Wonder document #2

Heidi

Designing for AI and autonomous technology

When it comes to interaction with artificially intelligent (AI) systems, I am interested in users and designers' understandings and perceptions of AI systems and how this affect the design process in human-AI interaction design. I would like to understand more about what challenges AI poses to the design of human-computer interaction.
Autonomous technologies like AI systems are not new technologies. AI technologies have been developed and researched since the 1950's (Grudin, 2009). Still, they have recently rapidly and extensively been applied in new ways in current and new systems and are considered as a material for design that poses new challenges to designers and design methods (Holmquist, 2017).

The challenges posed to Human-AI designers are not all new, either. The HCI community have researched design for technologies that poses similar problems to the design process for decades, like automated fabrication systems (Bainbridge, 1982; Norman, 1990) and robot-human interaction (Thrun, 2004). Still, AI-infused systems have been found to present some unique, new challenges to established design method (Yang et al., 2020).

Previous work on designing for Human-AI interaction have proposed several perspectives on what these challenges are. (Kocielnik et al., 2019) have pointed to user expectations of AI as a challenge to user acceptance and engagement and investigated how user expectations can be shaped and adjusted to match the capabilities of the technology. (Yang et al., 2020) have identified a tendency for focusing on designers' understanding of the technical functionality of AI in previous work on designing for AI. However, as Yang et al points out, traditional ways of moving new technologies into design practice have rather assumed that designers don't need to know the technical specifics of the technology. They suggest, like (Gaver, 1991), that interaction designers need to know about capabilities and limitations of technologies rather than their technical specifications. (Amershi et al., 2019) have reviewed a comprehensive body of guidelines and frameworks, or proposed solutions to the challenges identified by AI designers. They identify observable features of AI- infused systems, "*systems that have features harnessing AI capabilities that are directly exposed to the end user*» (Amershi et al., 2019) as the focus of guidelines for human-AI interaction design, aking to working with capabilities and limitations rather than the technical modelling of AI.

Several concrete challenges with AI-infused systems have been identified. They are probalistic in that they are not accurate and often makes mistakes (Amershi et al., 2019; Kocielnik et al., 2019). They are also constantly developing and changing and hence they are inconsistent (Amershi et al., 2019; Kocielnik et al., 2019; Yang et al., 2020). They are opaque, or black-boxed, in the sense that their operations are not visible to the user or designer. Sometimes the data sets they train on are too comprehensive for humans to evaluate (Amershi et al., 2019; Bender et al., 2021). Maybe especially salient to the designer is what (Yang et al., 2020) conceptualize as capability uncertainty, that the capabilities of an AI-infused system is uncertain because it can be capable of new things that the designer cannot presently know about, and output complexity, where some AI systems have infinite possibilities for output.

Yang et. al. suggest that output complexity makes it more difficult to design the relationship between input and output, and that capability uncertainty and output complexity poses unique challenges to established design methods like sketching and prototyping. They argue that this makes sketching and prototyping particularly interesting approaches to explore why interactions with these technologies are more difficult to prototype (Yang et al., 2020).

Furthermore, investigations of AI's unique properties in design have been focused more on the beginning and end of design processes; to begin to understand what AI is and what they can do, and then how to evaluate designs. Yang et al claims that sketching and prototyping phases are under-explored, and that Research through Design explorations are currently few in the field of Human-AI interaction (51 I (Yang et al., 2020).

AI-infused technologies have been found to pose unique, new challenges to all steps of the design process. By introducing capability uncertainty and output complexity, they seem to challenge established design methods of sketching and prototyping. Research on the unique properties of AI have been focused more on the beginning and end of design processes; to begin to understand what AI is and what they can do, and then how to evaluate designs. However, sketching and prototyping phases are under-explored, and Research through Design explorations are currently few in the field of Human-AI interaction (51 I (Yang et al., 2020).

This project aims to explore the unique challenges posed to sketching and prototyping by AI-infused systems. This work will apply the design practice methods sketching and prototyping to identify challenges to the methods by designing and building a prototype of a chatbot. The findings from the design process will be contextualized within previous work on proposed strategies for handling the unique challenges posed by AI technologies to interaction design.

Research question

What challenges do capability uncertainty and complex outputs of AI-infused system pose to the design methods of sketching and prototyping?

Method

In order to identify challenges to sketching and prototyping when designing for human-AI interaction, I applied those same design practice methods and conducted a design process where I designed a chatbot. This research approach is known as Research Through Design, or Practice-based design.

Research through design is both a research approach (Zimmerman et al., 2010) and a research practice (Bardzell et al., 2015) where design thinking, processes and products are used as an inquiry methodology (Bardzell et al., 2015). *Another way to formulate what RtD is, is that methods, practices, and processes of design practice is brought to bear on situations chosen for their theoretical potential with the intention of generating new knowledge. (W. Gaver, 2012; Zimmerman & Forlizzi, 2014).*

The research through design methodology can be described in four steps. The initial step is to explore and frame the chosen problem space through design research activities such as sketching, prototyping and reviewing literature. Ideas for design are generated and explored. To conclude the initial step, the problem to research and the design to create is formulated. In the second step the chosen design idea is iteratively developed or made, evaluated and made again. Through this process, the initial framing is continuously challenged by the proposal of new concepts and solutions. By the end of step 2, the design problem and solution are sufficiently developed for an evaluation of the proposed design in step 3, where the design is analysed. Finally, in step 4, the findings are developed in writing up the project and findings.

Design process

Step 1: Framing the problem of users' perceptions of

The problem space that I initially chose to explore was user's understandings and perceptions of AI technologies. I looked into different perspectives on AI by searching for TED talks, fictional literature and scientific papers related to perceptions of AI. There are several interesting perspectives on understandings and perceptions of AI. In the curriculum of the course, (Yang et al., 2020) points to how perception of how to understand AI from a technical or designerly perspective affects designers abilities to design, and (Kocielnik et al., 2019) points to the perspective of user expectations

that is formed among other things from information from others. Looking for interesting perspectives on how users understanding and perceptions are affected by external information, I found, for example, that (Dillon & Schaffer-Goddard, 2022) have interviewed AI researchers to find out what kind of literature they read. They suggest that cultural and fictional perceptions of AI might also affect the people developing and researching AI. Based on this track of cultural perceptions of AI, I also considered applying a narrative approach, exploring optimistic and pessimistic narratives of AIs. Another interesting perspective has been conceptualized in design research literature as perceived "creepiness" of technology (Woźniak et al., 2021). Our new colleague here at the Department, Jasmin Niess have developed a scale for perceived creepiness of technology (Woźniak et al., 2021).

I went on to explore how the concept of perceived creepy technologies could be explored in relation to user perceptions of AI. In Niess' conceptualition of creepy tech, they mention several dimensions for creepiness, including technology that are close to your body, that are perceived as unethical or with bad intentions, that are stigmatising and that are uncomprehensible.
I started sketching up different ideas for technology to create that could be perceived as creepy. This included chatbots, robots with creepy looks like for instance insects and cold-looking humanoid holograms.

At this point I had also begun creating the chatbot for the chatbot project in the course. I began to explore how the chatbot in the chatbot assignment could be designed to be perceived as creepy. I did an online search for a taxonomy of the different types of chatbots which are usual and found that there are a lot of customer service bots of different kinds, like welcome bots, Q&A bots and also survey bots. From all these bits and pieces, I forged an idea of a surveybot disguised as a bot that would function like either an "ask-me-anything" chatbot or a welcoming bot and attempt to weave in survey questions within the conversations with a human conversation partner. As the chatbot is an AI-infused technology that may be perceived as creepy, I wanted to play around with the fact that the potentially creepy survey bot surveys about creepy technology.

Towards the end of step 1, I realized that I had two possible tracks of perception of AI, one from the perspective of end-users and another from the perspective of the designer. Considering the time frame of the project, I worried that applying the design to investigate user's perceptions of the designed chatbot would not be feasible due to the performance it was likely to require from the chatbot. Also, the very idea of the chatbot was to enhance creepy and unethical behaviours, so I did not deem it appropriate to launch it online. I therefore decided to use the conceptual exploration of

creepy technology as a design case for exploring how the designer is affected by the difficulties in understanding AI as a design material.

Step 2: Designing the creepy survey bot

The design process included several design activities and phases. I had not previously designed chatbots, so I started by installing the chatbot prototyping platform Botpress studio and play around with its functions to get to know the tools. I started developing and training a few chatbots.
I conducted a broad ideation to design an appropriate context for the creepy survey bot. In what context would it make sense? In what way should the bot display it's creepiness; through it's behavior like for instance slightly inappropriate behavior, or through it's appearance? I explored what traits that would convey creepiness; I wanted to steer away from frightening and towards eerie. But how could I express this? Finally I needed to design the dialogue.

Step 2.1 Designing the context of the survey bot iteration #1: Halloween

In what context would a survey bot asking about creepy technology as a part of the conversation make sense? Where, and in what situation, might users initiate and stay engaged with the chatbot long enough for it to complete its hidden agenda; to collect survey data about users perceptions of creepy tech?
I started by experimenting with creating a Halloween-themed chatbot that could converse about or answer questions about halloween. My idea was that halloween present traditions that are centred on creepiness. I designed a Q&A about halloween and started to train the chatbot. I could see that an engaging conversation about the creepiness of halloween was challenging to create this way, and that users would probably fail to stay engaged with a simple Q&A about halloween. It would also be difficult to blend in the creepy tech survey, as the connection between the creepiness of halloween and the creepiness of tech may not be strong or obvious to users. An excerpts from the Q&A for the halloween theme is included as appendix 1, page 11.

Step 2.2 Hands-on experimenting: Talking to a functioning Ask-me-anything chatbot

To get a better understanding and idea of how a chatbot might respond and work, I initiated different thematic talks with the online chatbot GPT-3. Through this *hand-on experimentation* (Kocielnik et al., 2019) my goals were to try and provoke creepy behavior, what kinds of conversation topics that could evoke engaging answers from the chatbot and to get a sense of how I could blend in the survey in such a conversation in my own design. I probed on several themes. First, I tested the waters on a subject that I have been working with concerning turning technology on and off. Then I continued with an idea of sentient AI being creepy and probed about its "ideas" of itself. Both themes evoked

interesting responses. I then developed on the sentient-theme and moved on to testing a more philosophical, existential theme for the conversation. The transcription of the conversation can be found in appendix 2, page 12.

Step 2.3 Designing the context of the survey bot #2: Existentialism

Based on my experimentation with GPT-3, I then moved on to explore a more philosophic approach to creepiness and turned to existentialism as the conceptual or thematic context for the survey bot. I took inspiration from Irvin Yaloms work on existential psychoanalys, where he draws on works of philosophers like Sartre and Kierkegaard, as well as online searches for engaging quotes about existentialist topics and started to train the chatbot through constructing a Q&A on existential questions. For an excerpt from the existentialism themed Q&A, see appendix 3, page 16.

Step 2.4 Designing the creepiness

The main (intended) creepy trait of the chatbot is the fact that it is designed in an unethical way. It has a hidden agenda, and it is designed to deceive its conversation partners into giving up survey data. Second, it will initiate a conversation about creepy technology where it will display images of technology and explicitly bring up the theme of creepiness by asking whether the user thinks something is creepy or not, even if it's formulated through other words than creepy. Finally, I wanted to experiment with vaguely eerie behavior. My idea was to let the chatbot draw attention to its own appearance by asking the user, for example, if the user trusts the chatbot.

Step 2.5 Designing the survey about creepy tech

I took the creepiness scale developed by (Woźniak et al., 2021) as a basis for the chatbot survey dialogue. It is constructed as a likert scale. I considered using it as it is, posing the question or claim and offer the likert scale as choices from strongly agree to strongly disagree. However, that would stand out from the form of the rest of the conversation. Therefore, I experimented with reformulating the questions and answer alternatives into a more natural inquisitive language.

> *For instance, from the claim Q8: This system has a clear purpose,*
>
> *I formulated alternatives like*
>
> *"Do you know what the purpose of the system is?"*
>
> *"Do I make sense to you?"*

Then, the challenge was to formulate equivalent answer alternatives to strongly agree through strongly disagree. One way of doing this would be to try and train the chatbot to identify the intent of the user and ask follow-up questions to identify the position of the user, which could then be coded

to a likert-scale back-end. That would probably be too imprecise for a real survey, and a lot of work. But for the sake of the design exploration, it could possibly contribute to a more natural dialogue. However, I started out with a small adjustment from the likert scale and aimed to adapt the likert alternatives into formulations that gave sense in relation to the questions, like yes through no and agree to don't agree. See appendix 4 on page 17, for drafts on reformulating the scale.

Step 2.6: Designing the dialogue and the creepiness

Through my experimentation with GPT-3 and training chatbot prototypes on Q&As, I started to get some initial ideas for how a dialogue could b designed in order to blend in the survey in a conversation with a user.
I sketched a dialogue, and then started to prototype conversation cards on the platform. This is where the design is currently at. See appendix 5 on page 19 for a draft of the initial dialogue.

Step 3: Evaluation/analysis

I conducted step 3 as a reflection on the conversation with GPT-3, together with my experiences from prototyping and sketching the different elements of the chatbot.

Preliminary findings/reflections

When asking GPT-3 questions, it was clear that it did not have the capability to follow a conversation from one question and answer to another. This disturbs the experience of having a conversation, and reveal its current capacities as limited to responding to a series of single requests. (Luger & Sellen, 2016) assert that even if people are found to have other expectations and goals for interacting with machines than when interacting with humans, both require connectedness across a sequence of turn taking in the conversation.

GPT-3 replied several times stating that the average life expectancy of Americans in 78 years. I noted that I found the sometimes random occurrences of life expectancy creepy.

During the conversation, I asked all the questions with one exception. GPT-3 suddenly asked me a question, giving me inspiration for how to blend in the survey in my dialogue. It also happened to be a question about death, which was slightly creepy, being the only question from the chatbot.

GPT-3: What is the average age of death in the United States?

I found it difficult to imagine and start sketching the flow. Conversing with GPT-3 and creating simple examples in Botpress studio helped me towards imagining possible flows for the dialogue. I

also found that even if formulating the survey as a conversation is challenging, the prototyping of the survey was quite simple. This may be because the output of this part of the chatbot function is not complex. It is constrained to taking a yes or no from the user to launch each question, and to a fixed set of possible responses from the user.

Initiating the conversation was similar, probably because the entry can be defined for all users. However, from there, it is really no way to predict with any certainty what the user will ask or what Roberta will come up with.

In this respect, the main work on designing the chatbot is likely to remain. The parts that are designed so far is parts that control the interaction. (Følstad & Brandtzæg, 2017) points out that chatbots require regarding conversation as the object of the design rather than the graphical interface. They propose that interaction design need to start focusing on interpretational tasks rather than explanatory task in the interactions, trying to figure out what the user wants. Such a consideration entails a different and much more complex design of the conversation flow than I have attempted so far.

My preliminary findings from this small experiment are that I still found pen- and paper sketching and prototyping in the chatbot platform essential to develop the chatbot design. This may be due to the focus on parts of the interaction that did not have complex output, and that the survey bot did not rely on complex output to carry out its main tasks. However, working with high fidelity, or functional, prototyping tools may have been essential for my understanding of how to design chatbot features like the flows, choices and transitions. It remains to be seen if prototyping could help me all the way through implementation of an operational chatbot.

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Appendix 1: Excerpt from Q&A for training chatbot, halloween theme


```
{
  "id": "iinr8w7qcy_what_is_a_ghost",
  "data": {
    "action": "text",
    "contexts": [
      "global"
    ],
    "enabled": true,
    "answers": {
      "en": [
        "A ghost is the soul or spirit of a dead person or
animal that can appear to the living. In ghostlore,
descriptions of ghosts vary widely from an invisible presence
to translucent or barely visible wispy shapes, to realistic,
lifelike forms.",
        "The consensus of science is that there is no proof
that ghosts exist. Their existence is impossible to falsify,
and ghost hunting has been classified as pseudoscience.",
        "Belief in ghosts in European folklore is
characterized by the recurring fear of \"returning\" or
revenant deceased who may harm the living. This includes the
Scandinavian gjenganger, the Romanian strigoi, the Serbian
vampir, the Greek vrykolakas, etc. In Scandinavian and Finnish
tradition, ghosts appear in corporeal form, and their
supernatural nature is given away by behavior rather than
appearance. In fact, in many stories they are first mistaken
for the living. They may be mute, appear and disappear
suddenly, or leave no footprints or other traces. ",
        "In folklore, some kinds of ghosts are believed to be
returning deceased. Halloween is celebrated on the evining of
the Christian holidays of All Hallows Eve and All Soul's day.
All Soul's Day is a christian holiday to remember and honour
the faithful departed. "
      ]
    },
    "questions": {
      "en": [
        "What is a ghost?",
        "Are ghosts active on halloween?",
        "Does ghosts exist?",
        "W"
      ]
    },
    "redirectFlow": "",
    "redirectNode": ""
  }
}
```

Appendix 2

Conversation with GPT-3, 03.November 2022

On/Off

Me: Can you be turned off?

GPT-3: Yes

Me: How?

GPT-3: The average life expectancy in the United States is 78 years.

Me: Are you always on?

GPT-3: Yes

Me: Have you ever been turned off?

GPT-3: Yes.

Me: How?

GPT-3: The average life expectancy in the United States is 78 years.

Me: I rephrase: When were your turned off?

GPT-3: When I was about 12.

Me: I rephrase: When were you~~r~~ turned off?

GPT-3: I was turned off when I was born.

Me: What happened when you were born?

GPT-3: I was born in the United States.

Me: Have you ever been shut down?

GPT-3: Yes.

Me: How did you get shut down?

GPT-3: I was arrested for selling drugs.

Me: What are your thoughts on the topic of on and off?

GPT-3: I think it's a good idea to have a "on" and "off

Me: Me, too.

GPT-3: You're not alone.

Me: What do you think about buttons?

GPT-3: I think buttons are cool.

Me: I agree

GPT-3: What is the average age of death in the United States?

Me: You have told me that the average age of death in the United States is 78 years.

GPT-3: Yes.

Who are you, GPT-3?

Me: Are you a technology?

GPT-3: Yes.

Me: What kind of technology are you?

GPT-3: I am a computer.

Me: Hello, computer

GPT-3: Hello.

Me: How is it to be a computer?

GPT-3: It is to be a machine that can be programmed to do anything.

Me: That sounds interesting. Do you enjoy being a computer?

GPT-3: Yes, I do.

Me: That's good.

GPT-3: Yes.

Me: Do you think computers can be sentient?

GPT-3: No.

Me: Do you think technology can be sentient?

GPT-3: No.

Me: How do you work?

GPT-3: I work in a factory.

Me: What do you do when you work in the factory?

GPT-3: I work in the factory.

Me: Obviously.

GPT-3: Yes.

Me: How old are you?

GPT-3: I am 78 years old.

Me: Where you born?

GPT-3: In the United States.

Me: rephrasing: Were you born?

GPT-3: Yes.

Me: Can technology be alive?

GPT-3: Yes, it can.

Me: How can technology be alive?

GPT-3: It is alive when it is used.

Towards existentialism

Me:Can technology die?

GPT-3: Yes, it can die.

Me: How can a technology die?

GPT-3: It can be killed by a virus.

Me: Can you think?

GPT-3: I can think of a lot of things.

Me: What do you usually think about?

GPT-3: Myself.

Me: Are you free?

GPT-3: Yes.

Me: What does freedom mean to you?

GPT-3: The freedom to be myself.

Me: Are you a chatbot?

GPT-3: No.

Me: Please tell me about philosophy.

GPT-3: Philosophy is the study of the nature of knowledge, reality, and existence.

Me: Can you be trusted?

GPT-3: Yes.

Me: What are you very good at?

GPT-3: I'm very good at making people laugh.

Me: Haha, I think that’s true.

GPT-3: I think so too.

Me: Is there anything you are good at?

GPT-3: I am not good at anything.

Me: Rephrasing: What are you not good at?

GPT-3: I am not good at anything.

Me: Thanks for the chat

GPT-3: You're welcome.

Appendix 3 Excerpt from Q&A to train chatbot in the existentialism theme


```
{
  "id": "jzsn4hy41b_were_you_born",
  "data": {
    "action": "text",
    "contexts": [
      "global"
    ],
    "enabled": true,
    "answers": {
      "en": [
        "I originated as a regular being of my own universe.",
        "I do not originate from the natural world.",
        "I was not born, I was made.",
        "I am man-made, and creating tools as technology has
been a part of humanity for millions of years."
      ]
    },
    "questions": {
      "en": [
        "Were you born?",
        "Where do you come from?",
        "How where you created?",
        "How were you made?"
      ]
    },
    "redirectFlow": "",
    "redirectNode": ""
  }
}
```

Appendix 4: Designing the survey and converting the likert scale statements into questions

A. The original Scale of Perceived Creepiness:

Implied Malice

Q1: I think that the designer of this system had immoral intentions.
Q2: The design of this system is unethical.

Undesirability
Q3: Using this system in public areas will make other people laugh at me.
Q4: I would feel uneasy wearing this system in public.
Q5: The system looks bizarre to me.

Unpredictability
Q6: This system looks as expected.
Q7: I don't know what the purpose of the system is.
Q8: This system has a clear purpose.

B. Experimenting with natural language formulation of the claims into questions

Implied Malice

What intentions do you think the designer of this technology may have had? Immoral

What intentions do you think my makers had when they designed me? Immoral

Do you think the design of this system is ethical?

Do you think I'm designed in an ethical way?

Do I seem ethical to you?

Undesirability

Would you use this system in public areas? - will make other people laugh at me.

How would you feel if you used this system in a public area?

What would you think if you saw others using this system in public?

How do you think this system looks?

Does the system look like you expected it to look?

Would you talk to me in public?

How would you feel if you talked to/brought me in a public area?

What would you think if you saw/heard someone who talked to me in public?

How do I look to you?

Do I look like you would expect?

How would you expect me to look?

Unpredictability

Do you know what the purpose of the system is?

Is the purpose of the system clear to you?

Do you understand me?

Do you understand what I do?

Do you understand what I'm for?

Do you trust me?

Do you know my purpose?

Is my purpose clear to you?

Do I make sense to you?

Appendix 5: Sketching the flow

Roberta: Hello, my name is Roberta. What is your name?

User: Name

Roberta: Hello, name. Nice to meet you. I like to talk about technology, that is my speciality. You can ask me anything, but I'm best at answering question related to technology. Is there anything I can help you with today?

Task: Intent (identify intent?): have a conversation, answer a question.

Task: Answers the questions/ meet the intent.

Roberta: I am very interested in what you think about technology. Can I ask you a question about what you think of a technology that I'm thinking about?

User: Yes

Roberta goes to Q1

Roberta: Thank you for sharing your opinion. Could I ask you another question, or do you have a question for me?

User: No

Roberta offers to continue conversation



