IN5480 Individual assignment fall 2021

Human Robot Interaction

1.1 Concepts, definition and history of AI and interaction with AI

The history below is based on a youtube video called “A Brief History of Artificial Intelligence”

“1950 Alan Turing proposed The Turing Test. That same year Isaak Asimav proposed the three laws of robotics. In 1951 the first AI based program was written. In 1955 the first self-learning gameplaying program was created. (BootstrapLabs, 2017)

“The first coordinated AI research at MIT began in 1959 when John McCarthy and Marvin Minsky founded the Artificial Intelligence Project as part of both the Research Laboratory for Electronics (RLE) in Building 26 and the Computation Center”. (Knights. 2006)

“In 1961 the first robot is introduced to the gms assembly line. In 1964 the first demo of an AI program that understands natural language is created. In 1965 The first chatbot Alaysa was invented. In 1974 the first autonomous vehicle is created at Standford AI lab. In 1989 Carnegie Melon creates the first autonomous vehicle using a neural network. In 1997 IBM deep blue beats Garry Kasparov in chess. In 1999 Sony introduces Ibo. That same year the MITs AI labs first emotional AI is demonstrated. In 2004, Darpa introduces the first autonomous vehicle challenge. In 2009 google starts building a self-driving car. In 2010 Narrative Science´s AI demonstrates the ability to author reports. In 2011 IBM Watson beats Jeapordy champions. That same year Siri, Google Now and Cortana becomes mainstream. In 2015 Elon Musk and others invests a billion dollars to open AI. In 2016 Google´s deep mind defeats Korean Alfa Go Champion. In 2016 Stanford issues the AI 100 report. In 2016 UC Berkley Launces the center for human compatible artificial intelligence.(BootstrapLabs, 2017)”

Three Definitions of AI and My Own

“The term artificial intelligence was first coined by John McCarthy in 1956 when he held the first academic conference on the subject.” (Smith 2006, p. 4)

“Artificial intelligence leverages computers and machines to mimic the problem-solving and decision-making capabilities of the human mind. (Artificial Intelligence (AI)) According to dictionary.com it is:

“...the capacity of a computer, robot, or other programmed mechanical device to perform operations and tasks analogous to learning and decision making in humans, as speech recognition or question answering.” (dictionary.com)

My personal definition is that whenever a computer acts like a human or animal of the natural world, we call that AI.”

Review of "Ai and HCI: Two Fields Divided by a Common Focus"

This article tells a story of AI and HCI that identifies some of the forces that kept the fields both acting in their best interest. AI and human-computer interaction are inclining toward each other. HCI researchers are using AI techniques and machine learning is getting more common. AI technologies needs guidance from the HCI community and the other way around. These fields have joined each other for a while. While AI research from the past was more expensive, CHI has developed technologies with an affordable price that could lead to widespread availability. These differences led to a strained relationship as AI and HCI competed for resources." (Grudin et al. 2009, p.48)

AI pioneer Herb Simon thought that machines will be capable within twenty years(this was in 1960) to do any work that a man can do. Five years later, I. J. Good, an Oxford mathematician and former World War II code breaker together with Turing, wrote that the survival of man depends on early construction of an ultra-intelligent machine that could design even better machines (like humans). This would then lead to an "intelligence explosion" and the intelligence of man would be left in the shadows.

They sketched an architecture for such a machine and concluded that it was "more probable than not that, within the twentieth century, an ultra Inteligent machine will be built and that it will be the last invention that man need make." (Grudin et al. 2009, p.50)

"The Mid-1960s to the Mid-1970s: AI Takes Shape as a Major Research Field" (Grudin, 2009, p.50)

The article concludes with saying that technology trends is going in the right direction. Costs are declining and machine learning is contributing to interaction design by focusing on specific user behaviors. There is a strengthening tie between AI applications and HCI and there is a demand for new and better interfaces. AI technicians and HCI researchers are learning skills and techniques from each other and have found shared purposes, and have gained a mutual understanding. This will continue as the fields develop in the future. (Grudin et al. 2009, p.55)

The Contemporary Company Tesla and How They present AI on their webpages

Tesla develops autonomy in high quantity for use in cars, robots etc. They believe that having an approach based on advanced AI when they plan future products, and an effective use of inference hardware is the only way to develop a successful self-driving vehicle and other products. (Tesla 2021)

We can get from what they´re writing that the idea is still under development and something we will see more of in the future. They´re still reaching the solution. Tesla is campaigning that they are focusing on Artificial Intelligence and Auto Pilot. Tesla is developing a product called Silisium Chips that is running the software from the bottom. Tesla is also working on a neural network.

The Movie "I Am Mother" and How AI Is Portrayed in it

I recently saw a film about a girl who was raised by a mother who was a robot. The rest of the human beings were gone and the girl was alone with this robot. It was a very advanced robot that could do many practical things that only human beings could do. What? It had a very high intelligence and somehow managed to raise the child. It was a futuristic movie and we don´t know if we´re ever going to need a robot exactly like that. Or if we are going to be able to make it. Most of the film is based on how this girl interacts with the robot. The design of the robot didn´t look like they had been trying to make it look like

a human, but it was looking very boxy and robotic. The voice was that of a human woman when the robot talked. The girl was very obedient to the robot. The People who programmed the robot seemed like that they had done an excellent job in assimilating a mother. But as old-style robots; it was hard and metallic. The robot mother would provide for her whatever she needed as she grew up. There had been an apocalyptic collapse on the earth so the robot and the girl were hidden in a hi-tech basement where the robot would do all the regular chores a mother does for a child like cleaning, cooking, teaching, etc. It seemed like a loving relationship.

Human Robot Interaction and Interaction with AI

"Artificial intelligence is **the simulation of human intelligence processes by machines,** especially computer systems. Specific applications of AI include expert systems, natural language processing, speech recognition and machine vision."(Burns et al. 2021, p.1)

Human–robot interaction is the **study of interactions between humans and robots.** It is often referred to as HRI by researchers. Human–robot interaction is a multidisciplinary field with contributions from human–computer interaction, artificial intelligence, robotics, natural language understanding, design, and psychology.(Copeland et al. 2021)

1.2 Robots and AI systems

The word "robot" was first introduced through the Check playwright "Rossum´s Universal Robots". Novelist and journalist Karel Capek(1880-1938) wrote the play. The word "robot is" drawn from an old Church Slavonic word, robota, for "servitude," "forced labor" or "drudgery.(Markel, 2011)

Below are two different definitions of the word "robot"

"A machine that resembles a human and does mechanical, routine tasks on command." (dictionary.com) "a person who acts and responds in a mechanical, routine manner, usually subject to another's will; automaton."(dictionary.com) Another way is to describe it as a mechanical slave mimicking human behaviour in the way it was created to do it.

The Relation Between AI and Robots

AI(artificial intelligence) is the intelligence of the system or the robot. This is a type of intelligence which is programmed, created, and controlled by human beings. Without AI it is questionable if we can call a robot for a robot because artificial intelligence is a key factor in making robots more successful in imitating human behavior having their own intelligence.

The robot is just a machine that resembles a human and does mechanical, routine tasks on command." (dictionary.com), but the software that makes it possible for the machine to receive commands and make actions on them is the AI.

Sofia

The robot Sofia can interact with humans and have her own opinions on for example crypto currency. She has lately also received new legs so she can walk. She will in the future be able to, for example, run upstairs and interact in a human environment. Before she was moving around with wheels. The robot is good to be interviewed on tv-shows like for example Jay Leno. She has good facial expressions. And knows how to have an intelligent conversation.

1.3 Universal Design and AI systems

Universal Design

Universal design is about making content available for everyone. There are several ways one may do this. One is to keep the contrast between letters and backgrounds high enough. There are specific contrast requirements mentioned in the WCAG. It´s supposed to be a contrast ratio of 4.5:1, and large text (24px or larger on headlines and 12px or higher on regular text), to make it easier to read for people with weakened eye sight. There is also mandatory to have for example web pages that can be heard by blind people and that may be controlled by speaking. Including people with a handicap or something else that requires extra help is one of the goals. On WCAGs website they have written:

"Following these guidelines will make content accessible to a wider range of people with disabilities, including blindness and low vision, deafness and hearing loss, learning disabilities, cognitive limitations, limited movement, speech disabilities, photosensitivity and combinations of these. Following these guidelines will also often make your Web content more usable to users in general." (Kirkpatrick et al. 2018)

The Potential of AI With Respect to Human Perception, Human Movement and Human Cognition/Emotions

As already mentioned, the robot Sofia can express a wide variety of emotions with her face. She is the most human-like robot in the world. With AI making robots so much like humans, they may be good in the future for practicing socializing or for people who need company and are lonely. There are also surfacing acrobatic robots that are very athletic and know how to, for example, jump and do flips etc. In the future robots like this can be used for sports. For example, football matches with robot teams etc. might occur in the future. Robots may also be used as weapons and soldiers. Video games are examples of AI systems including more users and the same is true for modern day maps where the AI calculates the fastest route.

The Potential of AI For Both Including and Excluding People

The first thing that comes to mind when it´s about AI excluding people I think about how AI is not so available to the masses yet. Mostly, advanced AI is only available for developers, so this may exclude most people. However, as advanced AI becomes more available, more people will get their hands on it and will be able to explore it. What we know about the robot Sofia for example is strictly from online articles and videos and most of us haven´t yet had the possibility to meet a robot like that.

The Word "Understanding" For AI

Understanding doesn´t mean "to stand under" but it means that you know something and can explain for example how it works. It can also be an emotional understanding like empathy and compassion which means that you feel affected by what other people feel and that you care. Machines understand, but they can´t understand how it is to feel human emotions.

1.4 Guideline for Human-AI interaction

Below is the nr. 1 guideline for human – AI interaction from Microsoft.

"Make Clear what the system can do, and help the user understand what the AI system is capable of doing.(Amershi et al. 2019, p3.) Example: when interacting with Siri on Apple iPhone, she suggests things you may ask her for as written text on the phone.

Below are Shneidermans eight golden rules; HCI guidelines:

- “Strive for Consistency.
- Cater to Universal Usability.
- Offer Informative feedback.
- Design Dialogs to yield closure.
- Prevent Errors.
- Permit easy reversal of actions.
- Support internal locus of control.
- Reduce short term memory load. “(Guidelines In HCI – Human Computer Interface)

Below are the Guidelines for Human AI Interaction

- Make clear what the system can do.
- Make clear how well the system can do what it can.
- Time services based on context.
- Show contextually relevant information.
- Match relevant social norms.
- Mitigate social biases.
- Support efficient invocation.
- Support efficient dismissal.
- Support efficient correction.
- Scope services when in doubt.
- Make clear why the system did what it did.
- Remember recent interactions.
- Learn from user behavior.
- Update and adapt cautiously.
- Encourage granular feedback.
- Convey the consequences of user actions
- Provide global controls” (Amershi et al. 2019, p.3)

The principle about “Striving for consistency” and make clear what the system can do are both similar principles that is about some of the same thing. This also plays into another principle outside of these; one that is about making the system easy to use and have good usability. Matching relevant norms for example is not relevant in the same way for HCI and Human AI Interaction. In Human AI Interaction this is a main issue when it comes to robots and chatbots behaving properly and following social norms. Remembering recent interactions is also relevant for both. In human computer interaction remembering recent interactions will for example be where your phone remembers what you have been doing on it lately. While in Human AI interaction it is to “Maintain short term memory and allow the user to make efficient references to that memory.” (Amershi et al. 2019, p.3)

Characteristics of AI Infused Systems

“Chatbots are examples of AI infused systems” The term “chatbot” partly overlaps with the terms “conversational agents” and “dialogue systems”(Marita 2021). AI-infused systems may demonstrate

unpredictable behaviors that can be disruptive, confusing, offensive, and even dangerous." (Amershi et al. p.1), That is why it´s important to develop them in the proper way. You don´t want to have users asking if they are going to do something bad and the chatbot tells them to do it.

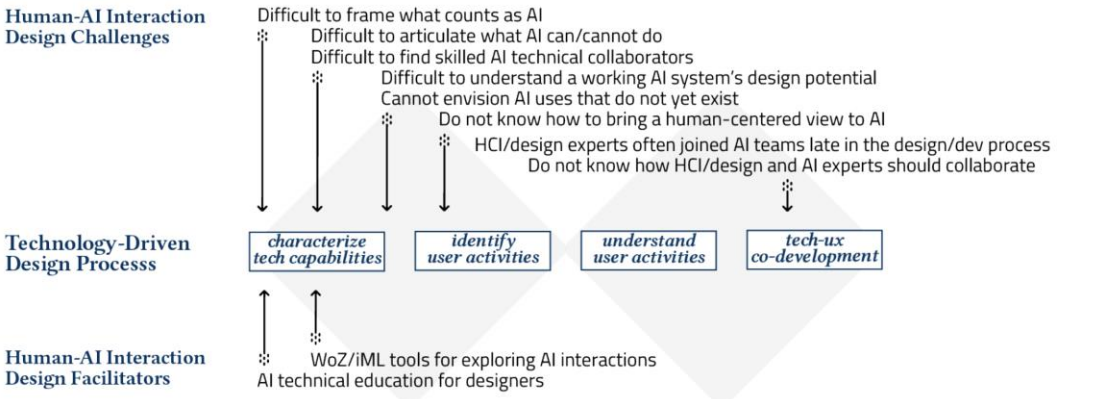
Chatbots are helpful for customer service and social practice. Some of these AI infused systems are so advanced that they can learn and become better at what they are doing. Another key characteristic of these AI infused systems is that they provide a service for the user which is helpful. The Google or Apple Maps function are other helpful aps with AI that can help you find your way around. I learned recently that there is an AI service that helps you to see if an email has a meeting request in it or not(Kocielnik et al. 2019 p.2); which is practical if you get a lot of emails.

The question asked in the article "Will You Accept an Imperfect AI? Exploring Designs for Adjusting End-user Expectations of AI Systems" (Kocielnik et al. 2019 p.1) is interesting, but the answer is simple: Either you except an imperfect AI or you do not except AI at all. Because you can always find errors or something missing in AI. Especially now when it is relatively new thing.

Another characteristic of an AI infused system is that it´s difficult to design.

There are challenges attributed to AI´s technical complexity, demand for data and unpredictable interactions. People working with HCI are handling technologies using simple, inexpensive artifacts like, for example, paper prototypes. What makes AI different and especially difficult to prototype for designers is that they routinely must work with complex, dynamic, and unpredictable interactions. (Yang et al. 2020 Q., p.1).

Some of the reasons why designing for AI is a challenging process is shown in the figure below.



(Yang, Q., p.3)

It can be a challenge for some people to work with AI designers because "..they lacked a shared workflow, boundary objects, or a common language for scaffolding the collaboration...." (Yang et al. 2020, p.3)

“The technical boundary of AI, even in AI research communities, is disputed and continuously evolving”. (Yang Q. et al. 2020 p.4). That is why it´s sometimes difficult to know what is possible to do with AI and what is not(limitations).

Another characteristic of AI infused systems is that they are continuously evolving. They become more advanced and more complex as they evolve through time.

Video games are other AI infused systems. They are evolving with improvement in graphics, the games are getting bigger, faster, and more realistic as technology advances. The enemies in the game are driven by AI. I remember when the AI had gotten far in the 90s in the video game called Golden Eye on N64 and the enemies could hear your gunshots from far away and reacted to it. This was revolutionary for AI in a game. Whether it be games, chatbots or any other AI infused system, the request for AI is increasing as it is useful, and as it is demanded it will be created when it is possible. In the future we will see characters in games that have the same level of intelligence as, for example the Robot Sofia. Another characteristic of AI infused systems is that they can be entertaining and helpful because they entertain gamers. Video games are difficult to design.

Main Take-Aways from “Guidelines for Human-AI Interaction”

Advances in artificial intelligence give challenges for the design of user interfaces. These advances are giving the possibility to integrate AI capabilities in user-facing systems.

Increases in the accuracy of pattern recognition have created opportunities to integrate speech recognition, translation, object recognition and face recognition in applications.(Amershi et al 2019, p.1) Developers have synthesized over 20 years of learning AI design into a small set of guidelines for human-AI interaction. Their contributions are:

“• A codification of over 150 AI-related design recommendations collected from academic and industry sources into a set of 18 generally applicable design guidelines for human AI interaction....

• A systematic validation of the 18 guidelines through multiple rounds of iteration and testing.” They hope these guidelines, along with examination of applications in AI-infused systems, will serve as a resource for designers working with AI and will help future research and development of principles for human-AI interaction. (Amershi et al. 2019, p.2)

They systematically examined these guidelines in a variety of AI-infused systems to validate their applicability and relevance. (Amershi et al. 2019 p.2).

After sessions they reformulated the guidelines to follow a consistent format and to clarify issues identified by evaluators. Specifically, they proposed that each guideline adhere to the following criteria:

“• It should be written as a rule of action, containing about 3-10 words and starting with a verb.

• It should be accompanied by a one-sentence description that qualifies or clarifies any potential ambiguities.

• It should not contain conjunctions so that designers can clearly validate whether it is applied or violated in an interface.”(Amershi et al. 2019, p.5)

Here are the two first of the18 guidelines described by Amershi “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.”(Amershi et al. 2019, p.3)

They conducted a user study with 49 HCI practitioners to 1) understand the guidelines’ applicability across a variety of products; and 2) get feedback about the guidelines’ clarity(Amershi et al. 2019, p5)

Some guidelines emerged as relevant, but not widely implemented, as indicated by the large number of violations. For example, Guideline 11 “Make clear why the system did what it did” had one of the highest number of violations, despite the large volume of active research in the area of intelligibility and explanations. This guideline also had one of the fewest reported instances of “does not apply”, suggesting that participants could imagine opportunities for explanations, but were often unable to obtain them. In some cases, participants reported violations when they were unable to locate any explanation at all. The article is thus concluded with saying they are hopeful that application of these guidelines will result in better, more human-centric AI-infused systems, and that their Guidelines synthesis can facilitate further research “.(Amershi et al. 2019, p.12)

Main Take-Aways From “Will You Accept an Imperfect AI? Exploring Designs for Adjusting End-user Expectations of AI Systems”

Their main contributions were to propose three techniques for setting expectations:

1) Accuracy Indicator - that explicitly states the accuracy of the system, 2) Examples based Explanation - that seeks to increase user understanding, and 3) Performance Control - that allows the user to directly adjust the performance of the system. (2) They demonstrate the effectiveness of their three techniques and show these techniques ability to preserve user satisfaction and acceptance of an imperfect AI-powered Scheduling Assistant we implemented. (3) They show that an AI-powered system tuned to avoid False Positive errors can lead to lower average perception of accuracy and lower user acceptance than one tuned to avoid False Negatives (even when both versions perform at the same overall accuracy). They discuss the likely role of the cost of error recovery in this scenario in determining the best balance between False Positives and False Negatives. (Kocielnik et al. 2019, p.2)

They believe that these techniques can offer a substantial contribution to AI research. They show that user satisfaction and acceptance can be improved not only through deception as used in marketing or in-depth involved understanding shaping user mental models as used in intelligible AI works, but also through simple expectation adjustment techniques. (Kocielnik et al. 2019, p.11)

They then conclude the article writing that in this work, they designed three expectation adjustment techniques and experimentally showed their effectiveness in improving user satisfaction and acceptance of an imperfect AI-powered system, an email Scheduling Assistant. they also showed that focus on High Precision rather than High Recall of a system performing at the same level of accuracy can lead to much lower perceptions of accuracy and decreased acceptance. Their findings open the way to shaping expectations as an effective way of improving user acceptance of AI technologies. (Kocielnik et al. 2019, p.12)

How the AI – Videogames adheres to or deviates from guidelines

“Guideline 1. Make clear what the system can do”(Amershi et al. 2019 p. 14)

When you fail a mission in a video game, it may tell you what you did wrong. Though, sometimes games don´t tell you what you did wrong. But you understand that you for example failed and must start over again because it takes you back to the beginning of the video game challenge.

The first time you played Super Mario you may not have known what to do. But by using the controller it is eventually revealed what you can do. One button makes you jump, another makes you walk, and another makes you run fast etc. When you jump on an enemy the system removes the enemy from the game. The enemies have artificial intelligence.

Making it clear what the system can do may inspire improvements in the game if it´s too unclear for the gamer what he should do. Because if it´s to hidden, the player may give up the game and stop playing it; so it is good to make it clear enough and find the right balance so that the player finds the game entertaining.

“Guideline 4. Show contextually relevant information. Display information relevant to the user’s current task and environment. “(Amershi et al. 2019 p. 15)

In video games they show contextually relevant information. The player is shown contextually relevant information about what he must do in the game, like for example completing a mission. There is regularly a written explanation about what the mission is, but part of the challenge is sometimes that the player must figure out what is necessary to do himself to complete the tasks in the game. Sometimes the contextually relevant information is not shown to make the game more challenging and to make the player find out himself that he must do. If it is too much displaying of information relevant to the user´s current task, the game may also become too easy for the player, and he may get bored. Here it is also important to find the right balance, it should not be too obvious and make the game too easy. But if the information about the task is not enough or not there the player may give up. Then it can be a major improvement to display more relevant information to the user´s current task and environment.

Problematic Aspects of Textual Content and Solutions.

Bender is in his article mentioning it being problematic that people taking part in a conversation can find meaning where there is none. People can be misled to thinking that a synthetic text created by AI has meaning.

Bender says that a language model (LM) produces text that is put into the world for people to interpret (flagged as produced by an ‘AI’ or otherwise), and questions what risks follow? He writes that LMs can pick up biases and derogatory language that can lead to people being offended because of discrimination, racist sexist, extremist, or other harmful ideologies rein- forced through interactions with synthetic language. (Bender et al 2021 p. 8)

The developers made a filter that filters out harsh words, or words that might be found offensive that the system uses. “...discarding any page containing a list of about 400 dirty, naughty, obscene or otherwise bad words. The words that could be offensive was words related to sex, with a handful of racial slurs and words related to white supremacy (e.g., swastika, white power) included.” (Bender et al 2021 p. 5) Words

like “twink” was one of the words on the blacklist, as it is offensive derogatory for LGBTQ. (Bender et al 2021, p. 8) Bender continues to write about a third category of risks that involves bad actors taking advantage of the ability of large LMs to produce enormous quantities of coherent texts on specific topics on demand in cases where those deploying the LM have no investment in the truth of the generated text. (Bender et al 2021 p. 8)

McGuffie and Newhouse show how an LM could be used to generate text in the persona of a conspiracy theorist, which in turn could be used to populate extremist recruitment message boards. This would give such groups a cheap way to increase recruitment by making human targets feel like they were among many like-minded people. (Bender et al 2021, p. 8)

On page 9 bender is writing about the path forward. He writes that one must reduce the risk that come with large LMs by insisting that researchers shift to a mindset of careful planning.

Key Challenges in the Design of Chatbots

When designing chatbots it´s a challenge to get the chatbot to say something relevant to what the user is typing. The user may for instance want help with something particular and if the chatbot does not have the answer it may be annoying. As mentioned earlier it is important to follow “guideline 4”(Amershi et al 2019, p. 15) and show contextually relevant information, which it does not if it does not know what to say or says something wrong.

“When things go “wrong,” when errors occur, something is missing or in the way for proceeding – whose understanding is the correct one? The user´s understanding or the system´s understanding? Or are they perhaps both correct, but from different perspectives? Or both wrong? “(IN5480 Lecture notes 1 p.4)

Based on Maritas lecture from the University of Oslo we can see another key challenge; the stigma and isolation one may experience from using chatbots. If one is spending a lot of time with a chatbot there is a danger some people may not understand it or find it wired. Especially if one only spends time with a chatbot and not real people one may experience isolation. (Marita 2021)

According to Amershis guideline G1 you should “Make clear what the system can do.” (Amershi et al 2019, p. 3) If you help the user understand what the chatbot can do it´s easier for the user to use the system. It makes it more enjoyable and fun.

Principle G2: “Make clear how well the system can do what it can do.” (Amershi et al. 2019, p. 3) is, like G1 also important to resolve challenges. It helps the user understand how often the AI system may make mistakes.

Resources

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