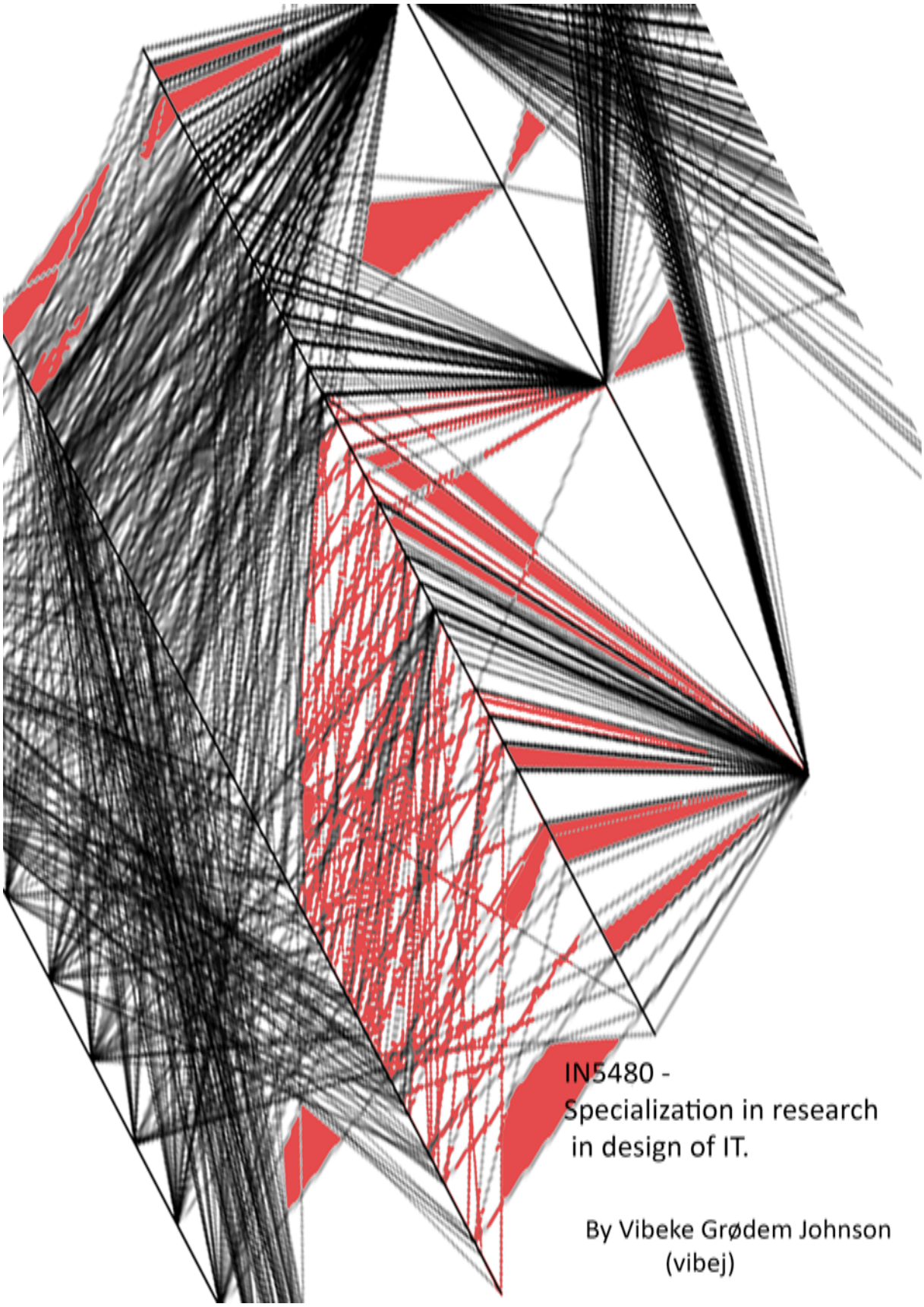


IN5480 -
Specialization in research
in design of IT.

By Vibeke Grødem Johnson
(vibej)

Content

Modul 1: Individual assignment.

Concepts, definition and history of AI and interaction with AI

During the World War II, code breaking and the understanding of coding were significant. And after the war, a few universities had the opportunities to build computers on campus. In 1949, Alan Turing, a British mathematician, wrote in the *London Times*, "I do not see why [the computer] should not enter any one of the fields normally covered by the human intellect, and eventually compete on equal terms. "(Grudin, 2009:49).

The founder of artificial intelligence, John McCarthy, introduced the term AI to the world in 1956. It was after a conference in Dartmouth College, where McCarthy was one of the main speakers. The conference was called *Summer Research Project on Artificial Intelligence*. Together with Turing, Newell, Simon, and Minsky, they are all seen as the creators of the term Artificial Intelligence.
1960 – optimism in computer development and a lot of money was given to the study of artificial intelligence.
1970 – is called the artificial intelligence winter, because the results were not coming as planned. The refunding was cancelled and further research limited.
1980 – Optimism where back and expert systems were introduced in the shape of artificial Intelligence. But they were not able to redeem to the point promised, another period of AI winter came back, and lasted until the mid 1990.
In the late 19th early 20th century AI was again peeking. In 1997 Deep Blue, the computer beat the world champion Gary Kasparov in chess (Grudin, 2009:54). Deep Blue is different from most AI used today, but made an introduction and surprised many, including long-time AI critic Hubert Dreyfus, author of "What Computers Can't do."(Grudin, 2009:55).

John McCarthy (1998)
"It is the science and engineering of making intelligent machines, especially intelligent computer programs." It is related to the similar task of using computers to understand human intelligence, but AI does not have to confine itself to methods that are biologically observable.

With this definition McCarthy (1998) concludes that you need human beings for making the inputs to the machines that will improve the capability and enhancement of the machine. The machine can understand human intelligence and help with the interaction between humans and machines.

Bratteteig & Verne (2018)
"AI is a subfield of computer science aimed at specifying and making computer systems that mimic human intelligence or express rational behaviour, in the sense that the task would require intelligence if executed by a human".

Bratteteig & Verne (2018) discuss in their definition that machine will learn from participatory design. The machine will gain knowledge from people interacting with them. Commencing with human beings the machine will learn rational behaviour, and then become more intelligent.

Axel Tidemann (2020)

Artificial intelligence (AI) is information technology that will adjust it's own activity and therefore appears to be intelligent.

The definition of Tideman is that AI can learn from mistakes and diverse input performed by humans. The artificial intelligence can execute different assignments from the history of tasks performed earlier.

Vibeke Johnson (2021)
"Artificial Intelligence has the ability over time to advance from the information provided by humans, and learn from previous tasks performed".

With this definition I mean that artificial intelligence has the possibility to become more intelligent, when additional information is encoded and the process has started. After some time the AI will acquire properties from earlier assignments performed.

The article by D.A Norman

The "problem" with automation: inappropriate feedback and interaction, not "over-automation"(Norman, 1990).

This article discusses how automation is present in the industry and how the design of the automation is more of a problem than the automation itself. Norman is looking at automation in aviation, and this appeals to me as I am currently working as an airhostess. Norman is looking into three accidents in aviation and how the automation and overall communication and understanding had an impact on these accidents to occur.

The first comment on this article has to be that the accidents happened between 1975-87, and automation in aviation has developed a lot since then. After discussion with captain Larsen in SAS, I have studied this article and I do agree and disagree with some of Norman's views of the topic. After every accident happening in aviation, several documentation and reports were made, and flight safety is updated. The one case where the incapacitation of the pilot occurred, this would probably not happen today. From previous accidents they have implemented communication techniques (challenge-response) in their flight safety and Standard operation procedures (SOP).

Norman also states that pilots are "physically isolated from the passengers and from any difficulties that may be occurring within the passenger section of the plane" (Norman, 1990:138). The flight attendants have nowadays more communication with the pilots, we are their eyes and ears in the cabin. And the threshold for calling and communicating with flight deck is low.
Automation in airplanes is important, and the Scandinavian Airlines System (SAS) implies that the highest level of automation is required in every flight. From this article written in 1990, pilot and automation in aviation have evolved. Pilots are more aware of the design of the automation and have a better understanding of the intelligent system (automatic pilot). I do not agree with Norman "the implementation of some new "improved" automatic system, warning signal, re-training or procedure is really a sign for poor overall design". Be aware that you cannot trust automation totally, and train for different situations can arise is important.

PICKR.AI

The contemporary company "PICKR.AI" has specialized themselves in robots with AI. The robots are made with the purpose of optimizing the warehouse storage facilities. The robots have a suction tool and camera attached, and they use this to recognize the different products and therefore learn by themselves. A 3D tracker is made in the robots to recognize small parts and pick these with their suction arms. AI takes a picture of the product and sort it by percentage of similar product seen before. These are autonomous and articulated robots that are used in picking production. This robot will improve the time used by companies in storage to streamline the storage facilities.

Westworld – HBO series where the robots are made to look like humans. The machine act and look like human, they have the same skills and are able to imitate them. But after a while, the robots start thinking and learning by them self ("The Turing test"), this causes the robots to make a riot against the world they are living and against the humans. The communication between the robots and the humans is fascinating. You cannot tell the distinctions between who is human and who is a robot. Because of this, a few humans die from other people not telling them apart from the robots. Westworld is made for the futuristic imagination of robots taking over the world.

Robots and AI systems

Robot - *robota*, for "servitude," "forced labor" or "drudgery.
Karel Capek (1880-1938) introduced the word "Robot" in his play called Rossums Universals Robots (R.U.R). The "Robots" where going to do the same work as the people, and he named them "Labori" after labor for English. He later called them roboti, because it did not sound so bookish (sciencefriday.com).

Robots.ieee:
"A robot is an autonomous machine capable of sensing its environment, carrying out computations to make decisions, and performing actions in the real world". (IEEE.org)

This definition means that the robot is able to adapt to the environment, and learn from tasks performed earlier. The robot is made with a specific intellectual to execute action in the real world. It is a software robot, installed with AI to make it intelligent.

Merriam-webster:
"*A machine that resembles a living creature in being capable of moving independently (as by walking or rolling on wheels) and performing complex actions (such as grasping and moving objects)". (Merriam-webster.com)*

By this definition a robot is made human like, made to perform special tasks as to move and handle objects. They can be made without AI. Many robots that are made for a specific task as picking up an object do not have Artificial intelligence.

My definition of a "Robot":
"A robot is a machine that is made to perform any given assignment. It can be built in different shapes and perform specific jobs depending on if the robot is made with software AI or without."

I think robots can come in various shapes, and are made to perform specific tasks. You have robots made for space, robots for home use or robots to interact with humans.

Robots and AI.

The relation between AI and Robots are that they both need input and interaction from human beings to work. Robots are the physical version while AI is the software. We have non-intelligent and intelligent robots. The Artificial Intelligence is the software that is built in the intelligent robots. The robot can work as a shell of the AI, a physical manifestation. AI is the software of machine learning, intelligence and consciousness, and a robot can execute these tasks. A software robot is intelligent, and for example, a self-driving car has a built-in AI that will tell them if some obstacles or danger is about to occur. Challenges have been identified with Tesla when they came across situations they did not have information about in advance, which led to accidents. This would probably not have happen if a human were driving the car.

AV1/No Isolation

AV1 is a communication robot made for children that cannot attend school. The robot is used in their place in class, recess or field trip. The kids can control the robot from everywhere, with phone, ipad or a computer. The kids use the robot as their eyes, ears and vocal in school. AV1 has a built in speaker, camera and microphone in the robot (noisolation.com).

Universal Design and AI systems

Definition of Universal Design:

”*Universal Design is the design and composition of an environment so that it can be accessed, understood and used to the greatest extent possible by all people regardless of their age, size, ability or disability”(universaldesign.ie).*

With this definition it is indicated that universal design is design made to include not exclude people. Regardless of different disabilities, physical or emotional state, people shall have the opportunity to use everything provided in the environment, from buildings, computers, products and much more.

Artificial Intelligence - human perception, human movement and human cognition/emotions.

Artificial intelligence has the opportunity to assist humans with practical, emotional or physical difficulties. With Artificial Intelligence we can implement and accomplish some of the same as human perception. In addition, we can make computers by coding them to perform similar logic and decisions comparable to humans. An example would be smart homes, and how people with cognitive disabilities can be helped with everyday tasks. The vacuum (robot) can understand where to go and will know when the battery is low. They can have a smart panel installed that will understand and assist with everyday chores. It can perceive information of something at home is not working, or threats are happening.

AI - including and excluding people.

I think artificial intelligence have the opportunity to include but also exclude certain people. With all the different communication platforms, like Smartphone’s, Skype and video calls some people have difficulties using these. A way to include them, a smart speaking is made for them to talk to day or night. Smart speaker is a way to include old people who live alone and cannot use the other platforms of communication.

The other example is face recognition, how they exclude people with dark skin. The computer cannot read the features of the people with dark skin and therefore exclude them from this.

WCAG 2.1 principles – understand and understanding.

Do machines understand?

Humans have the ability to understand and interpret other peoples feeling by communicating verbally and non-verbal to each other. Artificial intelligence has to understand humans by the information given to them. AI will then "understand" humans in some extent, they will recognize the information given to them and use this to interpret with humans. My conclusion of "Do machines understand?" I will emphasis the word to understand. "*To know how someone feels or why someone behaves in a particular way*"(dictionary.cambridge.org). Machines can to a certain extent understand the input provided to them and use this information to understand the user. But they will never have the human understanding of feelings.

Guideline for Human-AI interaction

Microsoft Guideline number 13:" Learn from user behaviour - Personalize the user's experience by learning from their actions over time".

This guideline means that the system has to pay attention to the previous action in intervening. For example, Spotify lists, remember the songs played and recommend similar songs in the same category. So with this guideline I found a similar on by Nejc Rodosek "*We can create the great user experience, only when we understand the user motivation that guides the action"*(Nejc Rodosek, 2018).

Similarities and differences between the HCI design guidelines and the Human-AI interaction guidelines.

From the book "Design of everyday things", (Norman, 2013), we do get an insight in the six principle of Human-Computer Interaction.
"Usability, feedback, affordance, mapping, constraints and consistency"(Norman, 2013). Norman use universal design principles to understand and design products that are technological. From designing everyday things from table, doors, thermostats and so on, he uses parallel on how to design technological products user-friendly. Microsoft Human-AI guidelines also write about the importance of user experience, but they differentiates in the way that Norman's guideline are more nonfigurative. The Human-AI interaction guidelines have four main areas and many more sub categories to specify the interaction.

Appendix: Feedbacks on individual assignments.

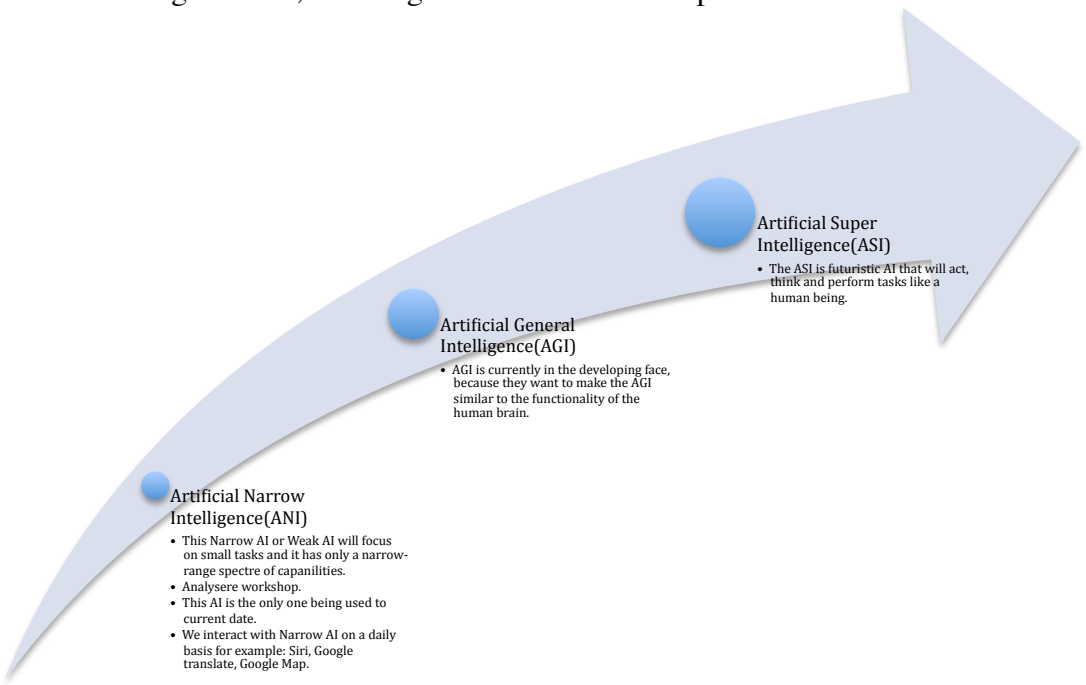
Iteration 1
I received a factual and precise feedback from my fellow student on the first iteration. She said that I answered well to everything and covered a lot in each answer, while being precise. She did comment that some of the paragraphs were a bit long and heavy to read. I do agree with this, so in the second iteration, I changed some of the paragraphs.

Module 2: Individual assignment

The individual assignment for module two is divided into three categories. The first is how we categorize Artificial Intelligence-infused systems and through reading the articles (Amershi et al., (2019);, Kocielnik et al., (2019), Yang et al., (2020)) and the specific characteristics explained by (Følstad, (2017)). The second category is about Human-AI interaction design and the main take-away from the two articles, Kocielnik et al., (2019) and Amershi et al., (2019). The third one is how we communicate and interpret with chatbots.

Characteristics of AI-infused systems

When interacting with AI, we categorize them into three parts.



From the first lecture of module two, Asbjørn Følstad separated the AI-infused systems into four characteristics:

- Learning

The system is learning from users interacting with them and what previous search or input has been implemented earlier. *"Many AI components are inherently inconsistent due to poorly understood, probabilistic behaviours based on nuances of tasks and settings, and because they change via learning over time (*Amershi et al., 2019:2)". From interacting with a dynamic AI the input and output will vary, this will cause a variation in the information received and formatted in the AI.

- Improving

The system will, over time, learn and understand the mistakes it has made before. Through interaction, the system will improve and become more intelligent, making fewer mistakes over time. Kocielnik et al. (2019) tell us about the expectations of the users and the unwillingness to use a system with mistakes. "We design expectation adjustment techniques that prepare users for AI imperfections and result in a significant increase in acceptance" (Kocielnik et al., (2019:1)).

- Black Box

The ”Black Box” refers to the AI as a secret box with hidden information. The users will not get any information about how the input will be processed in the AI. ”*Black Box is any system whose inputs and operations are not visible to the user or another interested party* (Wigmore, 2019)”. It is an impenetrable system such as a deep learning model.

- Fulled by large data sets

Fulled by large data sets means that the system can access a large dataset of input and output information. To function optimally and to learn, the AI needs an enormous amount of data in the system to perform in certain way.

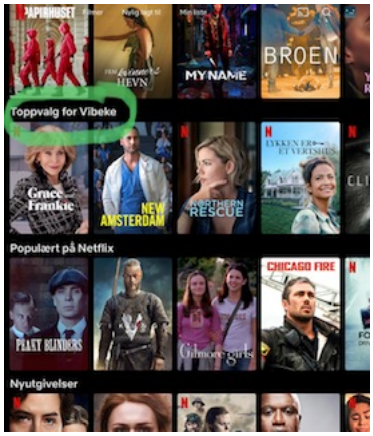
AI-infused systems are ' systems that have features harnessing AI capabilities that are directly exposed to the end user' (Amershi et al., 2019).

Amershi et al.,(2019), Kocielnik et al., (2019) and Yang et al.,(2020) all discuss in their articles how AI-infused systems are challenging to design because of the lack of understanding of the system. They all argue that AI-infused system is demanding to fully understand because of its complexity and variation of input and output. In this next phase I will identify and describe an AI-infused system that we are familiar with today, how the capabilities and characteristics of the system is presented.

Netflix as an AI-infused system

Netflix

Like many people across the world, I use Netflix to stream movies and series. Netflix is an AI-infused system in a way that they suggest new movies/series based on your previous viewings. The system has the capability to learn from previous input (what you have watched before) and process this information for future recommandations. The movie-recommendation and the library of thousands of movies/series are typical Black Box characteristics. The users do not understand how all the information is processed and are left in the dark about how the system works. “*AI´s output complexity affects how designers conceptualize the system’s behaviours in order to choreograph its interaction* (Yang et al., 2020:7)”. The algorithm for Netflix is complex, and it is difficult for the designers to adjust this accordingly to the user. These results in some of the recommendations made from the system to the user will be incorrect. Amershi et al., 2019) argues that recommendation to the end user is a typical characteristics of an AI-infused system. The system is learning, developing, and becomes intuitive through feedback and interaction with the users.



Human-AI interaction design

Amershi et al., (2019) argue that AI-infused system can act in an unpredictable way and bewilder the users in their interaction with the system. To help with further research and how to interact better with AI-infused systems this article argues rounds of iteration and testing from user studies. They have focused on human-centric behaviour and made three rounds of evaluation and testing. Amershi et al., (2019) haves in his article divided AI-infused systems into 18 interaction user design guidelines that are further divided into four categories for when the users are likely to interfere with the system. The four categories are ‘Initially’, ‘During

interaction', 'When wrong' and 'Over time' (Amershi et al., (2019:4)). The authors argues that the Guidelines for Human-AI interaction might not be applicable for all AI-infused systems, because of the sense of balance involving generalization and specialization.

Kocielnik et al., (2019)
Kocielnik et al., (2019) headline of the article *'Will You Accept an Imperfect AI?'* This question is the main takeaway the article is trying to research by testing different AI-infused systems and figure out the acceptance or not from the users. The settings for expectations are divided into three categories: 'Accuracy Indicator', Examples based Explanation', and 'Performance Control' (Kocialnik et al., (2019:2)).
"*We design expectation adjustment techniques that prepare users for AI imperfections and result in a significant increase in acceptance*" (Kocielnik et al., (2019:1)). Kocielnik addresses how the users accept imperfection in a system if they are aware of it. If they are not aware of this shortcoming, it can lead them to stop using the system. It is important that the gap between acceptance and the actual use of the AI-infused system is minimized to increase user experience. Kocialnik et al., (2019) point out the importance of perception of accuracy is for user experience and that you can divide this into two main parts. 'High precision' is able to give the user a lower perception of accuracy and a decrease of approval, and 'High recall' is false positive occurrences in the system (Kocielnik et al., (2019:7)).

Takeaways from articles, Amershi et al., (2019) and Kocielnik et al., (2019), address how to design human-AI interaction in a suitable way. Kocielnik et.al., (2019) focus is on the expectations of the system and how to shape this, while Amershi et al., (2019) have a more general approach to managing the interaction in the system. Amershi et al., (2019) follows a particular pattern with guidelines 1-18, that will help the designer accomplish a better user product by following the guidelines. Kocielnik et al., (2019) has a different approach to user expectation, by understanding the needs and anticipation of the user and categorize these by user testing.

Netflix and how the AI-infused system adheres to or deviates from the chosen Guidelines of Amershi et al. (2019).

G4 – *Show contextually relevant information. Display information relevant to the user's current task and environment.*
This guideline is relevant in Netflix, and it helps the user choose the category they want. Netflix has divided both movie and series selection into several categories, like comedy, drama, action, new release, documentary etc. If you choose to watch a series, this will come up on your front page, so you don't have to search for it later, and you can keep on watching. The possibility of creating different accounts in Netflix is useful, if you are many persons in the household that watch. You are able to create an account, especially for kids, so that they can only watch movies and series connected to the age you apply in the settings.

G9 –*Support efficient correction. Make it easy to edit, refine, or recover when the AI system is wrong.*
Guideline nine is not sufficient in Netflix because it does not let the users edit or understand the filters to refine movie selection. The movie recommender doesn't take into account the 'High recall'; it will show the user movies/series that they don't want to see based on previous watching. Netflix does give you the opportunity to select the desirable movies/series with a filter 'not for me', but this user guide information is hidden for common Netflix users. Thus,

Netflix can improve their AI-infused system by fine-tuning their recommendations for making the filters more users friendly.

Bender et al. (2021)

One type of a large language model (LM) is Google's BERT, this LM system can generate human language through recognition, genres and predictability. Bender et al. (2021) argues that when designing LM models it is important for the AI-developers to be careful when designing language models and they encourage them to consider weaknesses and accuracy in language modelling. Bender et al. (2021) is deep diving into previous articles on AI-systems and past findings on the limitation of the human languages.
"*Over 90% of the world's languages used by more than a billion people currently have little to no support in terms of language technology*" Bender et al., (2021:3). Because of the indifference's in the world most of the language technology is made for people in the vest (money based). So when we analyze the risk/use of language technology we have to consider how it affects people different because of social, economical and ethical indifference's in the world.

Bender et al. also state "*human tendency to attribute meaning to text, in combination with large LMs' ability to learn patterns of forms that humans associate with various biases and other harmful attitudes, leads to risks of real-world harm, should LM-generated text be disseminated Bender et al., (2021:9)*. With this statement (Bender et.al.) means that the language translator in LM can misunderstand what the person is saying in one language and translate this with a different meaning to another language.

"*Value sensitive design*" is argued in Bender et al. (2021) to identify how the designer is supporting values when designing the systems. The designer has to consider the stakeholders values to differentiate the direct stakeholder (use the technology directly) and the indirect stakeholders (affected by others using the system).
"We thus emphasize the need to invest significant resources into curating and documenting LM training data" Bender et al., (2021:7). These systems function of language has a statistical pattern. The AI-machine does not understand the world as a human so they do make peculiar mistakes compared to a real person. Further research in this field of LM and AI-systems are important for improving large LM systems in the future.

Chatbots / conversational user interfaces

Some of the key challenges to design a chatbot has been argued in the article "Chatbot and the New World of HCI" by Følstad & Brandtzaeg (2017). The main challenge of designing a chatbot is to make sure the chatbot will respond in a proper way according to the input provided (Følstad, 2017:41). Human-Computer Interaction (HCI) designers are constantly trying to improve their knowledge in conversational user interfaces in chatbot. Følstad & Brandtzaeg (2017) wants the designer to move away from a specific task as 'explanatory task' to an 'interpretational task' that means understanding what the user needs instead of explaining content and features available to the user.
It is important to see conversation and user interaction as a central part of the design process. "*The future era of chatbots and natural language user interfaces, the designer repertoire of graphical and interaction mechanisms will be greatly reduced*" (Følstad & Brandtzaeg, 2019:41).

From the lecture presented by Dr Morten Goodvin, he explains the technical parts of a chatbot and how the correlation between input, output, and hidden layers are essential to make up the deep neural networks. We differentiate between Rule-based and Self-learning chatbots. Self-learning chatbot is retrieval based and a generative chatbot that is more advanced and will require more technical understanding of algorithm, design, and interpretation.

Guidelines G1 and G2 in Amershi et al. (2019).

If, during the design of a chatbots, the Guideline G1 and G2 in the article Amershi et al. (2019) are complied, the typical problems with current chatbots can be minimized. These guidelines work as an education guide on how to manage the expectations of the users and will improve a better understanding of user experience.

G1 - *Make clear what the system can do*
Help the user understand what the AI system is capable of doing.

G2 - *Make clear how well the system can do what it can do.*
Help the user understand how often the AI system may make mistakes.

The expectations of how a chatbot is going to respond to your questions and how this will create a positive or negative user experience. As Kocielnik et al. (2019) argues in his article that it is important that the user fully understand what performance the chatbot is capable of. If the user is not satisfied with the answers received from the chatbot, this can result in a rejection in action and usability. With new technology, it comes new learning of functionalities, and in the second guideline the clarification of the system of the chatbot depends on what type of chatbot it is. If it is a self-learning chatbot, it is obvious that you have to interact with the chatbot several times, so it has the opportunity to learn from the mistakes. Chatbot and human-computer Interaction is a complex composition of several elements working together, and we will most likely in the future have more insight and knowledge on how to make this correlation better.

Appendix: Feedbacks on individual assignments.

Iteration 2

The second iteration feedback was very helpful as well. My fellow student did like the figures and pictures in the document and commented that it made it easy to understand the different types of AI and Nettflix. She also pointed out the use of references, direkte quotation and good variation in the written language. The wish was more information on the differences between Amershi et al. and Kocielnik et al. I do understand this wish and accomodated this with a fem more sentences. But I do think I made the differences understandable by writing about both of them in the text above.

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