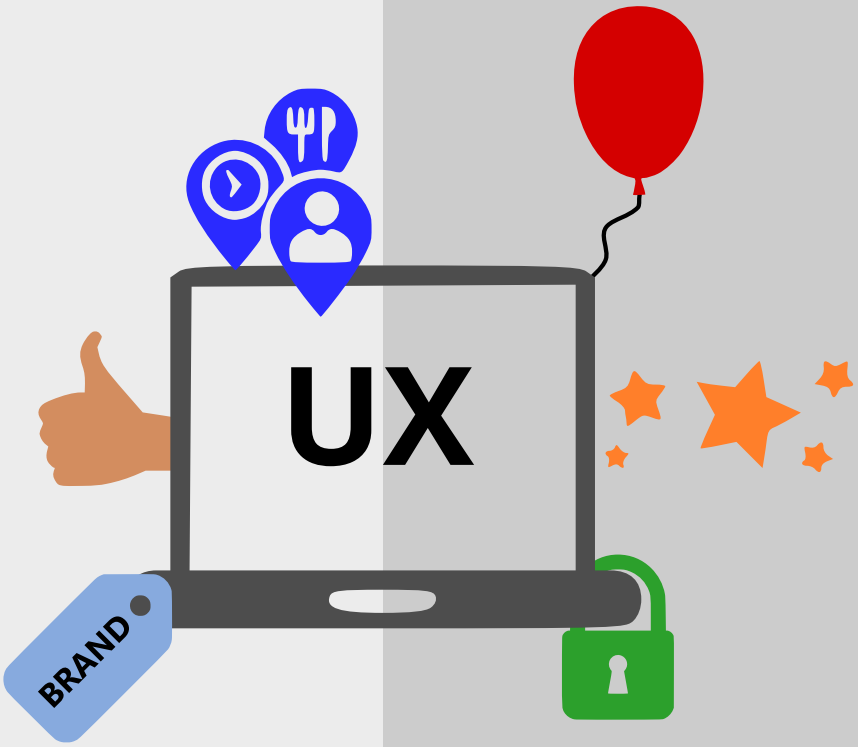
AALBORG UNIVERSITY

# UX Evaluation Methods: An Investigation of the Danish IT-Industry's Work and the Relevance of Literature

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**Synopsis:**


In this report, we set out to determine how the Danish IT industry and IT professionals understand user experience (UX) and work with UX evaluation methods and to what extent is UX evaluation literature relevant for practitioners. This was approached through three research questions using three research methods. In order to develop an understanding of UX evaluation literature we did a literature review. We collected papers from databases and conferences and our collection has papers from 1988 to 2014. Through this collection we found that questionnaires are the most used technique to collect data from UX evaluation results. We also categorized the UX dimensions into three categories and found how UX evaluations have changed over time. We found that the number of dimensions and technique variety has increased. Next we used a survey of the Danish industry to study the state-of-the-art of UX evaluation methods in industry. In preparing the survey we had interviewed companies and did a pilot survey. We sent the survey to direct employee email addresses and posted links to the survey through special interests groups in Denmark. From the survey we found that companies conduct UX evaluations either during the development process, by a separate department in the company or hire an external company to do the evaluation for them. We also found that companies that evaluate usability also evaluate UX and that UX practitioners in industry are not familiar with the UX evaluation methods that are popular in academia. In the third and final part of the report we performed an action research study on adoption and promotion of UX evaluations in a company. We found that workshops work well to introduce company employees to new methods and concepts. The company was also interested in presentable results that could be applied to improve their products. When it came to single methods, the company prefered methods that were adapted to their needs before they were considered for adoption by the company.

# Preface

*"We don't see things as they are; we see them as we are."* – proverb

This report documents the 10th semester specialization project in Informatics and Software Development produced by group is104f15 from Aalborg University. The project has been developed as a part of the Information System (IS) research unit in the first half of 2015.

The report is based on our three articles (in CHI format), that are available in the appendix, and contains 4 chapters. Chapter 1 is an introduction and presents our problem statement and research questions. Chapter 2 describes the contributions from the three articles. Chapter 3 describes the Research Methods used in the contributions.Chapter 4 is a Recapitulation of the report with conclusion, limitations and future work.

The literature in our report is set up using the APA standard method where the bibliography can be found in the back of the report.

The appendix of this report contains: Our three articles, the bibliography of our literature review and the questionnaire of our survey.

We would like to thank the participants of our survey. We would also like to thank our collaborators from the action research study. A special thank goes to our supervisor Jan Stage, for constructive feedback and assistance throughout the project.

Enjoy the report!

**IS1004f15** – Kristine Bang, Martin Akto Kanstrup & Adam Kjems

# Abstract

**UX Evaluation Methods: An Investigation of the Danish IT-Industry's Work and the Relevance of Literature**

**Subject:** User Experience

This report looks at how the Danish IT industry and IT-professionals understand UX and work with UX evaluation in practice, and the extent to which UX evaluation literature is relevant for practitioners. This is done by looking at three topics which are addressed in three CHI format articles. The report starts with an introduction of the research field and continues to present the research methods used in these articles. Before the appendix which contains the articles, the conclusions drawn from the research are presented. Each article uses a different research method to answer its respective question.

The first article is a literature review to answer, how and what are UX evaluation methods in literature measuring. This question is related to our overall question as it creates a baseline understanding of UX evaluation methods available in literature. Literature review was chosen to answer this question as we could look at past publications within UX research. Publications from a database search and conferences had over 2,500 initial papers. With a transparent and thorough sorting process the final collection of papers in the literature review was 90, with 93 UX evaluation methods. In answering how are UX evaluations methods conducted we identified seven techniques used, these are in order of popularity, questionnaires, interview, observation, self report, focus groups and expert evaluations. Also through our review we identified that academic UX evaluation methods do not have a consensus on the definition of UX to use and that the definition provided by the ISO is too broad to direct which dimensions of UX should be measured.

The second article contained in this report is a survey of the Danish IT industry. The article set out to answer How does the Danish IT-industry and -professionals currently understand and work with UX evaluation and is there an influence from academic literature? A survey was chosen as this would provide a wide breadth of results across the entire industry. To first develop an understanding of the industry before the survey we conducted 8 in depth interviews with employees of Danish IT-companies. This set the groundwork for conducting our survey. From article 1 we had the terminology with which we could question industry, to gain a measure of their familiarity with literature based methods. We learned that industry practitioners are not familiar with UX evaluation methods from literature however practitioners in industry and academia share a common understanding for the definition of UX. Academic and industry practitioners consider impression and use of a product as key UX dimensions with context of a lesser importance.

The third article was about how can UX and UX evaluation be promoted and adopted in a Danish IT-department of a bank, with a newly strategic decision of working with an HCI focus. This article used an action research approach in order to develop a deeper understanding of how the Danish IT industry and IT-professionals understand UX and work with UX evaluation in practice to complement our review results. We collaborated with the IT department of a Danish bank to implement new UX working techniques. Our collaboration involved training workshops, regular video meetings, and demonstrations of results that come from exper and user based UX evaluations. Results showed that the company was open towards working with UX and they showed eagerness to work with UX further. Company staff also said that our promotion of UX had played a key using in their adoption of it and improved the product they were creating.

In conclusion we used 3 different research methods to answer 3 aspects to the question how does the Danish

IT industry and IT-professionals understand UX and work with UX evaluation in practice, and to the extent is UX evaluation literature relevant for practitioners. We showed that academic and industry practitioners share a common approach to UX and that with promotion workshops, companies are eager to adopt UX evaluation methods. Future studies could look at how industry literature affects academic study of UX and how new UX graduates will affect the work market.

# Table of Contents

# Introduction 1

"*The literature evaluating usability methods is fundamentally flawed by its lack of relevance to applied usability work*" [Wixon, 2003]. The quote refers to the differences between academic work and industry, making their respective work irrelevant to each other. User experience (UX) is the new term replacing usability [Bargas-Avila & Hornbæk, 2011], and covers a broader range of topics from usability to experiential aspects of use [Hassenzahl & Tractinsky, 2006]. Some even consider usability and UX as interchangeable terms [Da Silva, Martin, Maurer, & Silveira, 2011; Roto, Law, Vermeeren, & Hoonhout 2011]. Industry is interested in UX because it is what separates successful products from competitors [Väänänen-Vainio-Mattila, Roto, & Hassenzahl, 2008] and academia is interested as UX is a progression from usability, looking beyond pragmatics and towards hedonic goals [Bevan, 2009b]. With both industry and academia researching UX, can it be on the same path as usability 12 years ago? If so, can anything be done to avoid a new chasm from forming? To answer these questions one has to understand how the academic literature and industry are working with UX and how their activities are related.

Before one can look at UX evaluations we establish what UX is because there exist a wide range of definitions for UX [Law, Roto, Hassenzahl, Vermeeren, & Kort 2009]. We have selected to work with the ISO definition as the UX definition of this report. User Experience (UX) is "*a person's perceptions and responses that result from the use or anticipated use of a product, system or service*" [ISO DIS 9241-210;2010, 2010]. The reason for using the ISO definition is that: it is in line with current understandings of UX [Law et al., 2009], the aim of the ISO is consistency [Bevan, 2009a], and the ISO is recognized by industry [ISO, 2015]. The elements of the ISO definition are demonstrated by Don Norman; "*I've been looking at the … Apple iPod. One... of the things that people love most about it is not the technology; it's the box it comes in.*" [Norman, n.d]. Here the focus is on the user's attitude towards the product and the effect of anticipated use on this attitude.

It is not only Wixon [2003] who has spotted a difference between industry and academia, especially in regards to evaluation methods. Tan, Ronkko, & Gencel [2013] point out that industry and academia have taken two independent paths towards developing UX evaluation methods leading to definitions and terminology that cannot be shared. Ardito, Buono, Caivano, Costabile, & Lanzilotti [2014], have worked with narrowing the gap between industry and academia. UX evaluations may also be incongruent with the way in which companies currently work [Roto et al., 2009], even though UX evaluations are key elements of high quality UX [Jokela, 2012].

HCI evaluation methods, and by extension UX evaluation methods, are changing and developing over time [Lazar, Feng, & Hochheiser, 2010]. They may provide qualitative or quantitative data. Research methods may involve observations, interviews, and other longitudinal techniques to make sense of socio-technical problems [Lazar et al., 2010]. We consider a method in an article to be self contained, meaning that all elements required to duplicate the method are included.

12 years ago usability did not meet the needs of industry, and now it may be the same case for UX, where literature is not relevant for practitioners. The work of academic literature may not be reaching industry due to lack of understanding or relevance of UX literature.

## 1.1 Research field

Our research is within the HCI field. Software developers are using UX research in order to differentiate themselves from competition and making software of our computer-dependent lives more oriented towards user perceptions and needs. Our aim is to bring the latest HCI UX research out of academia, to be adopted by companies in an open manner that enables future work to build upon ours. By encouraging fruitful cooperation between industry and academia we hope to further the development of better systems and stronger research connections.

## 1.2 Problem statement & Research questions

This master thesis seeks to study User Experience evaluation from two perspectives: Academic literature and use in the IT-industry. Combining these perspectives has lead to the following problem statement:

**Problem statement:** *How does the Danish IT industry and IT-professionals understand UX and work with UX evaluation in practice, and to what extent is UX evaluation literature relevant for practitioners?*

The problem statement is divided into the three research questions presented below:

**Research Question 1:** *What and how are UX evaluation methods in literature measuring?*

The first research question focuses on obtaining knowledge about UX evaluation and investigating the state-of-the-art of UX evaluation methods in published literature. Working with the results from a previous literature review about UX evaluation methods, this question extends the results and compares them with other literature reviews concerning UX evaluation methods.

**Research Question 2:** *How does the Danish IT-industry and -professionals currently understand and work with UX evaluation and is there an influence from academic literature?*

This research question will investigate the state-of-the-art of the Danish IT-industry. In relation to this, we want to investigate if the academic literature about UX evaluation has influenced how the IT-professionals currently work with UX evaluation.

**Research Question 3:** *How can UX and UX evaluation be promoted and adopted in a Danish IT-department of a bank, with a newly strategic decision of working with an HCI focus?*

The last research question is an exploration of UX evaluations in an IT-industry scenario, namely the startup of UX and UX evaluation in the development of IT-products. Promotion and adoption are key elements within this question, where the knowledge from the above two research questions is going to be integrated in the process of answering the third research question.

To answer the above problem statement and research questions, this master thesis has been divided into three activities resulting in three articles, one for each research question.

## 1.3 Research Process

In the 9th semester project, we collected knowledge about UX and UX evaluation methods. It consisted of both a literature review, from 2.516 to a final set of 90 academic publications, and 8 interviews with representatives from the IT-industry. We have used these results in our work with research questions 1 and 2.

# Contributions

2

In this chapter, we present three research articles, which constitute the main part of this master thesis. First, an overview and description of the relationships between them will be given, followed by a one-page summary of each research article. A sequential reading of the articles is recommended as some of the results from the articles build upon each other. The full articles can be found in the appendix.

To answer the problem statement and the research questions, the following three research articles has been written, which constitute our research contribution:

**Article 1:** Bang, K., Kanstrup, M. A. and Kjems, A. (2015) What are They Measuring? A Literature Review of Empirical Studies of UX Evaluation Methods. Department of Computer Science, Aalborg University, Aalborg. Article 1

**Article 2:** Bang, K., Kanstrup, M. A. and Kjems, A. (2015). How is UX Work Really Practiced? A Survey of the User Experience Profession in Denmark. Department of Computer Science, Aalborg University, Aalborg. Article 2

**Article 3:** Bang, K., Kanstrup, M. A. and Kjems, A. (2015). Promotion and Adoption of UX Evaluation in Industry: An Action Research Study in an IT-organization. Department of Computer Science, Aalborg University, Aalborg. Article 3

The common ground for the three papers is that they all address User Experience evaluations. In our master thesis, we have been studying UX evaluations from two perspectives: The published literature and the IT-industry.

The 2x2 matrix in Figur 2.1 below, provides an overview of the relations between the research contributions. The first row represents the academic literature's view and work in regards to UX evaluation, and the second row the industry and practical use of UX evaluation. The columns represent two types of foci within the UX evaluation field: The *Status* represents what the state-of-the-art is in regards to UX evaluation and *Change* represents investigations of how changes of the focus and work of UX evaluation can be made.

| | Status *(State-of-the-art)* | Change |
|---|---|---|
| UX Literature | A1 | |
| UX Practical | A2 | A3 |

***Figure 2.1.*** Relations between the research contributions.

The following three subchapters presents the three research papers in one-page summaries.

## 2.1 Contribution 1

Bang, K., Kanstrup, M. A. and Kjems, A. (2015) What are They Measuring? A Literature Review of Empirical Studies of UX Evaluation Methods. Department of Computer Science, Aalborg University, Aalborg. Article 1

This contribution presents a systematic literature review of papers containing UX evaluation methods. The sources of these papers were Scopus and ScienceDirect database searches and conference papers published in CHI, NordiCHI and Interact from 2010-2013. Previous studies have provided overviews of UX evaluation methods focusing on creating a scope of UX [Bargas-Avila & Hornbæk, 2011], listing all found methods [Roto et al., 2009], and future needs [Vermeern et al., 2010]. We added 4 years of new methods to the UX literature review studies and comment on the state of UX evaluation methods.

In order to document our search process as transparently as possible our search and documentation method was based on Vom Brocke, Simons, Niehaves, Riemer, Plattfaut, & Cleven's [2009] call for thoroughness in describing the search process. This would allow future scholars to build on our work and be able to use our same methods for their own research. The search went through 4 phases and looked at over 2,500 papers. The first phase defined our search as selective and exhaustive. We then asked key questions to narrow down our search. In phase 3 we started evaluating papers using a 4 step process, where papers were read and discussed. We also had a forward/backward search to get all papers written describing UX evaluation methods. this added 48 papers. The final phase was reading and analysing our collection of papers, which came to 90.

From the 90 papers in our literature review set we selected dimensions that were studied, and sorted the papers based on these 15 dimensions. Some dimensions were combined together to make the list manageable at 15. We then grouped these 15 dimensions into the 4 categories of UX (general), impression, use, and context. They represent the key elements of UX from the ISO definition [2010]. We also identified the techniques used to study the aforementioned dimensions. With the resulting table we could identify that the variety of techniques used to study UX has increased from 4 prior the 2000s to 7 between 2010-2014. A similar increase has been seen in the dimensions of UX with dimensions such as social UX and brand image being incorporated into UX evaluation methods. From the table we suggest a new definition of UX based on which categories of dimesions are measured as: the impression a product makes on a user influenced primarily by how it is to use and to a lesser degree the context of use. Looking at properties of UX evaluation methods involving product development phase and period of evaluation, we observed that the most popular type of methods were questionnaires taken after product use and generally on functional prototypes or complete products. The data provided in most cases (65%) would be a mix of qualitative and quantitative.

Our study raises questions about the popularity of questionnaires and provides a framework to organize future dimensions as we predict the number of dimensions and techniques used to study UX will continue to increase.

## 2.2 Contribution 2

Bang, K., Kanstrup, M. A. and Kjems, A. (2015). How is UX Work Really Practiced? A Survey of the User Experience Profession in Denmark. Department of Computer Science, Aalborg University, Aalborg. Article 2

This contribution presents a survey study of how IT-professionals and -companies currently work with UX. The survey was created with a basis in 8 interviews with employees of Danish IT-companies, and a pilot study to determine faults in the wording and sequence of questions. The respondents were collected through internet searches and networking, resulting in 373 recruitment e-mails sent, and two newsletter postings. We ended up with 147 respondents; 102 complete responses, and 45 partial.

To create the survey we sought inspiration in earlier HCI surveys [Gulliksen, Boivie, Persson, Hektor, & Herulf 2004; Law et al. 2009] and literature on how to construct surveys [Lazar et al. 2010; Oppenheim 1966]. This was to ensure a solid structure, as well as the opportunity to answer some of the same questions as earlier surveys. The survey used adaptive questions, where the sequence of questions could change according to specific responses. Our target respondents were employees of Danish IT-companies, which is why the first question of the survey was a qualifier question to sort out unwanted respondents. The question was whether the respondent works in a company that develop or adapt software and/or hardware with a user interface.

The results showed that a majority of the respondents work in companies that evaluate UX, either as separate full evaluations, or as added parts to usability evaluations. This range shows UX as a growing concept, rather than a sudden shift from usability. The UX evaluations are most often performed as an integrated part of the development process, with evaluations in separate departments or from external companies only reported by 10% of respondents each.

Almost all the respondents reported that they evaluate with users, where expert and developer evaluations is conducted by about half of the respondents each. This is because user evaluation is thought as easy, as you just have to ask the users. This means that when selecting an evaluation method, the least influential criterion is the respondents knowing of the method beforehand. The most influential criteria are resources needed and the time needed to conduct the method. This is supported by the fact that most companies combine tools and techniques into their own tailor-made methods rather than existing ones, in an effort to control resources and time needed.

In an effort to synthesize a definition that would fit practitioners, we looked at which dimensions they see as a part of UX, and combined the highest ranked. These are Impression, Functionality, Pleasure, Use, Sense of agency, Context of use, and Learnability. Each of these dimensions are agreed upon by at least 95 of the respondents.

## 2.3 Contribution 3

Bang, K., Kjems, A., and Kanstrup, M. A. (2015) Promotion and Adoption of UX Evaluation in Industry: An Action Research Study of an IT-organization. Department of Computer Science, Aalborg University, Aalborg. Article 3

This contribution presents an action research study of the promotion and adoption of UX and UX evaluation in industry. The study has been conducted through a four month period with a development team in a Danish IT department of a bank in two of the company's locations. Since knowledge about the use of UX and UX evaluation in industry is limited due to only few research publications about the topic, we decided to take an action research approach to the study in order to test our different UX promotion strategies and observing the changes this resulted in.

Throughout the study, 12 activities were conducted, involving team meetings, a UX workshop and demonstration of UX evaluation methods, with the development team spending a total of 98 employee hours. Since action research studies are rarely used in HCI and no studies were found in regards to investigating UX in industry, we used inspiration from the field of Information Systems. As our theoretical framework, we used one by Mathiassen [2002] with the purpose of understanding, supporting and making improvements in practice. In order to address this, we used the theory of 'Dual Cycle Process' from McKay & Marshall [2001] which both consist of a 'Problem Solving Interest'-cycle (how we can help the company we collaborate with) and a 'Research Interest'-cycle (how we can create research results).

The development team we collaborated with consisted of 10 employees with various job functions; UX designers, a method expert, a product manager, bank domain experts, business architects and software developers. 4 of these were key members of the team and two team meetings were held with them every month. Recently, the company took a new strategic decision of working with an HCI focus involving UX work. Since one of our goals with this study was to promote research literature about UX and UX evaluation methods we used this material in order to teach the employees about UX.

The overall findings indicate that changes has been made in the studied development team and that part of the promoted UX material has already been adopted in the development processes of the IT-department. Findings from the action research study were divided into three categories of elements in regards to lessons learned: The process of promoting and adopting UX evaluation (P), the definition of the UX term (D) and obstacles which occurred during the collaboration (O). The results demonstrate that the use of visual (video recordings) and practical (workshops) promotion strategies of UX evaluation methods were effective. They allowed the employees to get a better understanding of the resources needed for adopting the methods, as well as allowing them to work with the evaluation methods themselves. Further our study indicated that since the UX term is very broad, the employees did not have the same understanding of the different UX dimensions which resulted in a disagreement of the overall UX goal of the project. Lastly, the results showed that modifications to the academic UX evaluation methods have to be made in order for the development team to see the relevance of these and fit them into their development process.

# Research Methods

3

This chapter presents and discusses the research methods used in our master thesis. First we present an overview of the research methods and then we describe how the research methods were conducted, what the general strengths and weaknesses of the research methods are, and what we did to prevent or compensate for these weaknesses.

## 3.1 Overview

The overview of the research methods used in our three contributions, and to answer our research questions, is illustrated in Figur 3.1.

| Research Question | Research Method | Research Purpose | Research Setting |
|---|---|---|---|
| 1. Which UX evaluation methods are presented in academic literature? | Literature Review | Understanding | Not applicable |
| 2. How does the Danish IT-industry and professionals currently understand and work with UX evaluation and is there an influence from academic literature? | Survey | Understanding | Environment Independent |
| 3. How can UX and UX evaluation be promoted and adopted in a Danish IT-department of a bank, with a newly strategic decision of working with an HCI focus? | Action Research | Change/ Understanding | Natural Setting |

***Figure 3.1.*** The applied research methods used to answer each research question.

In order to classify the research methods used in this master thesis, we have used Wynekoop & Conger's [1992] three categories for research settings: Natural setting, environment-independent setting and artificial setting. Further we have described the purpose of using the research methods.

Below the research questions contain descriptions of their respective research methods (Literature review, survey and action research), from Figur 3.1. The section under each research question is structured by first presenting strengths and weaknesses in brief, the research method and how we used it, followed by the strengths and weaknesses in depth. Finally we describe how we worked to mitigate these weaknesses.

## 3.2 Research Question 1 - Literature Review

| Strengths | Weaknesses | Countermeasures |
|---|---|---|
| Collect and analyse literature about a specific topic systematically. | Important to fully describe the searching process.<br><br>Difficult to do a fully exhaustive literature search. | Detailed description of search process.<br><br>"Selective and exhaustive" search + forward/backward |

***Figure 3.2.*** Strengths, Weaknesses & Countermeasures of literature reviews

In order to answer the first research question, we undertook concept development writing to organize ideas through frameworks [Wynekoop & Conger, 1992]. This was done through a literature review of academic literature from both literature-database search and conference search. During the planning phase of the literature review, we have been using a framework adopted from vom Brocke et al. [2009] in order to structure the whole literature review process, from the initial steps in regards to establishing the scope of the literature review process, to analysing the results from the review (see Figur 3.3). The process consisted of 5 phases, where the first (1) is about constructing a definition of the review scope, i.e. the specific topic and goal of the literature review. The next phase (2) is about collecting knowledge about the studied scope to gain basic knowledge. After that the searching and selecting phase (3) of the articles begins, followed by the the reading and analysis phase (4), where all the publications are processed. The final phase (5) presents the results of the literature review.

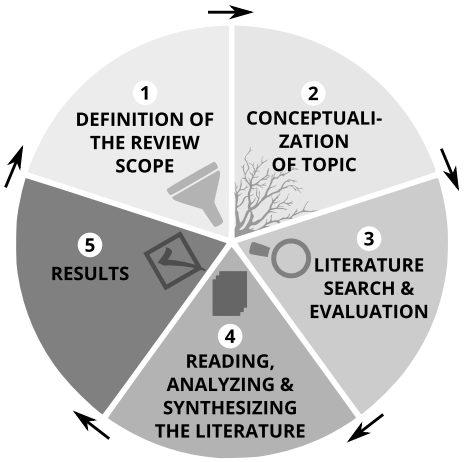


***Figure 3.3.*** The framework of our literature review process. Adopted from vom Brocke et al. [2009]

Strengths and weaknesses of literature reviews are described by vom Brocke et al. [2009]. They observed that Information Systems (IS) researchers often create short descriptions of their literature review and and do not fully describe their searching process. Vom Brocke et al. states that: "*…the process of searching the literature must be comprehensibly described. Only then can readers assess the exhaustiveness of the review and other scholars in the field can more confidently (re)use the results in their own research.*" [vom Brocke et al., 2009, p. 1]. It is therefore important to describe the searching process of a literature review in order to show others where and how searches have been made, as well as which inclusion and exclusion criteria were used.

Further, using a literature review approach gives you the opportunity to collect and analyse literature about a specific topic systematically. However, due to the amount of literature available from different conferences and literature databases, it is nearly impossible to do a fully exhaustive literature search.

Mitigating the weaknesses above, we documented every step in our literature search process and the

inclusion and exclusion of literature. With the goal of transparency we describe search strings, places we searched, number of publications excluded and included in every step, and how the literature were analysed. In regards to the exhaustiveness of the literature review, we chose to do a 'selective and exhaustive' search [vom Brocke et al., 2009], where we selected different literature databases and different conferences, before being exhaustive within these. To avoid missing relevant publications, we did a forward and backward search in the last step of the literature search process, where we were aiming for closure within the literature about UX evaluation.

## 3.3 Research Question 2 - Survey

| Strengths | Weaknesses | Countermeasures |
|---|---|---|
| Collect data relatively easy in a variety of setting. | Possibility of bias.<br><br>Questions may be interpreted incorrectly. | No use of UX in the survey introduction.<br><br>Pilot-testing |

***Figure 3.4.*** Strengths, Weaknesses & Countermeasures of surveys.

In order to answer the second research question, we conducted a survey, which is categorised as being environment independent, since "responses are collected directly from respondents and assumed to be unaffected by context" [Wynekoop & Conger, 1992]. The reason for using a survey, was to be able to make a quantitative study of the Danish IT-industry as a follow-up investigation of the 8 qualitative interviews with representatives of IT-companies. We found the follow-up investigation in the form of a survey necessary since the results from the interviews resulted in a very diverse picture of the IT-industry's use of UX evaluation. Every interviewed company had a different opinion of UX and were conducting UX evaluations differently. To make a state-of-the-art of UX evaluation work in the IT-industry, we therefore needed more respondents to develop a broader understanding.

The strengths of surveys are their ability to collect data relatively easy in a variety of settings [Wynekoop & Conger, 1992]. However, a weakness of the research methods is the possibility of a bias, which in our case is possible as respondents who are enthusiastic about UX are more likely to complete the survey. Another weakness of surveys is that the questions may be interpreted differently than expected which may result in mislead responses. Respondents do not have the chance to ask for clarification of questions and the researchers are not able to ask follow up questions.

Being aware of the above weaknesses, we tried to prevent them with the following countermeasures: As a solution to the bias problem, we ensured that the email to the respondents, as well as the beginning of the questionnaire did not use the term UX, but were describing the survey as being an investigation of how the Danish IT-industry evaluates the interface of their products. The background for selecting respondents was that they developed IT-products with an interface and not because they worked with UX or usability.

In order to ensure the quality of the questionnaire in our survey, we chose to conduct a pre-testing 5-step process with an pilot study included (see Figur 3.3). In the process of conducting the steps in our pre-testing process of the survey, we evaluated our survey with three different groups of respondents. First we evaluated the text and structure of the survey ourselves and then, step 2, we reviewed it with colleagues at the university. These first steps were conducted in order to find as many errors as possible before our pilot-study. Step three were a layout and functionality evaluation to ensure that the technical side of the survey should not be an obstacle for answering the survey. Next step where the execution of the pilot-study with 9 respondents who were or had been an employee of a IT-company. After the pilot-study, step 5, with refinements of the survey were made.

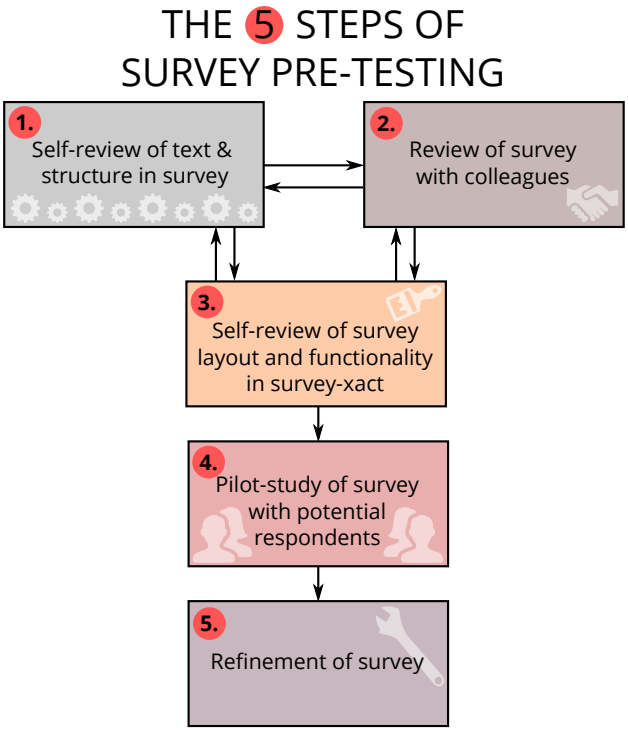


***Figure 3.5.*** Our self-made pre-testing 5-step process, conducted to ensure the quality of the survey.

## 3.4 Research Question 3 - Action Research

| Strengths | Weaknesses | Countermeasures |
|---|---|---|
| Gaining first-hand understanding of a situation and try out different solutions to practical problems. | The objectivity of the study.<br><br>Generalizability of the results. | Anonymous surveys.<br><br>No aiming for generalizability but construction inspiration case. |

***Figure 3.6.*** Strengths, Weaknesses & Countermeasures of action research studies.

In order to answer the third research question, we conducted a study in natural settings with the use of an action research study to get qualitative insights from within a company. Since we were interested in studying change as the result of promoting UX and UX evaluation from research literature in a company, this leans towards conducting action research; combining research and practice. The combination also reflects the wish of combining the knowledge gained from answering research question 1, which focus on the research side of UX evaluation, and research question 2, which focus on the IT-industry side of UX evaluation. Combining this knowledge makes it possible to investigate the academic influence in regards to the IT-industry's use of UX and UX evaluation.

Since action research studies in the field of HCI is still limited it is difficult to find guidelines for conducting these. As a result, it has been necessary to incorporate theory from the research field of Information Systems, where strategies for conducting actions research studies are more well established [Iversen, Mathiassen & Nielsen, 2004]. As an overall approach for our action research study, we have been using the work of McKay & Marshall [2001] and their "two, interlinked cycles" (see Figur 3.7).

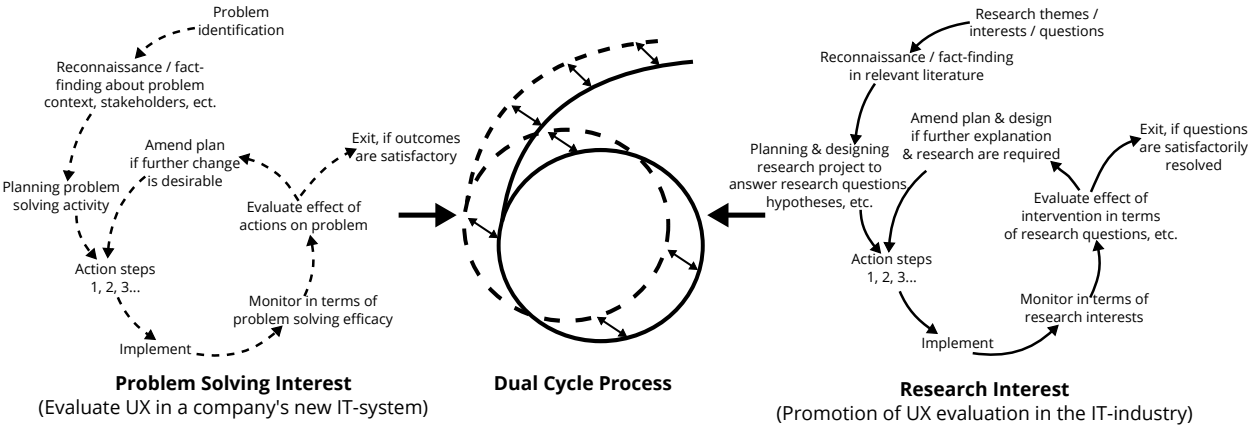


***Figure 3.7.*** McKay & Marshall's [2001] "two, interlinked cycles", including what the 'Problem Solving Interest' and 'Research Interest' cycle consisted of in our action research study. Adapted from McKay & Marshall's model [9].

As can be seen in Figure 2, the two interlinked cycles consist of a 'Problem Solving Interest' cycle and 'Research Interest' cycle, with different steps in each. Through this model it is clear that action research study is both about research and helping the subject solving a problem. With action research, you are also able to propose and test different solutions to a problem through several cycles and observe the different outcomes. Using this method ensured that we both had an focus on the subject's wishes as regards to a problem solution as well as ensuring that research were made in regards to our research question.

As a theoretical framework for our action research we chose to use the one presented by Mathiassen [2009] which has the purpose of "understand, support, and improve practice as part of the ongoing professional development.", which relates well to the McKay and Marshall's "two interlinked cycles".

According to Wynekoop & Conger [1992], action research studies have many strengths, e.g. "gaining first-hand understanding of the situation" since the researchers are seen as being equal to the subject. This is further clarified by explaining that "the subject forget they are subjects, forget the researcher is present for a different reason, and are more honest and straightforward in their dealings with the researcher" [Wynekoop & Conger, 1992]. Since the researchers are working alongside the subjects and have a stake in the success of the outcome, it is questioned whether the results of the study can be seen as objective. Furthermore, it is often discussed in the research literature whether the results from an action research study can be generalized and used beyond the studied context since it only investigates few cases in practice [Wynekoop & Conger, 1992].

In aiming for objectivity of our study, we chose to conduct anonymous surveys as a tool for the members of the IT-development team to evaluate the promoted UX evaluation material. By doing this, we could gather opinions from the team members without affecting them with our presence and giving them the shield of anonymity.

In regards to the generalizability of the results from the action research study, Hayes [2011] states that "AR does not say that no solution can ever be successful outside of the local context for which it was developed. Instead, AR provides a rigorous framework for generating and sharing sufficient knowledge about a solution that it may potentially be transferred to other contexts." With our action research study, the goal was thus not to be able to create generalizable results, but create solutions that may be relevant in other cases.

# Conclusion 4

This chapter presents the conclusion of the master thesis with our three contribution articles. We will first answer each of the research questions which will lead to the conclusion of the problem statement.

## 4.1 Research Question 1

The first research question was:

- *What and how are UX evaluation methods in literature measuring?*

Based on a literature review of 90 articles selected from 2.516 articles. The 90 papers were sorted and categorized based on the dimensions they observed and the techniques used to measure each dimension. To make the results easier to discuss we created 4 categories of dimensions to measure: UX (general), impression, use, and context. We found that most academic UX evaluation methods are in the impression category followed by use and context. The most measured dimensions are pragmatic at 52 times. emotion (general) (35 times), aesthetics (28 times), hedonic (23 times) and pleasure (19 times). We also found that questionnaires were the most popular type of technique to study UX. Other techniques were interviews, observation, physical body response, focus group, self report, and expert evaluation. In a listing of the most popular UX methods we identified the 7 most commonly used. These in order of use, Attrakdiff & Attrakdiff 2, SUS, Self-Assessment Manikin, Emocards, SUXES, UX Curve method, and User Experience Questionnaire (UEQ). Over time the variety of techniques used and dimensions measured has increased. Due to this wide variety within UX there was no unified definition that all the papers referred to. Instead several definitions were referred to among which was the ISO definition from 2010. The lack of a single set of dimensions and techniques may be due to the broadness of the ISO definition as it provides little guidance to the dimensions and techniques of UX that should be measured.

## 4.2 Research Question 2

The second research question was:

- *How does the Danish IT-industry and professionals currently understand and work with UX evaluation and is there an influence from academic literature?*

This was answered by a survey study, as documented in contribution 2. The survey ran for 6 weeks, yielding a total of 147 valid respondents; 102 complete and 45 partial. The results show that the employees in the Danish IT-industry see UX as consisting of dimensions such as Pleasure and Impression, as well as usability associated dimensions: Functionality, Learnability and Effectiveness. The employees therefore acknowledge that usability is a part of UX which were further supported by the respondents stating that

they see UX as containing usability. In regards to how they work with UX evaluation, the results show that the companies tend to conduct them as an integrated part of the development process, which is sometimes supported with evaluations conducted either by a separate department, or by an external company. Almost every company that evaluates UX also evaluate usability; sometimes conducted as full UX evaluations measuring usability dimensions as well or as minor UX add-ons to a usability evaluation. The UX work that is done is primarily by those that are trained on the job, however there is an aspect of education contributing to UX work. Many who do UX work have an HCI background. The influence of education, although, is limited. We presented 15 evaluation methods. The most known was UEQ. However it was only 20 of 68 respondents who were familiar with this evaluation method. The least known was Attrakdiff with 5 respondents.

## 4.3 Research Question 3

The third research question was:

- *How can UX and UX evaluation be promoted and adopted in a Danish IT-department of a bank, with a newly strategic decision of working with an HCI focus?*

This was answered by an action research study, as documented in contribution 3. The study was conducted with a development team in an IT-department of a Danish bank for a period of four months. During this period, we promoted UX and UX evaluation methods through the use of different strategies including team meetings, the execution of a UX workshop, and demonstrations of four UX evaluation methods from research literature (SUXES, Attrakdiff, UX Heuristic Inspection, and Product Reaction Cards). Our study indicates that changes have been made in the development team and that part of the promoted material has been adopted by the company. In our study we organised the results into three categories, ‘process’ (P), ‘obstacles’ (O) and ‘definitions’ (D), which represent lessons learned in regards to the research question.

Our results indicate that practitioners are interested in gaining practical knowledge instead of theoretical knowledge. The promotion strategies we presented were video recording of the execution of evaluation methods and conducting UX workshops where employees could learn the UX term and try to use the evaluation methods. By doing this, we were able to show the employees the resources needed to use specific UX evaluation methods as well as allowing them to work with them.

In regards to working with the UX term and definition of it in a company, our study indicates that the employees had different understandings of the different UX dimensions. Deciding to use and evaluate specific UX dimensions without establishing a shared understanding and definition of the dimensions, can therefore result in disagreements of the overall UX goal for the system to be developed. Our study demonstrates that conducting an activity where the employees can discuss the meaning of the different UX dimensions, may lead to a creative idea generation simultaneously.

We have identified a need in the development team for modification of UX evaluation methods from research literature in order for them to see the relevance of them. The reason for this may be the fact that methods from research literature are constructed with academic goals in mind and not the more practical use. Further we have observed that the employees in the development team were not familiar with the use of UX in early design activities, but saw it as a later design focus. However, after the promotion of early UX evaluation methods, some of these were later adopted in their system development process.

## 4.4 Problem Statement

In the following we gather the conclusions from the research questions in order to answer the following problem statement:

- *How does the Danish IT-industry and IT-professionals understand UX and work with UX evaluation in practice, and to what extent is UX evaluation literature relevant for practitioners?*

In the master thesis we have developed an understanding of the evaluation methods in literature and of the state of UX evaluation methods in the Danish IT industry. The Danish IT industry's understanding of UX is based on a need for creating products that meet customer requirements. They work with it as an extension of usability and some have not fully integrated UX into their own development processes. For their UX understanding some companies go to consulting firms to do external UX evaluations or receive on-the-job training. UX in industry and in academia share similarities in that the aspects of UX mostly ignored by academia are not of interest to the majority of industry; brand image and social UX. One very clear difference between the academic and industrial use of UX evaluation methods is the popularity of named methods. In literature the most popular UX evaluation method by a large margin was Attrakdiff with UEQ being less popular. In industry Attrakdiff was least heard of and the most popular was UEQ. However, in regards to the relevance of the UX evaluation literature for practitioners, our action research study indicates that practitioners benefit from workshops where they can work with the new methods. They also benefit from seeing methods in action with directly useful results, as was the case with our video recordings of UX evaluations of their products. Furthermore, practitioners just like academics, disagree on the meaning and scope of UX dimensions. By having a guided session to address definitions they created a single vision for the UX of their system. Finally by adapting UX evaluation methods to fit the company's present needs, we were able to overcome the barriers preventing UX from being adopted. This work resulted in UX evaluation methods being considered relevant for the company.

## 4.5 Limitations

Here we discuss the limitations of our work divided into the different contributions.

### 4.5.1 Contribution 1

A limitation of our literature review is a result of our selective and exhaustive search approach. Since we selected specific conferences and literature databases it can be discussed whether these provided the desired broadness of UX evaluation method literature from academia. With the choice of only focusing on publications from conferences in the period 2010-2013, we also have a bias in regards of having a higher number of recently published articles. In regards to the search string in our database search we may have locked out potential results by not including more terms such as VR, IT product etc. Comparisons of results to that of other literature reviews was weakened as some of our publications included more than one method, and we also had the same method referred to several times which may have skewed the results.

### 4.5.2 Contribution 2

A limitation of our survey is that not all respondents included their company name so we do not know if our results were dominated by a few companies or if all respondents came from different companies. Another is the bias that comes from UX enthusiasts completing the survey whereas non-enthusiasts would quit the

survey, resulting in their partial responses. Another limitation was that the survey was done in Danish with results presented in English; certain terms such as pleasure, and satisfaction were difficult to translate without losing or gaining new meanings.

### 4.5.3 Contribution 3

Limitations of the action research study were time based and scope based. Since our study could not continue to see the long term effects of our promotion of UX evaluation methods, we were not able to see whether the adopted UX evaluation methods result in permanent use of these in future projects. Furthermore, since we were mostly in contact with the UX designers of the development team, there is a possibility that they are in general more positive towards adopting UX evaluation methods, compared to management.

## 4.6 Future work

As a continuation of the work we have presented in this master thesis, there are five areas of research, which would be relevant to future understandings of UX evaluation methods and their industry.

### 4.6.1 Strengthening the relationship between industry and academia

In regards to our study, we have been investigating both the state-of-the-art of UX and UX evaluation in the IT-industry as well as in the research literature. In addition, we have conducted studies investigating the IT-industry's use/knowledge of UX material from research literature as well as how UX evaluation methods from academia can be promoted and used in companies. Since we believe that both academia and the IT-industry can benefit from each other, future research could address the flow of knowledge and material from academia to the industry and vice versa.

### 4.6.2 A literature review of the publications from industry

Of the list of articles used in our literature review 37 are from ACM, 8 from Springer, and from 3 IEEE. These publishers are behind paywalls. Therefore for further investigation we can see how many companies pay for journal subscriptions and what are their sources for UX knowledge. In gathering resources we have come across reports from the Nielsen Norman Group and articles from uxmag.com. The contents of these sources could be analyzed with a literature review to see how much of an influence they have from academic research and which sources do companies use for their UX knowledge.

### 4.6.3 Long term studies of UX evaluation in industry

As our action research study was only 4 months and in 1 company, it would be relevant to conduct more studies with a longer term approach. This would provide a deeper understanding of the company as well as ensuring that the adopted UX material results in permanent changes. It could be interesting to conduct an action research study, were the researchers could be a part of the whole system development process, from idea generation to a finished product and promote UX evaluation methods, for each step of the design process.

### 4.6.4 Do IT-companies work with UX, in the way that was reported by the respondents?

To get a deeper understanding of the survey respondents' companies' work with UX, we could find a representative set of respondents, and use them for interviews, to get a deeper understanding of their responses. This is also a way to have them weigh the different answers against each other, e.g. in regards to criteria or dimensions. The next step from interviews, are case studies, to see if the actual work, fit with the survey, or if some nuances of work were lost in the analysis. Some respondents had difficulty answering some of our questions, because they were from consulting companies. It could be interesting to investigate the differences between consulting firms and software development companies.

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# Part I

# Appendix

# What are They Measuring? A Literature Review of Empirical Studies of UX Evaluation Methods

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**ABSTRACT**
This paper sets out to determine the state of User Experience (UX) evaluation methods with a literature review of empirical research. We have systematically collected and reviewed 90 publications from an initial sample of 2,516 papers to provide an overview of publications describing UX evaluation methods published from 1988 to 2014. 93 different UX evaluation method descriptions were found. We have taken the large number of measured UX dimensions in the selected methods and sorted them into four categories: UX (general), impression, use and context. Our results show that there is still no UX definition consensus and that the ISO definition has had limited impact. We also discuss the trends of using diverse techniques to investigate UX. Finally, we propose a new definition of UX based on what UX evaluation methods investigate.

**Author Keywords**
User Experience; evaluation methods; literature review.

**INTRODUCTION**
User Experience (UX) is a growing field within HCI. It was first introduced in the mid-1990s by Don Norman [12] who created the term because "*Human Interface and Usability were too narrow; I wanted to cover all aspects of the person's experience with a system, including industrial design, graphics, the interface, the physical interaction, and the manual.*" [10]. Today, UX has become an all-encompassing term for emotions and experiences when using interactive products, covering dimensions such as hedonic quality, pragmatics and trust.

There is no agreed definition or set of dimensions of UX, so practitioners and researchers use different definitions and descriptions for the term. Some refer to others' definitions, others formulate their own, and some do not state any definition at all. The ISO definition of UX has been made as an attempt to formulate one shared definition of UX: "*person's perceptions and responses that results from the use and/or anticipated use of a product, system or service*" [8]. Three additional notes describe that UX is about emotions, physical and psychological responses, brand image, expectation and context of use [8].



In order to understand and develop for UX, researchers created different UX evaluation methods. The method characteristics differ in several respects, starting with the dimensions measured (trust, emotions, etc.). Techniques used (interview, questionnaire, expert evaluation, etc.) also differ. Evaluation methods are performed before, during, or after use and on prototypes, or on functional systems. Finally UX evaluation methods provide quantitative, qualitative or both types of results.

Some researchers have created overviews of the different UX evaluation methods [1, 14, 17]. These overviews provide overall numbers and comparisons of all accessible UX evaluation methods. They gather methods from conferences, networking and sessions with industry professionals. Theses overviews were created before 2010, which means that there is an opportunity to extend the overviews with 5 years of research.

The aim of this paper is to investigate UX evaluation methods in research literature to find what and how they are measuring UX. We include access to paper specific information about dates, authors, and method characteristics, and provide an overview of lacking areas of UX research. Our literature review contains published research articles from 1988-2014 and conference papers from 2010-2013. The purpose is to create an overview of papers describing a method, making it possible to illustrate where there is focus and where there is limited research. This is done by creating a table with dimensions of UX studied, how and when these are included in evaluations, and the type of results reached. The variety of UX evaluation studies is very broad, therefore we ask if there is agreement on how one can evaluate a system's UX.

In the following sections we outline past reviews of UX evaluation methods in related work. Then we describe the process used to gather our collection of UX evaluation methods and how we organized the collection. Results describe patterns and trends that arise from our UX

evaluation method categorization. In the discussion we relate our results to changes in the UX field.

## RELATED WORK

Creating overviews of UX evaluation methods is not new in the field of HCI. At CHI '09, Roto et al. [14] held a SIG (Special Interest Groups) session in order to collect known and used UX evaluation methods from 35 gathered participants, representing academia and industry. 30 methods were collected and categorized by evaluation techniques used (e.g. expert evaluation, survey and lab studies). The methods were collected through a group session and no description of the methods is available.

Another collection of UX evaluation methods has been made by Bargas-Avila & Hornbæk [1]. They systematically reviewed 51 scientific UX publications from 2005 to 2009 and investigated the methods, techniques used, and the dimensions of UX measured. The results were presented as percentages and number of publications using specific techniques and which UX dimensions were measured. Their study shows a tendency towards grouped dimensions under the heading generic UX or emotions, and they found most using questionnaires and interviews.

A study of UX evaluation methods was also made by Vermeeren et al. [17] where 96 methods were collected from academia and industry. The methods were collected through conferences, online surveys, and literature searches covering papers from 2007-2010. In the study they gave an overview in percentages of which UX evaluation methods contained different characteristics, e.g. product development phase, and data type. The complete list of methods was made accessible on the website allaboutux.org, where it is possible to see a description of each method and for some a link to an article describing the method. Results show a tendency towards evaluating UX on functional products and evaluating on a single episode instead of the whole product experience.

In summary, the presented papers have all made an overview of the UX evaluation methods from either academia or industry where they described trends, definitions and lists of methods.

Looking at other research fields paper overviews have been previously made. In [13, 19] each paper from a literature review was inserted in a table with categories on the x- and y-axis, making it possible to categorize each paper individually and observe where there is a focus or limited focus. These kinds of overviews make it possible to find and read the categorized papers, making the literature review more transparent.

In regards to our paper, one of the aims is to address the absence of a paper overview of publications about UX evaluation methods, and make a categorization of academic papers describing UX evaluation methods.

## METHOD

Our literature review is based on vom Brocke et al.'s article about the importance of being rigor in documenting the literature review process: "*…the process of searching the literature must be comprehensibly described. Only then can readers assess the exhaustiveness of the review and other scholars in the field can more confidently (re)use the results in their own research*" [18]. Below, we describe how we have achieved transparency, showing all the exclusion and inclusion steps as well as the search string and outlets used.

We modified the 5 phases of the vom Brocke framework [18] to fit the purpose of this review. These will be explained below.

### Phase 1: Review scope

The focus of this literature review is to find academic literature that provides a description of a UX evaluation method in such way that one is able to perform the method, with the paper as the only source. The reason for this is to make it easier to work further with our results and the UX evaluation methods found in the papers. By reading this paper, one therefore is able to conduct the same methods, modify the methods, or compare the methods to each other.

The review scope is characterized as a 'selective and exhaustive' review. We were selective by searching in Scopus and ScienceDirect literature databases with a search string and CHI, NordiCHI, and Interact conferences from 2010-2013. Scopus is the largest single abstract and indexing database on the internet, covering different topics and research areas [3]. We chose these three conferences, because they are well-known in HCI. The reason for searching in both databases and conferences is that conferences provide reviewed field leading papers from specific research fields and years, and databases provide both old and new papers from different research fields. Different literature databases and different conferences also have different foci, and we aimed to get a varied picture of the UX evaluation methods existing in academia. We looked at all of the results from our initial search, treating them exhaustively.

### Phase 2: Conceptualization

To gain a basic understanding about the research field of UX and UX evaluation, we investigated four questions:

1. What are the definitions and synonyms used for UX?
2. What is already known about UX?
3. What are UX researchers working on?
4. Which search strings and keywords provide results about UX evaluation methods?

The above questions guided the scope of this paper by identifying where research is missing within the UX field and creating a search string that resulted in relevant papers for the literature review. The search strings are in Figure 1.

**SEARCH STRINGS**
**Search string (Scopus):**
(TITLE ( user experience* OR ux OR experience* OR ue )
AND TITLE-ABS-KEY ( application* OR software OR interface* OR gui )
AND TITLE-ABS-KEY ( practical* OR requirement* OR measur* OR evaluat* )
AND ( LIMIT-TO ( SUBJAREA , "COMP" ) )
AND ( LIMIT-TO ( LANGUAGE , "English", "Danish" ) )
= 345 results

**Search string (ScienceDirect):**
(TITLE ( user experience* OR ux OR experience* OR ue )
AND TITLE-ABS-KEY ( application* OR software OR interface* OR gui )
AND TITLE-ABS-KEY ( practical* OR requirement* OR measur* OR evaluat* )
= 26 results

- Duplicates will be removed

**Figure 1. The search strings used in the database search**

### Phase 3: Literature Search & Evaluation

The search phase of the literature review was conducted through two search tracks (Figure 2), representing the conferences and literature databases.

Our literature search ended with 2,516 publications, 2,145 from the conference search and 371 from the literature database search. The following four steps were used to select the relevant publications for the literature review:

*Step 1: Paper selection – Title and abstract:*
In this step, we read the title and abstract of the potentially relevant papers of the 2,516 publications. To be selected, the title or abstract had to indicate that the paper was describing UX or a method to evaluate UX. With the literature-database search we ended up with 211 publications and in the conference search we found 75 publications.

*Step 2: Paper selection – Paper skim (1 pers./1 paper):*
These papers were skimmed by one person per paper. The selection criteria were that they potentially described a method to evaluate UX with details about the method and execution. It also had to include the same elements as the ISO UX definition [8], but did not have to include the term UX. After this step there were 106 papers from the literature-database search and 33 from the conference search.

*Step 3: Paper selection – Paper reading (3 pers./1 paper):*
All papers were read by three persons and the papers' relevance was discussed. Papers were reevaluated to ensure that enough information was provided about the described method to be able to use the method. At the end of step 3 there were 42 papers.

*Step 4a: Paper addition – Backward search:*
Ensuring we have all relevant papers a forward and backward search was conducted. The backward search technique is described in Persson et al. [13]. We backward searched the 42 papers resulting from step 3. On each paper that was cited, steps 1-4a were repeated until no new relevant papers were found.

*Step 4b: Paper addition – Forward search:*
With Google Scholar we did a forward search on all 42 papers from step 3. On these forward searched papers we repeated steps 1-4a until no new relevant papers were found.

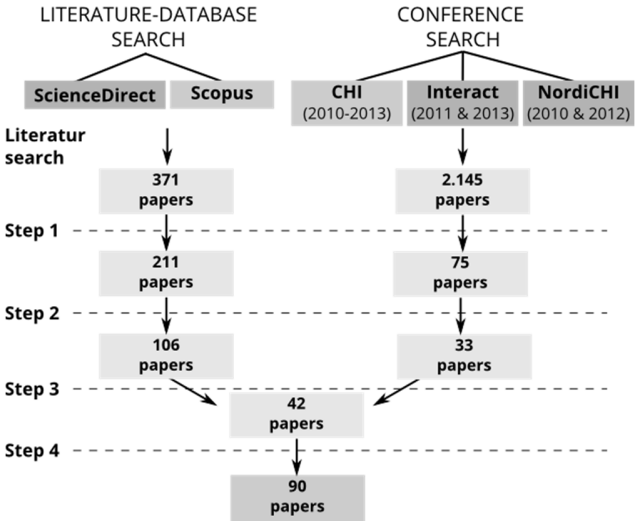


**Figure 2. Phase 3 of the two search tracks of our literature review showing the selection steps.**

From step 4a-b, 48 papers were added to the collection, with a total of 90 papers for the literature review. The full list is available at https://goo.gl/FPBkeP.

### Phase 4: Reading and Analysis

While reading the paper collection we made and continually updated a table similar to a concept matrix [16]. In the making of the table, we read the papers and used open coding [15] to develop characteristics in both the x- and y-axis of the table. The characteristics stemmed from the terms used in the UX evaluation methods presented in the papers. During this process, characteristics were combined and removed based on repetition of different terms used for the same phenomena. In the final table, each of the 90 papers was featured one or more times matching its characteristics to table positions.

## RESULTS

This section presents the results obtained from the literature review, starting with an overview table where the 90 UX papers are organized by technique and UX dimensions, followed by the changes in UX evaluation methods over time. Then UX definitions and their relation to UX evaluation methods are shown. Next are UX evaluation method characteristics and the section ends looking at the most used UX evaluation methods.

### UX Categorization

In the following subsection we present a table (Table 1) with the papers of our literature review (n=90) sorted by technique used along the x-axis and dimensions along the y-axis. Noteworthy features and patterns in the table are presented later in the section.

We categorized all dimensions into four categories: UX (general), impression, use, and context. These categories are described below.

| Technique | | Interview | Questionnaire | Observation (*=think aloud) | Physical body response | Focus group | Self report | Expert evaluation |
|---|---|---|---|---|---|---|---|---|
| **Category** | **Dimensions** | | | | | | | |
| **UX (general)** | | 3,4,9,22,26,27, 30,37,41,45,51, 55,67,68,70,71, 81 | 11,12,16,18,20,21, 22,29,30,31,34,35, 36,38,46,49,51,53, 62,67,73,88 | 27,41,70,84 | | 50,59,67 | 31,32,34,50, 53,55,74,77, 78,79,81 | 78,82 |
| **Impression** | **Emotion (general)** | 4,5,14,26,27,45, 48 | 1,3,4,7,10,15,16, 19,22,25,27,31,34, 38,41,43,46,49,56, 75,85,90 | 2*,26,45,47,52, 54,57* | 5,11,46,47,48, 52,88,90 | 42,84 | 27,31,34,55, 74,75,90 | |
| | **Hedonic** | 81 | 3,7,16,22,23,24,28, 29,34,37,59,60,61, 68,76,78,80,83,86, 88 | | | | 34,78,81 | 63,78,82 |
| | **Arousal** | | 1,6,19,62,87,90 | | 88 | | | 7 |
| | **Pleasure** | 13,33,48,71 | 1,6,13,19,31,33, 34,37,40,56,60,62, 64,65,76,87,90 | | | | 34,31 | |
| | **Aesthetic** | 30,33,71 | 3,19,22,23,24,28, 31,33,34,37,39,40, 46,49,59,61,68,72, 78,83,86,88 | 54 | | | 31,34,35,36, 78 | 78 |
| **Use** | **Pragmatic** | 3,33,41,51,78, 81 | 3,7,8,11,16,17,19, 22,23,24,28,29,33, 34,37,39,40,43,44, 46,49,51,56,59,60, 61,62,65,66,68,69, 72,76,78,83,84,86, 88 | 2*,9,27,37,41, 46,49*,52,58,64, 78 | | 42,84 | 31,34,35,36, 55,68,78,81 | 63,78,82 |
| | **Trust** | 9 | 7,39,40,49,65,66 | | | | | |
| | **Cognitive load** | | 7,23,24,25,80,89 | | | 42 | | |
| | **Sense of agency** | | 1,6,69,90 | | | | | |
| **Context** | **Expectation** | 2,16,67 | 7,16,27,30,34,73, 84 | 2* | | 67 | 34 | |
| | **Satisfaction** | 33 | 7,8,31,33,34,84,89 | | | | 31,34 | |
| | **Acceptability** | 2,30 | 7,16,30,31,33,34, 44,51,56,64,65,69, 86 | 2* | | | 31,34 | |
| | **Brand** | | 43 | | | | | |
| | **Social UX** | 33,81 | 33,37,41,56,69 | | | 67 | 27,55,81 | |
| **Total nr. of papers** | | 24 | 66 | 18 | 8 | 5 | 17 | 3 |

**Table 1. Illustrates which techniques are used to measure which dimensions in the UX papers.**

*UX (general):* Inspired by the work of Bargas-Avila & Hornbæk [1]. It is used to describe studies that do not elaborate on which UX dimensions are measured.

*Impression*: Subjective measures such as emotion, along with hedonic, arousal, and pleasure. These describe how a user responds to a product. Hassenzahl's Attrakdiff questionnaire appears so often it created its own dimension; hedonic. We have grouped UX dimensions with the same meanings into other dimensions to make results more comparable with each other. The first is affect, considered part of emotion (general) as affect is momentary feelings [6] and therefore often used as a synonym [2] for emotion. Aesthetic goes under impression as the attitude towards the look of a product is highly subjective and closely related to how a user is affected by a product. Enjoyment and fun describe a user's response to a product, categorized as pleasure. Arousal includes terms such as enchantment. Enchantment is the "*relationship between people and technology*" [1]. It relates to experiences, other sources of entertainment, and use, such as film and mobile phones.

*Use:* Dimensions that describe how the product is to use for its specified function. This category relates to usability under the term of pragmatic but goes further. It incorporates how a user trusts the product to perform its function securely and reliably, the stress on the user (cognitive load), and how a user feels in control (sense of agency).

*Context*: Information that stems from outside the product influencing the experience. These include expectations before use and if the user is satisfied with the role the product performed. Acceptable products are products that the user wants to use again in the future. Brand is the context from which the product arises, and social UX looks at using the product in a context involving others.

### Techniques Used to Measure UX

We identified seven techniques used in the study of UX, ranging from interview to expert evaluation (Table 1). A technique is a data-collection tool that can be used as part of a method.

The most used technique to measure UX are questionnaires at 73% (n=66). Questionnaires can be given to large sample sizes and results can be more easily quantified. Second most used are interviews at 27% (n=24), followed by observation and self report. The least used are focus groups and expert evaluations (Table 1).

There are many facets to UX [17] and a combination of techniques provide depth to UX results. Here we answer if techniques were combined to meet the demands of a multifaceted understanding of UX. A combination of techniques is used in 41% (n=37) of the identified papers. When an interview or physical body response is used, 88% (21 of 24 and 7 of 8) of the time they are combined with another technique. This was the highest combination rate. As a single method physical body response does not provide useable results [11], and interviews are an effective way for elaborating the physical responses. 54% of (13 of 24) interviews are combined with questionnaires. Here questionnaires are used for quantitative data, where the interview provides further qualitative information. Few papers combined three or more techniques. Interview, questionnaire, and observation are combined in two papers. This trend of combining techniques reflects that UX is not only multifaceted in measured dimensions but also techniques used.

### Changes Over Time

Since UX is a developing field the techniques and dimensions used have changed over time. Here we show these changes in Table 2. Our inclusion of conferences from 2010-13 has resulted in 83 papers from this period, significantly more than the 61 papers from all prior periods. Therefore when looking at changes we do so as percentages of the specific period.

Technique use has increased over time for questionnaires, interviews, self reports and focus groups (Table 2). Self report has increased with the use of long term evaluations. Physical body response, focus groups, and expert evaluations are the newest UX techniques starting to be used from 2005 to 2009. Expert evaluation and observation use has decreased in recent papers.

We have looked at which dimensions have been studied over time (Table 2). The number of distinct dimensions is greatest in the latest period. 2010-14 has 15 dimensions, 2005-09 has 11, 2000-04 has 10, whereas prior to 1999 only 7.

The first study of UX (general) was in 2002. In the 2005-09 period emotion are studied 7% more often than UX (general). In 2010-14 there is increased specificity of UX studies seen in that more dimensions are evaluated. This also explains the frequency drop in emotion (general) studies. In 2010-14 pragmatic is the single most looked at aspect of UX. Pragmatic is very much the traditional view of usability, showing how usability is being absorbed in the UX term. We see the rise of social UX; it has been studied by 7 papers in 2010-14 compared to once in the previous five year period. 16 of 23 papers evaluating on hedonic papers use Attrakdiff. This means that the biggest contributor to a dimension being popular is how popular the method to measure it is.

| Techniques | | | | |
|---|---|---|---|---|
| | ≤1999 (4 articles) | 2000-04 (12 articles) | 2005-09 (35 articles) | 2010-14 (83 articles) |
| **Questionaire** | 4 | 7 | 11 | 44 |
| **Interview** | 0 | 3 | 7 | 14 |
| **Self-report** | 0 | 1 | 4 | 12 |
| **Observation** | 0 | 1 | 6 | 4 |
| **Physical body resp.** | 0 | 0 | 4 | 4 |
| **Focus group** | 0 | 0 | 1 | 4 |
| **Expert evaluation** | 0 | 0 | 2 | 1 |
| **Dimensions** | | | | |
| **UX (general)** | 0 | 1 | 8 | 29 |
| **Emotion (general)** | 1 | 5 | 11 | 16 |
| **Hedonic** | 0 | 3 | 5 | 14 |
| **Aesthetic** | 1 | 3 | 5 | 18 |
| **Pragmatic** | 2 | 3 | 7 | 37 |
| **Cognitive load** | 0 | 2 | 2 | 3 |
| **Social UX** | 0 | 0 | 1 | 7 |

**Table 2. Techniques and dimensions over time**

### No UX Definition Consensus

Prior to 2010 a universal definition of UX had not been established [1, 14] and there are 23 different definitions of

UX in our sample set. 51% (n=46) of our papers were published after 2010. To see the current state of UX

definitions and to search for consensus we look at all the UX studies in our sample. This subsection presents the definitions used by papers describing UX evaluations and a comparison of paper definitions to the UX dimensions measured.

#### *Cannot compare results from different definitions*

The 64% (n=58) of the papers that did not provide a definition acknowledge that UX is undefined and therefore do not choose a definition to work from. 84% (n=49) of these papers measured specific dimensions. *Use* is looked at in 57% (n=33) of the non definition papers. This is less looked at than impression, 69% (n=40) marking a distinction between UX and usability. A similar critique is in Hertznum where without a common starting point these results cannot be reliably compared to each other [7].

#### *Attempts at Consensus*

In 2010 the ISO created a new definition for UX [8]. Potentially the ISO definition could have been cited by 51% (n=46) of the papers, however, it was only used by 10% (n=9). This shows that even though an effort has been made to unify UX into one definition it remains in the minority of papers. The papers using the ISO definition did not study the same dimensions and there was no pattern in the categories of dimensions measured. 8 of the 11 papers looking at before-product-use are from after 2010 showing that the ISO definition has increased anticipated use studies. This indicates that the ISO definition may be too broad in dimensions and therefore of limited value in choosing

| Techniques | | Interview | Questionnaire | Observation (*=think aloud) | Physical body response | Focus group | Self report | Expert evaluation |
|---|---|---|---|---|---|---|---|---|
| **Category** | **Characteristic** | | | | | | | |
| **Period of evaluation** | **Before** | 2,16,67 | 7,11,16,30,34,41, 64,73,75,84 | | | 67 | 28,34,75 | |
| | **During** | 48,61,67,81 | 3,10,15,25,29,34, 47,53,62,66,72,87, 88,90 | 2*,9,26,27,37,41, 45,46,47,49*,52, 54,57*,58,64,70, 78,84 | 5,11,46,47,48, 52,88,90 | | 27,28,34,35, 36,53,58,74, 77,78,79,81, 90 | 63,78,82 |
| | **After** | 2,3,4,5,9,13,14, 18,22,26,27,33, 41,45,48,51,55, 68,70,71,78 | 1,3,4,6,7,8,11,12, 13,16,17,18,19,20, 21,22,23,24,25,27, 32,33,35,36,37,38, 39,40,41,43,44,47, 49,51,56,60,61,62, 65,66,67,68,69,73, 73,75,76,78,80,83, 84,86,87,89, | | | 42,50,59,84 | 34,50,74,75 | 78 |
| | **Longterm** | 27,37,81 | 28,29,31,33,34,35, 36,37,53,85 | 37 | | | 31,32,34,35, 36,53,55,74, 77,78,79,81 | |
| | | | | | | | | |
| **Development phase** | **Concepts** | 4,14,16,33,71 | 4,6,14,15,16,56, 62,89 | | | | 74,90 | |
| | **Early prototypes** | 4,22,26,30,51, 61,78 | 4,7,8,10,17,22,24, 30,39,40,43,44,45, 51,60,61,62,76,78, 85,89,90 | 30,45,78 | 90 | | 74,77,78,79, 90 | 78 |
| | **Functional prototypes - Complete products** | 2,3,4,5,9,13,16, 18,22,23,26,27, 30,33,37,41,51, 55,67,68,70,71, 78 | 1,3,4,8,11,12,13, 16,17,18,19,20,21, 22,23,24,25,27,28, 29,30,31,33,34,35, 36,37,38,39,40,41, 43,44,45,46,47,48, 49,51,60,62,64,65, 66,67,68,69,72,73, 75,76,78,80,83,84, 85,86,87,88,90 | 2*,9,26,27,30,37, 41,42,45,46,47, 48,49,52,54,57*, 58,64,70,78,84, 87 | 5,11,46,47,48, 52,88,90 | 42,50,59, 67,84 | 27,31,32,34, 35,36,50,53, 58,74,75,77, 78,79,81,90 | 63,78,82 |
| | | | | | | | | |
| **Data** | **Qualitative** | 2,3,4,5,9,13,16, 18,22,26,27,30, 33,37,41,61,67, 68,70,78,84 | 12,13,34,35,36,46, 47,48,60,61,65,88 | 2*,9,26,27,30,41, 42,45,46,52,70, 87 | | 42,50,67, 84 | 27,31,32,34, 35,36,50,53, 74,77,79,90 | 63,78 |
| | **Quantitative** | | 6,8,17,18,19,20, 31,37,41,62,68, 76,86,80 | 49,54,58 | 5,11,52,90 | | 58 | |
| | **Both** | 14,51,55,71 | 1,3,4,7,10,11,14, 15,16,21,22,23,24, 25,27,28,29,30,33, 38,39,40,43,44,45, 49,51,56,64,66,67, 69,72,73,75,78,83, 84,85,87,89,90 | 37,47,48,57*,64, 78 | 46,47,48,88 | 59 | 75,78,81 | 82 |

**Table 3. Techniques were used at different periods, development phase and provided different types of data.**

dimensions of UX, but has played a role in period-of-evaluation.

After 2010, when one definition of UX is used it is most often (40%, n=13) Hassenzahl's definition [4]. From these papers nearly half look at the same 3 categories of dimensions; UX (general), impression, and use. This shows that using a common definition results in the same dimensions studied, creating a unified approach to the study of UX.

The lack of consensus on a UX definition and the broadness of the ISO definition are reflected in the differences of dimensions studied by UX evaluation methods.

*Finding Consensus*

From reading the textbook definitions or definitions in the papers above one cannot reliably predict method characteristics, such as dimensions, product phase and period of evaluation. Therefore we start from the characteristics and generate a new unified UX definition.

Here we look at the distribution of UX dimensions. 26% (n=23) of papers exclusively measure one dimension, 11 of these only look at UX (general) and 8 exclusively at emotion. 20% (n=18) of papers look at two dimensions, 17% (n= 16) look at three dimensions, whereas 37% (n=33) look at four or more. The multi dimensionality of UX is reflected in that 74% (n=67) of papers look at more than one dimension.

To make dimension comparisons more manageable we look at how categories can be used for a definition. UX (general) is not used in forming a new definition because UX (general) cannot break down the causes and influences affecting the UX of a product; they can only comment on the overall experience. Therefore, we disregard papers looking at UX (general) in forming our definition of UX.

Here we look at how often individual dimensions are measured. The most measured is pragmatic at 52 times. This

reflects that usability is a significant part of UX. The next four dimensions by times studied are emotion (general) (35 times), aesthetics (28 times), hedonic (23 times) and pleasure (19 times). These dimensions are part of the impression a product makes on the user. Following these four impression-based dimensions the next four most looked at dimensions are acceptability (14 times), expectation (9 times), social UX (9 times), and satisfaction (7 times). These four are part of the context category of dimensions. Thus adding up the totals we see that impression is studied 79 times, use 70 times and context 39 times. Context is studied half as often as the impression category. From these trends we identify the definition of UX of academic literature as:

*The impression a product makes on a user influenced primarily by how it is to use and to a lesser degree the context of use.*

### No Trends in Period, Product Stage or Data Type

Table 3 organizes the papers by characteristics other than studied dimensions; period of evaluation, development phase, and the type of data in the literature.

#### *Period for evaluating UX*

UX is defined to look at the anticipated use as well as the use of a product. To see how UX evaluation methods reflect this, Table 3 contains the period of evaluation. This shows whether the evaluation was done before, during or after interacting with the product. Long term periods of evaluation were evaluation methods requiring repeated use of the product and repeated evaluation sessions. UX is defined to cover the three stages of use, however most of the studies at 76% (n=68) take place after use, and only 14% (n=13) take place before-use. This is significant because the ISO definition places equal weight on anticipated use. Researchers, however, look five times as often at after-use, exposing their results to the peak end rule [9].

#### *Concept to Complete*

In order to see at what stage of development UX evaluation methods are used, Table 3 describes development state. The first phase is concepts, which we define as ideas, thoughts, and/or purely visual sketches. This is measured by 13% (n=12) of papers. In this phase, there are no interactive components and the product is purely static in nature. The next phase is early prototypes which include paper-prototypes, mock-ups, or other similar prototypes where there is limited interactivity, which is often mediated by the evaluators. 28% (n=25) of the papers address evaluation at this stage. The last phase incorporates everything from functional prototypes to complete systems at 89% (n=80) which means any product that contains completed interactive parts. This indicates that user tests are best performed on functional prototypes.

#### *Data type*

In order to see how quantitatively measurable UX is, at the bottom of Table 3 is the type of results that the method produces; qualitative only, quantitative only, or both. Seeing that 65% (n=59) of papers have looked at both qualitative and quantitative measures of UX indicates that most researchers agree that UX has both qualitative and quantitative aspects. However when only measuring one type of data qualitative is 10% (n=9) more used than quantitative.

### Exploring Consistency of Definitions and UX Evaluation Approach

In this section we explore the relationship between what a paper says UX is and how their approach reflects their chosen definition. This is to check paper consistency. This subsection is exploratory as only 33 papers have specified UX definitions that can be compared to their approaches.

12 of the 33 papers did not match the definition with their approach. The mismatches are between definitions and dimensions and definitions and period of evaluation. Context was mentioned in six definitions but measured only twice. 12 papers use a definition referring to anticipated use but only three measure it. Reasons of mismatch may be challenges in developing methods that can be used before product use, and methods that include context. These two areas of approaches have room for improvement in UX research

### Using UX Evaluation Methods

Here we identify the most popular UX evaluation methods in our sample of papers. This indicates which methods are being closely associated with UX.

Of our 93 identified methods, 58 are named. Named methods indicate that the methods were designed to be used in future research. 31 of the questionnaires were unnamed. This may show they were designed for one time use. Of the named questionnaires Attrakdiff and Attrakdiff2 are the most popular. This matches that the most used definition of UX is from the same researchers as Attrakdiff. SUXES had the highest percentage of modification with 4 from the 5 papers using SUXES having modified it. For Attrakdiff and Attrakdiff2, 9 of the 16 were modified. The SAM scale was not modified in its 7 uses and SUS scale was only modified once from the 8 papers that used the method. The reasons for modifications have ranged from unclear instructions to users, to modifying the method to match study goals. Figure 3 shows how many are modified. The 3 most popular UX evaluation methods from our sample are Attrakdiff, SUS, and SAM scale.

With a new kind of organization of UX papers we were able to show areas of weakness and developing trends in UX. Our four categories provide a lens through which UX work can be defined and our table made it possible to see how

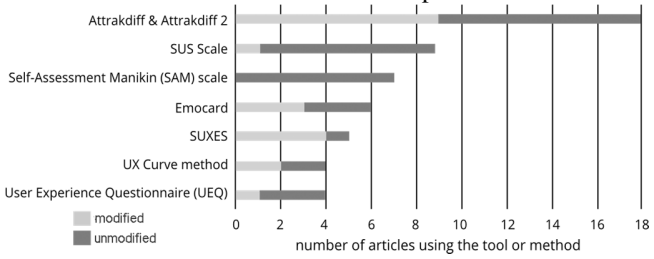


**Figure 3. The tools and methods used to measure UX**

definitions match dimensions measured. In the next section we will compare our results with related work. \

## DISCUSSION

In this section, we discuss our findings and place our results in the context of the literature reviews outlined in related work. First, we look at how the method of gathering results changes the final sample set. Next, developments in UX over the past five years are discussed. Then using the trends and UX dimensions from our literature review we create a framework for future research. The section ends with proposing the next 5 years of UX.

### 4 Gatherers, 4 Result Sets

In order to see the overlap of methods, we look at the collections mentioned in related work; allaboutux.org [17], the Bargas-Avila & Hornbæk collection of 53 scientific publications [1], and the Roto et al collection from their SIG session at CHI2009 [14]. All three papers aimed for a set of empirical UX research methods.

#### *allaboutux.org [17]*

Of the 84 allaboutux.org evaluation methods, 33 are in our sample. Methods were collected using a variety of tools ranging from conference sessions, to personal experience, and literature review. As their goal was to have the largest possible breadth of UX methods they have the largest collection of methods in a UX literature review. Of the 51 evaluation methods in allaboutux.org that are not in our sample we show why our search process did not include them.

(29 of 51) Methods found outside of a traditional literature review via; professional experience, SIG sessions, workshops, unpublished research or email survey.

(9 of 51) Material provided is not sufficient to run the described evaluation. Our criteria for a method entering our sample was that the material and procedures of the method were complete and accessible.

(13 of 51) Unreachable due to search criteria, not available with three stage forward/backward search.

Even though our collection of methods are different, we refer to them.

#### *Bargas-Avila and Hornbæk [1]*

Here our samples shares 7 of the 53 evaluation methods they have selected. They required empirical data, just as we did, however they mandated that the paper cites at least one of a key set of authors. Their collection also included papers that did not include complete and accessible material and procedures of the methods.

#### *Roto et al. [14]*

Their sample was fully present in ours. Our method gathering methods were very different and yet our sample and the Roto sample seemed to have the greatest overlap. This shows how comprehensive our result set is.

### 5 Years of Progress

Here we outline how UX evaluation method research has changed over time. Because we are discussing how the field is changing we look at papers published and not individual methods therein. We look at our own time distribution and compare our results with Bargas-Avila & Hornbæk's 2011 paper. For context and explanations of trends we refer to Vermeeren et al [17].

#### *UX data techniques*

UX data collection has not significantly changed. Most data are collected with questionnaires (73% n=66). This compares to 53% (n= 35) in the study by Bargas-Avila & Hornbæk [1] and continues the trend towards preferring questionnaires when evaluating UX. Our results show that the fraction of studies using questionnaires has increased in the past five year period by 22% (n=33). The reason for this may be that questionnaires provide a replicable way to do UX evaluations and are quick feedback from a wider audience [14]. We also had a tripling in the use of self report.

#### *Where are the experts?*

Another point to note is the low use, in fact decrease of methods with expert evaluations. Experts are used in less than 3% (n=3) of the papers. A reason for that may be that UX is not mature enough for expert evaluation heuristics[14]. Experts are used in specialized situations or when the users are unable to reliably self-report. Users that may not be able to provide accurate results are children or the elderly, warranting experts to judge UX. However no experts look at emotion, pleasure or context. There may be no value in using experts to measure such personal and subjective qualities as these. Bargas-Avila & Hornbæk have no expert data collection category [1] as it was used rarely.

#### *Dimensions change*

Compared to Bargas-Avila & Hornbæk the UX (general) category is less used in our set, showing researchers are more specific with what dimensions of UX they are measuring. UX was divided into 10 dimensions in 2011 [1] with an 'other' category. We avoided the 'other' category and ended with 14 UX dimensions. New to our list are brand and social UX. Reflecting the broader scope of UX, the study of context has grown significantly as UX is context dependent [14]. However context includes the usability terms of satisfaction which relates the growth of UX being the new term to study in academia without locking usability out. Impression has shrunk the most, reflecting UX is now less how a user is affected by the product, and more concerning how a product is used (use) and when (context) a product is needed.

#### *Qualitative or Quantitative*

Academics want scientific rigor and therefore more quantitative results [14]. However our study found that even though combining qualitative with quantitative data was popular, purely qualitative are more popular than quantitative. In a previous study [17] researchers seem to be

moving towards a more qualitative approach in understanding how people interact with computers. Two thirds of the methods looked at (65%, n=59) both qualitative and quantitative data. Under a quarter of the methods (22%, n=20) are only qualitative. About a tenth are only quantitative (12%, n=11). This marks a strong drop in the fraction of quantitative methods from the Bargas-Avila & Hornbæk paper, where quantitative results were 33%. However they had a significantly smaller portion of papers for both using qualitative and quantitative at 17%. Our results show that UX research combines qualitative results with quantitative results more than was found by Bargas-Avila & Hornbæk in 2011.

*What and when to evaluate?*

Early phase prototypes need lightweight quick quantitative measures, such as Attrakdiff, expert evaluation and heuristic matrix [14]. In [17] 25% of methods could be used at the concept stage. This is higher than our 14% (n=13). This could be as they found more methods from industry who test during development versus academic research who test functional products. We found 49% (n=46) during-use and 62% (n=56) after-use. These results follow the same trend as in the Bargas-Avila & Hornbæk's paper where most measures are before and after with a limited look at prior to use. However they found no long term studies in their sample whereas 19% of ours had a long term component.

### Cleaning up the Dimension Explosion

In order to make UX useful in understanding product use and to improve products, it must be broken down into distinct measurable dimensions. This has lead to dozens of UX dimensions. Some of which overlap and others have only been used in single papers [1]. From grounded theory analysis of the literature review set, we propose the following steps. First, a consensus on the key dimensions of UX, from the results section and then work to identify the best methods to measure these dimensions. Figure 4 is a format to work with future UX dimensions. This pyramid approach maintains UX as an overarching theme in HCI with layers that can be dissected and tested. When new terms and distinctions are made they can be added as new base layers to the pyramid. As example we present hedonic further broken down with the work of Hassenzahl into beauty and originality [4]. As new dimensions are developed, they are to be added as new levels to the pyramid. The ISO definition provides the breadth of UX with the three key dimensions of impression, use and context and our results further describe them in level 2. Therefore the pyramid will not grow horizontally in levels 1 and 2 but vertically with new more specific UX dimensions. This reductionist approach is justified as experiences with technology have common elements [5] and make UX measurable.

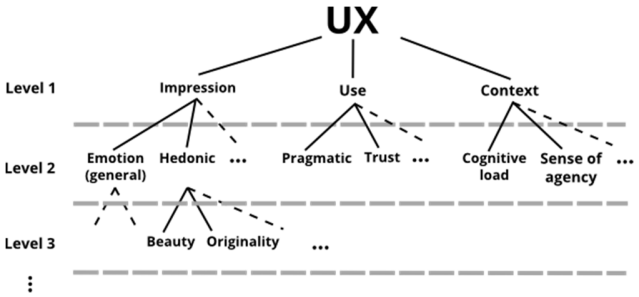


**Figure 4. A proposed framework for organizing future dimensions.**

### The Next 5 Years of UX

Based on the trends we have seen developing over the past decade we predict the next 5 years of what UX is and how it is measured.

There is a general consensus on the scope of UX as looking at the user, what remains is agreeing on the dimensions of UX and UX evaluations. We have seen the number of dimensions increase from 7 to 15 and this trend will continue. We hope they will do so following a framework where dimension validity can be discussed. We foresee novel approaches in HCI for before-use evaluations and exploration of physical body response to record during use to continue the increase we have seen in our literature set.

HCI will continue to look across different research fields to find solutions to new challenges that arise from the study of UX. Past examples include adopting ethnography for UX in context and other exploratory research techniques [14]. Our research found physical body response and focus groups in evaluation methods. Industry will also direct UX research by continuing to publish their own or be involved in university research, as we have seen from semi conductor manufacturers [55 in literature set] and Nokia [53 in literature set].

Therefore UX will continue to move further away from the scope of usability just as we have seen the development of brand and trust. Social UX is a dimension that has seen significant growth in the past eight-year period as the computer experience involves other users affecting our experience, e.g. such as Facebook, and recommender systems.

## CONCLUSION

In this paper, we have presented the results of a literature review containing academic papers about UX evaluation methods. The papers have been collected through both conference and database searches where each step in the literature review has been documented. The literature review has resulted in a collection of 93 UX evaluation methods in 90 papers. Each paper has been categorized and put in a table, providing an overview of both the measured UX dimensions in the papers as well as the three characterizations: product development, period of evaluation, and data type. Based on our analysis of the results, we have identified the following trends and needs in regards to the field of UX evaluation method research:

- UX reorganized into 4: We have organized the UX dimensions into four categories: UX (general), impression, use, and context. These match the ISO

definition and provide clear distinctions of dimension categories.

- No UX definition consensus: after two decades of the term UX there remains no consensus for a definition or on dimensions of UX.
- The ISO definition may be too broad in dimensions and therefore of limited value to the study of UX evaluations.

In future studies it would be interesting to look at conferences going further back than 2010 and updating new research with new conferences. The study has also raised questions about the lack of UX evaluation methods on prior perceptions affecting use and what memories of UX remain in the long term.

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# How is UX Work Really Practiced? A Survey of the User Experience Profession in Denmark

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**ABSTRACT**
This paper set out to determine the state of User Experience (UX) evaluation in Danish IT-companies. The purpose is to determine how they currently work with UX and UX evaluation. To do this, we conducted interviews with employees from 8 Danish IT-companies and then an online survey of 147 employees of IT-companies. The respondents were found through extensive internet searches, and networking. The results indicate that some practitioners see UX as not related to UI, but to requirements and client relations. Between the respondents there is great variation in what UX consists of. This led us to synthesize a definition of UX from their responses that will fit practitioners. Most of the evaluating companies do so with user involvement, which seems to be understood as easy, having to just ask the users what they think. The evaluations range from add-ons to usability evaluations to full self-contained UX evaluations, showing UX as a growing concept rather than a sudden shift from usability.

**Author Keywords**
UX; User Experience; Evaluation methods; Survey; Interview; Practitioners; Industry; Companies.

**ACM Classification Keywords**

**INTRODUCTION**
User experience (UX) was introduced in the 1990's by the Apple-researcher Don Norman [21], and has since gained momentum in software development companies. This is evident when looking at job postings today, where more look for 'UX designers' instead of 'usability designers'. Companies have started using the term UX, but it is claimed that they do not necessarily know what it entails. The intuitive understanding of UX is a user's experience but UX is more complex. UX consists of human psychology, emotions, and expectations, as well as the intuitive notion of a "user's experience" [16].

In the academic literature there exist many definitions for UX [17]. The International Organization for Standardization (ISO) states that UX is: "*a person's perceptions and responses that results from the use and/or anticipated use of a product, system or service*". It has associated notes that elaborate UX as containing emotions, physical and psychological responses, brand image, expectation and context of use [12]. It is not widely used because of the broad understanding that follows this broad definition [3, 17].



There is a lot of literature available about UX but the academic literature may not be well suited for how industry needs to work with it; a problem also found in usability [27]. In order to create relevant literature for practitioners, one must first understand how they work with UX, how they aim to work, and the obstacles preventing or limiting UX work. To be used as a tool for product improvement UX needs to be measured, which is often done on individual dimensions. However, measuring single dimensions reduces the understanding of the holistic user experience [18].

In order to contribute to the understanding of how practitioners work with UX, we have focused on UX in the Danish IT industry. In 2013, the Danish IT-industry had a turnover of 23.5 billion DKK and was among the top 5 in Europe for R&D investment in industry as part of GDP [9]. Denmark has an over 30-year tradition of user-centered design going back to the DUE [14] and UTOPIA [5] projects. UX has become increasingly important in Denmark, as evidenced by the Danish Interaction and Design group SIGCHI.dk with 1,262 members, changing their name to UX-Danmark in 2015 [25]. The increasing importance of UX in practice increases the interest in the study of UX and UX evaluation [11].

The aim of this paper is to investigate how Danish IT-professionals and -companies currently work with UX evaluations. We do so by conducting a survey asking practitioners about their understanding of UX, the components of UX, and how evaluations are performed. An approach widely used in HCI [10, 15, 17, 23].

In the following sections we present related papers from past usability surveys, and UX surveys describing how UX is used in practice. Next our methodology is presented, with pre-study interviews and survey collection methods. Then findings of the survey are presented. A discussion comparing trends from past work to our findings, and finally a conclusion are presented.

## RELATED WORK

In this section, five HCI surveys are presented, not only to serve as a source of inspiration but a foundation of research to build upon.

### Usability Surveys

It is our impression that IT-companies and –professionals see UX as the new term for usability, and do not know the differences between the two. In order to investigate the relationship between UX and usability we first need to understand usability work in practice.

Gulliksen et al. [10] investigated the usability profession in Sweden to determine how usability work is done. The survey was aimed at active usability practitioners. This means there might be a slight bias in the perceived importance and influence of usability, as those who are critical of usability were not targeted by the survey. By querying 194 respondents, they found that support from both management and employees are essential for successful usability evaluation. Without this support, usability has a low priority in the projects.

Obstacles for usability evaluations in practice have been investigated by Bak et al. [1]. They limited their investigation to IT-companies in one area of Denmark. After finding which companies perform usability evaluations, they interviewed 8 that do, and 2 that do not. In the 8 companies they investigated obstacles hampering usability evaluations, and why they did not evaluate in the 2. Through 39 respondents they found that resource demands are often perceived as too high, and that the developers see no value in usability evaluations.

### Defining UX

Law et al. [17] conducted a survey on the complexity and non-consensus of the nature and scope of UX. The goal of their survey was to gain an understanding of utilized UX, to create a baseline for a common definition. Their approach was to use 5 textbook definitions and 23 defining characteristics that the respondents could agree or disagree with. This way they could investigate how practitioners and researchers rank the definitions, as well as which characteristics make up UX. From 275 respondents, the key result was a general agreement that UX is broad, dynamic, context-dependent, and subjective.

In order to see if there has been a change in practice, from 2009 to 2015, Lallemand et al. [15] replicated the survey by [17]. Their secondary goal was to understand the UX perspective of practitioners. The answers from the survey were analyzed and discussed in order to determine how to approach UX, which factors shape UX, links to other parts of HCI, and if there is a need for a standardized definition. This study was aimed at active UX practitioners. Through 758 respondents from both academia and practice they found a lack of consensus on both definition and components of UX.

### Can UX be measured?

To explore not only the use of UX in industry but the measurability of it, Law et al. [18] made a combination study. Here they first made a literature review to identify which dimensions of UX are measured. They continued with both an interview and survey deployment of the User Experience Measurement Attitude Survey (UXMAS). The focus of this survey was to understand how researchers and practitioners understand dimensions of UX and their opinions on the measurability of UX. Their main finding was that UX measures are generally well-accepted, but that evaluation methods need to be well developed, especially for the purpose of redesign of the system.

In summary, the above UX surveys deal primarily with definitions, and attitudes towards UX measurement. There seems to be a lack of research dealing with how and why practitioners work with UX, as well as reasons for not working with UX evaluations. This paper aims to address these needs.

## PRE STUDY INTERVIEWS

We conducted semi-structured interviews [19] with employees of 8 Danish IT-companies. The goal of the interview was to learn how industry uses UX terminology and to find areas of interest for the survey.

In the use of UX terminology we learned that industry is familiar with the term of User Experience and to a lesser degree UX. We learned that industry does not use nor are familiar with UX evaluation methods published in academic literature. Methods such as Attrakdiff, SUXES, and EMOcards [6] were not known to them. Instead they used techniques such as interviews, observations and focus groups when evaluating UX of their products and services.

Even though practitioners are familiar with UX we found that each interviewee provided a different definition of UX. Responses ranged from the whole chain of interaction from hearing about a product, making the purchase and communicating with customer services, to an added aspect of usability during product use. Another result of the interviews was the reaffirmation that UX research is relevant and deeply interesting to the software development industry. All interviewees were enthusiastic about UX and eager to hear about results from a potential survey. Many also expressed eagerness for their respective companies to further pursue work in UX and were curious as to know the challenges their fellow UX practitioners experience in other companies.

Encouraged and familiar with industry UX terminology we set out to create a comprehensive survey of UX work in software development companies in Denmark.

## SURVEY METHOD

This section outlines the method used for our survey, and the distributed pilot survey.

We applied the lessons learned from interviews in writing the first draft of the survey for a pilot study. The survey did not use ‘UX’ but the full term ‘User Experience’ as some of our interviewees were unfamiliar with the abbreviation UX. In the survey we do not focus on academic methods but criteria used to choose methods as interviewees were unfamiliar with UX method names. From the interviews we learned the diverging

definitions for UX warranted further study which we included in the survey.

The pilot study consisted of 9 academic respondents with industry experience and was conducted to check survey wording, question sequence, and completion time. Three aspects of the survey were changed as a result of the pilot study. Textbook definitions for UX terminology [17] were removed and replaced with 18 dimension words [2, 3]. These dimensions were chosen as they were shorter than the definitions and self explanatory in meaning. Finally questions that took too long to answer were removed or modified.

Data collection was done with an online survey created in surveyXact (www.surveyxact.dk). Survey question design and survey structure were influenced by past surveys of industry [10, 17] and survey writing theory [7, 18, 22]. The targets of the questionnaire were employees of IT-companies. Respondents who did not work in a company that developed or adapted software and/or hardware with a user interface where excluded with a qualifier question. The questionnaire used adaptive questions, where the questions presented changed if respondents were working in a company using UX or one without. Some of the questions were multi-answer based and others required a single answer. Respondents were promised anonymity and providing company name was voluntary.

A full version of the Danish questionnaire is available at https://goo.gl/Dh7JAt. Contents of the survey are as follows:

Questions for all respondents:

- 6 about the respondents' understanding of UX
- 3 about the respondents' profile and their own experiences with UX
- 8 about the company and product types.

Questions for companies that work with UX:

- 12 about how the company evaluates UX and uses the results
- 4 questions about the company's motivation for, and work with, UX

Questions for companies that do not work with UX:

- 3 concerning reasons the company does not work with or evaluate UX

To distribute the survey we collected 373 email-addresses of IT-companies with development offices in Denmark. These email address were sourced from web searches, IT publications, and participants in usability and UX conferences. We aimed for email addresses direct to employees of the companies; however we also used general company addresses and contact forms. On the 26th of March we had 244 direct emails and 86 general contact addresses. As motivation for participation, respondents were promised a copy of the completed results if they provided a contact address. Table 1 shows estimated response rates from three sources: direct email addresses to employee inboxes, posting in a Danish oriented UX forum (DUXFOR) and as a link in a SIGCHI.dk newsletter.

| | Place posted or shared | Results from method | |
|---|---|---|---|
| **Date posted** | | **Complete** | **Partial** |
| 26-03 **First contact** | Emailed to 244 direct to employees | 37 | 19 |
| 10-04 **Email reminder** | Emailed to the 19 partially employees | 3 | 16 |
| | Emailed to 188 nonrespondents | 6 | 5 |
| 10 to 13-04 **First contact** | Emailed to 43 new direct employees | 7 | 4 |
| 19-04 **Totals** | | 53 | 25 |
| 20-04 | Posted in DUXFOR | 12 | 8 |
| 04-05 | Posted in SIGCHI newsletter | 12 | 6 |
| 07-05 | Posted on SIGCHI facebook group | 1 | 0 |
| | Un-tracked reponses | 24 | 35 |
| | Qualifier question | - | - 29 |
| 15-05 | Survey closed. Totals: | 102 | 45 |

**Table 1: Estimated responses (partial and completed) from direct emails, DUXFOR, and SIGCHI.dk.**

Direct-to-employee emails received a reminder email two weeks after initial contact. 19 reminders were sent to those with partial completion. 3 of these fully completed the survey. 188 emails were sent to the non-respondents, 5 of which partially completed and 6 fully. These emails reminded them to forward the survey to colleagues. In order to get more responses we found 43 more direct email addresses, between the 10th to 13th of April, bringing the total of direct emails to 287. Reminder emails added 9 complete responses, being only 5% effective. Un-tracked responses could have come from respondents forwarding the survey link to others or from our 86 emails sent to general company addresses.

The data analysis of the survey was done using the inbuilt tools of surveyXact where results could be filtered based on responses to other questions. Using this we could compare results between different categories of respondents.

## SURVEY RESULTS

In this section, the results of the survey will be presented. All in all we received 147 responses, with 102 full responses, and 45 partial. The partial responses are still included in the analysis of the questions they did answer, resulting in the number of respondents varying between the questions.

### Meet the Respondents

In this subsection we present the educational background of the respondents, and their personal work and views of UX.

#### *Educational Background*

Of the 102 respondents who completed the questionnaire, 73,5% has a degree in technology/software (n=41) or Human-Computer-Interaction (n=34). This is higher than compared to the results of the related UX surveys [15, 17] who report roughly 40% with a technical education background. They also reported more than 50% of respondents stating UX is very central in their work, contrasted by our 34%. This is because our aim is different than theirs, with our survey targeting IT-professionals instead of active UX practitioners.

To further understand the background of the people working with UX, we asked how they had received training in UX, where they could select multiple answers. This was cross-referenced with their educational background, and how central UX is to their work. 32 of 102 respondents are educated in HCI. 21 of these 32 state that they received training through textbooks, 25 from research papers, and 28 from academic courses (e.g. at universities). Further, on-the-job training is the most common way to receive training in UX, at 82% (n=83 of 102) of all the respondents. This shows that even though there may be an influence from the academic outlets and the educational background, it is not essential when on-the-job training is possible. This is further supported by the non-technical educated respondents listing on-the-job and internet resources as their main training outlets.

35 of 102 respondents rate UX as being very central to their work. 51% (n=18) of these 35 are educated in HCI. Those that see UX as central or somewhat central have a high tendency to have an education in technology or software, and some with HCI educations as well. Even though there is a strong connection between HCI education and working very central with UX, there is also a connection between an HCI background and only working somewhat centrally with UX. In fact, 34,5% (n=11) of the HCI-educated state that UX is somewhat central (n=8) or not central (n=3) at all. To further show the lacking connection between educational backgrounds and how central UX is, 48% (n=11) of the respondents who did not have a technical university degree state that UX is very central to their work. This may be because UX not only consists of IT topics, but a broad range of complex topics stemming from psychology and arts [29], and perhaps other of the reported educational backgrounds (business, economics, etc.).

### *Working With UX*

The distribution of hours spent in a week working on UX, among those who evaluate UX, is shown in Figure 1. It shows that the majority of respondents spend 5 or less hours a week working with UX. However, 25 of the 102 respondents spend more than 20 hours a week. The 20+ hour respondents primarily spend their time working with UI evaluation (88%, n=22) and UI design (84%, n=21). There number of respondents working with these areas increase as the amount of hours spent on UX does. This increase is also seen with method development, which can be related to incorporating UX into the best practices and project management methods in a company.

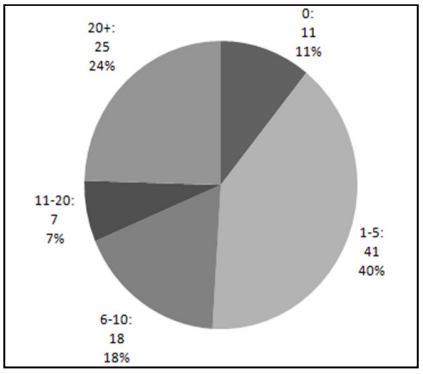


**Figure 1: Hours spent a week working on UX related issues, as answered by the 102 respondents who work in companies that evaluate UX.**

Further investigation of the value of UX, is done by looking at the respondents' job titles. The wide range of different job titles was grouped together in Table 2, using Affinity Diagrams [4]. Of the 147 people who answered this question, 33 had a job title that includes the term UX. Added to this are 5 people stating their job titles as UX Lead, giving a total of 38 respondents (26,5%). 37% (n=55) of the respondents have a managerial position, whether it is as head of a department, owner, chief officer, project managers, etc. These job titles may not contain UX, but it is assumed that they have at least some degree of UX knowledge.

| | |
|---|---|
| **UX designer/architect/engineer/tester** | 33 |
| **System/Software designer/developer/architect** | 25 |
| **Managerial positions** | 22 |
| **CEO/owner/partner** | 21 |
| **Other** | 13 |
| **Business analyst/specialist/developer** | 8 |
| **Head of Department** | 8 |
| **Graphic/digital designer/concept illustrator** | 6 |
| **UX lead** | 5 |
| **Chief officers** | 4 |
| **Usability specialist/engineer** | 2 |

**Table 2: The job titles of 147 respondents.**

It is interesting to note that there is only two respondents calling themselves usability professionals, raising the question whether the other usability professionals are simply renaming themselves to UX professionals. However, both of them distinguish between UX and usability, with one seeing it as two parts of user satisfaction, and the other sees usability as a part of UX. They further support this distinction, by stating that UX is mostly subjective; opposed to the objective nature of usability. Both usability professionals claim to work with UX more than 20 hours a week, spending their time on both UX and usability evaluations.

## Meet the Companies

To deliver insights into how different organizational profiles work with UX and UX evaluation, the respondents were asked about the organizational structure of their companies. The companies' degree of UX evaluation focus was investigated, along with the type of products they produce. The products are categorized along three axes: governmental to private clients, for leisure to business, and whether they are software to hardware.

### *Company profile*

The number of employees in the participating companies is shown in Figure 2. The 35 respondents that listed UX as very central to their work tend to work in bigger companies, with 30 in 50+ size companies, where there is focus on UX evaluation. This can be because bigger companies can afford to have

employees that focus solely on UX. The 1-4 sized companies also have a high degree of UX evaluation focus, at 6 of 7 respondents. This high focus may be because UX evaluation is their main selling point.

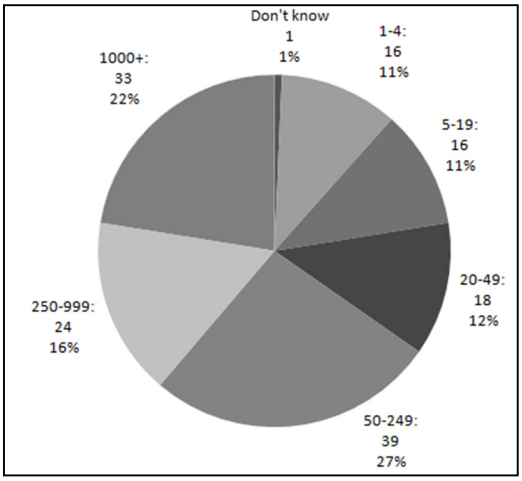


**Figure 2: Number of employees in the companies that the 147 respondents work in.**

In regards to the 3 axes of product types produced by the participating companies, the majority work exclusively with software (n=64 of 102) and exclusively for professional use (n=59); not for leisure. They tend to construct products primarily for private clients (n=30) or both private and governmental clients (n=26). When comparing the types of products to how much the company focuses on UX evaluation, the companies that cater mostly or exclusively to government clients (n=18) tend to have a rather low focus on UX evaluation. 8 of these state that their company has some degree of UX evaluation focus, and 5 to a lesser degree. This may be because government considers UX as an unnecessary expense. On the other hand, companies that cater primarily to private clients have a high degree of UX evaluation focus. 10 of 26 respondents claim to have a high degree of UX evaluation focus, and 7 a very high degree. This may be because private clients have more choices in choosing their developer, and are therefore more critical of products.

*Development Process*

When determining the development process, the respondents could choose more than one option. The majority of companies work in an agile process; 74% (n=75 of 102) of respondents. On the other hand, only 27% (n=28) of respondents work with the traditional waterfall model, and just as many work with a self-developed process. Most respondents elaborate that their development process is not static, but is determined partly by client and project, often resulting in a combined agile waterfall. One respondent used the name SCRUM-fall. About half the respondents that work with a self-developed process (15 of 28) report UX as being very central to their work, and that the company has a high or very high degree of focus on UX evaluation (11 of 28). This could indicate that companies with their own self-developed processes are more flexible in adapting UX.

*UX Focus*

When comparing how central UX is for each respondent and the degree of UX evaluation focus in the company, the results are as expected. When there is a high degree of UX evaluation focus, UX is very central to the work. When UX is somewhat or not central, there is a lesser degree of UX evaluation focus. None of the respondents said that their company had no degree of UX evaluation focus. This is because this question was only answered by those who reported that they do evaluate UX.

There is different ways for companies to adopt UX evaluations. A project manager or a developer may one day get the idea to perform evaluations, or it may be a core principle, decided by the leaders of the company. Among the respondents there is a clear tendency for management to take the decision of evaluating UX, at 45% (n=44), combining this with joint decisions between both management and employees totals 70% (n=68) of the companies. This is likely because UX is more easily disseminated through a company when there is backing from management. One respondent states that the decision came from the UX designers, and they have a hard time showing the value of UX evaluation to anyone else in their 1000+ size company. The dissemination pattern is also clear in that 19 of the 37 companies where management decided, the respondents report UX as being very central to their work.

**UX Evaluation Methods**

In this subsection, the companies' work with UX and UX evaluation will be presented. We will present how many companies perform UX evaluations, and how. We will elaborate upon why it is sometimes not evaluated. We investigate which named methods are used in their evaluations, and what criteria determine which approach is selected. Finally we report how the results of an evaluation are shared and used for further work.

*Do They Evaluate?*

Of 112 respondents, 67% (n=75) report that they do evaluate UX. It was possible for a respondent to report more than one type of evaluation, which revealed that UX evaluation is mostly done as an integrated part of the development process (n=67), supported by separate departments (n=16) and outsourcing (n=11). Only 8 of the respondents exclusively used separate departments and/or outsourcing. Of the 11 outsourcing companies 7 also evaluate during the development process, and of the 16 companies with separate departments 12 do so as well. 15 respondents elaborate that they gradually introduce one-to-one user UX evaluations as add-ons to formal usability evaluation workshops. This can be seen as UX growing in companies instead of a sudden shift from usability to UX, although we did not have questions to elaborate on this.

29 (26%) of the 112 respondents state that they do not perform UX evaluation at all, and 8 did not know. 3 stated that their company is going to start to work with UX in the near future. The most common reasons for not evaluating UX (both at n=11) are that the companies do not budget for it and that the company employees do not have the skills to conduct UX evaluations. 6 reported that UX is not part of the company's

identity and 8 reported no support from management, with 4 respondents reporting both reasons. Interestingly for 3 of these 4 respondents that reported both, UX is very central to their work spending more than 20 hours a week. However they do not evaluate or design UX, instead they work with requirements engineering and talking to clients. This means that some practitioners see UX not as design and evaluation, but as gathering requirements, and client relations.

Some respondents report that when dealing with UX, they only measure usability. Of the 29 who do not perform UX evaluations, 10 perform usability evaluations. This is explained as usability being part of a larger user experience, but easier to objectively measure and quantify. One respondent works in a company that only creates products for others, elaborating that product developers have no say in the overreaching UX but only in the functionalities and usability of the product itself. 95% (n=71) of the 75 respondents who evaluate UX, also perform usability evaluations. Only 4 solely evaluate UX. Thus there is a strong connection between those who evaluate UX and those who evaluate usability.

*How They Evaluate*

In the investigation of how the evaluations are conducted, we asked the respondents to state if they use an existing method, one of their own creations, and/or if they combine techniques and tools for a tailored UX evaluation. The 74 respondents replied that 26 create their own, 40 use tailor made, and 35 report that they use an existing method. Existing methods are most used in companies of 50+ employees, whereas combined methods are favored by companies with 1-4 employees.

To understand their knowledge of existing methods, we presented 15 UX evaluation methods from literature (Figure 3). The most popular of the methods is the User Experience Questionnaire (UEQ), known to only 20 of 68 respondents. Thereby showing the high degree of unfamiliarity of academic UX evaluation methods. The least popular method is Attrakdiff/Attrakdiff2, with only 7 respondents having heard of it, and none using it. Generally it is those that tailor or create their own methods who know of the presented methods. This could indicate that they need to know of the existing methods, in order to know how to combine them, and which elements could work when creating new methods.

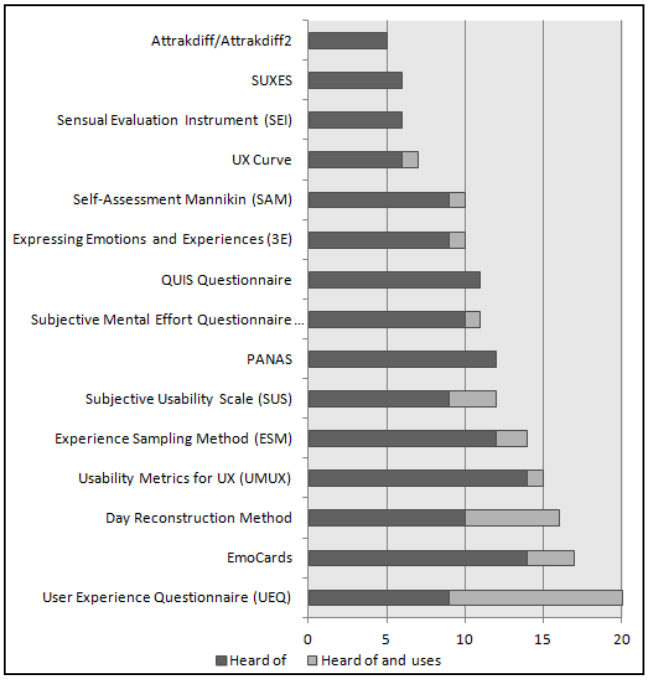


**Figure 3: How many of 68 respondents have heard of the 15 presented methods, and how many use them in their work.**

When asked which methods they knew or used besides those presented, the following were answered at least twice: observation, interviews, usability tests, diary studies, cultural probes, personas, user scenarios, and Instant Data Analysis (IDA). This adds to the notion that industry is more interested in combinable techniques, rather than complete methods [27, 28], and that perhaps some still see UX as usability.

75 reported their use of different evaluation categories. Nearly all the respondents who perform UX evaluation do so with user involvement at 91% (n=67). 56% (n=42) use expert evaluations, and 49% (n=37) perform evaluations in the development team. These categories of evaluation only affect 1 criterion for method selection, namely that employees should know of a given method beforehand. Those who evaluate only with users seem to disagree more with this criteria, whereas those who conduct expert evaluations tend to agree more. This is likely because an expert needs to know how to be an expert, known as the Dunning-Kruger effect [8]. With user involvement, some respondents elaborate that access to users is the only important criteria, because you just have to ask the users what they think. It is possible that more respondents share this view, which makes knowing the method beforehand redundant.

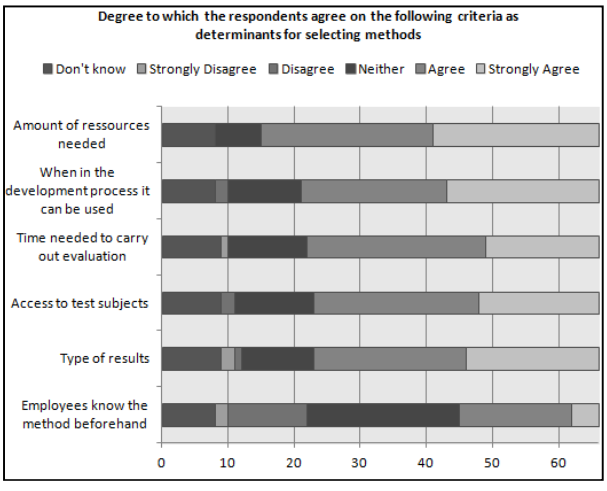


**Figure 4: The importance of different criteria when selecting a UX evaluation method, based on 66 respondents.**

In general, the most important criterion is how many resources a method requires, at 51 of 66 respondents agreeing. Followed by when in the process the method is done (concept, prototype,

or full products), at 45 respondents. Most criteria is deemed rather important, as seen in Figure 4, with at least 43 positive respondents of 66, except the need for employees to know of the method beforehand. This criterion has 14 negative respondents, as opposed to the other criteria that have a maximum of 3. This is because the companies report confidence that they can always train for a method, or adapt it to suit their existing skills.

*When and Why They Evaluate*

When conducting UX evaluations, it is by far most popular to do so as an ongoing part of the development process, which is done by 47 of 66 respondents. This is probably because some respondents see function and technical tests, as a form of UX evaluation, and they are a natural part of development. Otherwise there is a rather even split on when evaluations are performed, whether it is in the beginning of (n=28 of 66), in midst of (n=21), and/or in the end of development (n=24). This is elaborated as being because it depends largely on both clients and the type of project. Interestingly, only 12 of 66 respondents perform evaluations after implementation, likely because this is the point where it takes the most effort to implement changes and/or the product has been given to the customer. However, this means that only 12 use UX evaluations as a means of securing the value of the final product.

When evaluating after product completion, there is a tendency to have a higher degree of using the results for gathering knowledge on good UX, and to create better solutions in future projects. Results are most often used to improve the current product, which is done by 65 of 66 respondents, where the last respondent uses results for future products and to show customers that the product has good UX. The results are also often used either in future projects (n=44), or to improve the UX knowledge of the company (n=27). This shows that UX evaluations are not confined to a single product or project, but is used as a means of developing greater knowledge on how to develop user friendly and likable products.

22 used the results to prove that the product has good UX, and has a higher degree of UX being integrated in the development process. 15 of those 22 respondents state that they have a high or very high degree of integration, where the next highest degrees are 14 of the 27 who use the results to gather UX knowledge. This mirrors the responses of how much focus there is on UX evaluation in the company, indicating that in order to thoroughly prove good UX, the focus and integration has to be high in the company. Of 66 respondents, 13 state they have a lesser degree of integration, 22 some degree, 23 high degree, and 8 at a very high degree. This mirrors the spread of degrees of evaluation focus in the companies, with 31 of 66 saying high to very high integration, and 34 of 66 with the same degree of focus on UX evaluation.

**What is UX**

In order to really understand how industry sees UX, we presented 18 different dimensions, shown in Figure 5 (identified from a previous literature-review [2]), stemming from academic UX work, usability, or both. We present how the respondents see these dimensions as part of UX, and further elaborate upon how they define UX.

The respondents were asked to state how much they agree that the 18 dimensions are parts of UX, on a 5-point likert scale from strongly disagree to strongly agree. For the dimensions associated with usability, there is an average of 91 of 119 respondents that agree on their importance to UX. For the dimensions that are wholly associated with UX, there is an average agreement of 74 respondents. The 3 most agreed upon dimensions are the impression (n=105), functionality (n=102), and pleasure (n=100). These dimensions are mainly associated with UX, usability, and both, respectively. This shows that UX, as dealing with the impression of the user, incorporates traditional usability as well as other more user-centered dimensions. The 2 least agreed upon dimensions are social UX (n=38) and brand image (n=47). This is likely because these

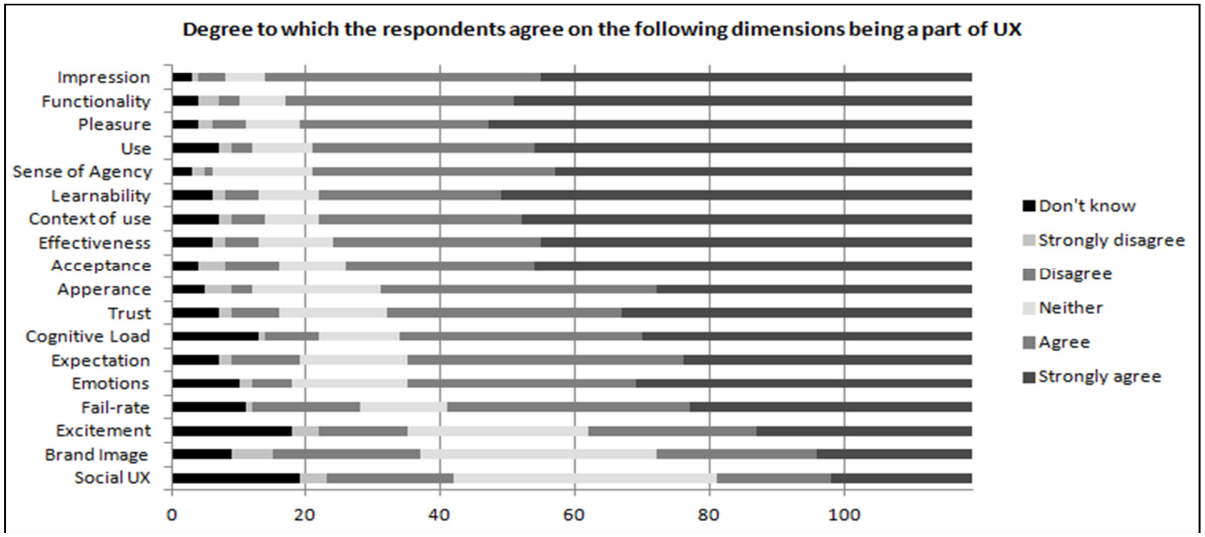


**Figure 5: The 18 different dimensions, and how much the 119 respondents agree that they are a part of UX**

are some of the newest additions to UX, as the social dimension was measured for the first time in 2007 [13], and brand image in 2014 [20].

In an effort to define UX as used by industry, we looked at the rankings of the different dimensions. The top 7 dimensions are all agreed upon by more than 95 respondents, and are therefore deemed most important for synthesizing a definition. These dimensions in order are: Impression, Functionality, Pleasure, Sense of Agency, Use, Context of use, and Learnability. 2 deal with the user's internal state, 4 with use of the system, and one with the surrounding context. A proposed definition from these dimensions could be as follows:

*A user's pleasure with, impression and use of a system in context, and the system's degrees of functionality, controllability, and learnability.*

Based on the agreement levels of the 18 dimensions, this should be a definition that most of the participating respondents can agree with, as all of the elements are agreed upon by at least 95 of 119 respondents.

## DISCUSSION

In this session, we discuss the representativeness of our survey, not only of Denmark, but of the UX profession in other countries as well. We then compare the results to the related work, in regards to whether we investigated UX or if it was actually usability. Finally we discuss the relevance and usefulness of the new synthesized definition, in relation to the related work.

### Results as Generalization

#### *Representing Denmark*

In order to find out if our sample is representative of the Danish IT-profession, we looked at company sizes, as provided by the Danish Bank of Statistics [26]. This is because a sample can be seen as a representative miniature if the spread of sizes match [24]. As seen in Table 3, our results are representative in that our sample is a miniature of the Danish IT-profession, averagely differing by 6 percentage points (from 3pp to 12pp).

| Company size | 1-4 | 5-19 | 20-49 | 50+ |
|---|---|---|---|---|
| Our results (%) | 11% | 11% | 12% | 65% |
| DK (%) | 15% | 17% | 15% | 53% |
| DK (#) | 14.929 | 17.518 | 15.413 | 54.628 |

**Table 3: The size of Danish companies, according to our results and to The Danish Bank of Statistics [26]. Companies with 50+ employees were grouped together, to be comparable to statbank.dk**

#### *Denmark Represents the World*

Of course the Danish results are not representative of other countries, but they can provide an understanding of UX evaluation work that can be compared to countries with a similar profile. Denmark has been in the top 20 of innovation driven economies since 2012, and is classified as an advanced economy [9]. There are 3 times as many with a master's degree in the IT-industry than the average of total employment [30], and all in all 103.000 jobs in the Danish IT-industry at the end of 2013 [26]. This means that countries ranking in or near the top 20 of innovative countries, with a well educated IT-industry, can use our results as a basis of understanding UX evaluation work in practice.

### UX or Usability

To determine if the respondents actually work with UX or usability, we first compare obstacles in usability to obstacles in UX. We then look at how the respondents see the relationship between UX and usability, and if their ranking of dimensions favors usability dimensions.

#### *Problems in Usability and in UX*

Obstacles in the Danish usability profession [1] are closely related to those of the Swedish usability profession [10]. They agree that there needs to be support from management and that developers need to understand the value of usability evaluation. The companies in our survey that did not work with UX evaluation, also state that management and/or clients do not support it, along with the employees lacking the proper skills. This seems to indicate that usability and UX are related in that both need support from management, but are different as the understanding of the value of UX is not an obstacle according to our respondents.

#### *Perspectives and Components*

We asked the respondents to state their perspective on UX and usability, where they could choose between the five shown in Figure 6. We supported the selection by asking whether UX is subjective or objective. Of 113 respondents, only 3 see them as the same, with the majority (n=81) considering usability to be a sub-part of UX. UX was only rated as slightly more subjective (n=38) than objective (n=33), with 36 respondents stating it was an equal mix of both. This is interesting because the difference between UX and usability is often defined by UX focusing on more subjective qualities such as emotion, trust, and perceived effectiveness [29], as compared to usability being objective focusing on task completion time, fail-rate, etc.[10]. This is further supported by practitioners generally only measuring the objective qualities of UX [18].

| | |
|---|---|
| P1 | User Experience and Usability are the same. |
| P2 | Usability is part of User Experience; User Experience contains more than just Usability. |
| P3 | User Experience is a part of Usability; Usability contains more than just User Experience. |
| P4 | User Experience and Usability are different, but is inseparably connected; User Experience and Usability affect each other. User Experience is more than Usability, and Usability is more than User Experience. The overlap between the two can be called User Satisfaction. |
| P5 | User Experience and Usability has nothing to do with each other. |

**Figure 6: The 5 different perspectives on the relationship between UX and usability.**

When looking at the dimensions reported as being part of UX, the 3 highest ranked are: impression, functionality, and pleasure. Two of these are clearly subjective UX dimensions, and 'functionality' is primarily attributed to usability. Among the lowest ranked is 'fail-rate', a definite objective usability

dimension. This indicates that they do in fact see usability as a part of UX, with a clear distinction between the two terms.

### A New Definition

Here we discuss the value and usefulness of our synthesized definition of UX. Even though an earlier study [15] found that the more experience a practitioner has, the less they see a need for a definition, there is evidence that they do not truly understand UX [16]. Practitioners favor evaluation methods that incorporate users, because they have an intuitive understanding of a user's experience. We looked at what criteria a definition should meet, in order to be fit for practitioners, as found in another study [15].

A definition should focus on the user and make room for different dimensions, as UX is multi-faceted. We incorporated 7 different dimensions in the definition, and focused it on the users by putting them first. A definition should be short, as to be easily understood, without oversimplifying. We achieved this by keeping it simple and using dimensions that are open to interpretation, as to let practitioners decide their meaning for themselves (e.g. impression). The dimensions used in the definition have the fewest respondents stating they did not know their meaning. This also fits the idea that a definition should use understandable wording. The aim of a definition should also be clear, where we target practitioners, using their own responses. Lastly, a definition should contain both components and results of UX. We focus mostly on the components, alluding to the different degrees of the dimensions being the results.

## CONCLUSION

In this paper, we have presented the results of a survey study of Danish IT-companies, -professionals, and their use of UX evaluation. To prepare for the survey, we gathered information from practitioners through interviews, where we learned how UX can be used in practice. We gathered 147 valid respondents, with 102 full responses, and 45 partial.

The results from the survey showed that a little over half of the respondents evaluate UX as an integrated part of the development process. Outsourced evaluations and separate evaluation departments are used less than 10% each. UX evaluations are also done as informal one-to-one talks with users in formal usability evaluation, showing UX as a growing concept in companies. Some of the respondents state that they do not work with design or evaluation at all, but still spend more than 20 hours a week on UX issues, which to them are gathering requirements and client relations. When evaluating, companies tend to combine tools and techniques in order to create their own tailor made methods, most often containing users. User tests are used because respondents see them as easy, having to just ask the user what they think of the given product.

UX evaluations are mostly conducted in companies where management has deemed it important. This indicates that successful UX evaluation depends on support from management, which is true for usability as well. They rank pleasure and impression as higher than effectiveness and fail-rate when asked what UX consists of. They acknowledge usability as a part of UX, as functionality is the second highest ranked dimension of UX, and most of the respondents directly stated UX as containing usability. This is because UX and usability are similar, but practitioners do know the difference between the two.

UX work is mostly done by employees who are trained on-the-job, but there is a great influence from HCI educations as well. This can be seen as academia having an influence on UX work in companies, but the best practices of the company taking precedence over educational backgrounds. This is further supported by the fact that of the 15 presented academic UX evaluation methods, maximum 20 of 68 respondents had heard of each method, with an average of 11,5 per method.

Our survey was victim to a sample bias, as most of the full responses are from those who like and work with UX. The respondents that did not work with UX or UX evaluation all quit the survey, becoming partial responses.

The next step from here is to get an even deeper understanding of the Danish IT-industry, as well as elaborate on some of the responses. This can be done with case studies to observe exactly how UX work is done, and to examine what the most important factors of UX are; whether it is a specific dimension or criterion. We found that there were some questions that could have added to the results. These include the respondents' level of education, age, gender, and how long they have worked with UX. These could give a broader insight in the different demographics, and if years of experience influence how they work with evaluations. We could also have asked about the temporal aspects of UX, to see if practitioners evaluate before, during, or after use of the product.

## ACKNOWLEDGMENTS

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# Promotion and Adoption of UX Evaluation in Industry: An Action Research Study in an IT-organization

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## ABSTRACT
This study sets out to investigate how UX and UX evaluation can be promoted and adopted in industry, with an action research approach. Through a four month period, we collaborated with a development team from a Danish IT department of a bank. We investigated different strategies for promoting UX and the possibility of UX adoption. Focusing on understanding, supporting and improving the practice of the development team, we conducted several promotion activities of UX evaluation methods with the strategy of presenting these in a more visual (video records) and practical form (workshops). Our results show that we have been able to promote UX in such a way that certain UX material has been adopted in the development process of the collaborating company. Further we present our experience with promoting UX in industry in regards to the process, working with the UX definition, and which obstacles occurred during the collaboration.

### Author Keywords
User Experience; UX; evaluation methods; Action research

## INTRODUCTION
User Experience (UX) is a term that has started to appear more and more often in industry [1, 16]. The older term usability, which involves technical reliability of products, seems to be taken for granted by users. To offer more, companies have therefore started to focus on products that deliver an experience rather than just being practical tools [16].

When working with UX you are interested in the user's thoughts and feelings while working with a task and the anticipation before using a product. Evaluating UX is about capturing and predicting these thoughts and feelings, including the study of e.g. emotions, preferences, brand image, functionality, attitudes, and context of use [8].

Although industry is eager to work with UX not all companies have adopted the term and some of those that have, has not properly considered it, meaning that they have not worked with the term as intended from UX research [1].



For a company to adopt UX it is essential how the term is being promoted, and therefore how to motivate the employees to use the term and be ready to create a change within the company. However, UX researchers are rarely working with the industry use of UX, even though UX originated from industry [11].

Looking at the work of UX researchers, they often work with creating evaluation methods or evaluating existing methods, but do not publish work for furthering their UX work to industry. Finding inspiration within the research literature about the promotion and adoption of UX evaluation in industry is difficult. Only few have been working with and investigated the topic using qualitative research [1, 5, 14]

Action research studies are often used within the Information Systems research studies as a means to study changes in a company. They can be used to study promotion and adoption of new concepts in a company. However, in the field of HCI, this research approach is rarely used and only few guidelines and inspiration cases on the execution of action research is available [6].

Working with published UX evaluation methods from academic research, this paper investigates how UX and UX evaluation can be promoted and adopted in a Danish IT-department of a bank, with a newly strategic decision of working with an HCI focus. The contribution of this paper is thus twofold: 1) Present how UX can be promoted in an IT-department with no prior experience with UX and 2) Investigate how UX can be relevant when working with a banking system. In addition, using an action research approach, this study investigates how this approach can be used to investigate changes in companies.

The following sections first present related work in regards to existing qualitative research about UX and Usability in industry. Then, the framework of the action research study is presented, followed by the method describing the research approach (the approach to action research) and the research practice (activities with the company in the study). Finally, the results from the action research are presented, followed by a discussion comparing our results to existing qualitative studies about UX in industry. The article ends with a conclusion of the study.

## RELATED WORK

Investigations of the use of UX and UX evaluations in companies are limited. Only few articles have made qualitative research about the adoption and promotion of UX in companies [1, 5, 14] and this section therefore outline some of these as well as a study about usability in industry.

### Study of Usability Evaluation in Industry

Since UX can be seen as related to usability, studies about usability in industry can be used as inspiration to conducting UX studies in industry. A good example of a qualitative process-oriented study about usability in industry is Nørgaard & Hornbæk [12]. They conducted an explorative study of 14 think-aloud sessions in order to investigate what usability evaluators do in practice. The researchers used observations to investigate seven companies and their use of test sessions in a usability evaluation. The study resulted in an overall picture of how companies are working with usability test sessions as they did not investigate one company in depth.

### Study of Promotion and Adoption of UX in Industry

Investigating the existing qualitative research about UX in industry, an experimental study was conducted in 2014 with a collaboration between researchers and software companies [1]. The purpose was to investigate how to promote UX in practice and several research methods were used, including an explorative study with one company. In the explorative study, several activities were carried out, e.g. team meetings, observations, interviews, and heuristic inspections. The study suggests using empirical research to reduce the gap between the research and industry use of UX. They found collaboration studies with researchers and practitioners instrumental in showing practitioners why to improve their development processes and how to do so.

An exploratory case study from 2015 had the goal of investigating how UX knowledge can be obtained and shared within a company [5]. Three case studies were conducted with three companies, who already had integrated UX in their development process. These studies included six interviews with the designers from the companies. Different methods to spread UX knowledge within a company were analysed and these methods were centred on UX competence flow between individual UX designers and the company in which they worked.

Another case study from 2012 investigated Microsoft and their practice behind UX management [14]. The study was conducted in situ at Microsoft where several interviews were conducted with seven managers from research and development departments. Since Microsoft has already integrated UX in their development process, this study describes a successful UX integration in a company.

The above mentioned papers about UX describe qualitative studies concerning the integration of UX in industry. However, these do not work specifically with UX evaluation. Also, two out of three of the papers investigate more than one company, resulting in general and short descriptions of the different cases with the companies. Two of the presented studies also investigate companies where UX is already integrated in the company and do not address how UX can be promoted and adopted in companies with a newly UX focus. In addition, no action research studies were found in the literature about practical UX integration.

In order to address the absence of in-depth studies of UX evaluation use in companies, the aim of this study is to use an action research approach as a means to investigate strategies to promote and adopt UX evaluation methods through collaboration with one company.

## FRAMEWORK

The theoretical framework of this action research study is adopted from a study conducted by Mathiassen [2002]. In this approach, the purpose was to "*understand, support, and improve practice as part of the ongoing professional development*". In our case we have worked with a company in order to promote UX evaluation methods in practice. Following the framework, we wanted to understand how the company current work with and understand UX, as well as support and improve their practice with promotion of UX and UX evaluation from research literature. The reason for using research literature is to investigate the possibility of using existing UX evaluation research in a company product development process.

The definition of UX used in this study is from the ISO (International Organization for Standardization), defining UX as a: "*Person's perceptions and responses resulting from the use and/or anticipated use of a product, system or service*". The definition also states that UX is about emotions, psychological responses, behaviors, brand image, the user's prior experiences, context of use, and that UX occurs before, during, and after use. In addition to this, some aspects of UX overlap usability [8].

UX evaluations provide a measurement of how a user feels towards the system. We previously identified 93 UX evaluation methods in academic literature [2]. In this action research study we decided to focus on well-established UX evaluation methods in the academic literature, such as SUXES [15], Product Reaction Cards [4] and AttrakDiff [17]. An expert evaluation method 'UX Heuristic Inspection' [13] was also included.

## METHOD

This section presents the method of the action research (AR) study. First, the research approach is presented. Next, the research practice is described, explaining the collaboration and investigation done with a Danish company in regards to promoting UX evaluations.

### Research Approach

AR studies are a duality of action and research; practice and theory. They are working towards producing new

knowledge through the creation of solutions and/or improvements to "real-life" practical problems [9].

Even though AR has been done before in HCI [6], guidelines and theory about conducting them within the HCI research field are limited. We have incorporated theory about AR in regards to the research field of Information Systems, where strategies are better established [7] to guide our research.

In this research approach, we have used [9], where AR is regarded as "*two, interlinked cycles*", one of practical problem solving and the other with production of scientific knowledge. The two interlinked cycles should be seen as operating in tandem with one another and functioning as a dual cycle process (see Figure 1).

The Problem Solving Interest cycle of this study aims to help our collaborating company in regards to using UX and UX evaluation in their IT-system development, and the Research Interest cycle aims to investigate how UX evaluation can be promoted in the IT-industry.

We went through the dual cycle process several times in order to meet our research goal of incorporating UX evaluation into the company's development process. On each cycle we used a different promotion strategy. Figure 1 illustrates the steps in each cycle (action step).

In AR the cycle continues with no definite ending point. However, in the majority of AR studies the goal of AR is for the company to be able to maintain the positive changes that have been made, once the researchers leave the company [5]. In our case, the exit points from both cycles of this study in Figure 1 were based on a predefined deadline agreed with the collaborating company at the beginning of the study.

### Research Practice

The AR study was performed with the cooperation of IT developers from an IT department team of a Danish bank. The company had recently shifted their development method to a user focused approach, resulting in new development activities, such as a closer integration with users, design workshops, and a focus on UX. Our purpose and goal with the collaboration was to promote UX and UX evaluation in their new project, which started early 2015. The new project is a construction of a banking system to manage loans with a smartphone.

We used video meetings throughout the collaboration, because we were in contact with developers from two locations in Denmark.

The development team of 10, which we have been working with, consisted of UX designers, a method expert, a product manager, bank domain experts, business architects and software developers.

In the collaboration, we were mostly in contact with the following key development team members: P1; our contact person in the company who also had the role of method consultant and UX specialist, P2; Project manager, P3; the chief specialist who worked with the design of the new system including UX, P4; senior specialist who worked with both the design and technical aspects of the system.

The AR study started in December 2014, with a start-up meeting, and ended at the end of May 2015, using 98 company employee hours. During this period, idea creation and the construction and evaluation of prototypes were done. Table 1 provides a timetable of relevant AR activities conducted in regards to the Problem Solving Interests Cycle. Not included in Table 1 are the weekly design workshops the development team held. We did not attend these meetings but the findings were reported back to us.

Below is a description of a selection of activities conducted with the company.

*Initiating meeting (activity 1)*

The first meeting with the company was held at the end of 2014. The meeting was conducted with P1. The purpose of the meeting was to gain information about the new HCI

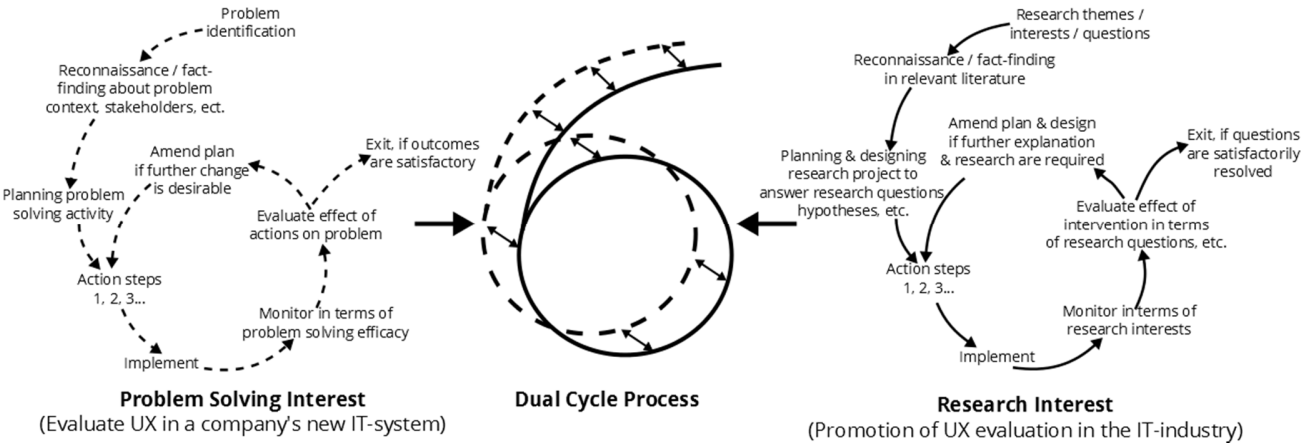


**Figure 1: The AR of this paper viewed as a dual cycle process. Consist of both a problem solving interest cycle and a research interest cycle. Adapted from McKay & Marshall [9].**

software development method, created by P1, as well as getting information about the new project in the company. Furthermore, we identified the main problems in regards to the promotion and work with UX evaluations, and discussed how we could contribute to the company's new project. We also collected information about the company's expectations from our collaboration.

*Team meetings (activities 2, 3, 4, 6, 7, 8, 10, 12]*
Throughout the collaboration with the company, we participated in team video meetings consisting primarily of the key members (P1, P2, P3, P4). The meetings lasted between 20 minutes to 1 hour and took place three to four times per month. In each meeting, the team members presented the status of the project. We then presented our suggestions for current and future UX integration and used these meetings to educate team members on UX topics. These topics consisted of presentation of the UX term in regards to the ISO definition as well as when, how, and why the company could benefit from UX evaluation methods. In the later stages of the collaboration, the meetings functioned as a means to evaluate the effect of our UX promotion.

*Workshop - early UX evaluation (activity 5)*
In this workshop we were invited as UX consultants and our role was to educate the whole team about UX as well as how they could evaluate UX in the concept design phase. The presented evaluation methods were modified so they could function as developer tests, meaning that the developers could evaluate their own system. The workshop lasted one day and was divided into several activities, designed to expose the team to UX.

The agenda for the workshop was as follows:

The workshop started with a 10 minute presentation of UX. We then asked the team members to brainstorm potential UX strengths and weaknesses of the new system. The same activity was conducted at the end of the workshop and functioned as an evaluation of our influence on their UX knowledge.

After the brainstorm, the team members were divided into

| Activities | | Action Research in regards to the key steps in 'problem solving interests cycle' *(Key: p1-4 = company employees, pa = all the member of the team, r = the authors)* | | | | |
|---|---|---|---|---|---|---|
| | | **Problem identification + company info** | **Planning problem solving activity** | **Action steps - planning** | **Action steps - implement** | **Action steps - evaluation** |
| 1. | **Initiating meeting (15/12/14)** | Info about the new development method, the company and the new project (p1,r) | | | | |
| 2. | **First team meeting (12/3/15)** | Presentation of the team members, the new project, our plan for the action study & presentation of the UX term (pa,r) | | | | |
| 3. | **Second team meeting (20/3/15)** | | Planning of the action research study + status of the project (p1,p2,r) | | | |
| 4. | **Third team meeting (27/3/15)** | | Status of the project + planning of the action research study (p3,p4,r) | | | |
| 5. | **Workshop - early UX evaluation (27/3/15)** | | | Planning of the workshop (r) | Facilitation of the workshop (pa,r) | Knowledge about UX before the workshop + lessons learned in the workshop (pa,r) |
| 6. | **Fourth team meeting (17/4/15)** | | | Planning of UX evaluations + status of the project (p2-4,r) | | Lessons learned in the workshop (p2-4, r) |
| 7. | **Fifth team meeting (24/4/15)** | | | Presentation of design sketches (p3-4,r) | | |
| 8. | **Sixth team meeting (30/4/15)** | | | Planning of UX evaluations + functional prototypes (p1, p3-4, r) | | |
| 9. | **UX evaluations (6/5/15-11/5/15)** | | | Planning of UX evaluations (r) | Conducting UX evaluations (r) | |
| 10. | **Seventh team meeting (12/5/15)** | | | | Presentation of UX evaluation results (p1, p3-4, r) | Feedback on the results (p1,p3-4,r)) |
| 11. | **Workshop - presentation of UX test results (19/5/15)** | | | | Presentation of UX evaluation results (pa) | Feedback on the results (pa) |
| 12. | **Last team meeting (29/5/15)** | | | | | Feedback on the action research study (p1-4,r) |

**Table 1: Action Research in regards to the key steps in Problem Solving Interests Cycle. Showing the activities conducted in a project in the IT-department of a Danish bank company.**

two groups (5 each). Each group was presented with a UX evaluation method (SUXES [15] or Product Reaction Cards [4]). None of the team members were familiar with the presented evaluation methods prior to the workshop. For both methods, modifications were made in order to use the methods as both a design brainstorming tool and a tool for conducting continuous UX evaluations of concept ideas.

**Figure 2: Picture from the workshop.**

After the method presentations, each group used their method as a tool for choosing which UX dimensions will be focused on in the new project. Afterwards they brainstormed ideas based on the chosen UX dimensions and lastly one group member from each team was used as a test person and conducted a UX evaluation based on the other group's method.

The workshop ended with the development team evaluating the workshop and the methods they had been presented.

*UX evaluations (activities 9 ,10, 11)*

As a way to show the team which kind of results you can get from an UX evaluation, we conducted both expert evaluations (UX Heuristic Inspection [13]) with HCI experts, and user evaluations (AttrakDiff [17]) with potential end-users. The evaluations were conducted in a lab and were videotaped for the development team to see how the evaluations were conducted, how the test moderator controlled the evaluations, and to hear participants' comments. To show the diversity of UX evaluation methods, we evaluated both a paper prototype and a functional prototype on a smartphone. The prototypes were a result of the previous workshops conducted in the development team (e.g. activity 5) and were modeled to fit the size of a smartphone. This was to explore how and what one can gain from evaluating UX of different stage of development. Since the company was making a prototype which should function on a smartphone, we designed a wooden smartphone-mockup to make the evaluation of the paper prototype more realistic (Figure 3). This made it possible to evaluate the actual screen size elements, to use the swipe function, and to change between different screenshots.

The results from the evaluations were analyzed and presented to three of the team members (P1, P3, P4) in a video meeting where results were discussed as well as how possible design changes could address the negative comments from the experts and users in the UX evaluations. Lastly, we gave comments about the potential future uses of the UX evaluations in the company.

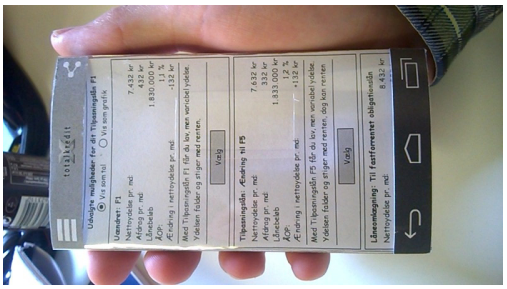

**Figure 3: The wooden smartphone prototype designed to test paper prototypes.**

*Last team meeting (activity 12)*

The last team meeting was conducted as a final evaluation of our collaboration. Here, two of the key members of the development team (P3, P4) evaluated our promotion of UX and UX evaluation methods as well as giving a report on which promoted material has been adopted in the company so far. Since not all key members were able to participate in the meeting, we also conducted a survey, which all employees in the development team answered.

### Data Collection and Analysis

Throughout the AR study, we collected data from the different meetings with the company through both audio records (in total = 5h 33 min.) and notes taken during the meetings (36 pages). Furthermore, we used three surveys throughout the collaboration to gather information about the development team including their UX knowledge as well as their opinion on the promoted UX material. These were as follows:

- Survey 1: Conducted before activity 5 to collect information about the development team's knowledge about UX.
- Survey 2: Conducted the day after activity 5 to collect information about the changes in the development team's knowledge about UX and opinion about the workshop.
- Survey 3: Conducted before activity 12 in order to gather information from the development team about the overall opinion on the collaboration, the promoted UX material, as well as the status on the adoption of the material.

Since the development team was anonymous in the surveys, we have used the term "anonymous" after the citations from the surveys.

To analyze the statements of the development team, we used a modified version of the Conventional Analysis Method [19], where we generated names for categories from the collected data. Using this method, we first read all the collected data to get an overview of it and were then analyzed word by word in order to derive codes. Afterwards, notes about our impression and initial analysis of the data were made, and codes were sorted into categories where some were combined in order to create new ones.

## FINDINGS

The analysis of the statements from the development team resulted in 8 topics. These categories are presented below and describe different aspects which are important to know when working with promotion and adoption of UX and UX evaluation in a company with limited focus on the UX term. The results consist of the following categories: *Process* (P), *obstacles* (O), and *definition* (D).

### (P1) From No UX Consensus To a Comprehensive Understanding

In the beginning of the collaboration with the IT-development team, all the members had different understandings and definitions of UX:

*"There are not many (of the team members) that have knowledge about UX. We are not experts in the field of UX and when we are discussing it, it is clear that we have different views on it."* – Anonymous

These multiple views may have been due to the company not establishing a companywide definition. This concern was expressed by P1 during one of the first meetings, where he wanted to create a single definition for the team.

To further investigate the development team's understanding of UX, survey 1 was conducted (see table 2). Results showed that there was a disagreement about the definition of UX and the dimensions UX consists of.

| | Select UX dimensions | Survey 1 (before workshop) | Survey 2 (after workshop) |
|---|---|---|---|
| Usability | Functionality | 5 | 7 |
| | Effectiveness | 5 | 7 |
| | Easy to learn | 4 | 8 |
| | Cognitive load | 4 | 6 |
| UX | Brand image | 2 | 4 |
| | Social aspect | 1 | 3 |
| | Emotions | 3 | 7 |
| | Context | 4 | 8 |
| | Trust | 3 | 6 |

**Table 2: Results from survey 1 (n = 7) and 2 (n = 8) showing a selection of the UX dimensions and how many agree that these are a part of UX.**

Furthermore, the results indicated that most team members saw UX as consisting of mostly usability related dimensions such as functionality, effectiveness, cognitive load, and if the system is easy to learn. Dimensions such as brand image and the social aspects were not seen as being UX related. Even though 7 out of 8 said they knew UX, the results indicated that they had limited UX knowledge.

The aim of activity 5 was to make the development team understand that UX is more than usability. Here, the UX term was presented based on the ISO definition, as well as having all the team members work with both UX and UX evaluation activities. Analyzing the results of a follow-up survey showed that the team developed a uniform understanding of UX dimensions, meaning that they see UX as being broad and consisting of different dimensions. Furthermore they saw UX as being more than usability dimensions (see table 2).

### (P2) UX Adoption or No Changes in UX Focus

During activity 12, when the collaboration with the development team and our promotion of UX were evaluated, the designers seemed happy to be introduced to UX and new UX evaluation tools. They also expressed that they had learned something new about working with UX that has already had an impact on how they work in their system development process:

*"If you haven't been here so we could get the knowledge from you this early (in the process), we would not have been where we are now. I have no doubt about that… It is also good to shake the heavy company culture up a bit and it has succeeded for you. Changes have been made." - P4*

In regards to the changes and definite use of the promoted UX and UX evaluation methods, the key members of the development team, expressed a concern. They were positive towards UX and UX evaluation methods and wanted to use the methods we presented, but were concerned about how other employees in the company would accept them. When presenting the UX topics to members of other development teams, they were more interested in the outcome than the process:

*"It didn't seem that they were very interested in the process. They all just wanted to see the prototype and to be able to interact with it… it's a little sad." - P4*

That it is difficult to promote UX to employees in a company were a problem which both P1, P3 and P4 were struggling with. However, they saw the UX workshop as a very positive way to promote UX, since people are then able to work with the presented UX tools and through this a greater possibility of seeing the value behind the methods. That other than designers and UX experts were part of the workshop, was expressed as positive, since the designers felt that the team now had a shared understanding of UX. It was also seen as being positive since the "non-designers" were able to get an understanding of the UX-workers' tasks and decisions.

*"Using workshops is the best thing you can do in a company (when promoting new methods and techniques). You can send us lots of material, but half of the people will*

*not read it, and the other half will read it and not use it. Participating in a workshop is the way to get things changed in a company" - P4*

*"When you have a workshop, people are quickly committed. As soon as you feed them with what they should do, they quickly start working with the methods and tools." - P3*

Whether the company is going to use the UX methods and tools provided is uncertain. However in the development team, small changes have already been adopted and the team is motivated towards continuing working with UX and UX evaluation, both in regards to this project and others.

**(P3) Opinion and Adoption of UX Evaluation Methods**

From the beginning of the collaboration with the company, P1 expressed that they had already decided to conduct user evaluations with the thinking aloud technique, but had not found a method for evaluating UX yet. When presenting the possibility of conducting UX on paper prototypes, it was clear that they did not have a method for that and P2 seemed surprised that you are able to conduct these kinds of evaluations. P2 was therefore very interested in a presentation of these kinds of evaluation methods. P1 also expressed a wish to work with both low-fi and hi-fi prototypes with the possibility of conducting user evaluations on these.

As a result of this, the two UX evaluation methods 'Attrakdiff' and 'UX Heuristic Inspection' were presented. Since the key members of the development team expressed a wish to learn about the methods, but did not have the time to conduct the evaluations, we decided to conduct them through activity 9.

After presenting the methods and results of the evaluations, the key members of the development team expressed enthusiasm in regards to the Attrakdiff user test. They found it a good evaluation tool which provided a clear overview of UX dimensions measured in the evaluation and were motivated towards conducting more, using the Attrakdiff method. They saw the method as being simple and straightforward, and were interested in the tools used to conduct the evaluation.

The two designers (P3, P4) were on the other hand a bit skeptical in regards to letting experts evaluate their system in the later steps of the process, since they saw them as being "fake users". However, they saw a potential use of expert evaluations in the early stages of their future system's development process as a way to find early problems and a way to get inspiration for new solutions. It was therefore seen as being an evaluation tool to test prototypes. From one of the later team meetings, it was however clear that the designers began to see the benefits of conducting evaluations, especially after reading the results from our conducted expert evaluations.

In regards to conducting evaluations on paper prototypes versus functional prototypes, they expressed that they were able to use the results from both evaluations, and were especially motivated in conducting tests with paper prototypes to catch early problems in the design phase.

When evaluating the strengths of the presented UX evaluation methods, most of the members of the development team were positive about these and wanted to continue using them:

*"We have moved from having a gut feeling about the quality (of the system) to have actual knowledge."* – Anonymous

*"By working with and evaluating UX with real users and experts which doesn't have the background knowledge that we have, we are able to get closer to the best result."* – Anonymous

This indicates that the development team is open towards adopting UX evaluation methods in their development process.

**(D1) UX Dimensions of Fun and Enjoyment**

Since the goal for the development team was to create a bank application, one would expect that popular UX dimensions such as enjoyment and fun would not be taken into consideration. The bank industry may be seen as conservative and boring, but being part of the development team for four months demonstrates that they were open towards all sorts of UX dimensions. They e.g. included words such as interesting, fun and different when describing which product they wanted to create in activity 5:

*"We have an opportunity to make it a little more fun today… I think it is possible to make it interesting." - P4*

Even though they did not end up working with these kinds of UX dimensions later on, they were open towards using them in the initial idea generation phase. This shows that they are interested in creating a different experience for future users of their bank system and express that they wanted to move away from their boring image.

In addition, after presenting the UX term for the development team, their view of UX widened, making them understand that UX is more than making systems fun to use, but is about giving the user an overall good experience in regards to the system (see table 2). However it is important to clarify that even though the development team see UX as being broad it does not indicate if they are going to work with UX broadly in practice.

**(D2) More Than One Meaning Per UX Dimension**

Especially during activity 5, it became clear that different UX dimensions were interpreted differently among the team members, which resulted in many discussions:

*"We spent a long time on creating a shared understanding of these (UX dimensions). When we evaluated the system with one from the other team (in the workshop), the person did not have the same understanding of the words."* - P4

However, during activity 5 the team created a shared understanding of the different meanings of the UX dimensions (see Table 2). During defining the UX dimensions, new ideas also arose in regards to the new system. Most of the development team therefore saw the time used to make a shared understanding of the dimensions as being useful:

*"Now we use these words (UX dimensions) and we have this understanding of them. We have then established the conceptual universe of this project and can use the same words."* - Anonymous

Especially the presented UX evaluation method 'Product Reaction Cards' were seen as being a good discussion tool, since it presents various UX dimensions.

**(O1) A Skepticism Towards UX Work**

Even though the development team seemed excited about working with UX in their new development process, it was clear that they had some concerns in regards to the project. In one of the first meetings with the key members of the development team, P3 expressed a concern in regards to the new UX development method:

*"We are all novices. None of us have tried to work like this before… so it will probably take a little longer (to work with UX). When we know the process, things will go faster. In the next project we will know the method and therefore be more confident with it." - P3*

*"What worries me is that I think there is an expectation from the board of managers that this is something we just do… and I do not think that. You have to practice and we are going to have a hard time prioritizing what should be made and what should not be made." - P3*

Not only did P3 have skepticism towards working with a more human-centered and UX focused development method, the people working with the design of the system also expressed concerns towards this new shift in focus:

*"It has previously been very uphill for this company to use the time and energy on these things (design and UX) and I am concerned that it will also be uphill in this project. I do not think so, but it is not a Google Labs business we're in. It is about finding a balance, cause we could easily use 100 million (DKK) on this."* - P4

In regards to working with UX early in the development phase, concerns were expressed by the two designers, and it appeared to be a consensus that UX is something one work with in later phases of a design process:

*"UX work first appears later on in the process when we test the sketches… then we begin to take UX into consideration."* - P4

*"I am a little nervous about becoming lost in the detail elements, when we first start to work with UX."* - P3

The skepticism towards working with UX early and fear of not challenging the team in regards to UX was a motivation for us to make the team work with early UX evaluation methods in activity 5.

**(O2) Working With Creatures of Habit in a UX Workshop**

In a meeting with key members of the development team, before the UX workshop, the designers (P3, P4) were skeptical in regards to promoting new UX tools and UX thinking to the development team:

*"We are creatures of habits. Many quickly fall back into the old way of doing things… the old way of thinking. One of the major challenges is to challenge the status quo."* - P4

However, they expressed that they were interested in learning new methods and techniques to bring them out of their comfort zone. Especially methods for bringing up UX early in the design process, which also functioned as a motivation for the UX workshop, facilitated by us:

*"It is always great to work with UX, unfortunately I see a lack of understanding of what UX is among my colleagues and often we discuss details that are unnecessary at this stage of the process (the concept phase). I wish we could take it (UX) in earlier in the process."* - Anonymous

In the workshop, this concern became reality. Even though they were given the task of thinking about which UX dimensions they wanted their system to represent, they began talking about technical aspects and future goals of the project, neglecting their future users and UX aspect.

However, after we presented the task again for the teams, emphasizing the different aspects of UX, they began working towards UX goals, using more UX dimensions in their conversation. By doing this, a more creative idea generating process began to emerge and it was clear, that they were thinking more about what the future users might want in regards to the system.

Comparing the activity in the beginning and the activity in the end of the workshop, some changes in the team members' way of thinking were observed. From being much focused on technical aspects, and the current way of doing things in their concept brainstorming phase, they began being more open towards thinking out-of-the-box. The workshop also resulted in the team members being more focused on specific goals for the project, including UX dimensions they wanted to focus on. Further, several team members expressed that the workshop exercises about making the developer evaluate the design ideas early in the concept creating phase were useful. However, they mostly saw the concept UX evaluation methods as a design tool for specifying key UX dimensions in regards to the new system, rather than an evaluation tool:

*"I think the methods (UX evaluation methods) are good to bring up discussions in the group, but I do not like to use the method to evaluate with."* - Anonymous

*"I think the many concepts (UX dimensions) are a good way to get the ideas flowing and simultaneously narrow the focus on the essentials."* - Anonymous

The key team members of the development team were expressing that they were happy to introduce new ways of thinking to the other members of the development team and liked that the workshop resulted in a shared understanding of UX. However, P4 expressed a concern in regards to a permanent change in the team:

*"(The method) introduced the colleagues to other ways of doing things. The question is whether it can be kept alive or whether we fall back into old habits."* - P4

To investigate this concern, activity 6 was held three weeks after the workshop. It was here expressed that they had integrated aspects of the tools from the UX workshop, and that the UX dimension cards from SUXES and Product Reactions Cards were already integrated in their weekly workshops:

*"It (the UX dimensions cards) is one of our bibles… we have decided to hang them on our whiteboards."* - P2

Further, P1 also expressed that he had already planned to use the SUXES method in an evaluation of another system in the company, and that the two designers (P3, P4) wanted to integrate the method in their project.

*"It shows that you have had an effect on us. SUXES has already been integrated"* - P1

#### (O3) A Need for UX Evaluation Method Modification

When presenting the UX evaluation methods from the research literature to the development team, these methods were often modified to fit the development team's wishes and available resources. Sometimes these modifications were made by us, but the development team also made their own modifications to the methods.

SUXES and Product Reaction Cards both use cards with prespecified UX dimensions. In activity 5, however, both teams found some of the dimensions irrelevant in regards to the goal of their new system, which resulted in both removals of cards as well as creation of new cards with UX dimensions.

From activity 5, it was also clear that the development team did not see the methods as fixed. Many of the team members talked about different techniques and parts of the methods which could be combined into one that would suit their development process better. They e.g. saw the Product Reaction Cards as being more useful as a brainstorming tool among the developers instead of being a user evaluation tool.

When presenting the Attrakdiff method to the designers of the development team (P3, P4), they also discussed possible modifications to the tool, e.g. combining the notation of 'acceptable' and 'desirable' levels of the UX dimensions from SUXES into the Attrakdiff method. The reason for this was that the company was focused on prioritizing the different goals for the new system to match team resources.

P4 further expressed that the words used in the Attrakdiff method were too academic and talked about substituting these with ones that are more interesting for the company to measure on:

*"Attrakdiff uses a lot of words that are not used in the danish language anymore. Its academia and we cannot use it, but we can drag the things out which make sense to use and throw out the rest." - P4*

The development team was therefore positive towards the academic methods, but did not see them as methods that can be used without modifications in the company, since they saw parts of the methods as being too academic for practical use.

*"Everything has to be modified to fit our culture." - P3*

## DISCUSSION

In this section, we are going to present the lessons learned of this AR study. Also, elements from the related work and framework section will be included.

#### Do Not Just Talk About the Methods, Show the Procedures and Results

Since the development team expressed that they had not worked with UX evaluation methods before and were skeptical in regards to the outcome of these, we decided to conduct the evaluations ourselves and video record the whole procedure as well as making an analysis of the results in a document form. The feedback from the key members of the development team was very positive, since they were able to see both the outcome of the evaluations methods as well as the procedure of the different methods. The videos gave a more realistic view on the methods as well as easy guidelines for conducting the evaluations.

A promotion technique of UX evaluation methods similar to ours has been used in the experimental study by Ardito et al. [1]. Here the researchers conducted heuristic evaluations by themselves to show the company they collaborated with, that these kinds of methods require limited resources and little training of company employees.

To promote UX evaluation methods, it can therefore be beneficial to not only present the methods, but show the company the results you can get from them when evaluating the company's own products, as well as showing them the procedure behind the methods. This is seen as being very important in companies, since companies tend to be very results-focused and want to know the procedure behind the methods in order to calculate the resources needed to use these.

#### Joint UX Workshops Results in Shared Knowledge

As a promotion strategy in our AR study, we have been facilitating a UX workshop with the development team, to teach all the members UX and UX evaluation methods.

Conducting workshops in a development team is already used in Microsoft, and is described by Szóstek [14] as a way to promote and inform UX within the company. She highlights the effects of joint UX workshops and expresses that: "*It is the most effective way to show others the value of UX.*". In our case, we also learned that employees are very keen on using workshops to learn about new things. The designers of the development team expressed that they liked that the workshop created a shared knowledge about UX, and that non-designers now have both an understanding of UX work and why the designers want to work with it. As in the Microsoft case study, it was also expressed by the employees, that workshops are an effective way of promoting UX, since the employees are able to work with the term in practice instead of just listening to what others claim UX is.

When promoting UX in a company, it is therefore important to educate more than just the designers of a development team. Since UX and UX evaluation are often seen as being messy and difficult to understand by non-designers, it is our experience that they often have difficulties understanding why designers are working with UX and what they can benefit from this. By educating the entire development team and making them used it in practice; it is our experience that the designers work with UX is more appreciated.

#### From UX Promotion to UX Adoption

Even though the company we collaborated with was positive towards both our promotion strategies and the evaluation methods presented, we do not know if the company is going to incorporate and use them in the long run, since our study lasted only four months.

Looking at other experimental studies of UX however shows that these are also conducted in a limited time period, making it difficult to talk about an actual UX adoption. The study by Ardito et al. [1] lasted only three months and speculations towards the effects of their promotion of UX in a company were therefore dimmed. However, their study mentioned that the company they collaborated with was positive towards the presented UX material and in the end of their study; some small elements of the promoted UX were already incorporated in the company's development process.

In our case, we are also not capable of talking about permanent UX adoption of our promoted UX and UX evaluation methods. However, just as Ardito et al. [1] were able to see some indications of UX adoption, we also witnessed parts of our promoted UX evaluation methods, being integrated in the development process at the end of the study.

Since we were not able to find investigations of long term adoption of promoted UX techniques and methods we cannot say whether the promotion strategies actually work in the long run.

#### Academic Evaluation Methods Need Changes to Fit the Companies

In our AR study we promoted UX and UX evaluation methods from research literature. With all the presented UX evaluation methods, both we and the development team saw a need to modify these in order to make them fit the development method and the goals of the company in regards to the new system. The development team expressed that some of the methods were using words that were too academic and wanted to make their own modifications on them in order to make them useful for the purpose of their projects.

Looking at the Ardito et al. study [1], this also resulted in modifications of the material from scientific articles in order to use it in a more practical context. They concluded that researchers have to be "*more careful in transferring academic work into practical value for industry*" [1] and describe that "*it is the responsibility of academics to translate scientific articles, which formally describe evaluation methods, into something that makes sense for companies and is ready to be applied.*" [1].

From our experience in regards to this AR study, we also believe that modifications have to be made in order to make the scientific methods useful in a more practical oriented situation. The reason for this is that scientific papers often have another purpose and goal for methods, e.g. finding if certain UX dimensions are measureable and testing certain conditions, whereas the practical use of the methods is not studied often.

#### The Usefulness of AR in Studies About Industry UX Adoption

In this study, we have been working with an AR approach and in regards to UX research; this is a new way of carrying out investigations of the term. However, in the field of HCI, some AR studies have been made and researchers are trying to promote the usefulness of this research approach in order to increase their use. In 2011, an article by Hayes [6] investigated the relationship between AR in HCI. She explained that some researchers does not see AR as being able to provide scientific rigor, since it only investigates few cases that cannot be generalized. However, she states that: "*AR does not say that no solution can ever be successful outside of the local context for which it was developed. Instead, AR provides a rigorous framework for generating and sharing sufficient knowledge about a solution that it may potentially be transferred to other contexts.*" [6].

The purpose behind AR is therefore not to be able to construct one solution that can be used by others, but to focus on local solutions to local problems, which have a possibility to be reused in other cases.

Further, since studies about promotion and adoption of UX evaluation methods in companies is missing from the literature, investigations have to be made to figure out how this can be done. We believe that this investigation requires

testing different techniques and observing the changes resulting from these. Looking at an article from Baskerville [3] AR is described as an opportunity to study social processes by "*introducing changes into these processes and observing the effects of these changes.*" [3].

In our study, the use of AR has made it possible to investigate a company in depth and observe the changes that resulted from our UX promotion strategies. Doing so, it was possible to test different promotion techniques, see the outcome of these and then modify the techniques to create better outcomes.

## CONCLUSION

In this paper, we have presented an action research study with an IT development team of a Danish bank, investigating how UX and UX evaluation can be promoted and adopted in industry. Using a theoretical framework by Mathiassen [2002] with the purpose to understand, support and make improvement in practice, we used different promotion strategies, including team meetings, UX workshop, and demonstrations of UX evaluation methods, with the development team spending a total of 98 company employee hours on the collaboration. Our results indicate that changes have been made and that part of the promoted material has been adopted by the company. Furthermore, we have identified the following in regards to the process (P), obstacles (O) and definition (D) of UX and UX evaluation:

- (P) In the process of promoting UX and UX evaluation, showing videos of evaluation methods and conducting workshops where employees can learn the term and try to use evaluation methods, is an effective promotion strategy. Using this show the participants the resources needed to use specific UX evaluation methods and allows them to work with these in practice instead of just reading about them.
- (D) When working with the UX term in industry, this study indicates that the employees have different meanings of the different UX dimensions. It is therefore important for employees to create a shared understanding and definition of UX dimensions in order to work towards the same goal. In addition, our results demonstrate that doing this activity may result in a more creative process, were different UX dimensions are being discussed.
- (O) It is difficult to use UX evaluation methods from research literature without modifying these to fit the individual company, since they are constructed with academic goals in mind. Further, our results indicate that the employees did not know the possibility of working with UX as an early design activity, but saw it as a later design focus. However after promoting early UX evaluation methods, some of the methods or parts of the methods were adopted to their system development process.

Whether the adopted material from our UX promotion strategies result in persistent changes is difficult to say, since our study is limited in regards to the period being studied. However our results indicate so far that some UX evaluation adoption has been made. Further since we have only conducted one action research study we cannot conclude that the presented results may work or can be used in other cases. However since the purpose of action research is to construct local solutions to local problems which may potentially be used in other cases, it is possible to build upon our study and results in order to investigate how UX evaluation can be promoted in practice. In future studies it would be interesting to conduct long term studies or follow up studies of the effectiveness of certain UX promotion strategies in order to see which promotion strategies results in persistent changes.

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# What are They Measuring? A Literature Review of Empirical Studies of UX Evaluation Methods

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The full list of literature used in Tables 1 and 3.

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**Velkommen til vores spørgeskema om IT virksomheder og IT ansatte i Danmark. Spørgeskemaundersøgelsens formål er at kortlægge den nuværende tilstand indenfor evaluering/test af IT-produkter med en brugergrænseflade. Vi er taknemmelige for at du vil deltage i undersøgelsen og gør opmærksom på, at dine besvarelser vil blive behandlet fortroligt.**

**Til at navigere frem og tilbage i spørgeskemaet, beder vi dig benytte 'Forrige' og 'Næste' knapperne i bunden af siden, i stedet for browserens indbyggede 'Tilbage' knap.**

**Spørgeskemaet tager højest 15 minutter.**

**For at sikre os at du og din virksomhed ligger indenfor vores ønskede målgruppe beder vi dig i første omgang besvare følgende spørgsmål:**

Udvikler eller tilpasser din virksomhed software/hardware (herunder f.eks hjemmesider) der har en brugergrænseflade?

- ☐ Ja
- ☐ Nej

**Da din virksomhed ikke udvikler eller tilpasser software/hardware der har en brugergrænseflade, kan vi desværre ikke bruge din besvarelse i vores studie.**

**Vi siger mange tak for interessen i vores spørgeskema, og håber du får en god dag.**

Hvis du har nogle kommentarer, er du velkommen til at skrive dem her.

## 1. Indledende spørgsmål

I første del af spørgeskemaet beder vi dig besvare en række spørgsmål vedrørende din virksomhed, samt din stilling og arbejdsopgaver. Dette gøres for at vi kan skabe et overblik over de de forskellige IT-virksomheder i Danmark, samt disses forskellige ansatte.

Hvad er din arbejdstitel i virksomheden?

Hvilken type arbejdsopgaver arbejder du primært med? (Vælg gerne flere svar)

- ☐ Generering af kravspecifikationer
- ☐ Design af system arkitektur
- ☐ Design af brugergrænseflade
- ☐ Tekniske tests
- ☐ Brugergrænseflade evaluering
- ☐ Programmering
- ☐ Metode udvikling
- ☐ Andet, uddyb venligst

Hvor mange medarbejdere er der i virksomheden? (Vælg kun ét svar)

- ☐ 1-4
- ☐ 5-19
- ☐ 20-49
- ☐ 50-249
- ☐ 250-999
- ☐ 1000+
- ☐ Ved ikke

## 2. IT-ansattes definition og forståelse af begrebet User Experience

*User Experience (UX) er et relativt nyt begreb indenfor IT. Vi vil i denne del af spørgeskemaet undersøge dine holdninger til UX. Vi er både interesseret i besvarelser fra IT-ansatte som aldrig har hørt om begrebet, samt ansatte som* er bekendte med begrebet.

Kender du begrebet User Experience (UX - dansk: brugeroplevelse)?

❑ Ja
❑ Nej

*Følgende er en bred definition af User Experience:*
*User Experience (UX) er brugerens opfattelse og reaktion som følge af brug og/eller forventet brug af et produkt, system eller service og omfatter:*

- *Brugerens følelser, holdninger, præferencer, opfattelser, fysiske og psykiske reaktioner, opførsel, samt præstationer der optræder før, under og efter brugen af et produkt.*
- *Brand image, præsentation, funktionalitet, system performance, interactive behaviour og hjælpefunktioner, samt brugerens tidligere oplevelser, attitude, færdigheder, personlighed og brugskonteksten.*
- *Usability kriterier kan bruges til at vurdere aspekter af User Experience.*

Ud fra ovenstående definition, arbejder I med noget lignende i din virksomhed?

❑ Ja
❑ Nej

Hvorfor arbejder din virksomhed ikke med User Experience? (Dette spørgsmål skal besvares)

Hvilket ord og definition anvender I, i stedet for begrebet User Experience?

For bedre at forstå din virksomheds arbejde med User Experience, beder vi dig udfylde i hvilket omfang de følgende begreber er en del af jeres ord for User Experience? (Vælg kun ét svar for hvert begreb)

| | Meget uenig | Uenig | Hverken enig/uenig | Enig | Meget enig | Ved ikke/ikke gældende |
|---|---|---|---|---|---|---|
| Brugerens indtryk af produktet | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| Brugerens følelser om produktet | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| Brug af produktet | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| Produktets funktionalitet | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| Brugskonteksten | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| Brand image | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| Brugerens accept af produktet | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| Produktets effektivitet | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| Produktets troværdighed | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| Brugerens følelse af kontrol | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| Brugerens forventing til produktet | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| Brugerens fornøjelse af produktet | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| Produktets sociale dimension | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| Brugerens mentale/kognitive belastning | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |

| | | | | | | |
|---|---|---|---|---|---|---|
| Produktets fejl-rate | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| Brugerens følelse af spænding ved brug af produktet | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| Produktet er nemt at lære | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| Produktets udseende | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |

Her kan du skrive andre begreber som er vigtige for jeres ord for User Experience i din virksomhed, eller generelle uddybende kommentarer til dine valg.

*I resten af spørgeskemaet, vil udtrykket User Experience blive brugt, som ord for dette begreb. (Du vil efter næste spørgsmål få præsenteret definitionen af User Experience igen, men du behøver selvfølgelig ikke læse selve definitionen endnu engang)*

For bedre at forstå din virksomheds arbejde med User Experience, beder vi dig udfylde i hvilket omfang de følgende begreber er en del af jeres opfattelse af User Experience? (Vælg kun ét svar for hvert begreb)

| | Meget uenig | Uenig | Hverken enig/uenig | Enig | Meget enig | Ved ikke/ikke gældende |
|---|---|---|---|---|---|---|
| Produktets funktionalitet | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| Brugskonteksten | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| Brand image | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| Brugerens accept af produktet | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| Produktets effektivitet | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| Produktets troværdighed | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| Brugerens følelse af kontrol | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| Brugerens forventing til produktet | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| Brugerens fornøjelse af produktet | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| Brugerens indtryk af produktet | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| Brug af produktet | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| Produktets sociale dimension | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| Brugerens mentale/kognitive belastning | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| Produktets fejl-rate | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| Brugerens følelser om produktet | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| Brugerens følelse af spænding ved brug af produktet | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| Produktet er nemt at lære | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| Produktets udseende | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |

Her kan du skrive andre begreber som er vigtige for User Experience i din virksomhed, eller generelle uddybende

kommentarer til dine valg.

Hvor subjektivt/objektivt er begrebet User Experience for dig? (Vælg kun ét svar)

- ☐ Udelukkende subjektivt
- ☐ Mest subjektivt
- ☐ Lige meget af begge
- ☐ Mest objektivt
- ☐ Udelukkende objektivt
- ☐ Ved ikke/Ikke gældende

I det følgende spørgsmål vil vi spørge ind til sammenhængen mellem begrebet User Experience og begrebet Usability (dansk: brugbarhed). Ifølge The International Organization for Standarization (ISO) er Usability defineret som: Omfanget et produkt kan bruges af specifikke brugere til at opnå bestemte mål i forhold til effektivitet, nyttevirkning og tilfredshed i en bestemt brugskontekst.

I relationen mellem Usability og User Experience, er der 5 forskellige perspektiver. Vælg det perspektiv der er mest passende for dig/din arbejdsplads (Vælg kun ét svar):

- ☐ User Experience og Usability er det samme.
- ☐ Usability er en del af User Experience. Den gode brugeroplevelse er betinget af den gode brugervenlighed, men User Experience indeholder mere end Usability.
- ☐ User Experience er en del af Usability. Den gode brugervenlighed er betinget af en god brugeroplevelse, men Usability indeholder mere end User Experience.
- ☐ User Experience og Usability er forskellige, men hænger uløseligt sammen. Den gode brugeroplevelse påvirker den gode brugervenlighed, og omvendt. Usability er mere end User Experience, og User Experience er mere end Usability. Overlappet mellem Usability og User Experience kan eventuelt kaldes User Satisfaction.
- ☐ User Experience og Usability har intet med hinanden at gøre. Den gode brugeroplevelse er noget helt separat fra den gode brugervenlighed.

Her kan du komme med uddybende kommentarer til dit valg af perspektiv:

### 3. Evaluering af produkter i IT-virksomheder

*I det følgende vil vi spørge ind til hvordan din virksomhed arbejder med evaluering af jeres produkter, herunder med fokus på evaluering af User Experience. Når vi anvender begrebet evaluering dækker dette både over ord som måling og test.*

*Da der eksisterer mange forskellige forståelser og definitioner af begrebet User Experience (dansk: brugeroplevelser), vil vi i de følgende spørgsmål bede dig besvare disse ud fra brugen af nedenstående ISO definition:*

*User Experience (UX) er brugerens opfattelse og reaktion som følge af brug og/eller forventet brug af et produkt, system eller service og omfatter:*

- *Brugerens følelser, holdninger, præferencer, opfattelser, fysiske og psykiske reaktioner, opførsel, samt præstationer der optræder før, under og efter brugen af et produkt.*
- *Brand image, præsentation, funktionalitet, system performance, interactive behaviour og hjælpefunktioner, samt brugerens tidligere oplevelser, attitude, færdigheder, personlighed og brugskonteksten.*
- *Usability kriterier kan bruges til at vurdere aspekter af User Experience.*

Ud fra førnævnte definition af User Experience, mener du da at din virksomhed udfører evalueringer af User Experience? (Vælg gerne flere svar)

- ☐ Ja, vi udfører dem internt i virksomheden (virksomheden har ansatte som udfører UX evalueringer som en integreret del af projektarbejdet)
- ☐ Ja, vi udfører dem internt i virksomheden (virksomheden har ansatte som udfører UX evalueringer i en separat afdeling)
- ☐ Ja, dem får vi udført eksternt (virksomheden har outsourcet UX evalueringer)
- ☐ Nej, vi udfører ikke UX evalueringer
- ☐ Ved ikke/ikke gældende

- [ ] Andet, uddyb venligst

Vi vil også gerne spørge om usability. Da det også er interessant for os at få et indblik i din virksomheds arbejde med usability, vil vi også spørge om din virksomhed udfører usability evalueringer? (Vælg gerne flere svar)

- [ ] Ja, vi udfører dem internt i virksomheden (virksomheden har ansatte som udfører usability evalueringer som en integreret del af projektarbejdet)
- [ ] Ja, vi udfører dem internt i virksomheden (virksomheden har ansatte som udfører usability evalueringer i en separat afdeling)
- [ ] Ja, dem får vi udført eksternt (virksomheden har outsourcet usability evalueringer)
- [ ] Nej, vi udfører ikke usability evalueringer
- [ ] Ved ikke/ikke gældende
- [ ] Andet, uddyb venligst

Hvorfor evaluerer din virksomhed ikke på User Experience (UX)? (Vælg gerne flere svar)

- [ ] Virksomheden har ikke budgettet til det (tid/penge)
- [ ] Virksomheden har ikke medarbejdere der har kompetencerne til at udføre UX evalueringer
- [ ] Virksomheden har svært ved at få fat på brugere der kan evaluere UX
- [ ] UX er ikke en del af virksomhedens værdigrundlag
- [ ] Der mangler opbakning fra ledelsens side
- [ ] Virksomhedens kunder finder ikke UX vigtigt
- [ ] Virksomheden finder det unødvendigt at evaluere UX, men de designer med UX i mente
- [ ] Jeg finder ikke UX vigtigt
- [ ] Jeg mener ikke man kan måle på UX
- [ ] Andet, uddyb venligst

Uddyb venligst dit valg af ovenstående svarmuligheder

Hvordan udfører I User Experience evalueringer? (Vælg gerne flere svar)

- [ ] Vi bruger en eksisterende metode
- [ ] Vi har udviklet vores egen metode
- [ ] Vi kombinerer værktøjer og teknikker til en skræddersyet metode til hvert projekt
- [ ] Andet, uddyb venligst

Hvilke af følgende tre User Experience evalueringskategorier udfører I, i virksomheden? (Vælg gerne flere svar)

- [ ] UX tests med brugerinvolvering
- [ ] UX tests med ekspert evaluering
- [ ] Der udføres UX tests blandt udviklerne af produktet
- [ ] Andet, uddyb venligst

Hvilke af følgende User Experience (UX) evalueringsmetoder har du hørt om og hvilke bruger I, i virksomheden? (Vælg kun ét svar for hver metode)

| | Ikke hørt om | Hørt om, men bruger IKKE i virksomheden | Hørt om, og bruger i virksomheden |
|---|---|---|---|
| Experience Sampling Method (ESM) | ☐ | ☐ | ☐ |
| The Subjective Mental Effort Questionnaire (SMEQ) | ☐ | ☐ | ☐ |
| QUIS Questionnaire | ☐ | ☐ | ☐ |

| | | | |
|---|---|---|---|
| Day Reconstruction Method | ❑ | ❑ | ❑ |
| Expressing Emotions and Experiences (3E) | ❑ | ❑ | ❑ |
| The Positive and Negative Affect Scale (PANAS) | ❑ | ❑ | ❑ |
| The Sensual Evaluation Instrument (SEI) | ❑ | ❑ | ❑ |
| The Usability Metric for User Experience (UMUX) | ❑ | ❑ | ❑ |
| User Experience Questionnaire (UEQ) | ❑ | ❑ | ❑ |
| UX Curve method | ❑ | ❑ | ❑ |
| SUXES | ❑ | ❑ | ❑ |
| Emocard | ❑ | ❑ | ❑ |
| Self-Assessment Manikin (SAM) scale | ❑ | ❑ | ❑ |
| SUS scale | ❑ | ❑ | ❑ |
| Attrakdiff og/eller Attrakdiff2 | ❑ | ❑ | ❑ |

Bruger I i virksomheden andre metoder til evaluering af User Experience?

Kender du andre metoder til evaluering af User Experience?

Ud fra hvilke kriterier udvælger I en UX evalueringsmetode i virksomheden? (Vælg kun ét svar for hvert kriterie)

| | Meget uenig | Uenig | Hverken enig/uenig | Enig | Meget enig | Ved ikke/ikke gældende |
|---|---|---|---|---|---|---|
| Hvor lang tid metoden tager at udføre | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| Hvor mange ressourcer metoden kræver | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| Hvornår i udviklingsprocessen metoden kan anvendes (konceptniveau, prototyper, færdige produkter) | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| Typen af resultater metoden giver | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| At medarbejderne kender metoden på forhånd | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| At der er adgang til testbrugere | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |

Andre kriterier der påvirker udvælgelsen?

Hvilken slags resultater er I mest interesseret i at få fat I ud fra en User Experience evaluering? Hvor kvalitativt er kendetegnet ved uddybende svar, og kvantitativt er kendetegnet ved statistiske svar. (Vælg kun ét svar)

- ❑ Udelukkende Kvalitativt
- ❑ Mest Kvalitativt
- ❑ Lige meget af begge
- ❑ Mest Kvantitativt
- ❑ Udelukkende kvantitativt
- ❑ Ved ikke/Ikke gældende

Hvordan bruges resultaterne fra en UX evaluering i virksomheden? (Vælg gerne flere svar)

- ❑ Til at modificere det nuværende projekt/produkt
- ❑ Til fremtidige projekter/produkter
- ❑ Til opsamling af viden omkring godt UX design

- [ ] Til at vise vores kunder at vores produkter har god UX
- [ ] Bliver ikke brugt
- [ ] Andet, uddyb venligst

Hvordan præsenteres resultaterne fra en User Experience (UX) evaluering? (Vælg gerne flere svar)

- [ ] Et møde hvor flere deltagere fra udviklingsteamet deltager.
- [ ] Et møde mellem to repræsentanter (fx en udvikler og en UX tester)
- [ ] Et møde med kunderne til vores produkt
- [ ] En rapport
- [ ] Andet, uddyb venligst

Hvornår i jeres udviklingsproces udfører I UX evaluering? (Vælg gerne flere svar)

- [ ] I starten
- [ ] I midten
- [ ] I slutningen
- [ ] Løbende
- [ ] Efter produktet er udgivet

Her kan du komme med uddybende kommentarer til hvornår i udfører UX evalueringer.

I hvilken grad vil du sige at User Experience evaluering er integreret i jeres systemudviklingsmetode? (Vælg kun ét svar)

- [ ] I meget høj grad
- [ ] I høj grad
- [ ] I nogen grad
- [ ] I mindre grad
- [ ] I ingen grad

Her kan du beskrive hvordan UX er, eller ikke er, integreret i jeres systemudviklingsmetode.

I hvor høj grad vil du sige at virksomheden du arbejder i har fokus på User Experience evaluering? (Vælg kun ét svar)

- [ ] I meget høj grad
- [ ] I høj grad
- [ ] I nogen grad
- [ ] I mindre grad
- [ ] I ingen grad

**4. Baggrundsspørgsmål (IT-virksomheden og IT-ansatte)**

I denne sidste del af spørgeskemaet beder vi dig om at besvare en række baggrundsspørgsmål omhandlende dig og virksomheden du er ansat i. Første del omhandler dig, hvor sidste del vil omhandle virksomheden.

Jeg er uddannet indenfor (Vælg kun ét svar):

- [ ] Menneske-maskine interaktion
- [ ] Psykologi, samfundsvidenskab

- [ ] Teknologi, software
- [ ] Kunst, design
- [ ] Andet, uddyb venligst

Hvordan har du tilegnet dig erfaring om User Experience evaluerings metoder, tilgange, værktøjer og teknikker? (Vælg gerne flere svar)

- [ ] På jobbet
- [ ] Fra en mentor (én-til-én undervisning)
- [ ] Web/internet ressourcer (blogs, web-kurser, eller lignende)
- [ ] Praktiker-kurser (fra kursus leverandører)
- [ ] Akademiske kurser (på universitetet eller lignende)
- [ ] Fagbøger
- [ ] Faglige artikler
- [ ] Andet, uddyb venligst

Hvor mange arbejdstimer bruger du på User Experience på en uge? (Vælg kun ét svar)

- [ ] 0
- [ ] 1-5
- [ ] 6-10
- [ ] 11-20
- [ ] 20+

Hvor centralt er User Experience i dit arbejde? (Vælg kun ét svar)

- [ ] Meget centralt
- [ ] Centralt
- [ ] Lidt centralt
- [ ] Ikke centralt

Hvem har taget beslutningen om at I skal arbejde med User Experience evaluering? (Vælg kun ét svar)

- [ ] Ledelsen
- [ ] Projektleder
- [ ] Udvikler
- [ ] UX designers
- [ ] Fælles beslutning
- [ ] Andre, uddyb venligst

Hvilket udviklingsparadigme befinder I jer i? (Vælg gerne flere svar)

- [ ] Agilt
- [ ] Vandfaldsmodel
- [ ] Rational Unified Process (RUP)
- [ ] Dynamic Systems Development Method (DSDM) eller variant
- [ ] Projektet for Projektstyring (PROPS)
- [ ] Intern Model
- [ ] Ved ikke
- [ ] Andet, uddyb venligst

Hvilken type produkter konstruerer I, i virksomheden? (Vælg kun ét svar)

- [ ] Udelukkende software
- [ ] Mest software
- [ ] Lige meget af begge
- [ ] Mest hardware
- [ ] Udelukkende hardware

- [ ] Ved ikke/Ikke gældende

Hvilken type produkter konstruerer I, i virksomheden? (Vælg kun ét svar)

- [ ] Udelukkende til fritidsbrug
- [ ] Mest til fritidsbrug
- [ ] Lige meget af begge
- [ ] Mest til professionelt brug
- [ ] Udelukkende til professionelt brug
- [ ] Ved ikke/Ikke gældende

Hvilken type produkter konstruerer I, i virksomheden? (Vælg kun ét svar)

- [ ] Udelukkende til private kunder
- [ ] Mest til private kunder
- [ ] Lige meget af begge
- [ ] Mest til offentlige kunder
- [ ] Udelukkende til offentlige kunder
- [ ] Ved ikke/Ikke gældende

*For bedre at kunne få overblik over de forskellige IT-virksomheder, samt besvarelserne fra ansatte fra de samme IT-virksomheder, vil det hjælpe os meget hvis du vil angive navnet på den virksomhed som du arbejder hos. Virksomhedsnavnet vil kun bruges til at kunne skelne de forskellige IT-virksomheder fra hinanden og vil derfor ikke blive opgivet i senere publiceret materiale.*

Din virksomheds navn:

*Hvis du kunne være interesseret i at få resultaterne fra vores landsdækkende undersøgelse af UX i danske IT-virksomheder, vil vi bede dig angive din email-adresse således at vi har mulighed for at sende disse.*

E-mail

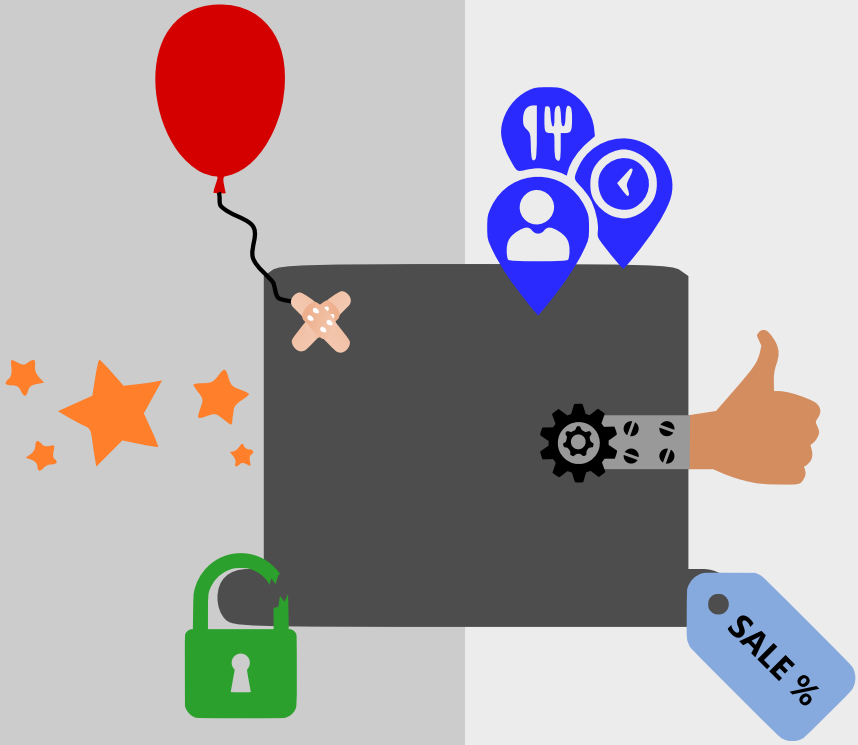
Mange tak for din hjælp til vores projekt.

Vi vil slutteligt bede om en enkelt tjeneste mere, nemlig at sende linket til vores spørgeskema videre til andre medarbejdere i danske IT-virksomheder som du er bekendte med.

Linket hertil finder du i den email vi sendte til dig.

OBS. Husk at trykke "afslut" for at registrere dine besvarelser.

AALBORG UNIVERSITY




MASTER THESIS

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