Individual Assignment IN5480

Bendik Kroken
bendikjk

MODULE 1

Concepts, definition and history of interaction with AI

First, write a section about how AI came about, the history of AI!. When, and by whom, was the term first used?

The first use of the term Artificial Intelligence was by American mathematician and logician John McCarthy. This definition appeared in a paper for the participation of a workshop hosted by the Macy Foundation in 1956 (Grudin, 2009:49).

Three definitions of artificial intelligence:

Definition 1: *"AI is a subfield of computer science aimed at specifying and making computer systems that mimic human intelligence or express rational behavior, in the sense that the task would require intelligence if executed by a human"* (Bratteteig & Verne: 2018:1-2).

This is a fairly recent definition of AI, it is defined by who researchers from the DESIGN group at IFI, a research group focused on participatory design and user-centered processes. I think it is interesting how they focus on the fact that AI mimics human intelligence, thus providing a clear difference between human and machine intelligence.

Definition 2: *"... the field of Artificial Intelligence (AI), deals with the creation of "machines that can think". Focused on traits of reasoning, knowledge representation, planning, learning, communication, perception and social intelligence.."* (Khanna 2012: 475)

This definition was coined by Khanna and is related to the use of artificial intelligence in the medical field. It specifies what often is seen as the traits associated with intelligence and cognitive actions so that the readers have a clearer idea of what the author means by "machines that can think".

Definition 3: *"Artificial intelligence (AI), the ability of a digital computer or computer-controlled robot to perform a task commonly associated with intelligent beings"* (Copelad, B.J, 2006,Encyclopedia Britannica)

This definition also focuses on intelligence, as AI does tasks that previously were done by non-machines. Du har funnet tre definisjoner fra forskjellige felt, og det er veldig interessant! Det er spesielt interessant å se at de velger å fokusere på forskjellige aspekter ved AI (de to

første fokuserer på lagingen av intelligente systemer, mens den siste fokuserer på evnen systemer har til å være intelligente).

My definition: *Artificial intelligence (AI) are computer systems created to give computers the ability to think, reason or do tasks associated with intelligence.*

Here I wanted to focus on the idea that AI gives computers the ability to “think” and therefore gives them the ability to perform tasks associated with cognitive abilities. I did not want to focus on humans too much as I still am unsure if intelligence is different between humans and machines, or if there is “one intelligence”.

Find one contemporary company that work with AI and describe how this company present AI on their web pages.
In what way does this company talk about AI, as a product, as a service, framework or “idea”?

I chose Telenor, and how they frame the use of artificial intelligence/machine learning on their websites. Telenor presents its use of AI as a way of improving both their products as well as services. They are also presenting their role in AI development in Norway, and aims to position and present themselves as a leading powerhouse in AI. This is done through links to projects Telenor has with places like NTNU and SINTEF.

https://www.telenor.com/innovation/artificial-intelligence/

Select one documentary or a fictional film, book or game that is about the use of AI systems. Describe with your own words how human interaction with AI is portrayed in this work.

Her

In this movie, which is set in the near future, we follow a man who gets an AI assistant(named Samantha). This assistant helps the main characters throughout his day, and he develops a deep, almost intimate relationship with the assistant. Throughout the movie, the main character continuously interacts with the AI assistant through speech. The AI helps the main character in in daily life in the beginning (more task-oriented), but throughout the movie, the AI assistant becomes more an emotional support and performs emotional labour.

Robots and AI systems

First, write a section about how the word Robot came about.

The first use of the word “robot” was in the Czech play “R.U.R or Rossum’s Universal Robots”. The word originated from old Church Slavic and meant “servitude” or “forced labour” (Markel 2011).

Then, find two different definitions of a robot. Describe and explain these definitions. Based on these definitions, make one definition yourself, and describe and explain this definition.

Definition 1: “A reprogrammable, multifunctional manipulator designed to move materials, parts, tools or specialized devices through various programmed motions for the performance of a variety of tasks” - Robot Institute of America (Thrun 2004:11).

This definition focuses on the specific tasks a robot is given upon programming. Thus, underlining the fact that most robots have very specific tasks and “jobs” they need to do.

Definition 2: “Robot, any automatically operated machine that replaces human effort, though it may not resemble human beings in appearance or perform functions in a humanlike manner” Encyclopedia Britannica, (Hans Peter Moravec 2005) “Robot”

This definition is also focused on work, and how focus can be moved from humans and their work-practices to robots. This definition is interesting as it underlines the fact that robots do not need to do tasks the way humans do or even look human.

My definition: “A robot is a machine that is optimized to automatically to human tasks, and are often highly specialized to do one specific task. Although this task is humanlike in function, it does not need to be so in form.”

As discussed and explained over, the definition focuses on work, and tasks that robots often can “relive” humans of. These are often very specific, underlining that robots cannot, nor compete with humans in all tasks they can do. This is because robots are highly specified in the tasks they do. Drawing on this we can see how robots are viewed very much as a tool, which is very interesting..

Discuss the relation between AI and Robots. Is “a robot” different from “an AI”? In what ways are they different and similar? Bring in the definitions that you described earlier about robots and AI for this discussion.

Central to all definitions of robots is the notion of “work”. The idea that robots exist to do tasks humans don't want to do is reflected in both the definitions I found during my research. This is one of the central aspects that separates a robot from AI. Robots are not able to learn or develop by themselves, but rather are highly specialized and programmed in the tasks they are given.

Find one contemporary physical robot, either described in a research article - or a commercial robot, and describe how this robot moves and how a human user is interacting and using the robot in a specific situation.

Lawn mower robot at IFI

This commercial robot is highly specialized in the task it is supposed to perform. It exclusively cuts grass and through a sensor system moved across the lawn in what seems like an unstructured manner. It moves through wheels, and when close to people (or other obstacles), it moves away from said obstacle. This is very on par with the definitions over as the robotic lawn mower has a very specific task (it might to better than humans), while at the same time it is very un-humanlike.

Universal Design and AI systems

Please find and describe a definition of Universal Design. Explain this definition, how you understand what Universal Design is about with respect to inclusion.

Definition: *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.*
(National Disability Authority: http://universaldesign.ie/What-is-Universal-Design/ (accessed 26/09/2019)

In this definition, NDA focuses on the environment to get an all-encompassing definition of the spaces where universal design should be done (whether it be physical or digital). In this definition they aim to include as many people as possible in as many contexts as possible too, it is not just digital, but physical environments too. There is also an aim to include all people regardless of the abilities they have.

Describe the potential of AI with respect to human perception, human movement and human cognition/emotions. You are encouraged to use examples.

AI has a huge potential in universal design if designed “correctly”. For example, has AI the potential to help those with reduced sight navigating and explaining the world. An AI that is developed for this purpose could possibly change how we view and interact with those with visibility impairments, but most importantly have the possibility to change their lives.

Describe the potential of AI for including and excluding people. You are encouraged to use examples.

The uniqueness of people, which is what universal design aims to support, often gets lost with numbers. As AI runs on averages and huge datasets the potential to exclude the ends of a bell curve (the extreme users) increases significantly. This is paradoxical as these often are the people who rely on universal design the most.

MODULE 2

Characteristics of AI-infused systems

In the first lecture of module 2 (ref) four key characteristics of AI-infused systems were identified. These are *learning*, *improving*, *black box* and *fuelled by large datasets*.

Learning: Central to this characteristic is that the AI-infused system is constantly learing, making it highly dynamic. This is also underlined by Amershi et al in how they not that AI-infused systems might appear different every time a user interacts with the system (Amershi et al. 2019).

Improving: drawing on the characteristics above, AI-infused systems are constantly improving through learning. Especially through an array of different and diverse feedback and input this process of improving becomes apparent. Another vital aspect to this is how these systems are bound to make mistakes, but it is through these, the system will learn. This can be seen in how AI-infused systems often becomes better the more the user interacts with it.

Black box: AI-infused systems can be seen as “black box”, this is because the user does not have insight (and often this is not the aim), so understand and “see” what happens within the system. The user often has some sort of input, receiving some feedback/output, often with no explanation of how this feedback/output was made.

Fuelled by large datasets: A central part of AI-infused systems are how they are made better trough large sets of data. It is also vital that these are quality sets of data as this is what the AI-system uses for improving and learning.

AI-infused system: *Google search.*

How the Google search mechanism works is a good example of the aforementioned characteristics. It constantly learns for you, the user, to make sure you get the most relevant hits for you. This can be illustrated in how different the Google searches becomes when you search on your personal computer vs. a computer at IFI. The results on my personal computer are now highly personalized for me, and the IFI ones are very general. The notion of black box is also relevant here too. When I do a Google search I don't really know what happens, but I still get the output I aim for. Google searching is also fueled by very large datasets too, which makes the system highly informational and learns and accesses this info. The system also improved drastically with my use, and becomes highly dynamic through this, and it changes in accordance with the things I search the most for. For example how when I write research essays about a specific topics, the results follow these themes.

Human-AI Interaction Design

Summary of Anashi et al.(2019)

Through their research, the authors aims to develop set guidelines for human-AI interaction. These guidelines are made from a set of guidelines from an array of other researchers writing about human-AI interaction. These were further evaluated by UX/HCI practitioners in their respective fields on products that all have some human-AI interaction (heuristic evaluation)(Amershi et al. 2019). Their aim with proposing the 16 guidelines of human-AI interaction is to give practitioners that develops AI-infused systems a tool to make more human-centric AI-infused systems.

Summary of Kocielnik et al(2019)

In their paper, the authors investigate expectations of end-users in AI-infused systems, and how shaping these expectations related to acceptance of these systems. They use certain techniques to mediate this shaping of expectations, and these are tested through an AI-powered Scheduling Assistant (Kocielnik, Amershi, and Bennett 2019). They identify three main ways in which expectations are formed, and applies these to the design of AI-systems. These are; information from *external sources*, *reasoning and understanding*, and *first hand experience*, these three inspired their three techniques for adjusting expectations; accuracy indicator, example-based explanation and control slider (Kocielnik, Amershi, and Bennett 2019). Through this the authors argue that shaping the expectations of end-users is an efficient way of improving acceptance in AI-infused systems.

Amershi et al.(2019), design guidelines applied to Google Search:

Guideline 4: Show contextually relevant information:

Google does this constantly, as it will show you information relevant to where you are and what you have searched for. Eg: how you can search for “indian food” and it will show you the closest Indian restaurants (even though you might just have been searching for a recipe).

Guideline 7: Support efficient invocation:

This guideline is based on the ease of invoking the AI-systems services. Google search makes it very easy to use the service, as you get right into the search once you open the website, making it readily accessible at any given time. This follows throughout the flow and use of the system, making it easy to further request and use the service of the website.

Google search follows both these guidelines to a high degree, making it an easy-to-use AI-infused system, where both expectations are met and frustrations reduced.

Chatbots/conversational user interfaces

Key challenges in the design of chatbots/conversational user interfaces:

One of the key issues with the design of chatbot and conversational user interfaces is that conversations break down fast (Følstad and Brandtzæg 2017:40), and as Luger and Sellen notes, the potential of natural language processing is often overshadowed by the errors (Luger and Sellen 2016). Another issue noted on this from Luger and Sellen, is that conversational user interfaces and chatbot lacks the contextual understanding that is so important to the natural language (Luger and Sellen 2016:5288).

Drawing on Kocielnik et al. too, the expectations of users are central to the experience of conversational user interfaces as proved by Luger and Sellens study (Kocielnik, Amershi, and Bennett 2019; Luger and Sellen 2016). Mediating and navigating the expectations of users therefore becomes one of the largest challenges in design interactions with AI-infused systems.

Challenge to move to conversations as the object of design. This makes design an interpretational task, where the aim is to understand the user, and the users need (Følstad and Brandtzæg 2017:41). There needs to be less focus on interfaces, and more on the service of a chatbot/conversational interface. The conversational interfaces also needs to be less generally design, meaning that the one-size-fits-all approach is one we need to move away from (Følstad and Brandtzæg 2018:41/42)

Amershi et als (2019) guideline 1 and 2, related to chatbots:

Guideline 1: **Make clear what the system can do**. This is central to chatbots, and the challenges chatbots face. One of the largest sources of frustration with chatbots/conversational interfaces is related to the lack of understanding in what the chatbot actually can do for you. Therefore, designing the system in a way that makes it clear what the chatbot can do should be a priority for any system that has a conversational interface.

Guideline 2: **Make clear how well the system can do what it can do.** This guideline highly relates to the first one, and in a way builds on it. It is not enough just to let the user know what

the system does, it is also important how well it can do it. In the case of a chatbot, making sure the user knows how well a system can answer the different requests for example, becomes vital. This relates well to what Kocielnik et al. argues with the importance of controlling and shaping the expectations of the user when interacting with an AI-infused system (Kocielnik, Amershi, and Bennett 2019).

MODULE 3

Collaboration and levels of automation

Endsley identifies four task aspects when discussing her taxonomy of automation, these are: monitoring of information, generation of options, selection of actions and implementation of tasks to either the human, the computer or a combination of the two (Endsley 2011,184). Further in the text, Endsley demonstrates (drawing on established research), how successful these tasks are with automation. Especially automation that helps with gathering of information and aiding in specific tasks are where people are most comfortable (Endsley 2011,184). Further she identifies 12 levels of automation from *manual contro*l to *full automation* (Endsley 2011, 185).

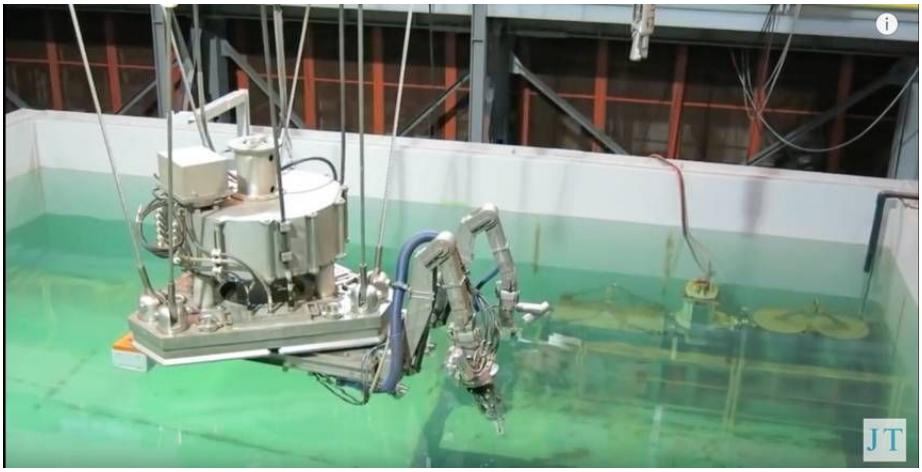
In their article, Phillips et als. argues that keeping robots more zoomorphic makes them better for the establishment of mental models related to teamwork between robots and humans (E. Phillips et al. 2012, 1554). They argue that the study of human-animal teams is an efficient way to model for human-robot teams as they can do a diverse set of tasks with different levels of autonomy.

Philips et al. places human-robot interaction on a continuum they call “tool-to-teammate”, proving a taxonomy in which to understand this interaction(E. Phillips et al. 2012). To do this they investigate the relationships by looking at task interdependence and human-animal team communication. As the authors demonstrate, both these ways to view human-robot relationships have different dimensions to them.

Examples of robots:

Example 1: Tepco cleaning bots (Fukushima nuclear disaster)

An example of the collaboration of humans and dogs that have been used in robotic teams, are military robots used to help humans in environments and situations that are dangerous or extreme. An example of this could be the robots used to help clean up after the Fukushima nuclear disaster (Phillips et al. 2016, 106). On the scale of autonomy Endsley presents, we can



find the cleaning bots on a level of “shared control”(level 6), this is because they both decide themselves on what needs to be cleaned up as well as the people operating these giving commands (Endsley 2011,185). It both does tasks as called for by humans, but could some extend make own decisions (especially the smaller types going into holes and/or pipes).

Phillips et al. argues for the efficient use of robots for tasks that are dangerous or mundane (E. Phillips et al. 2012, 1553). In this context, robots could easily benefit from a higher autonomy, as there is no direct teammate presence. Also this type of robot could benefit from having higher autonomy as it needs to make decisions in the context in which it is working. In the context of cleaning up, the robots at Fukushima worked as a team, calling for the need of collaboration and autonomy not only between humans and robots , but also between robots and robots (Husseini 2018).

Disadvantages with decreasing the autonomy in this situation is the potential loss of collaboration between robots in an extreme environment. But at the same time creating potentially dangerous situations for humans and they need to take a more active part in the team in this context. Thus, the “tool-to-teammate”-continuum must be carefully designed in this example, as these clean up robots must be enough of a tool that they do their intended task well, while at the same time be a teammate both for the people in need of it and to other clean

up robots. Drawing on the same example of an autonomous robot, as Endsley shows, people are not comfortable being in a team with a robot that suggests options and decision making (Endsley 2011). Therefore increasing autonomy for a robot that is supposed to be a teammate should be done very cautiously.

Example 2: Paro

Another example are robots inspired by human-canine relationships are robots which provide emotional comfort. An example Phillips et al brings up is *Paro*, a robot that is designed to provide companionship to eldery people (E. K. Phillips et al. 2016, 106). These are robots that are designed to mimic the companionship seen in humans and dogs, especially concerning the social aspects of these relationships. As noted, the analogy of human-animal teams are central to Phillips et als argument, as they mean this can help us design robots that fits neatly with people's mental models concerning animal-human teams (E. K. Phillips et al. 2016).

Paro follows this idea pretty close, especially how it is shaped as an actual animal - a seal. Drawing on the levels og autonomy given by Endsley, Paro is somewhere along the lines of batch processing or in some cases having shared control as it responds to the actions of people interacting with it.Paro mainly responds to human stimulation, and it does not act very autonomous.

Increasing the level of autonomy (over level 5) would risk the interaction that makes Paro successful. Paro does not seek interaction in the way an actual animal does, but increasing the autonomy of the robot might make it do so. It is the slow responsiveness that makes it ideal for emotional comfort for people with cognitive and physical disabilities, and increasing this might reduce the successfulness of the robot. As Endsley notes, the people are less comfortable with robots that makes decisions and not just helps you with tasks (often information-related) (Endsley 2011). Taking this into account it might not be helpful to increase the autonomy of Paro, as people want a more passive, yet interacting robot. As it probably would walk around making interactions as it deem fit.

However, if we were to increase the autonomy of Paro, there might be an advantage in it understanding more contextual cues, such as seeking people who needs comfort out, as opposed to them seeking out the robot for comfort.

The articles discussed above have some part of discussion concerning automation in robot-human interaction as well as how this should be designed.
Automation is central to the understanding of how humans and robots can work together, through reading Phillips et al. and Endsley it becomes apparent how important the specific tasks in which the robot is to be used is to its degree of automation. Drawing on the arguments and knowledge presented by these authors, there are many aspects to consider when designing these robots, like where on the tool-to-teammate continuum one might place the robot as well as if there is a desire to invoke and establish mental models based on a zoomorphic understanding of teamwork.

References:

Amershi, S., Weld, D., Vorvoreanu, M., Fourney, A., Nushi, B., Collisson, P., ... & Teevan, J. (2019). Guidelines for human-AI interaction. In Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems (paper no. 3). ACM.

Bratteteig, Tone, and Guri Verne. 2018. “Does AI Make PD Obsolete?: Exploring Challenges from Artificial Intelligence to Participatory Design.” In *Proceedings of the 15th Participatory Design Conference on Short Papers, Situated Actions, Workshops and Tutorial - PDC ’18*, Hasselt and Genk, Belgium: ACM Press, 1–5.

Følstad, A., & Brandtzæg, P. B. (2017). Chatbots and the new world of HCI. interactions, 24(4), 38-42.

Endsley, Mica R.. Designing for Situation Awareness: An Approach to User-Centered Design, Second Edition CRC Press. 2011 (chapters 2 and 10).

Copeland, B.J. 2006. “Artificial Intelligence”. Encyclopedia Britannica. https://www.britannica.com/technology/artificial-intelligence/The-Turing-test (Accessed 25.09.2019)

Grudin, Jonathan. 2009. “AI and HCI: Two Fields Divided by a Common Focus.” *AI Magazine* 30(4): 48.

Husseini, Talal. 2018. “Cleaning up Nuclear Waste: A History of Robotics Development.” *Power Technology | Energy News and Market Analysis*. https://www.power-technology.com/features/cleaning-up-nuclear-waste-robotics/ (November 15, 2019).

Khanna, Sankalp, Abdul Sattar, and David Hansen. 2012. “Advances in Artificial Intelligence Research in Health.” *The Australasian Medical Journal* 5(9): 475–77.

Kocielnik, R., Amershi, S., & Bennett, P. N. (2019). Will You Accept an Imperfect AI?: Exploring Designs for Adjusting End-user Expectations of AI Systems. In Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems (paper no. 411). ACM.

Luger, E., & Sellen, A. (2016). Like having a really bad PA: the gulf between user expectation and experience of conversational agents. In Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems (pp. 5286-5297). ACM.

Markel, Howard. 2011. “The Origin Of The Word ‘Robot.’” *Science Friday*. https://www.sciencefriday.com/segments/the-origin-of-the-word-robot/ (Accessed September 25, 2019).

Moravec, Hans Peter. 2005. “Robot”. *Encyclopedia Britannica.* https://www.britannica.com/technology/robot-technology (Accessed 25.09.2019)

Phillips, Elizabeth Kathleen et al. 2016. “Human-Animal Teams as an Analog for Future Human-Robot Teams: Influencing Design and Fostering Trust.” *Journal of Human-Robot Interaction* 5(1): 100.

Phillips, Elizabeth, Scott Ososky, Brittany Swigert, and Florian Jentsch. 2012. “Human-Animal Teams as an Analog for Future Human-Robot Teams.” *Proceedings of the Human Factors and Ergonomics Society Annual Meeting* 56(1): 1553–57.

Thrun, Sebastian. “Toward a Framework for Human–Robot Interaction.” : 17.

Appendix:

Feedback:

Central to my feedback was that I did not specify a lot of concepts in my writing, making some om my sentences and reflections hard to follow and sometimes unclear. I tried to to this where the person giving feedback had pointed this out. An example of this is how I tried to specify more what I meant when I compared AI and robots, Chris’ comments pointed out that this section especially was a little lacking. I have used his feedback to write more precise definitions, hopefully making my writing more clear and easy to understand.

For Iteration 2 i got feedback relating to the structure of my assignment - that there was too much white space and the paragraphs did not really flow well. Therefore I put some effort into moving them around so that they follow the structure given by the assignment.