I allow the thesis' regional library purposes: _____

Contents

1. Introduction

The story of Nokia started in 1865 when Finnish engineer Fredrik Idestam set up a wood pulp mill producing paper in South Finland. During the years Nokia has produced inter alia cable products, rubber boots and tires and mobile phones. However, telecommunications equipment has been in its repertoire since the 1880s even if other departments have been divested. Being a founder in many product sectors, Nokia is strongly technology-led organization. In 2007 Nokia redirected its business to telecoms infrastructure and merged with Siemens' similar operations. Nokia's vision is "Transforming the way people and things communicate and connect". Nokia "…create technology that helps people thrive" which statement communicates the company's value and philosophy customer first; positioning the user as a priority number one. This ideology is also present in the Nokia Product Design guidelines. The designers who for longer stayed in the company live the brand which is a natural consequence of believing the way the organization performs is correct. (https://www.nokia.com)

Figure 1.1. Nokia experience principles implemented in exhibition design

1.1. Research background and research problem

The first GSM (global system for mobile communications) call was performed in 1991 and network was built by operator called Radiolinja with Nokia telecommunications equipment. (https://www.nokia.com) Since then, telecommunication technology has increased its presence in the infrastructure in an accelerating speed. Telecommunication networks are now created everywhere. No matter whether the zone is a high-density habitation or no-man's land, communication is taken for granted.

This thesis is made for Nokia Mobile Networks' use. Nokia MN (Mobile Networks) presented the subject to me in May 2017. I had recently started working for the MN business group as an industrial designer. Carrying out a thesis work was both useful and natural way to create an insight on design related subjects and products within the Nokia MN business group. The research problem given was if there is a correspondence between Nokia MN products and Nokia brand design guidelines. I have approached the problem with help of three main research questions:

1. **Do selected Nokia MN products incorporate the Nokia experience principles encouraged in Nokia Brand design guidelines?**

2. **What are the challenges industrial design face in the product development process within Nokia MN?**

3. **How are Nokia experience principles to be applied in new concept design?**

Nokia's ideology is to create the technology to serve people in the society. Products themselves should not draw attention unnecessarily but be recognizable when needed. The outlook of the product is one of the priorities of industrial designers, not engineers usually. Including the brand specific design semantics in the products is without a question the interest of the industrial designer.

When developing an industrial design in a technology or other company, the purpose is to develop the user experience with the company's products. User experience is easily linked with devices and applications but in this research, it refers to a customer brand experience.

1.2. Research objectives

In addition to Nokia's intentions to produce the specific knowledge about the state of industrial design, the research is a Master's thesis for Industrial design in the University of Lapland, Finland. The objectives of the study are drawn from the interest on brand design and semantic brand cues in brand's products. Main reference in this study is Nokia Brand Design guidelines which is used deeper during the discussion chapter. This thesis aims also to guide the researcher into the design language of Nokia. Creating the idea of future products will be easier and some ideas will be discussed in the discussion chapter as well.

At Nokia Mobile Networks an increased awareness of the benefits of industrial design is raised. The newly recognized need for additional industrial designer is a consequence of the direction information technology is developing. The new 5G network technology causes 'shrinkage' of the radios and antennas. This is the consequence of higher frequencies of the network devices. Further it means that the radios will be much more and installed more densely and closer to the users. Apparently, the importance of the products' outlook will be much more important than so far.

What is the use of the research results for Nokia? As network will continue to develop along 5G, the devices will be brought closer to the user and so will be visible. In contrast with the many current devices, which are installed on base stations. Base stations typically locate in distance and end users do not recognize them in normal use. However, along the 5G the devices will be also more densely and the possibility

that an end-user notice is stronger if the device is not paid attention to its outlook. Obviously not only outlook and aesthetics of the devices will be of importance, but all the product qualities within the user experience. Anyhow to **create information**, also product development processes are discussed.

1.3 The structure of the work

The structure of the research is following; after introduction, theoretical framework is created. The research methods are explained in chapter three. The material is opened in chapter four of which follows two case studies in the chapters five and six. In the seventh chapter, the discussion brings the research together. Seventh chapter is also creating the sight of the future; how Nokia Mobile Networks benefit of a proper use of industrial design and how the organization adapts the industrial design's possibilities. The research as a process and the results with regards to the objectives are discussed. The research is partly retrospective, since most products analyzed are already launched and have reached over 10 years' lifetime.

1.4. Methods and material used

The research material is gathered from diverse sources. I conducted an interview with two Nokia industrial designers. Shorter discussion with the then line manager Markku Leskelä and colleagues in my team offered additional information. The visual material of selected products and concepts are picked from Nokia intranet Brand center. In addition, I have created a concept design for a new product is analyzed as a case study. The concept design started in May 2017 and finished in September 2017. During the months, I created the concept with two variants and ordered two appearance models for Nokia MN use. The concept material of the new product concept in chapter 6 is created by the researcher. The physical appearance models

were produced by external modelmaker. Pictures of the final model are offered by the modelmaker.

Brand values guide the company's activities. A company offers, according to the field design, a document for designers. At Nokia, the document is called Nokia Brand Design guidelines. For each interface between the customer and brand there is a specific document to help bringing Nokia experience principles into the specific field. In this study, I have referred to Product Design guidelines, which, like all others, contain the main blocks of the Nokia brand: Pure, Alive, Principled. Nokia has few business groups in addition to Mobile Networks. They are Fixed Networks, Technologies and Bell Labs. Additionally, Nokia brand is licensed and mobile phones are using Nokia brand. Lately the Nokia Brand Design guideline documents have been updated and the same experience principles are applied to each business group's design activities but also in the activities of functions that serve whole organization, like marketing. In the figure 1.1. and 1.2. examples of photography are shown.

Figure 2.1. Nokia brand photography show people performing in daily tasks

2. Brand design

The theory of the work consists of following parts: product development, brand design, design guidelines for brands and terms and concepts. Product development is discussed first in generally and after the typical challenges recognized by industrial designers are presented. Brand design is described first in general and after from company point of view. The link between brand and product is created. Brand design guidelines are a tool for brand's designers and they are explained. Last the concepts and terms are opened and shared with the reader.

2.1. Product development process

According to Michlewski (2015) there are two models of the product development process (PDP). The position of industrial design within the process differ in the two models. In the first model, the designer is subordinate to manager and he misses the direct link with the customer. Designer then don't reach the ultimate understanding of the customer and is obliged to act upon the manager's understanding of the customer needs. Managers are cultural distortion in the process. The processes of this type produce the products that do not correspond the customer needs and such fail in the markets (Michlewski, 2015).

In the second model Michlewski presents the designer is in a position of a product designer within the product development work but also in the earlier stages with managers where direct communication between the company and the customers happens. The designer then will apply his or her understanding of the customer needs to the design brief. Second model results with successful and emotional designs. (Michlewski, 2015).

The product design process itself is experienced messy and frustrating by all the participants. Accordingly, Holston (2011) lists the designers' frustrations and clients' frustrations which are collected in the table 2.1. A finding among industrial designers' work in PDP is that in many cases designers feel that they get involved in the product development process in late stages (Persson & Warell (Svengren, Lawson)). When the process has passed certain milestones, it is too late to impact on qualities of a product which are of interest of the designer.

Designer frustrations:	Customer frustrations:
Slow concept development	Slow or frustrating design process
Resistance in getting concpet buy-in from the client	Incorrect work
Changing course in the middle of the project	Unclear process
An unacceptable amount of client revisions	No ownership of the process
Getting top level sign-off	Inconsistent processes within the design firm
Unclear client goals	
Marginalization of design value	

Table. 2.1. Common designer's and customer's frustrations during the product development process

Jan Walter Parr asks: "Does the designer actually have the privilege of carrying out his own intentions?" The level of freedom the industrial designer experiences is greatly stressed by the type of product, and the company where design is carried out. The more technically complex the product is, the less freedom product's form and its designer experience. Highly technical products tend to be capital goods, and

consumer goods have then less restrictions (Vihma, 1995). In the figure 2.2 the objects on the right are very personal. The objects in the left instead are used by amounts of people. Telephone placed in the left might not be reasonable anymore, but when observing telephone's today, they are similar and main differences lie on capabilities and interfaces, which are interior or software designs.

Karjalainen (2004) states that it needs to be carried in mind that the technical functionality is the priority number one when developing a product and implementing design. Karjalainen writes: "When a groundbreaking product innovation (that establishes a new product category) is initially presented to the public, most attention is directed towards technology, product concept, use purpose or other aspects that precisely make the product an innovation. Industrial design supports this innovation and may not yet be optimized in terms of usability or semantic contents. For instance, first mobile phones were clumsy and difficult to use." This is many times the case within Nokia Mobile Networks where further innovation is always ongoing. For a designer, a modification in the physical size of the product may bring profound reconsiderations of outlook, design and essence, not to mention semantics and identity.

Industrial designer's task during the PDP is to collect the different requirements indicated to the product and make a synthesis, a solution, out of them. In addition to product's technical degree, various stakeholders involved in the product development process may be multiple and they do not simplify the designer's task. To name possible stakeholders, there can be the user, producer, management and other designers involved in the process. Also, various constraints derive from different production or distribution methods (Crilly & al, 2008).
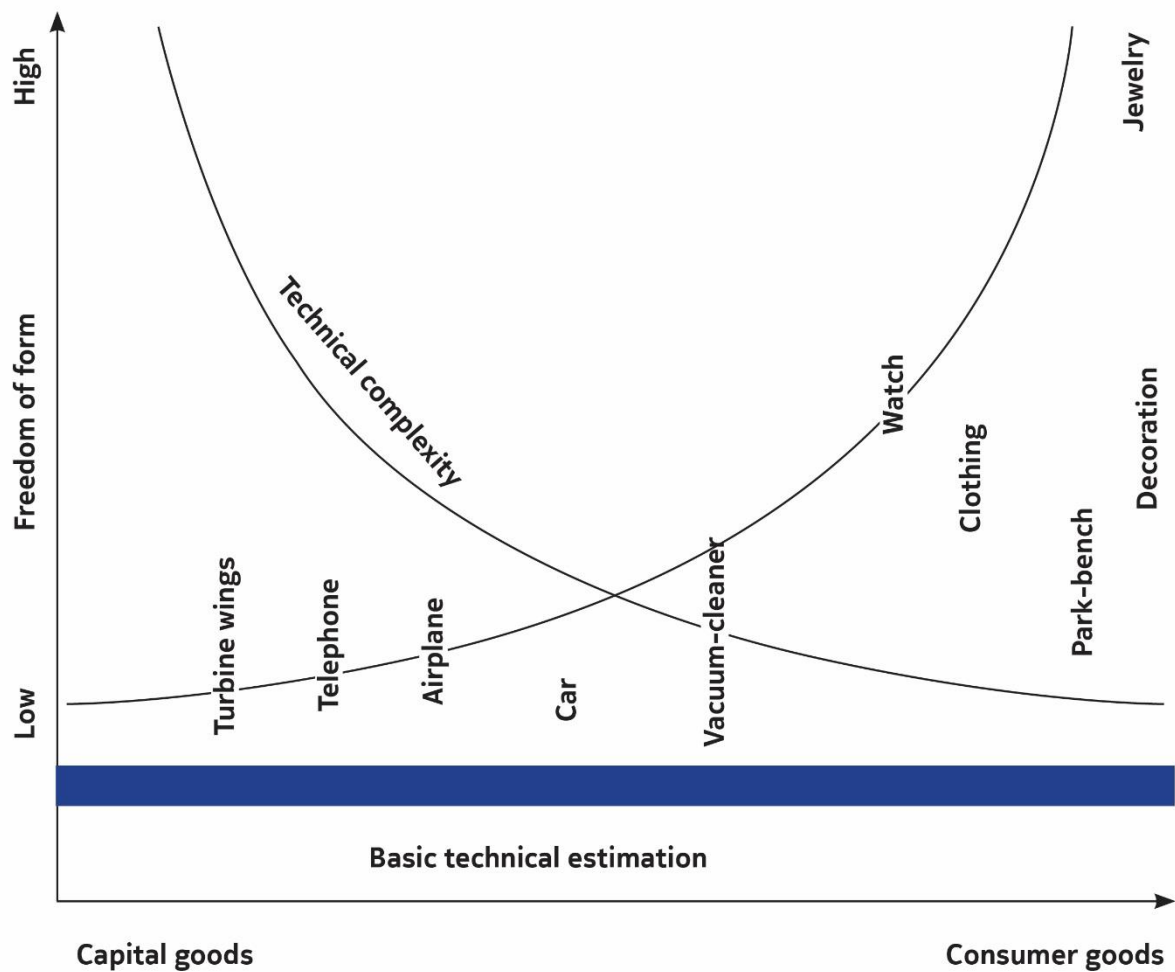
Figure 2.2. Level of freedom in form in different product categories (Vihma, 1995)

The product development activities going on inside the Research and Development (R&D) departments in technology companies mix engineering design and industrial design. Due to their diverse cultural backgrounds, engineering and design activities do not merge well (Persson & Warell). Industrial designers observe the product also from humanistic point of view (Krippendorff, 2006) applying intentions to creating the emotion into the use and outlook of the product.

Persson & Warell offer us four different modes of relation between industrial designers and engineering designers: one-way communication, reciprocal communication, interaction and collaboration. Of these, the last is preferred to achieve best results and best products where all the expertise are synchronized. The

researchers claim that "the purpose of communication in product development organizations in to transfer knowledge between individuals and to adapt different product perspectives into one design proposal". Warell & Persson note that "the communication fails partly due to diverse mental picture of the message". That is, "the received message is not necessarily the same as the intended or the sent message".

Industrial design's contributions to PDP

"design is both process and product. It is a way of thinking synthetically, of looking at the problems in unexpected and creative ways and seeking innovation. It is also about specific outcomes – products, graphics, communications and business settings. More broadly it is about how consumers and stakeholders experience the outcomes – the design interface must be all these things – a strategy for action, as well as the results of those actions and decisions" (Walton, 2002 [Hands in Handbook of Design Management])

Industrial designer's involvement in the product development becomes necessary when products are directed more to customers and marketing. An industrial designer design objects or artifacts, which will be produced by someone or something else. This is to be noted to make a difference between artist and designer. When designing, he needs to understand the laws of natural sciences but also the human part of the objects because objects are used by people. Design activity then consist of two different epistemological worlds; the one where the solutions are partially given and to be found, and the one where solutions does not exist but need to be created.

Designer as a natural scientist takes into consideration for example the laws of physics when designing a construction of, let's say, a chair. It must be rigid and made of the material supporting the human weight. An industrial designer as a humanist understands the user's preferences about the material, because each material

communicate different thing. Certain forms incorporated in the chair would communicate either poverty or individuality, just to give an example, and that's why they make a difference. The designer understands that users are different with unique preferences. This doesn't mean though that millions of unique chairs need to be done, but the designer needs to improve rather the lives of communities, not single users. (Argen, 2002)

Herbert Simon admits that design profession is problem-solving activity of ill-defined problems, cognitive as such, and differing from engineering. Anyhow, in his proposal for solving these problems, he attributes engineering steps to the process. (Keitsch [Vihma, 2010]). Design is then proved to be multidiscipline and complex by several philosophers who have failed to create an all-satisfying picture of the profession.

Artifacts have the power of communication; about themselves, about the manufacturer, about the culture they come from, about the owner. There's lots of capacity in products to communicate, and when not managed, artefacts can be understood in a wrong way. Because, as Peirce notes, the receiver of a message receives the message despite if the message is intended or not. The area of artefacts' communication needs to be managed by designers, who have a profound understanding about it. According to Krippendorff (2006), the designers are the only professionals who can understand the meanings that artefacts hold to the people and the cultures. This capacity makes designers unique from other professions. This idea brings also the conclusion that designers are professionals in communication through artefacts. Accordingly, brand's design cues' implementation into the products falls under the industrial designer's responsibility. Designer's don't experience great complexity in doing so (Karjalainen, 2004).

Parr states that the industrial designer does not only consider the aesthetics of the product and the immediate user but should also take care of our common physical surroundings and shaping them is the designer's "great responsibility which should be based on intentions that go far deeper than the mere seduction of a defined user".

Parr offers us with six different designer's aesthetic intentions listed in the table 2.2. The first approach is commonly known Form Follows Function invented by Bauhaus designers. The sixth is intention merges with architecture and does not result of products with extreme of highly outstanding aesthetics. These two approaches are – unintendedly - referred by Vuolteenaho in later discussion in chapter 5.

Aesthetic Intentions in Product Design
(Jan Walter Parr)

1. Form follows function
2. Counteracting social hierarchies
3. Industrial objects becoming aesthetic poetry
4. Industrial objects reminding us of nature and the human body
5. Following geometric and proportional rules
6. Custom fit a product to a place

Table 2.2. Different aesthetic intentions product design can have according to Parr.

Having an in-house designer, a company gains several advantages but also disadvantages. Some of them are listed in the figure 2.3. Many researches concentrate on products directed in consumer markets and business assets do not gain lot of interest. The category of Nokia MN base station products has been rather falling under business assets but it is about to change due the 5G technology. It means then that the product design activities applied in consumer product design and development will be of advantage also within MN product development.

Advantages of in-house designer

Cost-efficient

Easy coordination with other in-house departments

Company has control

Designer's intimate and direct relationship and understanding of company

Connection with internal networks

Disadvantages of in-house designer

Lack of creativity and innovative ideas

Losing touch with external developments

Risk of getting stale

Figure 2.3. Advantages and disadvantages of in-house designer (Von Stamm [The Handbook of Design Management, 2012])

The nature of the PDP

Researches on product development process aim at identifying the various problems that arise during the PDP. The eventual purpose of the research findings is to make the PD process more efficient or products cheaper or easier to produce. The target of an organization when improving its PDP is, however, the heightened product

quality and more satisfied customer. Product quality and customer satisfaction have become also differentiating factors between companies in the rough competition from customers.

Interdisciplinary product development teams usually face difficulties in working together. The problems, like inefficiency, limited understanding and respect occur (Persson & Warell). Different professions don't understand each other's competencies and viewpoints. Warell and Persson offer us four different modes of relation between industrial designers and engineering designers: one-way communication, reciprocal communication, interaction and collaboration. Of these, the last is preferred to achieve best results and best products where all the expertise are synchronized. The researchers claim that "the purpose of communication in product development organizations in to transfer knowledge between individuals and to adapt different product perspectives into one design proposal". Warell & Persson note that "the communication fails partly due to diverse mental picture of the message". That is, "the received message is not necessarily the same as the intended or the sent message".

Designers observe the product as a complete service; how it will be present to the customer, or in the use environment, and each part of the product they see belonging to the whole in the end. Engineers, instead, tend to cut the problem at hand in smaller pieces and solve one detail at time. Engineers also prefer the solutions which are common and used before, while designers naturally try to find novel and unexpected solutions. (Persson & Warell)

Another difference between natural sciences and design sciences is that the interest of knowing has different background. Natural sciences tend to explain phenomenon because they are mainly interested in knowledge itself. Design sciences instead want to know how to be able to construct the desired future. Design creates visions of the future and as an activity is fueled with better tomorrow. Thinking about any designer around, they all are concentrated on how things should or could be made differently.

Designers do analyze the past but gaining knowledge about the past is not the motivation of design activity. (Krippendorff, 2006)

Nature sciences aim at explaining the world we live in and presenting the phenomenon absolute and true. The nature sciences believe that the future is a linear consequence with the past and humans do not have the power to change it. (Krippendorff). Design sciences, instead, believe that the world and its future is not predominated by the past, but humans and their actions have the power to change the world in a desired direction. (Krippendorff, 2006)

To achieve the best solution possible, Persson and Warell state that a true cooperation between designer and engineer is the favorable method. They also state that cooperation is different from interaction or one-way communication. Cooperation means that the professionals genuinely work together and aim at understanding each other's viewpoints and doing so, are able create viable solutions to the problems. This ideal situation may be difficult to achieve. Either professionals do not know how to cooperate or they simply do not face each other.

During the PDP industrial designers, according to Persson & Warell, may experience the lack of a suitable person with whom they share the mutual understanding of the product and industrial design within the framework industrial designers operate. Sir Misha Black (The Handbook of Design Management, 2012) claims that managers and designers should work more closely together, because both professionals tend to vision the future and think about the environment and structure of society. Managers, many of them, have visions about the organization performing better or the world organized differently. They manage or lead other people in accordance to their visions. They want to change the status quo and they perform the activity to achieve the better. Designers have also visions which they are able to present with different means of presentation techniques. The common thing is that the both professions crave the change. Managers have the capacity of make it real and

designers have the capacity of imagining and representing the ideas. That's how both would benefit of a cooperation.

2.2 What is brand design

The history in branding and brand research is evolved in three phases (Krippendorff, 2006). During the first phase, the attention was on market growth achieved with product branding and making the brand stand out of others. This was a natural consequence at time, when industrially produced items started to spread rapidly and the distinction from the competitors' products was to be created rapidly too. The marketing production is then a rapid solution since the company didn't necessarily need to change the actual product. During the second phase, the attention was drawn to the consumer and common thought was that the brand exists only in the mind of customer. Third phase follows somehow the latest discourse in the field of organization research. Is claims that the organizations' environment is hasty and unstable and every socio-economic change as well as the pressures in the organizations' or here, brands' environment affect the consumer behavior. The future is therefore seen unpredictable and difficult-to-manage in the brand and organization research. Organization theories also state that the manager is no more capable of managing the actual life of his organizations.

When creating a new brand or redefining an existing one, the company needs to consider several things. Following list includes some, but is not comprehensive or complete. To start thinking about branding however good starting point is a question: why this brand needs to exist? Table 2.3. lists more considerations of a new brand definition.

- Why the brand needs to exist?

- Where the brand speak from?

- What vision, concerning the products and the world, the brand has?

- Brand's core values?

- How the brand wants to change people's life?

- Which product categories the brand covers?

- The core acts of brand mission and values?

- What kind of style and language brand has?

- Who is the client of the brand?

Table 2.3. Toni-Matti Karjalainen (2004) offers a list of brand creation concerns

Brand design and branding are traditionally studied in the field of marketing. By consumers brand is, however, mostly observed by users through products it offers. (Bloch; Warell). That is why some researchers give the most importance to products in creating the brand identity and interface with customers or users. Karjalainen (2004) made, for example, an enormous work in branding and product design.

What do organizations want to achieve with branding activities?

Branding is about telling a story about the organization, corporation or brand in question. The story may be real or imaginary. Both real and 'fake' stories can be effective and fascinating, and draw the customers to the brand. Stories are very strong in creating the mental images in people's minds. Stories are engaging because they give people tools to understand the society, human beings, the environment and the future. We conceptualize all the uncertainty and unpredictability with various stories and make the world more understandable to us. (Brown, 2016). Think about

Instagram, where the possibility to create instant stories, which remain in the app memory only for 24 hours, is extremely popular. Every user now wants to create his story, real or edited. Before applications there already were movies, books and in ancient times legends and tales. Stories are for information sharing, survival and imagination feeding.

The importance of a story for corporation can be explained with three points. Firstly, the markets are full of products, services and other companies competing about the consumer's attention (Brown, 2016). A right story will naturally draw right customers towards the brand. The customer may want to become part of the story by buying a piece of the brand. The consumer then experiences participating the brand's story. Secondly brand is valuable in the financial meaning. Strongest stock companies have undoubtedly strong brands and brands create the part of the value. Third reason for branding is social. Lately, when the ethical and environmental responsibilities have gained more importance in the discussions, also the corporates and companies are expected to behave in a responsible way. The brand is a means to communicate the responsibility.

No company exist without the customer and the logic is that the stronger the relationship will grow, the longer-lasting customership will be and more money will enter to the company. With branding activities organizations aim to create firm relationship with the customer. Products are the strongest interface between consumer and a brand (Karjalainen, 2004). In other words, the user evaluates the company mostly based on evaluations and observations of the product the company offers.

Perceiving intended brand associations in a product

When a customer or user is in contact with the product of a brand, associations are created in the user's mind. The agreed research finding is that brand associations are

created mainly by a person observing the product visually, since two thirds of brain stimuli are visual. One third is then caused by other senses like taste or smell. Scholars so far do not agree on what brand associations are. Aaker names quite a few of them, of which none Thellefsen and Soerensen claim to be associations but concepts that can create associations. Thellefsen and Soerensen reject also accepting Keller's (1993) view on associations which, according to Keller, are attributes, benefits and attitude. They claim, instead, that association is a connection where the formula of a connection consists of three elements; a mind, a brand as information and a collateral experience of the mind.

Humans are perceivers who scan continuously the environment. Huge amount of visual distractions enters our brain every day. Researchers claim that not all this that we see remains in the memory with a verbal description. Large amount of this data enters then in the subconscious, which is taken in use as associations. Associations our brains create are born for three reasons (Peirce): resemblance, contiguity or interest. Research is not evolved enough to explain everything about association creation process. However, scholars recognize also the segment of emotional associations but Thellefsen and Soerensen do not recognize emotional associations as a category of its own claiming that all other types (verbal, visual and sensory) of associations create emotional associations.

A physical product has a physical existence but in addition it has a character and incorporated meanings. Brand persona can be carried out in the outlook of a product. Then a product becomes an intended means of brand communication if used intendedly. Karjalainen (2004) and Vihma (1995) explain this idea with product semantics. Since the industrial designer designs the product and so characters and intended meanings into the product, I then like to call the designer a communicator and a storyteller.

A brand identity is the one which is visible to a consumer in diverse ways, depending how the company behind it creates the identity. As Karjalainen (2004) notes, the

great amount of corporate identity literature is written from the graphic design point of view. As industrial designers we are, anyhow, interested in products and how they communicate the corporate or brand identity. Because, in the end, identity needs to be communicated to be of use.

2.3. Design guidelines for brands

The brand identity defined earlier can be written in a design guidance for a designer. When a brand wants to incorporate their message into the means of communication with the customer, one way of having a control over it is offering a design guidelines. The document is given to designers to help them create intended message in the field they act in. Depending on the company, ways of communication can be for example graphic design (brochures, business cards), interface design (applications, websites), customer service (representatives' behavior) or products. Products are strongest interface when customer evaluates the brand and the company.

The term brand DNA refers to company's intention to create a unique brand. Some companies have created brand DNA as a guidance for the designers to create products for the brand. Other companies may offer simply and more modestly design guidelines. The content of design guidelines varies in accordance the objectives the company has. For instance, Volvo offers a VDP to the designers. VDP derives from Volvo Design Philosophy and is a document to the designers to implement the brand identify into the products. (Karjalainen, 2004). Anyhow, common is that to remind the designer of the reason of existence of a brand, there will be repeated the brand identity building blocks. They are at least vision, values and purpose.

After some years working in the same company, designers begin to 'live' the brand which means that they have the meaning of a brand identity in their veins and somehow naturally or in unconscious way can design the identity into the product. For a new designer in a company the brand guidelines are of significant support.

2.4. Terms and concepts

In a scientific research, the terms are used to refer to the concepts. For a reader who is not necessarily familiar with the field it is helpful to have an idea of the concepts used. The terms repeated during this research are explained in this chapter.

Base station

In radio communications, a base station is a wireless communications station installed at a fixed location.

Brand

Several definitions for a brand exists. Brown (2012) is at the heart of the explanation noting that "although brands are fantastic, fascinating, fun-filled things to learn about, they´re tricky things to define". Nokia as a corporate is also the brand. Under one corporation many brands may exist (VW Group for example). Some definitions from list of Brown, which may be useful for the reader:

A brand is any label that carries meaning and associations (Kotler).

A brand is a promise of an experience (Adams).

Brands are demonstrably the most important and sustainable asset for any organization (Hales).

A brand is the semiotic enterprise of the firm, the companion spirit of the firm, a hologram of the firm (Sherry).

Advanced study / Feasibility study

Studies are processes carried out in R&D before the decision is made to start a product development program. The study results direct the decision.

Product Development Process, PDP

PDP is a development of new product. During the process, the program needs to achieve several milestones with prenominated requirements. PDP duration may be for instance 12 or 18 months, depending on the company and the product.

5G

5th generation mobile networks offer high capacity and speed. New use cases will be allowed by high density and reliability.

3. Research methods

The research has two case studies. During first case, the attention is directed to selected Nokia MN products which the textual and visual data. The second case is descriptive process analysis of new product concept work carried out by the researcher for Nokia MN. In this section, the applied methods are described and their use within this thesis. The semantic approach is qualitative and interpretative or descriptive content analysis. However, the objectives of the research are of understanding the product communication and specifically brand cues incorporated into the products. Product semantics operates between brand and objects and thus is selected method for analysis. Textual data is collected by half-structured interview. The interview analysis method applied is thematization.

Figure 3.1. Nokia brand communication is positive and warm.

3.1. Product semantics as a research method

Semantics and semiotics Humans communicate with other humans in several ways. We inform and receive information about ourselves and others with language, which is probably the first mode of communication which we think of. Peirce offers a triangle where the relations are. Product semantics add a communicative dimension into the industrial designer's work.

To understand the history of meaning creation - and interpretation since they belong together – it's good to start with the idea of culture and its products. So far, human is the only species who has the level of intelligence high enough to use tools and create artifacts. Artifact is then a product of an advanced culture and a human creation that can be either material or immaterial product. Humans are only species in earth who have been able to create intelligent culture. Through actions humans create not only products as physical things but also language. Artefact has linguistic trajectory from Latin language. *Art* is something created by human being, by hands. Fact comes from Latin word *facto*, which means true, existing or truth.

Artifact can be either material or non-material product. Krippendorff (2004) offers us a 'trajectory of artificiality' where different human-created artifacts are listed in a timeline and by development of society. The artifacts are, in order from the oldest to newest: products; goods, services and identities; interfaces; multiuser systems/networks; projects; discourses.

So far three design discourses can be identified. The earliest design discourse started around mid-19th century, when the industrial designer as a profession was born. The attention was then directed to ethical and practical issues of profession, balancing between the manufacturer and the consumer. The second design discourse emerged in 1960 and 1970, which the author names "engineered industrial design discourse", EID. In the EID there is a belief that the objects have the predetermined meaning, and the observer can gain the knowledge of that.

Additionally, industrial design was considered as a marketing tool. Third discourse is about contextualizing industrial design with socio-culture and its codes. Products gain their meaning in correspondence with people's social and political interests. (Keitsch [Vihma, 2010])

Predetermined meaning is divided in primary properties and secondary properties. The primary properties are characteristics the object really has. The secondary properties are seen subjectively by the observer, and since varies according to the interpreter. This thinking can cause creating controlled experiment, since the designer must eliminate the effect of secondary properties, which he has no control over. (Keitsch [Vihma, 2010]).

Krippendorff attacks the Form Follows Function (FFF) -ideology as it is resulting old-fashioned today. FFF ideology was Louis Sullivan's dictum at the time mass-production spread over. The society then was also highly hierarchical and designers were not let into the discussions of the products' fundamental basis but were given mainly the responsibility of - one would claim superficial - form-giving activity. Fundamental basis means that one considers and challenges the product's functions and their origins.

Karjalainen (2004) has made a profound research about product semantics and branding. The attention in his research is drawn to cars and mobile phones, precisely certain products of Volvo and Nokia. Both products at time relied on distinctive design. Krippendorff (2006) notes that more and more forms of products are vanished because the technology, which nowadays play the functional role in the product, takes more importance. It is an evolution which no one can affect, and it does not make sense carrying the artificial forms within the products where they do not serve anymore.

In the discussion where brand and product semantics are together, the connection must be created between the communicative possibilities of a product and the

intended message of a brand. Karjalainen uses the terms explicit and implicit brand cues, which are incorporated in the product with the intention to create brand-specific language. Explicit brand cues are, namely, brand cues which are defined in an explicit manner in the products. Chen & Owen (1997), for example, list following elements that are possible: form elements, joining relationships, detail treatments, materials, color treatments and textures. Depending on the industry, some treatments can be identified immediately. For example, Apple is known of highly sophisticated borders where materials change.

Implicit brand cues are somehow trickier to recognize (Karjalainen, 2004). That is because they are implicit and work in the background. Looking at a product, one could recognize its belonging to a certain brand, but one cannot name a cue which unveils the brand. For a designer, the skill of applying both explicit and implicit brand cues is important because, as stated previously, designers are the masters of product communication.

In this research, the product semantic analysis is carried out using the data from interviews and secondary (visual and textual) material. The method is descriptive and aim at giving the information about the situation rather than statements or one-dimensional truth. In the chapter 6 product semantics is applied in the design process description.

3.2. Interview as a research method

Interview as a data collection method is widely used in research. Interview is suitable in a case study, when a researcher wants to achieve information from person or group of persons involved in case. The interview as a method does not necessarily give exact or valid information about the research problem. Due to interviewees' subjective experiences and position in a company, in this research, the interviewees

may give colored information to the questions. Researcher's critical approach is then recommended when analyzing the data. (Hirsijärvi & Hurme, 2001)

An interview is a discussion between the researcher and interviewee. The discussion may be structured or loose. With the interview questions, the researcher can manage the situation. Restricted questions allow the interviewee less freedom when giving the response. Roughly types of interviews are divided in two. Other is a structured type where well-organized questions and answers are given and the interviewee chooses one. The other possible interview type is open or half-structured interviews. The questions' openness depends on the type of data the researcher aims at. (Hirsijärvi & Hurme, 2001)

The interview situation needs to be planned. The environment where the interviewee feels him/herself uncomfortable may affect the answers and the data. Especially it must be considered in cases where interviewee is young or otherwise sensitive. However, also adults may experience themselves uncomfortable in unfamiliar environments and may, for instance, restrict the length of answers. Other people in the situation may cause that the answers are censured. The interview situation requires social skills from the researcher. He or she may unconsciously affect the interviewees' behavior with face expressions or actions. Neutral behavior is recommended and preferably comforting the interviewee if necessary. (Hirsijärvi & Hurme, 2001)

Some ideals about the interview as a data collecting method are listed below:

- o The interview is planned and the interviewer is familiar with the theory and practice of the subject.
- o The interview is emphasized by the interviewer.
- o The interviewee has the security that the data is treated confidentially.

4. Research material

The research objective is finding out how Nokia experience principles translated into brand design guidelines are transformed in product design. Nokia industrial designers are interviewed to gather the information of the transformation process. Nokia brand design guidelines will be under more precise observation in chapter 5 and 6 together with the cases. The material analyzed in this research consists of three parts; an interview, visual material of the products and an artistic work carried out by researcher during summer 2017. Main framework is created by interview carried out together with two Nokia in-house industrial designers who work in Oulu, Finland.

4.1. An interview

The interview was with Hanna Vuolteenaho and Harri Mustajärvi. Mustajärvi is a Nokia MN industrial designer who in the beginning carried out mainly the responsibilities of a mechanical engineer. He holds an Industrial Design degree from Rovaniemi Institute of Arts & Crafts, which later merged with University of Lapland becoming Faculty of Arts and Design. During last month's Mustajärvi's work has shifted more towards industrial designer's tasks. Mustajärvi has five and half years' experience as Nokia Mobile Networks' in-house designer. Mustajärvi's view on R&D work is rather realistic which results that not too much interpretations needed by the researcher.

Another interviewee was Hanna Vuolteenaho, a senior industrial designer currently in Nokia Fixed Networks business line. She did her trainee period at Nokia and continued as a member of 6110 design team in 1995. She came to Nokia right in the middle of the Mobile Phones' success story. In fact, she is the designer of beloved model 3110. Karjalainen (2004) describes the case profoundly in his doctoral thesis. In addition to

the interview the researcher has gathered information from shorter discussions with Markku Leskelä and mechanical engineers within Nokia MN Electromechanics team in Oulu.

The interview duration was 1 hour 20 minutes. Ten questions were presented. The questions were sent day before to the interviewees and they were prepared when the interview started. The interview was semi-structured. Ten questions allowed descriptive answers. Each answer was at least somewhat broad. Additional questions were presented during interview.

Ten interview questions:

1. What is your occupation and education?

2. How long you've worked for Nokia and for which department?

3. Describe your responsibilities.

4. Can you tell about the product development process at Nokia MN? What are the biggest challenges in bringing the industrial design more within the process?

5. Flexi radio has been successful in Nokia MN. How do you see the product as industrial designer?

6. Describe the AirScale concept. Where did you aim at when doing the concept?

7. How about the AirScale in production, what Nokia brand qualities there are?

8. Can you tell about the design process and the final product of FAS C.

9. How do you emphasize Nokia brand when doing industrial design?

10. How do you see the future in the industry of network products? How 5G will change the nature of Nokia MN products?

The discussion was written in open text. After this the content was divided in themes which were created previously in a manner that they would support the research objectives. Under each theme the data is then gathered. The data was modified so that it created a story. The analysis is then made and results presented. The interview is supported with the visual material and Nokia Brand Design guidelines. A description of the use of the Nokia experience principles and their presence within the selected Nokia MN products.

During five months of working within Nokia Mobile Networks Research & Design department the researcher has been given possibilities to talk with several people who have, within some of the products analyzed here, been working for the product development. This is how the secondary material is collected for the research and analysis. Of course, since the view in the position of R&D engineer is not as wide as, let's say product manager, the "right" information may lack. For the aims of this research it is not seen problematic because R&D does its everyday work and makes the decisions based on the information they have at that moment. That is, the secondary information is justifiable. In a large organization, it is rare that a universal understanding on things and situations is created; disagreement is characteristic of product development and healthy as such.

The data derived from the interviews is used along with the product pictures. The semantic analysis is then an interplay between the data and the linked material. The empirical data consists of the researcher's observations, short discussions and other information gained. Any proper interviews were not actualized. The source for analyzing the Nokia brand is Nokia Product Design guidelines.

4.2. Secondary material / Visual material

In addition to the interview visual material of Nokia MN products is collected. The visual material is used with an acceptance of Nokia MN authorities and it was found

directly from the Nokia Intranet. The visual material consists of pictures (photographs or visualizations) of the products the researcher has created somehow close relationship with. Some MN products have been left outside of the analysis, simply because they are either variables or not interesting in terms of product design and brand communication or the material was already sufficient.

NAME OF PRODUCT	FLEXI BTS (BASE TRANSCEIVER STATION)	CONCEPT FOR AirScale PRODUCTS	AirScale SINGLE BAND RRH (REMOTE RADIO HEAD)	RAS (REMOTE ACCESS STATION)	CONCEPT FOR MASSIVE MIMO ACTIVE ANTENNA
TYPE OF PRODUCT	CASING: BOTH RADIO AND SYSTME MODULES CAN BE INSTALLED	CONCEPT FOR AIRSCALE RADIOS AND SYSTEM MODULES	AIRSCALE RRH IN PRODUCTION	COMBINATION OF RADIO AND ANTENNA	COMBINATION OF RADIO AND ANTENNA
SIZE	MEDIUM	MEDIUM	MEDIUM	LARGE	LARGE
YEAR OF LAUNCH	2005	2016	2017	2015	N/A

Table 4.1. Nokia MN products analyzed in chapter 5. Concept for Massive MIMO is discussed in chapter 6.

The products analyzed during the research are collected in table 4.1. Flexi BTS (Base Transceiver Station) has been a successful product concept. The leap in technology allowed the shrinkage in physical size and a was first base station product with small size and, additionally, outdoor resistance. This allowed its installation in places which were not considered previously. The then Nokia NET design team is responsible for the outlook of grey casing. Concept for AirScale product family is a proposal created

by Harri Mustajärvi and Hanna Vuolteenaho. They were contacted early in the beginning of product development. AirScale RRH is the result of product development process. RAS product is first Nokia MN product of this category where antenna and radios are in the same construction. A new concept created by the researcher is discussed in chapter 6 as a case 2.

Outside of the analysis are left all the system modules, which are units that make transformations between radios and core network. System modules have the capacity to calculate and process the data. Radios then receive and transmit the data. The system modules are traditionally installed inside a chassis or a cabinet (see figure 4.2.) and the distance between radios and cabinets usually exist. In the figure 4.1. other product which are not analyzed are also shown. Only two products in the figure 4.1. are included in the research. Small devices are left outside of the research mainly because only few information was available.
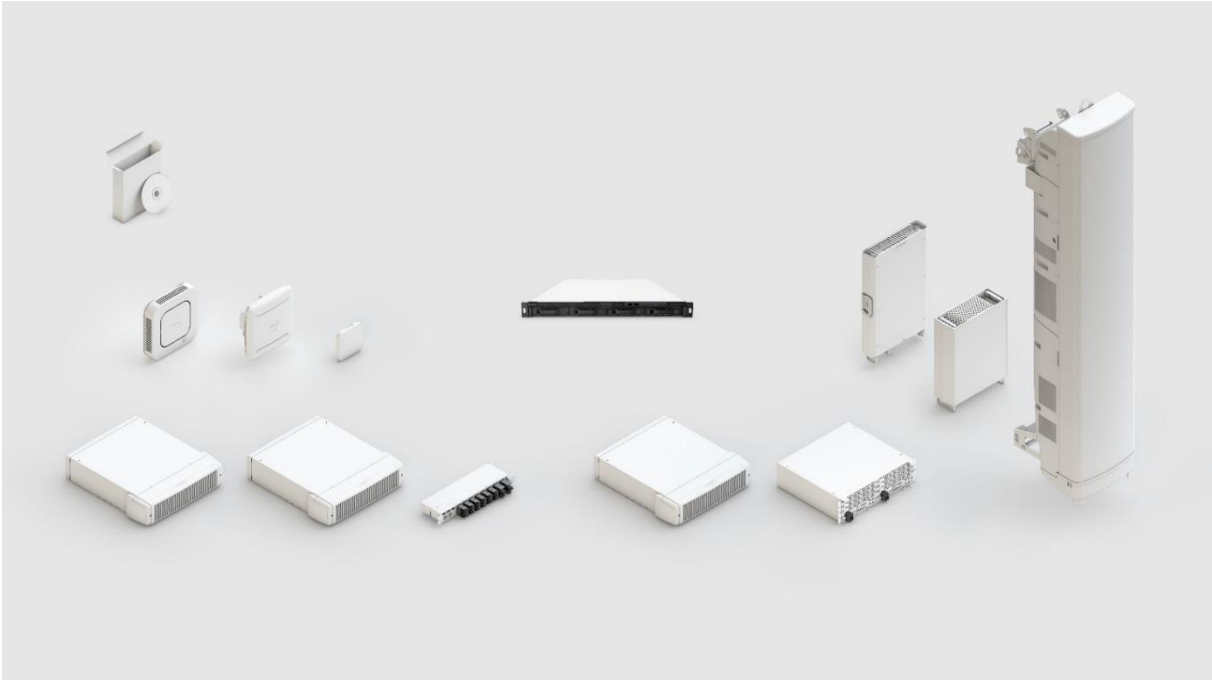
Figure 4.1. AirScale product family launch in 2015 at World Mobile Congress in Barcelona

Figure 4.2. Cabinet where system modules installed. The cabinets are usually located indoors

The datasheets of the products in market were available. However, they weren't considered as offering usable material for the research since the data they contain is highly technical concentrating on the product's performance. The scope of the research was in products' outlook and the Nokia product design use of experience principles. Also, the products from all other business groups are excluded in this

research. These are Nokia Health, Nokia Phones and Nokia Technologies and some of the products are shown in figure 4.3. to give an idea for the reader of their product type, which is remarkably different from Nokia MN products.

Figure 4.3. Products from other Nokia Business Groups excluded in this research.

4.3. Material of new product concept

All the material used in concept part of the research is produced by researcher during May 2017 – September 2017. The concept served for creating an appearance model for new product. Often some technology development has been carried out previously as a R&D activity within technical studies or advanced studies which then come together as a concept of a new product. Not necessarily, though, the concept continues to the product program. Diverse reasons may cause running down the development work of a new product. In this case, the concept was followed by product program.

Having started as a new industrial designer at Nokia MN it was an ideal situation to start concept work from the clean table without having the traditional thinking. During the concept, concentration was in refining the product language according to the Nokia experience principles. The main concern was on visual and communication

aspects of the new concept. At that stage of the new product development it is normal (Karjalainen, 2004) since the technical requirements would still search for final definitions and would be applied later into the product.

4.4. The research material's suitability in the research objectives

The existing material was adequate for carrying out the research objectives. However, more comprehensive material for product family analysis would had been of use. For instance, no visual material of the products developed in China site was available. It restricted the analysis of state of design management of product families and brand-wide product design analysis.

The material produced during concept design was easily accessible. However, due to poor quality of original sketches not a great amount was useful for the research. The research objectives were not in product design process and the tools of a designer but merely in transformation of Nokia experience principles into the product. The lack of early stage material then did not restrict the analysis.

5. Case Nokia MN products

During the last ten years Nokia as organization has gone through fundamental rearrangements. In addition to selling the Mobile Phones business group to Microsoft, it has acquired other businesses and melted them as a part of Nokia. Purchasing other brand is a way of expansion (Brown). For Nokia, it has brought also widened product range including products Nokia was not known before, like health devices (Withings). The need for unifying the design of the products under one Nokia design has arisen. In many Nokia consumer product categories brand and design is more critical than in "company goods". Industrial designers under the same organization are anyhow guided by the same brand design guidelines. Guidelines give designers a direction and a backbone when performing their work. The mechanical engineers have comparable guidance in the specific areas of theirs.

5.1. Nokia Brand Identity and Nokia Brand Persona

The Nokia design guidelines first explain the Nokia experience principles which are 'Pure, Alive and Principled'. Depending on the field of the design field, guidelines then go deeper in explaining how to bring Nokia experience within the design. In this research Product Design guidelines is mainly used together with more general Visual guidelines. There is, however, the core which remains the same in all guidelines.

Karjalainen (2004) states that corporate is behind the brand and so corporate identity is different from brand identity. Even though, as his research was also about Nokia (Mobile Phones), he regards Nokia corporate identity as equal or same with the Nokia brand identity. According to Karjalainen, Nokia is a corporate brand. Based on this, and on the fact that Nokia's organizational structure remained much the same, I follow Karjalainen's conceptualization of identity in this thesis.

How can Nokia brand identity and brand persona be described? In the design guideline documents, there is not given exact characters to Nokia. Some car manufacturers may adopt a character of an animal for a model (Karjalainen, 2004) or home devices might be given attributes. After getting familiar with Nokia brand guidelines I dare to create a person out of Nokia brand. After this research, the brand persona I have implemented later in concept design.

Nokia brand persona is humble in a way that it does not stand out for wrong reasons. When existing in its place it doesn't draw attention intentionally but rather gives space for people to act in a space. Nokia is friendly and positive.

The functions of products or applications work effortlessly. User does not have to hesitate when communicating with the products and the task the user has to do with the Nokia will be carried out efficiently. The use and technology is sophisticated and clear.

Nokia products are reliable and long lasting. With aesthetics and functions, they do not get old and they do not follow any fashions or trends. The aesthetics look fresh after years of service. There is no need to replace products or applications before designed lifetime has been reached.

Technology used is new, reliable and trustful. Technology is designed with the user in mind so that it is most in service for the diversity of needs. User must feel that he can perform in a life in the best possible way with the possibilities Nokia technology creates. Shortly, Nokia stands for people.

5.2. Nokia brand experience principles

Nokia brand design guidance is a documentation of a design philosophy, about how design has been carried out in Nokia throughout the years. The guidance released in 2015 is an updated version of the then Nokia brand design guidelines, but the same

three cornerstones exist, which Nokia calls experience principles. These three corner stones are **Pure**, **Alive** and **Principled**, and they are above all operating models inside the brand culture and Nokia design community guiding the designers to do the 'right things'. The new designers of course take some time when adopting the meaning of experience principles and implementing them in everyday design work. The Nokia experience principles and their use are, according to Mustajärvi, something which step by step make themselves concrete in the thinking and finally acting of a designer. The process of adopting the organization's culture and operating model takes some time, and the guidance is a necessary tool. As Mustajärvi mentions, after the latest release of the document the design work has become much easier.

Even though there have been various periods of concrete design activities in the company, the Nokia brand has been managed (Vuolteenaho). An appropriate brand management is important for organizations when presenting the products to the subcontractors and the operators. Organization's brand reputation has a direct or indirect effect also on the company stock value.

When carrying out their work, Nokia industrial designers emphasize products' use and the fitting to the use environment. The aesthetic thinking is present, but aesthetics is never a starting point of creating new design concept. This note uncovers the designers' aim to create an experience when user is in interaction with Nokia products. If applying the experience principles on Mobile Networks' products, the installation and maintenance then step up as fundamental properties in the design proposal. In addition, the product's correct representation in its final location where it serves people is an important consideration of the designers. The aesthetics of the products are probably so obvious for the designers to think of that they didn't raise that aspect as a primary consideration during the design process but rather as a conclusion of doing all the right things. As Vuolteenaho says: "in the end all these come together" in the product obviously.

In addition, the designers point out that by designing the product the people's perception of the product can also be designed. Vuolteenaho explains that the designer can decide if the technology is intended to be hidden in the environment or possibly something with which the user can create an emotional bond. Understanding the human aspects of the product is something which a design profession only has the capacity of, according to Krippendorff (2006).

5.3. Technology-led design

In most of the products produced industrially the price is a critical quality for the immediate customer which in this research is an operator. The operator must be able to set the reasonable price for the service it offers to the end user in order to retain the business profitability. Overall, in network device business, tough price competition exists. The demand of offering low price devices is directly seen in daily R&D work as optimization of different solutions. In the light of the low-price demand industrial design often suffers heavy restrictions when trying to bring the design into both process and products. In other words, industrial design easily contradicts with straightforward logic of seeing the product's price directly in BOM. The industrial design faces challenges specially when technicality and usability aspects are succeeded to solve by engineers but the product is missing the brand recognition or aesthetic quality. Those values are not considered traditionally in Nokia MN R&D work and, so, mostly are not high in valuation when considering a product's qualities.

However, the understanding that the industrial design holds is of a product's whole offering to the customer. The price tag is one piece of the whole if seen the product as a service. Other points of view are for instance handling and brand identity. These aspects should be of consideration besides purely technical aspects often stressed in R&D environment. The designers interviewed raise the question if the thinking model should be redesigned so that more importance would be given to industrial

design's concerns. Industrial design will be an additional cost in case it has merely aesthetic role in the product. Anyhow, aesthetics is not to be underestimated when the operator or end user faces the network product and moreover the product family. The technicality and usability will remain high in importance but the industrial designers call for the missing values mentioned here, especially when 5G will bring the devices in the sight of end user.

5.4. A success story: Flexi BTS

The modularity of Flexi BTS has been extremely successful concept for all the years since its launch in 2004. Inside the casing customer can install variety of radios or system modules designed to fit to the casing interfaces and the measurements the casing offers. In addition, updating the technical configuration with newer device has been possible simply by changing the unit inside the casing which means that the casing itself is reusable. At time of Flexi BTS launch the technology used was highly innovative allowing remarkably smaller physical size and thus installation more freely with respect to the solutions so far. Earlier, as Mustajärvi notes, the devices were installed inside huge cabinets and always indoors. Flexi BTS technology was made resistant and allowed the installation outdoors. The resistance was a big development in addition to the compact size Flexi BTS acquired.

To celebrate the leap in technology the casing embraced a new design language by Nokia NET industrial design team. This kind of a design language was not previously seen in networks products. The long lifetime achieved by the modular structure more than ten years have passed without the need to update the solution. The fact that the Flexi casing is still sold means also that the aesthetics or experience qualities of the product have not been reconsidered. However, the designers claim that the Flexi BTS casing aesthetics is outdated and should be updated by applying more

minimalistic design language. In the figure 5.1. an idea of size and design of the casing can be reached.

Figure 5.1. Flexi BTS configurations

Flexi BTS has also the benefits of allowing the low-price units. The casing creates the outlook and the casing's cost is not counted in the unit price once the casing is installed on site. The challenges that an industrial designer normally faces when device in design process are separated from the device itself and industrial designer has more freedom when the work is directed to covers.

5.5. Concept for AirScale

The concept for AirScale is a proposal for the new generation radios' design concept and their visual and Nokia MN new product language. The background of the product is that technology development activities had been ongoing and Vuolteenaho was contacted and requested to create a design concept for a new product family. Together with Mustajärvi - who already had put effort in the same product's concept design - they then came up with the concept proposal for AirScale product family. The idea for the product family was again modularity where efficiently and in a flexible manner different site configurations would be easily made according to the operator's needs.

The prerequisites for the concept were typical for base station products; easy handling, different mounting interfaces, miniaturization and one-box look. When observing these requirements, they each make sense. Easy handling is needed for production, installing and maintenance. Since the mounting locations vary different installing options must be supported. Miniaturization is merely a trend in the industry and in contemporary design language. One-box look demand comes mainly from the operator's part. The operator pays the rent for each device it has at the site, be it a mast for instance. If, when perceiving from distance the devices configuration looks a unique box the rent is then paid for one device instead of each separately. So, the designers searched for the solution where many devices installed side by side would still look one.

The starting point for the concept creation was the device's operating environment, according to Vuolteenaho. The device, above all, must be designed in a way it looks appropriate when installed and operating in its place. The AirScale modules would be installed in the mast and since observed from distance and these conditions direct the design work. In addition, network devices with lot of capacity create heat which needs to be guided efficiently out of the product. Heat is distributed in "heat sink" shown in the figure 5.2. as Core. For the cooling reasons, when installing devices side

by side, space needs to be left between the units. From far the configuration would then look striped if spacing is not considered in the product design. According to the designers, the concept for AirScale discovered an innovative way to prevent the stripe look but allowing the airflow between the units.
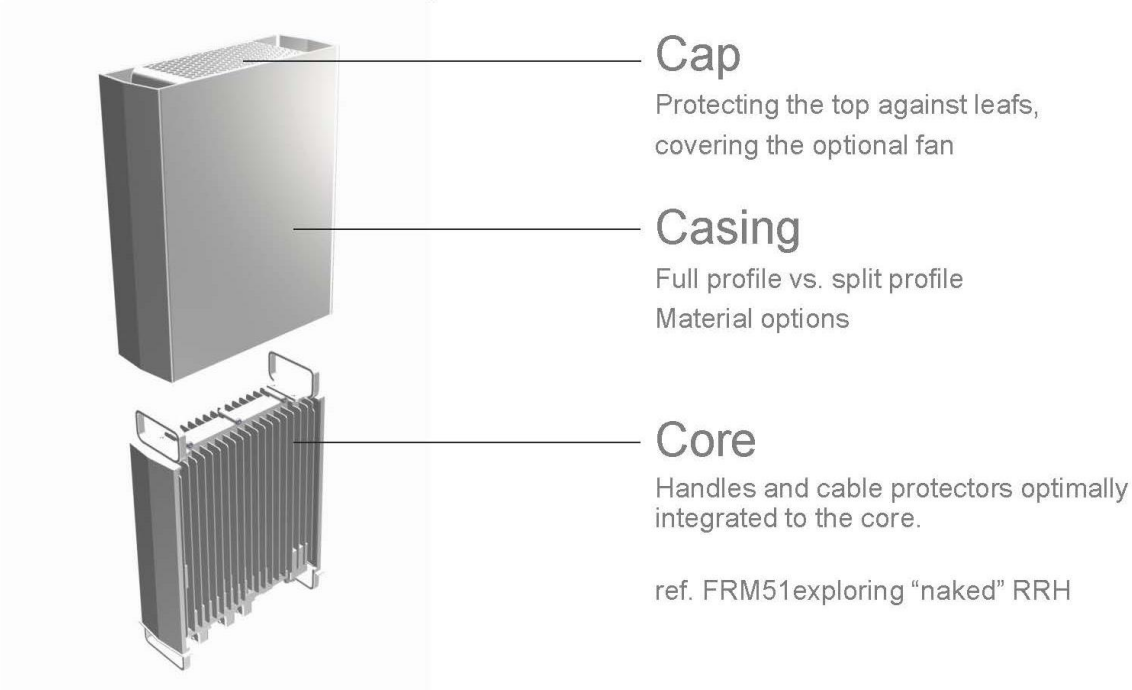

Figure 5.2. From presentation of the concept for AirScale.

Designers chose a pleated design because in a many units' configuration the reflection would make an interesting surface. The deep shadow is not formed between single units, which is apparent in figure 5.3., where also installation is documented. Difficulties with one-box demand appear when the measurements of the units are not in control. The designers set up different scenes where unit size varies and they evaluated what would it mean for overall design. The challenge is thus to manage the product family. However, AirScale radios designed independently in

different Nokia MN R&D sites and each adopted their own design resulting that the concept for AirScale was not applied to any of the realized products. The challenge lied in communication, in the processes and in the lack of resources industrial design has in Nokia MN.

Figure 5.3. Stacking and installation easiness presented in the pictures

5.6. AirScale product family

As explained already, AirScale is a name used to indicate a new product family. The AirScale family consists of all types of products necessary to build up a radio network base station. In the visualization presented in February 2015 during the Mobile World Congress in Barcelona the product family has still quite homogeneous appearance. In the visualization, also the concept for AirScale product family is included. However, the realized products haven't adopted the common product family design. The concept normally acquires modifications during the product development process. In the realized product family, the principle of modularity remained. Nokia AirScale

has a mounting kit where an operator can install for instance batteries, power solutions, radio heads or system modules.

It can be seen, when comparing the two product presentations, that the realized AirScale products have acquired very few visual attributes or elements from the concept presented in previous chapter. In the picture 5.4 can be seen that product family observation has not been included during the product development. The configuration has numerous visual stimuluses and such causing a confusing essence. The elements for different installation options are strongly visible also in case not needed. The designers' concern is if the design management will once cover the diversity of the radios Nokia MN produces.
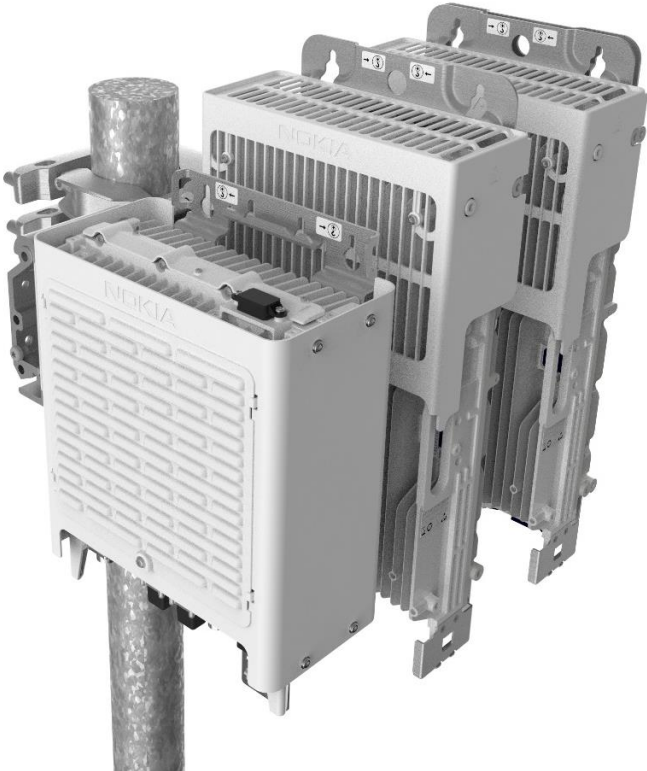

'

Figure 5.4. AirScale radios installed in a pole

AirScale RRH (Remote Radio Head)

Considering the first Nokia experience principle theme Pure, this product in figure 5.5. is probably closest to that of all AirScale radios. Although, the product "communicates technicality" and the design language is merely "from 60's or 70's". Some of the principles can be found like 'easy to handle' or 'easy to install'. The solutions are, however, realized in a strongly technical manner without considering the first experience principle, Pure. As Vuolteenaho comments, "could we had achieved a bit more" if applying industrial designer into the process. The meaning of "a bit more" would be the refinement of the aesthetics of the products and reconsideration of how the accessibility is managed. Pure means that the product has no detail without a purpose. Visually pure means cleaning the product from stimuluses which do not communicate the essentials of the product. Mustajärvi points out the efficiency in the technical solutions which itself is the right thing. However, the designers' ability to understand the human aspects of the product, like communication, would be of use when refining the product and its outlook.

Figure 5.5. AirScale RRH lead variant is designed in Nokia MN Oulu site

RAS (Radio Antenna System)

In this solution, two radios in the back of the product are placed which are covered with plastic covers. In the front, the long vertical surface is antenna and similarly covered. The time for the product development work was not long and the team around the project was small. The challenges were cabling and offering the heat a way out of the product. Also, the installing would create new challenges previously unknown as the weight and size of the product were more than typical Nokia networks products have. Mustajärvi, at time performing also the work of a mechanical designer, carried out both mechanical design and industrial design tasks within the development of RAS. However, as the time was not given enormously for the product development work, he adopted mostly a role of a mechanical designer. According to Mustajärvi, carrying out simultaneously both roles is rather impossible. However, he was given also the responsibility of aesthetics which meant mainly designing the plastic covers that hide the radios. The size and placement of openings were derived from thermal analysis. The rhythm of fixing elements for the plastic covers had also technical reasoning and such are acceptable. Mustajärvi says that the mounting solution would had needed more attention in order to bring the Nokia experience principles to the installation and use, and finally to overall aesthetics of the product.

The experience gained from RAS indicates that it is not necessary to cover the radios with covers in this type of product. The ideal situation would be rather to design the radios in a way that allows them meant to be visible. Also, the products in this category installed far from end-user, might allow less attention directed to industrial design, since the radios are in the backside of the product whereas the front, antenna, is mostly clean and pure without many parts. In the figure 5.6. the antenna is shown, which is the clean front of the product.

Figure 5.6. FASC product unites radios and antenna in the same construction.

5.6. Nokia mobile networks design process today

Around beginning of the 21st century Nokia NET, as the business line was named at time, had its industrial design team. Even before the team single designers worked with network products. NET design team merged with the rest of designers, who were mainly designing devices for Nokia Mobile Phones. The Nokia brand core was then same for Mobile Phones and NET although the product categories were remarkably different. Also, according to Vuolteenaho, NET designers were rather autonomous

because the same design demands were not applicable for NET products that were highly relevant for mobile phones. The latter are consumer products whereas NET products were at time company assets. In 2007 Mobile Phones were sold to Microsoft and in the organization the fundamental rearrangement of functions was carried out. This meant that all directly non-profit functions were shut down, among others the NET design team. Some people from the previous NET design team remained in the organization but in other positions. One of them was Markus Rahkonen, who found a position in Marketing where his tasks were about visual communications. Later he has changed organization. After the NET design team was shut down, NET has had a period when industrial design was not carried out. The situation regarding the design language then did freeze for several years. Other products in our environment gained development in the means of aesthetics.

Harri Mustajärvi was hired in Nokia Mobile Networks in the mid-2011. In the beginning his tasks concerned mostly mechanical design. In 2013 the responsibilities of Markus Rahkonen were directed to a new person and Harri Mustajärvi took over them from the beginning of 2014. These responsibilities were about brand support in industrial design. Mustajärvi being a lone industrial designer at Mobile Networks at time meant that a design organization or function which would had covered whole Mobile Networks did not exist. This situation hasn't changed but one additional industrial designer in Mobile Networks has been hired in 2017.

When Mustajärvi came to Nokia MN the industrial design was noticed in some product development programs but the lack of practical industrial design work was widely present. Thus, Nokia brand guidelines were not taken into consideration, partly because the updated brand design guidelines document did not exist yet. Considering the lack of industrial design resources in MN, the situation is understandable. The latest Nokia Brand Design guidelines was published in 2015 and before that no document was in use for any designer within Nokia. Although the designers with experience in Nokia have the brand in the veins, as Vuolteenaho

expresses the phrase "living the brand". Beginning from 2017 Mustajärvi has been directed to perform the industrial designer's tasks within 5G products. Also, his responsibilities now stress the field of industrial design, although not yet given a hundred percent of importance. Mustajärvi points out that the latest update of Brand Design guidelines is a warmly welcomed document supporting industrial designer's work in any Nokia organization.

When Nokia NET industrial design team existed, there was a document describing the NET product development process. Within the process the contact points indicated the activities of industrial design. In 2017 the document is under redesign and updated version is planned to be published in 2018. It is a welcomed document and the present MN industrial designers aim to have more visibility for industrial design especially in the preliminary stages of the product family planning. That way it is possible to achieve a uniform design for a product family. The document describing the process is an official guidance for work but the other force guiding the work, often being strong, is an operating culture. In Mobile Networks where industrial design has been absent for several years people are not familiar with working together with industrial designers. When setting up a project team, the need for industrial design is not always recognized. Mustajärvi also calls for the industrial designers' understanding for product pricing so that the right dimensions of industrial design's importance could be understood by designers. It is very challenging to offer a satisfying solution when lacking the complete understanding about the product price structure, product family and the customer.

5.7. Nokia Mobile Networks' need for industrial design in future scene

The designers interviewed for the research note that several different product categories will exist at Nokia MN also in the following years. There will be devices with low frequencies meaning bigger physical dimensions. New product categories will be

needed within high frequency devices which, on the contrary, have smaller dimensions. Also, due to the behavior of the rays the devices will be installed densely in the environment. In addition, the devices will come closer to the end users. This way the devices will be also visible for the end user and accordingly under observation. Put simply the devices will be seen more easily. This change will then raise the importance of aesthetics and communication of the products. Nokia MN will benefit greatly when offering devices with less technical outlook. Vuolteenaho says that a designer can manage the user's perception and interpretation of the product. She points out that the devices can be 'invisible' or evoke emotions.

The change in the industry demands changes also within the organization. The change is already carried out in Nokia Mobile Networks but – as acknowledged for some time already – the change is only thing constant. What kind of a position industrial design will gain in the organization is to be seen. The designers' intention, however, is to raise the awareness about benefits industrial design can bring in.

5.8. Results

Nokia experience principles that guide the design activities within the organization are not lately invented as something new. As Vuolteenaho remarks, Pure, Alive and Principled have been the Nokia design mode of operation for longer period. The updated documentation and the guidelines of their implementation within diverse areas of design are published in 2015. However, a several year's period in Nokia MN when industrial design was not involved in the PDP resulted the mode of operation within MN R&D where industrial design and especially its experience aspects were not present. The lack of industrial design in the Nokia MN for several years has created the mode of operation where technology is not used to discuss or compromise with industrial design.

Industrial design's position in the PDP

Industrial design is eventually recognized as a benefit of the product but cannot be used correctly because it is not located correctly in the process. Currently the industrial design does not have an umbrella-like viewpoint over the product families. Industrial design does not cover product families and design management is impossible to carry out if the ID is program specific and all programs are not obligated to contact the designer.

Industrial design's position in the company

Lack of industrial design resources is to be noted. MN having globally two (almost) full-time industrial designers creates challenges in design management. Considering the number of variants under developments and the teams' autonomous nature the scene is set.

The PDP carried out in diverse R&D sites cause the challenges in communication and design management. The concept is not bought in other sites and product design work is not in sync.

Industrial design benefits

Industrial design covers several aspects of a product. Some of them – like usability – can be achieved in some degree also without industrial designer's involvement in the PDP. The aesthetics and experience (communicative) qualities are of interest of industrial designer and are not controlled if the product design team is lacking an industrial designer.

Also, an understanding of the customer requirements and needs is not available. The customer requirements partly drive the product development process. Other drivers arise within the company and product itself. The nature of PDP is fuzzy and conflicting opinions appear.

Industrial design in future

Due the future demands and products' new circumstances, industrial design and especially aesthetics and communicative aspects need to be given more importance. Ongoing redesigning of industrial design's process flowchart will recognize the position of industrial design in preliminary stages of product planning. However, the diverse product categories might allow the level of industrial design implementation. The mast products gaining less visibility with regards to the short distance antenna devices have diverse aesthetic and experience requirements. The products' communicative aspects will be of importance and is the expertise of industrial design.

6. A concept design and Nokia brand

During the six months of work at Nokia MN I have produced my own design of a product. During the concept work I followed a feasibility study process within the R&D at MN. The study subjects within the feasibility study process were rather technological and there's no advantage with regards to this research to go through them. I rather talk about my journey in getting involved in Nokia as a brand, its experience principles and the process of bringing them into the concept proposal.

6.1. Getting familiar with Nokia brand and the product type

Gropius says that when a designer starts with concept design, he or she should first discover the very nature of the product; what is it for, what it does and for whom it is made. A form apart from the function according to Bauhaus designers is decoration. (Steffen [Vihma, 2010]). After understanding a product's essential nature, a designer can start giving the product its, not only form, but also language.

In the beginning, I did benchmarking for the related products. Nokia Mobile Networks has produced some products before in the same product type which I could use as a reference. A reference close was FAS C discussed before. Many discussions were carried out with the designers of FAS C. With their help in addition, the competitors had few more. The benchmarking material was not available as much as in the case of more common product type would have. I then searched for other devices governed by technicality for inspiration. Quite soon in the beginning I decided to leave the aluminum visible in the sides of the body. This was a semantic cue that would bring in the same nature that Nokia radios traditionally have. Also, due to aluminum part's essential function it seemed reasonable.

During the concept creation, different rendering settings were used causing unstable shades to the products. The same hues of white, gray and aluminum are always used. These colors are commonly used at Nokia MN products and are also common within the network industry.

6.2. Evolution of the form

From the beginning, I started producing sketches by hand. With them I tried to understand the nature of the product: what is it; what is it meant to do; what should be done with it; who will handle the product; what are the rough measurements; how about the colors; or distinct functions inside the body; how much I can play; what does Nokia brand mean within this product; what is the essence of this product. Gropius stated following: "An object is defined by its nature. (…) one must first of all study its nature." (Steffen [Vihma, 2010]).

Quick sketching offers with a way to search for and evaluate different possible characters and forms the product might adopt, also the bold ones. Sketching also helps a designer in understanding the structure and rhythm of diverse details and composition created with parts. The discussion with Nokia Product Design guidelines was constant, especially its recommendations to refine and purify. The initial understanding of the nature and form of the product was achieved by the sketches, of which some are presented in the figure 6.1.

Soon I realized that playing too much with the form is not an advantage in case of this product category. Once installed it will remain stable in the location never moving and an extreme form doesn't offer anything additive in the means of functionality or product semantics. Instead, a calm and silent design would profit the product. Another question to discover was how many parts the product would consist of. Obviously, there are the front and backside but since the product would be nearly
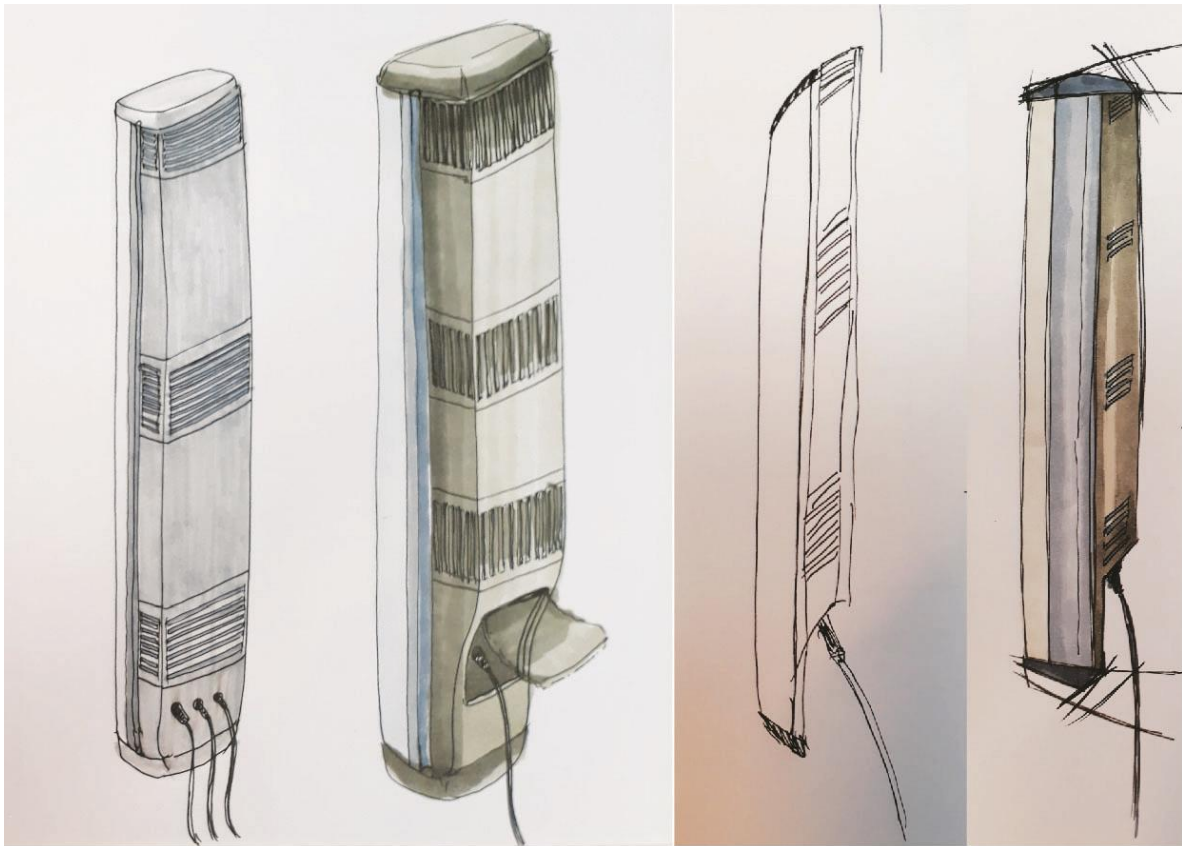
Figure 6.1. Some of the sketches produced in the early phase of the new concept design.

2,00 meters high, the amount of parts should be carefully considered because the product would face the both production and cost challenges. At the same time, I worked for two variants of the same concept, and the only difference was the width.

Problematic places in the product were several. First, the top and bottom endings. My aim was to make a design with invisible or very thin caps in the ends. This idea was not received well since that kind of design would face production challenges. Something like that had never been done and the question of the new solution's reliability was arisen. Also, within the given product development time no completely new solutions were supported. In the figure 6.2. version 3 the confusion around endings is visible. Also, some requirements from the production caused the different treatments of the back and front endings. Obviously, this solution would not be

acceptable in the eyes of Nokia brand guidelines, which encourages refinement, simplicity and careful treatment of details.

With the front of the product there are not so many different separate features. Basically, the front is covering the antenna radiators and there's not much you can do with the front. Keeping in mind that the technical performance is most important quality of the product, I didn't see useful to play with the front. Only the endings would be the area where design might make a difference but I faced the attitude of traditionality.

The design reviews during the study process were points of communication between the members of the design team. Design emphasizes communication in five ways (Crilly & Clarkson, 2010 [Vihma]). One is the communication amongst the team members who are involved in the PDP. In this case the team consisted, in addition to myself, of several mechanical engineers, electronics engineers, production responsible and people from the project management. No sketching was reviewed during the meetings but as soon as first renderings were available they were then shared to give an idea of the physical outlook and other qualities the new concept would adopt. The characteristics were evaluated and development brought into the design. Also, the technical characteristics and their evolution were an input to the concept design work.

In the figure 6.2. the stages of evolution are shown. Few versions may lack because I did not produce a rendering after each small modification but when the body or details had gone through enough development. The product consists of diverse parts and one task which I understood as important was achieving a balance of a whole product. Having other parts right but one part without attention would ruin the whole product in worst case. The designer benefits of keeping an adequate distance and seeing a whole, *gestalt*.

Figure 6.2. Evolution of product body and details were hand in hand.

6.3. Devil's in details

When considering the use and handling of this size of a product the handles would be of use and so the handles were also studied. I wanted them to blend nicely with the back surface but being noticeable pointing them out with aluminum when rest of the cover is of plastic. For technical reasons, this proposal was rejected. Another feature I initially wanted to bring with the product was diagonal longitudinal corners in the back of the product. At that time, when the product was still somewhat thin, the diagonality was acceptable. This feature is better seen in the figure 6.2 version 2 and 3.

The openings in the backside with different mesh design were studied with a scrutiny. I scrolled over the internet searching for inspiration for the geometry of the mesh. The proposal 2 in the figure 6.2. is one of the very first ones and idea was to strengthen the longitudinal nature of the product. Of course, within these first renderings the ideas are only new born and the estimation is done in a continuous manner throughout the concept evolution.

Within the front of the product not much can be done and the most interest was directed to what happened backside. However, the antenna endings would be visible also in front of the product and create a notable part of the feeling. It is typical that antenna endings are somewhat rough due their protective nature. I understood the freedom of proposing thin, barely noticeable endings in the concept.

The colors were interesting field of the product. In the beginning, I carried the white color within the design. I wanted the concept to look fresh and new. It also created a nice background for the aluminum which I wanted to point out in a controlled manner in the product. In the figure 6.3. the aluminum is on the sides of the body creating also handles in the ends. In addition, aluminum meshes are positioned in the back of the product. Too much white could had been quite sterile so I brought a hint of an

additional technicality in the aluminum meshes. Since at this point there was still some time I could leave things open and processing.

Figure 6.3. An early rendering.

When treating the sides and the back there were technical requirements connected, for instance, with the airflow in and out the product. Since the configuration of the

inner structure was not going to freeze soon, at some point I separated the appearance model from the rest of the process and started to observe the product brand-wise. Anyhow finding the rhythm between the different elements backside was one thing. Slightly diagonal lines are present in the design seen in the figure 6.3. For instance the white extension in the middle part in the back side spreading out towards the front merging with the aluminum sides. Being such a calm product I considered creating a slight movement with these diagonal treatments. Somehow, they didn't work out and in the end, weren't reasonable either.

As the product development proceeded the product acquired more thickness which I updated into the appearance model. At first, I was terrified because the smaller the better. Placing the additional thickness into somewhat peaceful composition already achieved became a consideration of its own. In the following page the confusion is obvious. This version was also the one I discussed with Hanna Vuolteenaho, a senior industrial designer of Nokia. According to Vuolteenaho, the design was not calm and the logic between front and back was missing. This is evident in the version 4 in figure 6.2.

6.4. Refining towards the final concept

The version 5 in the figure 6.2. shows the final form of the body design. This form did not change anymore. The different elements still searched for their placement and treatment. Also, the aluminum bridges in the top and bottom end of the product were trying to convince their usefulness. They were seen rather useless and were left out of the final concept.

For the meshes both in the back and the sides of the product I did several studies. In the case of the narrow product (see later the wide variant in the figure 6.5.) the effect of the mesh geometry was not great, since the whole mass of the product seems to be in balance. However, in the case of the wide product more consideration was used

in creating the right mesh design. Also, the size of the meshes was decided not completely by me but I got some direction from the thermal engineers.

Figure 6.4. The details of the product concept are designed carefully according to guidelines.

The fixing element, a bracket, in the back of the product visible in versions 5,6 & 7 in the figure 6.2 is a design of Mika Pekkanen, a mechanical engineer. His idea was to place the fixing elements partly inside of the back covers and only showing the parts, which are necessary when installing the product.

In some versions, the front and the endings of the product are white, the backside is grey and rest of the parts are aluminum. Mixing many colors and materials create a confusing product and a feeling of inconsistency. The treatments were therefore to be considered carefully in order to communicate the Nokia experience principles also with the colors, materials and finishing.

The details are encouraged to be designed with integrity in Nokia Product Design guidelines. As Eames said: "The details are not details. They make the design." This idea I have also followed through the design process, understanding that the details treated with care communicate the designer's dedication in his or her work. In the figure 6.4. some of the details are shown. The level of details is, however, to be adjusted into the whole product and its proportions.

6.5. Nokia brand implemented

In the beginning of the concept design process the decision was made with the guidance of Vuolteenaho and other colleagues that the concept would consider the aesthetics of the product without strongly concentrating on technical aspects or producibility. The purpose of the appearance model was presenting the new product type during the congress dedicated to network industry, Mobile World Congress in San Francisco in September 2017.

Due rather brief time initially given for the concept design, the emphasis was in bringing the Nokia brand experience principles into the concept stressing the first principle Pure during the process. Considering that the product would need at least four men for carrying the real understanding of the product's nature would be achieved after first physical mock-ups. Two different variants are shown in figure 6.5.

Figure 6.5. The two variants of the new product concept; 'wide' and 'narrow'. The colors are not final.

However, when bringing the Nokia brand into the concept I constantly asked a question: does this element have a clear function within the product? This question effectively pointed out all the unnecessary elements from the design. Having some freedom with the appearance model I also could leave out of consideration some pure technical requirements. Also, lack of knowledge and security of some fundamental product was guiding the concept design but it is understandable because the product is very fresh also technically. Lack of knowledge and uncertainty are also typically experienced characteristics of new product development process.

The different shades in product renderings derive from various rendering settings causing inconsistency in the shades to the products. Technically, the same colors of white, gray and aluminum are always used. The diversity lies in rendering tool's environment and camera settings. The concepts' colors are commonly used at Nokia MN products and are also common within the network industry.

6.5. Concept – a success or a fail?

After the study, the decision was made to create a product development program for this product. A program aims at product's mass production and customer satisfaction. Program team consisted of fresh people and the requirements were reconsidered. Besides the concept already presented (the appearance model shown in figure 6.6.), additional concepts were created and the decision was made to not to continue a product as presented in the concept. Instead, the radios would be without covers. The decision would radically change the appearance and aesthetics but also use of the product. Since the decision was made in the preliminary stages to concentrate on appearance of the concept, the installation and handling were not studied with scrutiny so far.

Figure 6.6. The final appearance model of the narrow version photographed by modelmaker for approval. Nokia logo on the sides was shifted to its correct location.

A designer would easily consider that above described changes mean the concept failing. However, product development process can be considered linear or cyclic. Linear PDP is common in western thinking and in this case the final product would adopt at least the main characteristics of the concept. If PDP is understood as being cyclic – common in eastern culture – the profound reconsiderations and redirecting are the very nature of the PDP and as such healthy. Applied in the concept presented here, the appearance model offered a product development team high-quality reference material for considering the product's diverse requirements. (Leskelä, 2017)

The appearance model has – at least – three purposes. Firstly, is a display unit shown to the customers in private events or network industry events. Secondly, in the PDP

its purpose is to offer material in evaluating the product decisions and direction. Thirdly, industrial design incorporates the intended direction of products' design language.

One of the results derived from the productive part is that Nokia Product Design guidelines are possible to incorporate into the product design. In this case study, designing of a display unit the designer had an amount of freedom which is not experienced in PDP.

Many of the Nokia MN products are user-specific which means that the company designs variants which are according to the specific customer's needs. Diverse customers' preferences about the product qualities differ and many discussions are to be carried out before mutual understanding is achieved. The competition in the industry of network devices is rough and the customer's needs must be considered. The industrial designer's position close to the customer would remarkably help in creating product concepts which genuinely correspond these needs.

The Nokia Product Design guidelines was an irreplaceable document for new concept creation for a new designer. The R&D designers were not able guide the process personally. Help was received when asked but the main reflection was made with the document. Creating the understanding how the experience principles are to be implemented in the product design is, however, a continuous process. During the concept design the challenges were of one kind. During the PDP with product requirements and specifications, the challenges for implementing experience principles are of other kind.

Diverse opinions of the product requirements and performance differ from each other and this is experienced in the product development as frustration and insecurity. New product development is a fuzzy process. The products with innovative technology tend to be at the first stage very technical looking.

What is the correct place of industrial design in Nokia MN processes to contribute effectively in the new product design? One option based on ideas Karjalainen (2004) presents is applying industrial design in the second version of products. Having the technical characteristics and performance right, the products would more easily acquire aesthetics and industrial design which are according to Nokia experience principles. This kind of proposal, however, draws industrial design completely from early concept design stages. It is not to be emphasized.

Another option is to place the industrial design with the discussions between customer and company. The industrial design then becomes a strategic tool for the company and design would acquire the previously mentioned comprehensive understanding of the product and the customer. Understanding also internal requirements directed to the product the design would better create proposals which fulfill the expectations of diverse parties.

7. Discussion

During the research, the present state of Nokia Mobile Networks' products and their level of industrial design has been discussed within the theoretical frame created by product development and brand design. The research is partly retrospective (chapter 5) and other part is strongly linked to the presence (chapter 6). Both the products and the new concept were reflected to the Nokia Brand Design guidelines of which an updated version was published in 2015.

7.1. Answers to the research questions

During the research, following questions directed the work:

1. **Do selected Nokia MN products incorporate the Nokia experience principles encouraged in Nokia Brand design guidelines?**

2. **What are the challenges industrial design face in the product development process within Nokia MN?**

3. **How are Nokia experience principles to be applied in new concept design?**

Nokia wants to be a company with high reliability and quality. The proved longevity of the products should be reflected also to the product outlook. That is, the design should be made in a way that the product emphasizes the organization values. Products may become the objects of violence if their character is provocative or irritating. For this reason, the Nokia design experience principles encourage calm and

friendly design. With the semantic analysis the nature of the products was uncovered and during new concept design the experience principles applied in practice.

1. Nokia MN products at varying extent incorporate the Nokia experience principles.

The industrial designers point out the usability and product's service in its use environment. As aesthetics and communication are not a starting point of new design, they are considered unconsciously in the product and seen as product's important qualities.

Flexi BTS has acquired Nokia experience principles. However, the product being launched in 2005, the aesthetics is outdated. If updated to today's standards, more minimalistic approach would be applied. Usability can be recognized within some products. For instance, in AirScale RRH there is an easy access to fixing points. However, the products lack refinement and the aesthetics is not considered appropriately. Products may lack Nokia brand recognition due to technical qualities drive the product development.

Products may lack Nokia brand recognition due to technical qualities drive the product development. Another notion is that Nokia MN products' cost demands tend to draw attention away from the product's aesthetics and experimental qualities. Technology and mechanical properties are considered primarily and products' communicational aspects draw remarkably less attention during product development. Product's usability can be achieved by mechanical designers. However, the refinement of products' outlook is missing when industrial designer is not involved in the PDP.

2. The challenges industrial design faces in the product development process within Nokia MN are

A challenge that industrial designers have in the PD environment in Nokia MN is whether they can discover an appropriate and suitable level of implementation of the Nokia experience principles. Products in categories where aesthetics is a minor concern may acquire less attention of industrial designer. Products that are observed frequently by end-user then need critical consideration and implementation of industrial design. Here the challenge lies in understanding the logic of a product and finding the justifiable means of bringing the Nokia experience principles comprehensively into the product. If industrial design is an add-on, it has less potential of being implemented. However, the researcher requests also the engineers' willingness to comprehend the benefits of Nokia experience principles and their adequate incorporation.

Industrial design's positioning solely in programs result in difficulties in product families design management. Industrial design resources are few and product programs do not necessarily find an industrial designer in the company. Either the contact is lost or the need is not recognized. Industrial design as an organization's function would avail its wide use. The flowchart of industrial design has been outdated and accordingly led to its organizational invisibility in Nokia MN.

Additionally, industrial design doesn't have a contact with customer, and the customer needs are filtered. Acquiring the product requirements' comprehensive understanding is then restricted. As industrial designer ought to be an interpreter between company and customer, a true potential is not achieved if industrial design is not strategically positioned.

Implementation of the concept in products is not linear. Industrial designers may experience frustration due the final product's relatively diverse outlook and use experience with respect to the concept. This is, however, not seen as problematic by

other R&D personnel who claim the nature of PDP being cyclic and therefore the trend described before is accepted. Concept may be considered as a material for product's specifications evaluation and possible reorientation of the product development work.

3. Nokia experience principles in new concept design

Nokia Product Design guidelines encourage designing products according to the experience principles Pure, Alive and Principled. In new concept design, mainly Pure was consciously applied in the product. To create an inclusive understanding of the nature of the product, its diverse demands that the customer address to the product and the discussion between technology and design, longer period would had been of help. The concept design aimed at carrying out a display model and therefore most focus was on product's aesthetics, integrity and communicational qualities. Creating a Nokia language for the type of product was the objective of the concept design.

Depending on the purpose of an appearance model, diverse product qualities can be brought into the design. Being able to work relatively independently the designer then reflected the design mainly against other Nokia designers and Nokia Product Design guidelines. The mechanical and technological concerns which are traditionally characteristic to Nokia MN products were mainly left out of consideration in initial stages due to the decisions made in accordance with thermal analysis. It was then possible to create a concept which embodies strongly the Pure principle.

However, the details are encouraged to be considered with integrity in Nokia Product Design guidelines. In case the product had poorly considered details, whole product could fall in the category of products with unnecessary stimuluses. Refining the design is elimination of stimuluses which doesn't communicate the product's useful and well-thought qualities. Within the concept design, the details were in the center of attention.

7.2. Reflecting the process

The research started with new concept design in May 2017. The design process duration was 5 months and the analysis and results are drawn after finishing the design. In a relatively brief period both concept and research are executed. The researcher's position in the core of product development environment prevented, occasionally, observing the subject objectively. Facts may be colored and results are drawn from the industrial designer's viewpoint. Carrying out a completely objective research was then a challenge for the researcher.

The research process itself was divided in two: the concept design and writing. Books and other sources were studied along the months not focusing on a special period. Naturally, in the beginning the knowledge acquiring was more intense. A researcher's way of working requires a good period of information processing, when writing doesn't come naturally. Additionally, the thesis was initially in Finnish but the researcher more effortlessly brought the ideas on paper in English. The language was the shifted relatively late.

One challenge the researcher faced was that lots of new information was needed to adopt. The researcher had started as an industrial designer in Nokia MN in May 2017. Carrying out efficiently both tasks was a challenge, although the contract covered 60% of time until the research was accomplished. However, the more empirical experience gained the more comprehensive research and, consequently, analysis was possible. Whether the thesis is successful or not, I prefer to claim that the process is too near to see. Whether the thesis is useful for Nokia MN, is to be evaluated by Nokia personnel placing the order.

7.3. About the future

All the activities within the Nokia MN aim at creating wireless network and keeping or gaining more share in the business, which is, staying strong and vital as a company. The shift from 4G to 5G technology brings also new demands in terms of the products' appearance. So far, the base station devices have remained relatively few and far, for example antennas in the telecommunication masts are located only every now and then. Low-latency devices cover kilometers of distance. During the following years of change they will, instead, be installed densely and inevitably become more visible for the end-user. In this shift the industrial design needs to be taken into the repertoire of the tools of product development process in Nokia MN.

To strengthen the Nokia brand communication in products, Nokia experience principles should be implemented in all their meanings. When considering the product families, common characteristics should be created to offer a solid brand experience to the user. This is possible to achieve by platform products but with current state of industrial design within individual programs the work is not encouraged.

When looking forward the industry of network building, the importance of design is not about to diminish. With 5G network the wavelength of radio rays change and it brings the demand of bringing the devices closer to the user and bringing them more. The size of the units will shrink and they will resemble more consumer products. In the future, more industrial designers are needed inside the Mobile Networks. The present state holds two full-time designers both located in Oulu. Nokia MN has, in addition, two sites where product development work is done but without an industrial designer involved. In theory, the development work is done across the sites. However, best results are achieved when close cooperation during everyday work is performed.

5G standardization is currently ongoing. With the changes in creating network the 5G zones needs to be reconsidered and for example following questions arise in the

mind of researcher: does 5G need to be reachable in every square meter in the environment? Which are the most critical systems depending on 5G technology? Who is responsible in creating 5G when the borders of use will blur. Think about self-driving cars, which are critically depending on fluent, complete 5G network in order to be absolutely safe to use. If in the cityscape the responsible is the operator, how about when the driver arrives home and living 30 km from the high-density 5G zone? Who will cover all the way for the cars until the forest? It will be tricky. 5G rays do not pass walls or other obstacles considered as walls.

List of References

Andersson, T. & Warell, A. (2015) 'Aesthetic flexibility in the management of visual product branding', in Procedia Manufacturing 3: 2191-2198

Black, Sir Misha (2011) 'The Designer and Manager Syndrome' in The Handbook of Design Management, Bloomsbury Academic

Bloch, P. H. (1995) 'Seeking the Ideal Form: Product Design and Consumer Response' in Journal of Marketing, Vol. 59: 16-29

Brown, S. (2016) 'Brands and Branding' SAGE Publications Ltd

Chen, K. & Shao, C-C. 'Managing Product Identity through Style Appearance'

Crilly, N., Good, D., Matravers, D. &Clarkson, P. J. (2008) 'Design as communication: exploring the validity and utility of relating intention to interpretation' in Design Studies 29: 425-457

Crilly, N., Moultrie, J. & Clarkson, J. P. (2008) 'Shaping things: intended consumer response and the other determinants of product form' in Design Studies 30: 224-254

Karjalainen, Toni-Matti (2004) 'Semantic transformation in design. Communicating strategic brand identity through product design references' Publication series of the University of Art and Design Helsinki A 48, Printed at Gummerus Kirjapaino Oy

Krippendorff, Klaus (2006) 'The semantic turn; A new foundation for design' Taylor & Francis Group, LCC

Parr, J. W. 'Aesthetic Intentions in Product Design. Making driven or alternative form'

Persson, S. & Warell, A. 'Relational Modes between Industrial Design and Engineering Design - a Conceptual Model for Interdisciplinary Design Work

Thellefsen, T. & Soerensen, B. (2015) 'What brand associations are', in Sign Systems Studies 43(2/3): 191-206

Valtonen, Anna (2007) 'Redefining Industrial Design' Publication series of the University of Art and Design Helsinki A 74, Gummerus Printing

Warell, A. (2015) 'Identity references in product design: An approach for inter-relating visual product experience and brand value representation' in Procedia Manufacturing 3: 2118-2125

Warell, A. 'Towards a theory-based method for evaluation of visual form syntactics'

Vihma, Susan (1995) 'Products as representations; A semiotic and aesthetic study of design products' Publication series of the University of Art and Design Helsinki UIAH A 14

Vihma, Susan (2010) 'Design semiotics in use. Aalto University, Publication series A 100

https://en.wikipedia.org/wiki/Base_station

http://www.fsd.uta.fi/menetelmaopetus/kvali/L6_3.html

Leskelä, Markku (2017)