



## **The impact of AI in the field of UX**

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## Abstract

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Technology advances at such a fast rate. Apps spring from digital space like mushrooms from the forest floor. Artificial Intelligence and Machine learning contribute to many of these processes. Apps that learn the users' behaviour and act, in most cases, accordingly to the needs and wants. At the same time, this added complexity adds to the need of a smoother interface that can be easily navigated by people from all over the world, with different understanding of technological concepts.

This thesis researches whether the aforementioned Artificial Intelligence is at a sufficient point to take over many tasks in regards to creating these User Experiences. It describes what AI and UX are as a concept and how they may work closer together in practice.

In order to answer this, I have chosen to use a literature review in combination with a series of semi-structured interviews with professionals in the field.

The results of this study indicate that AI is far advanced and potential for the future is vast. People are generally positive about AI and the contributions it could make, at least in a supportive capacity. It is also agreed that UX has become more important and the field is considered vastly more important these days than before.

Artificial Intelligence could, is and will continue to make a big impact on UX design. Research and personal interviews indicate that the field is already changing rapidly and trivial tasks, such as scheduling, basic frameworking, etc are already in many cases handled by Artificial Intelligence.

The Impact of AI in the field of UX is growing and will continue to do so.

**Keywords**

AI, UX, Affective, Over-The-Air, UI, Design

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## 1 Introduction

This thesis will talk about the influence that Artificial Intelligence (AI) has on the concept of User Interface Design. In recent years, AI has, in many ways, become a large part of our society both seen and unseen and takes a more prominent place in our society as we move forward. For example, we can now order and track our packages through devices such as Amazon Echo which uses the AI assistant Alexa (amazon.com, 2021), we can ask our smartwatches about tomorrow's weather forecast to see if we can go on that fishing trip, and we can set up our entire schedules by speaking to our smartphones and letting them know about lunch dates, meetings, and anniversaries. The aim of my thesis is to find out if Artificial Intelligence can be used to take over the process of designing a User Interface with no or minimal input from a human user, based on a variety of factors such as personal preferences, calendars and even moods. It is my belief that AI can be used to (almost) instantly create a variety of great designs based on user preference after we teach it what a good design should look like based on the preference of an individual user. I will do this by looking at Artificial Intelligence, User Experience design, Affective Computing and Over-the-air technology and the interplay between these technologies and concepts.

AI and the development of a proper User Experience is an important topic as currently this is done over a long period of time by a group of individuals and involves; extensive testing, finding willing test participants, designing multiple different prototypes, and having multiple people work together. I have experienced this method through personal experience in an academic setting. Working in a group, awaiting answers and results from third party applicants, turning these answers into practically applicable information, creating several prototypes, having these prototypes tested by third-party individuals, fine-tuning these prototypes, and then bringing out a finalised version takes a long time that could be reduced by removing or cutting back on the human element. This could also remove frustrations over the (lack of) quality in answers and responses from users. When we progress, as we have seen in the 20th and 21st century, the lines between human and technology become blurred and this can lead to a new revolution not seen since the Industrial revolution. This latest, or fourth industrial revolution is led on by the present internet in our daily life and the presence and use of AI and Machine Learning (Schwab, 2016).

The practical applications this could lead to in other fields, and the examples of practical applications in other fields such as the automotive industry cannot be underestimated and will be reflected upon in this thesis as well.

The benefits that a single AI could have in taking over these tasks are manifold; first the financial benefits can be rather substantial as a whole team of people can be replaced by a single machine that can earn back its investment over time. The many hours spent by a team of various people with many differing opinions can also be shortened to a space of mere minutes. The condensing of this work will be a great benefit to the customer who can ask for a specific set of things which a machine-learned AI can then provide. And the ability to switch UIs on the fly or have multiple ones for multiple purposes that cater to the needs of the individual becomes much easier.

Companies and users will be able to experiment more and enhance creative freedoms and customer engagement. User interfaces no longer must be static and come in a one-size-fits-all form but be dynamic and able to alter themselves based on individual user wishes and information gathered about users as they browse a website. The User Interface could consider how much time users spent on different pages, which products a user buys or puts on their wish list for a potential later purchase as is already possible and well implemented across numerous services on the internet. The UI could change to reflect this and scale itself in order to sell more products or improve interaction with a customer on the fly. We can also use this for other purposes such as changing UIs based on the time of the day, the time of the year and include holiday events in the user's geolocation. Special events that are personal to customers can also be considered such as birthdays, anniversaries, etc.

What this thesis aims to do is give the reader an overview of the current state of Artificial Intelligence, Machine Learning, User Experience, User Interface Design, Affective Computing and many of its fascinating aspects and Over-The-Air technology for easy sharing of information and updates. A view of the combination of these various technologies and an overview of the interplay that could lead to new technological applications in the future will also be taken.

## 2 Theoretical Framework

### 2.1 What is Artificial Intelligence

#### 2.1.1 History

The history of AI is as complex as it is interesting. Artificial intelligence describes the new field of studies, which was first created in 1956 at Dartmouth College in New Hampshire (Lewis, 2014). This came after fictional examples of Artificial Intelligence were created in literature (Baum, 1900; Čapek, 1921 and Lang, 1927). Humankind had been dreaming of the possibility of having human thought in non-human machines for over 2000 years (Reynoso, 2021). Development of Artificial Intelligence went more rapidly in the 50s and 60s of the 20th century. Several breakthroughs made were, among others; the development of a checkers game that could learn independently, the development of LISP as a programming language, still most popular when working with AI today, the first Industrial robot that could perform tasks by itself, the creation of ELIZA a faux psychotherapist believed by many to be self-aware, the creation of the first natural language programs (Reynoso, 2021).

After beautiful dreams of a near-future filled with science fiction-like objects, it turned out that the field would not develop quite as fast (Lewis, 2014). It is believed this happened because the initial hype was built up too much after a machine was invented that could translate from one language to another. This machine could, however, only recreate a certain number of phrases and its usefulness was quickly discarded (Schumann, 2019). This report and its findings were in part what caused the first AI winter, which is a period in which specific technological advances in AI were at a (near) stand still (Lew and Schumacher, 2020). A second winter took place after the optimism of the early 1980s, where cyborgs were shooting up bad guys on the silver screen (Verhoeven, 1987) and clever robots on television and cartoons were used to sell toys to masses of children. The very limited real-world application and progress in the technology led prominent members of the scientific community, such as the director of DARPA (Defence Advanced Research Projects Agency) to speak out and thus the overall income towards advances was halted for the second time (Schumann, 2019).

### 2.1.2 Rejuvenation

We owe the renewed interest in Artificial Intelligence to several popular advances and an emergence of AI related technology in the mainstream. Yves Saint Laurent is a brand that is popular for fragrances amongst other things and has incorporated AI in one of their latest fragrances for example (Lew and Schumacher, 2020). This is further expanded upon below by touching upon a few of the most common examples of AI those humans have a great interest in without maybe even knowing it. Netflix, with its machine learning to dictate what the user would like, is very popular. According to Netflix, the recommendation engine they have is in fact worth around a billion dollars (McAlone, 2016). This is an interesting testament to the staying power and ubiquity of Artificial Intelligence that is already guiding and steering people.

Amazon has great success with its Alexa personal assistant, which can be found in the homes of a great number of people. Alexa is by far the most popular assistant in the market and continues to learn new skills at an exponential rate (Policy-advice, 2020). The great advantage Alexa has is that it provides a very positive user experience. Alexa does this in a minimalistic way, by accepting spoken commands and turning them, on the fly, into actions that require zero extra effort on the part of the user. Users come to accept Alexa as part of their everyday life and the engagement can be quite high. It is highly mobile and can be placed anywhere, and the functionality can be further enhanced with extra hardware (Austin, 2017).

Artificial Intelligence and its other facets are, according to the previously mentioned examples, and more businesses make use of the technology. According to a study amongst 250 business executives that have practical experience with AI technologies, the three top choices for integration of cognitive processes were freeing up the workforce to be more creative by automating certain tasks, the optimisation of internal operations and enhancing features and products (Davenport and Ronanki, 2018).



### **2.1.3 Machine Learning**

Machine learning is a rapidly growing discipline that has fantastic future potential (Zhang and Neimith, 2018) also in the field of UX design. There are several different ways in which machine learning is used in practice, such as supervised learning, unsupervised learning, and semi-supervised learning. For each of these different methods data is used, either in a labelled and rigorously checked subset or as loose data in which the machine can discover patterns (IBM Cloud Education, 2020). A fascinating evolution of Machine Learning is Deep Learning, a deep learning program that uses sets of digital and audio-visual imaging to learn how to differentiate between different objects, colours, concepts, etc. This can then be applied to individual persons on a macro basis to learn their preferences (Nvidia, 2021).

### **2.1.4 Trust / Mistrust**

According to several US consumer surveys, a very large part of the population of that nation is very distrustful of Artificial Intelligence and does not trust it to control several important processes that would benefit from this technology. The promises made by leading figures and concepts in the field of AI also has caused scepticism caused by the unfulfilled promises that have led to disillusionment with the technology (Davenport, 2019).

When it comes to trust, there are two kinds when dealing with online transactions, that is general trust which relates to e-commerce in general and public's acceptance of purchasing, paying and security online and there is specific trust which deals with a particular instance of a website or app. Making a consumer feel trusted is also known to increase their spending. (Nagy and Hadjú, 2021)

Another issue that can give mistrust is the fact that people worry about the potential loss of job and income. Having a job that previously was done by several employees now being done by a single machine has given rise to this mistrust. This process is not new however as automation and evolution of jobs and workforce can be traced back far throughout history in which basic automation and inventions led to new jobs arising and people retraining to fill those jobs. The speed at which changes take place is higher now however and it is up to people to anticipate these changes and work with them instead of against them [Rod, 2017].

### **2.1.5 Potential for the future**

As we get closer to reaching a permanent state of ubiquitous computing, we will see many changes in the decades to come that will blur the lines between computer- and human interaction. Virtual assistants and AI will ingrain itself in our lives and take over roles that used to be done by humans for themselves or other humans (Lew and Schumacher, 2020). In four years' time the use of AI in business life has increased by more than 270 percent (Stahl, 2021) In her article, Ashley Stahl lays fear of a general takeover of our jobs by AI to rest. She states that AI for now is highly specialised in singular tasks and that yet, it does not have the generalised intelligence of humans to take on multiple larger tasks with the same accuracy (Stahl, 2021).

AI Systems learn from datasets and thus it makes sense that with the gathering of mass amounts of data, Walmart for instance contributes 2,5 terabytes of data per hour, our machines learn and grow at an exponential rate, thus enabling it to learn faster and more (Shankar, 2018).

## **2.2 What is User Experience**

### **2.2.1 An overview**

UX stands for User experience and the abbreviation may already hold enough of an answer to complete this topic, but a little more information may be enough to further justify the complexities. Each of us, no matter our age, culture, or social standing, create design experiences all the time by the things we say or do or live. In our jobs, we design experiences, and when we are out and about, we live and live out our (design) experiences. User Experience (UX) is a concept first named as such by Don Norman, who was working for Apple in 1993 and just as Edward Stull (2018) thinks everyone was already doing, it asked designers and developers to look at new products as experiences (Lew and Schumacher, 2020; Stull, 2018). In its current stage, UX design is a lengthy process that can be set apart in a variety of steps that include many deliverables. We have our personas, ideation phase, storyboards, various stages of prototypes and then we write a report as well that details the success of the design (Komninos, 2020).

Why do we need User Experience as a discipline, however? According to Jakob Nielsen (Nielsen, 2016), the technical expertise of the average user is far below that of the average designer. This can lead to a conflict between what is desired of a design by the user of a product and what is eventually presented by the designer of the product. When designing for a user, it is important to keep in mind that people are unique individuals from differing backgrounds and with unique skill sets that they've gained throughout life. What is simple for one person can be complex for another. Making sure to keep this in mind when designing will lead to better results and this, among other factors is why User Experience is an important, continuously evolving and constantly appreciated discipline [Nielsen, 2016].

### **2.2.2 The Complexities of Modern-Day UX Design**

When discussing the previous topic, I briefly touched upon the importance of UX, and this also leads into certain complexities that are present in the field. There are, however, other factors that make the design and implementation of a properly tested UX system a complicated procedure.

There are many steps involved in getting from a concept to a finished product. Other complexities stem from experience on behalf of users. Currently, after we've become used to the internet and it being all around us, I think that trust is still a difficult issue for certain people when using the internet. Past experiences and stories fed to us by the media that tell of criminals that robbed people of all the money they have are still very widely shared, even though a large amount of these stories is fake or overblown. Trust is therefore a very big obstacle to overcome. It is therefore important that we design with that trust in mind (Lew and Schumacher, 2020).

What UX designers set out to do is take a complex problem and divide it into more easily manageable sections (Ippen, 2019). Generally, the tasks of a UX designer are diverse and plentiful. There are a great number of deliverables that must be handed in on a deadline. Such as Personas, storyboards, and Journey maps, then follows a number of brainstorming sessions in which ideas are kicked around by various people which is followed by a user flow diagram. When this is done more hands-on work takes place such as Site Mapping, low and high-fidelity prototyping and eventually an interactive prototype for which users must be invited to test

them. Based on these tests, reports are written and after these, the final version might be made (interaction-design.org, 2020).

### **2.2.3 The Future of UX**

Writing about the future of a concept requires a healthy amount of speculation, but by looking at the past we can with some certainty make accurate predictions. As of the writing of this thesis the world is in the grips of a global disease that accelerates the need for better interfaces and work in the field is in high demand. A few fields to focus on will be Artificial customer service and bots that help us with basic and more complex problems that we experience. Furthermore, we will see UX on more devices than the standard ones, such as cell phones, televisions, and computers. Interoperability will, speculatively, also become an ever more important point of focus (May, 2021).

Another important aspect will be further market segmentation with personalised User Interfaces. This will categorise users and allow companies to focus on particularities of different groups of users that share commonalities for better direct marketing (Smith, 2021).

## **2.3 Affective Computing**

### **2.3.1 An Overview**

Affective Computing (AC) is a field of diverse disciplines that emerged over two decades ago and among its aims is studying the interaction between humans and machine technology (Calvo, D'mello, Gratch. Kappas, 2014). A particular emphasis in affective computing is placed on the recognition and structure of emotion and how this can be analysed and acted upon by computers (Picard, 1997). In this book she states that the advance of studies into emotion have been closely tied to developments in affective computing as we understand it today. This shows that technology and progress are a two-way street beneficial to multiple disciplines.

### **2.3.2 Application**

It's natural for us to wonder what this new technology can be used for. In his article '24 Affective Computing (Emotion AI) Applications / Use Cases' (2021), Cem Dilmegani created 24 scenarios in which this technology can be applied. Several categories are Marketing, for its use in measuring how people respond to certain factors and strategies can therefore be optimised to reap greater success. For this same reason we may also find it applied to Customer Service, Human resources, and retail. This allows us to understand better the people we work with and their honest reactions and desires. We can use this to assist us in making better decisions on the fly that appeal more to people and tell us whether a person would be a good fit. The technology would not only help us to sell more, understand customers more and measure different levels of emotion, cognition, etc. It can also assist us in more important tasks, such as driving and healthcare fields. (Dilmaghani, 2021)

It also has a great value as a tool to help people however, it can help us come to realisations about ourselves and it can help us realise things about ourselves. Affective Computing technology can be used to measure people's moods, stress levels, heart rates and the correlation of these various factors to determine what and how people reach certain levels of anxiety, stress, and relaxation. (Picard, 2014)

### **2.3.3 The State of Affective Computing**

At present we use technologies such as computer vision, which entails the recording of a person's features for study, acoustic processing to record a person's speech patterns, pitch etc, and computational psychophysiology which measures a person's bodily and physical reactions in response to psychological stimuli (D'Mello, Kappas, Gratch, 2017).

### **2.3.4 Ethics**

One stumbling block in the development of Affective computing as it exists today is the fear of privacy loss on the side of everyday people that would function as the targets for this technology. Furthermore, differences in culture, gender, social structures, and race may also halt progress or cause a need to revise Affective Computing strategies. (Purdy, Zealley and Maseli, 2019)

### **2.3.5 The Future of Affective Computing**

The future of Affective Computing is very much tied to the other concepts discussed so far. The advancements in AI and in particular deep learning will also see a difference in the potential, strength, and practical application of Affective Computing. As we keep building stronger, better, smarter, and faster algorithms these algorithms can be used for a multitude of purposes. The increase of their use in Customer Service to detect how someone is feeling or even predict what someone might need or say will make the jobs of humans easier and will streamline certain processes (Mar, 2017). What's more is that according to analytical speculation, it is said that Affective Computing could become a 25-billion-dollar business by 2023 (Future Today Institute, 2021).

## **2.4 Over the Air Computing**

### **2.4.1 An overview**

Over-the-air computation (AirComp) is a recent technology that was developed as a replacement for standard practices of communication with an eye on the future and the highly increased mobile devices and increase in machine as opposed to human interaction. What this technology does in essence is make more resources from already existing wavelengths available to computational devices and thus increase the speed of transfer, which will be able to happen simultaneously by sender and receiver. (Guangxu Zhu, Jie xu, Kaibin Huang, Shuguang Cui, 2020)

### **2.4.2 Practical Application Over the Air**

There are some practical applications of Over-the-air technology in the automotive industry. Practicality seems to be the main motivator for the advance of OTA technology. It's a massively cost- and time saving measure. Instead of consumers needing to go to a certain place, an update can be published and immediately sent to a large group of individuals. It makes sense that the automotive industry is one of the first to adopt this as safety is of the utmost importance. (Choksey, 2021)

Another practical application comes in terms of safety. A much-needed safety feature can be pushed to a device to users with less experience who have turned on their Automatic Update, and therefore even the people with the least amount of computer experience are always kept safe. This too goes for very remote devices,

such as measuring devices which can receive automatic security patches and potentially new features without the need to go out to them. (Mixon, Steele, 2020)

## **2.5 Combining Concepts**

### **2.5.1 Towards an AI based User Experience Design**

Artificial Intelligence and User Experience benefit a great deal from each other already, but in practice, good UX design is necessary for AI to live up to its full potential. AI holds a lot of promise, but to fully let it bloom and be accepted by a more general population, it needs to be more than a futuristic concept. Having the most amazing technology at our fingertips is nothing if a system is not put into place that allows the average internet user to manipulate and work with it. This is what the importance of good User Experience Design in AI boils down to. An AI may be able to do a million things, but if a user can't access these things, is it time wasted or time gained? There will never be general acceptance if a great product is diluted by too many features. It is best to put on the forefront those features that work. (Lew and Schumacher, 2020)

On the other hand, Artificial Intelligence can also be beneficial to creating a good UX design. Deep neural networks with accurate data on user behaviour from a large group of participants can be used to simulate user behaviour on various apps, websites etc. This can be used to assist in the creation of various internet products. Such features are as of yet unfortunately still heavily underutilised (Yang, Wei and Pu, 2020). Automation is an AI feature that can enhance a UX as well. Being able to automatically crop, adjust, edit and resize certain aspects that are user input or automatically generated can lead to better and more satisfying results. It can also help with colour adjustments on websites based on location, date and background light and lead to a much more personalised experience for improved engagement. The design process can also benefit from AI assistance. User Data and previous designs can be used to create flowcharts, wireframes and other more complex processes. Questionnaires can be auto-generated, send-out and its answers analysed with the right tools, all cutting down on time spent by the designer. The fear of replacement of employees by machines can be allayed by the fact that humans are needed for the creative element and final decision making (Donahole, 2021)

### **2.5.2 Affective Computing and Machine Learning**

Machine learning can be used to interpret and learn human emotion, complementing and supplementing Affective Computing as a field. Machine learning learns with practice. This can be done by having users fill out questionnaires about emotion and letting them answer questions.

When data gathered from Machine learning is checked well, psychological research models can be applied to them. To gather user information, we can use Visible Input techniques, such as keystrokes and mouse movements and invisible inputs, such as brainwave measurement and dermal measurement units. This information can be fed to a machine learning program which in turn improves affective computing ability to measure emotional states. (Bose, 2020)



### **3 Research Methodology**

During this chapter I will present the selection of the method I chose, the sources of information I have used, and I will describe how I will analyse and assess this information.

#### **3.1 Research Methods**

Two research methods will be used in this thesis, namely a literature review and a semi-structured interview to answer my research question “How can the impact of AI change the field of UX from a user-dominated to a machine-dominated one?”.

##### **3.1.1 Literature Review**

A literature review can come in different shapes and sizes depending on the need for the literature review. A literature review puts emphasis on both your own awareness and knowledge of an issue as well as your knowledge in how to construe and notice a lack of information or a gap in general knowledge. Often this can be done by offering fresh or personal viewpoints (Jesson, Matheson and Lacey, 2011). In the case of this thesis, at the start several topics were set apart that were covered in the theory section and then handled one by one. After doing this the interplay between the various topics was explained.

##### **3.1.2 Semi-Structured Interviews**

The semi-structured interview is a method that mixes open ended questions with close ended questions, for a tight experience that is still flexible enough to offer interviewees a chance to expand upon their answers and experience (Newcomer, Hatry and Wholey, 2015).

For this thesis, a semi-structured approach to the interview is desired as a semi-structured approach gives room for input from various people with different professional and personal employment backgrounds who have various experiences with UX design and Artificial. This will provide more insights into matters. It also helps in seeing how people with different levels of experience and familiarity with technology view and approach different programs that could benefit from AI assistance or improved UI design. To help me conduct these interviews, I will be using an interview guide, which can be found as Appendix 1.

An interview guide is an important tool for keeping focus, writing down the topics that need to be discussed and having a structured approach for doing so in an orderly manner. It being a guide means there needs to be a certain degree of flexibility to keep the interview from feeling stiff and forced. (Bird, 2016)

Questions are asked regarding User Experience and the difference between machine-driven and human-driven design approaches. Questions are also asked about the interviewees' personal views regarding the changes in UX they've experienced.

Drawbacks of a semi structured interview, based on the scope of the research can be that they are time consuming and that generally a large subject group is needed for conclusive evidence. These setbacks are offset by the ability to get broader information, the element of shame by sitting with peers is removed and can thus be more candid. (Newcomer, Hatry and Wholey, 2015)

### **3.1.3 Why were these methods chosen?**

Why choose both methods if one could suffice? A combination of thorough research with practical experience from users in the field can provide more valuable and up to date information. Conclusions can be drawn from the written words of experts in the field who often have lifelong experience with a subject. This can also lead to having tunnel vision and therefore it is important to talk to people who do not have this lifelong experience in one field but are (very) familiar with its daily application. This gives this thesis a broader perspective.

To understand why UX design could be done by Artificial Intelligence instead of extensive human labour, I will use a literature review as a research method. Literature reviews are used more and more often, especially regarding the social sciences (Davis, Mengersen, Bennett and Mazerolle, 2014).

### 3.2 How the interviews were conducted

Four of the five interviews were conducted virtually, via either Zoom meetings or Teams meetings. The interviewees were asked beforehand through a variety of channels, including the internet, email, and direct messages to take part in the interview. Two of the respondents were found on Linked-in UX groups. One of the interviews took place in person at Haaga-Helia UAS. All the reviews were recorded after seeking and receiving permission for this by the interviewees.

*User Profile Table:*

Participant	Experience in field	Job Title	Gender	Age
R1	20+ Years	Researcher, Teacher	M	40 – 50
R2	20+ Years	Teacher	M	40 – 50
R3	3 Years	UX Designer	F	18 – 30
R4	10+ Years	Lead Designer	F	30 – 40
R5	15+ Years	UX Designer	M	40 - 50

### 3.3 Analysis of data

#### 3.3.1 Literature review data analysis.

For the Literature review portion, I searched through databases and used virtual search tools for a list of specific keywords, such as UX, AI, Affective Computing, and a variety of combinations of these keywords together. A list of good results, the ones that can be viewed in the list of references references, and then grouped them based on usefulness and grouped by subjects, such as AI, UX, UI, Affective Computing, Over-The-Air Computing, etc.

Afterwards, this information was gathered, grouped, and imported into a note-taking tool to collect similar points from various books, articles, and studies. These parts were used for the theoretical framework of this thesis. Several entire books were also read to increase overall understanding of the field and concepts before gathering data was started, to make sure of an increased understanding of the

subjects and thus an easier time would be had discussing them throughout this thesis.

### **3.3.2 Interview data analysis.**

After the interviews, an AI-based transcription software called otter.ai was used, which was edited after completion. Five documents were combined after transcription was complete and highlighted various subjects, such as AI, UX, UI, Future Development, Pros and Cons, in the interviews in different colours to group them together. After grouping them together a summary was written of the information contained within and then further grouped them together by subject to use for the ultimate conclusions. From these files, information was gathered that was necessary for the interviews.

### **3.4 Reliability and Validity**

I have interviewed five respondents for this interview who were at the time of the interview at different stages in their careers. These careers were all related to UX and / or AI and the respondents had a combined experience of at least 50 years in the fields. Two of the people interviewed, R1 and R2 are educators with a long history in AI and UX and with unique specialisations in their separate fields. The interview used a standard set of questions that served as a guideline for the interview, which can be found as Appendix 1. The research materials I used for the research part were (peer-reviewed) scientific articles, books, and articles.

*Reliability* is a tool used to gauge in how far a result can be reproduced.

These measures how a result can be replicated by different people, studying material at different times. What is important to notice is that reliability counts for the duplication of the work that has been done, which copies the results achieved and does not naturally guarantee the quality or a correct result.

*Validity* on the other hand checks whether a specific thesis or other research work checks if the results are correct and if they correspond with other conclusions reached in the field. (Middleton, 2019)

## 4 Results

In this chapter, both the results of the literature review and the interviews are presented.

### 4.1 Literature Review Results

As we can already see with very popular products such as Netflix and Amazon, AI is already incorporated into UX in a big way. Users may not be a hundred percent aware that the recommendations that are provided for them when they open the UX's of these favourite products are handled by a machine that learns about their habits. Netflix's recommendation engine is worth around a billion dollars to the company itself and is a testament to how profitable the technology can be. Alexa is constantly being updated and learning new skills, it is minimalistic and operates in the background at the beckoning of the user. Engagement can be high and users gladly welcome Alexa into their homes, cars, and offices, even going as far as to buy supplements that can enhance the features of the device. (Merritt, 2017) We pull out our phones and speak to Siri, google and other such bots as if it were the most common thing in the world, all the while giving away parts of our privacy and persona.

A lot of this learning about us is done through machine learning and deep learning technology. User information is gathered by saving their clicks, pages, favourites, and purchases. Collecting this and studying it is what helps machines learn more about personality types and individuals, which then can be used to set up highly specified advertisements, personalised deals, and other macro-targeted content. Many studies that can be found online point towards this being a growing trend. (Fortune Business Insights, 2021), As more companies and individuals realise this is a great way of targeting consumers. I believe this in part shows that there is a trend of services going from user-dominated to machine-dominated ones. In fact, in four years' time, the use of AI in business life has increased by more than 270 percent. (Stahl, 2021)

We are getting ever closer to a state of ubiquitous computing (the internet of all things) and the lines between human and machine keep getting blurrier. Virtual assistants, AIs and bot supported chats, helpdesk and sales are part of our daily lives at an ever-increasing rate.

The way Artificial Intelligence systems learn, whether it is through supervised learning and specific, pre-defined batches of data or unsupervised learning, we can see the amount of data being gathered on us grow exponentially. 2,5 terabytes of data per hour for a single, multinational is not unheard of. And as we keep gathering more and feeding more to machines, more patterns will emerge from said data. (Shankar, 2018)

Trust remains an issue in this specific field of studies however with many people eyeing AI and this emerging technology with suspicion. Laws are drawn up to limit AI in certain ways. Unfulfilled promises and unattainable dreams in AI research have caused scepticism amongst people as well.

The way we handle UX design now can be a cumbersome process. It has been shown that AI, with its dependency on deep learning could potentially reduce this time by a significant amount. Human oversight might still be required for the foreseeable future, but technological leaps are made in terms of AI being indistinguishable from human-created content. As can be seen in certain call-centres that use machine operated workers. Machines might more easily pick up on differences between users, by learning their specific patterns and work operations. Technical expertise is often overestimated, and machine learning can help in determining the skills of an individual and assist the user by adapting a UI. This in turn can also go the other way around. A highly skilled user might want very different things than the average user.

UX designers take the UX as a problem and subdivide it into easily manageable sections (ippen, 2019) a machine could do this as well and focus both on learning more about these individual parts and will have a better view of the overall picture as it can process all parts at ones and has more information stored about how specific users, use the technology. Machines can also make quicker adaptations when plans are not approved by a consumer.

Affective computing can make a large difference in the way machines transfer information to a user and in what way. It will allow a machine to mimic emotion and read emotion in humans. This will help in adjusting a UI to the mood of a person. This technology can be used to measure moods, stress, heart rates and slightly

manipulate settings to bring the user in a specific mood which can lead to positive results in sales, engagement, and brand loyalty.

## **4.2 Interview Results**

The results are presented by dividing them under different themes.

### **4.2.1 Results: Human and AI**

The result from the interviews regarding the human perception of Artificial Intelligence for the future regarding User Experience Design and User Experience understanding shows that most respondents believed that the overall perception by humans is that a human element is still too important. The respondents want the human touch in their online experiences as R1, R2 and R3 stated in their interviews. It is believed human psychology; the human concept of the soul and human emotions cannot be fully implemented by machine technology or artificial intelligence at this moment in time.

Humans, according to R2, will believe that when something is created artificially, it falls behind the creation of a human in terms of emotional response and the element of trust in the creation of a software, concept or response in humans generates much larger levels of trust.

Respondent R4 in contrast believes that the reason AI is not fully accepted yet is because the human intelligence of the common person at this time falls behind in understanding but will grow within the next decade as general education becomes more available.

On the other hand, R5 believes that humans will become more dominant in the User Experience field and that human User Experience Designers will be further appreciated and grow into administrative and leadership roles and that, therefore, there is less room or need for Artificial Intelligence to fill in the gaps left by humans.

Lastly, R1 and R3 agree that humans are far more valued in the industry currently than they were before from personal work experience.

#### **4.2.2 Results: Machine and AI**

The Machine and User Experience future part of the interview showed that the respondents generally have faith that AI is going to play a big role in the industry in the coming years as the current trend of using AI in variety of different fields of employment will continue to grow and so will the development of software applications and websites that make use of a variety of AI technologies, such as Machine Learning and Deep Learning. R1 believed that affective computing and emotions will play a big part in things to come regarding Artificial Intelligence. R1 states, in agreement with the idea behind this thesis, that AI will be able to intuitively respond to users' moods and needs. R1 states, however, that more research and time is needed for this to be able to be implemented. Additionally, R2 states that he believes a lot of our jobs will be done by AI in the future and that the landscape will change based on that, but that as new jobs appear as they always have, there should be no cause for concern about potential human unemployment.

According to R3, who told of an example of AI in practice in the art community, a designer who created many logos and gained a lot of fame in her home country, was later found out to be an Artificial Intelligence, lending to the theory that we are at or near the point of passing the Turing test. And finally, R4 and R5 believe that AI could be used to save time and take over tedious tasks and believe that AI will take on more of an assisting role in daily life.

#### **4.2.3 Results: Worries and AI**

This part discusses about the overall potential worries regarding Artificial Intelligence heavily disrupting the job market and taking over human jobs.

Of the five respondents to this question, there is only one that has worries for the future. Others, such as R1 and R5 believe that AI development going forward is or is kept more stagnant. Also, R5 points out that getting from 0 to 92 percent in terms of the abilities of Artificial Intelligence in assisting us or developing itself has been much easier than making progress going forward. So, getting from 92 to 92,1 will take a large amount of research and the results may not be that impressive.



Furthermore, R1 mentions that developing all our current knowledge has taken so much time and has had so many growing pains that we should not start this all over again with AI learning and making mistakes like we did. R2 mentions that human trust and acceptance is not ready to allow AI to develop beyond a certain point and mentions that when it comes to trust, we will, at least for the time being, prefer a human over an Artificial Intelligence. He mentions that if a company is making a superior product through AI that the public could still prefer a company that can provide the mythical human touch. Also, R3 has worries for the future based on the speed with which AI is developing and being trusted and implemented by larger companies in the UX industry in which she works. R3 hopes and would prefer to work in conjunction with Artificial Intelligence to create a superior product that consists of human and machine intelligence.

#### **4.2.4 Results: Benefits of AI**

The interview with R1 started with him offering very good and robust applications that would make the process of transcribing easier and would help immensely with the large amount of data in my interview. So right out of the gate, the importance and benefit of AI was highlighted before the interview even properly got underway. After this, R1 described the benefits of Affective Computing, which is a branch of AI research that investigates human emotion and the stimulation and simulation of these emotions by machines. AI plays a big part in this according to R1 as AI can (machine-)learn different principles, emotional variables, and act on these in a near-instantaneous manner. The manipulation of emotions will lead to a higher engagement and satisfaction. This is a benefit that AI has over humans, the near instant processing capabilities.

Furthermore, R2 agreed in general terms the same benefits of speed and accuracy that comes with applications benefiting from AI, he further claims there are no limits to the skill increases of computers and thus AI might develop much further without or before hitting a roof. R3 sees a great deal of potential in AI-assisted software that will enable machines to take over large amounts of menial labour so that time can be freed up and actively uses similar programs regularly, R4 and R5 agree with the fact that AI will be able to free up more time for other tasks. Another benefit that R3 mentioned about AI is that it never tires, or experiences burnout as opposed to humans.

#### **4.2.5 Results: AI and UX**

As a general overview, the vision of interviewees of Artificial Intelligence and its relevance in the field of UX Design, most respondents agreed that AI will play a big role in assisting in the creation of user experiences. R3, R4 and R5 all mentioned specifically that Artificial Intelligence assisting them would make their jobs easier as it would take care of menial tasks, such as setting up frames, recurring tasks and setting up general guidelines, and give them more time to spend on other work, such as creative tasks and client communication.

## 5 Discussion

### 5.1.1 Literature review reflections

The research and the interviews shows very clearly that AI is here to stay based on the incredible growth and trend forecasts for the (near) future. (Stahl, 2021), (Fortune Business Insights, 2021) Information is easy to gather from people who click on cookies and documents without really reading them, being described as ineffective. (Kulyk, Oksana et al. 2020)

Alexa, Amazon, and Netflix are nearly ubiquitous in the lives of western society and are a largely accepted part of our everyday lives, further thinning the veil between what is Artificial Intelligence and what is machine. (Merritt, 2017)

The amount of data that is being gathered on and by us is astounding and exceeds many terabytes per single company. Much of this information relates to spending patterns, engagement with apps and reaction to certain deals and sales. This creates patterns that machine learning applications can investigate and use to finetune our sales abilities and the way in which customers are engaged. It can also be used to create highly, specialised targeted information that can increase customer engagement through personalisation. (Shankar, 2018)

### 5.1.2 Humans and AI Discussion

Summing up the information from the research and the interviews; The elements of safety, security and trustworthiness play a large role in the acceptance of Artificial Intelligence into different fields. Hiding the machine behind the curtain can make for easier and quicker acceptance. Therefore, it is important to normalise Artificial Intelligence and put it's 'human face' on the front. Respondents 1, 2 and 3 all agree with this firmly and stated so in the interviews. The 'human element' must always be remembered.

Perhaps it is therefore that Amazon's Alexa, which provides a great user experience and stays in the background when not needed is such a popular option (Austin, 2017)

The lines between what is and what is not AI are becoming blurrier as can be seen from the success and near indistinguishability of virtual assistants and chatbots

(Lew and Scumacher, 2020) The help these assistants can provide people in the background are creating better and quicker interactions between parties than before. (Picard, 2014)

### **5.1.3 Machines and AI Discussion**

The research and interviews display that having gone from the basics of DOS-based machines to our very advanced computers within the space of two generations speaks to the strength of machine development and its potential is exciting. Recently, AI and Machine learning have given us a new tool with which to improve and increase this development. Giving a machine the ability to learn on its own allows for a parallel field of accelerated process of certain technologies and will help machines be able to assist us in all sorts of ways as we can already see now with several handy gadgets and virtual assistants (Lew and Schumacher, 2020) It is this assistance from machines that the respondents to the interview see in large measures as well. R3 and R5 already experience this actively during their daily work as UX experts, R2 has great expectations regarding machine taking over many of our tasks in the future and R1 added that with increased capacity for feelings and emotions, machines will be able to intuitively interpret and adapt experiences to customer's needs and moods.

### **5.1.4 Worries and AI Discussion**

Based on the interview and the results of the research, there are more worries among the general population about Artificial Intelligence and its development than there exists among the professionals in the field that have been interviewed. R2 understands and recognizes the feelings of the general populace and states that more trust and understanding will have to be created about AI and its application to create more trust. (Davenport, 2019) R4 also believes that it is a lack of understanding that may contribute to the lack of trust by the general population and thinks that education will help in part to solve this problem. Safety also plays a role in creating mistrust. There are still many (anecdotal) stories about people scamming and being scammed out of money, or a producer that does not deliver on time or delivers shoddy produce. (Nagy and Hadjú, 2021)

When it comes to the development of Affective Computing, we must be mindful of not contributing with or working towards negative stereotypes.

### **5.1.5 The Benefits of AI Discussion.**

The research and interviews show that AI hums along nicely in the background as people do their work. Calculating, preparing, organising, improving, suggesting. It is all done while we work on our latest story or while we have a big presentation we need to prepare. During the interviews, at least 5 apps that incorporated some forms of Artificial Intelligence were suggested. All these apps could contribute to increased speed, accuracy, and convenience in producing this thesis.

### **5.1.6 AI and UX Discussion**

From the interview it became very clear that most participants see AI in UX in the future. R1 mentioned the impact of Affective Computing and Over-The-Air technologies as factors influencing the shaping of AI in User Experience. Having technology push updates while we are going on about our day, keeping everything up to date. Affective Computing would make sure that ease, comfort, desire, and all manner of other things can be subtly adjusted and played upon by a machine. Yang, Wei, and Pu agree with this statement in their 2020 research and believe that AI can be used to stimulate and simulate user behaviour going forward, but also believe that at present these features remain heavily underutilised (Yang, Wei and Pu, 2020)

R2, R3, R4 and R5 are all in agreement that AI will be a large influence in the way work is done and

## **5.2 Suggestions for further research**

A study like this among a much larger audience might yield more interesting results and insights. Asking a larger group of people that work in the disciplines of UX design, Artificial Intelligence, Affective Computing and Over-The-Air computing might give an even clearer picture of the current state of the industry regarding the embracement of Artificial Intelligence and new technologies that lessen the burden on humans. Moving towards implementation of AI in certain field, at least to remove menial tasks from professionals could lead to interesting insights.

### 5.3 Evaluation of thesis process and own learning

Writing the thesis was, for me, a lengthy journey as I had little experience writing academically before the start of the process. I've learned several things from the thesis preparation classes, but perhaps some extra focus on academic writing would have been helpful.

Coming up with the research topic was rather easy for me as the information and research question I wanted to attempt to answer came to me during one of my later classes in my degree program. I enjoyed creating UX design but found there must be a quicker way of doing this and thus I said out to try and find out whether there was. I believe that this journey answered a few questions I held, but also made me realize that having good ideas is not as useful if the technology is not entirely there yet to match these wild ideas.

My thesis instructor Amir Dirin was very helpful with all the guidance he gave me and all the questions that he has answered, I believe he also helped me narrow down the scope of my research a bit as my initial ideas and my initial thought process was lacking structure. Several video meetings and messages through Konto helped with this. Amir also gave very good feedback in the margins of my thesis process which I shared with him.

The thesis evolved very naturally and gradually over the months I spent working on it. Initially the idea was to do a systematic literature review, but this was later changed to a literature review. After having done this review, in accordance with my thesis coordinator, I decided to also add a portion where interviews were conducted with people in the field that had know-how in relation to UX Design and AI. I wanted to have a mix of people for this so that I would have varied experienced to write about and make sure that I approach this topic from various angles. I've learned during this those opinions can be very diverse, even among people working in the same field. This led to some interesting insights that I would have otherwise not considered, even after reading many books and articles about the topic at hand. I've learned from this that my thesis topic provoked many feelings amongst participants, namely fear, excitement and curiosity.

## 5.4 Conclusion

The conclusions drawn from the research and interviews is that it is plausible to already have an Artificial Intelligence take over many tedious and daily tasks in UX design, but not in as much of a capacity as the research initially set out to. After having a look at the history of Artificial Intelligence and the great divide between the AI of the 1950 and 1960s and now, a large growth can be seen and perhaps also a shift in its usage and application. The fact that AI is now accepted by a much larger portion of the population and consequently it is embraced by marketing, has pushed it more into the mainstream. This overall acceptance has increased awareness among people and businesses and more apps are being developed with technology that came forth out of the investment and research into AI. Several of these technologies for instance are Machine-Learning, which allows us to feed information to a machine which then looks for pre-set or new patterns in the data that can help us in a variety of ways. Affective computing is another big field in which rapid development leads to exciting prospects. Affective computing was a very important field of research for this topic as its results could lead to further and rapid evolution in the field of User Experience Design. From research, we can conclude that AI in User Experience is a principle that is already being practice in certain measures. We call a place of business or type with an employee of a company to assist us with a variety of issues, and we're not certain if we are speaking with a human employee or a machine one on the other end. If many of these apps and research could be combined and made to work together, we would have a very good template for an automated UX design workflow.

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## Appendices

### Appendix 1. Interview guide

Questions:

(Research question: 'How can the impact of AI change the field of UX from a user-dominated to a machine-dominated one?')

- How have you experienced the progress of UX Design throughout your career?
- What are, in your opinion some obstacles in UX design?
- How do you see UX design develop in the next few years?
- How do you see AI impacting UX design in the future or already now?
- How can AI improve UX design?
- What benefits do you see in UX design being done by humans that a machine would struggle with?
- What are some of the downsides you see if UX design is being done by humans?
- What are the drivers behind UX design going towards being a machine-based field as opposed to solely a human one?