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Tässä työssä käsittelen käyttäjäkokemuslähtöisen tuotesuunnittelun mahdollisuuksia vaikuttaa erottautumistekijöihin teollisissa yrityksissä, jotka toimivat B2B ympäristössä. Työn tavoitteena on tarkastella kokemuspohjaisen suunnittelun teoreettisia lähtökohtia, ottaen huomioon muotoilun, kognitiotieteiden ja kauppatieteiden alojen tutkimuspohja. B2B ympäristön tarkastelu on tämän työn yksi painopisteistä, koska siinä tuotteen omistus ja käyttö jakautuvat asiakkaiden ja käyttäjien kesken. Tämä toisaalta vaikuttaa tuotteen suunnittelun lähtökohtiin, sen markkinointiin, myyntiin ja vastaavasti asiakas- ja käyttäjäkokemukseen. Työ on tehty FIMECC:in aloittaman UXUS projektin yhteydessä. Projektin tarkoitus on tutkia ja soveltaa käyttäjäkokemuksen lähtökohtia teollisessa ympäristössä.

Työssäni pyrin kehittämään teoreettisen ajatusmallin, jolla asiakkaiden ja käyttäjien kokemuksia voidaan tarkastella eri tasoilla ja ottaa huomioon suunnitteluprosessin varhaisissa vaiheissa. Tämä malli pohjautuu osittain psykologisiin teorioihin, jotka tulevat esille aikaisemmissa tutkimuksissa mm. Carver ja Scheier (1998); Sheldon, K.M., Elliot, A.J., Kim, Y. ja Kasser, T. (2001). Ajatusmallin ensisijainen tarkoitus on toimia tukityökaluna tuottajayrityksen tuotekehityksen ja markkinoinnin yksiköille kun halutaan soveltaa kokemuslähtöisen suunnittelun periaatteita yrityksen toiminnassa. Mallin toinen tarkoitus on toimia perustana teolliseen ympäristöön soveltuvien kokemusmittareiden kehitykselle.

Työn toinen osio keskittyy yhden UXUS projektin yrityskumppanin toiminnan tutkimiseen (Rocla). Tässä osiossa pyrin kehittämään kokemusmittariston, jonka tarkoituksena on huomioida tuottajayrityksen, tuotevälittäjien, asiakkaiden ja käyttäjien näkemyksiä tuotteiden ominaisuuksista ja kokemuksista sekä mahdollistaa vertailu näiden osapuolten välillä. Kerätyn aineiston ja vertailun tarkoitus on auttaa tuotekehitys- ja markkinointitiimien työtä kun määritetään uusien tuotteiden kehityskriteerit ja myyntiargumentit. Kokemusmittariston suunnittelussa käytän sekä teoreettisia lähtökohtia, jotka käydään läpi työn alussa, että kymmentä johtajatason henkilön haastattelutulosta Roclan tuotekehityksen, markkinoinnin ja myynnin yksiköistä. Tämän lisäksi sovellan ajatuksia keskusteluista, joita käytiin läpi lukuisissa tutkijatapaamisissa, kenttä- ja yritysvierailuilla.

Ehdotetun kokemusmittariston avulla kerään aineistoa 57:ltä kokeneelta varastotuotevälittäjältä. Välittäjät vertasivat kahta erityyppistä varastokonetta heidän kokemuksiansa perusteella ja myös osoittivat näkemyksensä psykologisten tarpeiden tärkeydestä asiakkaiden ja käyttäjien näkökulmasta. Aineiston analyysi osoittaa, että vaikka välittäjät kokivat selkeitä eroja tuotteiden visuaalisen ulkonön viehättävyydessä, tämä tekijän tärkeys oli yleisesti vähäinen (mm. osittain linjassa Diefenbach, S. ja Hassenzahl, M. (2011) tulosten kanssa). Tämä tulos tukee ajatusta siitä, jos kokemuspohjaisia lähtökohtia halutaan soveltaa erottautumistekijöinä B2B ympäristössä, niiden pitää olla vahvasti ja selkeästi yhdistettynä taloudellisiin mittareihin.

Avainsanat user experience, customer experience, industrial products, business-to-business

Conveying User Experience in Business-to-Business Environment

A Case Study from Metal and Engineering Industry

Master's Thesis
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Conveying User Experience in Business-to-Business Environment:
A Case Study from Metal and Engineering Industry

Abstract

The main goal of this study is to investigate theoretical background behind user experience (UX) paradigm and its possible implementation in industrial product development within business-to-business (B-to-B) environment. This work is conducted in the realm of UXUS project (User Experience and Usability in complex Systems), which was initiated by FIMECC (Finnish Metals and Engineering Competence Cluster) in 2010. In contrast to business-to-consumer environment, B-to-B setting separates ownership and actual use of the product. My aim lies in elaborating on various impacts of this separation on user and customer experiences and possible ways to communicate benefits of better UX to customers and equipment distributors. In the content of this paper, I introduce a theoretical thinking model for approaching experiences in industrial product development and an experimental questionnaire set, which is meant to capture different aspects of product and operating environment experiences. I test the proposed questionnaire set with 57 experienced warehouse equipment distributors who evaluate two separate industrial products. Results indicate that distributors are able to appreciate differences in hedonic qualities of industrial equipment and that visual appearance is a major factor in indicated product perceptions. However, overall hedonic qualities were perceived as less important compared to utilitarian qualities, which is partially in line with consumer product findings by DIEFENBACH, et al. (2011). I also find that distributors were unable to appreciate the importance of three major psychological needs (relatedness, autonomy and competence as indicated by SHELDON, et al., 2001) in industrial product development. I also analyze interviews of ten managers from warehouse equipment manufacturing company Rocla to investigate whether individuals working in separate departments perceive implications of UX paradigm differently. Findings indicate that individuals dealing with R&D activities stress the importance of end-users in deriving criteria for product development whereas individuals dealing with marketing and sales activities emphasize the role of personal relationships with customers. The long-run aim of this research direction is to assess strategic potential of UX paradigm for industrial product manufacturers.

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INTRODUCTION

While usability and functionality remain in the core of every successful interactive product, the emphasis in product development has been shifting towards a more holistic perspective on design principles. These principles aim at determining emotional and hedonic aspects of product-user relationships complementary to function-based factors. Such pervasive viewpoint on product, service and system design is often referred to as experience design practice and it aims at identifying product qualities and attributes that would somehow contribute to evoking positive emotions. There are multiple reasons for emergence of experience oriented design direction and part of these are related to intense competition in the market where merely functional products do not elicit interest, emotional attachment or engagement. In other words, products that succeed in intensifying individuals' positive experiences have an advantage over their counterparts, taking into consideration that users are actually able to accredit products for these experiences. Somewhat less utilitarian reasons for experience based design approach to occur can be thought of as stemming from extensive research in fields of psychology, HCI, cognitive sciences, economics and design. Various studies have established theories, heuristics and broadened knowledge to allow for better understanding and analysis of human behavior and activities. This has also led to identification and classification of certain basic psychological human needs and values, fulfilment of which may be seen as key for improving well-being and quality of life (e.g. as described by HASSENZAHL, 2008). From this viewpoint, embedding or enabling experiences in products and systems would seem like an appealing direction for all involved parties, but there are many reasons why it is so hard to effectuate this principle in practice. In addition to complexity of psychological factors influencing human behavior, experiences and emotions cannot be completely derived from some specific product attributes but are evoked by combinations of various factors, situations and events which occur and change over time. However, despite obvious challenges and intricacy of understanding and implementing experience based design approach, I find it even more worthwhile exploring its potential to improve consumer and industrial products and also to change ways in which product development is conducted in the industry.

This study revolves around user experience (UX) paradigm and its possible implications for product and

system design on tactical and strategic levels. The term “user experience” came around in early 90’s from marketing and consumer research and was described in the sense it is currently used, among others, by Donald Arthur Norman (NORMAN, et al., 1995.). This term usually refers to emotions and experiences when using products, services or systems. What makes UX approach so intriguing in the view of product development, especially for products and systems utilized in working environments, is its potential positive impact on users’ work motivation and stimulation. The user experience based approach focuses on human-product interaction. Considering problems associated with depression, fatigue, frustration and other adverse effects caused by unfavorable working conditions, long working hours or repetitive operations, implementing UX thinking in design process may have a potential to alleviate these effects. As the nature of products, operations and transactions in business-to-business (B-to-B) environment has many differences compared to business-to-consumer (B-to-C) environment, also approaches to experience design practices in these environments should be considered separately. Perhaps one of the most apparent distinctions between business logics in B-to-B and B-to-C environments is the separation between acquisition decision makers (e.g. customers, buyers of the product) and end-users (e.g. workers, operators of the product). This B-to-B specific setting may raise difficult questions, for instance, whether manufactured products should account more for preferences of buyers or end-users and how to resolve possible contradictions e.g. if better end-user experiences are achieved only via additional costs to the product but benefits to customers are less apparent. Despite all the difficulties associated with conflicts of interest among different parties, successful implementation and communication of UX based design approach can contribute to resolving these issues and potentially result in win-win constructs. For example, if it can be shown that positive experiences evoked by the product result in reduced number of absences, sick-hours and increased end-user stimulation as well as productivity, the customer party will be probably willing to consider paying higher price for such products. In this sense, abovementioned contradictions and conflicts of interest may prove to be illusory and depend heavily on how well relevant qualities of the product are communicated to different parties. It must be mentioned, that although user experience approach puts an emphasis on emotional responses and heuristics, usability and user-centered design approach are nevertheless valid and should not be underestimated or neglected.

This study addresses perceptions of UX based approach among different departments of an industrial product manufacturer. In addition, the aim is to investigate how intermediate parties of the product distribution chain, such as distributors and equipment dealers, assess needs and values of clients and end-users as well as perceptions of separate product qualities such as usability and visual appearance. This research is done in a pursuit for better understanding of relevant challenges that stem from the separation of product ownership and use and how it influences implementation of UX based product development on organizational level. The long-run target of this research direction with exploring user experiences in B-to-B setting is to find a way to provide better communication tools for product manufacturers who could then better account for differences in perceptions of involved intermediate parties (e.g. distributors) and narrow down the gap between preferences of decision makers and end-users.

1.1. Connection to the UXUS project

This study is carried out as part of a wider research program named UXUS project (User Experience and Usability in Complex Systems). UXUS project was launched in 2010 in association with FIMECC (Finnish Metals and Engineering Competence Cluster) and brings together a noticeable number of industrial practitioners and researchers with multidisciplinary backgrounds including psychology, business, design and engineering. The core goal of the project is to investigate possibilities of user experience oriented approach in industrial environment, explore differences in perceptions of the UX paradigm and determine economic potential of this approach for industrial partners. In addition to theoretical research and studies, UXUS project provides concrete physical and digital prototypes with following tests and experimentation. The number of industrial partners involved in UXUS project is constantly growing and in the year 2012 some of the companies on the list included Kone, Konecranes, Fastems, Rolls-Royce, Rocla, Metso and Ruukki. The case study presented in this paper is mostly related to Rocla, a company involved in manufacturing and designing warehouse and forklift equipment. However, also information derived from other company cases including Metso, Konecranes and Rolls-Royce was utilized in deriving ideas and concepts for this study.

1.2. Relevant studies and research directions

Most of the papers and books referred in this thesis are related to definitions of UX, its practical implementations and methods of studying and measuring experiences. Psychological and behavioral theories are also considered as a crucial source because of their relevance and close connection to the user experience approach. Papers from the field of economics are reviewed to reflect on importance of organizational cultures and shed light on the interplay of different departments within an organization. As the theoretical focus of this paper lies in the realm of psychology, emotion and experience research, there is a multitude of varying theories which might be partially incoherent and incompatible among each other because of largely multifaceted views on these topics. This is why it is important to note in the beginning, that the scope of this study does not claim to include all or even a majority of these theories, but tries to introduce ones which are most relevant in the view of particular research objectives formulated more thoroughly in **Section 1.4**.

As an example addressing potential link between emotional responses and product qualities, DESMET et al. (2001) used particular method to assess emotions of users by psychological means utilizing *emotion cards* with varying emotion representations in the context of mobile phone evaluations. This approach is based on the model of product emotions presented later in this paper and it stands as one way how emotional aspects can be taken into account in product design and evaluation. What comes to the UX paradigm, in their paper, HASSENZAHN and TRACTINSKY (2006) determine three approaches to user experience: Beyond the instrumental, emotion and affect and the experiential. Each of these facets takes a different angle on how UX can be viewed or understood. Following this approach, LAW, et al. (2009) conducted a study on the interpretation and understanding of the meaning of user experience as a term by surveying people from academic world as well as people from the industry. Their survey indicates that there is a mutual understanding on the meaning of the UX term to some extent, namely, "The results show that the respondents tend to agree on a concept of UX as dynamic, context-dependent

and subjective, which stems from a broad range of potential benefits users may derive from a product". However, ironically, this mutually accepted perception of UX only shows how subjective and situation dependent the term actually appears. Authors recommend the "user experience" term to be used in relation with products, systems and services, which are accessed by user via user interface, thus making a difference between UX and other experiences e.g. experiences related to face-to-face interactions. One important distinction is also made between UX of the product itself and UX of product related services, which in turn can influence the overall perception of the product. There has been critique towards large variability in approaches and research methods under UX paradigm. Sometimes these multiple varying methods create barriers for robust enough study comparisons as pointed out by BARGAS-AVILA et al. (2011). In addition, various frameworks have been proposed to try to better explain experiences in product design e.g. FORLIZZI, et al. (2004) show how experiences can be divided into *experience*, *an experience* and *co-experience* along with their *fluent*, *cognitive* and *expressive* aspects. Other studies concentrate on analyzing users' interaction patterns to determine whether these might better explain individuals' goals with products (HARBICHA, et al., 2011). Another way to look at user experience is to consider it as stemming from basic psychological human needs. For example, in the article by SHELDON, et al. (2001), researchers identified a set of ten basic human needs from previous studies and conducted a research on their salience for individuals. Further research in this direction attempts to determine links between needs, affect factors and attribution to product features (e.g. HASSENZAHN, DIEFENBACH and GÖRITZ, 2010). The relevance of abovementioned studies to the topic addressed in this paper comes from their formulation of basis for emotion and experience research. This in turn helps to define a platform for more objective assessment and research method selection. As seen from the experiment by DIEFENBACH and HASSENZAHN (2011), the task of embedding hedonic values in products and expecting them to influence purchasing decisions is not a trivial task and requires thorough investigation of individuals' preferences and heuristics. Decision making in purchasing situations is only one spot where psychological and behavioral theories might prove useful in respect of improving product development. One prominent paper, describing versatility of the cognitive process and effects of psychological manipulations is based on the Nobel Prize lecture by Daniel Kahneman (KAHNEMAN, D., 2002.). His work culminates a viewpoint on psychological phenomena and some of the core principles behind this approach are touched later in

this paper (**Section 2.1.1**). Although the emphasis in the design practice has been shifting from mere individual behavior towards experiential and affect related factors, understanding and accounting for behavioral biases and heuristics is crucial as it might help the designer to comprehend some basic aspects of human tendencies and improve her or his understanding of individuals' needs and preferences. As shown in the book by CARVER, et al. (1998), there are many intriguing ways to approach behavior and decision making processes to be able to decode and categorize experiences. These ideas are presented more thoroughly in **Section 2**.

Perhaps one of the most interesting questions related to UX in design practice comes from measurement and interpretation of emotions and linking them to specific product features. Although it is clear that it is hard and almost impossible to assign experiences to individual attributes of a product, the aim of the research on this topic has been to categorize and describe certain emotions and factors which are crucial for eliciting experiences. Some of usability related methods and measures are described in detail in the book by TULLIS and ALBERT (2008). However, this book does not address user experience term broadly as it is meant in the context of this paper, but relates more to statistical documentation and analysis of usability tests. In addition to usability and instrumental experience measures, it is important to account for long-term experiences which evolve gradually. These experiences are harder to capture as they occur in time and studying them may require extensive time periods. Retrospective experience assessments can be considered as one way to document product related emotions without prolonged studies as shown in the study by KUJALA, et al. (2011), who use a "UX curve" method to assess user experience during different time periods. Also KARAPANOS, et al. (2010) introduce means for recalling long-term experiences with *i-Scale* tool.

A set of studies briefly described above is meant to give a quick glance on the research mind set in which this paper is written. In addition to studies in fields of design and psychology, I provide some references from business environment analysis, marketing and innovation research, as they are relevant from the perspective of my research questions. More thorough and extensive review on relevant fields is presented in **Section 2**.

1.3. Key terms and definitions for the content

As mentioned earlier, the field of design has many approaches and thus requires appropriate definition of terms used to describe different phenomena and concepts. Here I define some of the key terms used in this paper to allow for right interpretation of further content. The terms described further might be used differently in some other context and thus their definitions should not be regarded as general.

Experience design. The design practice involving experience design implies a design process which tries to account for user experiences instead of concentrating purely on the functional part of products, services or systems (HEKKERT, et al., 2003). According to this definition, the term is used to describe a thinking model and a design process, which are distinguished from other design processes and thinking models, for they emphasize experiences of users as main design drivers. For example, when talking about user-centered design, it is not defined whether it involves experience design, because for experience design to be present it is not enough to address only instrumental and pragmatic needs of users. Some studies use the term experience centered design.

User experience (UX). The UX term has been already mentioned in earlier text but it is relevant to define it properly before implementing it further. User experience paradigm is closely linked to experience design and relates to experiences and emotions which are elicited by product-human interaction also including experiences from services and systems. However, for the content of this paper, I use the UX term to refer only to experiences of *end-users* of the product (physical or digital). This is done to make a clear distinction between experiences of other parties in the business-to-business environment.

End-user. Referring to end-users denotes individuals who are in a direct contact with specific products, services or systems and utilize these either in their work or in other situations. Because this study deals with B-to-B environment, the term is mainly used for individuals operating or utilizing particular products, thus excluding individuals who are purchasing or selling these products and utilizing services related

to necessary transactions. In further content, such words as worker, operator, user and employee are meant as synonyms for the end-user term if not specifically stated otherwise.

Customers and distributors. In contrast to end-users, customers are not necessarily implementing specific products in their everyday work although they are responsible for purchasing decisions. I further use such words as clients, employers, decision makers and buyers to refer to customers. Distributors and other intermediate parties can also be referred to as decision makers, but they are a distinct individual group because they are not implementing products or services for their internal production of other products or services but engage in retail or leasing businesses.

Customer experience (CX). Contrary to user experience (UX), I use the term customer experience (CX) to describe experiences and emotions rising from products, services and systems when customers and distributors deal with a manufacturing company or with each other. The distinction between user experience and customer experience is especially important when talking about business-to-business environment.

UX and CX targets. The goal of experience design is to embed such qualities in products, services or systems, that would elicit positive experiences in end-users or customers. Setting UX and CX targets helps to reach these goals and can act as a reference for determining success level of the final outcome. The form of UX and CX targets is usually derived from basic psychological human needs and their more granular derivatives (e.g. feeling of control, sense of security etc.).

1.4. Objectives and contribution

The field of design research bears the advantage of having a large variety of methods and ways to address design problems and questions providing also for innovative and unconventional theories. However, this advantage may turn out to be a threat to the credibility of the research if it is taken lightly

without sufficient theoretical background and references. In this study, I try to formulate objectives which are based on previous research and theories as well as observations and interviews conducted with industry practitioners and among researchers from fields of engineering, design, business and psychology. Pursuing these objectives aims at contributing to understanding of user experience approach in industrial product development and especially in business-to-business setting. Main objectives and contribution are stated below.

OBJECTIVE I. Reviewing theoretical background behind user experience approach in product development and elaborating on possibilities to implement this approach within industrial product development in B-to-B environment.

By reviewing existing literature on user experience approach and its implementation in design practices I try to build a hypothetical thinking model for approaching UX paradigm with several levels of product experiences. As an example from earlier studies, DESMET and HEKKERT (2007) present a theoretical framework showing three categories of experiences to be taken into consideration in product designing process: Aesthetic experience, experience of meaning and emotional experience. Another way of approaching product qualities which could elicit emotions is to make a distinction between hedonic (e.g. be-goals; DIEFENBACH, et al., 2011) and pragmatic qualities (HASSENZAHL, 2003.), which have an influence on instrumental, non-instrumental and non-physical human-product interaction. The idea of hedonic aspect of products rises from consumer research (e.g. HIRSCHMAN, et al., 1982) and might be seen as leading to development of experience design approach. On the other hand, instead of defining specific product qualities it is plausible to assume that all positive and negative experiences stem from basic psychological needs (SHELDON, et al., 2001) i.e. experiences depend on how well these needs are satisfied. The reason behind formulating a new thinking model (**Section 3.3**) for UX in B-to-B setting has several facets.

First aim is to point out that individual product qualities should not be considered separately from the holistic product image perception defined by UX and CX targets. For this purpose I introduce a hypothetical

thinking model where product experiences are assumed to accumulate from the correspondence of product perceptions to desired product qualities, product image and product meaning. In this construct, interaction with the product is seen only as one part of the overall product experience. According to this logic, organizations aiming to implement UX paradigm on a strategic level should think about multiple aspects that influence perceptions of produced products (e.g. brand image, social and cultural trends, etc.) instead of concentrating merely on developing technical product features. This idea becomes relevant when talking about resource allocations to different organizational functions and departments.

The second goal is to introduce an *experience hierarchy* framework where customer and user experience targets can be dealt with simultaneously, thus accounting for specifics of UX paradigm in B-to-B environment. The starting point behind this framework is to initiate development of new products or product qualities from UX and CX targets. These targets are then transformed into more specific be- and do-goals and further into concrete product features. Dealing with experience-driven design in this manner allows to include both customer and user needs into one equation and to ensure that selected product qualities correspond to preferences of both parties. In addition, this framework can be used as a base for constructing argumentation chains for sales and marketing purposes by connecting users' needs to customer's benefits through particular product qualities. An essential part of the proposed framework is related to verifying links between different levels of experience hierarchy by means of research i.e. defining different levels of experience components reaching from system concepts to concrete product part and material choices.

OBJECTIVE II. Identifying differences and similarities in views of industry practitioners from separate departments in respect to perceived roles of end-users and customers in industrial product development.

Most of user experience research is focused on consumer products in B-to-C environment and again studies from B-to-B setting often concentrate on discussing customer experiences and values (e.g. FLINT, et al., 2000). My objective is to assess perceptions of user and customer needs by interviewing individuals

from different departments of an organization operating in B-to-B environment.

The purpose of this inquiry is aimed at better comprehension of mind sets and volition states in metal and engineering industry particularly in areas of product development, sales and marketing activities. The underlying assumption for this objective is that perceptions regarding roles of end-users and customers are different among individuals working in separate departments of an organization. For example, individuals working in R&D department might perceive the role of end-users differently than individuals from sales and marketing departments. On the other hand, sales department might have different perception about roles of different types of customers when compared to perceptions of R&D department. This assumption does not in itself state anything novel, but by approaching it from user experience perspective I try to find out what are the most salient areas with apparent similarities and differences in individuals' viewpoints.

From the design perspective, identifying viewpoint differences within a manufacturing organization is an interesting topic, because it is related to product development decisions and differences in influence of involved departments (e.g. ENGELEN, 2011). I approach this objective by analyzing ten interviews of managers from one of the UXUS project partner companies Rocla. These one-hour interviews were conducted with other researchers from UXUS project and were later transcribed for analysis. In addition to official interviews, I try to include information gathered during multiple related field visits to logistic centers and warehouses as well as partner company meetings. Complementary to identifying differences and similarities in views of different individuals from the industry, I implement following insights and findings in constructing hypothetical *thinking model* (in OBJECTIVE I) and *UX-mapping tool* concept described in OBJECTIVE III.

OBJECTIVE III. Conveying user experience paradigm in B-to-B environment. Introducing and experimenting with UX-mapping questionnaire set.

The third objective of this study is related to elaborating on ways in which user experience can be

conveyed to different parties in B-to-B environment taking into consideration differences in incentives and product quality perceptions. For this purpose, I introduce an experimental modular questionnaire set which aims at mapping product perceptions and needs of relevant individual groups including manufacturers, distributors, customers and end-users. Another aim of the proposed questionnaire set, besides collecting UX and CX related data, lies in communicating UX approach ideology to respondents and acting as functional PR material for the industrial product manufacturer.

The introduced *UX-mapping tool* takes some of its UX measurement methods directly from earlier studies on product experiences (e.g. AttrakDiff question module) but also contains question modules that are tailored to suit specifics of B-to-B context. Main idea behind combining different measures into single questionnaire set is to allow for comparison of product evaluations on different levels of abstraction. For instance, experiences indicated with semantic differentials in AttrakDiff questionnaire module can be compared against evaluations of separate product qualities such as usability, visual appearance etc. Similar cross-comparisons between different question modules can be used to get insights on key aspects that influence product experiences of different parties. More thorough description of the *UX-mapping tool* is presented in **Section 4.3.3**.

An experiment with *UX-mapping tool* involved 57 equipment distributors from 25 countries as a core group and ten individuals from Rocla's R&D department as a pilot group. With the help of data from the core subject group I test several hypotheses which aim at determining product perceptions of the distributor party e.g. whether equipment distributors are able to indicate differences in hedonic product qualities when comparing several pieces of equipment and how these individuals perceive needs of end-users and customers (e.g. CHITTURI, et al., 2008, find that security and confidence are related to positive experiences with more utilitarian products). Related hypotheses are presented in more detail in **Section 4.2**. Another aim of the questionnaire study was to capture the overall reaction of respondents to the questionnaire method which was intentionally designed with much emphasis on its visual appearance and graphics. Because one of the aims behind proposed *UX-mapping tool* was to convey UX paradigm by embedding questions on product experiences, concrete qualities and economic factors into the same

context, it was important to make sure that the general feedback on the questionnaire was positive.

1.5. Limitations

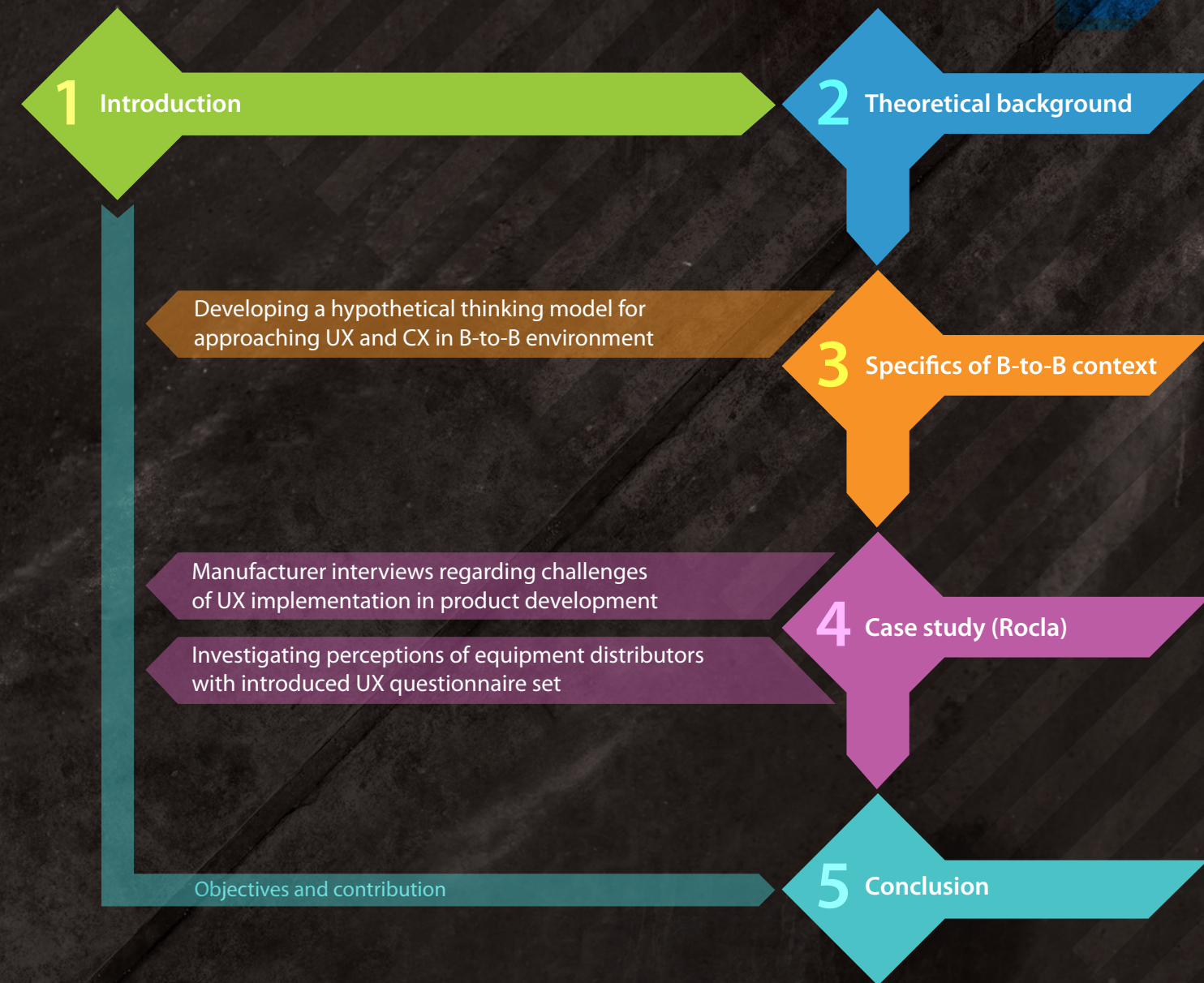
This study is based on investigating aspects of user experience approach in the metal and engineering industry and the data is collected from companies operating in B-to-B environment. First limitation of this research is related to the specific industry in which it is conducted and the results are based purely on the operating models of this industry. Another limitation concerns the number of companies taken into consideration. Although insights on implementation of UX paradigm in company operations are derived from discussions with individuals from multiple companies such as Rocla, Metso Automation, Konecranes and Rolls-Royce, the experimental data for UX-mapping tool is collected only from distributors of warehouse equipment dealing with Rocla. Despite the fact that all of these companies operate internationally, interviews were conducted only in Finland with Finnish speaking individuals.

Focus of this paper lies mainly in the realm of design research and although other fields and perspectives are discussed, this is made mainly to support theoretical and methodological foundations of this study and not to provide extensive overview of other fields or discuss their appropriateness. As stated in previous paragraphs, only a fraction of available thinking models and theories are included and presented in this thesis. This limits the study to selected models and methods and this research does not claim to provide a base for any generic methodology in given context. Although many reference papers used in this study consider user experience paradigm in consumer markets, this study is putting most of its emphasis on UX approach in business-to-business environment. In this sense, many psychological and organizational factors considered in B-to-B setting are different compared to the consumer market. Further limitations are posed on the objectives stated above. I focus on studying perceptions of UX approach among industry practitioners and intermediate parties as well as investigating potential of conveying UX paradigm on a practical level. My objectives do not involve thorough investigation of influences of different parties within any organization. It is also important to mention that the research is limited to studying needs and perceptions of individuals working within manufacturing organizations

and equipment distributors i.e. this paper does not involve any experiments or interviews with actual end-users or customers as the focus is on understanding how other relevant individual groups perceive needs of these parties. The proposed *UX-mapping tool* is used for the first time and will be developed further based on feedback and preliminary results. Taking this into account, the proposed questionnaire set cannot be generally applied to B-to-B companies at this stage without some modifications and customizations.

1.6. Structure of the study

Further content is structured as follows (**Picture 1**). **Section 2** describes theoretical background behind UX paradigm. This section includes descriptions of various theories that are useful for comprehending how product related emotions can be formed and how to account for these emotions in product design. Main differences between B-to-B and B-to-C environments are presented in **Section 3**. This section also presents a hypothetical thinking model which can be utilized as a starting point for defining UX and CX based product development criteria. Research questions and prerequisites for the case study are formulated in **Section 4**. This section describes main ideas behind proposed UX-mapping tool as well as data and methods for assessing research questions. Later parts of **Section 4** present key findings and data analysis from the case study and **Section 5** concludes this thesis.



Picture 1 depicts core structure of this study.

THEORETICAL BACKGROUND

This section provides a brief review of relevant theories, paradigms and research along with examples of some techniques for measuring and evaluating product related experiences. An attempt to capture aspects of different fields, including design, psychology and studies on HCI (Human-Computer Interaction), is made to be able to consider multiple views on the prevailing situation in product development domain. Main purpose of this section is to list, describe and compare relevant theoretical starting points for UX paradigm as such before going into specifics of implementing these ideas in B-to-B context.

2.1. Relevant Fields behind UX paradigm

This paper utilizes references from multiple fields of research and it is important to distinguish between these fields and to state to what extent and to what purposes these approaches are inclined. Main fields that deal with product related experiences and emotions include human-computer interaction (HCI), economics and marketing, design and psychology. HCI field deals mainly with user interfaces, usability and users' needs. The field of economics addresses experiences in the form of consumer and customer values, branding and expectation building. Psychology based research, on the other hand, concentrates on mental constructs of emotions, heuristics and behavioral patterns. Design research takes many aspects from previously mentioned fields and reflects them in the form of design processes and methods, deriving product qualities and aesthetical experiences. Although all of the mentioned fields are distinct in their way in which they deal with human experiences, they have a common ground and overlaps in emphasizing emotional and behavioral influences of products and systems. A short clarification for implementation of different research fields in this study is presented further.

Psychological theories

Because user experience deals with emotions and human behavior, psychological theories act as a base for trying to understand how emotions are elicited in the first place. Referring to empirical findings and theoretical models from social, cognitive and behavioral studies provides a glance at possible causes and

triggers behind experiences. Although only a very limited number of psychological theories is discussed in this work, the main purpose is to address a holistic picture of the UX paradigm on both micro- and macro-levels. This study does not go into thorough elaboration on differences between different psychological approaches (e.g. different starting points for behaviorist, cognitivist, phenomenological and activity based studies) but rather tries to highlight interesting aspects relevant to research objectives of this paper. Neurology and neuroscience studies are not highlighted in this paper although I believe these field are going to play a major role in human emotion and experience research in the near future.

Human-Computer Interaction point of view

In this paper, HCI studies are referred to mainly for identifying factors and measures of usability as well as methods for capturing interaction related emotions and experiences. Many papers on HCI are closely linked to psychological theories and include empirical experiments based on these theories. I try to make use of existing experimental settings and accepted methods applied in these papers to conduct research on product related experiences.

Economics and marketing approach

Most products are developed and sold to generate profits and cash flows for manufacturing companies. From this point of view, it is essential to account for economic factors behind customer and user experiences. Some of the relevant economic factors raised in this study are related to department influences, customer values and potential for strategic utilization of UX and CX based approaches. It is also important to remember that conventional marketing research methods can provide a valuable addition not only to customer experience research but also for user experience related studies.

Design approach

This research field complements psychological and economics approaches by linking them to actual qualities of products and services. Design field contains multiple theoretical frameworks which are aimed at explaining how experiences are related to product attributes also accounting for factors related to different user groups and various utilization environments. This paper focuses on design research by

trying to identify specific product features and properties, which are then studied from perspectives of different individual groups with respect to experience design paradigm. This approach is closely connected to main contribution aims of this study and relates to conveying later presented UX thinking model in the realm of B-to-B environment. Another link to design research, which is strongly present in this paper, is the emphasis on visual presentation and format of all introduced experiment and study materials. Because experience-driven design approach in product development implies the potential for eliciting positive emotions in individuals, I believe that the same logic should be also applicable to UX research and material design.

2.2. Hypothetical mental constructs behind experiences

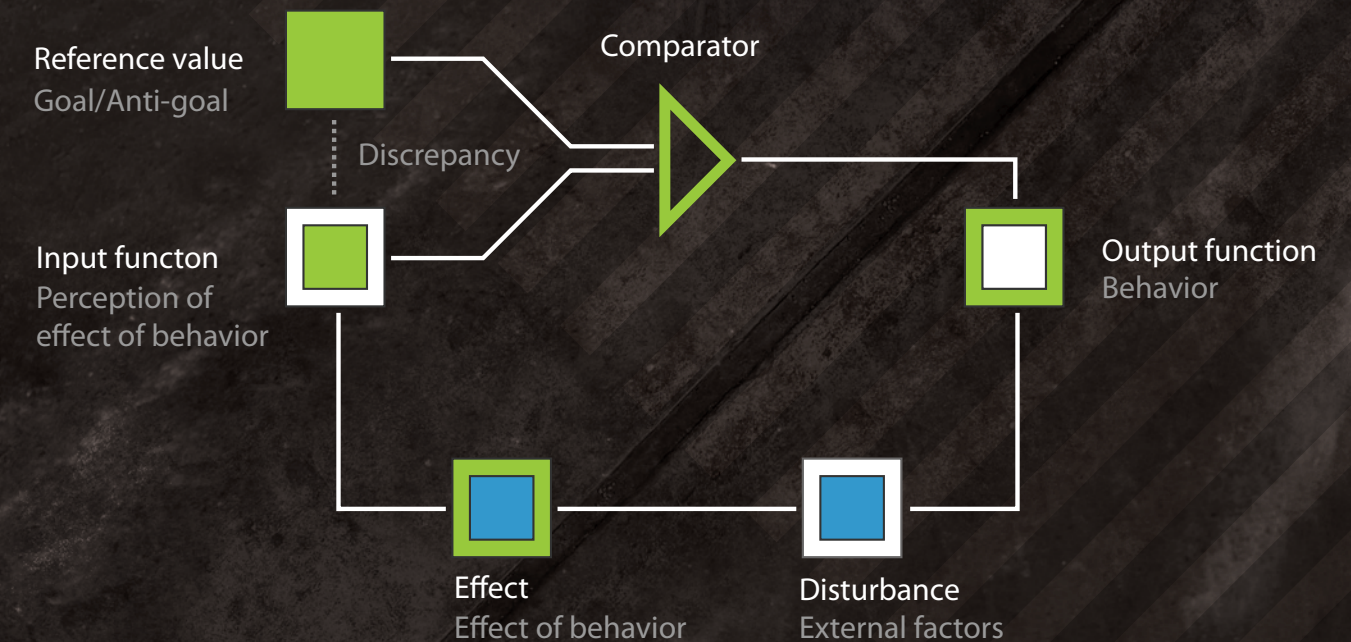
What are the starting points to understand and utilize user experience paradigm in the design context? This question can be regarded from many different perspectives and it is important to explore and compare some of these approaches before trying to formulate any specific arguments. Further I address some of the basic ideas behind underlying theories related to motivation, affect formation, hierarchy of goals, basic psychological needs and behavior without going too deeply in their origins and history of evolution.

From the economic point of view, a debate concerning hedonic consumption, consumers' fantasies and multisensory experiences became salient around 1960's (e.g. LEVY, 1959). An issue regarding emotions and their role in the decision making process was raised as a counterweight to prevailing utility maximization theories in consumer research. Utility theories usually assumed consumers striving to maximize their utility by evaluating tangible product attributes. The idea behind hedonic consumption, on the other hand, suggests that affect factors play a crucial role when choosing and utilizing different products. For instance, when individuals are searching through various goods, their mental state, mood, expectations and previous experiences have a direct influence on their decision making process. In some sense, hedonic consumption view was an extension to a purely pragmatic approach which assumed individuals' to assess product's expected utility by comparing positive and negative attributes of this

product. HIRSCHMAN and HOLBROOK (1982) describe hedonic consumption paradigm and compare it with the traditional approach identifying four areas to be addressed. These include *mental constructs*, *product classes*, *product usage* and *individual differences*. Such framework can be considered as an attempt to attenuate from purely instrumental attributes of products when investigating consumers' choices and a pursuit to classify different areas from which a more holistic view can be formed. However, understanding how emotions and experiences are elicited in our minds and how different products contribute to these experiences requires a much more elaborate investigation of psychological tendencies and their link to product evaluation process. In this study, I begin my investigation of user experience paradigm from psychological theories relating to hypothetical (and sometimes metaphorical) models of human thinking. The main aim of this investigation does not incline going too deeply into details of underlying cognitive processes but rather tries to derive an understandable framework to support arguments for UX approach in product design and its potential for practical implementations in B-to-B context.

2.2.1. Emotion mechanics: An example from a single feedback loop process

As mentioned earlier, there is a wide range of ways to approach human behavior and related emotions. However, one must distinguish for which purposes these approaches are intended for e.g. whether outcomes are expected to carry purely theoretical or more practical traits. Following discussion draws examples from cognitivist approach, which in its core attains human cognition and thinking as a complex computational process. Despite obvious simplifications (e.g. compared to activity theory based and phenomenological approaches) and critique associated with this approach, I want to highlight some of its underlying ideas because of the following reasons. First of all, the practical part of this study is conducted in the context of B-to-B environment involving quite pragmatic and concrete problems and requirements. In this respect, explaining emotions and mental states as concretely and mechanically as possible might be seen as a suitable way to convey UX paradigm in this environment. Another reason for stressing this simplified approach follows similar reasoning. It is much easier to present abstract ideas visually when they have somewhat mechanical structure despite being overly simplified. I perceive this particular aspect as an important intermediate step for moving from pragmatic view on product development criteria to deeper understanding of wider and more abstract perception of product



Picture 2 shows a single feedback loop process. The basic principle behind the feedback loop lies in comparison between an Input function (e.g. perception of current state) and some Reference value (e.g. desired goal) through a Comparator (e.g. some cognitive process) resulting in an Output function (e.g. some behavior). The Output function combined with external Disturbance (e.g. influence of external factors such as weather, mood etc.) results in some Effect (e.g. result from particular behavior) followed by perception of the effect from Output function and an adjustment to Input function. Source CARVER and SCHEIER (1998).

related emotions, decision making process and overall user and customer behavior. Taking into account abovementioned reasoning, I believe that from the perspective of my research objectives, cognitivist approach is useful when trying to create practical tools for explaining, conveying and implementing UX paradigm in product development and marketing alike.

One intriguing way to approach the abovementioned issue can be found in the book by CARVER and SCHEIER (1998), where authors describe hypothetical processes underlying human behavior and cognition. Although it is admitted that some of the presented theories are speculative, their sound reasoning and elaborated presentation of the issue cannot be disregarded. Although most of the more complex *dynamic systems* and *chaos theory* approaches are bypassed in this work, I use basic principles of the *feedback loop* process to try to elaborate on how experiences might be elicited from product use. A *feedback loop* model (e.g. CARVER et al., 1998) is one of the relevant models describing how people might think of their conditions and adjust their actions according to responses from the surrounding environment. This concept is important when taking into account further discussion on the decision making process and product-human interaction. It can also be seen as one of the key processes leading to emotions and their link to product qualities. In brief, the idea consists of a paradigm that individuals think in loops. This involves evaluation of the current situation, comparison to some preset reference state (e.g. desired or undesired situation) and adjustment of behavior or actions to become closer (or farther away from) to this reference state. **Picture 2** depicts a simple version of a feedback loop. Although overly simplistic and somehow mechanistic, the feedback loop model provides a relatively good base to build upon further ideas on how people might evaluate situations and reflect upon their behavior and themselves (This area can be seen as mental constructs mentioned in HIRSCHMAN, et al., 1982). One point to be picked up from this model, in the view of objectives of this study, is the assumption of existence of particular reference values in individuals' minds and discrepancies appearing from comparison of these values to prevailing states (Input functions in **Picture 2**). Increasing or reducing these discrepancies is achieved either by adjusting one's behavior or eventually changing one's prevailing reference values. Particulars of these theoretical processes are described in later paragraphs, but first it is essential to make a distinction between *positive* and *negative* feedback loops. The key difference lies in the direction of adjustment

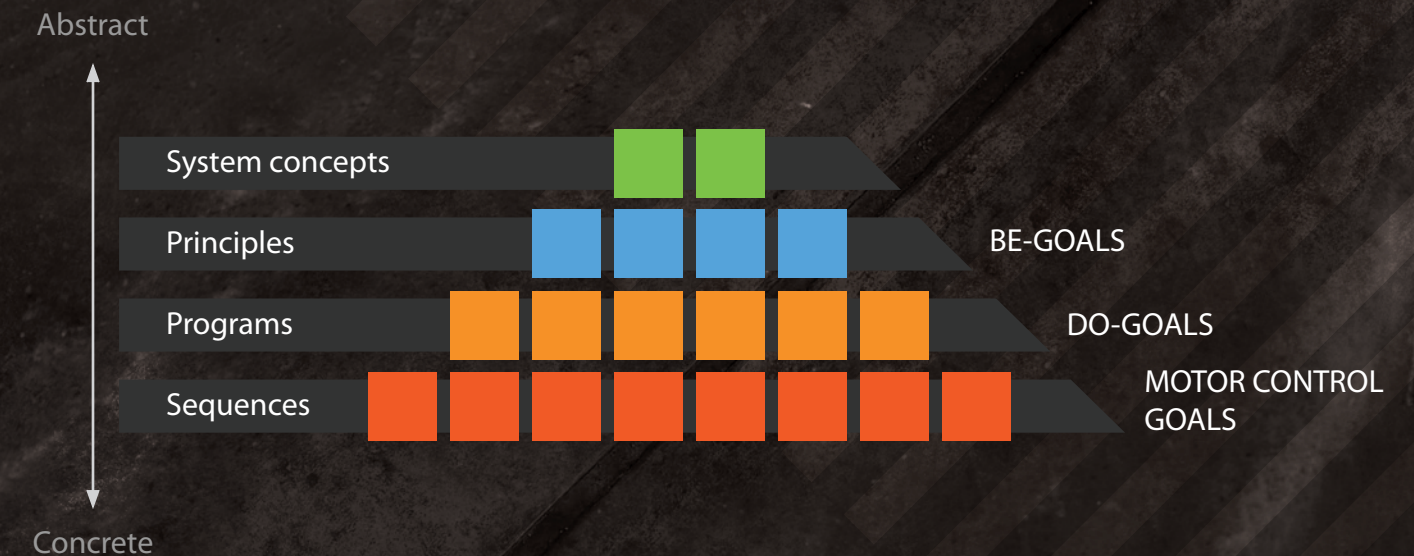


Picture 3 depicts possible types of motivation and regulation. The scale reaches from Amotivation (e.g. incompetence) to Intrinsic motivation (e.g. excitement and enjoyment). Extrinsic motivation reaches from External regulation (e.g. rewards and punishments) to Integrated regulation (e.g. congruence and awareness). Source: RYAN and DECI (2000).

of output function i.e. away or towards reference value. Negative feedback loop aims at discrepancy reduction (e.g. attaining to some desired goal) whereas positive feedback loop relates to moving away from the reference value i.e. increasing discrepancy (e.g. trying to move away from undesired state). Following discussion touches concept of motivation, psychological human needs, affect formation and hypothetical hierarchy of goals.

2.2.2. Goal hierarchy and types of motivation

What makes people act and behave in certain ways and what are the key drivers behind particular actions and attitudes? One way to look at these questions can be found in social psychology and *self-determination* theory introduced by DECI and RYAN (1985). For the purpose of this study, discussion regarding *self-determination* theory will be mostly limited to roles of intrinsic and extrinsic motivations as well as *basic psychological human needs*, fulfillment of which might be seen as a drive for self-motivation. To begin with, intrinsic motivation can be considered as a driving force for exploring, learning and seeking challenges, change and excitement. In other words, activities and goals set by intrinsic motivation do not rise from external pressures but are initiated from person's own will and curiosity. For instance, game-like settings can be utilized to enhance aspects of intrinsic motivation to learn practical things by appealing to individuals' fantasies and playfulness e.g. as described by VENKATESH (1999). Also BLYTHE, et al. (2006) describe how fictional scenarios can be used to influence product perceptions. Extrinsic motivation, on the other hand, has its origins in externally attained values, demands, requirements or norms. **Picture 3** shows a diagram categorizing among intrinsic and extrinsic motivations as well as amotivation described by RYAN and DECI (2000). From the user experience perspective, the concept of motivation is extremely important as it can be seen as one of the main drivers for people becoming interested and attached to some particular products which intensify their experiences and potentially contribute to satisfying their psychological needs. Authors also argue that fulfillment of these core psychological needs lead to enhanced self-motivation and overall well-being. Before going into elaboration on these basic psychological needs I want to return to the abovementioned feedback loop model and discuss what factors could be considered as reference values in that process.



Picture 4 demonstrates hypothetical hierarchy of goals. System concepts refer to top level goals such as desired self, Principles (be-goals) refer to higher-level goals such as becoming a more likeable person, Programs (do-goals) can be seen as means to reach be-goals such as greeting and smiling to people. Sequences (motor control goals) are fragments which form do-goals e.g. reaching arm to shake other person's hand. Source CARVER and SCHEIER (1998).

How feedback reference values or states are formed and what is their relation to experiences? First of all, it is important to note that there is no single answer or logic and multiple hypothetical models can be used to assess these questions. Here I present one of the possible approaches, which is based on hypothetical hierarchy of goals (CARVER et al., 1998). Goals can be considered as ultimate reference values for the feedback loop process as they often serve as a base for assessing whether some action or behavior led to becoming closer or further from that goal. For example, one goal could be thought of as owning a car whereas another goal could be formulated as becoming a gentler person. After the goal is formulated in person's mind, it can be divided into subcategories consisting of sequences of actions. As in the example with a goal to own a car, following action sequences could consist of saving money, reading car magazines to compare prices or evaluations and asking friends for hints or opinions. On the other hand, the goal to become a gentler person is rather abstract and can be attained to through other less or more abstract goals in addition to concrete action sequences. For instance, being friendly to strangers can be seen as contributing to the goal of becoming a gentler person. However, the principle of being friendly itself consists of such functions as smiling, controlling gestures and tone of voice as well as paying attention to what another person is doing. These functions become somewhat automatic with time when a person has adapted the goal of becoming a gentler person. Abovementioned examples were drawn to demonstrate that goals may vary in their level of abstraction thus suggesting possible classification by this parameter. Hypothetical hierarchy of goals is presented in **Picture 4**. It must be mentioned that same subordinate goals can contribute to several superordinate goals as well as some superordinate goal might be achieved by various subordinate goals or action sequences. It is also important to say that some goals might be more salient and conscious than others and vary according to their time horizon (e.g. some goals might be approximated throughout the whole life of an individual). Elaboration on links between different levels of goals is limited in this paper and it is also subject to a debate within fields of psychology and cognitive sciences. The relevancy of the goal hierarchy model for this study can be seen as follows. If it can be assumed that there are multiple levels of goals reaching from concrete to very abstract, there can be also a set of product attributes and qualities that might contribute to these goals on different levels. In other words, if a product is used as part of some action sequence (e.g. hammer is used to drive nails) it can simultaneously contribute to particular

higher-level goal (e.g. driving nails with this particular hammer contributes to one's goal of becoming a better builder). Keeping in mind the self-determination theory and motivation concept, it can be argued that different goals are set based on different types of motivation. However, as time goes by, the nature of motivation for attaining these goals might change as well as goals themselves. For instance, an individual who strives to achieve some goal set by intrinsic motivation might receive continuous positive feedback on her progress, which might gradually transform the nature of motivation toward extrinsic motivation for this goal (RYAN, and DECI, 2000). This might be an interesting point to keep in mind when considering human-product interaction, because the aim of enhanced user experience is mostly related to feeding intrinsic motivation. It is also important to note that the nature of motivation might be closely linked to whether acquired goals reflect communal, personal or self-representational aspects (CARVER and SCHEIER, 1998). As a hypothetical example, a person can be intrinsically motivated to attain to some particular goal (e.g. becoming an opera singer). However, if that person considers opinions expressed by other people regarding this goal, he might adjust his behavior according to these opinions. This in turn will lead to accounting for self-representation motives and shift toward extrinsic motivation (e.g. becoming a rock artist instead).

Taking another point of view, concepts of motivation and hierarchy of goals are closely linked to the underlying arguments of the *activity theory* (Originating from cultural-historical psychology by Lev Vigotsky), which describes human activities as phenomena consisting of complex behavioral systems influenced by various social and cultural factors. The basic idea behind the activity theory lies in considering human activities as determinants for all phenomena related to development of human mind as such, instead of looking solely at predetermined object or subject qualities. In other words, human mind is assumed to be shaped by its perceptions and interactions with the external world (i.e. with objects in a broad sense – tangible or intangible). What comes to the formation of goals and motivation from the perspective of the activity theory, they are viewed as products of the very nature of human-world interaction. Objects, in a broad sense, are seen as motives for all activities exercised by individuals (Subjects), who then divide these activities into more concrete actions. Actions are directed toward particular conscious goals which do not necessarily have a direct connection to the ultimate

activity but might have a much more complex indirect relationship. This idea becomes clearer with an example. An ultimate activity of an individual relates to increasing her social status (Motivating object). This activity might not be clearly formulated in her mind due to relatively high abstraction level, but she has formulated a set of more concrete and conscious goals which are estimated to contribute to this activity. For instance, having high education level, acquiring respectable position in a known company and wearing fashionable clothes can be considered as concrete goals directly connected to the ultimate activity. On the other hand, asking her colleagues for references, building personal connection networks and avoiding negative publicity are all indirectly connected to the ultimate activity and can be considered as parts of a complex goal attainment system which is typical only for humans.

Although motivation is often considered from the perspective of separate individuals, it is also a prerequisite for social interactions involving groups of individuals and possible artifacts (e.g. industrial products). In respect to main objectives of this paper, the core interest concerning activity theory and concept of motivation lies in touching a subject of social (Between subjects) and physical (Between subjects and objects) interactions in B-to-B environment. In their book, KAPTELININ, et al. (2006) elaborate on how the activity theory is implemented in the field of HCI and what are the possible benefits of this approach. It is important to note, that from the practical stand of UX implementation, activity theory approach is in place, because it does not limit the analysis of behavior to individual subject or object properties but accounts for social implications of group behavior and interactions between people and artifacts. For example, when analyzing experiences related to some particular industrial product, it is of outmost importance to include aspects of cultural and social meaning of these products for involved individuals and individual groups. As will be noted in following paragraphs, social and communal aspects are in the core of some basic psychological human needs and thus form indistinguishable parts of UX paradigm. I try to take this aspect into consideration when constructing questionnaire modules for capturing user and customer experiences. Because this study does not concentrate on detailed elaboration and implementation ways of different theoretical approaches, discussion on activity theory principles will not be taken further in the following context but some aspects of this approach are apparent in the thinking model presented later in this paper.

Class 1

- Competence - effectance — e.g. taking on and mastering hard challenges
- Relatedness - belongingness — e.g. a sense of being connected with people
- Autonomy - independence — e.g. choices are based on true interests

Class 2

- Pleasure - stimulation — e.g. experiencing new sensations and activities
- Popularity - influence — e.g. influencing other people
- Self-actualization - meaning — e.g. a sense of deeper purpose in life
- Security - control — e.g. life is structured and predictable
- Physical thriving - bodily — e.g. a sense of physical well being

Class 3

- Self - esteem — e.g. feeling of self respect
- Money - luxury — e.g. possibility to buy and own possessions

Picture 5 shows basic psychological human needs (SHELDON, et al., 2001). Three classes represent respective relevance of needs based on classifications by SHELDON, et al. (2001) and HASSENZAHN, et al. (2010). Physical thriving is allocated in Class 2 because it is assumed to appear as more salient need in an industrial environment.

2.2.3. Psychological needs and affect formation

Coming back to self-determination theory and basic psychological needs, RYAN and DECI (2000) indicate three of such needs which are most saliently related to increased well-being when fulfilled. These three basic needs include *autonomy*, *competence* and *relatedness*. Briefly described, need of autonomy relates to being able to make choices based on one's own interests and values, do things in one's own way and feeling that choices express one's true self. Competence need is linked to the feedback on how capable one is in performing difficult and demanding tasks, taking on and mastering new challenges and overall success in undertaken actions. Relatedness, on the other hand, concerns the need to be connected to people who care for and are important for oneself. It is argued that fulfillment of these psychological needs is of the utmost importance regarding human well-being. Several studies confirm this argument and also indicate other psychological needs that might play an important role for individuals' perceived quality of life. SHELDON, et al., 2001 indicate ten basic human needs which include self-actualization, physical thriving, stimulation, luxury, security, self-esteem and popularity in addition to the three abovementioned needs. Authors find that the most salient needs are the same as indicated by RYAN, et al. (2000) but also self-esteem plays an important role. Later, HASSENZAH, DIEFENBACH and GÖRITZ (2010) take seven of the abovementioned ten needs into consideration. Self-esteem, luxury and physical thriving were excluded from their list because of their relatively low salience in respect to consumer product use or because they can be seen as sub-products of other needs (e.g. self-esteem might result from fulfilled need of competence). **Picture 5** shows basic psychological needs roughly divided into three classes by their assumed importance in product experiences in an industrial environment. Although HASSENZAH, et al. (2010) excluded physical thriving from their need list, I believe that this need might become more relevant when considering operations and products in an industrial environment. This is based on the assumption that salience of needs might differ according to the environment in which they are assessed. For example, a factory worker might experience positive affects by recognizing that the working environment contributes to his health or that the machinery he uses takes into account his physical condition. But how affects are formed and why similar situations and product attributes might result in completely different affects? Further I describe one hypothetical way to think about affect formation and how it might be related to the feedback loop model.

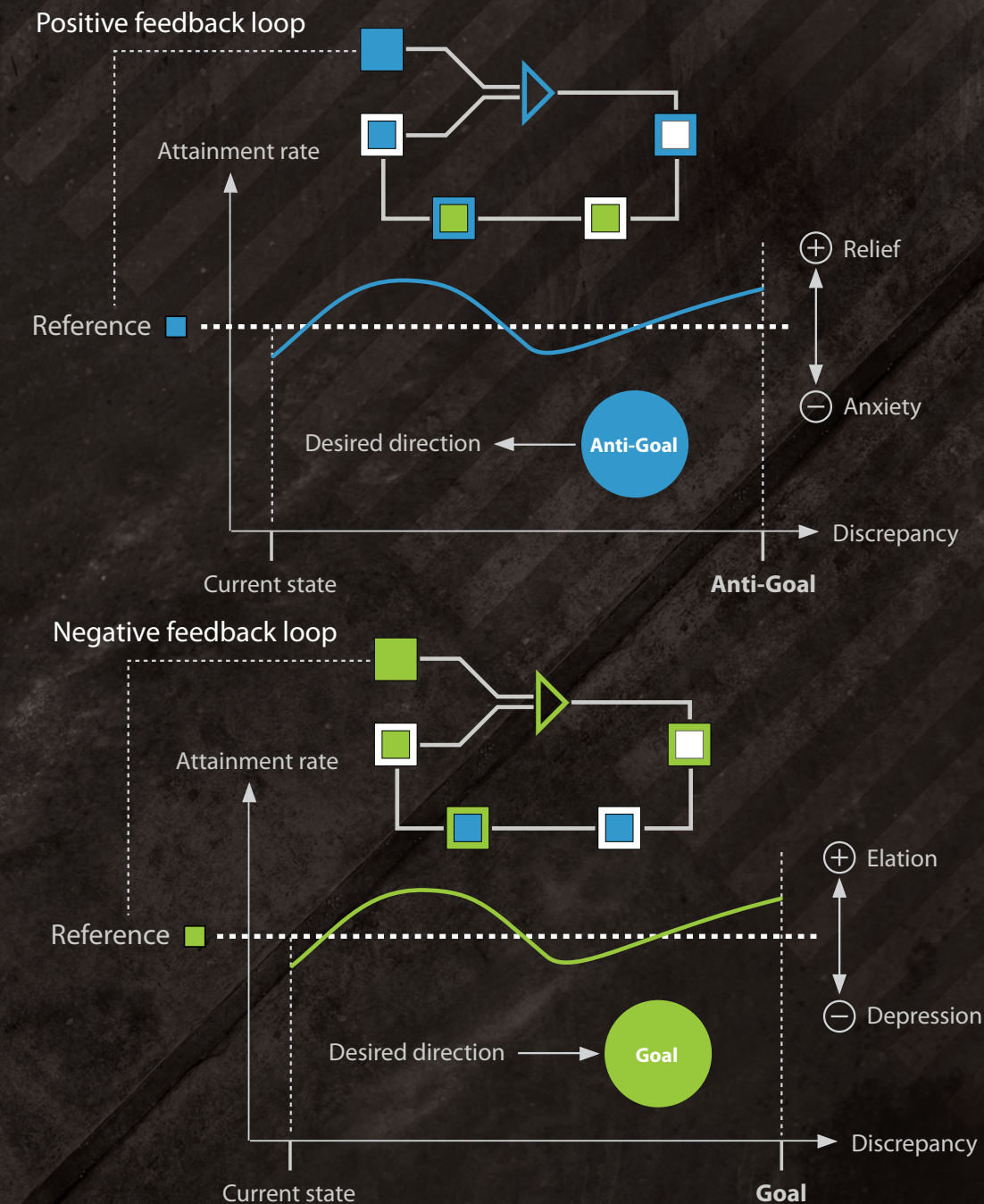
As described in the previous paragraphs, the feedback loop thinking model can be used to approach the process by which individuals might adjust their behavior based on established reference values. However, behavior implies some action whereas affects can occur without any following action. To put it other way around, feedback loop process may take place even if there is no obvious link to behavior and act on a meta-level of individuals' cognition. CARVER and colleagues (1998) propose that one possible explanation for affect formation is related to the *attainment rate* of goals. In this sense, individuals are thought to compare the rate at which some particular goals are attained to predetermined reference value for that rate. Perceived success or failure in attainment rate results in respective emotions. A simplistic example can be presented as a storage space where the worker pursues his goal to serve ten lines of shelves during one day. This person then compares the number of shelves he has served during few hours to see whether this service rate corresponds to the goal to serve ten shelves per day. Depending on whether the service rate exceeds or falls below reference rate, the worker experiences positive or negative affects. The abovementioned example is of course overly straightforward and the shelf serving goal lies in the domain of do-goals (or actions if considering activity theory terminology). Despite this, in the case of more abstract goals (e.g. be-goals) the feedback loop thinking model applies as well, but the reference for the goal attainment rate is not necessarily related to time or other countable factors. For instance, if one person has a be-goal to become more autonomous in his work, the reference for attainment rate might be thought in terms of relative responsibilities and freedoms he receives over the course of his life. Here we can draw one aspect from the activity theory describing the relativity of perceptions i.e. placing all individual perceptions on a two-dimensional scale of opposite known extremes (e.g. soft - hard, pleasant – unpleasant, good – bad). From this perspective, feeling of autonomy depends on currently prevailing perception of autonomy states of peers or other parties known to the individual. This means that the attainment rate reference is not static and will shift once an individual becomes aware of other autonomy states, adjusts his peer group or changes the nature of his work. An interesting point mentioned by CARVER, et al. (1998), is that individuals tend to reduce their effort once attainment rate has been exceeded for some goal. On the other hand, individuals strive harder to reach their reference attainment rate if it has been falling behind. It is peculiar to note, that the tendency of individuals to

strive harder when underachieving some goal and taking it easier when overachieving it, might be linked to the loss aversion phenomenon described in the *prospect theory* introduced by KAHNEMAN and TVERSKY (1979). Plainly put, individuals seem to react to losses more than to gains as well as feeling suffering of negative outcomes more keenly than rejoicing over positive outcomes. Partial explanation to this might be seen in our biological roots and the urgency to avoid danger before being able to start thinking about acquiring pleasures. This phenomenon becomes important from the user experience point of view when one considers qualities of products which are related to prevention and safety.

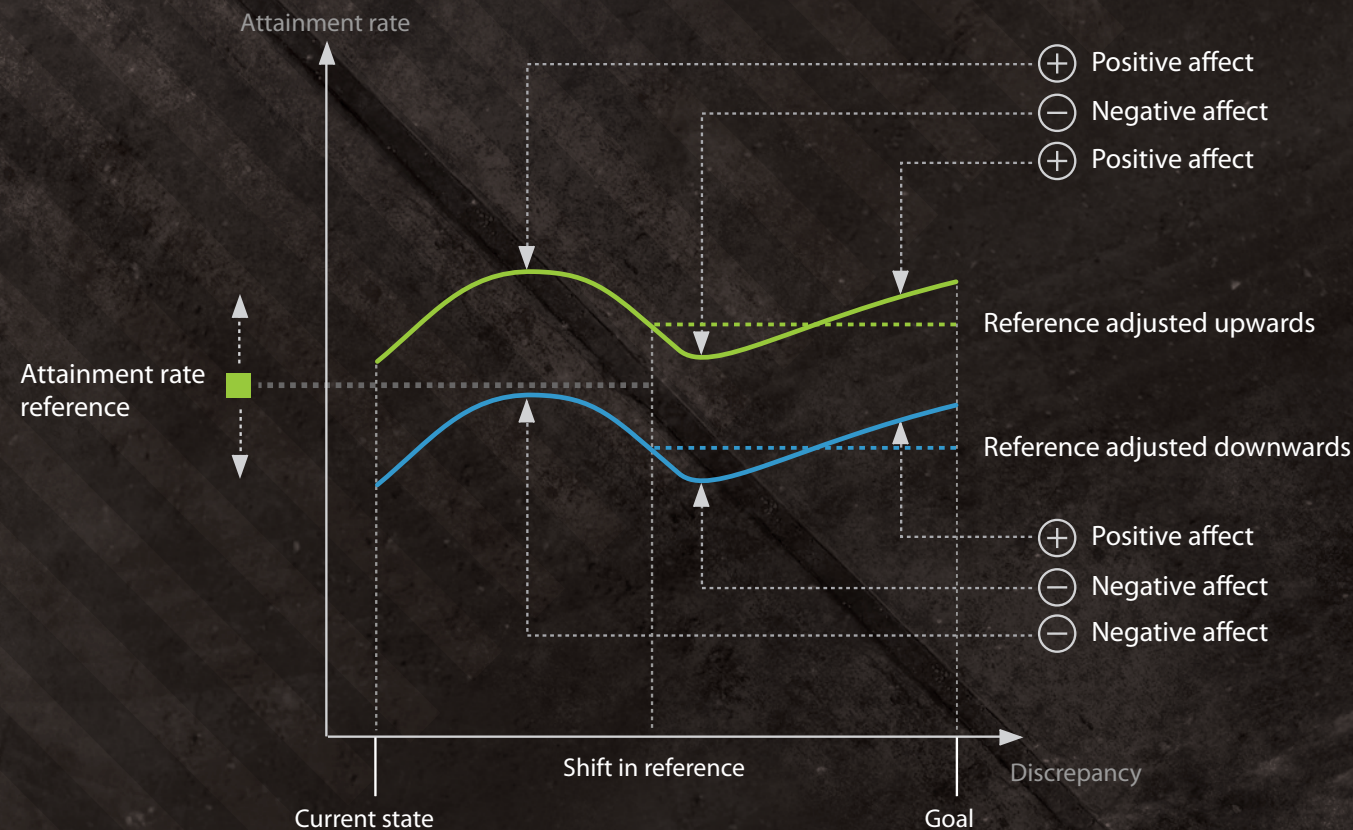
It must be remembered that not all goals set by individuals lead to psychological need fulfillment and might even result in quite the opposite outcome (e.g. setting pursuit for money as the primary goal might lead to diminished overall well-being in the case of some individuals). Looking back at self-determination theory, motivation can be considered as a driving force for setting goals and determining what “kinds” of goals (and anti-goals) are set and why. This is one of the reasons why it is essential to begin determination of relevant product design criteria by looking into possibilities to create right motivations for individuals who will use these products. By “right” motivation I refer to extrinsic and intrinsic motivations that are in the self-determined side of the regulation scale (Integrated and intrinsic regulation, **Picture 3**). It must be also remembered that the motivation itself is only a manifestation of the ultimate object (Tangible or intangible) which is pursued through interactions with the world. If successful, self-motivation will lead to attainment of goals that potentially fulfill individual’s psychological needs and elicit positive experiences on the way. I will later come back to this issue to describe how the experiential potential of product design ought to be complemented by expectation building and coherent product image reassurance through other means beyond sole product feature development.

2.2.4. Dual nature of goals

So far I have been talking about formation of positive and negative affects as resting on a two-dimensional scale despite the dual nature of the feedback loop process. Nevertheless, this duality is central to understanding how different types of affects might be formed. **Picture 6** shows basic idea behind attainment rate in cases of positive and negative feedback loops and **Picture 7** shows how this



Picture 6 shows basic principles behind attainment rate reference with positive and negative feedback loops.



Picture 7 shows how positive and negative affects can occur with possible shifts in attainment rate reference.

attainment rate can result in negative, positive or no affect. Applying this setting to emotions elicited by products, an example might be thought of as some product contributing to individual's goal attainment rate (a positive affect from elation) or improving rate of moving away from some undesired state (a positive affect from relief). Keeping in mind that the intensity of affects depends on the perceived attainment rate change, it is important to point out that affects are not uniform with negative and positive feedback loops. As mentioned earlier, the tendency of individuals to feel losses more than gains influences their behavior as well as the intensity of the affect. In other words, individuals striving to avoid some particular state (Anti-goal) might experience much more intense positive affect from relief when coming further away from that anti-goal than individuals experiencing elation from coming very close to some desired state (Goal). This would mean that people are able to experience positive emotions with both positive and negative real-life situations but also that individuals might turn objectively neutral states into subjective positive mental perceptions (e.g. relief from escaping stressful situation and returning to one's normal state). Trying to define and account for different types of individuals' goals and anti-goals might be useful for creating basis for manipulating experiences through introduction of more salient links between subjective perceptions and embedded product qualities. This is especially important when considering working environment where the use of industrial products is mostly associated with extrinsic motivation.

2.2.5. Behavioral biases and heuristics

Next paragraphs present a rather limited introduction of behavioral biases and heuristics which influence individuals' decision making and product perceptions. Most of these issues rise from behavioral and neurological studies and are closely linked to supporting the proposed statement that B-to-B and B-to-C environments must be considered separately in respect to UX implementations. Behavioral biases are usually empirically identifiable shifts in behavioral tendencies which rise from mental context as well as surrounding environment. Behavioral biases are often brought up when trying to explain individuals' decisions or choices in specific conditions. A limited number of these concepts are presented below and it might be interesting to consider these ideas in more detail when talking about differences in perceptions of separate individual groups within B-to-B environment.

Bounded rationality

The concept of bounded rationality refers to restrictions of individuals' ability to make rational decisions because of various constraints including time, available information, cognitive abilities etc. (See KAHNEMAN, 2002). Taking this into account means that logic and rationality based models (e.g. utility maximization theory) cannot fully capture decision making processes and thus are rather limited tools for making predictions or interpretations of human behavior. Another way to think about bounded rationality is that most individuals are rationalizing rather than rational in their behavior and their perceptions (weighting) of probability, value, optimization etc. is distorted and frequently far from reality dictated by logic and scientific theory. Many biases are extensions of the bounded rationality concept. Bounded rationality is linked to adaptive bias which results in a tendency to minimize the probability of severe errors at the expense of increased number of less severe errors. This is mostly due to individuals' limited cognitive capacity. For example, when making a large investment in capital items such as a paper mill, estimating wrongly that this mill pays itself back in two years even if it does not (Type I error) will result in much greater impact than estimating wrongly that this mill does not pay itself back in two years even if it does (Type II error). This behavioral bias has probably developed during a very long period of time as part of a survival instinct. Taking into account UX approach and its application to product development and marketing, the key challenge is related to providing hard proof of benefits of this approach in order to lower the threshold associated with making Type I errors. Some potential ways to alter this behavior might be seen in priming tools or relativity decoys in the form of indirect marketing material. Another behavioral aspect already mentioned in earlier discussions is related to loss-aversion of individuals. This means that losses are generally weighted more than gains when it comes to making decisions under uncertainty. This bias might be also considered as carrying a compound of bounded rationality as it has limited knowledge in its origin. Effects of this phenomenon could be empirically shown in cases involving individuals' decision making. A classic example used to demonstrate this bias involves a bet situation with positive expected outcome but individuals consequently choosing not to bet. Another more abstract example can be drawn from real-life situations where customers tend to choose partners and suppliers they are familiar with although other partners and suppliers might be in fact much more

reliable or cheap. Same applies to selection among company brands or product types. In these cases individuals might value familiarity as it carries a mark of implicit certainty, whereas taking a novel path requires stepping into realm of uncertainty although every countable fact would support this path. This example highlights only one facet of a multifaceted phenomenon of loss-aversion. Rationalization and hard proof are only partial components of decision making process and other more implicit factors such as habits, cultural heritage, religious customs and personality traits play an essential role.

Two system approach

The reason why 2 System approach (KAHNEMAN, 2002) is relevant from the perspective of this paper is that it may be used to explain why some particular communication methods are more efficient than other in particular situations. In brief, this approach considers decision making process as consisting of two different states or systems. System 1 (S1) is related to fast, automatic and effortless associations and perceptions whereas System 2 (S2) monitors S1 and is responsible for slower, controlled and effortful operations. The main assumption is that people are not inclined to exhibit additional cognitive effort if the benefit of doing so is not salient enough and thus often rely heavily on outcomes from S1. This does not mean that people are lazy or incompetent by nature but the reason might lie in primordial instincts requiring concentration only on relevant things from the point of view of survival. S1 is also closely related to intuitive judgment and accessibility concepts. For instance, in a grocery shopping situation, a quick estimation of the final price for the whole basket is made based on previous shopping experiences and fast overlook of the basket contents. An exact calculation of the final price is not necessary because the correctness of the outcome might not have any significant impact on individual's well-being. In this case, an individual might rely on the S1 to create fast estimates with reduced reliability of outcomes. However, if the similar task of estimating the final price of a grocery basket was given in a matriculation exam, an individual would probably put much more emphasis on actual arithmetical calculations trying to derive an exact answer. In this case S2 would be involved to a much greater extent than S1. This concept can be linked to the learning process and the activity theory. If some goal driven actions require attention and operation of the S2 in the beginning of the adaptation, they will become automatic with repetition and later require only minor involvement of S1. An intriguing topic might be initiated

from discussing how this shift from S2 to S1 (e.g. learning and adaptation of technologies or product qualities) in product related activities influences the gradual recession in positive emotions if there are no change, progress, customization or surprise qualities involved. However, this discussion is saved for later sections (**Section 2.4**).

Framing effect, Salience and Availability heuristics

Framing effect captures the tendency of individuals to make decisions and judgments based on the way in which the problem or situation is framed. In other words, individuals rely heavily on their mental filters to derive judgments not realizing that the same situation or problem presented in slightly different form with same probabilities and outcomes will result in very different judgments. This behavioral bias is widely confirmed and its potential for manipulations in information transfer is utilized, among other fields, in politics and marketing. However, framing should not be labeled with negative associations because it is apparent in everyday life even without external manipulations. Salience and availability heuristics on the other hand are related to prioritizing and overweighting recent, more familiar, recognizable and understandable information compared to relevant but less salient (available) information (Causality effects might be established to selective perception, anchoring effect and hindsight bias). Making decisions based on more salient information may often lead to suboptimal outcomes and judgment errors. From the perspective of potential communication challenges between separate departments within a company, salience can be accounted for by analyzing different parties and information they regard as more relevant or important from the point of view of their field or area of specialty. The availability heuristic is also related to the concept of myopia, which can be described as failure of individuals to make long-term decisions but instead concentrating on short-term optimizations. In other words, myopic decisions imply relatively short optimization horizons. For example, HSEE, et al. (2006) describe how individuals often fail to make decisions that would make them happy in the long-run by underestimating or overestimating their forthcoming emotional states (See also DIEFENBACH and HASSENZAHL, 2011, for hedonic product quality rationalizations). Sometimes marketing strategies utilize this tendency in pursuit of increased short-term sales at a cost of longer-term customer satisfaction but long-run success of such strategies is rather doubtful.

Examples presented in previous paragraphs demonstrate only a small fraction of aspects related to mental constructs. However, the idea of going through these concepts was not only to scratch the surface of psychological theories but to identify relevant basis for linking cognitive processes to product attributes as well as pointing out that these attributes are only partial prerequisites for conveying UX paradigm. For instance, pointing out possible classification of different abstraction levels of goals, potential causes for affect formation and distinction between different sources of motivation is used further to formulate proposed tools for capturing and conveying UX. The next step is related to classification of product qualities and elaboration on how they might elicit emotions based on abovementioned discussions.

2.3. Product qualities and user experience

Previous sections described some theoretical aspects behind human behavior and possible mechanics of affects. However, from the perspective of industrial design, the most interesting question relates to defining concrete features of products that can be seen as eliciting certain types of affects. Further I elaborate on possible ways to categorize product qualities and link to previously discussed mental constructs.

2.3.1. Product quality categorization

Connecting product features to experiences is a tedious task for multiple reasons. Separating effects of different product qualities alone requires carefully planned, prolonged and controlled experiments. In addition, as noted earlier, product qualities and varying context walk hand in hand when product related emotions take place, thus making assignment of experiences to particular product features nearly impossible. However, generating sets of probable scenarios simulating usage contexts as well as categorizing product qualities might be useful in trying to reduce context related uncertainty in the view of experience design. For example, CRILLY, et al. (2004) provide a basic setting for connecting product qualities to their interpretations and behavior. In his book, NORMAN (2004) indicates three types of product qualities: Visceral, behavioral and reflective. Visceral product qualities are ones that can be

perceived from a distance and interpreted with relation to the surrounding environment. For instance, visual appearance, sound and smell can be described as visceral product qualities. These qualities are especially important in creating first impression of products and for this reason such perceptual stimuli are widely utilized in commercial marketing for communicating desirable product images. FENKO, et al. (2011) explore visceral product qualities in respect of noisiness and find that sounds and noises play an important role in product perception alongside visual stimulus. Behavioral product qualities determine actual product use i.e. how the product behaves and responds to user's actions. For example, usability and functionality can be considered as behavioral qualities of a product, because these factors determine whether this product fulfills its intended function and how well it does this. Touch and feel are also essential parts of behavioral product qualities and they add to visceral qualities by providing broadened sensual experience of products. The final product quality category is linked to product related associations, expectations and interpretations. Reflective product qualities are often context related and become more or less salient depending on a multitude of cultural and habitual factors. For instance, some product might remind its owner of pleasant memories from the past. On the other hand, more general associations with surrounding environment, such as pleasant sound of a water stream or warmth of a morning sun, are less personal. Simulating and embedding these associations in products might be thought to result in a more controlled effect, however, even these presumably general associations are often hard to replicate in products. Coming back to the article by DESMET and HEKKERT (2007), three types of product related experiences are indicated (Aesthetic experience, experience of meaning and emotional experience) and these might be seen as resulting from previously described product qualities. For example, aesthetic experience might be due to visceral product qualities as well as behavioral qualities and experience of meaning might be due to reflective product qualities. SCHIFFERSTEIN, et al. (2008) describe elaborately how product qualities do not in themselves produce emotions but experiences are derived from the meaning that an individual assigns to these qualities. Another way to categorize product qualities might be to divide their properties to appeal, pragmatic and hedonic qualities (e.g. HASSENZAH, SCHÖBEL and TRAUTMANN, 2008). Appeal factors include many properties implied in visceral product features such as aesthetic qualities. However, these factors take into account more holistic product perceptions such as goodness and attractiveness of products rather

than only initial impressions. This issue relates to discussions on perception of beauty in objects e.g. HASSENZAH (2004) argues that visceral beauty in experiences does not exist because visceral perceptions are based on spontaneous affect responses (See also relevance to System 1 in KAHNEMAN, 2002) and cannot be comparable with satisfaction or love. Pragmatic product qualities carry functionality and usability traits. For example, if some product is described as clear, controllable and familiar, it can be interpreted as to include these positive pragmatic qualities. However, if some product is described as exciting, original and impressive, this description refers to hedonic product qualities. Hedonic qualities in general involve aspects that bring additional pleasure from observing, utilizing or expecting utilization of products. Referring to previously discussed granularity of UX, it is hard to determine directly whether some particular product qualities contribute more or less on certain levels of granularity. For example, in the case of visceral product qualities the first impression can be expected to influence anticipations of future use of this product (This is especially relevant in the beginning of the UX time span). However, it all depends on the salience of particular visceral factors and the overall message behind the product that determines whether anticipations become related to particular functions of the product or the overall self-image when owning this product. Such experience building nuances are mainly considered on a macro level of marketing and R&D.

No matter in what manner product qualities are categorized, this categorization serves some concrete purpose. One such purpose could be to analyze existing products to see what qualities are appreciated by users and which qualities need improvement. Another useful aspect behind product quality categorization might be seen in R&D process where developers try to identify specific qualities to be embedded in a completely new generation of products. Part of these qualities can be derived from similar product families, some might be taken from seemingly unrelated products with similar context and some are derived from research and theoretical frameworks. Of course, identifying and compromising between different product qualities to be implemented is never a trivial task and it is often a debatable topic between different departments within an organization. The third purpose of categorizing product qualities, which is also emphasized in this study, is to determine differences in values and attitudes of individuals who are involved with the product at some stage. For instance, these individual groups

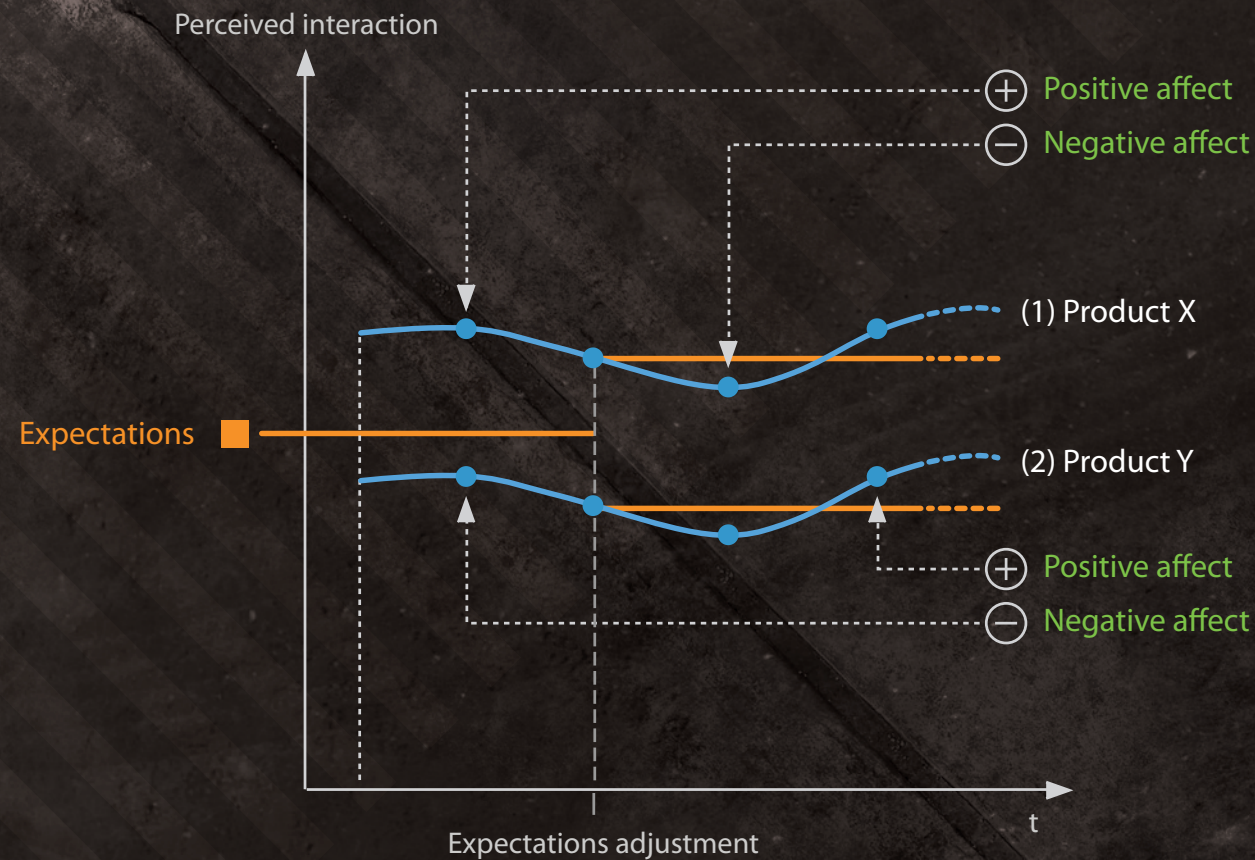
include different departments of manufacturing organization, external consultancies and advertisement agencies, retailers, dealers and finally customers and end-users of products. All of these parties place their own influence on forthcoming product image, properties and supporting systems (e.g. product related services). These factors are an essential part of product innovation process and some of product feature related particulars are described in the article by RINDOVA, et al. (2007). For instance, it is emphasized that associations with similar and earlier products play an important role in creating first impressions and further product experiences. Another crucial aspect of innovation lies in maintaining the delicate balance between innovation and familiarity e.g. radical innovations to product appearance or functions might result in negative experiences due to habitual expectations and presumptions (In this respect it is important to account for time span and granularity of user experience). Further paragraphs present a thinking model for possible practical implications of UX.

2.3.2. Model of product emotions

Previous sections contained mentions about theoretical models which attempt to describe how product qualities are linked to experiences. DESMET and HEKKERT (2007) show a basic framework where concern and product are linked to emotion through appraisal (**Picture 8**). Roughly put, concerns in the model of product emotions by DESMET, et al. (2007) can be interpreted as sets of goals or needs with different abstraction levels. Appraisal might be seen as a cognitive process by which basic psychological needs are ascended on with actions which might be supported by particular products and their features. Most importantly, the model indicates that product qualities by themselves do not elicit emotions but require realization of link to “concerns” i.e. individuals must create cognitive evaluations of specific product qualities which can be perceived as helpful in attaining to particular goals or targets. As noted earlier, there can be various ways to categorize product qualities (e.g. visceral, behavioral and reflective) and different categories might have varying effect on the cognitive appraisal process. It is the combined effect of appraising different qualities which results in product related emotions. However, it makes sense to elaborate whether there can be certain qualities that are more important in the initial stage of product use and on the other hand if some features become increasingly important in the long-run. KARAPANOS, et al. (2010) describe possible phases of product adaptation which are put into a



Picture 8 depicts a model of product emotions by DESMET and HEKKERT (2007). The idea is derived from Appraisal theory which states that emotions are elicited when individuals evaluate specific events or products. In this sense, similar events and products can result in different emotions with different individuals depending on their interpretation (appraisal) of the event or product.



Picture 9 depicts how positive and negative affects can occur when expectations are exceeded or not met. A blue line presenting (1) Product X shows how expectations are exceeded at first causing positive emotions, but with time when expectations shift upwards negative emotions can occur. Blue line representing (2) Product Y shows how expectations may shift downwards after being not met at first, but afterwards positive emotions can occur if the new expectation reference is exceeded.

proposed framework of Temporality of experience. This framework presents three main driving forces behind product adaptation: Familiarity, functional dependency and emotional attachment. This model is relevant as it accounts for time dimension of UX and can be brought up when discussing longitudinal measurements of user experience described later in this paper. Anticipations and expectations are in the center role of the Temporality framework. In a sense, expectations factor might be regarded as some kind of an anchor or reference value for experience formation. Similarly as discussed earlier with feedback loop process and goal attainment rate models, expectations can be seen as reference values for product emotions. This idea is sketched in **Picture 9**. In a nutshell, the idea lies in the continuous comparison between expected and actual product use (More elaborate presentation of this idea can be found in hypothetical thinking model in **Section 3.3**). For simplicity, this can be regarded as a feedback loop process where expectations act as reference values for product use. Positive and negative product emotions arise when the expectation reference is met or not. Obviously, expectations are continuously in motion and shift with time. For example, advertisement material influences expectations of product use and perceived product image, but when the product is actually purchased and utilized, expectations are adjusted accordingly. Another example of expectation adjustments might be drawn from substitute products. If there are new substitute products available in the market and these incorporate innovative qualities, individuals' reference (or desired state) for this product category might shift upwards, thus making older products lagging behind and delivering less positive emotions. Of course, this example neglects possible product attachment and the influence of reflective product qualities e.g. pleasant memories and associations. However, important point to be taken from abovementioned examples is that expectations can be adjusted internally i.e. when users adapt the product with time, discover new features and are able to use this product in different contexts; or externally i.e. users compare these products to available substitutes and their suitability for attaining newly occurring or shifting goals.

2.4. Practicalities for UX implementation

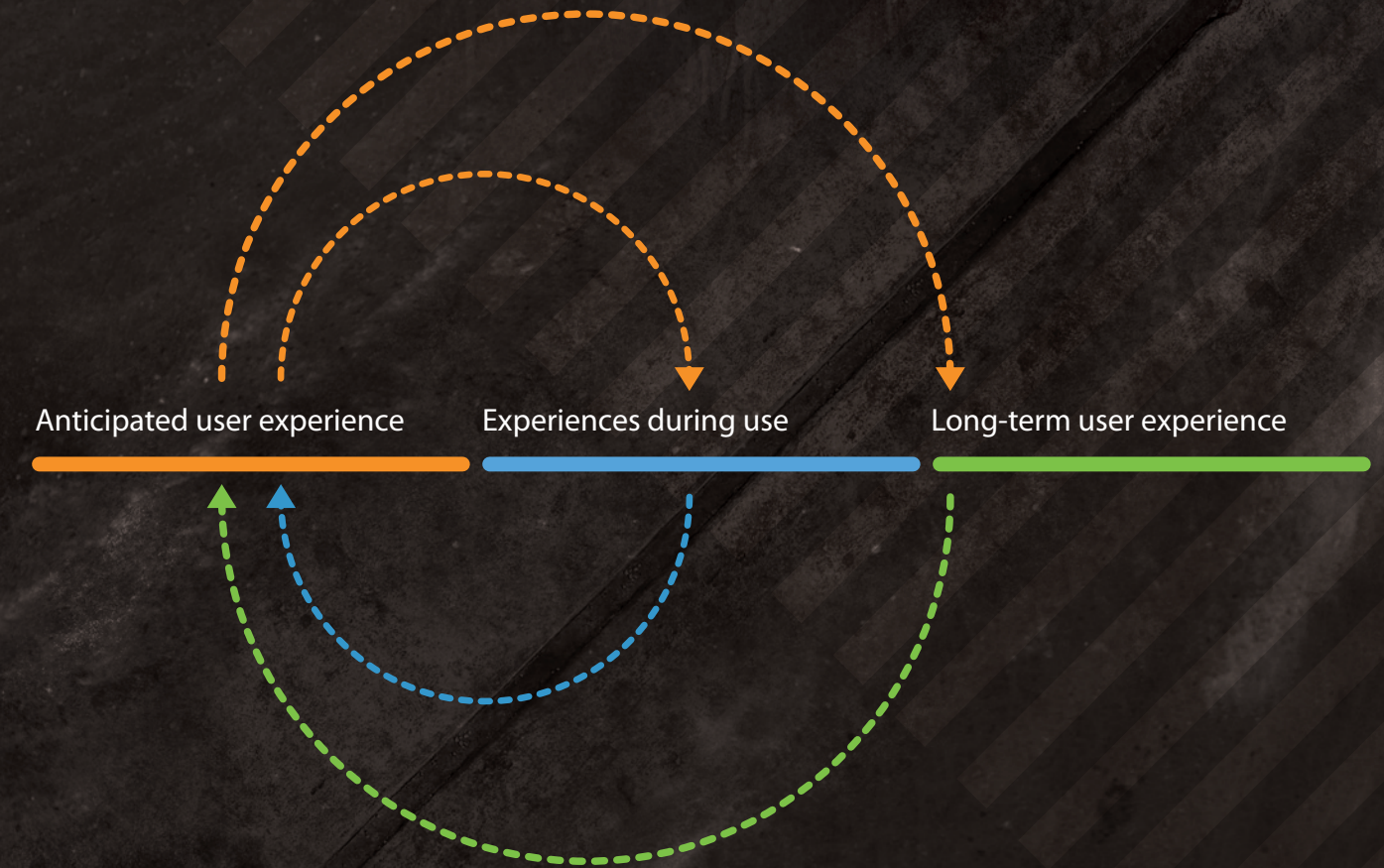
Previous sections were ascending on user experience paradigm from perspectives of mental constructs and product quality categories on a somewhat abstract and general level. Following discussion is aimed

at clarifying ideas stated in previous paragraphs by formulating potential for practical implementations of user experience paradigm in product development. This is done mainly by identifying dimensions of UX and describing levels at which this paradigm can influence company operations.

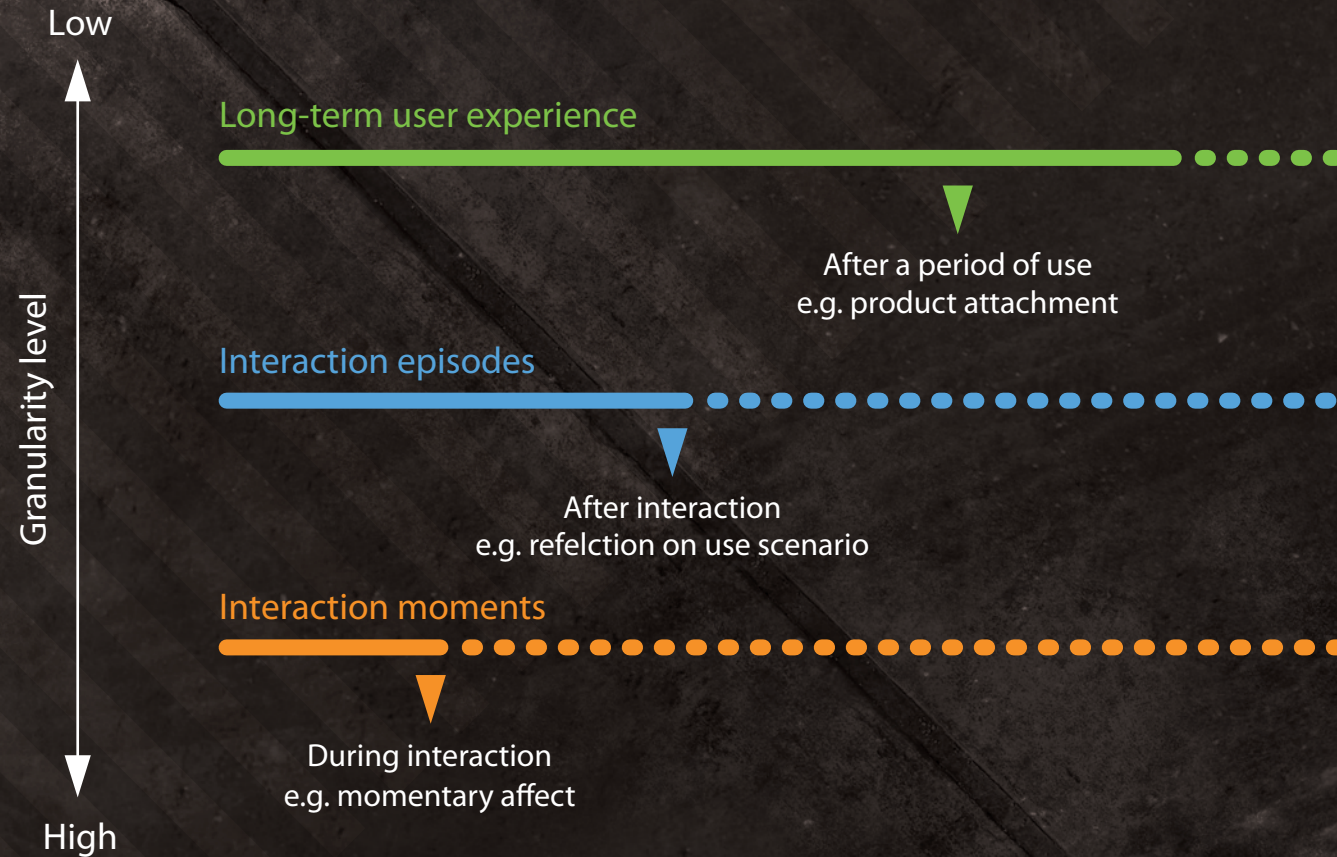
In addition to different ways to approach experiences, other aspects of UX which require clarification are the time span and granularity of experiences. By the time span of user experience I refer to the cycle during which particular product related experiences occur. This cycle might include experiences related to anticipation of use and expectation formation, experiences related to learning to use the product and long-term user experience. **Picture 10** tries to capture the main idea behind user experience time span. For example, this idea serves as a base in the paper by KUJALA, et al. (2011). Taking time span into account is especially important in experience design because it determines for which phases and in what situations positive experiences might be elicited (See KARAPANOS, et al., 2010). It is also an important factor for moving away from speaking of general experiences and creating links to more concrete usage scenarios. Another aspect of UX is related to granularity of experiences. This might be to some extent interpreted as hierarchical order which reaches from momentary experiences (e.g. pushing a button) to long-term experiences (e.g. feeling of trust in technology in relation to some particular product). Granularity of user experience is depicted in **Picture 11**. This aspect might be also seen as an additional dimension for analyzing product related experiences and this issue will be brought up when I elaborate on product quality categorizations in Section 2.3. Following section will address hypothetical models of emotions from the point of view of psychology.

2.4.1. Different levels of UX implications

Comparable with previously mentioned identification of several dimensions of user experience, it is also justified to elaborate on what are the possible dimensions of UX implications on the organizational level. When speaking about UX in product development context, it often arrives at discussions which hypothesize on various ways to establish links between product qualities and experiences. This might be seen as a reasonable goal because this potential link would allow designers to embed combinations of certain product features with expected experiential outcomes. However, it must be kept in mind that the



Picture 10 captures the idea behind time span of user experience paradigm with anticipated, during use and long-term scopes of UX. This picture demonstrates that all three areas are interlinked and have an influence on one another.



Picture 11 shows typical granularity levels for UX paradigm. Interaction moments are at high granularity of UX and can be considered as experiences from pushing a button or touching a surface. Interaction episodes are at mid-level of UX granularity and consider complete episodes of human-product interaction e.g. lifting a load with a forklift or starting up a paper mill. Long-term UX granularity level considers experiences which become apparent with prolonged product use and include aspects of attachment, memories and associations.

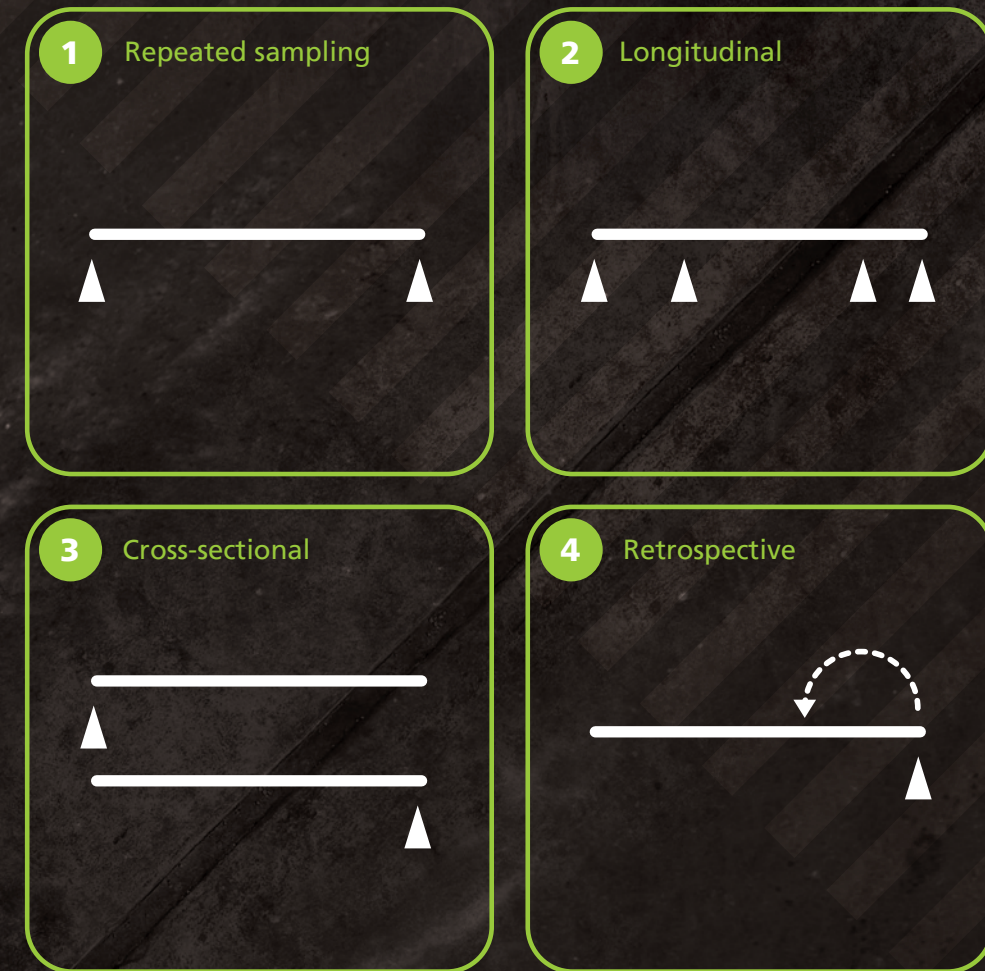
product quality level of experiences is only one implication of the UX paradigm. Another implication level could be seen in development of methods and measures to be used when trying to capture and identify emotions leading to specific experiences. This is an important prerequisite for being able to start designing actual product qualities of UX. Usually this level of UX paradigm implication carries a psychological trait and multiple tests and experimental settings are available for identifying particular product related emotions (e.g. PANAS, SERVQUAL, Emocards, i-Scale, AttrakDiff etc.). Nonetheless, although generally accepted tests provide a good insight on potential emotions and experiences, case specific tailoring should be always in place and integrating these research phases in the R&D process is often challenging in the view of successful UX implementation. This issue brings up another level of UX implications which relates to conveying benefits and aims of the UX based development direction throughout the company. Despite substantial complexity of this issue, it cannot be disregarded because of its direct impact on whether individuals within an organization perceive user experience approach as a common value. Communicating and materializing UX paradigm to be conveyed to separate departments and individuals on different hierarchical levels of an organization lies in the domain of organization cultures, communication and strategic planning. Although none of these topics are addressed extensively in this study, it is possible to identify this area as a separate level of UX paradigm implications. The final level of UX implications lies at a macro level and addresses integration of the paradigm as part of the corporate strategy. In other words, integrating user experience based thinking in systems, practices and corporate culture does not influence only the internal operations of the company but determines external policies and brand image of this company. The core benefit of this implication might be seen in the market positioning and a benchmark setting for competitors as they perceive this company as a forerunner in the industry. Despite influencing different areas of development and distribution processes, all these levels of UX implications have a common denominator, namely, their effect has to be explicitly brought up by tangible measures. As earlier discussion has pointed out that measuring and distinguishing experiences is a time consuming challenge thus organizations are willing to undertake this challenge only if they recognize its potential for substantial improvement of their competitive edge.

2.4.2. Measuring UX and related challenges

Some of the previous chapters addressed hypothetical differences in abstraction levels of goals and basic psychological needs. Similar type artificial hierarchy structure might be useful to explore UX targets and related measures. For example, top levels of UX target hierarchy might be derived from basic psychological needs and then subdivided into lower level UX targets. The main idea behind classifying and breaking down user experience targets is to try to facilitate creation of measures for these targets. The book by TULLIS, et al. (2008) introduces user experience metrics, but these metrics concentrate mostly on usability which is only a partial factor in UX paradigm. In addition, general usability measures such as completion time, efficiency and number of operations needed to complete a particular task lie on lower levels of proposed hierarchy of UX targets. However, usability measures are crucial parts which can help to reduce the level of abstraction associated with higher level UX targets. A more complex issue is related to combining and inventing measures to cope with more abstract UX targets e.g. attachment, feeling of safety, sense of relatedness and competence. Earlier mentioned emotional measures (Psychological emotion identification tools as AttrakDiff, PANAS etc.) provide somewhat more sophisticated methods to measure higher level UX factors than mere usability metrics. Nonetheless, accounting for UX dimensions related to granularity and time span of user experience pose challenges for selecting proper combination of measures from several levels of abstraction. In addition, it is important to mention that there is always a danger of misusing standardized experience measurement tools which rises from the very nature of experiences and emotions. We can try to analyze experiences with the help of actual users who have tried out the product or have used it for a longer period of time, but how to measure assessments of user experience with individuals who have not used the product to a sufficient extent or not at all? It can be argued that it would be somewhat futile to try to use similar tools to get insights or assessments of UX from marketing department or top management of a manufacturing company. In this case, the goal would not be to identify actual product experiences but UX targets for forthcoming products. I will elaborate more on this issue in the experiment design section (**Section 3.3**).

Longitudinal measuring methods for UX

It was already mentioned, that taking into account time dimension (time span) in UX measurement



Picture 12 depicts four methods for longitudinal UX measurement methods: (1) Repeated sampling, (2) Longitudinal, (3) Cross-sectional comparison and (4) Retrospective assessments. White arrows indicate measurement points and white lines indicate the time-line.

might be useful for evaluating how experiences develop over time. But what are the practical benefits of capturing longitudinal experiences e.g. from business perspective? It would seem that raising anticipation and ensuring positive initial experiences would be enough to lead to purchasing decisions. However, from the perspective of long-term strategies it is essential to understand how individuals' perceptions change during different stages of product's life-cycle. This issue is linked directly to company branding and image building as well as to customer relationship management (CRM). One practical benefit from understanding longitudinal product experiences could be seen in a possibility to shorten the learning curve and allow for quicker adaptation to the new product. In addition, various stages and contextual scenarios of product use might reveal crucial information for further product development. There are multiple ways to address longitudinal UX but here I describe four generally accepted methods. These methods are cross-sectional, repeated sampling, longitudinal and retrospective paradigms. **Picture 12** visualizes general principles behind these methods with use of time-line and measurement points.

A cross-sectional study implies identification of separate individual groups which differ in their expertise or familiarity with the product. For example, one such division could be made between expert and novice users. These groups are then compared to each other in terms of predefined variables. One distinguishing feature of cross-sectional data is that it is collected at a definite time, which makes this method relatively fast compared to other longitudinal study types. However, there are some drawbacks which make cross-sectional studies only partially reliable. For instance, the very identification of individual groups might fall to a subjective judgment and thus comparability of study outcomes becomes questionable. In addition, some observations with cross-sectional data do not reveal whether some particular behavior is a cause or a consequence (e.g. whether expert users utilize this product in some specific way because they are experts in technology in general or did they become expert users as a consequence of utilizing this particular product). In this sense, it is sometimes hard to tell for certain if differences in experiences indicated by separate individual groups rise as a result of prolonged product use or as a result of some contextual differences between these groups. Despite some of its drawbacks, cross-sectional study is useful for identification of interesting areas which might be then addressed further with other research methods.

Repeated sampling method is used in measuring longitudinal experiences when observations take place in two periods of time with the same subject group e.g. in the beginning of use and after the subject group has adapted the product. In contrast to cross-sectional study, this method includes same individuals for measuring time related effects, thus avoiding biases and noises related to group identification. However, if the within-subject repeated sampling method is used as an observational study and not as a controlled experiment, this might result in new challenges associated with contextual and uncontrolled effects. For example, different individuals within the subject group might have varying utilization habits and use frequencies which might interfere with controlled variables in not properly accounted for. In addition, this method requires a longer time period which roughly corresponds to the period during which individuals become acquainted with and learn to use the product. From the perspective of organizations, this method could be quite useful if it is built in the CRM systems e.g. automated questionnaires sent to customers immediately after the acquisition and after some predefined period of time.

Longitudinal study is an extension of repeated sampling method and it requires more than two measurements or observations during the study period. A definite advantage of this method is that it enables to better understand different phases of product adaptation and also to distinguish subjective differences within the sample group. In this sense, longitudinal study solves some reliability issues of the repeated sampling method. The price for this comes in the effort and time to make multiple observations and measures. Sometimes this type of study might seem too costly for companies if the resulting outcomes are not estimated as being critical for product development. However, if one really wants to understand how individuals' perceptions and experiences develop over time, this method is perhaps more suitable and extensive compared to other approaches.

The fourth mentioned longitudinal experience measurement paradigm was referred to as retrospective method. This method inclines that individuals reflect on their earlier experiences with the product and reconstruct these experiences in chronological sequence. For example, individuals might be asked to recall their most salient experiences with the product and describe what elicited these experiences including

contextual background. This method is an attempt to save the effort and time resulting from periodical observations during the product's utilization cycle. However, the drawbacks of these savings come in various forms. For instance, bearing in mind behavioral biases mentioned in the mental constructs section, one can argue that individuals' can recall only some particular experiences and events from their memory. The salience of these events might be influenced by individuals' current state of mind and surrounding environment thus potentially neglecting important but less salient experiences. In addition, this method is limited by the period of time in a sense that individuals' can hardly recall well their initial learning experiences if they took place long time ago. However, by careful planning of retrospective study, one can get the most out of chronologically ordered user experiences without spending longer periods of time on observations.

Any of the abovementioned methods can be considered as potential ways to capture longitudinal user experience, but thorough elaboration and justifications must take place before actual implementation. Further text describes some of the potential tools for utilizing these methods.

Implementation examples

The following examples show how abovementioned longitudinal study methods can be conducted in practice. One of such examples is a diary method which requires an individual to keep a record of his or her daily activities during a required period of time. It is important that experiences are written down as quickly as possible after they have occurred to ensure unbiased results. For instance, experiment subjects can document their product interaction experiences or feelings in a free form. This method resolves problems concerning biasedness of retrospective evaluations but requires commitment and effort from users. Somewhat similar technique to document daily experiences is an experience sampling method. This method requires individuals to reflect on their feelings at random points during the day to show how they feel in different situations. This can be a structured documentation with open-end questions or questionnaires containing predefined measure scales with different alternatives. Such reflections can give relatively good insights on individuals' contextual environment as well as actual content of actions and thoughts. Another experience capturing method is closely linked to the retrospective paradigm and

consists of assertive day reconstruction of individuals' activities and emotions. In other words, individuals are asked to recall and write down their daily actions, important events and feelings associated with these events. If experiment subjects are able to reconstruct and record their daily activities and experiences during a prolonged period of time this might reveal relevant behavioral and experiential patterns or trends. Another retrospective method is the UX curve (As proposed by KUJALA, et al., 2011) which tries to identify different stages of product experiences during the time of ownership and use. Individuals constructing UX curve are asked to recall their relationship with the product from the initial stage to the present day and sketch it on a timeline. This method can be especially useful when trying to collect larger data samples in limited amount of time.

Accumulating UX curves can reveal patterns of use or some problem areas related to product adaptation. These can be also used as a base for identifying how quickly people become attracted and accustomed with the product. One standard way to record experienced attractiveness of a product is an AttrakDiff questionnaire. This questionnaire consists of multiple choice questions with opposite adjective pairs which are meant to describe the product according to its hedonic, pragmatic and appeal qualities. Specifics of these qualities were described in product quality categorization section but it is important to recall that AttrakDiff method is aimed at recording only reflection of experiences and not actual experiences. In addition, this method does not contain any weights or preferences which individuals could assign to different UX aspects. Concrete examples of AttrakDiff are presented in later sections with relation to case study experiment design (**Section 4.3.3**). Abovementioned examples provide only a fraction of available experience assessment methods and various combinations and modifications can be made to tailor experiments to better correspond to case specific parameters.

SPECIFICS OF B-to-B CONTEXT

In this section I illustrate why assessment of user experience in business-to-business context must be considered separately from B-to-C setting. B-to-B environment is different in many ways, starting from products, services and transactions and ending with roles of different parties involved in these transactions. An overlook of these differences is in place before formulating approaches to UX related questions. This section includes general overview of B-to-B specific factors and proposition for potential ways to categorize and allocate aspects of UX and CX to different business functions.

3.1. Essential differences in B-to-B and B-to-C settings

Some of the differentiating aspects of B-to-B and B-to-C settings were already briefly stated in previous paragraphs and these included a mention that in B-to-B environment buyers of products or services are in most cases not the end-users of these products or services. Although this distinction is in the very core of UX approach to B-to-B environment, it is merely one differentiating aspect among a multitude of various factors ranging from differences in knowledge distribution of manufacturer's departments to the very nature of industrial products. It is out of the scope of this study to explore all of the distinctive aspects regarding user and customer experiences in B-to-B environment but only most general and salient ones are discussed.

Roughly put, it can be said that the core activity of the first business in B-to-B setting is culminated in providing tools and services for other businesses allowing them to run necessary operations. This is a rather generalizing statement and most real-life cases involve much more complex and intertwined business relationships. However, even this simplified setting implies that instead of concentrating on end-users' needs in product design, the manufacturing company has to account for its customers' needs (both on individual and business level) as well as for its customers' clients' needs. Such arrangement introduces a large set of additional variables compared to B-to-C environment, which results in a substantial increase in complexity of the operating environment and product development criteria. For

example, when mapping development criteria for a new industrial product, manufacturer has to take into account what their customers want to achieve with this product business wise, how this product will help to solve customers' challenges more effectively and how it will fit with customers' brands. To assess these questions, one must have an extensive understanding of customer's business in addition to knowledge about users and their needs. Further, I elaborate on what are the differences between consumer and industrial products and whether these distinctions can be regarded as relevant ones from the perspective of UX approach.

3.1.1. Consumer and industrial goods

What distinguishes consumer products from industrial products and is it possible to draw a strict line between these categories? There is a common definition which states that consumer goods are acquired by individuals for personal use and industrial goods are acquired to produce or maintain other products (Often referred to as capital items if acquired for long-term use). However, it is often impossible to determine directly whether some particular product belongs to a consumer good or an industrial good category. For instance, considering an example with a laptop, it could be purchased by an individual for personal use or by a company for business purposes. The distinguishing factor between a consumer and an industrial product is actually the purpose of its use and not its attributes or features. Because this study focuses on business-to-business environment, it also concentrates on industrial products, capital items and their potential to elicit experiences. Classification of product types might be important for further discussion relating to specifics of UX approach in B-to-B setting and I will pick up this issue when talking about customer's responsibility and loss-aversion. Following classification (From Encyclopedia of Business and Finance) is also relevant for the case study presented in **Section 4** and can be considered as relating to "product classes" in four relevant hedonic consumption areas identified by HIRSCHMAN, et al. (1982).

Installations are usually long-term investments (capital items) in heavy machinery and systems such as paper mills, conveyer lines and automated production systems. These products are usually customized according to customer needs and require substantial investigation of client's requirements. Installations

are mostly implemented directly in producing some other goods. **Accessory equipment** has usually a shorter life-span (in economic terms) and requires lower investment compared to installations. Accessory equipment can be involved directly or indirectly in the production process of other goods. For example, hand tools can be used directly in producing new products but forklifts are used mostly for supporting activities in logistics operations. **Raw materials**, as the name implies, must be processed before being converted into products. For instance, leather, timber and gold must undergo some modifications before they can become clothes, furniture or jewelry. **Fabricated parts and materials** are used as such (parts) in producing other products or modified according to specific needs (materials). For example, car battery can be considered as fabricated part and custom made fabric can be considered as fabricated material. Industrial supplies are simply necessities that are required for production and management operations to run smoothly. These include light bulbs, staples, cleaning tools and greasing oil.

Taking into account abovementioned categorization of industrial goods, it can be argued that the first two categories (installations and accessory equipment) are more relevant from the user experience perspective because they involve individuals who are actually operating tools and machinery, whereas other three categories are mostly materials and parts used in the production process. However, it must not be forgotten that experiences might be also elicited by services included alongside specific materials and parts (e.g. delivery and packaging methods).

3.1.2. Roles of external parties in B-to-B environment

In the following text, external parties refer to individual groups that operate outside the manufacturing company. These include, among other, suppliers, competitors, customers, end-users and retailers. Emphasis is made on customer, end-user and distributor parties, whereas roles of legislative, supplier and customer's client parties are not considered as relevant for this thesis. Some basic characteristics and roles of relevant parties in B-to-B context were already addressed earlier. However, psychological aspects related to these characteristics were not discussed properly. Further paragraphs try to shed light on possible consequences for the new industrial product introduction and utilization which rises from behavioral biases and heuristics discussed in earlier sections (**Section 2.2.5**).

End-users and Customers

One of the most obvious specifics of B-to-B environment and industrial products is related to the separation of ownership and actual use. But what are the potential consequences of this separation regarding UX approach and its implementation in product design? Indeed, this situation creates a wholly new set of challenges for UX approach in product design. For example, end-users might have reduced or no feeling of ownership related to the product. This can be seen as a serious barrier for eliciting feeling of attachment or care in respect to this product. Possible solution for this problem might be derived from customization and personalization qualities embedded in developed products. In their article, MUGGE, et al. (2009) show how personalized products can elicit emotional bonding and thus contribute to the sense of attachment. Also SCHIFFERSTEIN, et al. (2008) describe possible design strategies to enhance feeling of attachment. From the perspective of product qualities, reflective aspects (e.g. associations and interpretations) are ones that might be useful to overcome indifference resulting from lack of actual ownership. Trying to improve the feeling of attachment does not aim purely at benefiting the user of the product but also the customer party. The result of eliciting feeling of attachment can be seen in prolonged life-cycle of products which are treated with care and repaired instead of being discarded or substituted by replacements. This in turn has a direct impact on maintenance and spare part expenses. In this sense, it comes to strategic choices of the manufacturing company whether it wants to concentrate on short-term goals by trying to tighten replacement periods and generate profits by providing cheaper substitute products or does it concentrate on longer-term upgrading, retaining and service business models. This choice of strategy is often reflected in customer groups of the manufacturing company. In particular, individuals who are in charge of acquiring new equipment for their factory or warehouse are concerned with product quality and features. Experiences of buyers and decision makers are often referred to as customer experiences (CX). In B-to-B context the key question might be set as whether UX can be formulated in a way that would improve CX directly or indirectly. This is an extremely important question because it concerns the challenge related to the lack of actual product use and operation by customers. In other words, customers are often unable to enter appropriate mind set to appreciate potential for improved UX of the product and possible economic benefits in the form of saved maintenance or training

costs. Of course, customers often test the product before acquiring it to get some understanding of what users will feel like operating it. However, as it was made evident in introduction of longitudinal nature of UX, this testing cannot reveal all the potential longer-term benefits of intended experiences. This challenge is multifaceted and some of its facets include restrictions of time needed to provide sufficient experiences from the product use, high abstraction level of users' psychological needs and indirect economic benefit from fulfilling them and tendency of individuals to make myopic choices based on short-term product evaluations. It can be argued that improved user experience benefits the customer whether he or she realizes it or not. From this point of view, manufacturers must make an effort to make this realization more salient and easy for their customers.

Trying to enhance end-user understanding within customer and distributor groups is only one side of the challenge in B-to-B context. Another side could be seen in perceptions of risk related to new product acquisitions. The end-user rarely carries any substantial financial responsibility related to new product purchases, whereas for customers this risk is often of outmost importance. As we recall from the industrial product classifications, these products are often called capital items, and rightly so. The fact that these items often bind large portions of company's assets must not be neglected. From this point of view, customers are very keen to ensure that they are binding their capital to appropriate, productive and safe assets. Another related issue concerns customers' responsibility for other employees, which stands on a completely different level when it comes to decision making regarding industrial products compared to consumer products. In contrast to consumer product purchasing, where the buyer is usually responsible only for the influence of this product on himself, acquiring capital items consisting of heavy machinery and equipment involves taking responsibility for influences this equipment has on many individuals beside the person who makes the decision. This is an important factor to consider when using user experience as a selling point, whether when stressing its positive emotional effects on equipment operators or emphasizing potential for reduced fatigue and injury risks. As mentioned in theoretical background section (**Section 2**), individuals' tendency to myopic loss-aversion might result in sub-optimal choices when it comes to investing in required industrial product. Taking this into account, one must consider how UX approach in product design should be presented to customers to

evoke the feeling of safe and reliable investment (e.g. psychological need of security from SHELDON, et al., 2001), which will not only state some vague advantages in the future but show concrete and measurable indications of improved performance. This is easier said than done, especially if we account for communication and collaboration issues with other parties in the product delivery chain. Some of these parties along with their assumed preferences are presented below.

Product Distribution Chain

A direct sale to the customer is only one channel through which industrial products find their way to end-users. Usually there are many other intermediate parties which acquire and distribute these products. These parties might include various distributor, dealer, wholesaler and retailer chains, which ensure that manufacturers can save in distribution costs and customers are able to get desired products close to their location. Although there are undeniable benefits from having various intermediate actors in the distribution chain, from the perspective of conveying UX in the industrial environment, this factor poses another set of complications. For instance, whereas we have considered ownership and use division between customers and end-users, the product ownership status of retailers is usually meant to be merely temporary leaving rental business as an exception. This setting is somewhat puzzling in the view of defining clear benefits from experiential product design to distributors. One obvious advantage for distributors might be seen in being able to sell the product with less effort if the UX message is clear and communicated correctly to the customer. However, in practice, this is doubtfully a realistic assumption because it inclines that the intended message does not get distorted at any stage from the R&D department to retailer parties. Some studies explore cross-functional integration of separate departments in innovation projects as a potential for approaching this communication challenge. For instance, BRETTEL, et al. (2011) find that department integrations might increase efficiency but that these effects are complex and depend on degree and stage of innovations. One potential solution could be considered in the possibility to communicate experience design approach benefits directly to the customers, thus surpassing distribution chains. This possibility is available through even more active use of IT technology, mobile devices and social media. With the help of technology and virtual communities customers become aware of product qualities and experiences via multiple channels instead of relying

heavily on the message carried out by distributors. For instance, customers might refer to their peers to evaluate and share experiences related to industrial products. This way opens a wholly new perspective on how customers receive product information as well as a potential for the UX message to be communicated with less interferences. On the other hand, if distributors act as agents in rental business, they might benefit from the same potential UX effects e.g. in the form of prolonged life-span of their products as a result of product attachment among users. In later sections I will present questionnaire based data analysis from responses of product distributors which gives a hint about possible preferences of this external party (**Section 4**).

3.1.3. Product UX at work and in spare time

Previous sections already listed some differences between industrial and consumer products as well as main individual groups that could be influenced by qualities of these products. However, it is also important to address influences of different operating environments, working conditions and times of use in respect to industrial and consumer products. Roughly put, most industrial products are utilized by individuals as tools in their working environment whereas consumer products are utilized to satisfy personal, family or household needs during spare time. This statement is overly generalized, but it reveals an important issue which relates to potential differences in attitudes of individuals towards products in varying life situations. From the perspective of UX, the key challenge is related to “it is only a tool” or similar kind of mentality. It was already pointed out, that lack of ownership can reduce the tendency to become attached to industrial products. It was only one example of a substantial and broader challenge arising from implicitly more task oriented set of mind of individuals during work time compared to their free time. Individual product features are hardly sufficient to change this mindset without appropriate coherence and correspondence with respective operating environment. Interestingly, there are multiple real-life examples which show that in military conflicts soldiers (Users) may develop deep emotional relationship with appliances assigned to them, in some cases even personalizing and naming their equipment. It can be argued that the very nature of work and working environment, which in the abovementioned case is associated with constant presence of lethal danger, influences the attitude with which individuals relate to products they use (Relevant reference to the psychological need of security).

Again, I can point out that extreme feeling of potential salvation or relief in the face of immediate danger can generate very intense positive emotional responses directed towards products that could enable such relief (Refer to **Section 2.2** for discussion on this topic). Example brought from military applications is an extreme case where users do not directly own their equipment but can experience strong emotional bondage with it. However, it must not be forgotten that the general pursuit of the majority of individuals is assumed to be away from dangerous situations (e.g. war zones and other hazardous environments) and from the perspective of civil product development it would be rather odd to suggest artificial generation of more dangerous working environments for the sake of eliciting positive product related emotions. This example should not be misunderstood for claiming that danger could not be sought purposefully or bring pleasure, but rather that it is an excessive measure and can be hardly beneficial in the view of activities in industrial working environment as a whole. If some individuals engage willingly in activities that are potentially harmful to their health, it is usually due to adrenalin seeking behavior or lack of other meaningful stimuli. The trick of changing individuals' attitudes might rest in attempts to manipulate their motivation and perspective of undertaken activities. For example, if some product related activities are undertaken with pragmatic, utilitarian and purely functional attitude (e.g. "I need to attain to this activity because it is part of my work for which I am paid for"), there is hardly room for noticing hedonic aspects of the product use even though all the necessary experiential product qualities would be in place. On the other hand, a person might well attain to a certain work tasks that bring him simultaneously joy and monetary rewards directly or indirectly. An interesting question lies in how the working environment (in a broad sense) influences work attitudes and what is the impact of individual product features on UX. For example, one way to combine influences of the working environment and product qualities is related to enhancing salience of individuals' goals and targets at work as well as providing concrete milestones and paths to attain to these goals. A negative side effect of such practices might be seen in performance driven working attitude, which sometimes results in a tendency to neglect positive emotions and experiences from intermediate successes in an anticipation of even greater end reward (See hypothetical affect formation in **Section 2.2**). These issues are not explored any deeper in this study but they stand relevant when considering UX approach as a whole.

3.2. UX as a strategic factor for B-to-B companies

In this section I summarize general ideas and user experience dimensions presented previously and combine them into a UX thinking model applicable for B-to-B environment. The main aim of this model is to indicate relevant distinctive aspects of business-to-business setting and determine possibilities for strategic implementation of the UX paradigm. I also elaborate on how different interest groups i.e. distributors, customers and users, can be taken into account in user experience research as well as in deriving new features for industrial products.

3.2.1. Phases of implementation and the role of incentives

One of the reasons that makes user experience approach in product development appealing for companies is the potential for differentiating from their peers in the market. However, as most differentiating advancements, this step requires time and resources to build upon. Previous sections described some methods for evaluating and measuring UX, but they were mostly highlighting abstract indicators of subjective quality assessments of user experience and not its economic benefit. This is an essential issue to consider when talking about UX as a strategic factor. As mentioned earlier, UX paradigm must be implemented on many levels of manufacturing organization to result in an economically profitable outcome. I propose three general phases at which UX can be implemented as a strategic factor. These can be indicated as (1) knowledge building and implementation, (2) product image and positioning and (3) CRM policies. The first phase implies finding right tools and methods for collecting customer and user data, creating processes and databases for efficient knowledge building to derive main development criteria as well as actualizing these criteria in new products. The second phase is about building and shaping corporate brand image, adjusting and controlling product related expectations and anticipations as well as determining right communication channels and formats. Third phase relates to ensuring that expectations correspond to distributors', customers' and users' experiences, maintaining customer relationships by systematic caretaking of existing client base, providing supporting services and prerequisites for aftersales by means of customized offers and UX benefit reassurance. These phases are not necessarily chronologically ordered but have to occur cyclically. To embed UX paradigm coherently

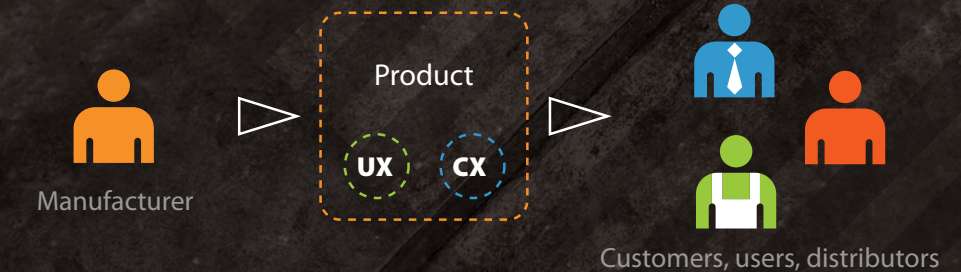
into a corporate strategy all of the abovementioned phases have to be taken into account with equal share of persistence. In other words, implementation of UX starting points in product development must be supported by sales and marketing strategies and vice versa. **Picture 13** visualizes abovementioned phases of UX implementation.

Discussion in earlier paragraphs pointed out how B-to-B environment may differ from the consumer market in terms of product types, their qualities and utilization environments. From the strategic point of view, these factors are implicitly related to identification of various incentives for relevant individual groups such as distributors, customers and users. Incentives can be regarded as external means of shifting motivation towards some particular concrete goal. In economic terms this term is usually linked to monetary rewards but in this context it is taken in a broader sense. The nature of incentives is closely connected to the concept of motivation and in this respect user experience paradigm should be accounting for differences in incentives when trying to utilize it as a strategic factor. Typical interest group incentives can include financial (e.g. bonuses and monetary rewards) and non-financial (e.g. formal or informal status and position) incentives. The nature of incentives is peculiar in itself because consequences of artificially generated incentives are hard to predict accurately in advance. From the perspective of UX approach in product design, incentives are relevant because they have a direct impact on extrinsic motivation of individuals when it comes to testing, acquiring, utilizing and renewing products. For example, customers and users may have coinciding economic incentives to increase productivity of their operations in the form of bonuses or productivity related pay. However, effects of specific product features which might be associated with contributing to these incentives (e.g. speed, acceleration, efficiency) often become apparent to customers with longer intervals (e.g. monthly) whereas users are exposed to these perceptions on daily basis. Why this aspect might be important from UX and CX perspective is that it has a connection to the frequency of experiences associated with products. It can be assumed that when product performance reviewing intervals become longer, as in the case with customers and distributors, individuals are less affected by periodic negative and positive experiences of relative performance i.e. experienced performance compared to expected performance. In this sense, users might be subject to feel more frequent and intense product related emotions form

1. Knowledge building and implementation



2. Product image and positioning



3. CRM policies



Picture 13 depicts three phases of UX implementation. (1) Knowledge building aims at collecting and utilizing external information in product development and marketing strategies. (2) Product image phase addresses corporate brand image and (3) CRM policy phase ensures that communicated image is perceived correctly and sustained.

qualities that contribute to their financial incentives (This logic can be linked to myopic loss-aversion and the prospect theory mentioned in **Section 2.2.3**). For example, products may have specific qualities that support the link between daily achievements and financial incentives on a concrete level (e.g. software which indicates when the daily target has been underachieved or exceeded). Some product qualities that can be linked to financial incentives might be improved by means of usability enhancements. However, the cause and consequences of measures aimed at supporting users' economic goals are not straightforward. As described earlier with elaboration on affect formation, realizing that the targeted attainment rate has been exceeded lowers the extrinsic motivation to continue working with equally high pace. In addition, emphasizing the link to financial incentives might even undermine other work motives possibly rising from intrinsic motivation (GNEEZY, et al., 2011). For customers and distributors, the link between specific product qualities and their incentives is vaguer and is often hidden behind numbers in performance and productivity reports, which do not reveal particular details or influences of individual features (e.g. maintenance and repair costs, working hours and output quantities). On the other hand, this link between product qualities and performance is brought up quite explicitly when equipment acquisition decisions are considered. Performance based financial incentives (e.g. output rate based bonuses) have applications for users only in some organizations but there are other incentives which do not carry any direct economic advantages. These non-financial incentives can take form of promotions and additional responsibilities or of less formal status increase which becomes apparent through respect of colleagues and superiors. Such incentives are often directed by intrinsic motivation mentioned in **Section 2.2.2**. In this respect, embedding product features that support non-financial incentives should be also considered when defining product qualities from UX perspective. For instance, various informal promotion schemes such as experience points or other indications of status difference can be utilized in industrial product design. These might have a direct influence on individuals' moods and play a distinctive role in affecting judgements and behavior as shown by FORGAS, et al. (2001).

Simultaneous consideration of differences and similarities within and between relevant subject groups (including various customer, user and distributor groups) is an important issue for being able to generate new product development criteria. For instance, some product qualities might include presets

that are fixed as they are seen as being equally important for all individuals in that group but also some presets that are adjustable according to differences in subgroup preferences (e.g. operators with varying expertise and skill levels). The salience of different psychological needs in users' minds depends on their working environment, incentives and the nature of their work. In addition, it must be remembered that individual groups are closely intertwined and end-user group provides product related feedback to their peers and superiors either directly or indirectly through quality of their performance. This feedback is often considered by customers and distributors as an important input information for formulating perceptions about industrial products.

3.2.2. Relevant communication measures

By speaking about user experience alongside communication measures I refer to areas in product development and delivery chain that might be critical for conveying UX paradigm successfully on both strategic and tactical levels. For example, ensuring that communicated messages and expectation management correspond to actual product properties is an important active measure for preventing excessive gaps between expectations and perceptions of actual product qualities (As shown by example in **Section 2.3.2** in **Picture 9**). Passive aspect of this measure can be described as avoiding emphasis on features that do not show any significant advantages over competitors or that these advantages cannot be proven convincingly. There is a multitude of similar tactical measures for managing product perceptions but they are widely overlapping and intertwined making a general distinction between them troublesome. Following examples will describe how some of these measures could become apparent at several points of proposed UX implementation phases.

Knowledge building and implementation

This phase is crucial for gathering insights regarding product perceptions from different individual groups including people from different departments of a manufacturing company, distributors, customers and end-users. Regarding UX approach this phase is related to determining actual end-user needs, assessing potential benefits of fulfilling these needs for other parties and reflecting these needs and benefits in new product qualities. Important touchpoints in this phase include contacts between R&D, marketing

and sales departments and distributor, customer and end-user groups. As pointed out by ERNST, et al. (2010), the cooperation between R&D and sales departments is especially important in initial phases of new product development projects. Potential contact sessions could take a form of public informative events, fares, steering group workshops, small scale face to face meetings, customer premise visits or other events. No matter what is the form of such occasions, they should be systematic and aimed at generating coherent and comparable information for assessing product perceptions and experiences. For instance, end-users could provide better insights on concrete challenges in their working environment, nature of their work and main incentives. On the other hand, customers are assumed to understand business related challenges better than end-users, thus information gathered from this party might be indirectly linked to users' experiences but focusing on potential economic perspectives of positive UX e.g. improving productivity, stimulation and reducing sick hours. In this sense, customer and distributor groups might be seen as acting as filters for UX targets derived from end-user studies. It must be noted again, that in B-to-B context customer and distributor parties are among crucial gatekeepers for successful implementation of UX approach on a strategic level, thus their perceptions of end-user needs (Although they are likely to be biased) must be taken into consideration alongside actual end-user feedback. All in all, tactical measures in knowledge building phase have two agendas, one of which is more explicit and was described above (Gathering relevant information for product development), another is less explicit and carries traits of implementing *framing effect* as discussed in **Section 2.2.5**. One communication for this second agenda relates to creating argumentation chains for sales and marketing strategies from expressed concerns about needs of different parties. In other words, if customers, end-users and distributors believe that their feedback and opinions were utilized in product development, it is much easier for these parties to feel as contributors to the development process and through that potentially develop an emotional relationship with that product model. The same principle should be applied internally i.e. make utilization of knowledge of sales and marketing departments explicitly apparent in product development processes and new product introduction to enhance commitment among individuals working in these departments.

Product image and positioning

Discussion concerning expectation formation and temporality framework (KARAPANOS, et al., 2010) mentioned in **Section 2.3.2** indicated that individuals' pre-use perceptions of the company brand, product families and individual products have a major impact on what are customers' and users' experiences from the actual product utilization. I will point out only a few communication measure examples for product image and positioning phase which I believe are the most critical ones from the design perspective. For the purpose of concretization I will address two example scenarios where the product image i.e. perception of what the product is like in general, has been already established but the product (1) requires quality reassurance due to problems with its predecessor model and (2) needs more justifications for its relatively high price. In the first example scenario, preventive measures in product development could be taken by designing the problematic product quality to be radically different from the previous model in visual and behavioral sense. In this way, individuals would not associate this quality with problems they encountered with the previous model and thus will not put additional effort to seek out nonexistent problems (This is related to the *confirmation bias* and individuals' tendency to seek confirmation to their earlier perceptions). Explicit communicative measures would require mentioning the resolution of the issue with problematic quality but not overstressing it to avoid drawing too much attention to one particular aspect. In terms of expectation management these steps are undertaken to dilute negative expectations regarding some product qualities potentially giving a fresh start to product experiences and improving brand image as a whole (MORGAN, 1997). The second example scenario is related to one of the most common issues, namely the price of the product. Communication measures can be used to try to increase transparency between advantages of the product and its pricing and on the other hand position the product as belonging to a higher quality category. These measures are aimed at avoiding an overly wide discrepancy between expectations set up by the pricing and embedded experiential benefits which are not immediately perceivable but become apparent only with sufficient utilization time. For instance, visual appearance could be directly perceived and interpreted as communicating speed and quality, whereas actual durability and long-term emotional responses of users (e.g. attachment) become apparent only with prolonged utilization period. Obviously, to confirm expectations regarding benefits of UX approach in product development, actual performance and users'

feedback must correspond to these expectations as well as echo in other products sold under the same brand. An important product image communication measure regarding the end-user group is related to training and adaptation processes. In addition to practical issues concerning proper operating methods and working practices, the learning phase might have a tremendous impact on the attitude of users towards the product. For example, advantages of some novel features must be pointed out explicitly allowing users to discover their potential in shorter period of time compared to a situation where users have to adapt to these features by themselves. The learning process ought to be planned and controlled allowing users to experiment with the product but at the same time ensuring that novel features are implemented as intended. This communication measure is also related to expectation management i.e. the aim is to enable end-users to find support for their expectations based on experiences with previous product models and at the same time create basis for forming new expectations regarding novel qualities (RINDOVA, et al., 2007).

CRM policies

Finding new customers and persuading them of UX implementation benefits has an important role in gaining differentiating edge in the market but perhaps even more important factor lies in keeping existing customers reassured in quality and viability of provided products. Communication measures concerning UX in this matter are mostly related to developing services supporting adaptation and implementation of the delivered equipment. Part of these aspects was already covered in product image and positioning discussion but CRM policies can be regarded as a more general and extensive view on the steps needed to secure customers' loyalty. For instance, communication measures in the form of services that aim at enhancing product utilization and tools for measuring UX can be seen as contributing to after-sale and order renewal goals of the manufacturer. Also integrating some specific product features such as feedback databases or "mood recorders" (e.g. devices which allow users to indicate their mood) can be considered as a part of CRM strategy. For example, manufacturers could provide services involving data analysis generated from interactions between users and products along with suggestions for working practice and product use optimizations. A somewhat less sophisticated method with similar aims could be implemented in a form of systematic feedback forms for both end-users and customers.

Regardless of the format, all measures for successful UX paradigm implementations in CRM policy phase should be aimed at establishing a more concrete link between positive end-user experiences and their practical economic benefits for customers. Although developing internal systems for this purpose poses creates a new challenge for manufactures, this idea should be in the core of CRM policy phase of UX implementation.

Implementation phases and communication measures reviewed in the above paragraphs contain only a fraction of tactical nuances when it comes to utilizing UX as a strategic factor in B-to-B context. Earlier I stated that to be able to implement UX approach in product development and to succeed in economic terms within the frames of B-to-B environment, one must create a very robust link between positive experiences and economic viability. Such link cannot be established by embedding some particular product qualities alone but requires a more holistic approach where UX approach benefits are conveyed throughout many different phases in a systematic manner. This would seem to be the most suitable way to go if one wants to get the marginal utility of implementing this paradigm in product development to the same level as in B-to-C context. Next section proposes a hypothetical thinking model for addressing UX on multiple levels of product utilization.

3.3. Hypothetical thinking model for UX in B-to-B environment

The main idea behind the proposed thinking model is to combine theoretical parts that could be relevant for experience based product design in B-to-B environment from practical point of view. Although mechanical constructs of human thinking presented in **Section 2** may have little to do with actual mental processes, the core purpose of the model is to communicate important message when it comes to being able to implement UX paradigm on a strategic level. One of the main points behind this model is to indicate the need to address product experiences as a whole instead of concentrating on mere product qualities. From the economic perspective this becomes crucial when one considers resource allocations to R&D, manufacturing, sales or marketing functions. As a second point, I introduce an experience hierarchy framework which relates to simultaneous and parallel consideration of customer

and user experiences through experience targets when deriving criteria for individual product qualities. Such approach could be also useful when one considers generating argumentations for selling points with aspects from experience design approach. Next paragraphs go through details and main points of the thinking model and experience hierarchy.

I. Product experience formation (Hypothetical thinking model). This model takes its presentation principles from domains described in **Section 2** with ideas derived from the book by CARVER, et al. (1998). Ideas behind this thinking model are depicted in **Picture 14** with reference numbers (in brackets) pointing to individual components to be discussed further. Despite being overly mechanistic and far from describing real-world cognitive processes, provided representation of experience formation makes several important points that can be relevant from practical point of view. First point takes into account a discrepancy between some desired state of an individual (1) with its roots in psychological needs (e.g. becoming more competent) and perceived prevailing state (2) respective to these needs. Obviously, these states can be considered as rather abstract and the discrepancy between them might not be clearly formulated in individual's mind. The top level element in the proposed model is seen as the desired state (1). However, also this state is not static and can be adjusted when new information becomes available e.g. through evaluation of one's prevailing state in comparison to respective states of other people. As a hypothetical example, if a person was born to captivity, he might have not realized limits of his autonomy state to full extent until he was able to compare his state to some more autonomous person. This possibility for reference values to shift is denoted by letters (A), (B) and (C) on different levels of the thinking model. Abovementioned hypothetical state comparison is assumed to lie on the *product meaning level* of experience formation. On this level, the question is not only about products but about all known means which can contribute to coming closer to the desired state. For instance, the psychological need to be connected to other people (e.g. relatedness - belongingness) can be ascended upon by communicating with other people in common language, using a telephone or sending a message with a post pigeon. However, because this study deals with products and not with all possible means to fulfill psychological needs, the product meaning level implies that some products can be considered as having a potential to contribute to coming closer to the desired state (1). This leads to the

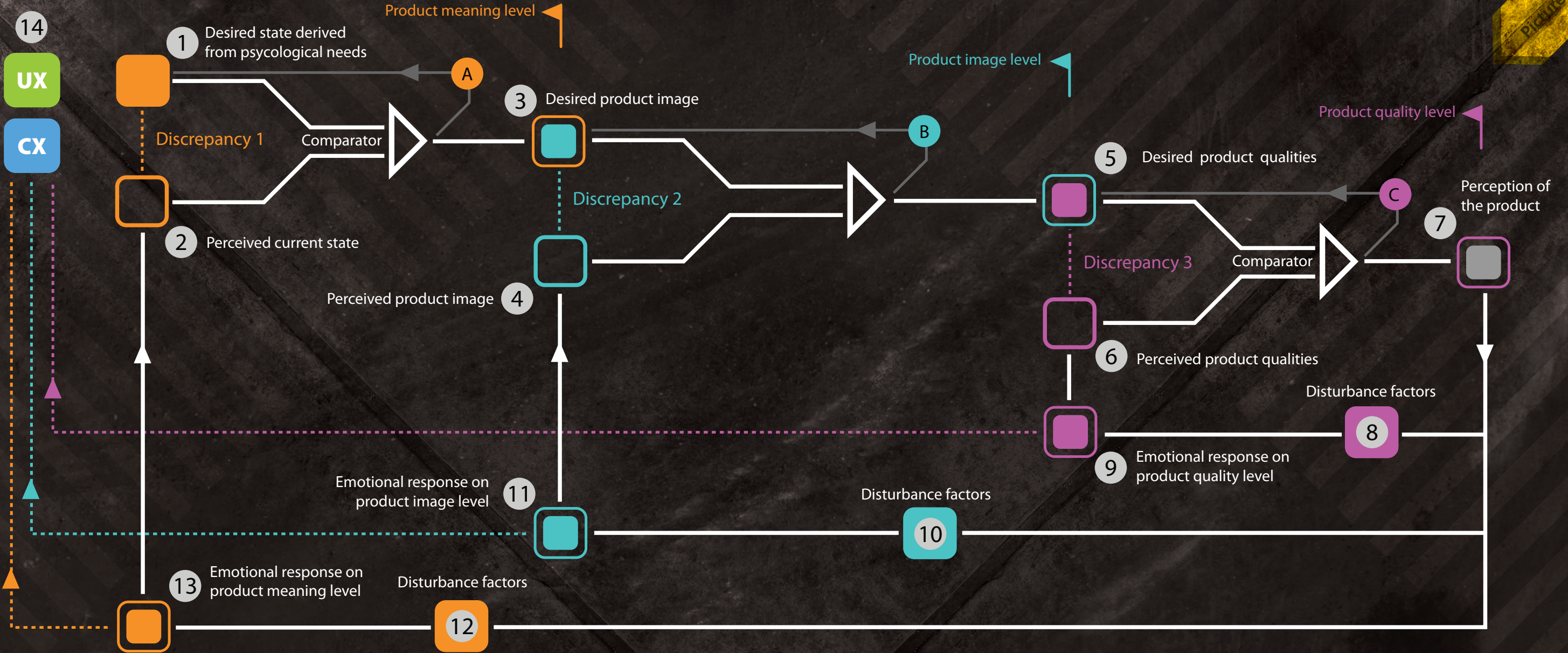
next step of the model which distinguishes a second hypothetical discrepancy between desired product image (3) and perceived product image (4). The desired product image (3) is assumed to be formed from identification of some known set of products which could potentially contribute to attaining to the desired state. In this context, the term product image refers to the mental image of some particular product or product category, which is accumulated and updated over time with new information. For example, product image and perception of a camera in 19th century was quite different than it is now. It is important to note, that product image is only a subjective perception of objective real-world physical product. This is accounted for in the model by separating interaction with product qualities from product image. The idea behind this distinction is derived partially from the model of product emotions by DESMET and HEKKERT (2007). It is assumed, that by some mental comparison (e.g. appraisal) of perceived product image (4) and desired product image (3) individuals can experience positive or negative emotions (e.g. anticipation, anxiety, excitement etc.) even before they have a chance to actually utilize products for their functional purposes. The key difference to the model of product emotions is the separation of perceived product image (4) and perceived product qualities (6). In this respect, desired product image (3) can be formed long before an individual is actually able to experience qualities of the physical product. For example, brand image, previous experiences and known technologies might all have an impact on desired product image (3). The comparison between desired and perceived product images is assumed to take place on the *product image level* of the experience formation model. This level describes how product related mental image might influence product experiences even before actual product qualities are revealed. This is the basic reason why individuals are able to describe some products as novel, exciting, inspiring or interesting based on fragments from advertisement material. It must be mentioned though, that such verbal or written indications do not necessarily mean that individuals actually feel that way about presented products. Taking this aspect into consideration, I introduce a third discrepancy which might arise between desired product qualities (5) and perceived product qualities (6). The main point behind singling out this discrepancy is related to earlier discussed expectation formation and how people respond when these expectations are met or not. In other words, desired product qualities (5) are assumed to be derived partially from the desired product image (3), but the question is whether these desired qualities correspond to perceived qualities when actually interacting with the

product. The term interaction calls for a definition and in this context I incline to use it in a relatively broad sense where all direct links between senses of human being and physical product are considered as some kinds of interactions. As this definition requires mutual reciprocal action, looking at and touching the product are also interpreted as interactions and lie on the *product quality level* of the experience formation model. In this sense, visceral product qualities (NORMAN, 2004) can play their role when third discrepancy is considered e.g. if the desired visual appearance derived from desired product image is not met by perceived visual appearance, this might elicit negative emotional response. An important difference between *product quality level* and *image* and *meaning levels* is that perceived product qualities are usually formed by conceiving tangible products whereas image and meaning perceptions are abstract and can be influenced by intangible factors e.g. rumors, narratives, beliefs, interpretations etc. This becomes relevant when one considers which channels are to be used to convey intended product message. The proposed hypothetical thinking model assumes that product related UX and CX (14) are results of emotional responses (9, 11, 13) on three mentioned levels of product experiences. This idea can be illustrated with an example where an individual wants to become a more appreciated and respected person (e.g. desired state (1), popularity - influence). This can be considered as partially subconscious and abstract goal but it is nevertheless reflected in that individual's behavior. He can define some ways in which people will notice and appreciate him more by trying to act in the public, learning some particular skills, wearing fashionable clothes or using prestigious products. The effect of doing these activities can be reflected in the perceived current state (2) and result in either becoming closer or further away from the desired state. This is a preset for emotional response on a product meaning level (13) i.e. recognizing that some product brings one closer to a desired state. Similar idea applies on a level of product image where an individual compares desired product image to perceived image of a particular product. If the perceived image becomes close or even exceeds the desired image, an individual might experience positive emotions (11) in the form of excitement or anticipation. On the other hand, if some competing substitute products become available under an even more popular brand, an individual might change his perception of a desired product image and the discrepancy (This is also comparable to the example in **Picture 9, Section 2**, where product expectations are shifted upwards resulting in relatively more negative affects). Emotional response (9) on a product quality level is assumed to be formed from

appreciating product qualities which correspond (or do not) to some set of desired qualities derived from product image. For instance, if the product produces similar sounds as in the commercial (link to desired product image), this can be interpreted as a confirmation signal to desired product qualities. However, if this individual discovers some new interesting features which he was not aware of before actually using the product, he might experience positive emotions from exceeding perception of desired product qualities. This realization is then further reflected on higher *image* and *meaning levels*. Negative emotional responses on *product quality level* might occur if an individual fails to find qualities he was expecting from the product.

It is clear, that real-life experiences and emotions have a far more complex nature than the one presented in the model. However, this complexity can be accounted for to some extent by considering external disturbance factors (8, 10, 12), which intervene with abovementioned hypothetical thinking processes. For example, user's expertise level, his operating environment and work incentives can influence how this particular user perceives product qualities on the *product quality level*. On the other hand, publicity stunts, communicated brand image and earlier experiences with similar products may act as external disturbances for perceived product image on the *image level*. Social and cultural trends can be seen as affecting perceived state on the *product meaning level*. However, it is essential to point out that all external disturbances have also direct or indirect impact on reference values in the model i.e. desired states, product images and qualities. For instance, earlier mentioned operating environment or working conditions, which may influence perceptions of product qualities (6), are also having an effect on what are the most salient desired states (1) and desired product images (3). In other words, our perceptions of the surrounding world are not only influencing how we interpret or evaluate some product qualities, but also our higher-level goals and needs. This point becomes one of the key arguments when we consider why experience based product development should be initiated from deriving and classifying appropriate UX and CX targets from the *product meaning level* and not from the *product quality level*. Further discussion will present a more detailed description of what could be the possible factors influencing experiences and how they could be categorized. The relevance of this categorization becomes apparent when organizations consider resource allocations to different functions including marketing and R&D.

1 Product experience formation (Hypothetical thinking model)



Picture 14 shows hypothetical thinking model with three levels of product related emotional responses: Product meaning level, product image level and product quality level.

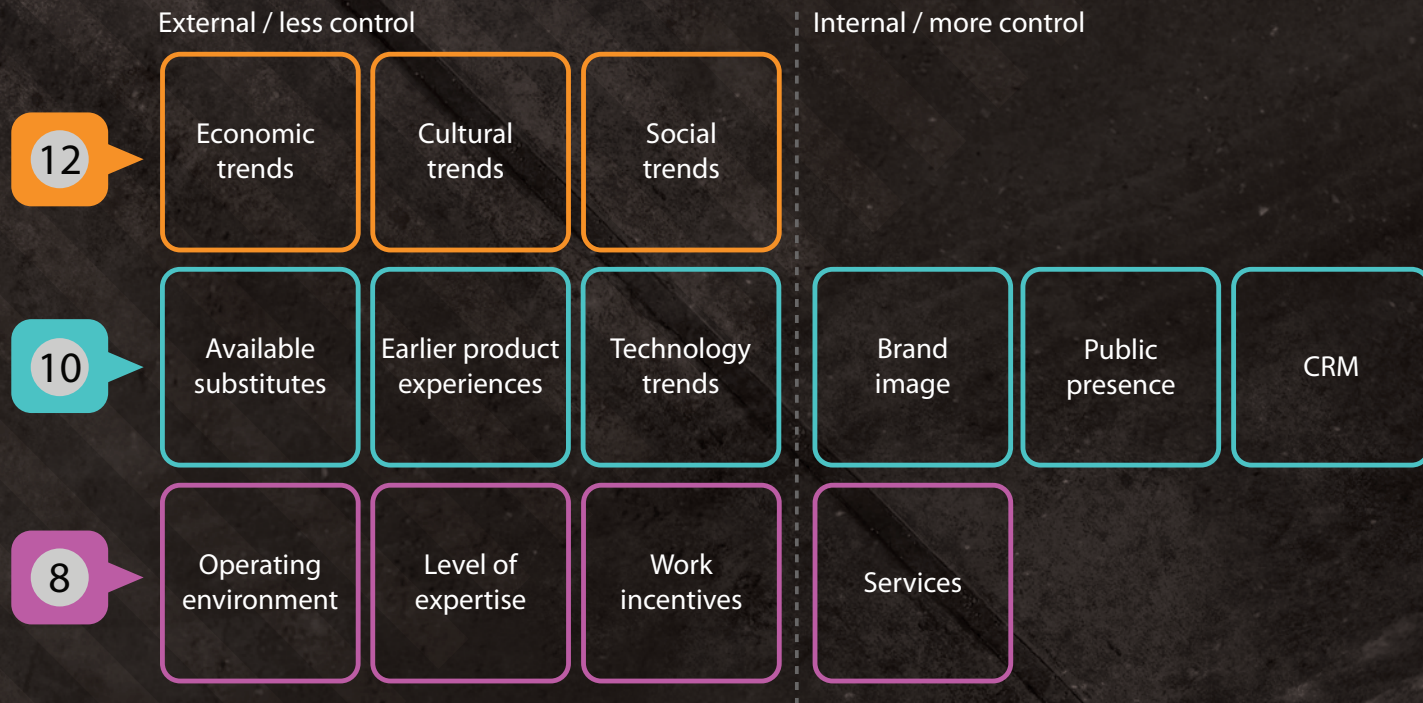
If some desired experiential effect can be achieved by allocating more resources to creating appealing stories and diverse marketing material instead of allocating all resources to development of costly technological product features, these decisions can make the difference between profitable and loss-making businesses.

II. Product experience hierarchy. As mentioned above, the hypothetical thinking process behind experience formation tries to account for multiple factors besides mere product qualities. Some of these components are presented in **Picture 15** depicting hypothetical experience hierarchy. Three levels of external disturbances (8, 10, 12) indicated in this process were described in previous paragraph. Some possible factors which could be considered as external disturbances are shown on the left-hand side of **Picture 15** and their presented grouping is made according to the extent to which individual product manufacturers can influence these factors. For example, factors causing disturbance to perceived product image can include currently available substitute products, technological advancements or earlier experiences. Such factors are hard to change or control from the perspective of a single product manufacturer, but they should be still recognized when deriving development criteria for new products. On the other hand, some factors causing disturbances for perceived product image can be influence by means of marketing and public presence e.g. positioning of the brand image, CRM policies, service offerings and appealing narratives created for particular products (10). Components that influence desired states (1) are likely to be dictated by external factors outside the reach of individual organizations. Such components can contain shifts in social, economic and cultural trends which are reflected in salience of various psychological needs. However, it would be misleading to say that companies should not attempt to try influencing factors on the product meaning level despite complications related to being able to control them. Despite obvious difficulties in predicting directions of such trends, an attempt should be made to include those in UX and CX target choices.

Levels at which abovementioned components of product experience can be taken into account in deriving product qualities is presented in the experience hierarchy framework (Right-hand side of **Picture 15**). The idea behind a hierarchy for different levels of UX and CX components in experience

driven design is derived partially from the earlier presented hierarchy of goals (**Section 2**). Although such hierarchical structures are artificial and strict distinction between different levels might fall subject to varying interpretations, these structures are useful in the view of creating basis for common understanding when breaking abstract experience targets into particular desired emotions, key activities and product qualities. Introduced framework has three levels of experience hierarchy for customers (18) and users (17) separately. The idea of having these two distinct parties in the same setting lies in simultaneous processing of user and customer needs and following product quality preferences (19). Top hierarchy level is set at system concepts (Similarly as in **Picture 4** is **Section 2**) and considers abstract self-perceptions of users and customers (e.g. what kind of person a typical forklift operator wants to be). This must not be confused with stereotyping particular individual groups based on their occupation or proficiency level. The second hierarchy level is essential from the perspective of this model as it is meant for determining UX and CX targets carried throughout the whole product development process. These UX and CX targets can be derived from psychological human needs presented earlier in **Section 2** (**Picture 5**). For example, one UX target could be identified as need of security and can be broken down into several components e.g. feeling of trust in technology, sense of being safe from uncertainties etc. These components are meant to reflect users' and customers' *be-goals* which also play an essential role on the product meaning level in **Picture 14**. The third hierarchy level considers more concrete activities (*do-goals*) and product qualities which are assumed to contribute to selected experience targets and *be-goals*. For instance, important activities which are relevant to the feeling of security might include "driving a forklift in narrow spaces with low visibility due to a large load". Related product qualities could be defined as "the machine is very responsive to controls and has a warning system alerting about nearby traffic" or "the machine does not sound as it is going to break down". However, the latter quality is in the form of an anti-target, which is to be used only if there are no better defined targets e.g. "the machine must sound like a V12 Formula-1 sports car engine". These qualities can be broken down even further to detail level e.g. "the hydraulic pump must operate silently but so that it can still be heard to verify that it is functioning properly". At the detail level the hierarchy chain ends with possible options for concrete product features to be embedded in the product (19). When the abovementioned process of braking abstract experience targets into product features is done simultaneously from perspectives of

II Product experience hierarchy



Picture 15 shows examples of various components influencing product experiences. Points (8), (19) and (12) indicate external disturbances introduced in the thinking model (I). Point (19) indicates a set of product qualities which should contribute to both UX and CX targets. Points (17) and (18) indicate UX and CX targets derived from psychological human needs.



customers and users, it should lead to some set of product qualities that have a potential to satisfy both customer and user needs by meeting selected UX and CX targets. However, to get some reassurance that presumed links between experience targets and products qualities are actually possible in the real-life situations, these links between different levels of hierarchy must be confirmed by means of user and customer research already in early stages of product development projects (15). Some of potential methods were already mentioned in **Section 2.4.2**. In addition, I introduce one method involving a questionnaire set for approaching different levels of product perceptions (**Section 4.3.3**).

Practical implementation of the model

Perhaps one of the main intended uses for the presented hierarchy of experiences is its potential to be utilized as working canvas for ideation and generation of experience driven development criteria within R&D departments of companies operating in B-to-B environment. Theoretical part with thinking model indicating hypothetical distinction between levels of product experiences can act as a background for determining relevant factors influencing product perceptions. Another useful aspect of the model might be seen in its potential to be utilized for generating UX argumentation chains for marketing and sales purposes (16). These argumentation chains might be derived from the hierarchy of experiences when linking UX targets to respective CX targets through concrete product features (19). For instance, one argumentation chain might include consequential stream such as: “Feeling of trust in equipment among users due to more stable product platform leads to less mistakes in operations. This on the other hand leads to reduced costs from spoiled products and more predictable output. As a consequence, customers feel more reassured about realization of their production plans and thus safe from uncertainties”. Although this example is overly straightforward, similar principle could be applied to generate more elaborate and catchy consequential streams for selling point implications. This does not incline that these argumentations should be presented to external parties as such, but they can be shared internally to increase coherence of the communicated message and cooperation between marketing and R&D departments in early stages of development projects (OLSON, et al., 2001). Next section will address a case study in which I attempt to implement presented theories and models in practice.

CONVEYING UX IN B-to-B ENVIRONMENT: A CASE STUDY

This section presents main research questions for the case study as well as methods by which these questions are addressed. Following paragraphs indicate chronological order in which the study was conducted and specifics of interviewing and questionnaire design processes. The core idea of the upcoming discussion is to treat the link between theoretical background and empirical implementation of the previously formulated UX thinking model within company cases.

4.1. Perspective mapping

Before going into details on how the research was constructed I want to discuss some important particularities regarding the background information, preliminary interviews and visits to various companies and faculties. Presented general insights are relevant from the perspective of research question generation and later assessment.

Main sources of background information for this study were acquired from literature reviews, discussions with UX experts and company and faculty visits. In the autumn of 2011 I participated in a tour which was part of the UXUS project and during which the researcher group visited companies and faculties in Holland and Germany. These included universities such as Delft University of Technology, Eindhoven University of Technology and Folkwang University of the Arts along with company visits involving Philips research department in Eindhoven and SAP in Darmstadt. The UXUS European tour provided an outstanding opportunity to meet with leading UX experts and researchers to discuss prevailing research directions along with current challenges and approaches. Some of the UX experts I met, to name but a few, included Marc Hassenzahl, Jacques Terken, Arnold Vermeeren and Hendrik Schifferstein. Company visits, on the other hand, provided insights on how user experience paradigm is approached and applied to actual products.

In addition to UXUS tour in 2011, I participated in multiple meetings and discussion sessions with practitioners from leading Finnish and international metal and engineering companies (Including Kone, Konecranes, Rocla, Metso, Fastems and Rolls-Royce) and researchers from VTT, Aalto University and Tampere University of Technology. One of my goals concerning these meetings was to try to map differences in understanding and interpretation of user experience based approach indicated by individuals with varying backgrounds. Such mapping posed a challenge of its own and was done mostly by comparison of presented ideas and examples from previous outcomes of UXUS project. Based on faculty and company visits and discussions with UX researchers and company practitioners I identified some specific areas of interest which seemed to be especially salient and challenging.

Difference in approaches to UX in B-to-B and B-to-C environments

Most of the empirical studies containing UX as the main theme consider consumer products in B-to-C environment whereas studies on CX in B-to-B context are usually based on marketing and customer satisfaction research. This poses one of the interesting challenges of combining relevant aspects from varying studies and creating a thinking model for experience based approach in B-to-B setting which accounts for both CX and UX in equilibrium-like manner.

Balance in emphases on User and Customer perspectives

Finding equilibrium between UX and CX in product development leads to the second challenge. Briefly put, this refers to the difficulties when trying to decide how much emphasis (resources) should be allocated to improving user experience versus customer experience. Sometimes these allocations are not contradictory but in other situations it can be argued that further enhancement of UX does not carry any additional value to the customer or customer's business. However, as user experience and its influences are sometimes hard to measure and take relatively long period to make the difference, it often comes to the matter of opinion and personal views whether companies end up with purely utilitarian approach or put additional weight on softer values such as users' emotions and experiences. One potential treatment of this problem could be seen in introduction of comprehensive and understandable

cause and consequence links regarding end-user experiences and following improvement in customers' experiences.

Abstraction level of UX paradigm

Another point arising from the abovementioned challenge is related to the sometimes overly high abstraction level of the introduced user experience paradigm. As noted earlier in the section concerning mental constructs (**Section 2**), theoretical background addressing these issues is extremely complex and involves multitude of levels and directions of approach. It is reasonable to assume that presenting user experience paradigm solely on this theoretical and abstract level will create confusion and dispersion in comprehension of the thinking model. This situation might be somewhat linked to difficulties in formulating more abstract levels of individuals' goals (be-goals). From the psychological perspective these challenges might be explained by the accessibility concept which is described thoroughly in the paper by KAHNEMAN (2002). Perhaps the main point to be derived from accessibility and salience concepts for the purpose of this challenge is that accessing higher level of abstraction requires more cognitive effort which is harder and slower. In addition, this effort is automatically compared with faster and more intuitive perceptions of user experience which lie on lower level of abstraction (e.g. do-goals and functions). For example, in conversations between researchers and company practitioners it is sometimes apparent that lowering the level of abstraction is required to create a unified understanding. In other words, reducing level of abstraction in conveying UX paradigm, at least partially, could be beneficial to establish a comprehensible link between UX theory and its practical implications. This was one of the basic ideas behind developing the experience hierarchy model presented in **Section 3.3**.

Generic and case specific implementations of UX

Because industries and fields of operation typically pose environment specific challenges, it is often hard to create any generic procedures or tools that would be suitable for conveying user experience paradigm in all company cases. However, this generalization might be potentially achieved on a more abstract and theoretical level, which would involve such aspects of UX paradigm as basic psychological needs, levels of motivation and be-goals. In some sense, this problem combined with previously introduced

abstraction level challenge results in a paradoxical situation where the pursuit to create some general UX framework leads to increase in abstraction level of terms and ideas used in that framework. This on the other hand undermines the attempt to create a viable link between the theory and concrete practical UX implications referred to in the earlier paragraph.

Internal communication and department differences

Another topic that became salient from discussions with company practitioners was related to communication issues between different departments within a company. Especially issue related to communicating product development criteria and their implications for customers and end-users was raised on multiple occasions. Although the field of internal communication strategies lies mostly outside the scope of my study, it could not be neglected completely because of its crucial role in being able to convey UX paradigm within an organization.

Integration of UX paradigm into organizational culture

Perhaps one of the hardest challenges regarding advancement of user experience based thinking model could be seen in its integration into corporate strategies and practical implementation on multiple levels of organizations. Nevertheless, this is the long-term aim of conveying UX paradigm in B-to-B and B-to-C environments and it requires carefully planned as well as gradual and controlled change. The general vision could be formulated as elevation of user experience paradigm into operating principles and processes which constitute the organizational culture where these principles are implemented, encouraged and shared.

4.2. Research questions for the case study

From the abovementioned challenges related to implementation of UX thinking model I derived a list of research questions to be addressed in the scope of a case study conducted in one of UXUS project partner companies Rocla. Part of the research questions are studied by interviewing managers from different departments of the organization and other questions are addressed with experimental UX-

mapping questionnaire set.

RQ1 = What are the main differences between perceptions of industry practitioners from different departments regarding challenges and relevance of UX approach for external parties including customers, users and distributors?

This research question arises from discussions with industry practitioners and indicated concern in lack of common understanding between different departments of how user experience can be utilized to design better products and differentiate in the market. Because conveying UX paradigm externally requires internal cooperation between different departments, getting relevant insights regarding this issue is especially important in the view of the topic of this study. It is also important to distinguish how different individuals perceive external parties such as distributors, customers and users and how they see roles of these parties in their own work. This question is addressed mainly by interviewing individuals involved in R&D, sales and marketing operations.

RQ2 = What product qualities are relevant for distributors of industrial equipment?

The second research question was formulated from the discussions regarding product distribution chains and how the intended product image gets distorted on its way to customers and users. In this respect, studying views of intermediate parties is an important part of getting information on how UX paradigm should be conveyed and what are the most relevant product qualities for equipment distributors. For the purpose of addressing this question I define hypothesis H1, which is tested with experimental UX-mapping tool presented in data and methods section (**Section 4.3.3**).

H1 = Product qualities that have a more direct link to profitability are seen as more important from the perspective of equipment distributors.

Testing this hypothesis aims at mapping relative importance weights which individuals of the distributor

party tend to assign to various product qualities such as usability, visual appearance, ergonomics etc. It is assumed that product qualities such as efficiency, functionality and cost factors will be seen as more important than qualities with vaguer link to economic benefit i.e. factors such as visual appearance, touch and feel, ergonomics etc. Although this assumption seems like a common sense in the case of equipment distributors, it is interesting to test whether indicated differences between these factors would be statistically significant.

RQ3 = What psychological needs are seen as most important for equipment development in an industrial setting by individuals from the distributor party.

Answering this question becomes relevant when one wants to prioritize and select certain UX and CX targets to be used in the experience hierarchy framework presented in **Section 3.3**. In this case, I investigate how product distributors perceive psychological needs and what are their preferences regarding their implementation in product development. This question is ascended on with experimental UX-mapping questionnaire set.

H2 = Taking psychological human needs into account when developing new product qualities will be viewed as more important for users than for customers by the distributor party.

The main idea behind testing this hypothesis lies in the assumption that distributors are not necessarily able to perceive the link between satisfying psychological needs of equipment operators and economic benefit for customers. This hypothesis is tested with experimental questionnaire set.

H3 = Equipment distributors operating in Southern Europe will see psychological human needs as less important for developing new product qualities.

Another issue that was raised in discussions with industry practitioners concerned differences in attitudes, purchasing criteria and distribution of influence, which was due to varying organizational cultures in

different countries. For example, it was assumed that individuals from southern and eastern parts of Europe are less responsive to hedonic product qualities and are less concerned with working conditions of operators. In this study I do not test this hypothesis with customers but only with distributors operating in various countries.

RQ4 = What is the relationship between assessments of pragmatic and hedonic product qualities and perceptions of individual product features from the point of view of equipment distributors?

This research question aims at determining links between abstract product descriptions such as appealing, novel, exciting etc. and separate product qualities such as visual appearance, usability, functionality etc. Insights from this question can be used to establish links between experience hierarchy levels presented in **Section 3.3 (Picture 15)**. These links are assumed to be different for varying interest groups including manufacturers, users, customers and distributors. In this study I address this question by three hypotheses (H4, H5 and H6), which are tested with the help of experimental UX-mapping questionnaire set provided to individuals from the distributor party. In addition, I investigate whether distributors are able to identify differences in hedonic qualities when comparing two separate products.

H4 = Pragmatic quality of products (PQ) is associated with usability of the product by the distributor party.

H5 = Hedonic qualities (HQ-I and HQ-S) are associated with visceral product qualities (visual appearance, sound and noise, smell) as well as understandability and customization possibility by the distributor party.

H6 = Overall attractiveness of the product (ATT) is associated with visual appearance, usability, efficiency and functionality by the distributor party.

Assumptions in hypotheses H4, H5 and H6 are based on interviews and discussions with industry practitioners and their perceptions of links between product qualities and abstract descriptions.

H7 = Equipment distributors will not indicate differences in hedonic qualities but will find differences in pragmatic and attractiveness qualities when comparing two industrial products.

Assumption behind this hypothesis rises from similar principles as indicated in RQ1 i.e. prioritization of pragmatic qualities to hedonic qualities by the distributor party. In other words, I test whether distributors are able to identify any significant differences between products based on their hedonic qualities. AttrakDiff questionnaire setting is used to test this hypothesis.

4.3. Data and methods

In this section I go through in detail what are the different phases and methods based on which this research is conducted. As mentioned in the beginning of this paper, the statistical analysis presented in this study is derived from data collected by the UXUS project research group from internationally operating forklift manufacturing company Rocla and its parent company MCFE (Mitsubishi Caterpillar Forklift Europe). The key interest area for practical purposes was located in the domain of cross-department communication in respect to UX paradigm and external communication to distributor, customer and end-user parties. The main goal of the proposed study method was to determine whether properly designed questionnaires and interviews can be used for preliminary mapping of differences in department perspectives on critical product qualities and whether UX related assessments of distributor party can complement information gathered from actual customers and users. From the industrial design point of view, I try to explore areas in which UX related knowledge can be collected internally and externally for the manufacturing company taking into account perspectives of other relevant parties in addition to the end-user group. Following paragraphs present brief overview of the operating and business environment in question along with basic equipment characteristics.

4.3.1. General characteristics of warehouse equipment and operating environment

The basic idea behind forklift manufacturing business can be roughly formulated as manufacturing equipment and selling it to customers through direct sales or with the help of equipment distribution chains. Forklifts can be classified as industrial products belonging to accessory equipment category as mentioned in earlier sections. In contrast to automobile industry, typical customers of forklift manufacturers are not private individuals but other businesses engaged in various logistics operations or warehouse and storing businesses. Targeted customer groups differ in many ways according to their size, geographical location, extensity of operations, nature of their business, labor and natural environment based requirements. Also end-users are influenced by the abovementioned dimensions e.g. the nature of the business often determines skill and experience levels required from operators and geographical location has often a link to organizational culture and how much influence operators have in respect to equipment purchasing decisions. **Picture 16** tries to capture basic dimensions related to customer, user and distributor groups which have a direct impact on equipment requirements and consequently on UX targets. Some of these dimensions were already mentioned when describing experience component canvas in **Section 3.3**. There are multiple forklift contract and sales models involved, reaching from pure equipment based sales to service contract and customized solution sales as well as leasing business. From the perspective of customer retaining and business effectiveness, longer service and equipment renewal contracts are usually in focus. However, the competition is tight and when it comes to justifying implementation of user centered or user experience based design in forklift manufacturing, these justifications must carry a clear message and proof regarding efficiency and economic benefit of such an approach. In addition, the size and brand of a manufacturer plays an important role as it is usually reflected in differentiating and marketing strategies as well as in the number and specifications of offered equipment models.

The actual physical environment where forklifts are operated ranges from basic outdoor storing areas to highly sophisticated and efficiency oriented logistics centers. Also organizational culture can be considered as part of the operating environment, because it is often reflected in quality of physical premises, proficiency and experience level of hired operators, utilized incentive schemes and overall

working conditions. Natural environment poses its own challenges for the equipment with factors such as temperature fluctuations, moisture and dust related issues.

As discussed earlier, operating environment has a great deal of influence on attitudes and needs of equipment operators and must be taken into account in offerings as well as in UX oriented product development. For example, equipment meant for operators working in efficiency and precision driven logistics center might have more salient features that support competence need (e.g. software that allows following and comparing real-time performance). On the other hand, equipment meant for general warehouse where there is room for alternatives in operators' working schedules, might have features that support users' feeling of autonomy (e.g. work planning and optimization software). Some product qualities can be adjusted to correspond to multiple operating environments and thus can be suited for multiple equipment models, whereas other features require compromising between some particular aspects and their general implementation is not viable for technical or cost effectiveness reasons. Clearly, critical decisions concerning what product qualities should be integrated or combined and in what equipment are not made solely based on recognized specifics of operating environments and user needs, but are largely dependent on manufacturer's customer target groups, time horizon of product image and positioning strategies as well as external factors such as developments in the market (e.g. suppliers, materials, spare parts), competitor benchmarking and overall state of the economy. In this relatively wide palette of relevant strategic factors, product related UX can play only a limited role, but this role might prove to be elevated to serve as an important differentiating aspect and a critical competitive advantage.

Forklift equipment has many product classes that are meant for different functions in warehouse or storing space environments. Typical classes for these products are counterbalance trucks, stackers, pallet trucks, order pickers, reach trucks and tow trucks. **Picture 17** includes brief descriptions of varying functions and specifics of mentioned product classes. All equipment types in presented product classes are usually operated by individual operators but the nature of interaction with the product differs across these classes according to primary functions of this equipment. For example, the primary function of

- Relevance for distributors
- Relevance for customers
- Relevance for users

- ● ● Nature of the business: _____ Industry type, Size and growth of the industry, Client groups etc.
- ● ● Geographical dispersion: _____ Local vs. Global operations, Distribution networks etc.
- ● ● Size: _____ Facilities, Personnel, Financial solvency etc.
- ● ● Organizational culture: _____ Strictness of hierarchy, Influence of operators vs. customers, Work incentives etc.
- ● ● Operating environment: _____ Natural environment, Built environment and facilities etc.
- ● ● Role of the equipment in operations: _____ Utilization hours, Work load and intensity, Work criticality etc.
- ● ● Expertise level: _____ Work experience, Age, Occupation, Responsibilities etc.

Relevant dimensions for UX and CX targets



Picture 16 displays important dimensions to be accounted for when determining UX and CX targets for warehouse equipment development. Some of these dimensions were mentioned in experience component canvas in Section 3.3.

Counterbalance trucks

- Used for heavy loads
- Requires space to turn and operate
- Electric, gas or diesel powered



Order pickers

- Order picking on low and mid-levels
- Requires quick on and off access
- Electric, battery powered



Tow trucks

- Used to perform towing functions
- Requires quick on and off access
- Electric, battery powered



Reach trucks

- Moving loads from upper shelves to lower shelves for order picking
- Indoor warehouse use



Stackers

- Used for load stacking functions
- Indoor warehouse use
- Electric powered



Pallet trucks

- Used for moving pallet loads
- Indoor warehouse use
- Manual or electric powered



Picture 17. Typical classes of forklift and warehouse equipment.

reach trucks could be described as moving packages to and from the upper shelves of a warehouse so that operators of other equipment (e.g. order pickers) could pick up these packages for further processing. Operators of reach trucks do not have to leave their driver's compartment while performing their primary function whereas operators of order picking equipment have to move back and forth from their driving position to pick orders by hand and place them into the scaffold attached to their order picker. In this sense, primary function of forklift equipment might be seen as another important dimension influencing UX implementation in addition to the abovementioned more general dimensions. One important forklift class which is not described in detail in this study is related to automated forklifts or AGVs (Automated Guided Vehicles). AGVs involve a radically different nature of operation compared to operator driven trucks, thus their UX factors must be considered separately.

4.3.2. Data gathering and information sources for the case study

Main groups of interest presented in my research include: Sales and R&D departments of a forklift manufacturing company Rocla (Owned by MCFE) and distributors of warehouse equipment. Secondary groups of interest, which are not directly assessed in this paper but play a crucial role in the introduced UX-mapping tool concept, are actual operators (End-users) of warehouse equipment and corresponding customer groups (Owners of logistics chains and warehouses). All of the abovementioned parties play a distinct part in influencing product development directions as was described earlier. The reason why intermediate parties such as retailers and distributors are interesting in the scope of UX in B-to-B environment is related to their role in conveying product related message and image to customers and end-users. The aim of studying this group lies in understanding their perspective when it comes to assessing UX targets and needs of customer and end-user parties. Consequently, these perceptions can be compared to feedback from customers and operators as well as views of manufacturing company (Rocla) with respect to separate departments. Following paragraphs present utilized data sources and methods involved in studying operating and business environment specific challenges and perceptions of manufacturer and distributor parties.

Interviews

For the purpose of studying UX related questions regarding product development in overall strategy of Rocla and MCFE the UXUS researcher group conducted series of interviews with managers from different departments of the company. Altogether, ten (10) interviews were conducted with four (4) managers from sales and marketing, three (3) R&D managers and three (3) business and offering development managers. All interviews were one-hour semi-structured interviews involving one interviewee and two researchers (I was present in 5 of 10 interviews). The semi-structured interview was divided into two parts: Part 1 considers general questions related to practices of user centered and UX based approaches in product development as well as potential effects of customer and user involvement in determination of development criteria for new equipment, Part 2 considers one specific case which involved development criteria for a new order picker product family. General guidelines which were used for conducting interviews are presented in **Table 1**. These guidelines were identified during UXUS researcher group meetings and interviews were recorded and transcribed for further analysis. One of the main aims of interview guidelines was to find similarities and differences in views of managers from different departments regarding customer and user involvement in product development, perceptions of UX as a term in general and potential differentiating factor, identified relevant customer and user groups, possibilities to convey UX paradigm internally and externally and main challenges associated with these steps. Another aim was in identifying concrete phases and challenges in the development process of previously introduced order picking equipment as well as potential for improving this process. I also use ideas and insights derived from these interviews for shaping ideas in earlier discussed strategic levels of UX implementation in B-to-B context and refining the concept of UX-mapping tool presented later.

Events, field visits and video material

In addition to interviews and company visits mentioned in perspective mapping section (**Section 4.1**), I utilize information gathered from field visits to Rocla’s manufacturing facility in Järvenpää and Berner Ltd. logistics center in Vantaa, Finland. Derived insights are used for understanding possibilities and challenges related to conveying user experience paradigm in B-to-B setting as well as general nature of operations in storage space environment. The main goal behind field visits was in better comprehension

of working conditions and processes involved in using different types of forklift equipment. Field visits to Järvenpää included tours to the manufacturing and training facilities with test driving and demonstration of various forklift equipment types. Field visit to Berner Ltd. logistics center was coinciding with product introduction event involving multinational distributors and dealers of forklift equipment. During this event multiple warehouse products, including several stacker, order picker and pallet truck models, were introduced and demonstrated to Mitsubishi forklift dealers. Product introductions conducted by Rocla’s

Table 1 shows basic composition of the semi-structured interview with industry practitioners.

Background of the respondent	
Main tasks and responsibilities	
Role of customers	
How customers are perceived as a group and what are their main characteristics	
What information is collected from customers	
How this information is utilized in the domain of the respondent	
How this information is helpful from the perspective of product development	
Role of users	
How users are perceived as a group and what are their main characteristics	
What information is collected from users	
How this information is utilized in the domain of the respondent	
How this information is helpful from the perspective of product development	
Role of distributors	
How distributors are perceived as a group and what are their main characteristics	
What information is collected from distributors	
How this information is utilized in the domain of the respondent	
How this information is helpful from the perspective of product development	
How UX is understood, implemented and communicated	
What are the possible benefits of UX in product development	
How it is communicated internally and externally	
What parties and individual groups are most relevant for conveying UX based approach	
What are the main challenges in conveying UX approach	

R&D department were videotaped for further analysis. The core focus in respect to the topic of this paper was related to product introduction principles, emphasized product qualities and other important aspects that were communicated by the R&D department to distributors. Comparing these aspects to perceptions and insights derived from the interviews with Rocla's managers would serve to further adjust the basis for internal UX-mapping tool presented in the following section. Complementary to event videos and field visit to the Berner Ltd. warehouse in Vantaa, Finland, I interviewed one product manager in relation to differences in needs of customers, distributors and operators as well as selling points utilized for these different parties. I was also able to observe actual work of operators in the field and review earlier videos filmed by R&D department for user research purposes. These included head-set camera and other views which provided a rather extensive picture concerning the nature of operators' work with specific equipment in a given environment.

4.3.3. UX-mapping tool concept and experiment design

The main idea behind developing UX-mapping tool was to introduce a questionnaire set that would involve relevant measures for capturing UX and CX on more abstract and concrete levels and enable customization for various interest groups for later cross-comparison. Another point behind this tool was to create means for longitudinal measurement of product experiences with systematic intervals over time. This method was derived as one possible way to utilize core ideas presented in the hypothetical thinking model in **Section 3.3**. For instance, presented questions reach from assessments of concrete product qualities to more abstract product image and meaning.

Based on the literature review and information gathered through interviews and field visits, I introduce a concept for mapping UX related factors for manufacturing companies operating in B-to-B environment. The main purpose of this UX-mapping tool is related to a relatively easy and quick way to gather information on product experiences, needs and qualities from relevant parties. The aim is to propose a modular multi-choice questionnaire set which can be customized based on selected target groups to provide comparable statistical information which can potentially reveal crucial areas of interest to be investigated further with more elaborate qualitative methods. Mentioned relevant parties according to

which questionnaire modules are to be customized include manufacturers, distributors, customers and end-users. These four groups of interest form a general base for assessing user experience related factors such as particular product qualities, working environment, psychological needs and overall product perceptions. From the practical point of view, this tool might be considered as a supporting part for determining development criteria, UX targets and product selling points for R&D, sales and marketing departments of a manufacturer. The secondary implicit aim with this tool can be seen in providing additional PR material and shaping development direction perceptions and brand image communicated to external parties (distributors, customers and end-users). Further paragraphs present implemented measure dimensions for six separate questionnaire modules.

Content and structure of questionnaire modules

I propose six different questionnaire modules which can be combined into a questionnaire set depending on the interest group and required information. All of the proposed modules contain multi-choice questions with 7- or 5-choice evaluation scales. Multi-choice questions are used for relatively quick and easy access to trend and tendency information from larger respondent samples. In addition to these questions each questionnaire has a free feedback section for identification of more specific product related issues. Although questionnaire format is unable to provide in-depth information on why individuals value some qualities or needs over other, combining information from multiple modules can reveal interesting relationships or anomalies which can be studied further by interviewing individuals and visiting operating environments. **Picture 18** captures visual appearance of some of the utilized questionnaire layouts in printed format.

Identified dimensions for relevant UX related factors in questionnaire modules include (1) *general – product related* dimension, which determines whether individuals are asked about their general preferences or their perceptions of a particular product, (2) *general quality – particular quality* dimension, which relates to whether individuals evaluate products as a whole or as their separate features, and (3) *own perspective – others' perspective* dimension, which determines whether individuals indicate preferences from their own perspective or try to assess perspectives of other parties. As mentioned earlier, these

Picture 18



Picture 18 shows examples of UX-mapping questionnaire layouts in printed format.

dimensions are applied for four interest groups: manufacturer, distributors, customers and end-users. Proposed questionnaire modules with respective dimensions include the following. **Module 1:** AttrakDiff question set is used as *product related* and *general quality* perception measure. **Module 2:** Questions related to importance of psychological human needs are used as *general* measures for determining perceptions of different individual groups on *own perspective* and *others' perspective* dimensions. **Module 3:** Evaluations related to specific product qualities include both *general* and *product related* questions. **Module 4:** Work practice assessments are used for determining factors related to working environment, work incentives and influence perceptions on *general* dimension along with evaluations of particular products on *general quality* dimension. **Module 5:** Cost perception module is introduced for determining perceptions of manufacturers, customers and distributors regarding potential economic benefit from positive UX in *general* and relationship of particular product qualities to their preferences in respect to product cost. **Module 6:** Hypothetical product configuration scenario is intended to capture perceptions of individuals in the manufacturing organization concerning product development directions on *general quality* and *particular quality* dimensions. Above-mentioned measure types try to include important aspects discussed in the section regarding UX implementation on tactical and strategic levels (Section 3.2). **Picture 19** summarizes the main idea behind combinations of different question modules for separate interest groups.

1. AttrakDiff. The first questionnaire module contains earlier described AttrakDiff question set with four areas of product quality assessments with multiple opposite adjective pairs: (1) Pragmatic quality (PQ) describes usability of a product and how successful users are in completing their goals with the product, (2) Hedonic quality - stimulation (HQ-S) describes how the product stimulates users and provides encouragement, novelty, interest and content, (3) Hedonic quality - identity (HQ-I) indicates to what extent the product allows the user to identify with it and (4) Attractiveness (ATT) describes a global value of the product based on the quality perception. **Appendix 1** shows how the AttrakDiff question module is depicted in the UX-mapping tool and what are the utilized adjective pairs. Although comparing different products based on these adjective pair descriptions might provide useful information for assessing experiences of respondents, these descriptions are context dependent and their meaning

Picture 19



Picture 19 displays recommended combinations of separate question modules in UX-mapping questionnaire set along with respective dimension adjustments.

should not be interpreted directly before in-depth analysis (SCHIFFERSTEIN, et al. 2011). This module becomes especially relevant when comparing perceptions of different products within and across interest groups.

2. Psychological needs. The second module is related to assessing importance of psychological needs in developing industrial products. A set of most salient psychological needs was presented in **Section 2** and I utilize a similar but modified set of eight psychological needs subdivided to more concrete examples. Identified set of psychological needs includes security, confidence, relatedness, competence, autonomy, physical thriving, stimulation and influence (**Picture 5**). The corresponding subset of more concrete examples for abovementioned needs is formulated as follows: (1) feeling of controlled and safe operations, (2) trust in technology, (3) feeling of belonging to a community, (4) receiving and accomplishing enough challenging tasks, (5) sense of being able to influence and organize own work, (6) feeling of being physically fit and healthy, (7) stimulation and pleasure at work and (8) feeling of appreciation by colleagues. The need of physical thriving was added because this study targets working environments with heavy machinery and hazardous situations. This might make physical health related issues more salient in this context. Although confidence might be considered as a sub-product of competence and security, it is taken separately in my questionnaire setup because it is directly linked to trust in technology and how individuals feel working around equipment and machinery. In the case of Rocla, I use additional concrete feature examples alongside psychological needs to create transparency and more coherent understanding how these needs can be reflected in practice. **Appendix 2** depicts visual appearance of this module presented to equipment distributors with *others' perspective* dimension.

3. Product qualities. Question sets concerning separate product qualities compose the third module of the UX-mapping tool. This set was mainly based on theoretical backgrounds of product quality classifications discussed in **Section 2.3.1**. Some of the presented product quality categories were pragmatic, hedonic and appeal (HASSENZAHN, et al., 2008) as well as visceral, behavioral and reflective (NORMAN, 2004). Based on these categorizations and interviews with people involved in operations within the industrial environment, I derived a combined setup for product quality categorization which

aims at distinguishing slightly different groups of industrial product qualities. Proposed categories include (1) *senses*, (2) *function*, (3) *adaptation* and (4) *utilitarian* quality groups. Senses category relates to qualities that can be accessed with basic human senses such as sight, smell, touch and sound. Function category includes qualities that describe use related product qualities such as usability, functionality and safety qualities. Adaptation category contains qualities related to learning process, comfort of use and customization possibilities of the product. The final category is linked to more utilitarian qualities of products such as cost, efficiency, durability and available services. The idea behind the proposed categorization lies in the pursuit to distinguish between areas which could be more or less relevant for different parties involved with the product. **Appendix 3** indicates how these quality questions are presented in a more visual format. Responses acquired from this module can be also tested for correlations with AttrakDiff module of the questionnaire.

4. Work practices. This module is intended for determining end-user's perceptions of their working environment and attitudes towards their industrial equipment. Areas that are touched in presented question sets relate to the nature of work, possibilities to influence working environment and equipment (Autonomy) and perceptions regarding meanings of industrial products. In addition, this module presents product association scales which aim at determining how operators perceive their and equipment. The general purpose of this module is to map potential user profiles which can be then tested for correlations with other questionnaire modules e.g. psychological needs and product qualities. **Appendix 4** and **Appendix 5** show basic layouts of work practices module. First of the *general* dimension parts is related to the nature of work including (1) assessments of work dynamics i.e. abruptness or continuity of work flow, (2) perception of stress levels, (3) perceived work criticality in respect to other people and environment as well as (4) overall intensity and pace of work (Upper left part in **Appendix 4**). Influence part on *general* dimension asks questions about perceived influence on (1) equipment acquisitions, (2) available equipment for everyday work, (3) working conditions and environment, (4) nature of work i.e. tasks, schedules and locations and (5) product customization and personalization possibilities (Right part in **Appendix 4**). Work motivation part is implemented only with certain customer and user groups and includes questions about work incentives and motivation (Lower

left part in **Appendix 4**). Product perception related sections of this module involve various examples from common real-life situations or activities with certain emotional loads (i.e. semantic differentials) which are derived from literature, field visits and interviews. I divide product perception questions into *product use* and *relationship to product* parts. Product use perception part includes six semantic differential scenarios with the following content: (1) slow paced game (e.g. curling) – a highly intense game (e.g. ice-hockey), (2) inefficient tool (e.g. stone age axe) – highly efficient tool (e.g. a chainsaw), (3) driving a slow and clumsy vehicle (e.g. a moped) – driving a fancy and fast vehicle (e.g. a sports car), (4) using a weak tool (e.g. a hairdryer) – using a powerful machine (e.g. a jet fighter), (5) using confusing and unreliable system (e.g. being in a labyrinth) – using clear and trustworthy system (e.g. receiving instructions from a navigator), (6) using a highly unreliable object (e.g. climbing on a flimsy and unreliable rope) – using a highly reliable object (e.g. climbing on a strong and reliable chain). Opposites and picture examples for these scenarios were created according to estimated emotional loads which these real-life situations can carry (Left side of **Appendix 5**). Relationship to product part also contains six semantic differential scenarios which are aimed at determining whether users have any persisting emotional perception of the product. All of these scenarios include two opposites: (1) a hated foe – your best pal, (2) cheap plastic toy – a high quality tool, (3) worn-out boot – stylish new shoe, (4) just another tool – your beloved pet, (5) inconvenient stool – cozy armchair, (6) outdated telephone – modern phone (Right side of **Appendix 5**). The main idea behind presented scenarios is to sketch perceptions of product image as described in the hypothetical thinking model in **Section 3.3**.

5. Cost perceptions. The fifth question module considers perceptions of distributors and customers regarding extensity to which products can influence their costs and savings directly or indirectly through product users. In other words, questions in this set are aimed at determining whether distributors and customers see any potential links between product UX and economic benefit. **Appendix 6** demonstrates suggested questionnaire layout. First part of the cost perception module includes questions regarding decision making in specific scenarios which are aimed at assessing whether some particular product qualities can overweight lower cost of products (Left side of **Appendix 6**). Obviously, these are rather abstract evaluations with no account for relativity of costs and benefits.

However, the main goal is to look for indications of what are the most important product qualities in relation to product cost. These might be also considered as indirect indications of what qualities are to be emphasized as selling points and in product development criteria. Examples of question sets in **Appendix 6** include evaluation gauges with two products A and B. Product A has a lower price and product B has a higher price and a distinctive superior quality, which differs across eight separate scenarios. Distinguishing qualities of product B include (1) better part quality and durability, (2) superior appearance and styling, (3) better customization possibility for various tasks, (4) better performance and efficiency, (5) better ergonomics and user satisfaction, (6) better safety and control features, (7) significantly lower maintenance requirements and (8) larger variety of available services. All of the abovementioned distinctive quality sets came up saliently in study interviews. The second part of the module includes questions regarding perceived links between overall product quality and economic factors. The list of presented economic factors that are assumed to be influenced by product qualities and user interaction directly or indirectly involve (1) costs due to sick hours and absences, (2) costs due to mistakes and safety hazards, (3) indirect costs from low work motivation and reduced productivity, (4) costs due to high labor turnover and hiring costs, (5) costs due to adaptation and learning process, (6) indirect savings due to positive reputation and brand image, (7) costs related to mistreatment of products and equipment and (8) indirect costs due to misunderstandings in operating principles of the equipment. The primary goal behind these questions is related to assessing whether customers and distributors comprehend the link between product quality and mentioned economic consequences as possible and relevant factors. The secondary objective of these questions lies in a more abstract domain related to making respondents think about product UX factors and economic benefits as closely related. This objective takes its roots from basic principles of the framing effect and salience in behavioral biases as discussed in **Section 2.2.5**.

6. Hypothetical product configuration scenario. This question module is aimed solely for the internal use of the manufacturer and considers hypothetical products and their optimal configuration. The idea behind this module is to identify whether separate departments within a manufacturing organization differ in their views in respect to various product qualities and their desired

effect on users and customers. In addition, this module might provide insights on the overall orientation of the manufacturing organization and with systematic measurement can be used to follow development of this orientation i.e. this module is aimed at providing hints about attitudes of individuals regarding UX approach versus more utilitarian or technical approaches. The basic structure of the module presents fourteen (14) product features with their presumably known effects on users and customers. In fact, there are only seven (7) distinct product features which differ only slightly in their verbal presentation but completely in their presented effect on users or customers. For instance, it is claimed that customization possibility leads to increased attachment of operators to the product, but on the other hand, in another representation of the same customization possibility quality, it is claimed that it leads to increased efficiency and productivity of operators. In other words, each of the seven presented product qualities has an example with UX effect for operators and another example with more utilitarian effect in the form of increased efficiency and productivity or decreased costs. In the case of Rocla, I use a hypothetical scenario where I present respondents with possibility to configure qualities of order picking equipment. After getting acquainted with available product qualities, individuals are asked to configure the product according to their preferences with three options of improvement extent: slightly improve (1), moderately improve (2) or significantly improve (3). Individuals have only nine (9) improvement points to allocate to the mentioned fourteen (14) different options and improvement extent consumes 1-3 points respectively. **Appendix 7** shows the basic structure of this hypothetical product configuration scenario. In addition to evaluating qualities they want to improve, respondents are able to choose preferable visual appearance for their newly configured product. Utilized examples of product appearances are shown in **Appendix 8**. The aim of this visual model presentation lies in increasing tangibility perception in respect to the configured product. It is assumed that by providing such visual models, respondents are better able to assimilate hypothetical qualities with real-life products.

Visual appearance of the questionnaire

Because visual appearance plays an important role in UX paradigm I want to emphasize this aspect in the introduced UX-mapping tool. Although multi-choice questionnaire setup has nothing new in itself, its visual presentation can have a substantial impact on perceptions of respondents. When it comes to

motivation and justifications for filling up the questionnaire, I argue that graphical elements and visual presentation of the form might be used to boost response rates and potentially even improve overall quality of collected data due to more concentrated and excited respondents (Similarly as perceptions of usability may be influenced by aesthetic appearance e.g. SONDEREGGER, et al., 2010). In addition, visual representation often communicates implicit importance of the intention behind questionnaires through the effort put into its composition. Another practical point behind emphasizing visual representations can be seen in their ability to better communicate situations or ideas as well as to create more believable basis for hypothetical scenario as in the abovementioned configuration scenario module.

For the purpose of creating more credibility and understandability for the hypothetical configuration scenario in case of Rocla, I created three hypothetical products. These products correspond to the existing equipment in their technical specifications but their visual appearance is different. Proposed hypothetical products are presented in **Appendix 8**. These hypothetical models were created based on three predetermined guidelines which included “modern”, “technical” and “retro” looks. Models “Y”, “V” and “U” represent these guidelines correspondingly. One idea was to see whether preferences towards some of these models correlate with product quality preferences indicated in other modules of the UX-mapping tool. I also stress visual representations in the work practices module (**Appendix 4 and 5**). As mentioned above, emotional load scenarios were specifically customized to better suit industrial products and environment. Complementing verbal product experience assessments in AttrakDiff module with more visual representation of different scenarios might prove to be a good way to get better insights on how users feel about particular industrial equipment. However, this investigation lies outside the scope of this study.

Cross-comparison within and between interest groups

As presented earlier in **Picture 19**, each of the four interest groups is supposed to have its own modified set of UX-mapping tool modules. To allow cross-comparison between these groups, there must be some overlapping across customized questionnaire sets. A simple example of this cross-comparison may be drawn from comparing product related AttrakDiff module responses between distributor, customer

and user groups to assess differences in perceptions of varying product qualities. Identifying possible differences might reveal controversies in product perceptions, which can be investigated further with more elaborate methods. However, before going into other methods such as interviews and field studies, UX-mapping tool enables to identify possible correlations between question modules within particular interest group. For instance, AttrakDiff responses can be compared against evaluations of separate product qualities in the third module depicted in **Appendix 3**. This comparison might become useful for better interpretation of responses in separate modules and on the other hand can be used to construct more focused field studies or interview outlines. As an example, if there are substantial differences among distributor and user groups in respect to pragmatic quality (PQ) evaluations (e.g. users’ score is significantly lower), additional cross-group and within-group comparison can reveal (hypothetically) that distributors’ PQ score is correlated with usability satisfaction whereas users’ PQ score is correlated with usability and customization possibility satisfaction. In this case, it could be suggested that in addition to general usability related aspects measured by PQ of AttrakDiff, users associate customization possibility with being able to complete their goals with the product successfully. Such finding could prove to be a valuable insight when interpreting differences in PQ scores of separate groups and planning further in-depth research.

In addition to different question modules, each interest group based questionnaire has a modifiable cover page aimed at collecting basic information such as country, organization, gender, age, occupation and work experience. These cover pages differ according to interest groups and also according to whether the questionnaire is meant to map perceptions of a single or multiple products.

4.3.4. UX-mapping tool study with subject groups

Results of this study are limited only to partial experimentation with the proposed UX-mapping tool and the focus is on within-group comparison of a selected distributor group. The data sample from distributors was collected in two separate events and contains evaluations of two types of warehouse equipment.

Pilot subject group

Before launching first questionnaire sets in upcoming dealer and product introduction events, I piloted the distributor based UX-mapping tool with ten individuals from R&D department of Rocla. Earlier, the questionnaire was iterated and adjusted several times with the help of an industrial design manager from Rocla and researchers from UXUS project. Questionnaires were provided in both paper and digital format (interactive pdf-file form). Pilot subject group responded to questionnaires involving perceptions of one industrial product (a reach truck) developed by Rocla. The aim of having a pilot group before launching the experiment with the core subject group was to make finalizing adjustments and corrections in the questionnaire. Some of these adjustments included clarifications in question formulations, and questionnaire module order.

Core subject group

The main data set used for the UX-mapping tool study was collected during two separate distributor events held in April of 2012. One of the events was held in Malaga, Spain and the other was held in Vantaa, Finland. All of the 57 individuals included in this core subject group are distributors of MCFE equipment on a managerial level. Summary statistics for this subject group are presented in **Table 2**. UX-mapping tool for this group was a shortened version including product qualities, psychological need assessment and AttrakDiff modules as well as free feedback section. All questionnaire sets were provided in printed format and distributed/collected during these two events. Individuals from the first event (Spain) evaluated one product (a counterbalance truck) branded as Caterpillar whereas individuals from the second event (Finland) evaluated two products (a counterbalance truck and a reach truck) branded as Mitsubishi. This setting allowed determining whether individuals in the core subject group were influenced significantly by brand image factor and whether evaluating two products simultaneously produced different evaluations than single product evaluation i.e. evaluations of counterbalance truck were compared. The overall response rate to the questionnaire was close to 75% and was boosted significantly by Rocla’s R&D department representatives who introduced the questionnaire to the distributor party. Following section discusses main results and outcomes from the study as well as more general discussion on the proposed UX conveying method.

Table 2 shows summary statistics of the core subject group consisting of warehouse equipment distributors.

	Total	Spain event	Finland event
Number of individuals	57	29	28
Average age	46	47	45
stdev.	9.99	8.83	11.21
Average work experience (years)	18	17	21
stdev.	10.63	11.69	10.86
Males	54	29	25
Females	3	0	3
Number of countries	25	16	17
country overlap	8		
Ave. representatives per country	2.28	1.81	1.65
Evaluated products	2	1	2
Respondents by country		Belgium (2) Czech (1) Finland (1) France (3) Holland (4) Hungary (1) Italy (2) Kuwait (1) Lebanon (1) Poland (1) Romania (1) Russia (2) Sweden (2) Tunisia (1) Turkey (3) UK (3)	Belgium (3) Czech (1) Estonia (1) Finland (1) Germany (1) Greece (1) Holland (4) Ireland (2) Italy (1) Kazakhstan (1) Norway (2) Portugal (2) Spain (2) Sweden (3) Switzerland (1) Turkey (1) UK (1)

4.4. Case study results and analysis

Presented results are based partially on interviews from one of the UXUS project partner companies Rocla, which operates in warehouse and forklift equipment manufacturing business, and partially from experimental questionnaire study with industrial product distributors operating in the same business environment.

Interviews and field visits

Basic findings from interviews and field visits were used to identify challenges associated with conveying UX paradigm in B-to-B environment and also for shaping and refining experimental UX-mapping questionnaire set. In this respect, interviews served as a base for assessing **RQ1** and prerequisites for implementing hypothetical thinking model formulated in **Section 3 (Picture 14)**. As mentioned earlier, ten managers from different departments of Rocla were interviewed with semi-structured interview setting. Following findings present main points indicating similarities and differences in perspectives of interviewed managers and also insights derived from field visits and dealer events.

Primary objective in **RQ1** was to identify most salient differences and similarities in UX perceptions among individuals working in separate departments of a manufacturing company (Rocla). One of the main differences that came out in interviews was related to the role of users in product development and possibilities to utilize UX as a differentiating factor in sales and marketing processes. All three (3) R&D managers and one (1) offering development manager stressed that experiences of equipment operators will be reflected in customer's value even though customer might not realize this. These individuals also emphasized that this fact should be made more transparent to customers through demonstrations and validated increase in efficiency figures. Other six (6) individuals stressed the role of sales personnel, more personal relationships with customers and quality of CRM activities. These six managers viewed operators as important actors in Nordic countries where they have more influence in product acquisition decisions but less important in Southern and Eastern parts of the world. From the perspective of product

development, sales and marketing managers (4 individuals) viewed the role of operators as important for developing concrete product qualities such as ergonomics and usability features but less important in conveying their experiences as selling points to customers. However, one of the offering development managers indicated that if the link between experiences of operators and economic benefit to customers was made obvious and easily demonstrable, it would potentially become a differentiating factor which could be utilized in sales argumentation and marketing material.

Insights on the role of product design and styling were mostly derived from R&D department interviews. One of the challenges related to product styling in contrast to consumer markets was indicated as the potentially wrong message perceived from visually appealing products. In other words, Customers could interpret better styling as indication of consequently higher price or even question suitability of this product for "dirty" work. Although this might not be the case with all customers or industrial products, the message communicated by styling should be treated carefully in an industrial environment. A common view among all interviewed managers was that novel styling can be an efficient door opener for new contacts and offering negotiations. I will later present results regarding perceptions related to importance of visual appearance of warehouse equipment among equipment distributors. Interestingly, it was also mentioned in three interviews (Sales and R&D) and during one dealer event in Finland, that some operators would come to work earlier to be able to drive the newer and better looking equipment. On the other hand, it was indicated that radical changes to ways in which equipment is operated may result in open rejection if operators are not trained to use this new equipment properly. This indication is in line with innovation process factors presented in the article by RINDOVA, et al. (2007). Radical innovations such as changes in positions or shapes of controlling devices or interface icons may lead to dissatisfaction of users if advantages of these innovations are not presented strongly and clearly. As in one recent example with a new order picker model, some customers were negatively surprised by the different position of the battery not realizing that this was done to increase the space compartment for operators to work more efficiently. One way to make these advantages more obvious is to provide guidance and training in the early phase of the adaptation process. However, this usually brings additional costs to the manufacturer or to the customer. Again, the challenge is related to increasing transparency

between additional value from learning experience and following economic benefit to the customer. Various training software programs and other types of support material can be used to enhance this transparency but it is doubtful that those would completely remove the need for personal guidance

Another issue that rose from all interviews was related to differences in customer and user influences in different countries. It was indicated that the role of operators in countries in southern parts of Europe (Including Italy and Spain) was notably different than in Nordic countries. For instance, interviewees described that operators in southern and eastern countries tended to have very little to say about equipment that was acquired for their use. It was also hard for R&D and sales research to get sincere answers from users regarding qualities and imperfections of equipment, because operators were evidently concerned about undermining their work positions if negative feedback reached their superiors. Physical operating environment and working conditions also vary by country. This factor poses challenges not only for specific qualities of equipment, such as durability and safety features, but also for identification of proper UX and CX targets for these environments. For example, in more hazardous environments experience targets may emphasize security with following emphasis on safety features, whereas safer and more developed environments may have competence and autonomy as primary UX targets. The challenge related to this point relates to being able to create products that could contribute to several different UX and CX targets without compromising between those. Modular components or varying marketing and sales strategies could be used to bolster different product specifications without significant customization efforts. However, this is not always technically possible or economically viable. Nevertheless, the factor related to differences in customer and user influences should be considered when thinking about variations in product model assortment and the extent to which these models can be customized.

All interviewed individuals indicated that the main challenge related to conveying UX paradigm is associated with difficulties in internal and external communication. Interviewed managers mentioned multiple shortcomings that were due to lack of coherence in intended and perceived product related messages. Particular concern was pointed towards distributors who are considered as independent actors

in the market and thus manufacturers' ways to influence how this party communicates with customers and users is rather limited. Possible ways to go around distributor party and communicate directly to customers and users may be seen in new technologies and social structures such as virtual communities and blogs. Although these methods are widely utilized in consumer markets, their implementation in B-to-B environment is but a fraction of that. However, things may change in the near future and some of the interviewed individuals mentioned that customers are starting to use their peers as information sources for feedback on warehouse equipment choices. In other words, some customers did not see each other as competitors but product information was spreading rapidly through the word of mouth. Another way to keep the intended message in its initial form, at least to some extent, is to provide tools and guidelines for distributors, that would not only serve preferences of the manufacturer but also act in distributors' interests. Obviously the distributor party has first to realize and accept these intentions and guidelines. In this study I presented an experimental tool in the form of UX-mapping questionnaire which is intended to serve the abovementioned purpose. Following results present findings from experimental implementation of this tool.

Experimental UX-mapping tool

As mentioned previously, UX-mapping tool was tested with individuals during two unrelated distributor events. The collected data set is rather unique because involved subjects are closely involved with related products and have extensive experience within their field (Average work experience of the core subject group was 18 years). First I explore indicated importance of different product qualities (Product quality module in **Appendix 2**) to determine whether qualities carrying more utilitarian traits are seen as relatively more important ones for the distributor party as inclined by **H1** in **RQ2**. Results of this comparison are presented in **Chart 1**. I do the comparison in two ways, first by simple comparison of averages of importance indications across evaluated qualities (**Chart 1**) and then by scaling importance indications by average importance for each individual (Relative importance of product qualities is presented in **Appendix 9**). The second way of comparison allows to show relative importance of different qualities and eliminates potential bias resulting from overweighting overall importance of all qualities by indicating that they are all equally "extremely important". Such indication from individuals

CHART 1

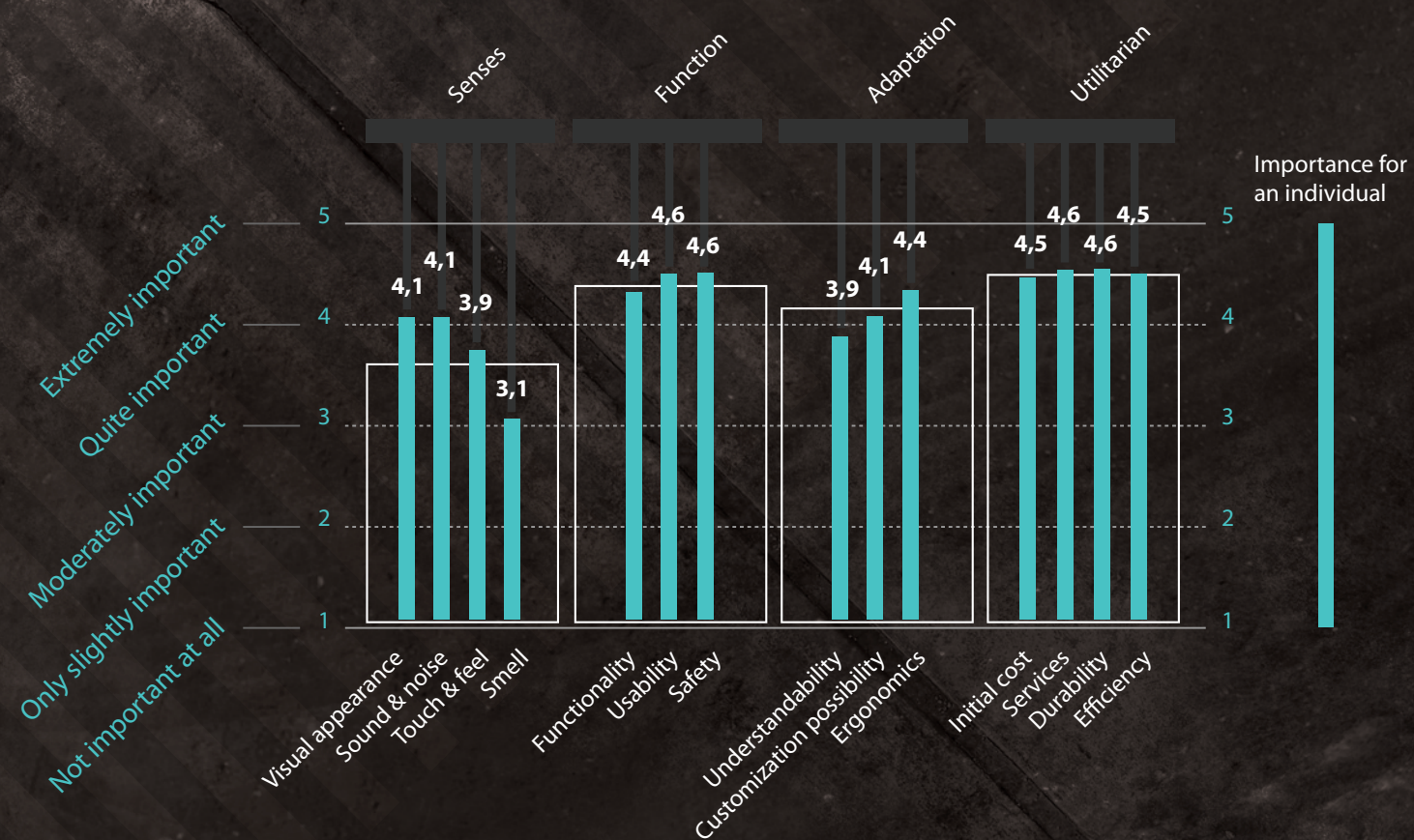


Chart 1 shows results from the questionnaire module related to distributors' perceptions of importance of various industrial product qualities (Module 3). Distributors were asked to indicate importance of 14 different product qualities of warehouse equipment.

could be interpreted as a reluctance to take realistic stand on relativity of quality importances, propensity to avoid indications of lesser importance of any product quality or lack of incentive to evaluate qualities sincerely. Described potential tendency was not present in the core group or pilot group individuals. Results also show that all of the involved individuals indicated at least some variation in their product quality importance evaluations.

One of the insights for answering **RQ2** is apparent in the results from relative importance evaluations of product qualities, which show that durability is considered relatively more important than other qualities with 10 percentage points above average. Statistical significance tests (Wilcoxon signed-rank test presented in **Appendix 11**) are used to identify a group of most important qualities from the perspective of distributors. These perceived most important qualities include (1) durability, (2) usability, (3) initial cost, (4) safety, (5) services, (6) efficiency, (7) functionality and (8) ergonomics. Group of less important qualities, as perceived by distributors, includes (1) visual appearance, (2) sound, (3) touch and feel, (4) smell, (5) customization possibility and (6) understandability. Identifying these groups can be considered as partial confirmation of the hypothesis **H1** stating that product qualities with more obvious link to profitability and performance are considered as most important from the perspective of distributors. For instance, all sense related qualities are in the group of less importance. However, it is important to note that usability, safety and ergonomics are among eight most important product qualities perceived by distributors, showing that qualities belonging to *adaptation* and *function* categories reflecting users' interests are also considered as important by distributors.

When considering the importance of different human needs for warehouse equipment development (As described by Module 2 in **Appendix 3**), individuals from the distributor party had to indicate their perceptions of importance separately from the perspective of customers (buyers of the product) and from the perspective of operators (end-users). Results of these importance estimates are shown in **Chart 2**. **Appendix 12** displays similar results in relative format and **Appendix 13** shows matrices with Wilcoxon signed-rank test results for average importances. These results show that importance of "feeling of controlled and safe operations", "feeling of belonging to a community", "stimulation and

CHART 2

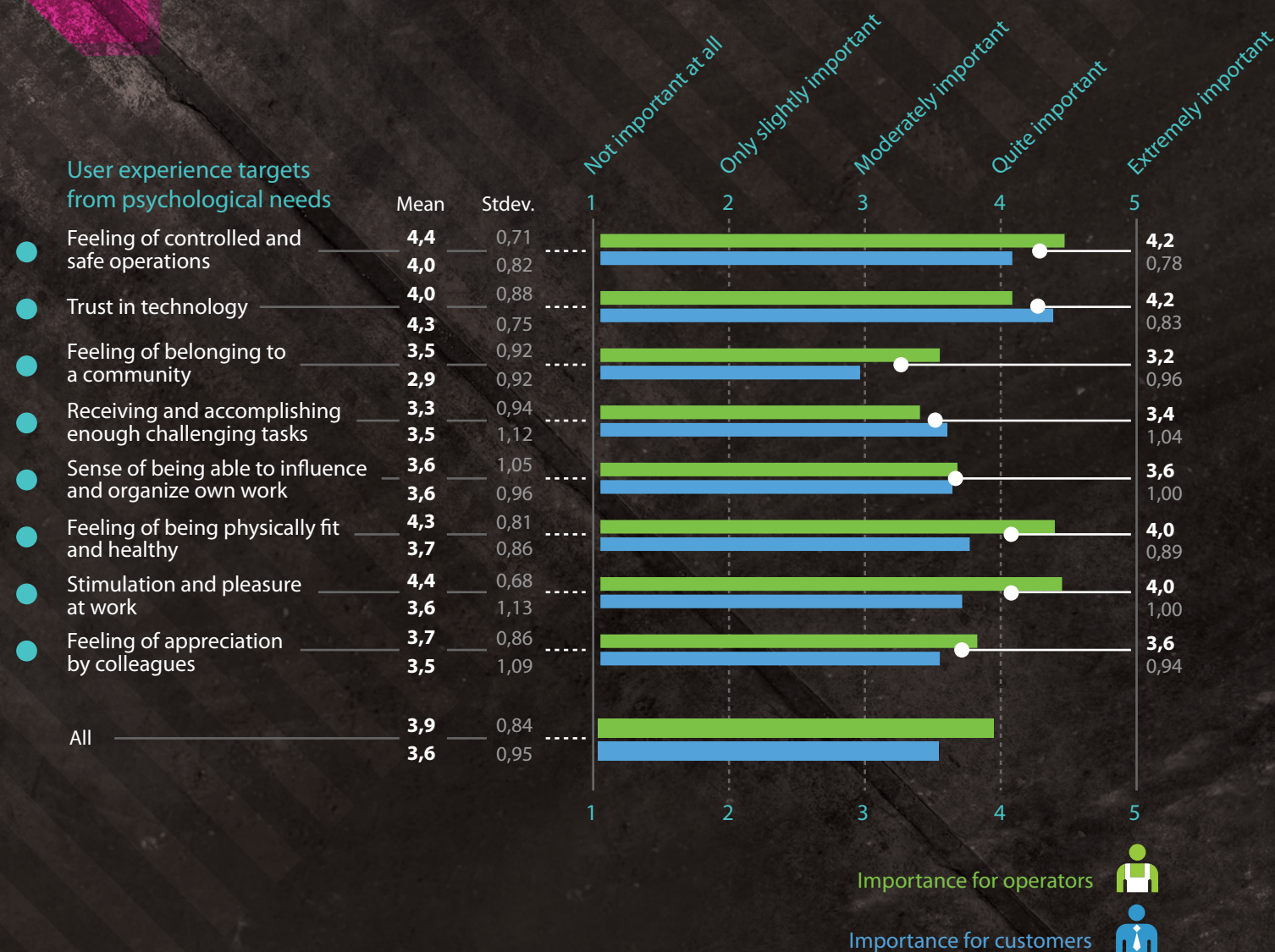


Chart 2 shows results from the questionnaire module related to distributors' perceptions of importance of psychological human needs in product development separately for warehouse equipment operators and customers.

pleasure at work" and "feeling of being physically fit and healthy" were perceived as more important psychological needs for operators than for customers and these differences are statistically significant. At the same time, none of the presented human needs was seen as more important to customers with statistically significant difference. This finding supports hypothesis **H2** in **RQ3**, which states that human needs for product development would be perceived by distributors as less important for customers because the link from positive operator experiences to improved economic factors is less apparent and not too elaborate.

RQ3 was formulated to determine relative priority of psychological human needs for product development as perceived by the distributor party. Distributors' perceptions of operators' needs show that "feeling of controlled and safe operations", "stimulation and pleasure at work" and "feeling of being physically fit and healthy" were seen as most important ones from the point of view of warehouse equipment development. On the other hand, distributors perceived "trust in technology" and "feeling of controlled and safe operations" as most important needs to account for in equipment development for the customer party. Although presented need perceptions are collected from the intermediate party which is not directly involved in final product utilization, these indications are relevant when evaluating areas which should be emphasized when dealing with this party. For instance, UX targets derived from relatedness (belonging to a community), competence (accomplishing challenging tasks) and autonomy (being able to organize own work) were perceived as less important for product development criteria despite findings in earlier studies (e.g. SHELDON, et al., 2001) showing that these needs are among the most salient ones for individuals. This indication calls for further investigation to determine whether these needs could be communicated to distributors in such a format that would establish a more robust and explicit link between fulfilling these needs and the potential for economic benefit.

Data collected from the distributor group included basic information such as age, experience, country and gender. I test for the potential impact of these factors on perceptions of importance of human needs in product development for customers and operators. Because the sample included individuals from 25 countries, it was not possible to statistically verify whether this factor had any influence on perceptions.

Another way to test regional factor was applied by dividing countries into Southern, Eastern, Northern and Western Europe as well as Other countries. These categories were implemented as dummy variables in a regression model with perceived importance of human needs as a dependent variable separately for customers and operators. However, no statistically significant effect was identified even with this setting. Also work experience and age did not result in statistically significant effects. Complementary to abovementioned classification, I tested regression models with Nordic Countries (17% of all responses) as a dummy variable alongside age and experience variables. Although this factor did not result in any effect with regression against average scores for importance of needs for users (less than 0.03), similar model showed that Nordic Countries dummy had a 0.25 positive effect on average scores for importance of needs for customers. Despite this small inclination towards region factor effect, none of the tested regression models were statistically viable (Significance $F > 0.01$). In addition to testing basic information factors against perceptions of importance of needs, I experiment with similar regression model with respect to product evaluations based on product quality and AttrakDiff modules (**Appendices 1 and 2**). None of these tests indicated any significant relationships of product quality evaluations with age, experience and region factors. Based on these results, I have to reject hypothesis **H3**, which states that individuals from southern regions would see psychological needs as less important for warehouse product development. Although information derived from interviews indicated that the geographical location factor should influence perceptions of product qualities, negative statistical results from distributor party might be due to relatively small sample size and wide diversity of countries. On the other hand, the very format in which questions are presented in the questionnaire might not suffice to reveal actual psychological need attitudes or perceptions of respondents. In this sense, questionnaire format has no possibility to confirm whether the concept of psychological needs is understood coherently among respondents, although I include examples of concrete product features that might be derived from these needs. However, this does not mean that information resulting from the psychological need module cannot be utilized to identify UX targets or to experiment which needs are perceived as more important than other. Another speculative reason for rejection of hypothesis **H3** might be that individuals in the dealer party are a more homogenous group and do not differ significantly in their perceptions by region in contrast to customer and user groups. This calls for additional experimentation with the UX-mapping

tool which can be expanded with a more elaborate qualitative research.

Complementary to analyzing results from separate UX-mapping tool modules, I include cross comparisons between results from separate modules to identify possible correlations between various UX factors. In the case with individuals from the distributor party, I compare AttrakDiff product evaluations and results from product quality module. This is done to explore whether four groups (PQ, HQ-I, HQ-S, ATT) of AttrakDiff module responses have a link to separate product quality evaluations such as visual appearance, efficiency, ergonomics etc. For this purpose I construct a regression model where the dependent variable is one of the four AttrakDiff qualities and independent variables are presented in the form of weighted satisfaction values of product quality module (Module 3). In this case, I use relative importance as a weight for satisfaction level (in contrast to using direct weights resulting from evaluation scales from 1 to 5). This is done because the intention is to distinguish relative and not absolute satisfaction levels. Results from the regression model are presented in **Table 3**. Findings show that pragmatic quality (PQ) measure of AttrakDiff is positively related to satisfaction in “usability” and “understandability” of the product, although statistical significance of these effects is only at 0.05 level. The model also indicates that “visual appearance” has a strong impact on HQ-I, HQ-S and ATT scores of AttrakDiff (Especially on HQ-S). This effect is significant at 0.001 level. In addition, overall ATT score is positively correlated with “ergonomics” satisfaction. Although the experimental UX-mapping tool is tested for the first time and results are collected from a relatively small sample of distributors, these findings are rather promising and give partial support for hypotheses **H4**, **H5** and **H6** under **RQ4** presented in **Section 4.2**. Despite this, further research will be needed to establish more robust understanding and interpretation of UX-mapping tool cross-module comparisons. For instance, it is interesting to note how strong was the effect of visual appearance satisfaction on HQ-I, HQ-S and ATT scores of the AttrakDiff module, despite it being among less important qualities indicated by distributors. One way to interpret this finding is that mere AttrakDiff scores are poor indicators of whether distributors will actually acquire products with better HQ-I, HQ-S and ATT scores. This finding can be linked to the study by DIEFENBACH, et al. (2011), which shows that although hedonic qualities are appreciated, their ability to influence purchasing decisions is questionable. On the other hand, this finding supports indications of interviewed managers that styling

Table 3 shows results from a regression model with AttrakDiff module evaluations as dependent variables and weighted product quality satisfaction evaluations as explanatory variables.

	PQ	t-stat	HQ-I	t-stat	HQ-S	t-stat	ATT	t-stat
Visual appearance	-0.03	-0.33	0.70 ■■■	6.74	0.94 ■■■	7.32	0.70 ■■■	5.82
Sound and noise	-0.05	-0.49	0.09	0.73	0.06	0.37	0.00	0.00
Touch and feel	0.09	0.69	0.16	1.08	0.09	0.48	0.32	1.86
Smell	0.00	0.03	0.28	1.69	0.32	1.59	0.16	0.88
Functionality	-0.29	-1.78	-0.41	-2.26	-0.23	-1.05	-0.05	-0.24
Usability	0.34 ■■	2.91	0.00	0.04	-0.13	-0.80	-0.14	-0.94
Safety	0.18	1.69	0.13	1.05	0.07	0.48	0.00	-0.03
Understandability	0.32 ■	2.69	0.12	0.89	-0.12	-0.72	0.12	0.75
Customization possibility	-0.01	-0.08	-0.06	-0.47	-0.02	-0.14	-0.05	-0.36
Ergonomics	0.09	0.91	0.14	1.26	0.26	1.91	0.32 ■	2.51
Initial cost	0.04	0.68	-0.08	-1.07	0.10	1.09	-0.05	-0.59
Services	0.12	1.05	0.16	1.32	0.12	0.77	0.12	0.84
Durability	-0.02	-0.20	-0.09	-0.98	-0.15	-1.31	-0.01	-0.07
Efficiency	0.11	0.82	0.24	1.65	0.10	0.57	0.12	0.72
Constant	4.36 ■■■	34.42	4.24 ■■■	29.88	3.74 ■■■	21.58	4.13 ■■■	25.25
Observations	85		85		85		85	
R squared	0.42		0.70		0.70		0.71	
Significance F	<0.000		<0.000		<0.000		<0.000	
2-sided p = <0.01 ■ <0.005 ■■ <0.001 ■■■								

can be used as a door opener and raising interest for new and existing contacts even in B-to-B context with industrial products. In the view of further research it would be interesting to investigate whether product quality evaluations and AttrakDiff indications of other parties would result in similar correlations or whether some other dependencies would emerge.

I compare results collected from two dealer groups in separate events to determine whether these groups differ in terms of indicated product perceptions (regarding counterbalance truck). This comparison is done to test if product brand (Caterpillar and Mitsubishi) or the questionnaire setup with single or multiple product evaluations has any statistically significant effect on questionnaire results. Results show that comparing product evaluations from these distributor groups did not reveal statistically significant differences at any separate parameters when estimated with non-parametric Mann-Whitney test (**Appendix 14**). This comparison was made based on AttrakDiff (7-choice evaluation scales) according to four quality types (PQ, HQ-I, HQ-S and ATT) and fourteen weighted product quality evaluations (5-choice evaluation scales). Weighted product quality satisfaction values are calculated from indicated relative importance of varying product qualities (weights) and their respective satisfaction in particular product. Relative satisfaction values are also scaled so that the lower limit is indicated by -2 (highly important and not satisfied at all) and the upper limit is indicated by 2 (highly important and very satisfied). Acquired results suggest that product evaluations from two separate distributor events with involvement of different individuals do not differ significantly, although evaluated product was presented under different brands and individuals in the second event (Finland) had to evaluate two different products at the same time. The lack of differences indicates that both dealer groups had quite similar product perception of this particular counterbalance truck and these evaluations can be combined into one sample to be compared with the evaluation of the second product (a reach truck). Another result supporting the similarity of product perceptions within separate dealer groups is indicated by comparison of differences between product evaluation factors within these groups. For instance, within group comparison of four parameters of AttrakDiff module reveals differences that are statistically significant and practically identical in both groups.

CHART 3

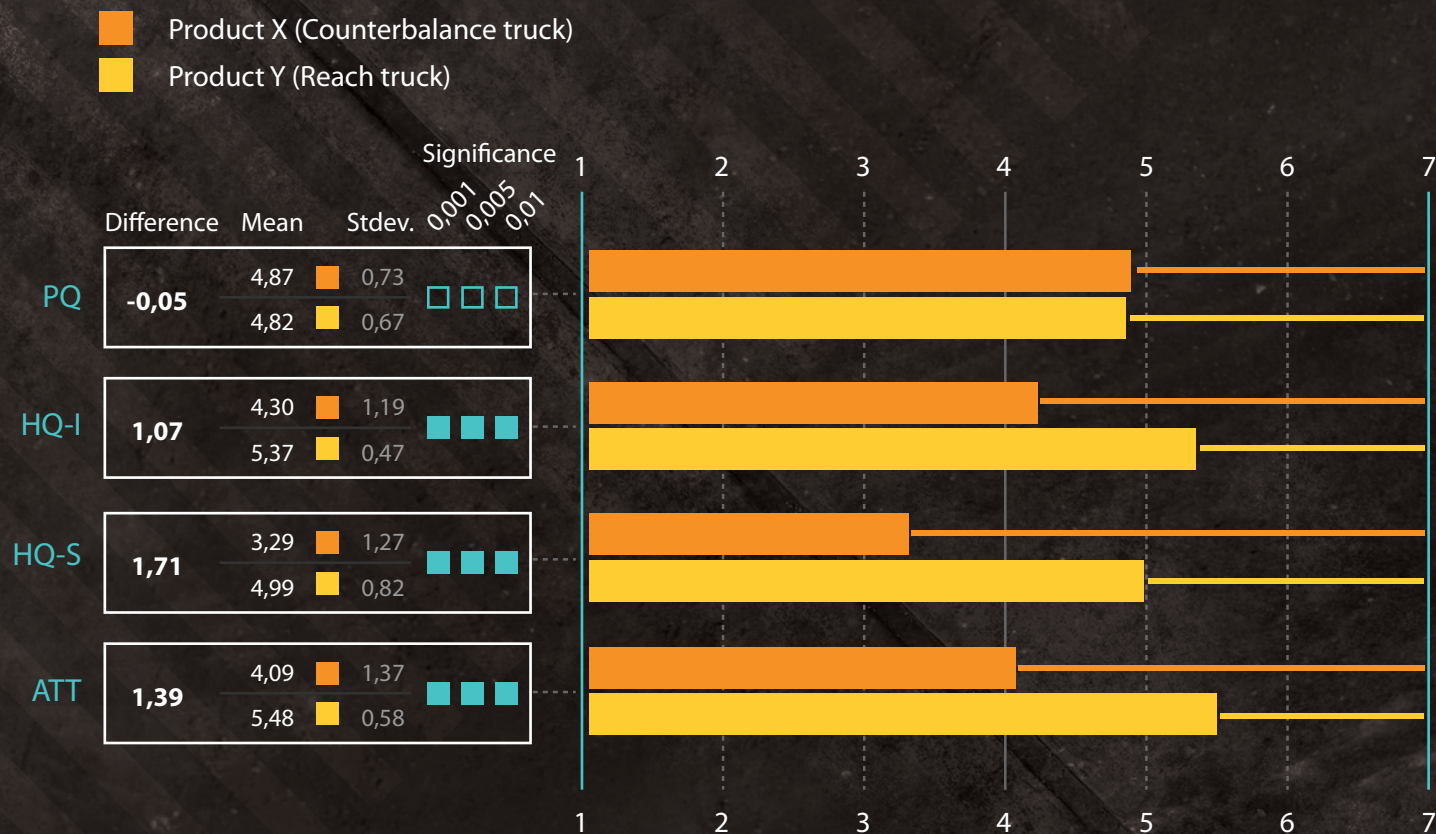


Chart 3 displays AttrakDiff question module results for two pieces of warehouse equipment (A counterbalance truck and a reach truck) evaluated by distributors.

One of the key features of the UX-mapping tool was the possibility to compare various industrial products with different evaluation schemes. In the experiment involving equipment distributors, two products were evaluated based on AttrakDiff and product quality modules. Evaluated products included one reach truck and one counterbalance truck (See **Picture 17** in **Section 4.3.1**). **Chart 3** and **Chart 4** show comparison results with AttrakDiff and product quality modules respectively (**Appendix 10** displays AttrakDiff results for separate adjective pairs). Product quality satisfaction figures presented in **Chart 4** are based on weighted satisfaction indications with relative quality importance as weights. Results from AttrakDiff questionnaire module comparison indicate that both products received almost identical pragmatic quality scores (PQ) but also that product Y (the reach truck) received much higher scores on other three parameters (HQ-I, HQ-S and ATT). These differences are statistically significant at 0.001 level (Mann-Whitney test). This finding is contrary to the hypothesis **H7**, which assumed that distributors would probably find pragmatic differences of products but will not indicate any hedonic differences between them. In fact, this result suggests that distributor party is influenced by hedonic qualities of products and that these qualities could be potentially used as differentiating factors also for intermediate parties. Earlier it was pointed out that visual appearance might be an important factor for overall attractiveness and hedonic quality perceptions of industrial products for distributors. However, the question remains whether hedonic qualities are potent enough to influence acquisition decisions and what is their relative impact compared to pricing and other utilitarian factors. Further research will be needed (e.g. involving value formation questionnaire module) to assess these questions in more detail. When it comes to comparing mentioned products based on separate qualities (product quality module), the product Y (the reach truck) shows better satisfaction scores especially in senses and adaptation quality categories. In these categories, (1) visual appearance, (2) touch and feel, (3) noise and sound, (4) customization possibility as well as (5) ergonomics show statistically significant differences in advantage for the evaluated reach truck (Product Y). Again, these results do not support assumptions made in hypothesis **H7**. On the other hand, weighted satisfaction figures in function category are higher in general than satisfaction figures in other three categories (mainly due to importance weights) and thus can be considered as more important decision making drivers for distributor party than qualities in adaptation or senses categories. One particular factor which shows high dissatisfaction is related to

Product X (Counterbalance truck)
Product Y (Reach truck)



Chart 4 shows weighted satisfaction scores for two pieces of warehouse equipment (A counterbalance truck and a reach truck) evaluated by distributors based on 14 product qualities.

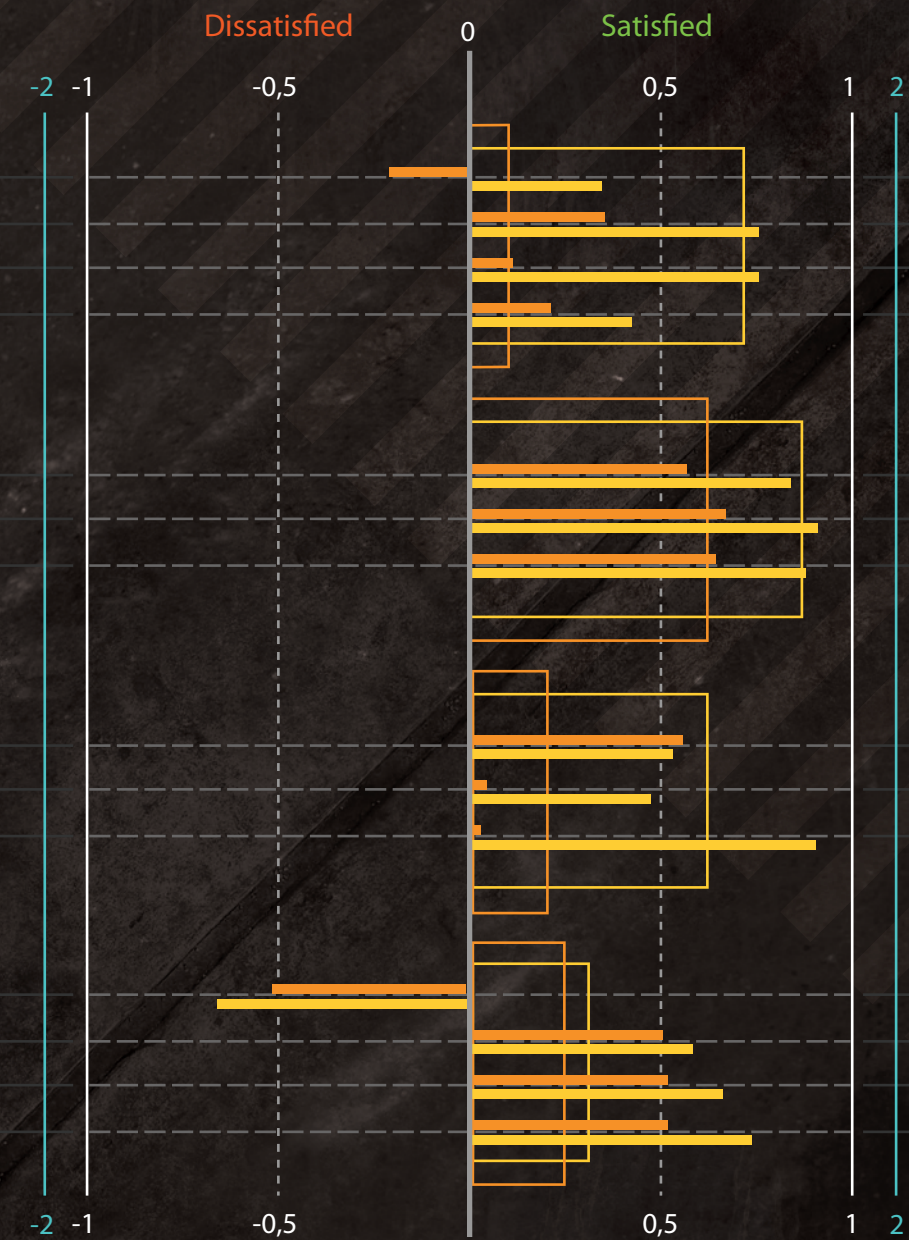


CHART 4

initial cost of products. This indication cannot be called surprising as the very profitability of distributors depends largely on profit margins of equipment resale or lease creating powerful incentives for retailers to bargain for a lower price. However, this explanation must not be taken as the only possible one and indication of pricing dissatisfaction must not be taken lightly. In this sense, manufacturers might try investigating options for diluting negative price reactions by improving product image (e.g. as elaborated in the hypothetical thinking model presented in **Section 3.3**) and/or by finding direct solutions for cutting production costs and improving resource utilization. Results from the UX-mapping tool implemented with distributors reveal some interesting insights on how this party perceives industrial products and importances of psychological needs for operators and customers. Part of these results also indicate that this tool might be useful for mapping differences in product perceptions and relation of these perceptions to particular product qualities. However, this is only partial demonstration of the possible use for this tool. Other more implicit advantages might lie in conveying the message about implications and links between positive experiences of users and potential economic benefit for customers. It is also an important message when considering positioning of industrial products and the image of the company which produces them. Following discussion will conclude this study and elaborate on potential for further research implementing the proposed UX-mapping tool.



CONCLUSION

The main goal of this thesis was to overview theoretical background and potential for implementing user experience paradigm in development of industrial products in business-to-business environment. The first objective of this study was related to deriving a hypothetical thinking model for approaching UX in B-to-B context based on psychological and design research theories. Development of this model was mostly inspired by ideas presented in the book by CARVER, C.S. and SCHEIER M.F., (1998) and feedback loop process. Basic implementation of the feedback loop process in the proposed model assumes that product related affects occur when individuals compare some reference state, product image or quality to their perceived current state, product image or quality. Thinking model presented in **Section 3.3** tries to account for various factors influencing product experiences on multiple levels of abstraction. For instance, *product meaning level* considers influences of social and cultural trends, *product image level* takes into account effects of brand image and CRM policies and *product quality level* is related to actual features and details of industrial products. Another purpose of the proposed model is to be utilized as ideation and documentation canvas for R&D, sales and marketing departments wishing to implement UX approach in their activities.

The second objective of this thesis was related to determining differences and similarities in views of individuals from separate departments of a manufacturing organization in respect to UX approach as such. Interviews with managers from different departments of the manufacturing company Rocla revealed that there are several identifiable areas which should be attained to in order to be able to successfully convey UX approach in B-to-B environment. In particular, improving coherence in communication between different levels of manufacturing organization as well as providing measurable links between product UX and economic benefits for customers and distributors could be regarded as essential steps for implementing UX as a differentiating factor in industrial product development. Individuals from R&D department perceived communicating benefits of UX to customers as an important issue whereas individuals from sales department stressed the importance of personal relationships with customers. Other salient areas to be accounted for in conveying experience design approach are related to differences

in organizational cultures and work incentives of users and customers along with variations in physical working environments and conditions. All of the abovementioned areas may have a strong influence on emotional responses of varying individual groups when considering particular product qualities. These areas should be thoroughly studied before defining UX and CX targets for new equipment projects.

In the third objective of this study I attempt to develop tools for conveying UX approach for companies operating in B-to-B setting. I introduce a questionnaire based tool which is composed of several question modules which are combined into a questionnaire set based on targeted individual group such as users, customers, distributors or manufacturers. In this study I experiment with the proposed tool and test it with warehouse equipment distributors. The questionnaire set was distributed and collected from 57 individuals belonging to equipment dealer party during two separate events in Spain and in Finland. Results from the UX-mapping tool indicate that intermediate parties in industrial product distribution chain are able to appreciate differences in hedonic qualities of separate industrial products but these differences are largely dependant on visual appearance perceptions which belonged to the group of less important product qualities. This finding is partially in line with results from the study by DIEFENBACH, et al. (2011), who show that hedonic qualities are appreciated but are often neglected in purchasing decision justifications. Another finding shows that distributors are not able to comprehend potential benefits from most salient psychological needs (autonomy, relatedness and competence as shown by SHELDON, et al., 2001) in industrial product development, but emphasized the importance of needs that are more directly linked to concrete product features (e.g. security and physical well-being). In addition to analyzing statistical data from the experiment, the aim was to capture general reception and feedback from the questionnaire format and its contents. Average time respondents spent filling the questionnaire was closer to 15 minutes although estimated completion time was around 5 minutes. Several individuals from the distributor group asked if they could have the same questionnaire for their internal use. Many respondents expressed surprise, because they never thought that industrial product qualities could be linked to psychological human needs or described as pleasant or attractive. In the light of received feedback from Rocla and distributor party further implementation of the UX-mapping tool seems promising.

Discussion and further research directions

Starting points behind this study are mostly practical and presented theoretical background is mostly limited to a small fragment of psychological and HCI studies. For instance, neurological and philosophical aspects behind experience formation are not discussed in this study. However, these fields can not be neglected when considering UX paradigm at large. Some intriguing topics associated with formation of experiences are related to neuroscience, the concept of *self* and its influence on individuals' perceptions. From this perspective, conscious brain activity is but a fraction of all mental processes and perceived experiences can sometimes be quite illusive interpretations and narratives derived from our interaction with the world. Metaphorically, experiences are like a hole in a doughnut where the doughnut represents all the surrounding context, people we meet, products we use and memories we form and reconstruct later. When a piece of this doughnut is missing or substituted with another piece, experiences might get distorted, transform or cease to exist. This is only one aspect that I try to embed in the presented thinking model where product qualities are put on the highest granularity level of experiences whereas product image and meaning represent larger entities with links to changing social and cultural contexts. Despite some critique towards UX paradigm regarding its vagueness and lack of established and widely comparable research methods, I think that this approach carries its own practical benefits to product design practices. I believe that defining and specifying exactly what user experience contains and how it should be measured cannot be the most important research agenda in this respect, because it can be compared to trying to nail dessert cream to a wall. Emotions and experiences are not sortal concepts, thus their measurement should not be considered possible and credible only when it can be expressed with numerical values. This does not incline that these more abstract concepts involving emotions and experiences are not real or do not influence how people interact with products. As discussed earlier in this study, conveying UX in business context often requires concrete proof and measurement of its influence on improving products and individuals' satisfaction. However, from the perspective of product development practices, I see that the main contribution of UX paradigm lies in raising the abstraction level of design criteria and considering things that are intangible and sometimes hard or impossible to define exactly. In other words, this approach helps designers and other industry practitioners to look at

their work from a wider and more holistic perspective. This is especially useful as a way of thinking in innovation processes, because investigating individuals, products and their functions on broader and more abstract level may help to avoid excessive resource allocations to developing inappropriate, futile or harmful product features.

Following UX research directions in B-to-B environment can be related to further experiments with experience measurement tools and cross-comparison between preferences of relevant individual groups. However, it is important to remember that conveying UX approach internally within manufacturing organization is a prerequisite for successful external communication and differentiation in the market. Conveying user experience paradigm is not so much about some tangible results and formats but rather about persistence and coherence of the communication process between relevant individual groups. Previously mentioned results from experiments with UX questionnaire sets included only a limited number of UX aspects and were tested with a single relevant individual group. Further research calls for collecting more data from other parties including customers, operators and individuals from varying departments of product manufacturers. At this point, similar questionnaire sets are implemented with manufacturer party and the next step would be to compare these results with ones presented earlier. Mapping differences in views of these relevant individuals groups might reveal more insights on important areas related to conveying UX paradigm in B-to-B environment. In addition, I will experiment with the experience component canvas and its potential use for deriving experience based development criteria and qualities for industrial products.

In general, the research direction concerning implications of UX paradigm should be expanded towards finding concrete steps and practices with which this approach could be gradually implemented on multiple tactical and strategic levels of manufacturing organizations. For instance, virtual communities and other channels for sharing product images and related experiences could be managed and shaped to provide concrete examples about benefits from improving UX of industrial products. In addition, such product related narratives could act as potential triggers for emotional responses when interacting with actual products.

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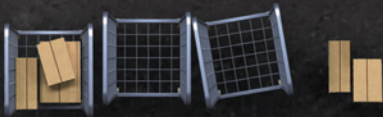
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How would you describe this equipment based on your experience?

Following evaluation scales present opposite adjective pairs. Please indicate to what extent these ajectives correspond to your experience with the product. Choose one of the white circles for each adjective pair and mark it with .



Technical	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	Human
Complicated	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	Simple
Impractical	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	Practical
Cumbersome	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	Straightforward
Unpredictable	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	Predictable
Confusing	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	Clearly structured
Unruly	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	Manageable

Isolating	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	Connecting
Unprofessional	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	Professional
Tacky	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	Stylish
Cheap	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	Premium
Alienating	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	Integrating
Separates me from people	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	Brings me closer to people
Unpresentable	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	Presentable


Conventional	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	Inventive
Unimaginative	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	Creative
Cautious	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	Bold
Conservative	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	Innovative
Dull	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	Captivating
Undemanding	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	Challenging
Ordinary	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	Novel

Unpleasant	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	Pleasant
Ugly	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	Attractive
Disagreeable	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	Likeable
Rejecting	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	Inviting
Bad	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	Good
Repelling	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	Appealing
Discouraging	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	Motivating

Appendix 1: UX-mapping tool module - AttrakDiff



How relevant are the following human needs for developing warehouse equipment?

Following list presents some of the possible human needs. Please evaluate how important these needs would be to **operators** and **customers** in general. Mark your answers with 

Feeling of controlled and safe operations

For example: Safety

Equipment is responsive and feels safe to operate. Controls are intuitive and safety features reduce injury risks.

Trust in technology

For example: Reliability

Operators feel that they can trust in this equipment because it seldomly malfunctions and provides required maintenance information.

Feeling of belonging to a community

For example: Not being on your own

The product enables operators to communicate with each other and share visual information in order to provide support and help if needed.

Receiving and accomplishing enough challenging tasks

For example: Competence at work

Equipment provides feedback on daily progress and operators can view their achievements.

Sense of being able to influence and organize own work

For example: Autonomy

Equipment helps operators to plan and optimize their working day.

Feeling of being physically fit and healthy

For example: Healthy working environment

Operators feel that this equipment contributes to their health by ensuring comfortable operating and possibility to customize position.

Stimulation and pleasure at work

For example: Joy at work

Operating this equipment is joyful and keeps operators stimulated in their work.

Feeling of appreciation by colleagues

For example: Getting feedback

This equipment enables giving and receiving feedback on work goals as well as to share tips on good working practices.



From the perspective of operators
(Operators utilize this equipment in their daily work.)



From the perspective of customers
(Customers own the equipment and make purchasing decisions.)

Not important at all
Only slightly important
Moderately important
Quite important
Extremely important

Not important at all
Only slightly important
Moderately important
Quite important
Extremely important

1 2 3 4 5

1 2 3 4 5

1 2 3 4 5

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1 2 3 4 5

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1 2 3 4 5


1 2 3 4 5

What product qualities are especially important to you?


Following evaluation scales present various product qualities. Please evaluate how important these qualities are for your overall product experience. The scale ranges from 1 to 5, 1 = not important at all, 5 = extremely important. Mark your answers with 

	Not important at all	Only slightly important	Moderately important	Quite important	Extremely important	
Visual appearance How the product looks from the exterior and interior.	1	2	3	4	5	Sound and noise What noises and sounds does the product produce.
Touch and feel Feel and touch of product materials and parts.	1	2	3	4	5	Smell Perceived smell of product materials and parts.
Customization possibility Qualities that allow for easy modifications and adjustments.	1	2	3	4	5	Usability Smoothness and easiness of overall product operation.
Ergonomics Qualities supporting comfort of operations.	1	2	3	4	5	Durability Perceived robustness and quality of the product.
Initial cost Purchasing cost of the product compared to similar products.	1	2	3	4	5	Services Amount and quality of available services for this product.
Understandability How easy and fast it is to learn to use the product.	1	2	3	4	5	Efficiency How efficient is the product in completing its primary tasks.
Functionality How well does the product correspond to its primary tasks.	1	2	3	4	5	Safety Amount and quality of safety and security features.









How well did this equipment correspond to your preferences based on the following product qualities?

Please indicate how did this equipment satisfy your preferences in respect to its qualities. Evaluate these qualities on a scale from 1 to 5, 1 = not satisfied at all, 5 = very satisfied. Mark your answers with 









	Not satisfied at all	Not quite satisfied	Can't really say	Quite satisfied	Very satisfied
Visual appearance	1	2	3	4	5
Sound and noise	1	2	3	4	5
Touch and feel	1	2	3	4	5
Smell	1	2	3	4	5
Customization possibility	1	2	3	4	5
Usability	1	2	3	4	5
Ergonomics	1	2	3	4	5
Durability	1	2	3	4	5
Initial cost	1	2	3	4	5
Services	1	2	3	4	5
Understandability	1	2	3	4	5
Efficiency	1	2	3	4	5
Functionality	1	2	3	4	5
Safety	1	2	3	4	5

Please describe your current work situation.
Following evaluation scales present opposites of possible working conditions and attitudes. Please evaluate to which end you perceive your work and mark your answers with 

How would you describe the nature of your work?

Constant shifts between different tasks		Work dynamics		Full concentration on one particular task
Extremely stressful		Stress level		Not stressful at all
Not critical with respect to other people and environment		Work criticality		Very critical with respect to other people and environment
Extremely intense working pace		Work intensity		Relaxed working pace

What motivates you in your current work?

I will become/I am a true expert in what I'm doing		<div>Not at all Very little To some extent Quite a bit A lot</div> <div><div>1</div><div>2</div><div>3</div><div>4</div><div>5</div></div>
I am able to get enough interesting and challenging tasks		<div><div>1</div><div>2</div><div>3</div><div>4</div><div>5</div></div>
I am compensated well monetarily		<div><div>1</div><div>2</div><div>3</div><div>4</div><div>5</div></div>
I really like people with whom I work		<div><div>1</div><div>2</div><div>3</div><div>4</div><div>5</div></div>
I can influence the nature of my work and my working environment		<div><div>1</div><div>2</div><div>3</div><div>4</div><div>5</div></div>
I am appreciated and respected by the people I work with		<div><div>1</div><div>2</div><div>3</div><div>4</div><div>5</div></div>
I feel that I am going to stay physically fit and healthy in my work		<div><div>1</div><div>2</div><div>3</div><div>4</div><div>5</div></div>
My work is structured and predictable with familiar habits and routines		<div><div>1</div><div>2</div><div>3</div><div>4</div><div>5</div></div>

To what extent you can influence the nature of your work?

Regarding working **equipment** you feel that you can influence:

What equipment is purchased for your company
(e.g. new machinery, tools etc.)

Not at all
Very little
To some extent
Quite a bit
A lot

1

2

3

4

5

What equipment is available for your everyday use
(e.g. available machines, tools etc.)

1

2

3

4

5

Technical adjustments of your work equipment
(e.g. personal settings, operating position etc.)

1

2

3

4

5

Personalization of your equipment
(e.g. personal stickers, names, drawings, markings etc.)

1

2

3

4

5

Regarding **working environment** you feel that you can influence:

Who are the people you are working with
(e.g. your colleagues, superiors, subordinates etc.)

Not at all
Very little
To some extent
Quite a bit
A lot

1

2

3

4

5

The quality of your physical working environment
(excluding equipment, e.g. premises, surroundings etc.)

1

2

3

4

5

Complexity of work and number of challenges available for you (e.g. tasks, responsibilities etc.)

1

2

3

4

5

Organization of your work (e.g. schedules, planning of tasks, locations, shifts etc.)

1


2

3













4

5













Please describe how you perceive this product.

Following evaluation scales present various examples how the product might feel like to use. Please evaluate how you perceive this product and mark your answers with 

Using this equipment feels more like ...

A slow paced game		<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>		A highly intense game
Using an inefficient tool		<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>		Using a highly efficient tool
Driving a slow and clumsy vehicle		<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>		Driving a fast and fancy vehicle
Using some weak power tool		<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>		Using a highly powerful machine
Confusing and unclear labyrinth		<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>		Clearly presented instructions and guidance
Climbing on a flimsy and unreliable rope		<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>		Climbing on a strong and reliable chain

This product feels for you more like ...

A hated foe		<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>		Your best pal
Cheap plastic toy		<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>		High quality tool
Worn-out boot		<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>		Stylish new shoe
Just another tool		<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>		Your beloved pet
Inconvenient stool		<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>		Comfortable armchair
Outdated telephone		<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>		Modern phone

Please indicate your preferences in eight hypothetical product acquisition scenarios.

What are your equipment preferences in the following eight separate scenarios?

	EQUIPMENT A		EQUIPMENT B
1	Lower price	Obvious choice Tough decision Obvious choice	Higher price + Better quality and durability
2	Lower price		Higher price + Superior appearance and styling
3	Lower price		Higher price + Better customization for various tasks
4	Lower price		Higher price + Better performance and efficiency
5	Lower price		Higher price + Better ergonomics and operator satisfaction
6	Lower price		Higher price + Better safety and control features
7	Lower price		Higher price + Lower maintenance requirements
8	Lower price		Higher price + Larger variety of available services



Based on your expertise, please indicate how do you perceive the indirect influence of industrial equipment on costs and savings.

To what extent qualities of industrial equipment can influence the following economic factors?


	Not at all	Not much	Moderately	Quite much	Very much
Costs due to sick hours and absences	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Costs due to mistakes and disregard of safety norms	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Indirect costs from low work motivation and stimuli	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Costs due to high labor turnover and hiring process	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Costs due to new product adaptation and learning process	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Indirect savings due to positive reputation and brand image	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Costs related to mistreatment of products and equipment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Indirect costs related to misinterpretations and misunderstandings of equipment operating principles	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Product configuration challenge

Step 1. Your company produces a wide range of warehouse order picking equipment. Currently your **low level order picking equipment** has the following product features with their known **consequences** (Features A-N). Please read them through and then move to Step 2.

- A** Integrated software allows managers to follow how operators plan and organize their work. This leads to optimized and more efficient order picking process. [1] [2] [3]
- B** Operators are able to customize the product according to their needs. This leads to increased sense of attachment to the equipment among operators. [1] [2] [3]
- C** Driver's compartment is ergonomically designed and allows for quick on and off access. This leads to faster order picking and increased work productivity. [1] [2] [3]
- D** Modern design enhances visual appearance and selected materials provide pleasant touch and feel. This results in feeling of stimulation and pleasure among operators. [1] [2] [3]
- E** Smart software allows operators to view their work progress and learn to use the product properly. This results in feeling of achievement and competence among operators. [1] [2] [3]
- F** Integrated software allows operators to learn better working practices and to follow their work progress. This shortens the adaptation period and reduces training costs. [1] [2] [3]
- G** Intuitive steering system enables responsive and precise operation. This leads to feeling of control and safety among operators. [1] [2] [3]

9

Step 2. Your equipment includes all of the listed features already. However, you can configure and improve part of these features. Please choose which features you would like to enhance and to what extent. The improvement scale is as follows: **(1) Slightly** improve, **(2) Moderately** improve and **(3) Significantly** improve. You have to compromise between your choices and can allocate only **9** improvement points to listed features. Mark your configurations with 

- High quality materials and solid frame structure make the product very durable. This results in prolonged product's life-cycle and lower maintenance costs. [1] [2] [3] **H**
- Attractive visual look as well as possibility to select exterior materials allow fitting the product for various brands. This leads to improved customers' brand coherence. [1] [2] [3] **I**
- The product has a very robust structure and is made of reliable components. This leads to feeling of trust in equipment among operators. [1] [2] [3] **J**
- Customization possibility allows operators to modify the product to better correspond to their functional needs. This leads to an increase in working speed and productivity. [1] [2] [3] **K**
- Spacious driver's compartment enables operators to find a comfortable driving position. This results in a sense of physical well-being among operators. [1] [2] [3] **L**
- Intelligent software helps operators to optimize and plan their work. This leads to a sense of autonomy and influence among operators. [1] [2] [3] **M**
- An innovative steering wheel allows driving with one hand only. This results in increased work speed and efficiency. [1] [2] [3] **N**

Maintain the same
Slightly improve
Moderately improve
Significantly improve



Appendix 7: UX-mapping tool module - Hypothetical product configuration

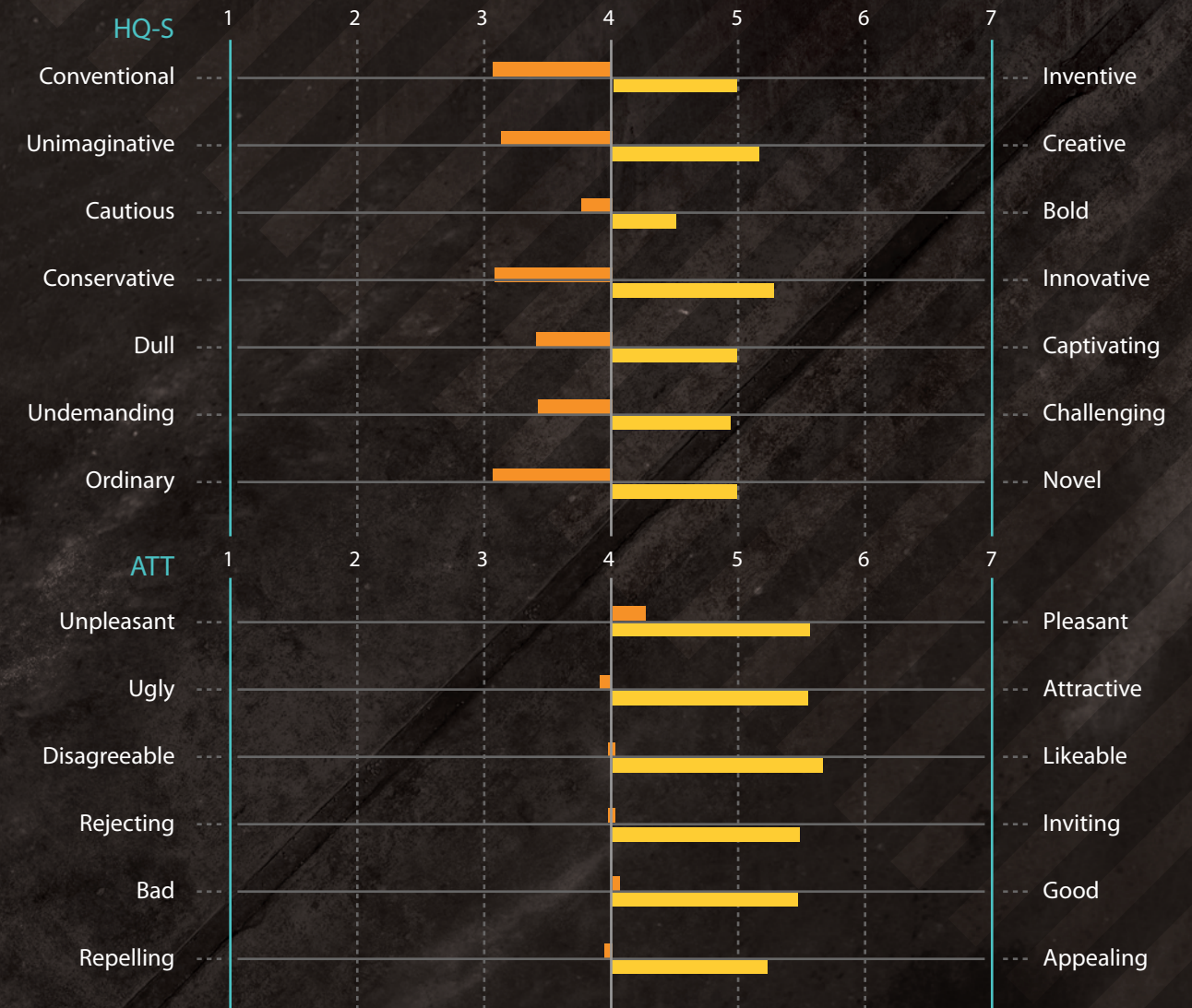


Appendix 8: UX-mapping tool module - Hypothetical product configuration, low-level order picker models

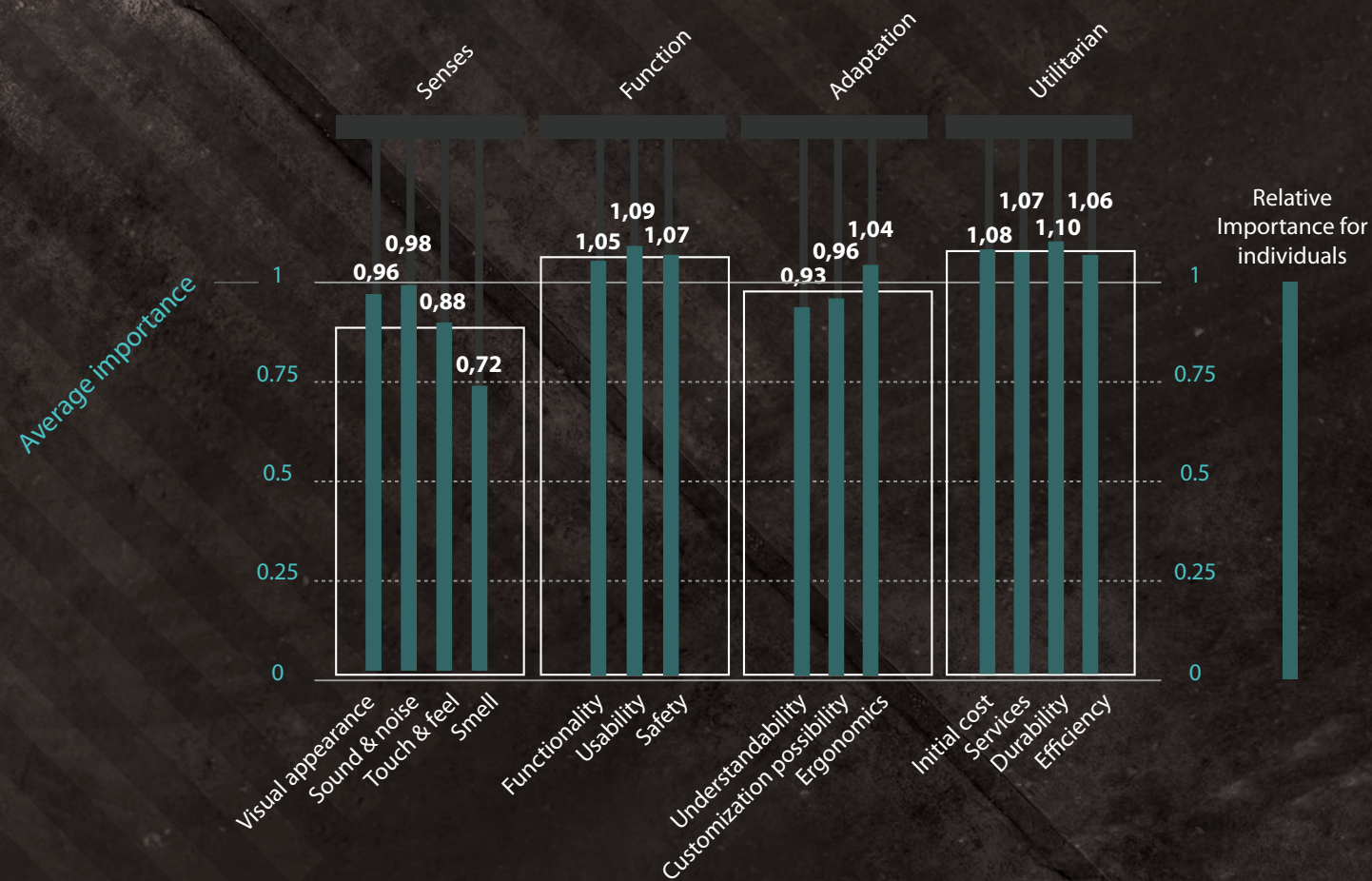
Significance														
0,001 0,005 0,01														
Visual appearance														
Sound & noise														
Touch & feel														
Smell														
Customization possibility														
Usability														
Ergonomics														
Durability														
Initial cost														
Services														
Understandability														
Efficiency														
Functionality														
Safety														
z-stat. p-2 sided														

		Relative importance score		Average importance score (Scale 1-5)	
Durability	Score	1.10		4.60	
	Stdev.	0.15		0.62	
Usability	Score	1.09		4.57	
	Stdev.	0.12		0.57	
Initial cost	Score	1.08		4.51	
	Stdev.	0.18		0.72	
Safety	Score	1.07		4.49	
	Stdev.	0.12		0.63	
Services	Score	1.07		4.49	
	Stdev.	0.15		0.65	
Efficiency	Score	1.06		4.46	
	Stdev.	0.14		0.68	
Functionality	Score	1.05		4.42	
	Stdev.	0.13		0.62	
Ergonomics	Score	1.04		4.38	
	Stdev.	0.16		0.76	
Sound & noise	Score	0.98		4.11	
	Stdev.	0.14		0.68	
Visual appearance	Score	0.96		4.01	
	Stdev.	0.15		0.67	
Customization possibility	Score	0.96		4.02	
	Stdev.	0.16		0.74	
Understandability	Score	0.93		3.93	
	Stdev.	0.15		0.72	
Touch & feel	Score	0.88		3.74	
	Stdev.	0.16		0.85	
Smell	Score	0.72		3.06	
	Stdev.	0.23		1.06	

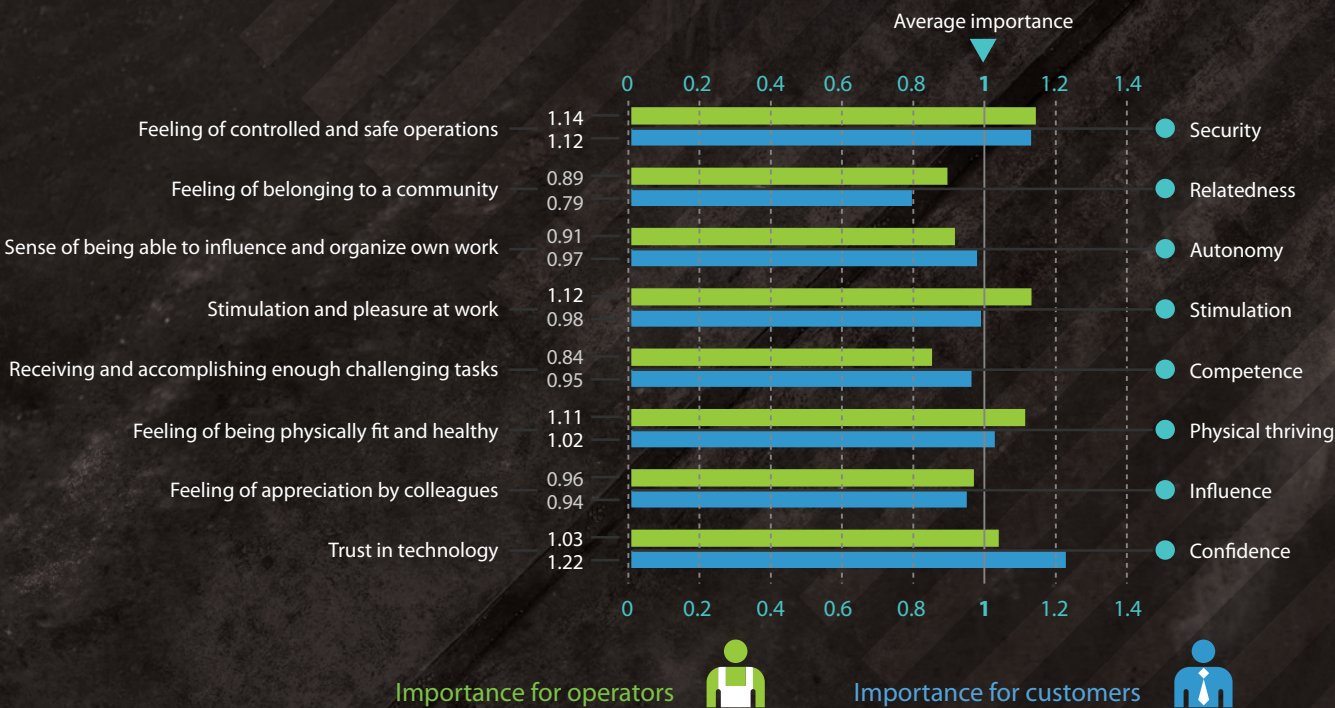
Appendix 9: Product quality evaluations - Wilcoxon signed-rank test results and product qualities in score order



Appendix 10: AttrakDiff results by separate adjective pairs for evaluations of two pieces of warehouse equipment



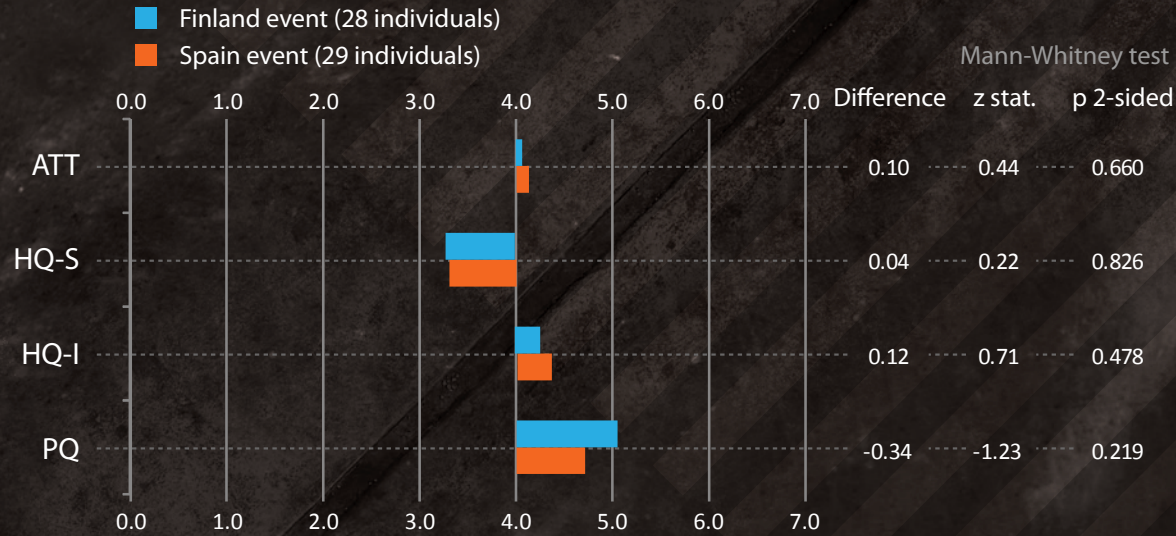
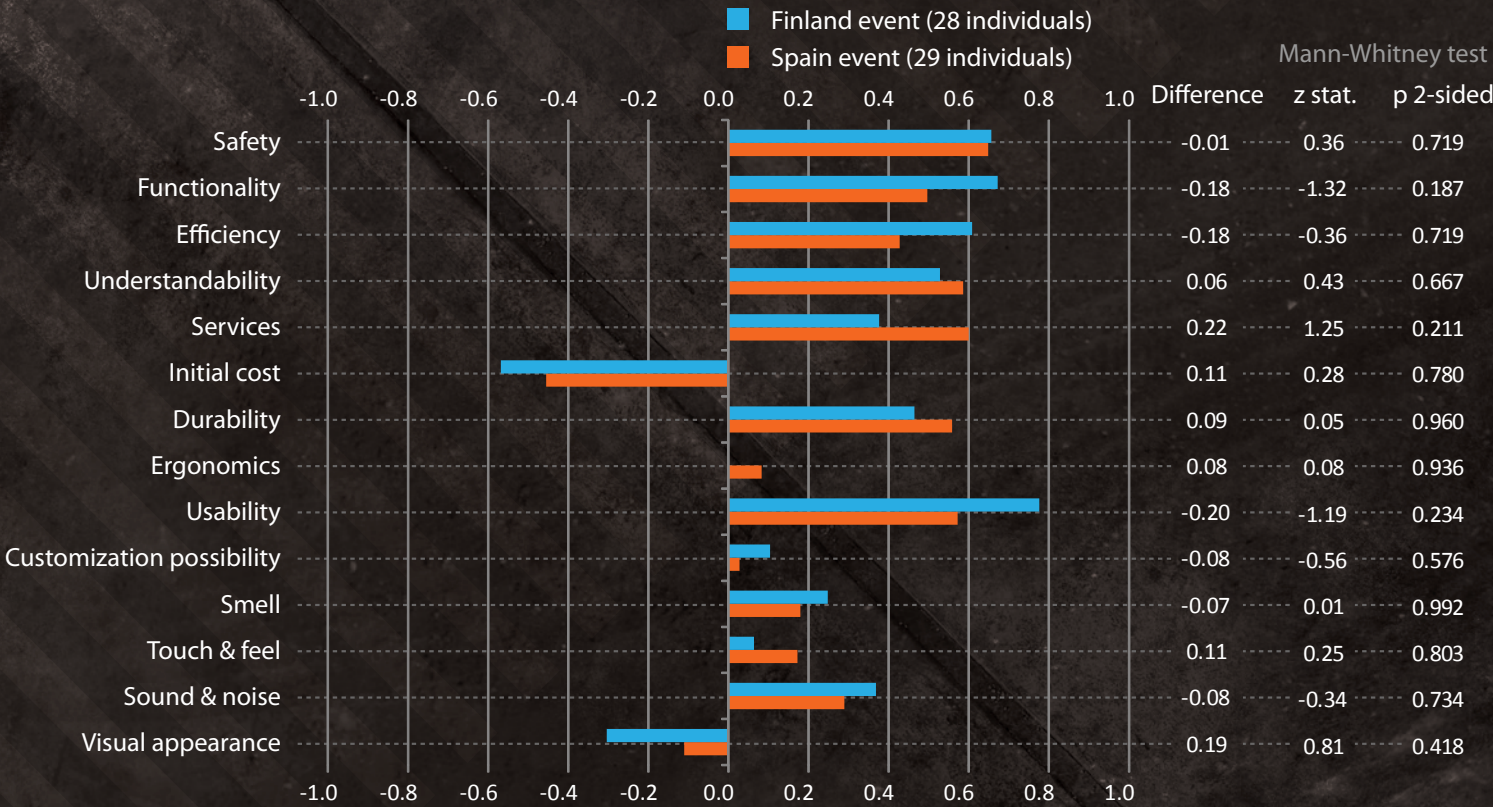
Appendix 11: Importance of different product qualities as perceived by distributors. Relative importance scores.



Appendix 12: Importance of psychological human needs as perceived by distributors. Relative importance scores.



Appendix 13: Wilcoxon signed-rank test results for distributors' perceptions of psychological human need importances. Psychological human needs in score order indicated by distributors.



Appendix 14: Mann-Whitney test results comparing individual groups from separate distributor events in Spain and Finland. Results from product quality and AttrakDiff evaluations of one industrial product (A counterbalance truck).

