IN5480 - Individual assignment

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1. Three definitions of AI

The book, Computational intelligence: a logical approach, definition: "Computational intelligence is the study of the design of intelligent agents. An agent is something that acts in an environment - it does something (..) An intelligent agent is a system that acts intelligently: What it does is appropriate for its circumstances and its goal, it is flexible to changing environments and changing goals, it learns from experience, and it makes appropriate choices given perceptual limitations and finite computation." (Poole, Mackworth, & Goebel, 1998, p. 2). AI from this definition is something that can act intelligently in the environment, i.e. agents that can do appropriate decision independent. For clarifications the aforementioned term "computational" is to be understood as artificial. (Poole et al., 1998, p. xv).

John McCarthy definition: "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." (John McCarthy, 1998). AI according to his definition is the activity of engineering and constructing intelligence in machines/computer programs. AI is also not limited to evolution such as humans are biologically.

SAS definition: "AI makes it possible for machines to learn from experience, adjust to new inputs and perform human-like tasks." (Statistical Analysis System (SAS), n.d.). AI according to this definition is Machine Learning, from learning through experience the machinery can perform similar tasks as humans can.

Module 2. Discuss definitions relative to discussions of AI in the course.

In this course various definitions were discussed in class. The aforementioned definitions can all be used in the three categories of artificial intelligence: super, general and narrow. However, I think that John McCarthy's and SAS definitions leans more towards general artificial intelligence, as AI is compared to humans here. This is a misconception when we are trying to

understand how to design interaction with AI according to Asbjørn Følstad lecture, super and general artificial intelligence tend to belong to sci-fi movies. When we talk about AI, we talk about all three categories, when we talk about interaction with AI we talk about artificial narrow intelligence. AI consist of large data-sets and may be understood as computer systems learning and improving on the basis of its data e.g. the Google product *quickdraw* which was used in class, this understanding of AI also relates to the aforementioned definitions.

2. Three definitions of Robotics

David Hitt, from NASA, definition: "Robotics is the study of robots. Robots are machines that can be used to do jobs. Some robots can do work by themselves. Other robots must always have a person telling them what to do." (Hitt, 2009) Robots according to this definition are machinery that can do jobs, and the execution of the task can either have a low or high dependency of humans.

ISO definition: "An automatically controlled, reprogrammable, multipurpose, manipulator programmable in three or more axes, which may be either fixed in place or mobile for use in industrial automation applications." (International Organization for Standardization, n.d.) Robot according to this definition concerns industrial robots, humans are in control of them as they are maintainable or manipulative, and the machinery can have many purposes in either a fixed or mobile state.

The book, Robot Law, definition: "A robot is a constructed system that displays both physical and mental agency but is not alive in the biological sense" (Richards & Smart, 2016, p. 6). Robot according to this definition is a constructed system that "exist" physically, but isn't alive biologically.

3. Three definitions of Machine Learning

A course about Machine Learning at Stanford University definition: "Machine learning is the science of getting computers to act without being explicitly programmed." (Stanford University, n.d.) Machine Learning according to this definition is a system-process of self-learning and self-acting without the machine being explicit told to do something.

Dorian Pyle and Cristina San José, from McKinsey & Co, definition: “Machine learning is based on algorithms that can learn from data without relying on rules-based programming.” (Pyle & José, 2016). Machine Learning according to this definition is based on algorithms that enables machines to learn from data without being bound to a set of rules.

The book, Machine learning, definition: “A computer program is said to learn from experience E with respect to some class of tasks T and performance measure P, if its performance at tasks in T, as measured by P, improves with experience E.” (Mitchell, 1997, p. 2). Machine Learning according to his definition is a computer program which improves its performance in doing a task through its experience.

Module 2. Discuss definitions relative to discussions of Machine Learning in the course.
Machine learning uses deep neural networks to learn and improve e.g. when we try to make a machine learn we supply large collection of text, the machinery inputs this data into a deep neural network and predicts an outcome or a class it belongs to depending on probability. In other words, if we had a data collection of car pictures and feeds this to the machinery the deep neural system can predict more certainly that another picture is a car. More high quality data means also a better outcome.

4. The relationship between AI and Robotics.
I see AI and robotics as two separate fields, as they can function independent from each other. Regardless of this, they can be combined with each other, creating a relationship. For instance, a can robot be programmed to do a certain automatic task. This cause the robot to behave automatic, but not autonomous. For the robot to function autonomous it will first need AI, the brain of the robot.

5. Own definition of AI.
“Machine learning derives from AI, the latter differs as it can perceive its environment and can adapt to it by doing intelligent decision making”. AI for me is a self-taught and intelligent system, with the features to sense and reason. However, I think it’s difficult to truly understand what intelligent means, and how we can distinguish a system from being intelligent or just

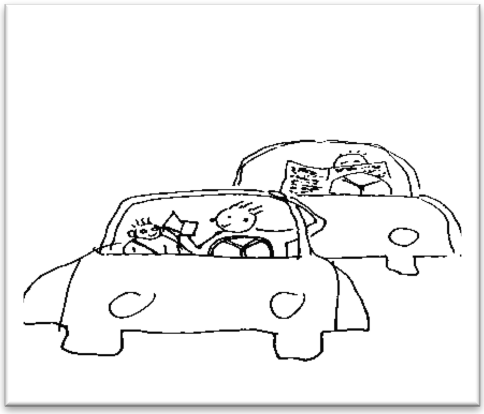
machine learned. Even James McCarthy, the coiner of AI, seems to find trouble defining intelligence. (John McCarthy, 1998, p. 2)

Module 2. Expand on this text to explain the relation between AI and Machine Learning

Machine Learning is a subset of AI which is mentioned in the definition above. AI is made available by large quantity of quality data and computational power. In terms of data collection, we see that Google and Amazon collect data by having free services (Gmail) or cheap products (Alexa) to gather data from its users while being used, which was an example from Dr. Goodwin in class. This data is valuable first when it's inserted into deep neural networks, which learns the system to improve tasks with experience. AI can use these lessons learnt to its advantage for its decision making. AI needs Machine Learning to work properly, but not vice versa. This is the relationship between Machine Learning and AI as I understand it.

6. Artificial intelligence drawing

This drawing illustrates self-driving vehicles and the behaviour of the drivers. In this image I've tried to portray that the driver's attention is on their phone or newspaper, rather than the road. Hence they have become bias to automation too.



Module 2. Summarize key characteristics of interaction design for AI-based systems (challenges, principles, trends).

On Google Trends, the topic chatbots are becoming more relevant. We can see that Giant tech-firms already has their chatbots rolled out, and they are becoming more relevant than before. Lately, their systems have been getting attention because artificial intelligence is evolving and is now made available by computational power and large datasets. As chatbots and other AI-based systems are becoming more relevant, it might be the new preferred interface for user activities e.g. messaging services.

Conversations as the object of the design is a challenge when it comes to design of AI-based systems. This is because the HCI field has had its attention on designing explanatory task i.e.

conveying a message to the user how and what information is available and desirable steps to reach the information e.g. a vending machine. Interacting with AI-systems is different— as we now need to design interpretational task, understanding and serving the user need for information e.g. in VA like Siri or Alexa. (Følstad & Brandtzæg, 2017)

When designing these system, we need to understand the conversational processes. The ability of a chatbot to have a meaningful and acceptable conversation with the user. Some principles we need to take in account is that we speak to perform, and the chatbots should understand the various way we express ourselves. Understanding when the design of the conversation can be cooperative and task-oriented and as well as designing the conversation to be as informative as required, speak what you believe is the truth, be relevant, be clear and unambiguous. For a conversation repair try to prevent it by expecting variations, if this doesn't work provide helpful cues or alerts – and *fail gracefully*.

It's important to be aware that these system is supposed to be able to communicate to people with age, language and gender differences- and if their data collection is bias the conversation breaks down e.g. having only samples of male-voices in their voice-recognition will make it difficult to understand females. This example might also show that there is a need for a guidance in both ethics and privacy as these communication agents emerges.

Module 2. Sketch a user interface illustrating one or more of these characteristics.

7. The different perspectives on the human relationship with tools.

The first view is from a German biologist, Jakob von Uexküll (1864-1944). Uexküll writes in his paper "Functional Tone" that each subject lives in its own subjective universe, where the subject and object form their own niche. It's first when the subjects enter into a relationship with an object the object becomes meaningful. The object can also be perceived differently in another subjective universe and thereby get a different meaning. When the subject enters a relationship with an object it imprints a meaning to it, thus the object will transform into a "meaning-carrier". As the object becomes a meaning-carrier it obtains a "functional tone" which is based on the subject's mood. As I interpret it, Üexkull primordial focus was the relationship between animals and objects, but the theory could nevertheless be applied on humans and objects, for instance can a human enter a relationship with a sharp object and use it for dinner purposes or as a weapon, this is dependent on the subject's mood.

The second view is also from a fellow German, the philosopher Martin Heiedegger (1889-1976). In his article "Equipment" it emerges to me that subject and object cannot be fully separated and that there is a correlation between them. Perception cannot explain the relationship between subjects and objects and that we have to see beyond this relation and look at the "bigger-picture", what it means for a being to exist. Subjects are according to him "being-in-the-world", and the subject's activity is what forms the perception of a tool and its use. Thus, objects are only a tool in a meaningful context. For instance, for the ongoing activity "dining" at a living-space-environment a sharp object is used by a human e.g. as a knife for slicing the bread which is a meaningful activity and thus is the object also perceived as a tool in this meaningful context.

The third view is from an American psychologist, James J. Gibson (1904-1979). He opposes the activity of dividing the subject and object relationship, and rather emphasis their mutual relationship. For him each animal, the subject, lives in its own special environment or an environment with a set of affordances. The reflected lights from the surface is how the affordance is made available for perception by the subject. Depending on the subject bodily movement, the subject needs may change and is crucial for becoming aware of the affordance through the senses. Affordance is objective properties in the environment and is always there to be perceived by the subject, as they are objective properties they are also never changing i.e. the affordance is always there even though the user's activity and their bodily movement may change. As an

example of the concept of affordance in a human-tool perspective: when a human perceives a stone on the road it can afford walking on, throwing, holding, lifting etc.

The fourth and last view is from David Kirsh (1950), a researcher in cognitive science. He describes how active subject structures their environment to achieve tasks. Humans will actively structure their space and thereby create entry points which sets up a structure for their work day. This will, according to him, reduce cognitive demands. Entry points may be objective (user independent) or subjective (user depended). In the perspective of a human-tool use an entry point may be objective when it's in the dimension "visibility", a to-do list for instance is a user independent entry point or i.e. a tool to structure humans' daily work. An entry point may be subjective when it's in the dimension "relevance". For example, when a programmer is handling errors related to a system, the exception-handler tool gives several entry points where to look to find the error in the code, the programmer may get an entry point which is more relevant for him in his search for the cause of an error.

8. One perspective from the article

David Kirsh is a cognitive-scientist, he takes interest in how work-context can be understood and improved. When he talks about work-context, he mainly refers to work places like offices. In his view, achievement of various tasks in subject's interactions with the environment can be done more efficient by restructuring the environment. Hence, reduce cognitive efforts, and improve their performance at work. This cognitive reduction is achieved when subjects actively structures their day by creating entry points which organise and prioritise their workload. Entry points are environmental structures which invites subjects to information or activities, i.e. to-do list, files, papers etc. In likelihood with affordance, entry points invite humans to do certain things.

9. Summary of an article from module 1

I chose the article Automation Bias in Intelligent Time Critical Decision Support System by M.L.L Cummings (2014). In this article Cummings discusses and suggests how various levels of automations (LOA) should be designed in intelligent decision systems, the discussion is situated in the aviation domain. The discussion elaborates that humans tend to be automation bias, which means that we trust automation too much and accept its decision as correct without searching for a contradiction. The consequence of automation bias can be major incidents in the aviation

domain, where there is no room for errors. A a higher automation can also come with a cost on human's performance, which can be seen as a disadvantage: loss of situation awareness, skill degradation, automation bias and complacency. Their results show that LOA is a concern when designing intelligent decision systems, and designers should be aware of the negative effects of increasing LOA and keeping humans out of the decision making.

10. Summary of a fictional TV-series

I've selected the TV-series Black Mirror and the episode "Be Right Back", which tells the story about Martha who lost her boyfriend Ash in a car accident. As she mourns him, a friend tells her about this new and exciting AI technology which can mimic the voice of Ash. Martha isn't interested at first, thinking Ash is irreplaceable, but after a lot of grief she decides to try it out. The conversation goes through a Chabot, she quickly finds comfort speaking to the bot, or more precisely the bot's imitation of the boyfriend, and from here it escalates to the thirst of having more for Martha. Further into the story she upgrades the Chabot with new features and properties, until there is an actual intelligent robot, looking and behaving just as her boyfriend. Despite that the robot is satisfying her in different ways, she finds something odd in the interaction with it. One evening she gets irritated of the robot's silly answers, and orders it to leave the house, the robot does as it's instructed, which annoys her as the real boyfriend would have argued against. Throughout the story, misunderstanding between her and the robot awkwardly happens — and that is also how she realise that her boyfriend, Ash, is and always will be irreplaceable.

11. Human autonomy and machine autonomy

Autonomy is about having a choice and execute a decision independent without being influenced from anyone else. For humans, autonomy is the decision to self-determine what's right without being influenced by other humans. For machinery, autonomy is also the decision to self-determine what's right without being influenced by other systems, a controller or programmed to do a task.

12. When was the term "AI" first coined?

The term AI was coined by James McCarthy in 1955 when he in a letter proposed a meeting

concerning the field of AI, his proposal was later carried out at the Dartmouth conference in Hanover, New Hampshire 1956. (J. McCarthy, Minsky, & Shannon, 2006)

13. One question for the article "What we talk about when we talk about context"
What could Dourish view be on designing predefined context in computing?

14. One question for any other article in the curriculum.
As I see it, automation bias could be a reason to disclaim accountability, this is particularly an issue concerning intelligent systems that can harm people. According to Cummings, designers of intelligent systems is advised to design with automation bias in mind (Cummings, 2004, p. 5), should designers of these systems therefor also have an ethical perspective in mind?

15. Summarisation and discussing of "Like Having a Really Bad PA" by Luger & Sellen.
I think this article gave some valuable insight on how individuals interact with various communication agents (CA), in particularly with hands-free devices. Their findings show that CA is currently unsuccessful and limited in its capability when interacting with humans in everyday situations e.g. conveying feedback, voice recognition, trust, affordance, context awareness, and unrealistic expectations were amongst the difficulties for the participants within CA.

The authors discuss work in design before the potential of CA is realised. They suggest to consider: (a) the design to reveal system intelligence, (b) the interactional promise made by humour, (c) new ways of conveying CA capability though interaction (d) system feedback and design goals in light of the dominant use case.

Tech-firms are focusing more on AI than ever before, e.g. the relevance for chatbots on Google trends has been skyrocketing. As mentioned, the article findings show on the other side that chatbots fails user expectations and in its capability. The reason for this is that their products affords and represents features which ‘belongs’ to sci-fi movies/books like the TV-series Person of Interest featuring an ‘artificial super intelligent’ machine characterised by its anthropomorphist properties. Today’s CA seems to be rushed towards that direction, but we have to accept that we are not building ‘super intelligent’ in the first phase, but rather narrower artificial intelligence.

Because of the popularity we see a rapid development of the CA's and when these systems are not understanding our use cases, we often find blame in ourselves. The message from the article is that the design approach and goals of CA should be reconsidered, by communicating a clear message what it is capable of and what it's limited to, limit anthropomorphism that it may have and focus on building user trust. This will benefit the user interactions with CA and thereby become helpful and time saving and perhaps more socially accepted outside the house.

Module 3. 16. Different levels of automation and advantages/disadvantages related to higher/lower levels of automation.

The levels of automation (LOA) can be seen on a scale from 1 to 10. Where the lowest level shows that humans take all decisions and the highest level shows that the computer acts autonomously and keeps the humans out of the loop in all decision making. The determined LOA should depend on what task it performs, and the designers of such automated system should be aware of both the negative and positive effects. In class we looked at Sheridan and Verplank's 10 level Autonomy scale. In this assignment I will look at the LOAs in Table 2 below.

Table 2. Levels of Automation

Automation Level	Automation Description
1	The computer offers no assistance: human must take all decision and actions.
2	The computer offers a complete set of decision/action alternatives, or
3	narrows the selection down to a few, or
4	suggests one alternative, and
5	executes that suggestion if the human approves, or
6	allows the human a restricted time to veto before automatic execution, or
7	executes automatically, then necessarily informs humans, and
8	informs the human only if asked, or
9	informs the human only if it, the computer, decides to.
10	The computer decides everything and acts autonomously, ignoring the human.

Note: (Cummings, 2004, fig. 2)

In complex-time critical domain, like the warfare domain, there is no room for errors. In this domain decision support systems are commonly used, with human experiences in combination with computation speed of a computer system in order to generate solutions in a timely manner (Malasky, 2005). This combination, also known as HMCDM, can be useful in combinatorial, visual, computationally and heuristic-heavy type of problems. However, we see instances where these type of systems become a problem. In Iraq, 2004, an U.S. automated missile system shot down allies, killing three aircrews. It operated under LOA 6 (Table 2) and the operators failed to veto the computer solution, among other things they lacked in training on this complex system (Cummings, 2004). This example gives an indication that the LOA should've been lower, and at least not higher. Having a higher LOA in complex-time critical domains can therefor not be advisable. A high LOA can also come with a cost on human's performance, which can be seen as a disadvantage: loss of situation awareness, skill degradation, automation bias and complacency (Cummings, 2004)**.** For less complex decision-making tasks, a higher LOA can be useful. Like traffic lights which directs the traffic. For this automated system, the LOA can be as high as 9-10 (Table 2), which ignores humans in its decision-making and has a low probability to fail. In general, this can be seen as an advantage as it relieves human workload.

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