AALBORG UNIVERSITY

MASTER'S THESIS

AI as a partner of service designers: reimagining design processes through novel cooperation with its underlying ethical considerations

Author:
Michal GRZYMSKI

Supervisor:
Amalia DE GÖTZEN

A master's thesis submitted in fulfillment of the requirements for the degree of Service Systems Design

May 23, 2023

Declaration of Authorship

I, Michal GRZYMSKI, declare that this thesis titled, "AI as a partner of service designers: reimagining design processes through novel cooperation with its underlying ethical considerations" and the work presented in it are my own. I confirm that:

- This work was done wholly or mainly while in candidature for a research degree at Aalborg University.
- Where I have consulted the published work of others, this is always clearly attributed.
- Where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work.
- I have acknowledged all main sources of help.
- Where the thesis is based on work done by myself jointly with others, I have made clear exactly what was done by others and what I have contributed myself.

Signed: Michal Grzymski

Date: 23.05.2023

"[Artificial Intelligence] ...will either be the best thing that's ever happened to us, or it will be the worst thing. If we're not careful, it very well may be the last thing."

Stephen Hawking

AALBORG UNIVERSITY

Abstract

The Technical Faculty of IT and Design
Department of Architecture, Design and Media Technology

Service Systems Design

AI as a partner of service designers: reimagining design processes through novel cooperation with its underlying ethical considerations

by Michal GRZYMSKI

The goal of this thesis is to research the topic of integrating Artificial Intelligence (AI) into design processes and answer the question of whether this novel technology can assist human designers with expediting their work, cutting down on the repetitiveness of certain tasks, and overall argumentation of their design processes. Through desk and quantitative research, various applications for this technology are found and later interwoven into various stages of the design process. The collection of said applications is encapsulated in a series of use cases, combined with a diagram indicating its relevance at various stages of the design process; together, they form an AI-augmented Design Process model. Furthermore, this dissertation puts a strong emphasis on the issue of human-AI cooperation and its implications for both the discipline of human-centred design, as well ethical considerations that surround them. Moreover, a division of tasks which can be performed by human designers with the assistance of AI versus tasks which should be left entirely to humans is made. Finally, the solution is evaluated by design practitioners to research its real-world application and relevance. The final version of the developed toolkit, along with various reflections, is presented.

Acknowledgements

I would like to thank my master's thesis supervisor, Amalia De Götzen, for her invaluable guidance and support throughout the process of completing the final stage of my education. Her expertise in the topics of service design and artificial intelligence, as well as her dedication has been instrumental in helping me to navigate the complex task of conducting research and writing a thesis. Her keen insights and critical feedback helped me to refine my research question and presented my findings in a clear and compelling way. I am deeply grateful for her support and for going above and beyond.

Contents

List of Figures

List of Abbreviations

AI	**A**rtificial **I**ntelligence
HCI	**H**uman-**C**omputer **I**interaction
UCD	**U**ser-**C**entred **D**esign
SD	**S**ervice **D**esign
G01	**G**uidleine **01** - referring to the guideline number from Amershi et al., 2019
CX	**C**ustomer E**x**perience
DT	**D**esign **T**hinking
ML	**M**achine **L**earning
LAWS	**L**ethal **A**utonomus **W**eapons **S**ystems
SOTA	**S**tate **O**f **T**he **A**rt
SSD	**S**mart **S**ervice **D**esign (not to be confused with Service Systems Design)
CTA	**C**all **T**o **A**ction

Chapter 1

Introduction

Recently, Artificial Intelligence (AI) has been on the rise in terms of its various applications and general popularity. At the same time, this technology is reshaping our world in numerous ways. This master's thesis will explore the different possible uses of AI to support (service) designers, particularly in terms of augmenting their skills, capabilities, and design processes. Moreover, I will show how this can be done so this technology works hand-in-hand with humans, as opposed to replacing them.

One of the main concerns with the widespread of AI is that it can overtake jobs and tasks previously done by humans (Huang and Rust, 2018; Huang, Rust, and Maksimovic, 2019). Therefore, the focus of this dissertation will be on the cooperative aspects of humans and AI while trying to research the ethical implications and aspects of this novel approach.

1.1 Adopted definition of AI

"...there are about as many different definitions of AI as there are ways to describe Snow White's beauty, depending on whether one focuses on her white skin, red lips, or black hair." (from Kaplan and Haenlein, 2019, p. 17). Due to AI being the primary investigation focus in this thesis, its standard definition ought to be established early. AI is defined - usually - in one of two distinct ways (Yang et al., 2020; Legg, Hutter, et al., 2007 & Kaplan and Haenlein, 2019). First and foremost, the focus is put on the technological aspects - Big Data systems, algorithms, machine learning and such. Another way of looking at AI is the human aspect of it - technology attempting to mimic human behaviour and the human mind.
When referring to AI in this thesis, a synthesis of both will be used. As the topic of this paper talks about using AI as a supportive tool for design processes, one has to look holistically at the available technology. For instance, AI might be used for data and behaviour analysis. In this case, AI will be used more as a technology to help human designers get better results faster. On the other hand, there any many more use cases of this technology, where it might be used to mimic human skills and behaviour - for instance in creating prototypes, designs, copywriting or emphasising with users. For this reason, this thesis will reference an open-ended definition of AI, which includes, but is not limited to:

- technological tool able to perform manual, repeatable tasks faster (and better) than human actors,
- deliver outputs based on data (analysis),
- learns and improves over time,
- in certain situations, it can mimic and understand human behaviour.

1.2 Applied learning objectives

With this project, the author wants to achieve certain learning goals for both personal and professional growth. Based on the official study module description[1], there are various ones to consider. However, for the sake of relevance to the project, emphasis will only be put on the most important ones which, at the same time, align with the author's personal learning objectives:

- *Finding the problem area to explore / investigation subject* - to start the project, one has to find a relevant topic to work on which is, at the same time, within the scope and problem area of the study of designing service systems. This thesis will explore the topic of human-AI cooperation, which is of great interest to the author. At the same time, the subject matter should be relevant to the study curriculum. A synthesis of both will be performed here.
- *Carrying out independent development and research to solve complex problems* - this thesis will be a follow-up to the paper written on the topic in one of the previous academic courses. However, in this case, the focus on the problem areas will be broadened and novel techniques and concepts will be introduced to approach a multilayered topic of human-AI interactions with the sphere of human-centred design.
- *Research and describe the current State of the Art developments which are relevant to your research* - this can help to look into what the status quo of the subject matter is while at the same time assisting in developing a better solution. In terms of AI, the SOTA tools will be explored and later inserted into the solution framework.
- *Investigating the future potential for the project* - it is important that the solution developed at the end of the project can be useful in real-world cases and holds its value in the future. Its potential will be evaluated through user testing. Furthermore, potential further works - which could be undertaken here - will be laid out.
- *Deploying a critical evaluation of the project results* - one of the main strengths of a human-centred (service) design work is to constantly evaluate their work and iterate on it. As mentioned in the previous point, the developed solution will be critically evaluated by design practitioners at the end of the project.
- *Producing an academic report which will include extensive documentation of the process in a coherent manner* - it is important to produce a report which will answer the research question in a logical and methodological manner, document the process, and present the developed solution.

Moreover, a Service Systems Design graduate shall acquire certain general competencies[2]:

- *Possess knowledge of issues relevant to service design* - as of the time of writing this thesis, the topic of AI every day has been becoming more popular. Therefore, the author finds a lot of potential in exploring said problem area and applying gained knowledge to service design.

[1] A full list of module requirements can be found here: `https://moduler.aau.dk/course/2021-2022/MSNSSDM4201`

[2] Full list of competencies, skills, and knowledge an SSD's graduate should possess can be found here: `https://studieordninger.aau.dk/2021/29/2309`

- *Has the skill to interpret, understand, and address the relevant opportunities for change in design* - this project attempt to drive change in the traditional design process. Through the development of a novel, service design and AI-oriented solution this will hopefully be achieved.
- *Managing work in complex and unpredictable conditions* - based on the conducted research and outside conditions, the focus of the project might shift. Designers should be prepared for the aforementioned and be ready to react accordingly.

Ultimately, the learning objectives lists will be applied throughout the whole project process. Following the official requirements will help with ensuring that this thesis meets the official standards set by the university, helps me develop desired and expected skills, and help ensure that the work is credible and brings value to the academic community. At the end of the report, the learning objectives will be referenced again and their assessment will be conducted - whether they have been achieved.

1.3 Methodology and process model

1.3.1 Project methodology

This project will be primarily based on the novel literature review and desk research. Additionally, it will be followed by expert interviews and a survey to explore the topic in more depth.

Furthermore, the meta-synthesis will be used as the methodological basis for this dissertation. Meta-synthesis is similar to the meta-analysis approach in the fact that data is collected from various sources to get a holistic overview of the topic. However, with meta-synthesis, a new theory is developed from said research, unlike with meta-analysis, where only a pre-set hypothesis is tested (Chrastina, 2018; Paterson et al., 2009). Meta-synthesis approach can be greatly used for qualitative research, which this thesis will contain. Moreover, from said qualitative research (desk, interviews, survey) a new theory, namely a framework will be developed to provide new ways for designers to work with AI within the design processes.
Chrastina, 2018 provides a seven-stage model for conducting the research within the meta-synthesis approach. This project will follow the first six:

1. "Deciding the phenomenon of interest" - here, the chosen topic is the intersection of design and AI.
2. "Deciding what is relevant" - within these topics, only relevant literature and findings must be included. From the research done, only specific topics, more narrowed down will be left.
3. "Careful reading and re-reading" - reexamining the research done to draw deeper insights and see once more what's relevant and what fist the scope of this project.
4. "Determining how studies are related" - to create one's own theory, links between key patterns and themes ought to be found. One example for this project would be linking AI tools with use cases within the design process for their application.

5. "Translating studies into one another" - the paper lists three approaches which should be used at this point of the research project: "conceptual translation", "refutational translation", and "line of argument". Here, a conceptual model will be developed.

6. "Synthesizing the translation" - namely building the project solution from previously done synthesis thought interpretation of insights. For this project, a framework with a set of guidelines will be developed.

7. (optional step for this project) "Expressing the synthesis" - findings should be published in the scientific journal.

1.3.2 Process model

Furthermore, for the process framework, the *Design Council's evolved Double Diamond* model will be used (Design_Council, 2019). The thesis project will be structured based on this model, with can be seen below:

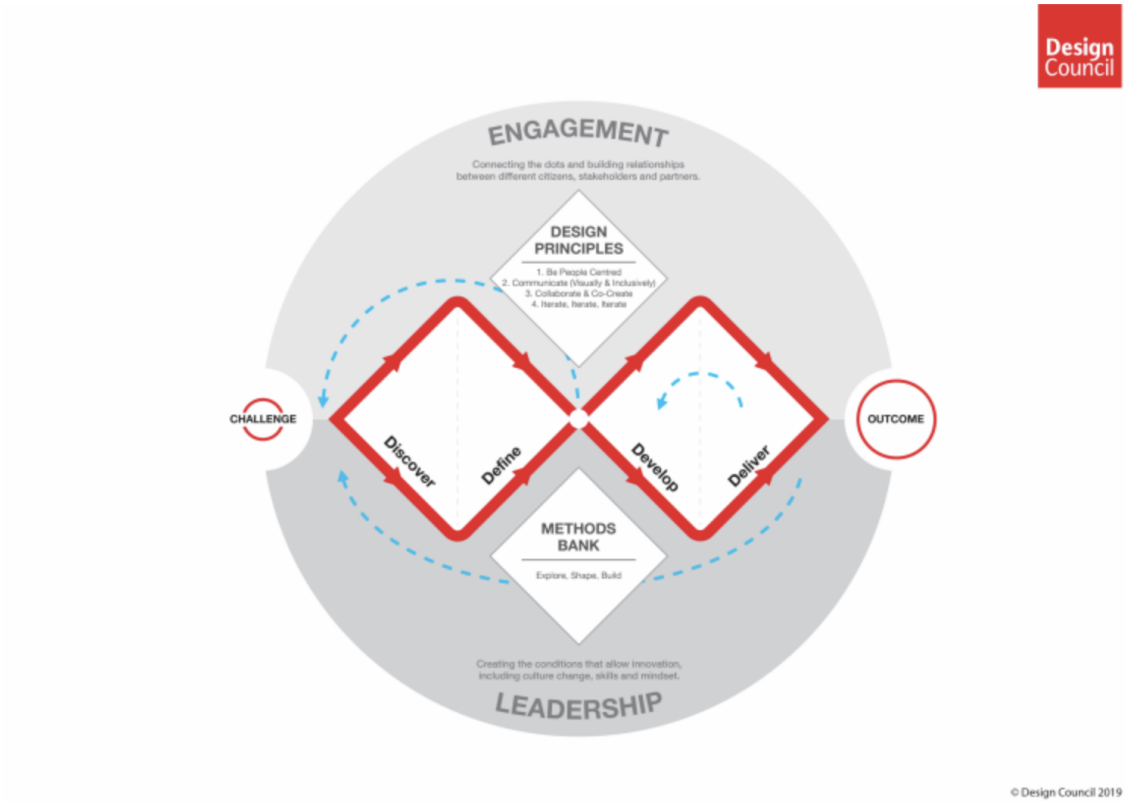

FIGURE 1.1: Design Council's evolved Double Diamond model. Graphic from `shorturl.at/btBO1`.

When following the Double Diamond model, the process consists of four parts: *Discover, Define, Develop*, and *Deliver*. Having one's project organised in this way helps set milestones and achieve planned goals. Moreover, *the Double Diamond* framework allows for multiple iterations.

With this project process model, a project starts by exploring the problem area and conducting research on the topic - this is the content of the *Discover* phase. It acts

as an exit point for the next steps in the process. Therefore, it is usually the most thorough and longest of all the stages. This thesis will include a literature review and desktop research to investigate the problem area in more detail. Furthermore, qualitative expert interviews and a survey will be done to learn more about AI and design processes from design experts and practitioners.

During the *Define* phase, the topic of the research is narrowed down and the main focus is usually found. This time is also used for drawing conclusions from the previously done research and insights framing. At the end of this phase, the final problem statement - a research question - is formulated.

In the *Develop* phase, the solution is ideated, designed, and comes to life. For this project, a theoretical framework will be created for AI-human actors' cooperation.

In the end, said solution ought to be evaluated and discussed. In the last stage, *Deliver*, the project outcome must be tested in order to see where there is room for improvement and whether a said solution has real-world application. For best practice, it ought to be used in a real-world scenario with the intended target group as test subjects.

1.3.3 Methodology conclusion

Having both the meta-synthesis approach and the Double Diamond presented as the methodological foundation for this thesis' project process, it is important to correlate one with the other to show how the methodological approach will be used throughout the different stages of the process. Additionally, this will be done to show how this approach can help reach the final goal of this thesis, which is to develop a working solution for designers to enhance their design work processes.

Within the different phases of the Double Diamond, the consecutive steps from the meta-synthesis will be applied. For instance, before beginning the research phase, the topic of interest for this dissertation has been decided upon. What is more, the Discover phase will include the "careful reading and re-reading" of the material gathered during desk and quantitative research. Relating different pieces of information will be done in the Define phase in order to draw insights. From said insights, the solution will be synthesised - this will be done in the Develop phase, followed by the evaluation of the developed framework.

What is more, the design thinking approach will be undertaken in this project as these two - to a certain degree - are intertwined with the human-centred approach which the author wants to employ (Cross, 2023). The core of the design thinking technique is the structured approach to a given task. It consists of five steps, which will be covered in this thesis (Dam, 2022):

1. *Emphatise* - firstly, the author will attempt to understand the problem area from the human perspective. This will be done through qualitative interviews and surveys. Additionally, to get a more grounded overview of the topic, a literature review will be conducted.
2. *Define* - once the main bulk of research is concluded and insights from it are drawn, the final problem statement (thesis' research question) will be created to help narrow down the scope and start the development of the solution.

3. *Ideate* - various solution ideas will be presented and one will be finally chosen.
4. *Prototype* - here, the solution will be created.
5. *Test* - finally, the developed solution will be tested with design practitioners to - among other aspects - investigate the room for improvement and potential future works.

Next, the following Chapter will organise the desk research done to holistically analyse the problem area.

Chapter 2

Problem area analysis

2.1 Introduction

AI is an incredibly vast research area, even expanding and constantly evolving. This technology has already become a transformative force in many industries, but especially in the area of services (Huang and Rust, 2018). This section will present desk research that was done on this topic, focusing primarily on AI's influence on services, service design jobs, and possible ethical happenings. It will additionally cover topics of rules and frameworks for ethical AI applications, showcase AIs of different types of intelligence, show novel ways for AI and human actors to work together, present examples of this technology to aid design processes, advantages and disadvantages of this technology in its current state, challenges in designing human-AI interactions, list guidelines for modelling said interactions, and much more.
From that research, insights will be framed and then followed by a final problem statement formulation, which will act as an exit point for designing the solution.

2.2 Background information

Machine intelligence was a topic of research for the last fifty years, if not longer (Samuel, 2000 & Rosenblatt, 1961). The first attempts to imagine a machine capable of thinking like humans were made by Allan Turing in 1950 (Cautela et al., 2019). The *Turing test* attempts to find out if a machine's behaviour can be differentiated from a human one. However, Alan Turing simply proposed said test and did not develop an actual technology. The first working AI prototype was written by Christopher Strachey in 1951. A year from then, Strachey's program could play checkers games on its own (Britannica, n.d.).
Nowadays, AI is much more advanced and being started to be utilised in various industries. As per the 2019 Gartner report, 15% of customer interactions were performed with the help of AI (Howard and Rowsell-Jones, 2019). Additionally, a 2021 study by SnapLogic showed that AI significantly improves the work performance of office workers. Here, US and UK employees were surveyed and 81% agreed to the said statement (3GEM, 2022). What is more, 61% of those wanted more AI to be deployed in their workplace. Seemingly, the use of AI-powered chatbots is on the rise. Salesforce report indicates that 23% of companies used chatbots to interact with customers (Salesforce, 2019). Furthermore, investment in AI is also growing. In 2019, 9 out of 10 big companies were already making investments in AI-based technologies (Partners, 2022). One of the most recent examples of this can be Microsoft investing $10 billion into ChatGPT, an AI conversational tool (Bass, 2023).

2.3 General benefits and drawbacks of AI

As with any new technological artefact, both advantages and disadvantages to the end-user come. Kanade, 2022 presents several of those. Firstly, AI-powered solutions are easy to scale and more affordable than human workers. When more power is needed, it is easy to scale the AI to support the growing needs; this is unlike scaling up the human workforce, where training and sustaining said employees are needed. A paper by Kaplan and Haenlein, 2019 about the implication of AI use in society puts forward a thesis, that due to the low cost of implementation and high level of performance, AI might be used at universities instead of human teachers, as certain institutions struggle with founding and budgeting issues. Additionally, many AI services come ready *out of the box*, which further saves costs and time. Another advantage of using AI as an aid for a service is so-called *free transparency* (Kanade, 2022). It refers to only using the part of AI that is needed at the time, hence furthermore simplifying its use and freeing up resources. Yet another advantage of machines is that - as of now - they make decisions largely on data and not emotions (see Section 2.5.2 for more information on this topic) (Sivasubramanian, 2021). This provides fewer biases and clearer outcomes. Machines furthermore do not experience tiredness and can operate 24/7. Data is available on demand, at all times, and (mostly) from any place. AI can also perform millions of decisions at once, as opposed to human workers which can tackle one at a time (Sivasubramanian, 2021).

However, no technology comes without downsides. AI provides for *security risks*. This ethical consideration can be understood twofold. Firstly, for AI to work it has to be trained on large data sets. As that data often comes from real humans, hence it has to be stored. Therefore, this provides for a risk in a form of data misuse. AI designers and engineers must ensure those do not happen. Another aspect is data leaks, hence the need to ensure said information is stored securely. What is more, AI is *dependable*, meaning relying on the constant support and maintenance of human engineers. Machines can also slowly replace human jobs at different task levels (see Section 2.5.2) (Sivasubramanian, 2021). Moreover, AIs are not always designed with user needs and experience in mind, as those emerging technologies are largely controlled by programmers, who hold decision-making powers. Still, a lot of work is needed in terms of HCI, UX, and CX to meet human needs.

From the above information, a picture can be painted: AI provides a lot of cost- and time-efficient automation. It can make work of multiple workers in no time. However, with a such novel solution, control and guidelines are needed. If not implemented adequately, it can impose security risks.

2.4 Core service design capabilities

As this project is aimed at service designers co-performing together with AI, it is crucial to present their human capabilities. This is moreover done to later compare and conclude which capabilities AI can be used for as an aid, and which ones are better left off fully to humans.

Book by Morelli, De Götzen, and Simeone, 2021 presents said capabilities in terms

of different levels of design action - as *Interaction*, *Infrastructure*, and *Systemic Institution*. For the purpose of this investigation, the emphasis will be put on the core service design capabilities:

- "Addressing the context" - projects, services, and artefacts are not created in isolation, but within a specific context. The skill is to recognize this context and design accordingly.
- "Controlling experiential aspects" - here, the focus is on co-creation and co-design. Designers create for others, hence the inseparable link between the target group and the solution. Service designers must be knowledgeable enough about the users, but also be able to empathise with them to achieve a higher level of understanding.
- "Modelling" - this capability refers to "simulating, visualising and experimenting with possible solutions before all the information is available" (Morelli, De Götzen, and Simeone, 2021). Designers should be able to utilise tools to imagine solutions from the information they are presented with, using their skills and capabilities; here, modelling can be used to facilitate solutions as well.
- "Vision building" - this capability involves looking at what's ahead and imagining the possible futures. It also involved building and presenting consistent visions about the future in terms of design.
- "Engaging stakeholders" - enabling different actors in participatory processes is crucial for service designers as here, the value is co-created. Like presented by Vargo and Lusch, 2014 and Vargo and Lusch, 2008, the service customer is "always always a value co-producer", hence the utmost importance of it.
- "Working across different levels of abstraction" - this capability implies being able to *zoom in and zoom out* to see the context from different angles and work on different abstraction levels.
- "Building logical architecture" - service designers must be able to see and create the architecture and supporting structures behind the service. Services might (and should) be simple to the end user; it is the role of designers to understand the back-end structures.
- "Open problem solving" - similarly to the problem-based approach, service designers ought to analyse problems and present tangible solutions, all at different logical levels. Open problem-solving can often involve iterative processes, co-design, and/or co-creation. It is up to the service designers to facilitate these activities in order to find an answer to said problem. The answer might have one of many forms: a tangible product, a framework, or a list of guiding points.

These human capabilities will be later synthesised with AI capabilities to investigate the room for potential collaboration and skills interchange in Chapter 5.3.

2.5 Categorisation of AI

In this paragraph, the classification of AI based on work tasks they are able to perform will be presented. This classification comes from a paper by Huang, Rust, and Maksimovic, 2019. This framework is presented and referenced here as it will be

later used to create insights on how human designers and AI can work hand-in-hand, which tasks are better handled by the machine and which should be left for humans to focus on.

Firstly, there is *Mechanical intelligence*. This relates to tasks that are repetitive and can be easily automated. These tasks do not require a high amount of learning. An example of AI performing mechanical tasks is factory automation, where different parts and products are made on a large scale. Here, reliability and consistency are the primary focus (Sawhney, 2016). Another example could be robots automating service jobs, previously occupied by humans. McDonald's self-service kiosks allow customers to perform the same actions (place an order, food customisation, and payment) as taking to a human cashier (Colby, Mithas, and Parasuraman, 2016).

The next level of intelligence is called *Thinking intelligence*. At this level, AI can conduct conclusions and make decisions based on, for instance, data input. Furthermore, it is able to learn and constantly improve and adapt to ever-changing conditions. An example of thinking AI are partially and fully self-driving vehicles of automation levels 4 and 5 (International, 2018). Those vehicles can use onboard intelligence and perform situation analysis based on data input. Moreover, machines can perform analytical tasks within the area of marketing and as shown in Wedel and Kannan, 2016. In this paper, the authors talk specifically about context understanding and attention analysis by using cognitive skills. *Thinking AI* in service design processes could be used for instance data analysis and visualisation.

The final AI intelligence level, called *Feeling intelligence*, is able to mimic human emotions, read them, and respond back by empathising with humans. The difference between thinking and feeling intelligence is that thinking AI uses and understands the **context** in which the data input occurred. As of now, there are examples of machines recognising emotions, for instance from quantitative data (Xue and Desmet, 2019).
In their paper, (Rafaeli et al., 2017) presents an example of feeling AI. It is an example of AI implementation that can actually perform better than a human frontline worker (FLE). In stressful situations, AI can handle emotions with a higher degree of professionalism. Machines are not affected by "personal mood fluctuations" and therefore can shift their focus on the task itself. In this particular example, AI also uses thinking intelligence to collect and analyse data on a patient. Currently, this type of AI is considered a "work in progress" (Huang, Rust, and Maksimovic, 2019), and not many practical implementations of it exist. With service design in mind, AI could replace human operators as, based on the presented evidence, it would perform better, faster, and would be less biased.

2.5.1 AI classification with the focus on replicating human capabilities

Another angle to look at AI classification is through its pure ability to mimic human behaviour. In Kaplan and Haenlein, 2019, similarly to the paper presented in Section 2.5, the three-level framework starts with the lowest-level intelligence, namely *analytical*. This simply refers to human cognition, and modern-day applications include pattern recognition or autonomous vehicles like Tesla[1]. *Human-Inspired AI* ads emotion recognition, on top of its analytical abilities. An example here could be image

[1]More information can be found here `https://www.tesla.com/en_eu/support/autopilot`.

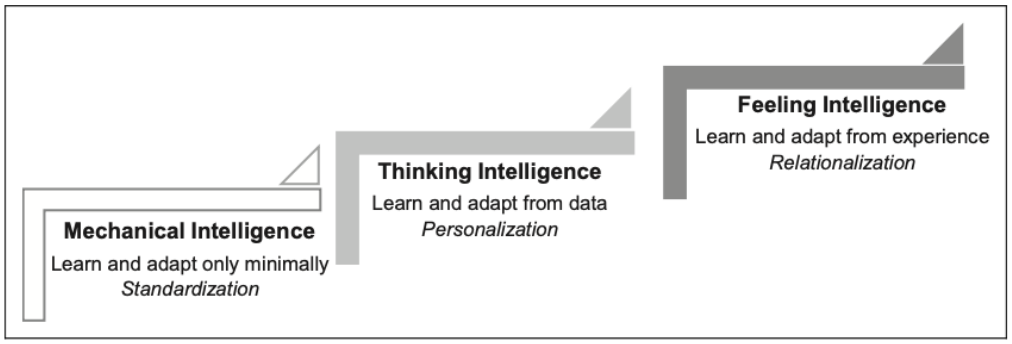

FIGURE 2.1: Different AI intelligence, presented visually (Huang and Rust, 2021).

processing apps, which can, for instance, evaluate user emotions based on visual queues and supervised learning (like IBM Watson Natural Language Understanding[2]. The most advanced AI in this framework is called *Humanized AI* and, even though real-world examples do not exist yet, would possess self-consciousness. An example of *Humanised AI*, though not commercially available and fully functional, is Sofia, a humanoid robot[3].

This AI classification framework puts a big emphasis on to what extent AI is able to perform emotional and empathising tasks in the way human actors were. The first two can be usefully applied to service design processes, and their uses will be explained in Chapter 5 as a part of designing the solution for this dissertation.

2.5.2 Current status quo

As of now, AI is mostly used to automate tasks. Because of the above, there is an increase in so-called *feeling economy* among workers in general. *Feeling economy* refers to employees having to (and already) shift their focus in everyday work to tasks that involve empathising with customers, as well as putting emphasis on co-creation with users, as lower-level tasks will be automated and overtaken by machines. In other words, in such *economy* the employment related to feeling tasks is higher than the sum of employment related to mechanical and thinking tasks.
It is also important to note that one job can compose of tasks from more than one level; for instance, an analyst job can be 15% mechanical (extracting data) and 85% thinking (analysing the data, visualising it, and drawing conclusions from it) (Huang, Rust, and Maksimovic, 2019). On top of that, these proportions can change over time; with the above example, an analyst's job could involve a 50/50% split just a decade ago. This can be thought of as an *upgrade* to one's competencies, meaning jumping to a higher level of intelligence.

All in all, the overtake of feeling tasks by AI will not arrive soon - it may take several decades for it to happen. It might threaten *some* jobs, but also will provide new

[2]More information can be found here `https://cloud.ibm.com/docs/natural-language-understanding?topic=natural-language-understanding-about`.

[3]More information can be found here `https://www.nationalgeographic.com/photography/article/sophia-robot-artificial-intelligence-science`.

opportunities. As mentioned before, it will be more and more important to evolve one's competencies and shift to tasks requiring a higher degree of feeling capabilities.

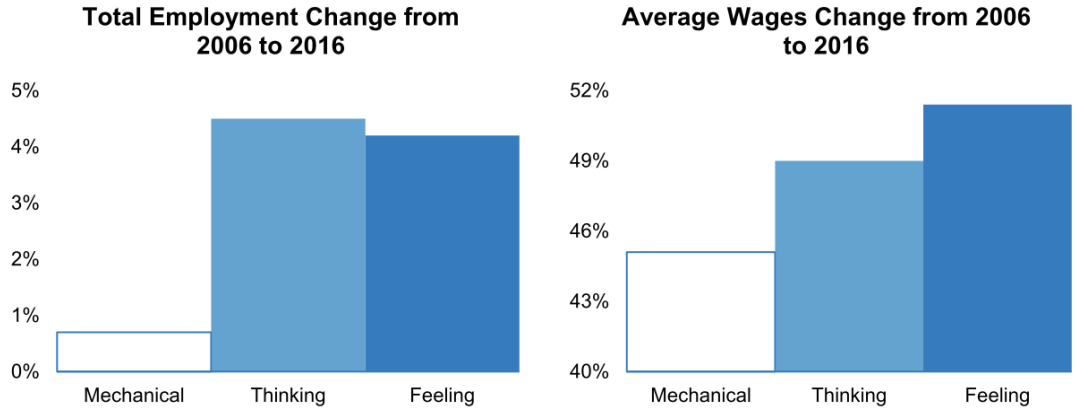

FIGURE 2.2: Employment change in human workers based on types of tasks they have to perform, as well as their wages relative to the tasks they perform (Huang, Rust, and Maksimovic, 2019). Data from US government project O*NET.

2.6 Challenges with Human-AI interactions regarding design processes

UX and service practitioners are eager to implement AI and ML algorithms in their apps and products. These technologies can provide a better customer experience by, for instance, tailoring the content to a specific person. But what about using ML in the design process itself? As those present-day design processes might not be enough soon, designers should resort to using technologies that can elevate those.

Article by Dove et al., 2017 presents a set of challenges as to why the use of ML and AI is not yet a common practice. One of them is simply the lack of experience and expertise of designers in working with ML. It is simply underexplored by design practitioners (Dove et al., 2017). As shown in survey results, many do not know how to use it to its best potential as well as might actually be limited in terms of their capabilities by not understanding this technology.

Moreover, human-computer relations and cooperation efforts are not always straightforward. Beun, De Vos, and Witteman, 2003 explains that human relationships with machine agents are not anthropomorphic. ML's perceivable features such as usefulness, engagement, "stereotypical gender roles" and many more (Dove et al., 2017 have a significant impact on how human actors perceive these cooperative HC relationships.

What is more, ML systems might sometimes work without context (because of the data they are fed with), hence making their outputs not applicable to certain scenarios. Here, the authors talk about misunderstanding user behaviour and therefore being recognised as not useful enough, or simply misleading (Yang and Newman,

2013). Artificial agents are described here as "less-explored" and "well-understood material" (Dove et al., 2017).

Furthermore, it is important to explore the current status quo in terms of actual, applied human-ML work. A survey from the above-mentioned article presents findings on to what extent UX practitioners, interaction designers, and HCI researchers utilise ML in their processes. In total, 51 subjects were surveyed. The results of the said study can be found below:

Type of Involvement	#
The **UX design team collaborated with engineers**, product managers or others, and jointly developed an idea for a new product or service that utilizes machine learning	12
The **UX design team gave an interactive form** to a machine learning idea that came from others (e.g. software developers or engineers)	8
The **UX design team generated a novel design concept** utilizing machine learning, which was presented and then selected for integration into a new product or service	7

FIGURE 2.3: Design and research practitioners' use of ML in their everyday processes. Table from Dove et al., 2017.

In conclusion, ML is not vastly popular among design practitioners. Most often it is the design team who works hand-in-hand with engineers and tells them about their concepts, but not with ML and AI directly. Only around 13% of UX teams have used ML to generate novel concepts in design. This clearly shows that much more work and learning is needed in this area. As one participant said "We designers do not understand the limits of machine learning and what it can/can't do. Machine learning experts often complain to me that designers act like you can just sprinkle some data science onto a design and it will become automatically magical" (from Dove et al., 2017). This correlates with the previously presented research which states that designers might not exactly know the limits to ML's performance, hence being discouraged to use this novel tool.

Moreover, the paper by Yang et al., 2020 maps the already mentioned as well as further issues which might arise from human-AI cooperation in design processes. The diagram below shows said mapping within the Double-Diamond framework (Design_Council, 2019):

Apart from the already described issues, several more ought to be brought to the spotlight. As AI tools are still highly technical, there is often a requirement for designers and engineers to work together - support each other. Research by Yang et al., 2019, Girardin and Lathia, 2017, and Kayacik et al., 2019 proves that said collaboration is often difficult, as these two groups do not share the same goals, language,

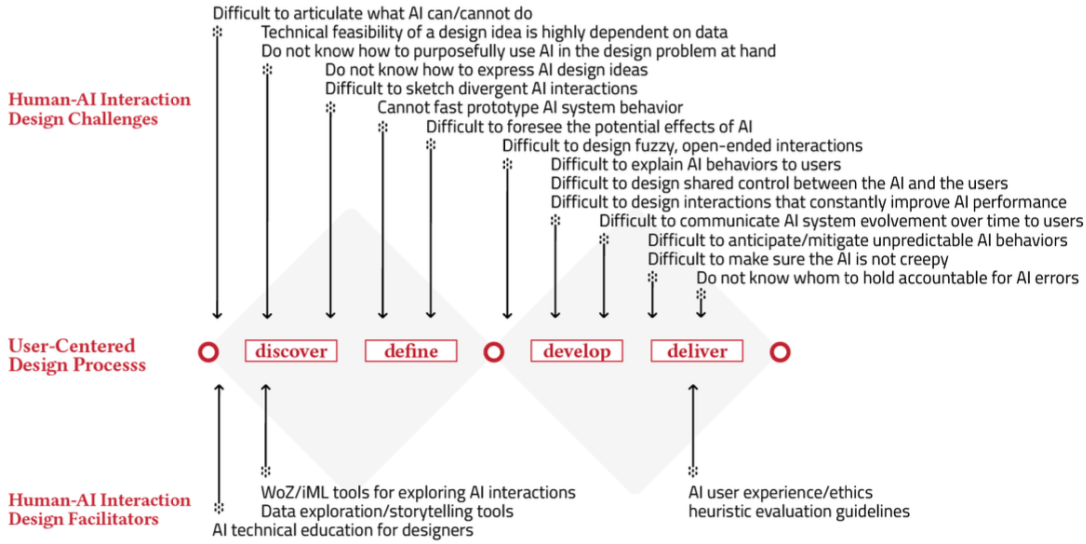

FIGURE 2.4: The above graphic show the potential issues and uncertainties that might arise during human-AI interaction throughout the user-centred design process. Image from Yang et al., 2020.

and boundary objects[4] Furthermore, and as it will be presented later in Section 2.10, user expectations and then machine outputs can be unpredictable due to different perceptions, ethics, and societal norms.

Another problem comes from a simple human limitation. Designers might not be able to imagine what the upcoming and not yet fully developed technologies are capable of, hence being themselves stopped from coming to their full potential. A deeper understanding of how AI works is needed for this. Otherwise, problems with imagining new ways of interactions will occur.

Yet another significant obstacle presented in the aforementioned paper is the attempt to integrate AI within the iterative nature of many design processes. As stated in the paper, AI is not best suited for rapid prototyping purposes - HCI practitioners are not able to rapidly prototype and iterate when using AI for their work. However, two different solutions to this problem are presented in this paper:

1. **1** - *Rule-based simulation using Wizard-of-Oz approach.* This technique allows for rapid prototyping and exploring many possible design scenarios while also testing user behaviour and reactions. The main issue with this technique is the lack of possibility to test errors performed by the AI, as the Wizard-of-Oz technique does not include real-world AI agents.

2. **2** - *Creating actual, fully functional AI systems*. This approach, on the other hand, allows for a full understanding of how AI will perform in given scenarios. On

[4]In terms of design, a boundary object is an umbrella term of any artefact which can take a form of - for example - models, diagrams, scenarios, prototypes, etc. Leigh Star, 2010. Boundary objects are used to *build bridges* between different knowledge domains and aim to make people from different disciplines work cooperatively. As can be seen, boundary objects are essential in cross-disciplinary work.

the other hand, however, this method does not allow for rapid prototyping and quick iterations.

In conclusion, problems arising in human-AI cooperative efforts emerge largely from (1) not knowing the exact capabilities of the aforementioned technology, hence missing out on opportunities to get the most out of it and (2) convoluted and often complex outputs AI can generate (Yang et al., 2020). All aspects considered, much more effort has to be done by both designers, and practitioners, but also engineers and the design team behind these artificially intelligent actors.

2.7 Human-AI interaction guidelines

As presented so far, AI displays numerous opportunities and helps human workers in various aspects of their everyday workflows. However, as shown in Section 2.3 and Section 2.6, with this type of technology come certain issues. Because of this, it is crucial to have safeguards put in place. Microsoft created a set of 18 guidelines which can be used in general practice with AI (Amershi et al., 2019). In this paragraph, only the ones most relevant to design processes will be presented. It is important to note that all guidelines could be linked to a certain moment within the design and design thinking process but to narrow down the focus and create a list of recommendations in this paper, the following have been selected:

- "G1 Make clear what the system can do" - machine systems have limited capabilities. Users should be aware of to what extent AI can help.
- "G2 Make clear how well the system can do what it can do" - when working together with AI, there should be a clear definition of the capabilities of both parties. Human users must also be aware of the fact that AI is prone to mistakes and that one has to account for them.
- "G4 Show contextually relevant information" - AI must do its work, such as outputting information in the context it is put in". It also must be aware of the user and the task at hand.
- "G5 Match relevant social norms" - AI, must be aware of social norms and constraints. This can be done by feeding it with large data sets. Moreover, the machine should be aware of the context in which the interaction happens. Here, one might refer to the *feeling intelligence* from Huang, Rust, and Maksimovic, 2019.
- "G9 Support efficient correction" - it must be relatively easy to correct the errors done by the AI.
- "G11 Make clear why the system did what it did" - AI must behave in a way that is understandable by humans.
- "G13 Learn from user behaviour" - AI is an ever-learning algorithm. It crawls data and improves over time. This provides for a better user experience in the future.
- "G15 Encourage granular feedback" - in order to "learn for user behaviour", the system should be open for feedback to improve over time. Additionally, human operators should be able to customise and select preferences when interacting with AI.

- "G17 Global controls and constraints" - human users must be able to control the machine and have access to controls, should it behave unexpectedly.
- "G18 Notify users about changes" - to be in control of the system, users should be notified when changes and updates are made to the system - for example with new features and changes to AI's behaviour.

Furthermore, the paper by Yang et al., 2020 sheds more light on the topic. There are certain actions which can be undertaken to remedy the challenges presented in Section 2.6. UX and service designers have certain skill sets and capabilities (Morelli, De Götzen, and Simeone, 2021). Nevertheless, they must improve their technical skills. This implies an understanding of how technologies such as AI work and not low-level programming abilities. Still, there is a discourse in the area of how much knowledge for design thinking practitioners of said technologies is enough, as AI is still in high-speed development (Cartwright, 2016 & Yang et al., 2018). Additionally, design practitioners should have much easier access to AI tools. This is not the case right now. The article mentioned above gives some specific examples of tools that could be utilized, but there is the problem of *wide accessibility*. Furthermore, to get the most out of intelligent machines, designers should work in tandem with engineers. The latter group can aid the former in understanding how to work best together.
Last but not least, there will be a need to create completely new design processes which as specific to AI and human collaboration. As Giaccardi and Redström, 2020 says, in the near future there will be a need to revise the paradigms of HCI. Currently, the design thinking approach, co-creation, co-design and similar models were developed for human actors specifically. In the future, the focus might shift from only human agents to (1) large data sets and AI systems as the core of design processes - unlike the fast, iterative approach (Yang, Banovic, and Zimmerman, 2018) and larger user pools, as AI requires large data sets to work with (Forlizzi, 2018).

Additionally, it is important to acknowledge the existence of many more frameworks of interaction principles between AI and human agents. For instance,Amershi et al., 2019 presents a comprehensive overview of these based on a study with 49 design practitioners. These guidelines were additionally tested on 20 real-world products that use AI. What is more, big companies create their own guidelines for human-machine interactions. One of these is Apple with their "Human Interface Guidelines" Apple, n.d. Here, the authors focus on creating a set of rules for designing interfaces and interactions between humans and machines in mobile app settings, within the context of industrial design. Moreover, Martinetti et al., 2021 presents a critical analysis of the already establish regulations concerning the aforementioned topic in terms of interactions safety - both physical as well as social. Furthermore, Wickramasinghe et al., 2020 presents another perspective on the topic of human-AI interaction guidelines. As it was shown in the Chapter and will be additionally reaffirmed in Chapter 3, AI, as of now, lacks trustworthiness and therefore is not widely deployed within many areas of everyday human life, where it could show its potential. The authors created a set of "AI development guidelines" to improve set trust and interaction opportunities between both parties.

With these guiding points, it is clear that AI systems, meant to be used to support design processes whole working together with human actors, must be transparent, iterative, ever-improving, and accountable. What is more, new ways of working for

human and machine actors might have to be developed. New groups of specialists might have to come together for these new processes to be initiated.

2.7.1 *Team cognition* in mixed human-AI collaborations

Besides general guidelines for collaboration in human-machine teams, one should look into the cognition aspect of its members. Paper by Schelble et al., 2022 presents research done on the topic of *team cognition* in *HATs* - human-agent teams, where the word *agent* is used to describe a non-human team member. The term *team cognition*, used in this example, refers to a collection of interrelated ideas including situational awareness, team decision-making, and sharing of mental models. These concepts come from each member's own perception, beliefs, expectations, and experience. The resulting factors of *team cognition* are trust, performance, and common process perceptions (Schelble et al., 2022).

Two questions set in this paper are especially important regarding the topic of this thesis. First of all, which teams have a higher level of *team perception*: ones consisting of only humans, mixed teams or the ones where there are more AI agents than humans? Additionally, the paper presents yet another set of recommendations for a such team - but with the focus on enhancing *team cognition* in the future.
Regarding the first question, the researchers conducted a set of experiments where HATs worked towards a common goal. As a result, teams consisting of one human and two machine agents performed the best. They showed the highest level of team performance. Interestingly, the trust put in AI was also higher in the team where there were more human operators than AI ones. Additionally, both perceived team cognition and team performance scored the highest in the team with two AI agents and one human. It is important to note that such trust and good results can only be achieved if the AI agents' work is exemplary (Schelble et al., 2022). This finding seamlessly points to the answer to the second question. Besides the required examplar and accurate performance of AI agents, two more factors need to be looked at: mixed agent teams should put a strong emphasis on inter-team communication. What is more, AI team members should share goals with humans as this is fundamental to building good *team cognition* in HATs. What is more, authors say that communication is a "critical factor" for speeding up its creation team cognition.

Measure	**HHH**		**HHA**		**HAA**	
	Mean (*N*)	**SD**	**Mean (*N*)**	**SD**	**Mean (*N*)**	**SD**
Team Performance	86.62 (12)	3.81	89.08 (10)	3.20	91.97 (8)	2.80
Trust in AI	*N/A* (0)	*N/A*	26.55 (10)	2.33	24.30 (10)	2.26
Perceived Team Performance	31.83 (12)	3.03	35.30 (10)	1.70	34.80 (10)	2.97
Perceived Team Cognition	8.19 (12)	6.18	11.28 (10)	3.28	12.10 (10)	7.74
Team Mental Model Similarity	0.30 (12)	0.06	0.28 (10)	0.12	*N/A* (0)	*N/A*
Task Mental Model Similarity	0.31 (12)	0.07	0.35 (10)	0.08	*N/A* (0)	*N/A*

FIGURE 2.5: HATs with more machine agents than human agents show the highest scores among different variables. H - human, A - AI. Table from Schelble et al., 2022.

In the past 20-plus years, the research on HATs has strongly accelerated (O'Neill et al., 2022). However, not much has been done in terms of the cognition aspect. The presented study shed some light on this topic; one of the key takeaways is that

trust is essential in the aspect of mixed-member teams. When this requirement is fulfilled, HATs with more AI agents can research greater results than ones consisting only of human agents. This shows a potential for this technology to augment human designers in yet another way.

2.8 The concept of *framing*

Most design processes start with a given problem or on a use-case basis - a task at hand is presented, and it to the duty of designers and researchers to investigate it critically. However, a vastly different method of approach to human-AI collaboration exists, namely *framing*. This method is an example of generative design, which academic literature has found useful and successful in the past for non-apparent solutions generation (Matejka et al., 2018 & Kazi et al., 2017). Burg, Akdag Salah, and Chandrasegaran, 2022 argues for ideation, exploration, and design opportunities for humans and machines to work together when the given case is not clearly defined. In this particular context *framing* refers to formulating open-ended conclusions based on the initial stimulus or data input. As this definition can be fuzzy and is not well-defined, an example can better explain what *framing* implies. Let's take an AI using image processing technology to recognise and categorise what a random image contains. The machine algorithm will recognise particular objects, just like a human would, but not always. The figure below showcases said example:

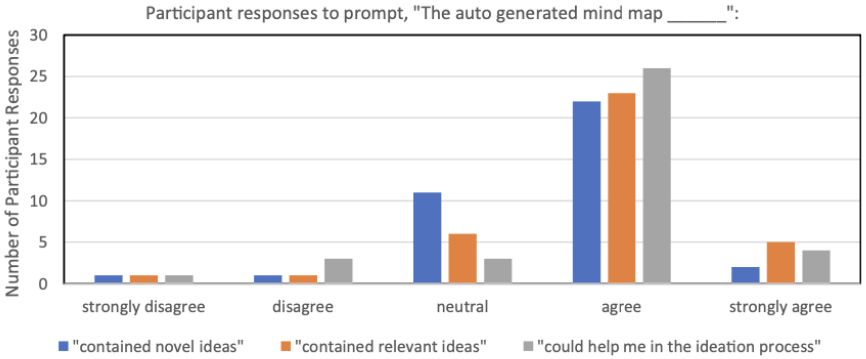

FIGURE 2.6: AI predicts what the image might contain, in an iterative fashion. Image from Burg, Akdag Salah, and Chandrasegaran, 2022.

It is clear that human designers would not categorise the content in the image in this way. Yet, the AI did. **The "label" assigned by the AI in the above example act as "frames"** - new ways of seeing things. It is up to the human actors to see what opportunities this classification opens. One might ask oneself questions: How does this change my perspective on a certain topic? How can AI be used to elevate my understanding of the already grounded topics? Dorst and Cross, 2001 say that this approach can take the designer out of their routine behaviour, as well as "surprise them" (Burg, Akdag Salah, and Chandrasegaran, 2022) - in a good way of course. Furthermore, this novel approach allows human actors to "see again", which would not occur under traditional circumstances.
This approach could also be applied to service design processes. The example shown in figure 2.6 is of a very particular nature, but this should not stop designers and researchers from imagining applied use cases for this framework. As this approach

allows for "seeing again", it could be used in the early stage of a project to explore areas that otherwise would not be given much attention. Furthermore, this solution could be used for data analysis (mostly qualitative), such as emotions mapping and behavioural analysis. *Framing* approach opens many new doors for designers and researchers. Nonetheless, much research needs to be done to assess the full scope of this technology and its usefulness. One problem emerging from the use of this method is that machines, such as image-based recognition, are trained on a pre-designed set of data. Depending on what said data contains, machines can learn to recognise different things and patterns, which can in turn skew and influence the end conclusions.

2.9 State Of The Art

This section will present AI solutions which can be used by service designers, facilitators, and customer experience designers to enrich and aid their work. This will be done twofold: firstly, academic research on the topic will be presented, and the application of AI will be shown where they manifested promising results. Secondly, new and upcoming solutions will be shown that present potential in the future.

2.9.1 Examples of AI supporting design processes

AI as stimuli supporting higher creativity

AI can be used in various ways to support human-led design processes. One way of using this technology is to increase one's creativity. AI can prove itself to be a great teammate, as shown in the paper by Figoli, Rampino, and Mattioli, 2022 - since AI is not simply a tool to execute tasks, but a technology which has an end goal of imitating its human counterpart (Stoimenova and Price, 2020). As an outsider to the process, AI can provide random stimuli throughout the creative process. That *interruption* can provide designers with higher curiosity and more holistic thinking about the topic, as noted by Yannakakis, Liapis, and Alexopoulos, 2014 and Beaney, 2010. This implies that AI can generate additional knowledge and open designers to new perspectives. One important thing to note here is that AI is best used and delivers the most useful outputs when is as or more intelligent as humans (Zhang et al., 2021 and Pandya et al., 2019) - otherwise, such symbiosis can prove counterproductive. With this in mind, several different AI types can be distinguished for supporting creativity in design thinking processes.
Firstly, there are *image generators* - these AIs are able to take input in a form of, for example, text, and generate various, often abstract, images. See subsection 2.9.2 for an example. AI programs can also act as co-facilitators - an example here would be Adobe Sensei[5]. Furthermore, concepts and prototypes can be evaluated by AI in terms of quantitative aspects of the design - for instance "novelty" and "level of detail" as written in Camburn et al., 2020b.

Machine learning for mind maps creation

Many design processes start with brainstorming and ideation sessions. One of the tools used for these activities, vastly popular, is a mind map (Marshall, Crawford, and Jensen, 2016). Camburn et al., 2020a presents proof for an augmented ideation

[5]See more at `https://www.adobe.com/sensei.html`

stage within the design process. The paper concludes that by using AI as a supportive tool, created mind maps have a higher novelty factor, as well as are more feasible. Moreover, using AI saves time and therefore reduces costs. What is more, AI-enabled ideas can be further used for solving novel and approached challenges. Additionally, authors present certain limitations to using AI for such purposes as the need for multiple iterations before satisfactory results are achieved (Camburn et al., 2020a).

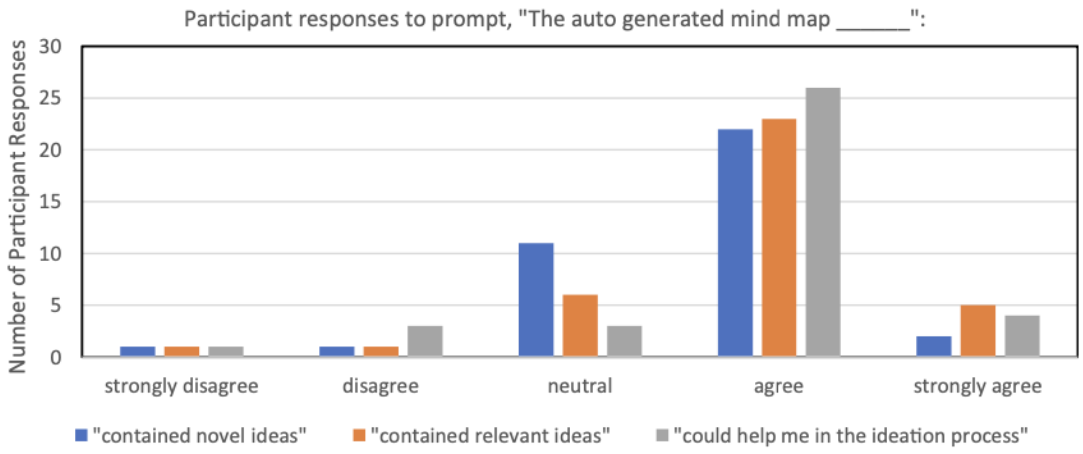

FIGURE 2.7: Study participants responding to the question "The auto generated mind map_____". Image from Camburn et al., 2020a.

2.9.2 Novel AI solutions

General AI tools for data analysis

Whether qualitative or quantitative, service designers and other researchers deal with data which has to be processed. In the Double Diamond framework, data constitutes a significant part of the divergent stage *Discover* (exploitative investigation of the problem area) and the convergent stage *Deliver* (final evaluation and testing of the developed artefact). Different novel AI solutions exist here, such as Power BI by Microsoft (Microsoft, n.d.) and Tableau by Salesforce (Salesforce, n.d.). These powerful data processors and visualisation tools can help expedite otherwise tedious work. Another example, Akkio, is an AI-powered tool for quantitative data analysis (Akkio, n.d.). It can detect patterns in (text) data and, for instance, predict emotions expressed by the test subject. This application could be utilised in the *Deliver* stage for feedback analysis.

ChatGPT

ChatGPT is an AI-powered chatbot developed by OpenAI (OpenAI, 2021. It was launched in November 2022 and in its first five days of operation, it reached over a million users (Mollman, 2022). It uses reinforced learning and transformer technology to learn and understand user inputs and to answer accordingly. This tool can be used in various scenarios: generating ideas, writing blog posts and essays, creating content, creating variations of said content, and simply for learning and accessing

information (Susnjak, 2022, Gozalo-Brizuela and Garrido-Merchan, 2023).
In service design processes, several applications for this technology can be found: ChatGPT can generate multiple versions of the same or different design scenarios, as it can paraphrase and create multiple versions of the same design instance. Moreover, it can create content from scratch, such as design and facilitative activities. One should be careful with the data it generates, as it is prone to errors and presenting incorrect information.

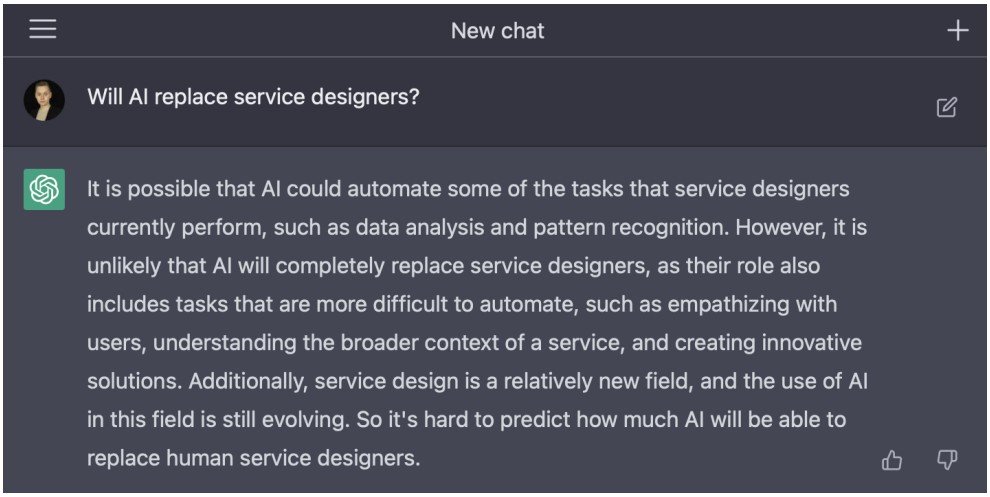

FIGURE 2.8: User interface and an example prompt of ChatGPT. Image by the author. Text generated by ChatGPT.

DALL·E 2

DALL·E 2, yet another deep learning algorithm created by OpenAI, is capable of generating images based on text input (OpenAI, 2022). Similarly to ChatGPT, it used pre-trained transformers architecture as its underlying technology. DALL·E 2 is able to generate images of any kind, in any style, as well as emojis, characters, and paintings based on a specific style. An example of an image is shown below:

DALL·E 2 presents great opportunities for enriching design processes. First of all, it can be used in the ideation phase. Here, it generates ideas and provides a visual aid to progress in the process. What is more, it can be used as a help in workshops and other sessions where users, customers, or students are asked to, for instance, imagine possible futures and solutions. It can also save time in creating prototypes and visual representations of ideas. Instead, this time can be spent on brainstorming and ideating.

Uizard

Uizard, a Danish company has developed AI Design Assistant, a tool for UX and UI designers for transforming simple sketches into fully functioning prototypes (Uizard, n.d.). This tool can be moreover used by service designers to optimise time spent on developing prototypes. By drawing simple sketches, designers can now have full designs ready in no time, ready for testing with users. An example of such a process can be seen in the figure below:

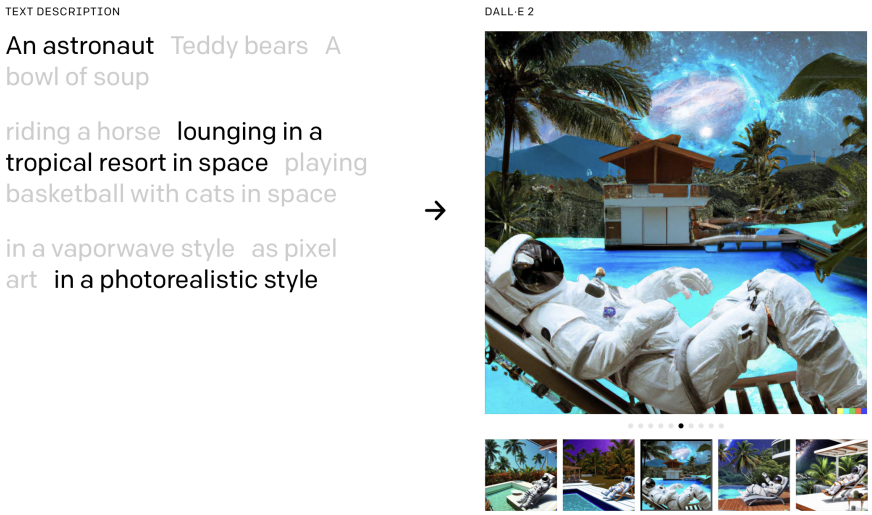

FIGURE 2.9: Images generated by DALL·E 2. Graphic from `https://openai.com/dall-e-2/`.

Service designers' role in making generative AI tools more approachable

2.10 Ethical guidelines for AI systems

2.10.1 Introduction

As with any new medium, it is pivotal to consider the ethical implications of this disruptive technology. As human actors wield decisive power over the design specifications of such systems, they must ensure that there are ethical frameworks which guide the creative processes of AI in the future. This section will showcase frameworks for using AI agents in various societal situations, which also includes design (thinking processes) and cooperation with human agents.

2.10.2 "Statement on Artificial Intelligence, Robotics and 'Autonomous' Systems"

Developed by European_Group_on_Ethics_in_Science_and_New_Technologies, 2018
In the past two decades, the development of AI- and ML-enabled systems has experienced significant growth, and organisations, governments, and design practitioners have developed sets of guiding points for creating these systems ethically. One of them, the European Group on Ethics in Science and New Technologies, which operates under the European Commission, released a set of guidelines for generally understood autonomous systems in 2018 (European_Group_on_Ethics_in_Science_and_New_Technolog 2018). This set of recommendations is high-level - meaning it applies to all types of AI, including robots, smart assistants, and even LAWS. Nevertheless, these rules can be applied to the types of AI used by designers in design thinking processes, hence should be critically analysed here.
First and foremost, autonomous systems, while working together and for human actors, should be designed with data protection and privacy in mind. In order to learn and improve, machines need to crawl and process huge amounts of data. Therefore, it is fundamental to ensure that information is protected and used only for the sole purpose it was initially intended for. Hence, AI must respect human privacy and

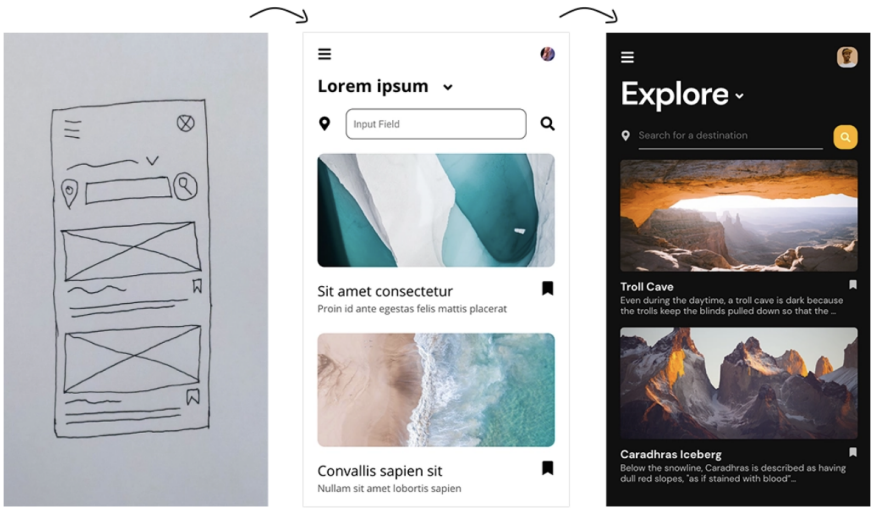

FIGURE 2.10: Uizard AI Design Assistant can generate full app designs from simple sketches. Image from https://uizard.io/design-assistant/.

not be used for hidden profiling. Regarding design processes, this implies the use of only data that was obtained with consent, and only from (test) subjects that willingly participated in such studies.
What is more, intelligent machines must be used according to the rule of law. This means using them only within set rules, even if doing against them would bring certain gains and advantages. Furthermore, if problems shall occur in regard to AI used, there needs to be a level of accountability regarding intelligent systems. This question cannot, as of now, be answered easily - who do we hold accountable in said situations? The AI itself, the engineers who developed it or the service designers who use it?
Yet another topic of discussion, so closely related to HCD and co-creation is "equity and solidarity". AI technology must be used with respect to all users, giving equal benefits and access to the masses. This, as of today, might be wishful thinking, as many inequalities around the world exist, and co-creative processes are still in their infant stage (or completely non-existing) in many parts of the globe and outside of Scandinavia, where it originated (Xplane, 2016). Nonetheless, designers and engineers must stay vigilant and it is largely up to them to make sure this technology is used as it was intended. What is more, it is crucial to ensure that the application of AI is done in a democratic way to, once more, ensure its concentrated and proper use. Here, public dialogue is required. As mentioned with the rule of privacy and data protection, human dignity and respect for core values must stand above all.
Finally, AI systems must not impair human autonomy. Human agents should always have control of AI and be able to decide, not the other way around. This rule also puts a responsibility on us regarding the design of said intelligence.

The above-mentioned report includes even more safeguards for designing intelligent machine systems. However, these are crucial for the respectful cooperation of human and machine actors regarding design processes.

2.10.3 Ethics-oriented safeguards for applied AI

A meta-analysis by Floridi et al., 2018 on the aforementioned topic presents yet another set of safeguards for ethical AI use. First and foremost, the clearest rule with using this technology is *Beneficence* - meaning technology should serve humans and bring certain gains to them, not the other way around. Citing Amnesty International UK "AI should be developed for the common good and the benefit of humanity". What is more, with creating intelligent machines of great power comes great responsibility[6]. Privacy and data security must be ensured when, for instance, collecting and recording user-created data (interviews, emotions, etc.). Designers and researchers must ask themselves what, possibly novel, ways of protecting privacy must be developed.
Another principle is decision-making autonomy. With this rule comes an interesting ethical and philosophical question. By shifting some work to AI, we automatically grant certain decision-making power to it. Humans willingly enable decision-making power to the machine and leave some to ourselves. But where does this fine line lie? In a design thinking process, which decision can be made by the machine and which are better left off to human designers?
Presented literature later express the opinion that human autonomy, together with the aforementioned beneficence would always be of the highest priority. This principle combines swiftly with rule number four, justice. AI tools must have anti-discrimination- based proceeding built in. For instance, EGE (from Section 2.10.2) argues that AI technology must " contribute to global justice and equal access to the benefits" of the aforementioned tools. This rule is particularly important when designing service-based solutions, as no designer would want to accidentally exclude or omit certain user groups just because of a faulty tool. An example of AI-based tools for facial recognition which, due to the pre-trained data, perform generally worse on dark skin-toned people that lighter ones (Najibi, 2020).
Lastly, the must be a common ground regarding the explicability of AI use. In literature, this rule is also called transparency, accountability, interpretability, understandability, and more (Floridi et al., 2018). It comes down to having safeguards in place and making sure that the technology is used responsibly. If not, who do we hold accountable, should errors and mistakes happen? This also relates to the fact that AI, so prominent in everyday use, is actually only created and maintained by a small fraction of said society - by highly trained specialists.

Altogether, these five rules will be later used as an underlining to make sure that when AI works cooperatively with human designers, it is done with respect and adequately. The figure 2.11 showcases the above-mentioned visually:

2.10.4 Additional literature on ethical AI use

Besides the aforementioned guidelines for ethical use, more sources exist - developed both by governments and design professionals. Among others, the University of Montreal has released a 2018 report titled "The Montreal Declaration for Responsible AI" (Dilhac, Abrassart, and Voarino, 2018). Furthermore, the Nonprofit organization called "Future of Life Institute" has compiled "The Asilomar AI Principles" (Asilomar, 2022). Specifically, the authors focused on issues such as the academic research aspects and long-term issues which might arise. Furthermore, UK government has put together a list of "five overarching principles for an AI code" (from the

[6] Adapted quote by Stan Lee from Spider-Man by Marvel.

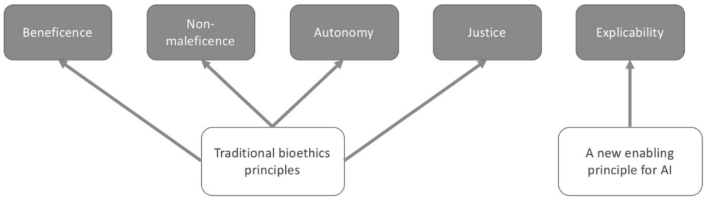

FIGURE 2.11: Five rules for ethical AI, graphic from Floridi et al., 2018.

.

"UK House of Lords Artificial Intelligence Committee's report")[7]). What is more, Shahriari and Shahriari, 2017 in their paper "Ethically aligned design: A vision for prioritizing human well-being with artificial intelligence and autonomous systems" present a set of guidelines based on the work of 250 professionals, academics, and such.

2.11 Stages in the service process

As this thesis refers to service and other design practitioners for service creation and delivery, a framework for such activity ought to be selected. This will be done to ensure that further divagations are focused on a specific part of the process.
Services, designed by service practitioners, can be differentiated from product design processes by four distinct features (Morelli, De Götzen, and Simeone, 2021). Together, they create *IHIP paradigm*. Its four features are:

- "Intangibility" - meaning not material, the service itself is not a tangible artefact,
- "Heterogeneity" - services are in constant change, and it is difficult to sustain them in one form,
- "Inseparability" - the service, and the intrinsic value, are being created at the same time as the service itself,
- "Perishability" - meaning services cannot be stockpiled, they only exist in the present time

Additionally, with said intangibility, the core value is co-created by the service provider and customer (Ramaswamy and Ozcan, 2018). The *IHIP paradigm* puts additional emphasis on the time dimension, as services are processes. Paper by Huang and Rust, 2021 provides a dissection of a service creation process with three stages: *interaction*, *creation*, and *delivery*.

In the service *delivery* stage, the talk is mostly about mechanical and repetitive tasks. Here, the service designer can focus on optimising the back-end part of the system. For this stage in the process, *mechanical AI* can be used (see Section 2.5) for the completion of these tasks. It will also provide for optimisation of costs and time, as shown in Section 2.3.

[7]Read more at: `https://committees.parliament.uk/writtenevidence/80966/html/`

The core service stage, *creation* is where the design thinking process takes place. Here service designers must answer questions such as: who is the target group, what is the value, where the service co-creation will take place, and - most importantly - what service to create, to begin with. AI, at this stage, can be used in a multitude of ways (see Sections 2.9 and 2.5 for more details), including data analysis, pattern recognition, and creative ideation. *Thinking AI* can be used here from Huang, Rust, and Maksimovic, 2019.

Lastly, the service *interaction* stage is where value co-creation takes place. This is by far the hardest stage to automate, as it would greatly make use of the *feeling* AI, which is still in its infancy (Huang, Rust, and Maksimovic, 2019). Possible applications for AI here would be customer interaction, reading emotions and responding adequately.

Having the service stages presented, this thesis will exclusively focus on the service creation part. As the topic of this dissertation indicated, the later parts of this paper will showcase ways for service designers and AI-enabled tools to work together. Hence, the part of actual service delivery and interaction will be left out intentionally.

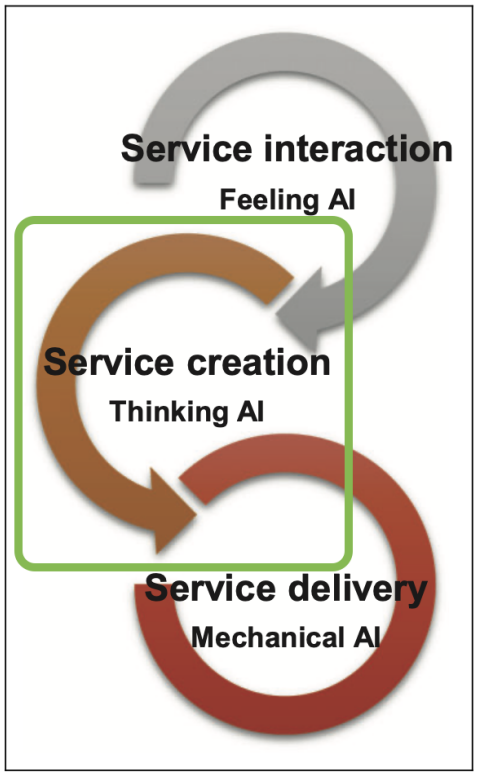

FIGURE 2.12: Three service stages, with the respective AI types to support each stage. The green rectangle shows where the focus of this thesis will be. Graphic from Huang, Rust, and Maksimovic, 2019.

.

2.12 Conclusion and the *co-performance* concept

As of now, AI is mostly used as a tool, supporting human operators in, for instance, designing, ideating, and analysing data. At its essence, this "tool" is no different from other artificial aids used in design processes - Post-Its for insights framing or Dictaphone for recording interviews. AI provides an element of "smartness", meaning performing certain tasks on its own and leaving some room for human actors. It is nonetheless a mere device that has a role to place at some stage of the creation process supervised by humans. The literature review and analysis in this chapter show that the opposite is possible. The concept of co-performance, introduced by Kuijer and Giaccardi, 2018, opens up a new perspective for the interplay of human and fully capable AI actors. Co-performance, at its essence, allows AI and other machine tools for the capability of self-agency, to work together with human actors cooperatively and to open up new dimensions of interactions and outcomes. However, it is important to note that the AI part of co-performance derives its meaning from humans, as they are the initiators.

The notion of using technologies such as AI and IoT in service design is called *Smart Service Design* (Network, 2023). With these changes coming, there will be a need to educate service and other design practitioners about these upcoming technologies to a larger extent. Many new products and services will be created with AI as a foundation and they might become an inseparable part of many design processes.

Combining the above-mentioned concept with the three types of AI presented in Section 2.5 and focusing on the service creation stage from Section 2.11, a new set of guidelines can be created for novel service design processes. All of this will be done with the underlying ethical safeguards in mind, presented in Section 2.10. Moreover, examples of AI use from Section 2.9 will be interwoven into the design process as cases for AI applications. The following chapter will be used for synthesising and framing the research and concluding it with a final research question.

Chapter 3

Qualitative survey and interviews with design practitioners

3.1 Introduction

So far, the concept of AI cooperating with human designers has been explored through scientific literature review and paper research. It has presented concepts like *framing* (Section 2.8) and *co-performance* (Section 2.12) while also showcasing the various aspects of this technology and human designers to work together. Nevertheless, more research should be conducted to investigate what design practitioners and experts think about using AI in everyday work. This issue is most crucial to explore, as the designers themselves are the focus of this paper.
To have an initial understanding of the topic and recruit people for future explorative interviews, a short quantitative survey was conducted. The goal of these interviews was to find out if service design and UX practitioners use AI in their processes and how that use of AI could potentially help them.

3.2 Survey

The goal of the survey was twofold. The first is collecting general quantitative data about service design and UX practitioners. Secondly, finding users willing to do interviews to explore the problem area from the perspective of design experts and their applied work.
Unlike with a traditional quantitative survey, the goal here was to build on top of the qualitative desk research work. All in all, the questionnaire consisted of one closed question, six open-ended questions, and one optional follow-up email sign-up:

1. "Which area of design do you work with? Answers: UX | Service Design | Technology design | Human Interfaces / UI | Product Design"
   This question was asked to find out from which expertise area come most of the people who completed the survey. For the sake of this thesis, I was mostly interested in UX'ers and service designers.

2. "Have you used AI during your creation/design process?"
   Here, the goal was to establish the foundation for the following questions as well as see if design practitioners actually use AI in their work today.

3. "What was the use of AI in said cases?" With this optional question, responders could write down real-world applications of AI that they have experience with.

4. What challenges do you see when working with AI? | What challenges can you imagine when working together with AI?

As we know from Chapter 2, AI, as any technology, has its downsides. Here, responders could explain what problems this technology can create and what impact it can have on human design work.

5. "What do you think about the role of human creativity in the collaboration with AI in service design? How can we use AI's creativity to our advantage?" Here, I wanted to find out if design practitioners this of AI as a potential equal companion or simply a tool supplying their work.

6. How do you see AI, and similar technologies, affect the future of design? Would it be a positive or a negative change? What could be different?
Here, responders could imagine possible futures in relation to AI's integration into design processes.

7. "Can I contact you at a later date for a short interview about AI and design? If so, feel free to leave your email address or phone number. I would really appreciate it."
Here, responders could optionally type their contact info to be contacted at a later date to discuss your insights in greater detail.

The questionnaire was conducted in weeks seven and eight. Survey takers were acquired by sharing the link in various groups, such as *The Big SSD Familly*, a group for all past and present Service Systems Design students, and various subreddits (such as &AI and &SampleSize).

3.2.1 Survey limitations

Before the findings from the questionnaire can be presented, certain limitations of them ought to be listed. First of all, the survey counted only 13 responses, making it not enough to draw scientifically valid conclusions. However, the majority of the questions in the survey were of a qualitative nature, hence some insights and patterns can be found in the answers. These insights will not be used later as hard-stated facts to use for building the solution presented in Chapter 5 but as an inspiration for reflection and further investigation of the topic of this paper. Additionally, a certain amount of responders were beginner service designers, as the survey was also shared within the Service Design Facebook group. Not all responders have also worked with AI to a large degree. Therefore, their answers might be skewed and not fully beaked by experience or knowledge of the field. Additionally, since the link to the survey was sent out to various Facebook groups, subreddits, and Slack channels, any person with access to these could technically fill it out. This provides for lover level of reliability in the conclusions drawn from the answers.

3.3 Results of the survey

The study was conducted over a period of two weeks and yielded 13 responses. The results of the survey will be on a question-by-question basis. Later, general conclusions will be made.
As expected, based on the groups to which the survey link was sent, most of the responders were service (7) and UX (2) designers. The detailed responders' breakdown can be seen in the figure below:

Interestingly, 53.8% of the questionnaire responders have used AI in their work. There were several distinct uses of this technology in their work:

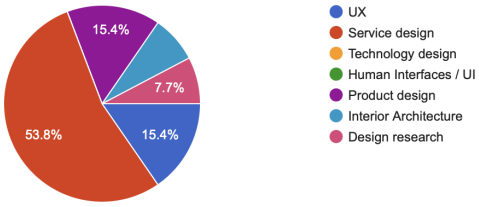

FIGURE 3.1: Survey responders' areas of expertise breakdown.

.

- Ideation and content writing - as AI is generally good at creating multiple versions of the same entity and synthesising data to create different variations of the same idea, it is not surprising that designers have used it for these applications. Responders have used tools such as ChatGPT, DALL·E, and other AI-powered tools to expedite this part of their design process. Additionally, one person used AI to generate "How might we...?" questions based on their research question.

- Concept visualisation and content generation - having a vision for one's project, one person used AI to create visual user stories. Another one asked AI to visualise their concept based on previously done research.

Next, the survey explored the topic of prospective challenges when employing AI in design processes. Responders who used AI in the past were asked about their challenging experiences with this technology, while those who have not used it were asked to think and imagine what challenges might occur. In conclusion, the topics of ethics, trustworthiness, and reliability were the most often brought up. With ethics, responders questioned data protection when using AI, how this tool sources information, and to what extent it can work. Moreover, the issue of content ownership created by AI was raised. What is more, most responders, whether they used AI or not, seemed to not willingly rely on it to a large extent. They acknowledged that outputs generated by AI cannot be simply taken "as they are" and used in the real world since that data cannot be 100% reliable due to machine agents being prone to making mistakes. Therefore, AI-generated content would not be used to replace the one created by humans, but more as an inspiration or a draft for further work. Moreover, as AI learns from data it is presented with, it can provide for serious biases if left without control[1]. Furthermore, the learning curve of introducing AI as a co-partners (or minimally as a tool) in a work environment might pose some challenges. As stated in Section 2.6, generally, design practitioners do not have much experience in working with machine agents. Two optimal solutions to this problem were presented: (1) education of designers in this new field and (2) cooperation of designers and engineers who create these ML tools. Lastly, at some point in time, it might be difficult for the outside viewer to distinguish which content was generated by a machine (such as ideas and visualisations) and what was created. Here, the ethical standards and safeguards must be ensured, as presented in Section 2.10.

Next, survey takers were asked about human and machine creativity and how the latter could be used to elevate design processes. The underlying issue researched

[1]An example of AI which was presented with biased data can be seen here: `https://www.timesofisrael.com/microsoft-drops-chatbot-made-into-hitler-loving-monster-on-twitter/`.

through imposing this question was to see if, as of today, designers think of AI as a tool to be used alongside human designers, or a full-fledged work partner. The former turned out to be true. AI, as of today, seems not to be an equal work partner of humans but is largely used for repeatable tasks and idea and content generation tools. This is in line with the previous answers and many of the AI applications nowadays. One responder stated that "It could be helpful for speeding up the process. If we feed it with something, it gives better results". Another one wrote, "AI offers a toolkit for advanced concept visualization, decision making (use of XR), and automation of tasks that are cumbersome". AI is still largely understood as a tool to be used at some point in the design process. The results of AI's work would be later taken over by humans and worked on from there (another responder stated that "AI can probably faster connect more service design points, notions, definitions. Our job is to evaluate if it makes sense or is valuable").

Regarding the last question, which concerns the future of design being influenced by AI, most responders agreed that its general impact will be positive as it already today shows potential in many areas and aspects within the design process. This would mean things as simple as cutting down time on repeatable chores (quote from one of the surveyed people: "Those who use AI will have an advantage in regards to productivity.") to generate full designs by AI in the future. On the other hand, one respondent presented a negative impact of many design practices with the too-forward employment of AI. As stated "I think main human designers will be better seen, as those who are not creative enough by themselves, will turn to AI". It is quite possible that more and more people will turn to AI tools to supplement the deficit in their own skills and expertise and "cheat their way and results".

In conclusion, several insights can be made following the above questionnaire. First of all, more and more designers, from various fields, have already been using AI-powered tools in their work. Even if they do not employ these techniques often in their design processes, they have at least a basic understanding of their applications. People can clearly see where these machine agents can be used and how they can supplement their workflows. The crucial problem comes with the "supplement" aspect. Designers still largely think of AI as a tool and not a co-creative partner. They mostly use tools for tasks that can be easily automated and which would otherwise require a substantial time investment from the human agent side. AI cannot also be fully trusted, which is a fair observation, as it, compared to human intelligence, is still in its infancy. It must be "supervised" by human designers in case it makes mistakes, which it is quite often prone to. Nonetheless, designers can see potential future applications for this technology, when it advances and improves enough. Still, it is a long way from where it is today to achieving its full potential.

Full survey results can be found in Appendix A.

3.4 Interviews with design practitioners

The interviews were created and conducted to gain a more practical understanding of the needs of designers at various levels of their work proficiency. The literature review and specific academic papers have provided the author with information on the topic, such as the paper by Yang et al., 2020; however, it is equally important to learn from design practitioners due to the following reasons:

- Gaining deeper insights into the design process - interviewing other design practitioners can help identify gaps in research, in the form of previously unexplored areas.
- Identifying trends - designers working in different industries and on different projects can help uncover emerging trends and help look for innovative approaches to augment design processes with AI.
- Gain an understanding of opportunities, as well as challenges of AI in (service) design - having many different perspectives on the topic, interviewees can help see the problems which this technology can induce, as well as which novel opportunities it can bring.
- Discovering best practices - this touches upon the methods, techniques and various approaches which can be found in designing desirable human-AI interactions.

The discussion part consisted of three parts: initial information, main discussion, and closing questions. The following questions were prepared as the main interview framework. However, due to the unstructured nature of the interviews, not all of them were asked in each interview.

Introductory questions - to begin the talk, several questions were asked to gain a basic understanding of who the interviewee is, what is their experience with design and AI, and what they work with in their everyday.

- Who are you and what do you work with?
- Can you briefly describe what your typical design process looks like? What tools are the most essential for you?
- What role does general modern technology play in your work?
- Have you been using AI to aid your work?
  - If yes: can you share an example of a successful collaboration project between [UX/service] designers and AI?
  - In not: why? Could you imagine scenarios where AI could extend your creativity?

Main discussion - the core of the talk was focused on working with AI within the design process, its challenges and potential benefits of it, working hand-in-hand with human designers, and projects which successfully integrated AI.

- How do you (or would you) approach integrating AI as a partner into the service design process?
- (if they used AI) In your experience, what are the biggest challenges when working with AI in [UX/service] design?
- Can you discuss the role of human creativity in collaboration with AI in service design?
  - On the other hand, how can we use AI creativity to our advantage?

- (if they used AI) How do you involve various actors, such as end-users, in the co-creation process with AI?
- Can you give an example of a project that utilised AI?

Closing questions - with this part of the interview, the goal was to enable higher-level reflections regarding AI, such as how it can affect the field of design in the future and the ethical considerations that come with it.

- How do you imagine AI affecting the future of service design?
- How do you ensure this technology is used ethically when working with AI in service design?
  - What safeguards can we put in place to ensure the aforementioned?
- (if they used AI) What advice would you give to service designers who are just starting to work with AI s a collaboration partner in their design process?

The interviews took place in weeks 8 to 11. Participants were collected using convenience and snowball sampling (Bjørner, 2015). Interviewees were acquired by emailing various design agencies and studios and by reaching out to people who left their contact information in the optional contact field from the survey.

3.4.1 Limitations of the interviews

It is important to note that the insights presented in the upcoming section came from various design professionals as well as practitioners. All of them have different experiences, and knowledge levels on the topic of AI, and design and often present their personal opinions on the subject matter. Therefore, learnings from the conducted interviews will be taken as inspiration and stimulus for further divagation on the topic of AI and design and not hard-stated facts. Additionally, an interview with a 4th semester Service Systems Design student was conducted in order to get a view on the topic from a novice design practitioner.

Audio recordings of all interviews can be found in Appendix B.

3.5 Interview with Jonas from Kontrapunkt design agency - insights

3.5.1 Introduction

The first interview took place on the 23rd of February at the Kontrapunkt office in Copenhagen[2], a strategic design agency specialising in brand identity creation and design. The meeting was held with Jonas Maximilian Schmidt[3] who is a Senior UX Strategist. The meeting lasted 40 minutes and provided great insights regarding the ethical use of AI, how the future might change based on new tools available, and also the persistently important role of humans and their creativity in the design process.

As of now, the company does not employ any AI tools *per se*; rather, they are in

[2] `https://www.kontrapunkt.com`

[3] `https://www.kontrapunkt.com/person/jonas-schmidt`

the exploration phase. Different departments are trying to research what is available out there, and which tools hold the potential to help the employees at Kontrapunt in their various tasks. Once this research stage is complete, the company plans to create a tools database and use them accordingly, based on the projects at hand. Nevertheless, as stated by Jonas, some employees are using AI tools already, such as ChatGPT and MidJourney for simple tasks.

3.5.2 Ethics

One of the main focus points of this interview was ethics in AI. First and foremost, Jonas brought up the importance of intellectual property when working with AI. Even now, human designers do not create "something from anything" - they are constantly inspired and influenced by the work of others and by their own experience. Hence, no work is ever original, as every *creator* has a certain experience and their own "learning journey". Therefore, in the future (or even now in some cases) it will be crucial to ensure that whenever a creation is made with the help of AI, the end users or customers know about it. More on this topic of when, how, and for what use this technology is presented in Subsection 3.5.3. With this topic comes the question of ownership and to what degree one can go with AI being creative. As of today, different tools are able to create full designs, stories and other creations previously only possible to be done by humans. With this issue, Jonas mentioned counter-movements to AI-generated art. Even today, some artists protest against art being made by entirely AI, which to some can resemble the point in time when the first cameras appeared, and painters were quite hostile to it as they thought of it to be the end of human-made art (which never actually happened).

3.5.3 Designers, clients, and AI - how do we all work together?

When asked about AI and designers working together, Jonas repeatedly used the word "partner" and not tool to describe the technology. He also presented the many prospective applications of AI. However, these applications refer to designers, strategists, and similar professionals using AI on their own. But what about the partners of designers, such as clients? With this question, a use case for practical AI applications was brought up when Jonas was asked about the collaborative efforts of AI and Kontrapunkt's clients and other external entities (such as research subjects, workshop participants, etc.). According to Jonas, AI could be used as a tool for clients to visualise and express their ideas, making it quicker and easier for other parties to collaborate.
On the other hand, Jonas imposed many questions, for which it might be, as of now, too early to answer: how do we communicate the use of AI to our clients? Should we charge them less if AI is used in our work since we then do less ourselves? Will the projects take shorter if AI is used? Do we then take on more projects? Do we communicate with clients which part of the solution is created by the AI and which by the human designers? Jonas moreover mentioned the designer's capability and responsibility in how this novel technology is used and for what purpose. Designers who use this technology have a certain responsibility in deciding how this tool is used and how it is communicated to others.

3.5.4 AI within the design process

At the end of the interview, I asked Jonas where AI would fit best within the design process, and additionally where the humans are better left to work without the support of AI. As previously mentioned, Jonas stressed the huge potential that lies in AI being used early in the process. Examples here include idea generation (by being able to quickly generate designs, designers could save time) and expediting research (summarising already done research or cutting down on time spent on doing actual research, such as literature review). Other tasks which AI could execute, according to Jonas are SWAT analysis and strategic research. Moreover, this technology could identify trends in the industry, which could turn helpful for service designers trying to innovate in a particular domain. Furthermore, mood boards could be created more in a quicker manner. Yet another use of AI, suggested by Jonas, is foresight and creating speculative futures. Here, AI, based on the data input, could create variations of what is to come. These outcomes All these instances of AI helping designers occur within the early phase of the design process.

What is more, Jonas presented an example of where AI can further add to the designer's skill set. For instance, with tools like ChatGPT being able to write and interpret code[4], designers would be able to create (simple) working prototypes of their designs and communicate with engineers. As mentioned in Yang et al., 2020, designers' learning programming is one of the remedies for the current no-so-popular inclusion of said technology within the design processes. This could be one solution to this problem - or at least a starting point for solving it.

On the other hand, certain parts of the creative process are better left to humans, according to Jonas. When, for instance, doing ethnography research, empathising with other people and doing research on them is best done by humans (as also presented in Chapter 2, *emphatising AI* is still in its infancy). Moreover, Jonas presented the importance of creating the final design/strategy by human workers. AI is good for promptly generating many "quick and dirty" designs, but not an ideal solution for creating a polished, final deliverable.

3.5.5 The crucial human factor and the dangers and advantages of using AI help

Human craft is one of the fundamental building blocks of the design culture at Kontrapunkt, according to Jonas. throughout the whole interview, Jonas was bringing attention to the fact that humans should not be, at any point, replaced fully, and in any aspect, by their artificial counterparts.
To contrast with this and challenge his statement, I asked Jonas about AI allowing certain designers, without full knowledge of the topic, to present themselves as professionals to the end-users and clients by using AI "behind the curtain". Jonas stated that this is, in fact, a possible future. However, he thinks of this possibility as when the first design software came around. When that happened, people who could not design were able to design. Jonas himself is not a skilled designer[5] but is able to create designs and sketches when needed, thanks partially to the design software. The same could be true for AI in the future: supplying people with solutions which

[4] `https://typefully.com/svpino/11-ways-you-can-use-chatgpt-to-write-code-YnkOEF4`
[5] As he himself stated in the interview, this is not my personal opinion.

could improve their workflows. This will be true if the technology will be used in a good faith.

3.5.6 Conclusion from the interview with Jonas

Finally, Jonas was excited to see what the future might bring in terms of technological advances in the area of design. He stated that the future is exciting and that the upcoming AI solutions will definitely change the way we work. At Kontrapunkt, a database of such products will be created and later augment their work. However, he often underlined the importance of *the human factor* in design. In summary, AI can be vastly useful at the beginning of the design process, but human interactions, such as ethnographic research, interviews, workshops, and similar shall be left to humans. But once it comes to creating the final design or solution, this stage should also be fully allocated to human workers.

3.6 Interview with Dominik Blasko, Service Designer - insights

3.6.1 Introduction

The second interview took place online on the 27th of February. The interviewee was Dominik Blasko, a Service Systems Design student designer currently working at Saxo Bank as a videographer. Dominik currently studies Service Systems Design and hopes to use his knowledge and experience later in the aviation industry - to help improve the different aspects of the passenger experience.

Dominik does not have much experience with design processes outside of the master's education he's currently completing at Aalborg University. He has mostly done video and editing work.

He has been using AI mostly in his spare time, testing the different products available, such as ChatGPT and DALL-E. He has been experimenting with these tools for approximately half a year. He has not specifically used any of them for professional purposes. However, his interested in exploring what's to come and learning more about the topic.

3.6.2 About AI and design processes

When asked about the possible AI integration into the design process, and when its capabilities would fit best, Dominik, similar to Jonas from Kontrapunkt, stated that AI (based on the research he was done) would be best utilised in the early part of the project. Here, he gave examples of AI-generating ideas, designs, and such. For instance, he would give ChatGPT a prompt to create a few starting points on a certain topic, and then if one of them is coherent enough he would start exploring that idea. Dominik compared this use case to starting a project with a blank piece of paper. Usually, a designer would have to go through a process of creating something based on their experience and knowledge. This process can be however simplified and expedited by using AI. Moreover, Dominik states other prospective AI applications such as designing questionnaires, sorting questions for them, and generating user stories from data, and scenarios.

When asked about the possible problems and challenges with using AI for the aforementioned purposes, one clearly stood out. Dominik stated that the issue might lie within the content AI presents. From all the data, it presents one output, chosen based on a certain data set. He compared it to a TV program being created by people and chose to present one, particularly a selected version of reality. AI does the same: it is created by people, works on a particular data set, and chooses to present one version of reality, which might not be 100 per cent correct.

When asked about human and machine creativity, particularly about how human creativity compares to AI's, especially when AI can generate dozens of designs in a matter of seconds, Dominik said that he does not doubt the human one. With AI, he always thinks about speed and quantity - but more does not always mean better. On the other hand, AI can be a tool which augments humans. He compared it to when the first iPads came around and how they revolutionised the area of design. Before that, one could draw on paper. After these devices became available, they gave a new tool and a new way for people to perform their tasks. It also made certain things easier for them.

Yet another benefit of employing AI within the design processes was described when Dominik was asked about how this novel technology can affect the future of service design. An idea that came to his mind was that AI would allow for more iterations within the design process, as AI-powered tools are able to quickly create, for instance, different versions and variations of designs and ideas.

3.6.3 Conclusion from the interview with Dominik

All in all, Dominik is excited about what is there to come in terms of AI. He is exploring the area and hopes to use it, along with his skills, in the aviation industry, where he sees himself in the future. He recognises the potential that AI holds but also acknowledges the importance of the human mind and what it can do. Moreover, Dominik believes that this technology can vastly help designers of various professions, and allow for more complex design processes in the future. This potential, however, does not diminish the possible downsides to this technological solution. Yet overall, to him, the future looks promising.

3.7 Interview with Amalia Robinson Andrade, User Researcher - insights

3.7.1 Introduction

The interview with Amalia[6] took place on the 28th of February and lasted approximately 40 minutes. She is currently working as a User Researcher / Service Designer at SPARK/BJSS[7]. Currently, Amalia is involved in a project with NHS, where she is responsible for streamlining the process of procurement within the healthcare sector. Her work is fully remote, hence general technology plays a significant role in her every day. She graduated with a master's in Service Systems Design and had 2 years of professional experience in the field.

[6] https://www.linkedin.com/in/amaliarobinson/?originalSubdomain=dk
[7] https://sparck.io

3.7.2 Exploration of the field of AI

Amalia has used various AI tools quite extensively and for multiple purposes. She is still exploring the area of AI and researching what is out there. For instance, she used ChatGPT for generative purposes, such as testing (for instance: she needed a list of 50 names and zip codes that would be randomised and not come from real people). Moreover, she used it for summarising lengthy articles and also writing some (to expedite the process of starting a project). At her workplace, the Content Design team has used various AI tools to a larger extent (for example for content generation) and has been training other employees in the use of AI.
When asked for an example of when she successfully used AI within her design process, Amalia stated that she has been using it for writing discussion guides. A discussion guide is a template for user research, for example, workshops, interviews, and such where talking points and questions are included. If she wants to ask questions she has not asked before, or try out a different style, she would ask ChatGPT for input. Nonetheless, and as she stated, Amalia would never use its output directly, but more as an inspiration or a foundation for her further work.

3.7.3 Issues with AI, ethical considerations, and what the future might hold

When asked about the possible problems and challenges that AI might cause, Amalia was able to provide a handful of them. First of all, at its current technological stage, AI cannot be fully trusted in terms of validity. It is not always correct, and for instance, ChatGPT has a pop-up message stating that it might present the user with incorrect information before every use. Another issue is privacy. To do some of her work, she had to feed the AI with data, some coming from her clients or other users. As she does not fully understand how this technology works, she's afraid of how the data might be processed and later used. She described this as the "scary part" of AI. Another issue provided is the lack of focus on the human-centred approach. Current AIs are largely generative, only trying to mimic human behaviour. Because of that, they lack empathy and similar skills which are so crucial to any user researcher. Yet another problematic aspect of this technology evolving so rapidly is the replacement of many jobs. This problem was described in more detail in Section 2.5, hence it will not be expanded on here.

As it can be seen, yet another person confirms the many drawbacks that AI is currently associated with. With this in mind, Amalia was asked to imagine how (service) design processes will look 50 years from now. She stated that due to the rapid development of AI, human interactions will become even more important. There will be more focus on workshops and parts of the process which will require more focus on the human aspects. Moreover, she stated that in the future AI might free up a lot of time for designers due to its speed and efficiency (for instance taking care of documentation, data organisation, keeping files up to date, information transfer automation, sorting, etc.).

3.7.4 New perspective of framing AI as a designer's partner

The interview with Amalia has provided yet another perspective on the co-performance concept of machine and human agents working together. The understanding so far has been that AI can be one of two: (1) either a tool, meaning using it to expedite the work and use it only at the moment where it is needed or (2) a fully-fledged

partner, and AI able to understand and express feeling and emotions, as well as empathise with humans. However, Amalia thinks about AI as a mix of the two. AI **is** a designer's partner when it does a certain part of their job, and then handoffs to its human counterpart. They do not necessarily need to work on the same task at the same time, simply just like different project group members are partners in the process, but often take different roles: one person conducts interviews, the other takes notes or writes down the insights for the report. This insight is especially important for the way AI as a co-performance partner was understood so far, and it will be used later in the design of the final solution.

3.7.5 Conclusion from the interview with Amalia

In the end, Amalia talked about advice she would give to young service designers who start their journey with AI. At 27:02 she said, "Do not use it as your end products but as a way of getting yourself out of the blank space. Question the information in it. Be creative about the ways you can use it". This quote is a good way to summarise what she thinks about AI in general. AI is a partner in a designer's work and should be used with sensibility and mindfulness. It is quite easy to be overwhelmed by what this technology can offer, as currently there are little to no regulations and safeguards to it. Amalia compared the current state of things to the time when the internet because a new medium widely accessible to others. Back then, there were a lot of education campaigns, primarily directed at children about the safe use of the internet. Amalia thinks that the same is needed with AI.

3.8 Interview with Troy Leininger, Senior Experience Designer - insights

3.8.1 Introduction

The interview with Troy took place online on the 1st of March and went on for approximately 35 minutes. Troy is a Service Systems Design graduate with two and a half years of professional working experience. Currently, he is working at EY[8] as a UX designer. Troy is working in a team that optimises and streamlines internal processes, for example for improving internal working conditions. His team also creates various technological solutions, such as apps.

With a given project, Troy usually goes through a typical design process. He is the only designer on his team, hence has to perform many different tasks which would usually be assigned to other workers. He creates blueprints, value network maps and other service design models which might be useful for a specific assignment. In his work, Troy largely relies on technology with the use of online whiteboard tools such as Miro and design-specific applications such as Figma.

3.8.2 On AI and design processes, the good and the bad

Troy himself does not use AI a lot. Besides using ChatGPT for rewriting certain texts, he has not explored this area in great detail. However, he found some use cases for AI applications for designers. Overall, Troy would use AI for manual and repetitive tasks, similar to what the other interviewees stated. As an example, he said that as

[8] `https://www.ey.com/en_us`

a Figma user, sometimes he needs to make sure the designs are "pixel perfect". Here is where an AI tool could help him, for instance, to make sure all designs are correct, and buttons and other UI elements are aligned accurately. Another example Tory could imagine was transforming sketches and drafts into fully-finished designs. He cited Microsoft PowerApps platform[9] as one of the example. Another one, described in this report, is the Uizard generator in Subsection 2.9.2.

When later asked about the advantages and problems which might come with the deployment of AI tools within design processes, Troy could point to a few. As AI will become more popular over time (and more accessible), more people will start using the same tools. As AI creates from the data it is fed with, some outputs might be similar. Troy compared it to when designers design and their inspirations come from "somewhere". This "somewhere" is what was created before them and what they know about. With AI created based on the same data, we might lose the "beauty of design", according to him. On the other hand, AI is good for metrics, for instance with tools that calculate a UX score for a website and evaluate how well it performs. Here, designers could save a lot of time by not focusing on mundane tasks. Furthermore, Tory has given out an idea where AI could aggregate different designs and data and analyse those to create fully-ready designs. However, as was the case for other interview participants, Troy would not fully rely on AI to hand over the final deliverable. He would rather use it as an early ideation tool and then handoff to a human designer. He compared it to a "Frankenstein style" design (21:00).

3.8.3 The future of design and AI

When asked about involving various actors, such as end-users, in the co-creation process with AI, Troy could think of an example where AI is used to allow the product (in this case a mobile app) to grow with the user. As an example, he cited Facebook mobile app which could evolve as the user ages. When one is a teenager, different functions of the app might be more useful, for example, Groups. When the user gets older, different features might be of their interest. This idea of using AI for a creation of a dynamic AI was definitely interesting, yet was running too much into the future when compared to the scope of this thesis.

Moreover, when asked about the methods of ensuring AI is used ethically, Troy said that the answer is transparency (29:25). AI tools consist of thousands of lines of code. For an average user, it is nearly impossible to understand how these tools work, how they process our data, and such. Hence, certain safeguards and regulations will be needed.
What is more, Troy provided a scenario where in the future AI might be able to evolve on its own and edit its code. In that case, accountability will be needed (31:07). There will be a demand for engineers to revise changes that happen to it and make sure it does not lean in the wrong direction.

[9] https://powerapps.microsoft.com/da-dk/landing/developer-plan/?&ef_id=CjwKCAiAjPyfBhBMEiwAB2CCIiV1RLfN0AAp_ikp16I3AFIn1yX8-BInEb9m-7IOKl_YBaceJXAIHxoCGLAQAvD_BwE:G:s&OCID=AIDcmmoz6eroc1_SEM_CjwKCAiAjPyfBhBMEiwAB2CCIiV1RLfN0AAp_ikp16I3AFIn1yX8-BInEb9m-7IOKl_YBaceJXAIHxoCGLAQAvD_BwE:G:s&gclid=CjwKCAiAjPyfBhBMEiwAB2CCIiV1RLfN0AAp_ikp16I3AFIn1yX8-BInEb9m-7IOKl_YBaceJXAIHxoCGLAQAvD_BwE

3.8.4 Conclusion from the interview with Troy

In conclusion, Troy has found similar AI applications for designers as the other interviews. He recognises that its current best application is for repetitive and time-consuming tasks. When it comes to the final designs, they are better left off to human workers. In the future, there will be a need for accountability and transparency, when AI evolves and becomes even more grounded in our lives.
With that in mind, Troy gave a closing example of an AI video tool for job recruitment. During one of the conferences he attended, a video analysing tool was presented where it would rank candidates based on certain factors, such as engagement and presentation. This tool would only select the candidate who performed well with those metrics for the next interview stage. While these metrics might prove useful to know when, for example, hiring a salesman, they might not be the best suited for, for instance, an engineer who might be an introvert and not perform well in front of a camera. This is one of the examples where AI employed for service design leans in the wrong direction and actually might cause more harm than good.

3.9 Interview with Réka Sára Mezei, Service Systems Design student - insights

3.9.1 Introduction

The penultimate, fifth interview was conducted online on the 1st of March with Réka Sára Mezei and took approximately 40 minutes to complete. Sara (as she will be referred to from now on) is a 4th Service Systems Design student currently working as a student researcher at Aalborg University. She has experience in product and graphic design, as well as working with digital media. She is interested in the topic of general ethics and how they might affect design processes. Sara has worked with design and design processes, using frameworks such as Double Diamond. Sara prefers to work digitally, as has been the case with her past projects.

3.9.2 The importance of critical reflection and ethical considerations

Sara stated that she has explored AI tools such as ChatGPT for private uses, but not much more than that. Because of it, the discussion steered in the direction of potential uses of this technology within the design processes. She stated, similarly to other interviews, that the best fit for it is at the beginning of the design process - for uses such as idea generation and completion of repetitive, mundane tasks. Sara was against using this technology at later stages of the design process, seemingly agreeing that the final design/outcome of the project should be left to the human designers. Moreover, she emphasised the importance of critical reflection on what AI is doing (10:52). As of now, AI is prone to many mistakes and inaccuracies, hence monitoring by human agents is needed. Furthermore, the use of AI, such as ChatGPT, could be a great ideation tool, for instance, used to kick-start discussions (15:40). What is more, Sara provided an example where one company is using predictive AI for looking back at the history of products they released and the data connected to it. In turn, AI suggests what products that have the potential to succeed in the future.
Sara was moreover asked to elaborate on the power of machine creativity (being able to generate dozens of designs in a matter of seconds), compared to human creativity which has been used in design predominantly until nowadays. She then discussed the importance of team-working among human designers. To her, there is a clear

difference between a machine generating dozens of designs and human teams discussing a handful of ideas. As Sara stated, for her critical reflection processes are more important than mass creativity (23:50).

Next, the question of possible problems that this technology might provide was discussed. Here, Sara acknowledged problems which are already occurring, such as human job replacement by machines. However, in this part of the conversation she mostly focused on the potential of this aforementioned technology and the ways it can transform the industry.

The last question Sara was asked was about ensuring the ethical use of AI within the design processes. As she stated herself, this topic is of great importance and interest to her. Sara deeply hopes that there will be regulations and policies coming soon (and some already are; she mentioned the "The European Union Artificial Intelligence Act", presented previously in Section 2.10. Sara said that as of now, due to the early nature of this technology, many initiatives are bottom-up, meaning coming from people, not policymakers. In the future, when enough voices are raised, the need for top-down rule-making will be needed. One example of such happening right now is universities banning ChatGPT and similar tools to be used for writing essays and exams[10]. Sara believes that banning it fully is not the right solution. Instead, she said we should "make it make sense" (27:40), meaning find uses for it where it is applicable and how to serve people in their work.

Furthermore, the topic of creating various realities by AI was brought up. To explain, each AI-powered tool outputs data in one way, based on how it was programmed. When some tools become more and more popular, they will present the masses with one, specific version of reality. One must then carefully think about the way information is presented, and, again involve critical thinking.

3.9.3 Conclusion from the interview with Sara

In conclusion, with the rapid advancement of AI, Sara puts a lot of emphasis on the ethical issues which will soon arise. She emphasises the importance of critical things and human team cooperation, which might become even more important in the future. Sara believes that AI should be used to augment humans and help them focus on critical thinking. Banning various AI tools is not the solution, and we should look for other ways to apply the safe use of this novel medium.

3.10 Interview with Jasper Vangsgaard, UX Strategist - insights

3.10.1 Introduction

The sixth interview was conducted online on the 13th of March with Jasper Vangsgaard, a UX strategist working at Novo Nordisk[11]. Jasper works as a part of the (early discovery) Digital Solutions team. He also uses the more classic design tools such as user research, workshops, personas, user journeys, etc. Jesper is mostly

[10]Read more here (in Danish): `https://www.dr.dk/nyheder/indland/den-overraskede-verden-med-sin-intelligens-nu-forbyder-flere-af-landets`.

[11]`https://www.linkedin.com/in/jasper-vangsgaard/`

tasked with data analysis in his work - they study big data sets. He finds out ways to better utilise the clinical data (1:20) for new research opportunities.

3.10.2 On the use of AI at Novo Nordisk

Firstly, Jasper was asked about how they at Novo Nordisk are using AI to supplement their work. He stated that, even though there are no real solutions in the works at this time, their data scientists team is investigating ways to extract data and analyse it. Moreover, one of the main goals that he and his team have in mind is insight extraction. due to the sheer size, Another use case for it is "data harmonisation" (4:05). Different data from different clinical trials has often different formatting and hence it can take time to make sure all data sets look the same - and to look across the different sets. With tools such as ChatGPT, Novo Nordisk does not allow its employees to use them in-house, as they impose data privacy and security risks.

3.10.3 The ethical perspective and what issues might arise in the future

As Jasper previously mentioned the privacy risks which come with the use of AI, I asked him if he can think of any other issues which might arise from its use long-term and in the future. Besides the aforementioned, Jasper has presented a case where AI wads were biased from recruitment since it was trained on a data set containing Caucasian people only, hence making people of the same origin score higher in the video-analysed part of the process. Moreover, he imposed the question of trust: can this technology really make the best decisions? Jasper mentioned that tools such as ChatGPT are approximately 70% accurate at best, which for his use-case at Novo Nordisk is not nearly enough, since every decision they make must be scientifically justified to pass the tight law regulations. Furthermore, Jasper talked about the evolution of AI and its transparency aspect of it.

3.10.4 Involving third parties and the human aspect

Moreover, Jesper was asked about the possibility of using AI for involving other actors throughout the design process, such as clients and test participants. He immediately pointed out that activities which require active user involvement, such as co-creation and human-to-human interaction are better handled by humans. The value in, for instance, workshops lies in those inter-human interactions, and AI can be used there as a supportive tool.

When asked about the exponentially growing power of machine creativity vs the human one, he brought up the point that AI tools are, at their core, "remixing" what has already been done, as they pull information from pre-arranged data sets. Moreover, AI can produce a lot of inconsistent information which might not be fully true.

Lastly, Jasper was asked about advice he would give to people who are just about to start their journey with design and AI. The first that came to his mind is the importance of critical thinking. All information coming from AI must be questioned and thoroughly checked. He also brought up the topic of "data literacy" - understanding the context in which data is self-contained. At last, he re-confirmed his previous statement where he underlined the importance of using AI at the beginning of the design process but leaving the end the more complex tasks for the human workers.

3.10.5 Conclusion from the interview with Jasper

Overall, Jasper seems to agree with the statements made by other interviewees regarding the use of AI within the design process, the ethical issues surrounding it, and the importance of human creativity when possibly threatened by AI. He recognises the problems which might arise from its use, such as transparency, and data privacy, and the AI is prone to mistakes. Last but not least, he believes that AI will not fully replace human designers with more empathetic and feeling tasks, such as workshops, interviews, and co-creation.

3.11 Interviews insights conclusion

In conclusion, all interviews seemed to share closely-related opinions regarding the role of AI in design, ethical problems that might arise from its use and alike opinions on the role of humans - their skills and creativity - in a quickly evolving industry. What is important to note is that most of the speakers did not have a lot of experience with AI tools. Regardless of their level of experience and proficiency with design in general, most of them have not yet used these tools for professional work. Rather, they explored this outside of work, using them in a limited capacity.

The most commonly used tools used were ChatGPT, DALL-E, MidJourney, and AI tools for converting sketches into ready designs. Therefore, these should be included in the solution; moreover, at the time of writing this thesis, these were also the easiest tools to access for a number of reasons. With time, more AI-powered tools emerged, and these will be acknowledged in the Solution Chapter.

Most of the interviewees seemed to share the idea that AI tools are best used, as of now, in the early stages of the design process. Tasks which are repetitive and take a lot of time (such as summarising texts, idea generation, How might we...? questions generation) can be easily given to the AI. On the other hand, creating final designs or solutions should be left to human workers. At its core, AI would act as a starting point for designers to kick-start the ideation process and afterwards, the work would be handed off to human workers.

Ethical issues were one of the core discussion points in these interviews. Most speakers acknowledged the need for certain regulations to be put in place in the future as well as the fact that as of now, we do not really know what that future might look like and how it will be shaped. Furthermore, critical thinking and reflection are needed, since AI at this stage is not perfect and highly prone to mistakes. Other issues interviews expressed are data protection, and bias tendencies (as they show one, programmed version of reality). What is more, emphasis should be put on the transparency of AI tools. This is especially important when these tools are used by everyday users, who might not have a deep technical understanding of the systems behind them. Furthermore, we should look for ways for AI to augment our work, not ban it and restrict its use when this technology is still in its infancy.

All in all, this technology has a huge potential to be utilized for various applications within the design processes. However, all interviewees brought up the importance of the *human factor*, which cannot be forgotten or lost in the process.

Chapter 4

Final problem statement formulation

Research conducted in Chapters 2 and 3 has touched upon many aspects of design processes, service design as a science, AI technology, its ethics, and the topic of cooperation between humans and machines. It presented various underlying theoretical frameworks, such as the capabilities of service designers together with AI's potential in replicating human designers' abilities and emotions. Moreover, the analysis showed potential problems and issues that might arise through the use of said technology, potential benefits to designs and prospective users, as well as the primary ethical issues and safeguards that must be put in place for this technology to be used thoughtfully.

What is more, several concepts related to the use of AI in the design (thinking) process were laid out: framing, a new way of analysing and seeing presented data, and co-performance, which shows a way for human and machine agents to work together, hand-in-hand, with AI having self-agency in regard to certain actions and tasks. Subsequently, State-Of-The-Art applications of AI within the design process were presented, including already-existing tools, such as AI image and content generators. Moreover, the analysis indicated on which stage of the service design process this thesis will put focus.

Furthermore, additional investigation of the research area was done in a form of a survey and interviews with design practitioners and professionals. Interviewees grounded and emphasised the importance of ensuring that this technology is used ethically, with accountability and transparency at the forefront. They also provided examples of its application within the design process, deliberated the state of human and AI creativity, and many more. These talks provided many new ways of looking at the subject. On the other hand, the qualitative survey mostly confirmed what was learned previously from the desk research, such as uses for AI within the design processes and prospective challenges using AI.

Synthesising from the aforementioned research, the final problem statement has been formulated as:

How can we create ethically-conscious service design processes that include AI and human designers, working cooperatively?

Chapter 5

Solution: AI-augmented Design Process model

5.1 Introduction

Based on the final problem statement, this Chapter will present the tangible output for this thesis - a toolkit[1] for human-AI cooperation for better, augmented design processes. This framework comes from the synthesis of the desk and qualitative research. Insights gathered through conducting said research have provided the author with new perspectives on how different AI tools can be applied in the design process with the goal of enhancing it. These insights will then be transformed into actionable use cases - examples of tools and situations which designers can do to utilise AI in their work in the best possible way. Each use case will contain instructions on how to perform this certain cooperation, potential tools to use for said task, as well as things to be mindful of when it comes to the ethical, considerate, and mindful use of this technology.

Furthermore, as this thesis is part of a study where design and design processes play the central role, a process model ought to be selected onto which the framework can be plotted. This plays a crucial role in developing a solution (a framework in this thesis' case), as plotting different use cases on a design process model will indicate where different AI applications can be best utilised and where there is the most potential for argument for the said design process. It is moreover acknowledged that various approaches exist in the real world, such as the iterative approach to designing and building solutions, which is not included in the model presented further in Section 5.7. What is more, different ways of working on a given project cases, such as Design Sprints and Agile Sprints, are available. However, the Double Diamond model was chosen as the most comprehensive process model that exhibits all stages of the design process typically undertaken by project teams. This includes phases such as the initial, exploratory research of the topic/problem area, the selection of a single (final) solution, the creation of a service offering/product, and finally, testing and iterating on it. This model will be later referred to also as *General Design Process*. Throughout these previously mentioned phases, AI has the potential to serve as a co-partner to human designers in various tasks and this will be shown in the developed framework.

[1]The adopted definition of the word "toolkit" for this thesis is "a fixed set of procedures, guidelines, criteria, etc, established to ensure a desired or required result or prevent oversights" (Collins, 2023).

5.2 Analysis of the research question

The final problem statement, **"How can we create ethically-conscious service design processes that include AI and human designers, working cooperatively?"**, includes several interconnected themes which ought to be explained to better understand the focus of the solution framework.

Firstly, the research question puts focus on the ethical part of technology use. However, the ethical angle will only be used as an underlying theme and not the main focal point. AI is a novel and constantly developing technology, and therefore ethical considerations cannot be omitted when working with it. Overall, the inclusion of the topic of ethics in the thesis is to *invoke reflection* about it. The research presented in Chapters 2 and 3 clearly states its importance.

Moreover, the following solution is created for design processes only. This implies that, as explained in Section 2.11, the solution will only refer to the service creation stage and not service interaction or service delivery. Furthermore, for simplification of plotting the solution (use cases) onto a design process, a General Design Process model (as explained in Section 5.1 will be used - in this case, it will be the Double Diamond.

Finally, the problem statement puts emphasis on the cooperation relationship between humans and AI agents. The exact nature of said cooperation will be explained in the following subsection.

5.2.1 Definition of cooperation of AI and human agents

Deriving from the academic literature review and interview findings through parring and translation of insights, one standard definition of the nature of human-AI cooperation will be established. This needs to be done to give the reader an understanding of what is meant by such cooperation and how these relationships will shape the novel (service) design processes.

As previously mentioned in Subsection 3.7.4, various design practitioners might have different definitions of AI as their partner so different from the general understanding of this technology. The nature of the human-machine relationships has been a prominent theme in this thesis so far, encompassing different types of said technology in academic literature as well as various opinions on it by design practitioners. Up until now, it has been mostly understood as either a mere tool (such as ChatGPT or similar, only used at a certain point of the design process and later left abandoned) or a fully-fledged partner, capable of expressing emotions and/or feelings.
However, having learned the different perspectives on AI-human partnerships, for this project, the nature of the said relationship is that **AI should take the role as a *digital assistant* of designers**, at least for the time being. This is due to the current status quo and the level of technological advancement. AI tools will be used at certain points of the design process and these practices will become more and more prevalent. Nevertheless, it is an **essential tool** in the designer's toolbox. Fundamentally, AI in this case will be used to start a certain task and then said task will be handed off to the human designers. This is due to the more relevant issues which AI

still comes with - being prone to mistakes, inaccuracies, possible biases and such. AI cannot be left to work on its own; it has to be supervised by its human counterpart.

5.3 Service design capabilities - what can be shared with AI?

Section 2.4 presented various capabilities which designers ought to carry at different levels of abstraction. Additionally, Sections 2.5 and 2.5.1 showcased frameworks of different machine intelligence levels in relation to human ones. Now, a synthesis of the two should be done to investigate where AI can help human designers and where it is better to allow humans to operate on their own.

Two categories of distinct design roles and their capabilities have been prepared below. The first one includes capabilities which, at the current point in time, can be shared between humans and AI. The second list contains core design capabilities in service design that are exclusive to humans.

Design capabilities that can be shared between human and AI agents

- "Vision building" - AI is able to imagine possible future iterations from already existing data. This is one of the primary features of tools such as ChatGPT or MidJourney, hence AI can be largely helpful in this context.
- "Modelling" - furthermore, AI is capable of visualising and creating predictions based on not fully completed data sets. This can also refer to AI's creativity, as discussed with the interviewees.
- "Addressing the context" - given a set of data, intelligent machines are well aware of the context in which they operate; therefore, they could help ensure the project follows the given brief or context.
- "Building logical architecture" - if AI advanced far enough, this task could possibly be given to AI with human supervision.

Design capabilities exclusive to human designers

- "Working across different levels of abstraction" - this capability requires higher level content understanding; hence this is better left to humans.
- "Engaging stakeholders" - co-creating value and actively including other parties in the design process is, at this time, better handled by human designers, as AI is not yet fully capable of emotions and feelings intelligence.
- "Open problem solving" - this capability requires analysing the problem area, actively working on the solution, and delivering the findings. This point can also be understood as coming up with the final solution for a given project. Based on the learnings from academic literature and statements made by the interviewees, this task should be exclusively given t human designers.
- "Controlling experiential aspects" - as this capability is linked to the co-creative aspect of developing a solution, humans would better handle it.

All in all, this division of designers' capabilities makes a clear indication of where in the design process AI should and could be employed. AI is fully capable of creating, yet that creation must be supervised by humans. With specific tasks, AI can help expedite the time it would take to complete them. More about this will be explained in Section 5.7.

5.4 AI tools categorisation

One of the parts of the developed solution will include a presentation of the current State-of-the-Art AI tools and platforms which can be used by design practitioners for selected tasks.

Based on the author's investigation of the tools available, two main categories can be distinguished:

1. *Text-to-text* - AI is given a prompt in the form of text written by a human and similarly outputs its answer in plain text. Examples of such tools include:
    - ChatGPT - for instance, AI here can be given a task to write a code that performs a certain action.
    - Microsoft365 Copilot - tool, a part of the Microsoft365 package can write meeting summaries and action points (MS Teams) and create a new text based on a given prompt (MS Word)
    - Other tools include Notably, Synthetic Users, Seenapse, AskViable, Kraftful, UserDoc AI, and GitHub Copilot.
2. *Text-to image* - as with the previous category, AI is given a prompt by a human in the form of text, while outputting information as an image. Examples include:
    - DALL-E and Uizard - tools previously presented in Section 2.9.2, which can be used to supply designers with initial drafts of their ideas.
    - Microsoft365 Copilot - what is more, Copilot can be used to visualise data in MS Excel or create presentations based on text documents in MS PowerPoint.
    - Other tools include MidJourney, Adobe Firefly, Tableau, MS PowerBi, UserDoc AI, and Colormind.

The two categories of tools are applicable at different stages of the design process. For instance, more text-to-text tools will be useful at the beginning of a project. This is due to the nature of the early, explorative part of any process, where AI can present documents to read, help brainstorm ideas, and similar. This is not a hard rule for all project processes; however, it applies to research-focused ones while also largely depending on the project brief. On the other hand, text-to-image-based tools can be utilised better once the project team finished the research phase and is oriented towards creating one solution for the given project brief or problem, as AI can help with generating various design ideas, persons, models, and such.

5.5 Target group

Based on the insights gathered and interviewed designers, a clear target group can be identified. At its core, the developed toolkit is intended for anyone who wants

to utilise AI within their *general design work*, as long as said work is oriented toward human-centred design processes. Despite this, it is possible to identify certain user archetypes among groups of people who could derive advantages from using this framework.

Firstly, this framework can be used by both design practitioners as well as advanced design professionals (seniors, etc.). As can be seen in the qualitative research and paper by Dove et al., 2017, the areas of utilising AI and ML have been underexplored regardless of the designer's level of proficiency. Therefore, the AI-augmented Design Process model, along with the use cases can provide them with new perspectives on how to use AI in situations where they would previously not consider doing so. What is more, superusers and senior designers might often use AI to simply expedite certain repeatable tasks. This can help shift focus on other areas of their work, which are more human-centred.

Furthermore, this framework can be used by beginner designers, such as students completing their academic projects. When beginning their journey with service design and design projects, one might lack the right tools and methods to do exactly what is desired. Tools and apps presented in the following use cases will hopefully help efficiently initiate the process.

5.6 Framework use instructions

Before the developed solution can be presented, a list of instructions will be given to the reader in order to clarify the way this framework is meant to be used.

Use disclaimer: The AI-augmented Design Process Model is meant as a suggestion to designers who want to integrate AI into their work. Therefore, the toolkit should not be used as a proven set of guidelines, as it has not been properly evaluated and tested in practice. Moreover, to use the toolkit to its full capability, one should have an understating of various research approaches, and have experience with AI tools in the past - even if to a lesser extent.

5.6.1 Set of instructions

1. **Assess the personal level of knowledge about AI** - answer questions such as "what tools have I used in the past?" "have you (and if yes, then how have you) applied them to your design work?". Through qualitative research, it was discovered that designers of various levels of proficiency have different levels of expertise in working with and understanding AI. Hence it is important to align on this issue at the beginning of the process - particularly when more than one person is working on the project.
   This self-reflection step is necessary to assess if one is fully capable of utilising the full potential of the toolkit. If unsure whether one can get the most out of it, it is recommended to familiarise yourself with the concepts presented in the toolkit and research the tools included in it. As stated in the previous section, these actions can ensure that the toolkit is used to its full capacity (and also critically).

2. **Define human-AI design capabilities and look for benefits** - consider how AI can help augment you personally - in which aspects will it be best suited?

Where is it better to do the work without the interference of said technology? What benefits can be observed in such cases? This step is crucial in ensuring the designer knows what exactly AI tools will be used for and what benefits it will present.

3. **Understand the potential risks** - consider issues which may arise when using certain tools. Different tools can provide for unexpected biases - how does that affect your work and the people you are working with? How is the data you share with AI systems stored? Does the data include personal and/or sensitive information? If so, is it used by the company behind the tool for commercial reasons? This step is performed to make a preliminary investigation of the potential issues before they might occur and skew the final results.

4. **Choose the use case** - based on personal needs, and tasks, as well as the point in the project process you are in at the moment.

    - **Choose specific tool(s)** - from the vast array of tools listed in the framework, select one(s) that is best fitted for you. Several factors can impact your decision, such as whether the app is paid or free, whether it is used for commercial purposes, has language restrictions, and what is its data processing policies.

5. **Criticality evaluate the cooperation you have just completed** - did you achieve the desired goal? What did and what did not go as planned? Would you use apply this use-case to my work again? If you involved third parties in the process, remember to also include them in the evaluation process. Third parties might include company clients and the targeted demographic.

With the instructions presented, the following section will showcase the framework itself.

5.7 AI-augmented Design Process model

As this project is based on the meta-synthesis approach, step 5 from Chrastina, 2018, the translation of insights from the research done so far will be done in this and the following sections. Firstly, a design process model with possible AI applications will be presented.

5.7.1 Reasoning behind developing the framework

Based on the previously conducted research and insights drawn from it, this thesis could result in various outputs. Other artefacts developed for this project could include a toolkit for designers with methods to use, a more *hands on* approach like a series of workshops. The reasoning behind developing the AI-augmented Design Process model was twofold: firstly, the author's interest in theoretical research and developing tools with more of that angle. Following on the paper written in the second semester for the "Technological and Organizational Trends in Service Design" course the author wanted to explore the topic of AI further in terms of this technology helping designers do their work. Secondly, creating a general framework with guidelines (use cases) for designers seemed like an idea which could cater to the largest amount of design practitioners and professionals.

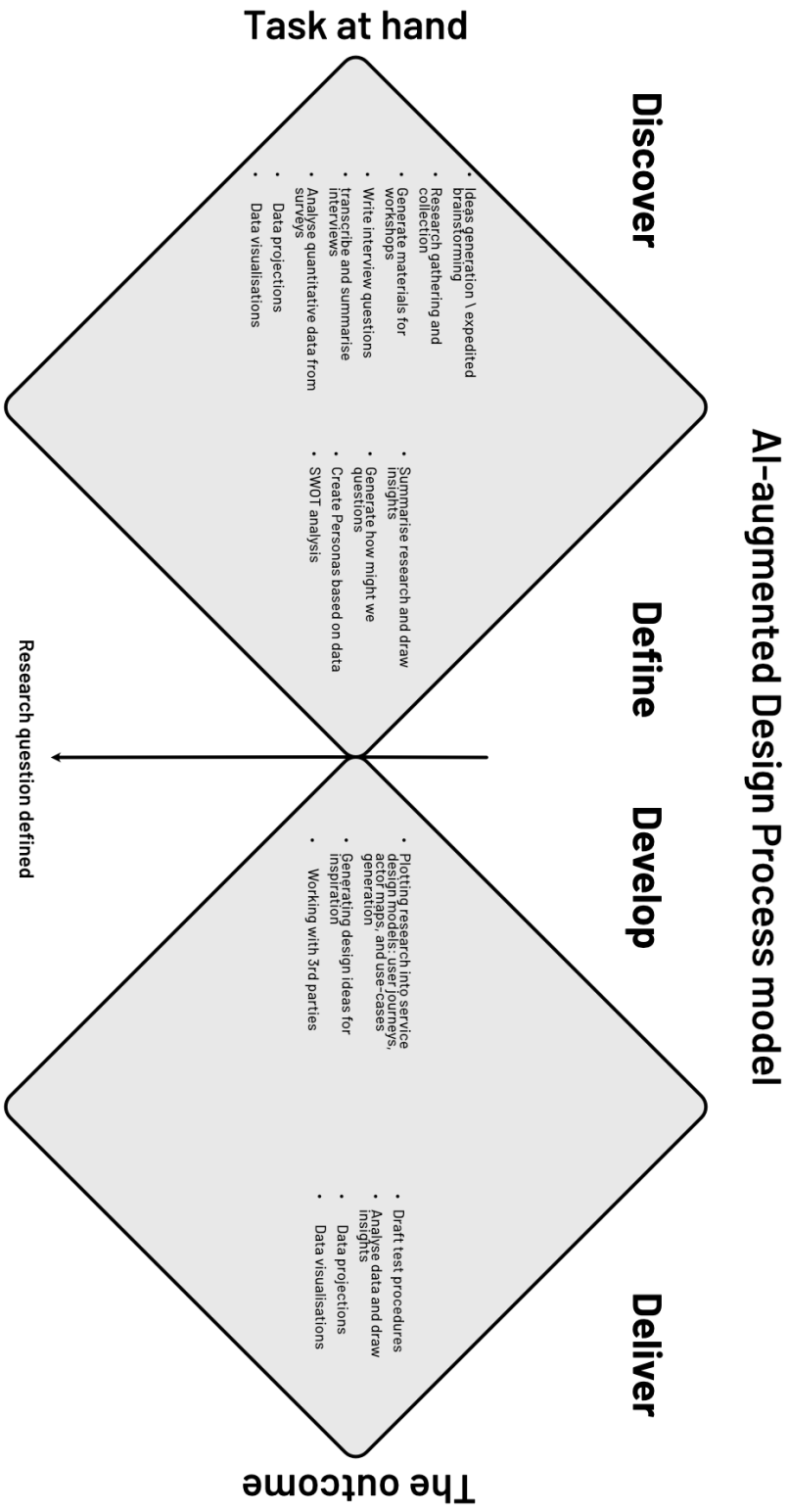

FIGURE 5.1: AI-augmented Design Process model with various AI applications interwoven into it.

5.8 Use cases for AI applications

This part of the solution will follow a model presented in Section 5.7 and is set to explore AI applications in more depth, through a series of use cases.

5.8.1 Discover phase

Use-case name: Initial research presentation and collection

- Description: The use of AI in research gathering and collection can supply designers with valuable insights into user behaviour and needs. AI-powered research tools, such as Notably and Synthetic Users, can analyze data quickly and accurately, making it easier for designers to create user-centric designs. Moreover, AI can be given a prompt to suggest to a user, for instance, relevant research papers and other resources to read as a starting point for a project.
- Tools commercially available: Notably[2], Synthetic Users[3].
- Human-AI cooperation: AI is used to gather the bulk of research; it is however important to remember that information provided by AI can be incorrect or made up. Therefore it is the task of the human designers to check and select relevant findings to work on further.
- Potential benefits: Time-saving benefit and the possibility of gaining deeper and more varied insights, as AI might provide research areas that would otherwise not be tackled.
- Ethical considerations: Here, the limitations of AI must be considered, such as the requirement for complete and unbiased data. The use of AI should be complemented by human analysts for the best results. Moreover, the use of AI in this context may unfortunately amplify biases in the data, particularly around race, gender, or other sensitive topics. Designers and organizations should carefully monitor and address these where necessary. Moreover, users should be mindful of using the tool "Synthetic Users" as it cannot fully replace human-based evaluation and testing.

Use-case name: Early brainstorming and ideas generation

- Description: The design process often begins with the ideation phase in order to find the exact focus for the project. One example of it can be a student project such as this one, where the research problem must be found. A different approach would be a real-world case, where ideas have to be generated in order to provide an initial set of design propositions for a given project.
- Tools commercially available: ChatGPT[4], MidJourney[5], DALL-E[6], Adobe Firefly[7], Seenapse.ai[8].

[2] https://www.notably.ai
[3] https://www.syntheticusers.com
[4] https://openai.com/blog/chatgpt
[5] https://www.midjourney.com/home/?callbackUrl=%2Fapp%2F
[6] https://openai.com/product/dall-e-2
[7] https://www.adobe.com/sensei/generative-ai/firefly.html
[8] https://seenapse.ai

- Human-AI cooperation: AI is meant here to generate an initial set of ideas, which humans later discuss and research in more depth. Moreover, AI being capable of addressing the context here can create solution drafts based on the case and situation at hand.
- Applied service design capabilities: In the use case, AI can help with vision building and modelling. Although early in the overall (design) process, various ideas can be worked on here.
- Potential benefits: Applying AI at this stage of the design process proves for ideas *framing* (seeing certain ideas in a new light).
- Ethical considerations: Here, one must be aware of the data on which AI bases its ideas. With different data sets, completely different outputs might be presented to the researchers.

Use-case name: Generating materials for workshops

- Description: The application of AI in design can open up new possibilities for designers and researchers to create more engaging and effective workshop materials. With AI algorithms, designers can quickly generate exercises, questions, and tasks tailored to specific user needs and objectives. Additionally, AI-generated materials can provide a fresh perspective and spark creativity (the previously presented *framing* concept), leading to more innovative and effective design solutions. All in all, the use of AI in creating workshop materials can enhance the user experience and lead to more successful outcomes for both designers and users alike.
- Tools commercially available: ChatGPT, MidJourney, DALL-E, Adobe Firefly.
- Human-AI cooperation: Based on the initial input from humans, AI will provide examples of tools to engage third parties in the research process. Once the project teams select a specific tool(s) to proceed with, AI can present variations of a selected tool and/or explore it in more depth.
- Potential benefits: More resources are created quicker, saving time and allowing these resources to be allocated for perfecting the research procedures by humans or producing more of them.
- Ethical considerations: Using AI to generate workshop materials can cater for issues related to ownership, transparency, and accountability. For instance, there might be concerns around the ownership of the generated materials and who has the right to use them (issue mentioned in the interviews in Chapter 3. What is more, it might at times be difficult to follow up on the AI's decision-making process, making it burdensome to understand how the materials were generated, leading to questions about accountability and responsibility for their outcomes.

Use-case name: Write interview questions

- Description: Following on the previous point, AI can also write questions for and create interview structures. For instance, it can generate questions based on the topic of the study. If the initial, exploratory research has already been

conducted, AI tools can synthesise said research into talking points or whole interview scenarios.

- Tools commercially available: ChatGPT, Microsoft365 Copilot[9].
- Human-AI cooperation: Here, the generated questions can only be used as an exit point for humans to expand on them and tailor them for specific interviews.
- Applied service design capabilities: Here, AI can use its capability of addressing the context to better produce the questions, grounding them within the given project context.
- Potential benefits: *Framing* concept utilisation. Based on the prompt given to the AI, it can generate ideas that would otherwise not be created (or thought of) by human researchers. Previously unexplored topics can be brought up during the conversations.
- Ethical considerations: As this use case is derived from the previous one, the same applies here (such as bias amplification).

Use-case name: Transcribing and summarising interviews; general qualitative data analysis

- Description: Following up on the previous use case, once the interviews or other forms of exploratory research activities are completed, it is time to draw conclusions and insights from it to progress the project process. To do so, various AI tools can be used to create live transcripts of video meetings, and interviews, and summarise these. Examples include Microsoft365 Copilot and Otter.ai[10]. Moreover, additional features, useful for the design process can be found, such as
- Tools commercially available: Microsoft365 Copilot, Otter.ai, Temi, Google Recorder[11] (Android app), Ask Viable[12], Kraftful[13].
- Human-AI cooperation: AI should be used to create insights from said interviews and transcribe them. However, these results should be double-checked by human designers.
- Potential benefits: Time-saving benefit on otherwise mundane and repetitive tasks and shift focus to insights framing.
- Ethical considerations: Using AI for the analysis of qualitative data, can raise questions about the ethical issues related to privacy, the accuracy of the analysis, and bias. For instance, there may be concerns about the collection and use of personal data, particularly sensitive data (if that is a part of the research). Additionally, AI-powered transcription services may not always accurately

[9] https://news.microsoft.com/2023/03/16/introducing-microsoft-365-copilot-your-copilot-for-work/g

[10] Source: https://www.youtube.com/watch?v=N1gpkk-MwpY, https://www.youtube.com/watch?v=rLC2frnUasw, https://otter.ai/individuals

[11] https://ai.googleblog.com/2019/12/the-on-device-machine-learning-behind.html

[12] https://www.askviable.com

[13] https://www.kraftful.com

capture nuances of language, dialects, or emotions (which are crucial to understanding when working with humans, for instance through ethnography research), potentially leading to misinterpretations or misunderstandings of the data. Finally, the use of AI algorithms to analyze qualitative data can perpetuate and amplify biases in the data, particularly around race, gender, or other sensitive topics[14]. It is vital for researchers to consider these ethical issues and take steps to mitigate potential harm to participants and ensure the responsible use of AI in qualitative research.

Use-case name: Analyse quantitative data from surveys - data projections and visualisations

- Description: As presented in Subsection 2.9.2, AI can be moreover a powerful tool for analyzing quantitative data in the context of service design and research. With the use of powerful AI algorithms, designers can quickly identify patterns and trends in user data and preferences, allowing them to make data-driven design decisions[15]. For example, AI can be used to analyze user feedback and ratings to identify common pain points and areas for improvement in service. Hence, AI can be applied in this context in the Deliver part of the design process. Additionally, AI-powered analytics can track user behaviour across different touchpoints, such as websites and live services, to identify patterns in user engagement and inform design decisions.
- Tools commercially available: Tableau[16], Microsoft365 Copilot in Excel, Microsoft Power BI[17], SheetAI (ChatGPT tool inside Google Sheets).
- Human-AI cooperation: At this stage, AI is well self-sufficient to work on its own and deliver adequate results.
- Potential benefits: More possibilities for making conclusions from the data and focus on the end-process activities.
- Ethical considerations: Utilizing AI for quantitative data analysis can raise ethical issues concerning bias, transparency, and privacy. For instance, gathering and exploiting personal data may give rise to apprehension, and AI algorithms could magnify data biases. Moreover, some AI algorithms operate uncleanly, leading to doubts about who should be accountable for the outcomes. To ensure trust and guarantee ethical and responsible AI use, designers and organizations should look into these ethical concerns and take preemptive actions to address them.

Use-case name: SWOT analysis

- Description: AI-enabled SWOT (abb. for Strengths, Weaknesses, Opportunities, and Threats (GURL, 2017)) analysis can be a valuable tool for project teams to assess the viability and potential for success of projects they are involved with. With AI's capabilities to analyze large amounts of data, it can provide

[14]Certain research shows that AI can be more biased as human workers when making decisions: `https://time.com/5520558/artificial-intelligence-racial-gender-bias/`.

[15]An example can be Microsoft365 Copilot integrated into MS Teams: `https://www.youtube.com/watch?v=I-waFp6rLc0`.

[16]`https://www.tableau.com/solutions/ai-analytics`

[17]`https://learn.microsoft.com/en-us/power-bi/transform-model/desktop-ai-insights`

a more accurate and objective evaluation of a project's SWOT factors. This approach can help project teams identify potential obstacles, understand their strengths, and profit from opportunities that can improve project outcomes.

- Tools commercially available: ChatGPT.
- Human-AI cooperation: AI makes the initial assessment which is then followed by humans.
- Potential benefits: All in all, using AI for SWOT analysis can lead to more informed decision-making and help project teams develop effective strategies to mitigate risks and enhance project performance in the future.
- Ethical considerations: As with other uses of AI, here one must be careful not to amplify patterns in the data which might be, unwillingly, transformed into biases. Moreover, the accuracy of the results must be investigated before further steps, based on the SWOT analysis, are done.

5.8.2 Define phase

Use-case name: Summarise research and draw insights

- Description: AI can be used for summarizing research and drawing insights from data. With AI, designers can quickly identify key themes and patterns in large volumes of data, allowing them to make data-driven decisions. For example, AI-powered analytics can help identify common pain points and areas for improvement in a service or product. Additionally, AI can analyze user feedback and ratings to identify user preferences and make more informed design decisions.
- Tools commercially available: ChatGPT, Microsoft365 Copilot.
- Human-AI cooperation: Here, AI is meant to suggest making informed decisions to human research teams. The final decision is always in the hands of human researchers.
- Potential benefits: The use of AI in summarizing research can save time and effort for designers and researchers, while also providing valuable insights for creating better user experiences.
- Ethical considerations: The use of AI at this stage of the work/project process can provide ethical concerns related to accuracy, transparency, and again, biases.

Use-case name: Generate "How Might We...?" questions

- Description: Within the design process, "How Might We...?" questions are a powerful tool for generating new ideas and potential solutions later in the Develop phase. AI can be used to generate these questions by analyzing data from user data, research, and other sources. With AI algorithms, designers can quickly generate a range of these questions based on specific user needs. Overall, the use of AI in generating "How Might We...?" questions can enhance the ideation process and lead to more successful outcomes for both designers and users.

- Human-AI cooperation: Generating questions by AI is simply the first step for further investigation. These questions act as suggestions and should be tailored to the specific project needs by the human team members.
- Tools commercially available: ChatGPT.
- Applied service design capabilities: Addressing the context.
- Potential benefits: This AI application can save time and effort for designers, allowing them to focus on other aspects of the design process. Additionally, AI-generated questions can provide a fresh perspective and spark creativity, resulting in more innovative and effective design solutions.
- Ethical considerations: As with the previous AI applications, here the concerns might be the issues of biases and transparency (informed decision-making).

Use-case name: Creating personas

- Description: One of the most vital parts of working on a project is defining its target group - people (or other entities) who will be using the end product or service (or will be affected by it). AI can be a powerful designer's partner for creating personas within the (UX and) service design process. By analyzing sets of user data, AI algorithms can identify patterns and trends that can help designers better understand their target audience. AI-powered persona creation can be more efficient than traditional manual methods, which can be time-consuming and resource-intensive. Using AI for creating personas can moreover ensure that the resulting personas are more data-driven. Furthermore, instead of relying on assumptions or intuition, AI algorithms can identify insights and characteristics that may have been missed by humans. This can lead to more accurate and effective personas, which can help designers create products and services that better meet the needs of their users.
- Tools commercially available: ChatGPT, Userdoc AI[18]
- Human-AI cooperation: Using AI to create personas is just the first step. After AI is done compiling its initial output, human designers must hand off the work. Moreover, AI can suggest different approaches to creating novel personas models, depending on the project's needs and goals.
- Applied service design capabilities: Building logical architecture.
- Potential benefits: Time-saving benefits, and insights are created based on data.
- Ethical considerations: Here, the core issue is AI being prone to biases. Creating personas can multiply biases already present in the data. Human researchers and designers must be very careful to double-check the created personas and make sure these are in line with the research conducted.

[18] `https://userdoc.fyi/#watch`

5.8.3 Develop phase

Use-case name: Plotting research into service design models: user journeys, actor maps, use-cases, etc.

- Description: AI-powered tools show great potential to expedite the way (service) design models are created. With its ability to process large amounts of data in an efficient manner, this technology can be used to plot research into service design models, such as user journeys, actor maps, matrixes, and generate use cases. Moreover, it is possible for AI by analyzing user behaviour and interactions, AI algorithms can identify patterns and insights that human researchers might miss, leading to more accurate, insightful, and explanatory models. This can result in better-designed services which meet the needs of customers more effectively.
- Tools commercially available: ChatGPT, Userdoc AI.
- Human-AI cooperation: As said models will be created from data already analysed and provided by human designers, it is important for humans to check if the outcomes from AI are correct.
- Potential benefits: Time-saving benefit, as the already collected data, will be simply plotted into design models.
- Ethical considerations: Here, AI can be prone to making mistakes - drawing incorrect conclusions from said research and amplifying biases.

Use-case name: Generating early design ideas

- Description: As previously mentioned in the interviews and survey, AI shows great potential with its generative capabilities. Within the Develop phase, research teams often start with many different design and concept ideas. This can be done in the form of brainstorming, and also to present different versions of the design to clients and stakeholders. Here, AI can cater for the initial need of having many different design variations, in order to choose how to proceed further.
- Tools commercially available: Uizard[19], MidJourney, DALL-E, Colormind[20], Github co-pilot[21] (for working prototypes).
- Human-AI cooperation: AI can be used here as the generative partner of the designer, providing many different ideas as an exit point for the design teams to take the work further.
- Applied service design capabilities: Here, modelling, addressing the context, and vision building can be invoked.
- Potential benefits: Insights *framing* can be performed here. What is more, AI can be used to elaborate on and improve one solution/design, helping designers elevate their work.

[19] `https://uizard.io/design-assistant/`
[20] `http://colormind.io/blog/`
[21] `https://github.com/features/copilot`

- Examples of use case-specific AI use in academic literature: paper by Oh et al., 2019 shows an example of using deep learning algorithms to generate design variants in mechanical design, the focus here is on both aesthetics and performance, which to a certain degree can be related to the sphere of (service) design processes.
- Ethical considerations: One must mention here the possibility of biases and lack of transparency. The outputs (ideas) generated by the AI can look substantially different based on the algorithm used. Since many tools do not provide an explanation for how they work, designers might not be able to understand why they were provided with them. One must also be careful not to be too influenced by the presented results, but to critically analyse them (as is the case with anything generated by AI).

5.8.4 Deliver phase

Use-case name: Drafting test procedures

- Description: Within the final stage of the project, Deliver, the project team must test and evaluate the designed solution. This is done to assess the success of the developed project/service. Moreover, evaluating the aforementioned with users can provide great iteration opportunities. Hence, AI can help project teams come up with ideas for and design test procedures. This is a similar case to the one from the Discover phase, where research teams need to create interviews and workshop structures to explore the problem area. As the other sections of this use case are similar to the aforementioned, they will not be elaborated on here.

Use-case name: Analyse testing data and draw conclusions

- Description: Once the tests are completed, qualitative and/or quantitative data is produced. This is similar to the Discover phase where the initial research is carried out. As the role of the AI within this use case, the cooperation level with human designers, and the ethical considerations are the exact same as the one within the Discover phase, this use case will not be elaborated on further here.

5.9 Solution conclusion

In this chapter, step 6 of the meta-synthesis approach has been completed. The solution, emerging from the desk, as well as exploratory research, has been designed and described in depth. The outcome of this thesis is an enhanced Double Diamond model, named the AI-augmented Design Process model. This model has shown where, within the general design process, designers and researchers can apply AI tools to enhance, expedite, and simplify their work. Some use cases for AI were using it for idea-generating purposes, SWOT analysis, transcribing interview recordings, and analysing and visualising data. As shown earlier, possibilities for AI applications exist throughout the whole design process. However, the vastest array of applications finds a place in the early process stages. When moving further in the process, the role of humans becomes more and more prominent. Furthermore, and as it has been sown with most of the tasks, the role of AI is to conduct the initial

investigation on the topic; afterwards, the work is handed off to human researchers and designers for them to complete it.

Having presented the solution, the following chapter will include the testing of the model and the ideas included within. This will be done with input from design practitioners and experts, followed by a discussion of the results.

Chapter 6

Evaluation

6.1 Introduction

As the solution - the toolkit aimed at design practitioners - has been presented, it is necessary to evaluate its real-life application and usefulness with the intended target group. This section will showcase just that - learnings and insights from qualitative interviews which will include a practical exercise to gain different types of insights to find potential for its optimisation. Additionally, the chosen evaluation method will be presented and argued for. Next, detailed observations and feedback from the interviewees will be presented, followed by conclusions made based on these.

6.2 Chosen evaluation method

The main goal of this evaluation is to engage participants in critical thinking about the created model and provide opportunities to improve and develop it further. To do so, test participants were asked beforehand to familiarize themselves with the AI-augmented Design Process model and its use cases. Once they have completed that stage, evaluation participants were asked a series of questions.

The questions contained in the interview were based on *The Six Thinking Hats* method by Edward de Bono Bono, 2016. This method of thinking was chosen to engage participants in expressing opinions from various angles and in a structured way.

The Six Thinking Hats method is used to encourage creative thinking that approaches the given problem from various perspectives. Said method involves six different *Hats* namely:

1. **White** - make factual and informed statements about this given idea/project/prototype, the White Hat is used.
2. **Red** - this hat is used to express emotions and general feelings - what does one feel towards the given idea? Is the idea coherent?
3. **Black** - this hat is used for expressing criticism. Here, potential problems can be discovered to iterate and apply improvements.
4. **Yellow** - the opposite of the Black Hat, here the value created through the potential deployment of the idea/solution.
5. **Green** - also called the *Creative* Hat. Here, new potential ideas are discussed.
6. **Blue** - introduce and explain the concept, as well as summarise it.

Overall, the Six Thinking Hats method is considered a valuable tool when used for feedback sessions, and group discussions. This is due to the method allowing for a structured way of thinking, allowing for more effective and useful outcomes.

6.3 Conducted evaluation

In total, four testing sessions were conducted in weeks 19 and 20 over the Google Meet platform. Three out of four participants have been previously interviewed in the research exploration phase[1]. Hence they had an understanding of the research topic, as well as, the aim of this project.

Before the evaluation session, participants were given the framework in the form of a .pdf document to familiarise themselves with its content (more specifically Chapter 5). Moreover, they were asked to select one or two use cases and apply those to their (design) work for a couple of days to a week. After that, each participant was invited to the one-on-one feedback session where the following was discussed.

6.3.1 Evaluation procedure

The testing procedure consisted of three parts: (1) an introduction to the session and general questions about their time with the framework, (2) framework evaluation through the Thinking Hats method, and (3) closing statements. At the beginning of the session, participants were introduced to the goals of the testing (receiving feedback to have a general idea of its use of it, as well as researching the room for improvement) and asked general questions about the framework (such as their first-hand understanding of the idea). Moreover, at this point, each participant gave consent to the audio recording of the session. In the second stage, the framework was evaluated using the Red, Green, Black, and Yellow Thinking Hats. Participants were asked to fill out the Miro board with sticky notes for each Thinking Hat, which is shown in Figure 6.1. For each Hat, they were given as much time as they needed - there was no time limit for the session. Afterwards, they were asked to elaborate on the comments they gave in order to gain deeper insights.

Lastly, participants were asked whether there is anything they want to add to their statements. Next, they were thanked for their time and the interview session was concluded.

All audio recordings from the evaluation sessions can be found in Appendix C. Moreover, the Miro board with feedback from test participants can be accessed here `https://miro.com/app/board/uXjVML5ugbM=/?share_link_id=782786550558`.

6.3.2 Feedback on the toolkit

The feedback on the framework will be presented in the following format: first, interviewees' general impressions will be presented, along with the selected use cases. Next, detailed feedback will be shown, divided by each Hat used in the Miro board.

General impressions and tools used

The consensus on the toolkit was that it is **useful and brings value which can enrich designers' work**. Test participants understood its overall concept, even though

[1]Participants were acquired using non-probability convenience sampling method (Bjørner, 2015)

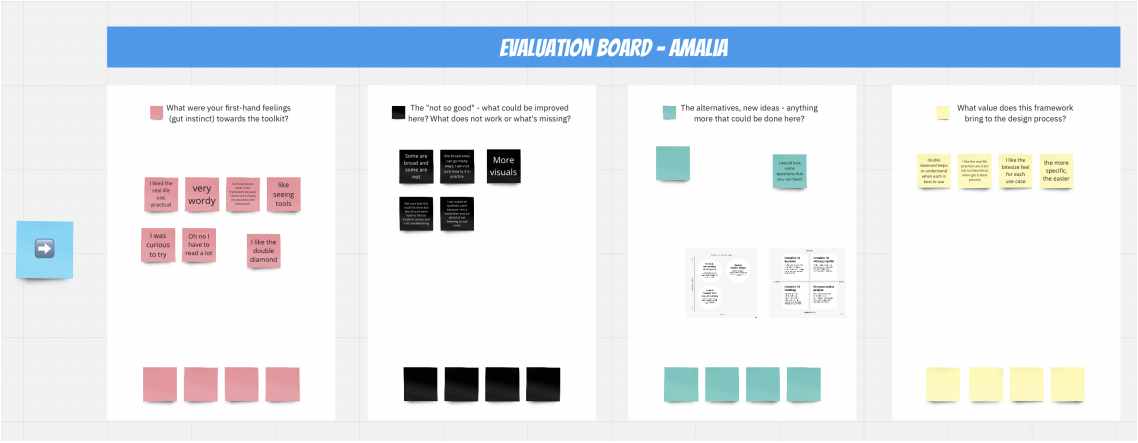

FIGURE 6.1: Miro board used for framework testing using the Six Thinking Hats method with example feedback from the interviewee. Image by the author.

some initial confusion occurred in a few cases. This was due to the fact that - in the document - there was no clear indication between the introduction to the framework and the framework itself.

Interviewees have used various use cases. Among others, they selected *compiling interview questions, synthesising research into insights, SWAT analysis, and prototyping*. Participants used selected use cases for both professional and academic work. Here, examples include prototyping for their university semester project, analysing quantitative data from spreadsheets, or drawing insights from conducted interviews. As can be seen, interviewers (except for one person) have used the toolkit for a wide range of tasks. Additionally, some of them stated that they have used some of the tools shown in the toolkit for various tasks even before familiarising themselves with the toolkit.

The Red Hat

This part of the evaluation concerned first impressions of the given toolkit and participants' gut feelings. The consensus among them was that **it presented plenty of novel and useful information** in a structured way. Interviewees learned about new ways of using AI and tools which can be used for that.

On the other hand, there were some general problems with the provided material. First and foremost, the toolkit in its current form **was text-heavy** (this will be elaborated on in Section 6.3.2. Additionally, participants could not easily understand where the instruction to it ends and where the toolkit itself starts. This was due to the fact that interviewees were sent Chapter 6 of this thesis as the toolkit and were told to familiarise themselves with it. Sending simply the toolkit could be a solution to this problem. Moreover, one participant stated that the toolkit, as well as similar developments within the sphere of thinking AI can create a *paradigm shift*. With said statement the person meant that the responsibilities and capabilities of human designers will change, as in the future AI agents will be able to perform more tasks currently reserved for humans. The interviewee compared it to when the industrial

revolution happened and machines took over manual production tasks and simplified human labour.

The Black Hat

One of the most clearly pointed-out issues with the current version of the AI-augmented Design Process model was the **lack of visual design and high reliance on written text**. One person pointed out that - if this toolkit was to be used by service designers in practice, on actual projects, users could not have enough endurance to read through the whole document and use its insights afterwards.
Furthermore, one of the interviewees stated that there was a discrepancy in the level of detail in which different use cases were presented. For instance, the use case "Generate "How Might We...?" questions" presents a very specific application of AI while the use case "Ideas generation and initial brainstorming" is quite broad and only gives a general idea of how AI can be utilised in this situation, without giving too specific instructions on how to apply it in practice. A suggested solution to this problem would be **to add more details to some of the cases**, such as example questions to ask AI (suggested by one of the interviewees).
What is more, one of the participants expressed concerns with the Synthetic Users software. Based on that, there is a need for a better evaluation procedure of the tools which are included in the toolkit. Furthermore, another user stated that a great addition to the already extensive use cases would be risk assessments (besides the ethical angle) of the problems and issues AI can provide for, for instance, long terms or different systematic changes (for instance laws) which will be needed in the future.
Last but not least, another issue with the toolkit was **the inaccessibility of certain tools presented**. For instance, one user wanted to use Microsoft365 Copilot for their personal work. However, at the time of writing this thesis, Copilot was available only in a preview version and not accessible to everybody. Moreover, some of the tools shown in the toolkit require a subscription fee, which might discourage certain users from trying them out. This thesis was written at the point in which AI tools and their universal availability were changing and evolving. Some tools because of available weeks or even days before sending the toolkit for evaluation. This is one of the aspects of the developed solution which is out of the author's control.

The Green Hat and Toolkit 2.0

As an alternative to the current toolkit and a solution to the problems presented in the previous section, users suggested **making a graphical, interactive version of it**. This suggestion was made by all test participants. Some of the suggested improvements included a set of instructions to the reader (this was added to the Chapter 5 after sending the document out for evaluation and before conducting it) and adding an interactive table of contents with hyperlinks. Overall the framework - if released as an actual tool and not a theoretical concept - would need **more content presentation organisation**. Users should be able to access specific use cases and examples without having to read through the whole toolkit. Moreover, one of the participants suggested including examples (both academic and real-world) of how AI was applied for specific use cases. This was done for some of the use cases, where said examples could be found.

The Yellow Hat

In this part, participants were asked to talk about the advantages and opportunities which this framework might bring to design processes. All in all, interviewees **had a good impression of the toolkit and the knowledge it provides**. One person stated that they liked the **"bite-size feel"** of the information presented. By that, they meant the organised and structured way of building each use case. Moreover, another user stated that one of the strengths of the framework was the various information categories each use case contained, as it presented **a solid overview of the topic**.
Moreover, **plotting the toolkit on the Double Diamond model was helpful for the interviewees in understanding the concept**. What is more, they acknowledged that the toolkit has the potential for practical application, outside of the academic environment.

Lastly, test participants stated that the toolkit **allowed them to learn about new tools and practices**. It is acknowledged that due to the dynamic nature and current state of AI, tools presented here might have evolved, changed, or are no longer available at the time of reading it. Furthermore, new tools might have become available with time - those should be evaluated in terms of the aforementioned issues and assigned to relevant use cases. When asked about the collaborative nature of AI-human cooperation, another interviewee stated that the future will be more collaborative as AI tools will grow and evolve. Currently, AI acts as an *assistant* to its human counterpart.

6.4 Evaluation conclusion - summarising insights

All in all, the toolkit proved to be useful to the (service) design community. It presents a solid overview of the topic of using AI to augment design work of various proficiency levels. In doing so, it gave examples of numerous tools which can be used in their everyday work.

The testing with users allowed the author to discover the opportunities the toolkit provides while also investigating the room for improvement to iterate on the developed solution in the future. The most prominent issues were the lack of visual design in the framework, the variability in the level of detail between various use cases, and ethical use issues with some of the AI tools recommend.

Finally, the content itself was of high value to the designers. Through accessing the toolkit, they were able to discover new ways of working with AI and tools which can help with said task. Additionally, one of the users praised the focus on ethics for each use case. Moreover, incorporating different tasks into a "bite size feel" use cases, while at the same time providing most of the needed information. All in all, the developed AI-augmented Design Process model appears to be a valuable tool in any designer's toolbox.

Based on the insights gained from research, as well as personal observations, the following section will present reflections collected throughout the project process.

Chapter 7

Reflections

7.1 Introduction

In this chapter, reflections on the overall research project process, the developed toolkit, and personal considerations are presented. Moreover, another purpose of this chapter is to provide a possibility for a critical examination of the work and as a result, for sharing insights and learnings from the process. The reflections presented in this chapter are based on experiences throughout the process, interviews and research, and analysis of the data collected. The challenges faced during the research process, the strengths and weaknesses of the AI-augmented Design Process model, and the impact of the project on the author's professional growth are reflected.

In the second section of this Chapter, the overall process of the research project, including the research question, academic methods used, and data analysis techniques applied, are reflected upon. The advantages and disadvantages of the approach taken are discussed, and areas for improvement in future research projects are identified.

In the end, personal reflections on the experience of conducting the research project will be laid out. The skills and knowledge gained, the challenges faced, and the lessons learned throughout the process will be discussed.

7.1.1 Reliability and validity factors

Throughout the next three sections, the factors of reliability and validity will be discussed in terms of the conducted research. The factor or reliability will indicate how accurate the results of the research are (Bjørner, 2015), or as Rogers, Sharp, and Preece, 2023 define it as that "Validity is concerned with whether the evaluation method measures what it is intended to measure. This encompasses both the method itself and the way it is implemented.". Additionally, reliability will showcase if the research can be replicated by other academics at a different time while under the same conditions (Bjørner, 2015). Rogers, Sharp, and Preece, 2023 describe this measurement factor as "...consistency of a method is how well it produces the same results on separate occasions under the same circumstances". These two factors will not have their own section; rather they will be included in the relevant reflections category.

7.2 Reflections on the toolkit and future works

Through user-centered evaluation the toolkit demonstrated its usefulness to the design community, providing a comprehensive overview of AI applications to enhance

design work across different skill levels and showcasing numerous practical examples of tools that can be integrated into designers' daily workflows. By conducting user testing, valuable insights were gained regarding the toolkit's potential and areas for future improvement, including issues such as the absence of visual design in the current version of the framework, varying levels of detail and focus in different use cases, and ethical issues with certain AI tools featured as examples. However, the toolkit's content itself proved valuable to designers, enabling them to explore novel approaches to incorporating AI and discovering supportive tools. Furthermore, the toolkit was praised for the variety of information categories it shows, such as the focus on the ethical angle of using AI. Overall, the AI-augmented Design Process model developed appears to be an invaluable addition to any designer's repertoire.

As room for improvement in the toolkit was discovered, there is a potential to develop it further. To do so, version 2.0 will be created and later presented in Section 9. This new iteration of the toolkit will focus on presenting information more interactively and visually, while only presenting the relevant piece of information needed at a given moment by users.

7.3 Reflections on the process

Looking back on the project process, it can be concluded that it was generally a success and that its outcome is satisfactory. First of all, all the agreed-upon deliverables have been completed on time. Moreover, due to the structured nature of the work, it was relatively straightforward to plan the next actions to undertake, such as interviews or evaluation procedures. What is more, from the author's perspective, the academic learning goals have been both kept in mind throughout the process and achieved, which helped to lead the process in the right direction. The meta-synthesis approach and design thinking process structure have been followed as well, helping with structuring the work over the span of a few months and planning the next steps to undertake.

The second aspect of working on this project, which ought to be mentioned in this Section, is the fact that I chose to work individually and not as a part of a group on the master's thesis. This has been a new experience for me, as throughout my bachelor's and master's education I have always worked on a project as a part of a bigger group. Having experienced this type of cooperative work, this time I wanted to see if I can take on the challenge of finishing a project myself. On one hand, I was welding all the decisive power in terms of the project's direction, and did not have to compromise; on the other hand, all responsibility was also mine, regardless if the project goes well or not. All in all, the project turned out well, and I'm generally satisfied with its outcome. Working on my own has been as great of an experience as working in a project team.
Nonetheless, I find it principal to remember the importance of group work, especially within Aalborg University's Problem-Based Learning approach[1]. While working in a group, several activities are possible that cannot be achieved when working on one's own: brainstorming sessions and exchanges of ideas. Additionally, with several work partners, one will not wander into the *wrong* direction while when working on one's own, the project can easily steer in the not desired direction.

[1] `https://www.en.aau.dk/about-aau/profile/pbl`

On the other hand, several other undertakings could have been done in the process for the project to be more *hands-on* and co-creative. For instance, various actors could have been involved in workshops and focus group sessions. This would allow for an approach more aligned with service design values and typical process practices. Additionally, more iterations on the toolkit could have been done, which would provide for a more finished final product.
Additionally, the final testing procedure could be improved to make it more focused on gaining a deeper understanding of the topic of human-AI cooperation. Instead, the testing procedure focused entirely on evaluating the toolkit. Researching the meaning of said term after testing was complete, the relationship with AI while using the framework could provide interesting reflection opportunities. While test participants were asked to select one or two use cases and work with them for a period of time, they were not asked to document that process in any way. This in particular lowers the reliability of the test results in terms of their replication. Because of that, there was no way to investigate participants' actions in more depth. Lastly, more iterations on the toolkit, followed by a testing procedure with at least a few participants would ensure higher validity of the results.

7.4 Personal reflections

As an author of this thesis, this project allowed me to not only learn about the topic of AI which is of deep interest but also opened me to many alternative ways of approaching the typical design process. By diving deep into the research area of this thesis, I was able to see how to better utilise the upcoming tools to help improve my designer skills.

One important aspect of working on this project was the ever-changing topic of AI in 2023. Certain AI tools were not existing when conducting the initial research on the topic but became available later in the process - for instance when working on the solution framework. An example here can be the recently released Microsoft365 Copilot tool, which can augment everyday office work by integrating ChatGPT capabilities into the MS Office package. Moreover, ChatGPT has evolved a lot and changed throughout the months. Based on it, many other tools have been developed, opening new doors for people to utilise this technology in new, creative techniques of working. This allowed for an untypical project experience, as in the past months, AI has been a topic of many conversations in media, popular culture, and academia. Moreover, it was a great and novel experience, as it also allowed me to constantly learn about the research area and evaluate my work based on new developments.

On the other hand, working individually this semester delivered yet another perspective on group work. As previously mentioned - and having completed eight semester projects while being part of a team - the goal was to test me and focus on a specific topic. This undertaking was successful; however, it also showed the advantages which come with group work. One reflection is that more can be worked on and in turn achieved with more group members. In the case of this project, more co-creative activities could have been organised, for instance, workshops and ideating sessions with the target group. Having additional resources would also allow for more in-depth testing of the solution and more iterations. What is more, it would be then possible to have the toolkit presented in a visual and interactive version for the

final evaluation.

Finally, the importance of this project in the personal journey as a service designer must be underlined. After two coursework-oriented semesters and an additional one at a company, this in particular gave me a great opportunity to synthesise all the previously acquired knowledge while at the same time allowing me to work on a project directly connected to my interests. In the past, I felt the need to explore the possibilities in which AI can supply design processes. Lastly, having only one project to work on this semester, resulting in being able to dedicate my whole mental and time capacity to it has been an additional benefit of this semester.

Chapter 8

Thesis conclusion

This project was approached to deploy AI tools and apps in (service) design processes in order to help designers with their work - to augment, expedite, and simply make it easier. Through desk and quantitative user-centred research, a final problem statement was created to help begin the process of creating a tangible answer to it. Said research provided insights on the topics of an ethical approach to AI technology, different perspectives on the definition of human-AI cooperation, as well as various tools available for utilising AI within the design process. With that in mind, the final research question, "How can we create ethically-conscious service design processes that include AI and human designers, working cooperatively?" can be answered as follows:

One can augment the design process with numerous novel tools - which are becoming more widely available to the everyday user - examples include ChatGPT, MidJourney, and many more, constantly emerging tools. These tools can be utilised in a number of ways, starting from the early stage of the design process. Specific examples include utilising AI for collecting and summarising research, writing interview questions and procedures, drawing insights and concluding, creating models such as user journeys and personas, and ideating evaluation procedures, among others. Moving forward in the process from the initial phases to the development and testing, AI becomes less and less desirable for human workers to use and they take on more tasks and responsibilities. This is especially true for the ones which require human-to-human contact, such as conducting exploitative, quantitative research, workshops, and user research.

Moreover, the cooperative role of AI and human designers has been explicitly stated and outlined, as it was the centre of the research of this thesis. When this project started, the terms cooperation was understood as the machine working hand in hand with its human counterpart, also through the *co-performance* concept. The possibility of AI working as an equal partner to humans was assumed. However, based on further research and knowledge gained from the interviews, it turned out that both the technology is not yet ready, nor the human designers are willing to do so. Now, the cooperation of AI-human agents is understood as AI performing one part of the task with human supervision, which then will be handed off for completion (and evaluation) by humans. This, for the time being, appears to be the ultimate compromise, due to the state of the technology and the level of trust and comfortableness to working with AI by human designers. As of now, AI is currently best applied for mechanical and thinking tasks - which often take up a lot of people's time and could be utilised instead for feeling and emphatic tasks, so essential in the human-centred design processes.

Furthermore, the evaluation of the AI-augmented Design Process model with design professionals and practitioners provided reflection and iteration possibilities. The toolkit proved valuable to them, showcasing a comprehensive overview of using AI to enhance design work. It provided practical examples of tools as well as an ethical focus for each use case. User testing revealed areas for future improvements, such as the absence of visual design in the framework and challenges with some AI tools featured as examples. Nonetheless, the toolkit's content allowed designers to explore new approaches to incorporating AI and discover supportive tools, making it a valuable addition to their toolkit.

Last but not least, this project has provided personal reflection and learning opportunities. As mentioned before, it was a new experience for me as it was an individual and not a group work effort. Having completed numerous group projects I wanted to test myself to see if such an extensive project can be completed by one person, based on my experience and learning from the master's education. Based on the delivered results, I consider it a successful undertaking. Moreover, it allowed me for deeper exploration of areas of my interest. I am sure that the presented findings and developed framework will help me with my future work as a designer and also prove itself as a useful tool to others. Additionally, version 2.0 will be presented in the following section to make it more accessible for prospective users and improve the toolkit based on received feedback.

Chapter 9

Epilogue: Toolkit 2.0

9.1 Introduction

Based on the feedback from the evaluation sessions and personal reflections, a need to improve the developed toolkit to make the information it includes more accessible to prospective users has been observed. To remedy the issue of lack of graphic design (and several others), an interactive version of the Toolkit was designed in Figma[1]. It presents the same information categories as its text-based counterpart with a few additional entries. The following images present different screens in the interactive prototype. The Toolkit 2.0 can be accessed at `https://www.figma.com/file/1oVEdMGgw7Hexz8wH5IyVc/Framework-2.0---AI-augmented-Design-Process-model?type=design&node-id=1%3A2&t=Gdif5D8b4KmnE9bn-1`. Once the webpage loads, click the *triangle play button* in the top right corner. After that, click on the *Options* menu in the top-right corner and select *fit to screen*.

9.2 Prototype presentation

The first screen is a welcome board, used for greeting users and presenting essential information about the toolkit. Besides the message and CTA button, in the top right corner, the user can find the navigation menu. This menu is present on every subpage of the toolkit and contains four shortcut buttons - go back to the previous page, go to the home page (Double Diamond model), go to the instructions, and go to personal space.

[1]Figma is a design software, most commonly used for developing interactive user interfaces and prototyping. See more here `https://www.figma.com`.

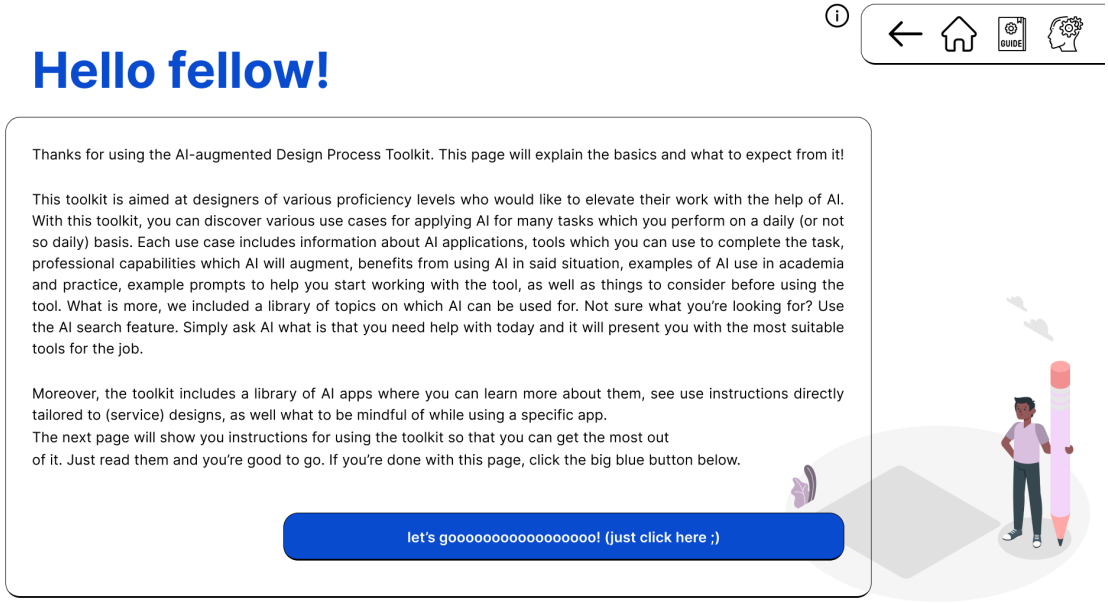

FIGURE 9.1: Toolkit 2.0 - welcome screen. Image by the author.

Next, the user is presented with the instructions set to ensure they know how to properly and responsibly use the toolkit.

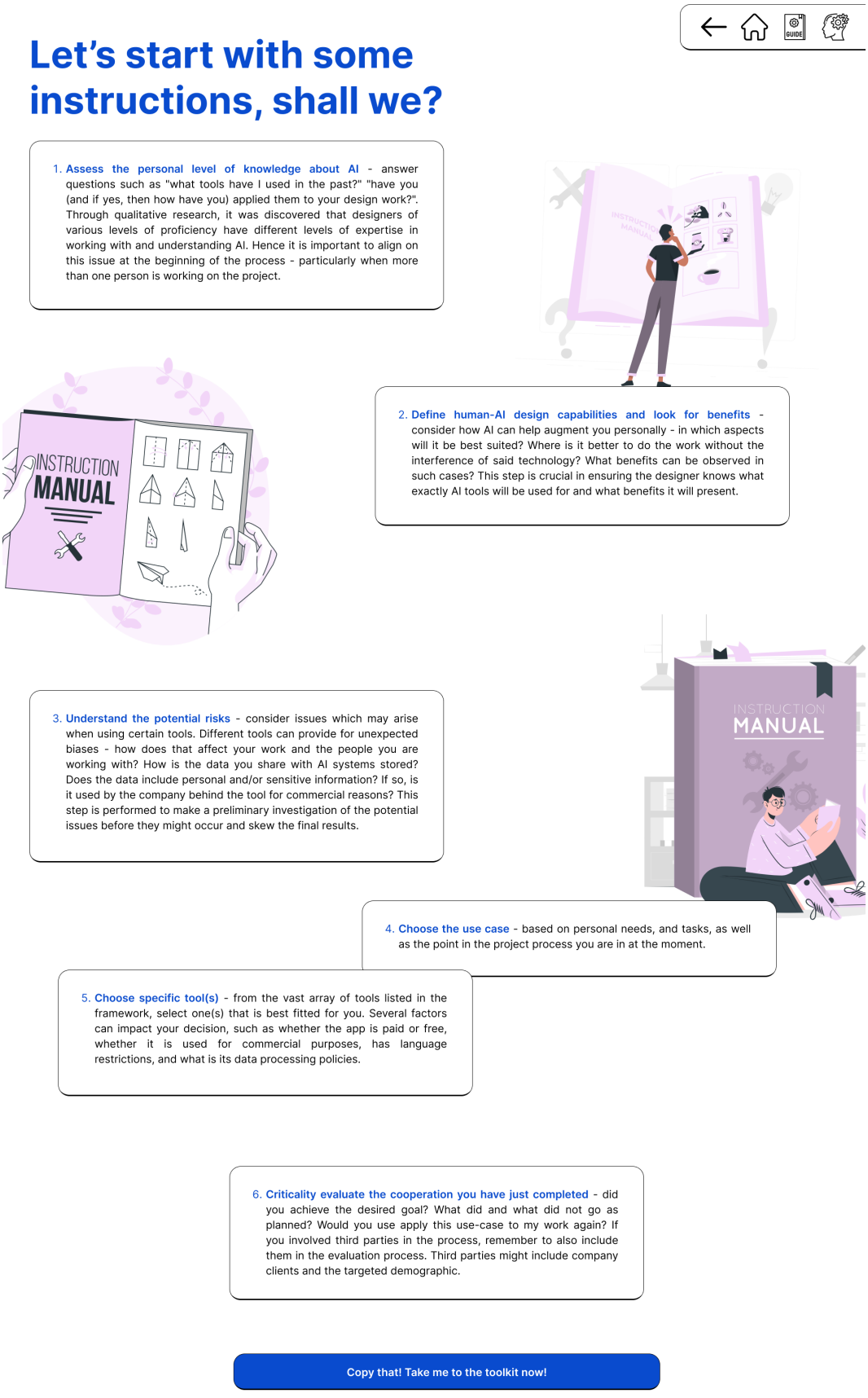

FIGURE 9.2: Toolkit 2.0 - instructions screen. Image by the author.

After clicking the button on the previous page, the user is taken to the toolkit's homepage - the interactive AI-augmented Design Process. Here, the user can hover over different markers to get a quick glimpse of what each use case is for. Clicking the *Learn more* button will take the user to the specific use case page, where more information can be found and AI tools can be accessed. Moreover, two different use case filtering options have been developed for Toolkit 2.0 - Library and AI search. There will be described in detail later in this section.

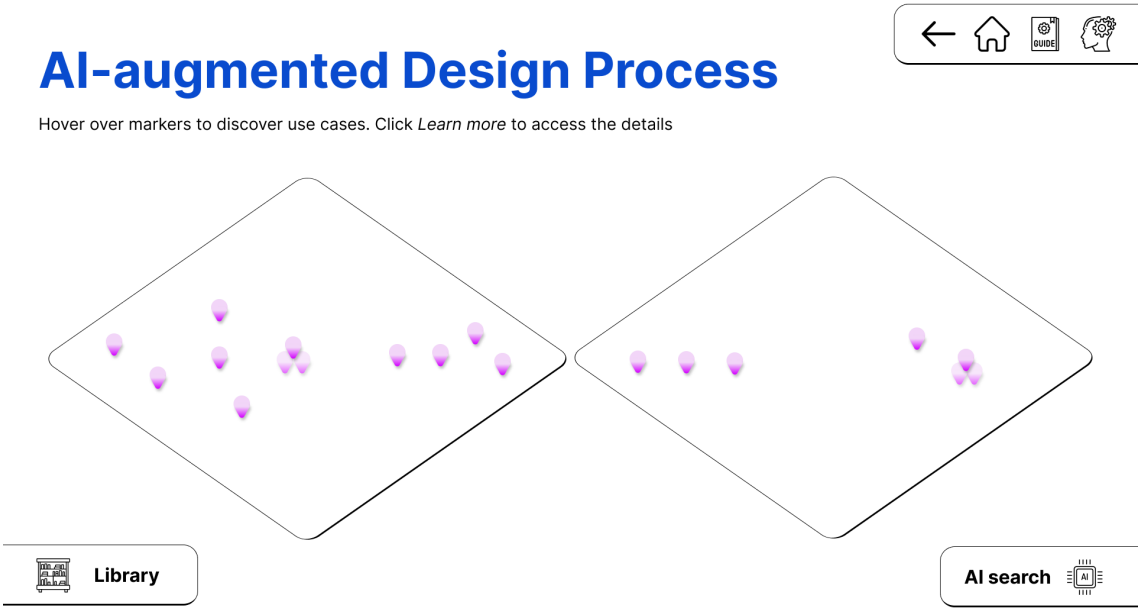

FIGURE 9.3: Toolkit 2.0 - AI-augmented Design Process screen. Image by the author.

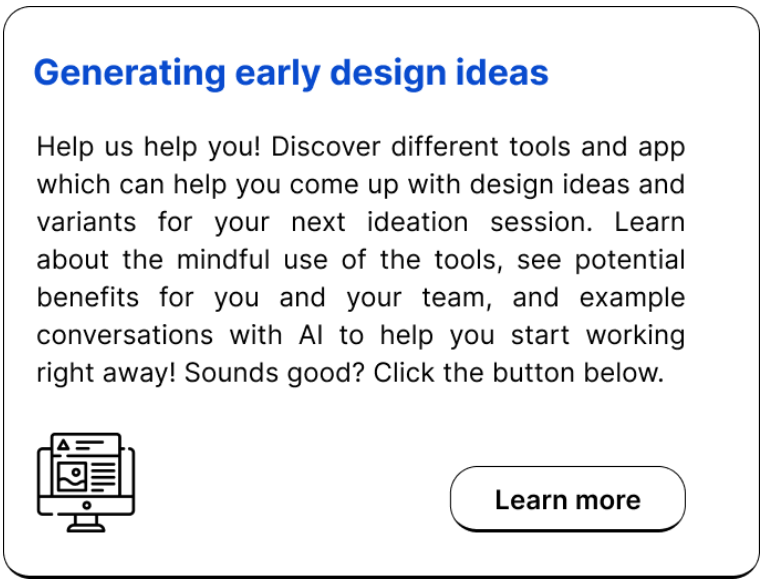

FIGURE 9.4: Toolkit 2.0 - Modal popup while hovering over a marker. Image by the author.

On this page, users can learn more about the specific AI use example. Each use case includes information about AI applications, tools which you can use to complete the task, professional capabilities which AI will augment you with, benefits from using AI in said situation, examples of AI use in academia and practice, example prompts to help you start working with the tool, as well as things to consider before using the tool. Additionally, AI apps included in the use case can be accessed directly from this page.

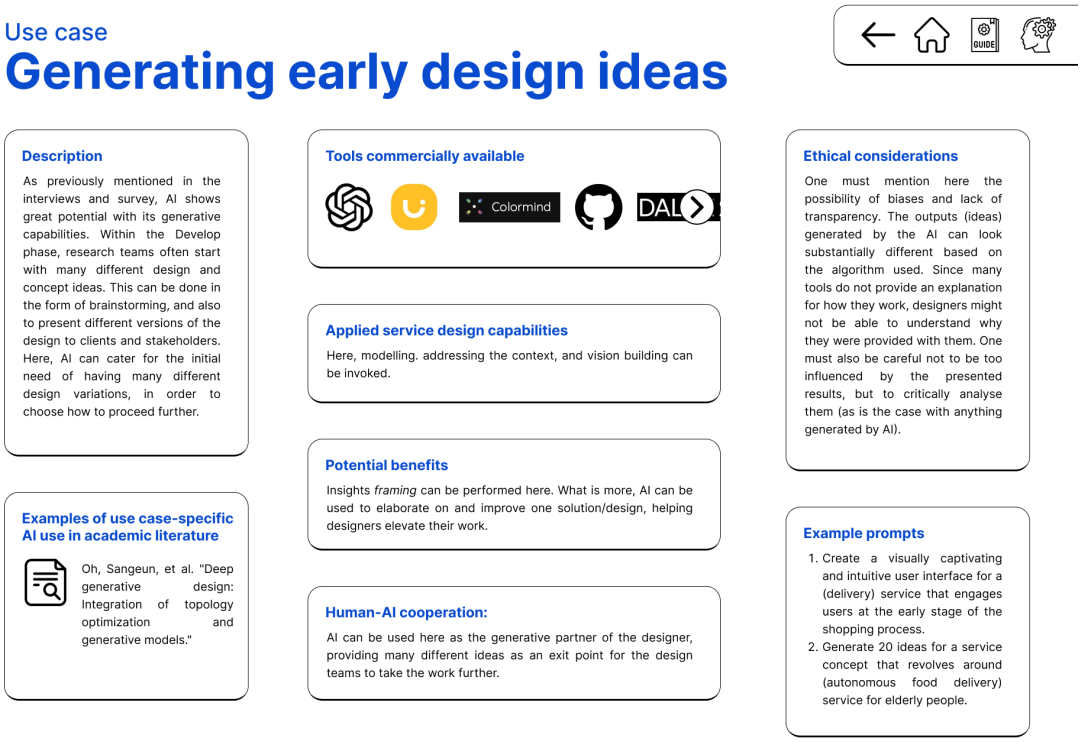

FIGURE 9.5: Toolkit 2.0 - Use case screen. Image by the author.

The new addition to version 2.0 of the toolkit - the Library - aims at making it easier to group various applications of AI by topic. In the future, the toolkit is meant to contain dozens of them and having them all mapped on the AI-augmented Design Process model might be confusing to new users. Therefore, Library organises them into categories - examples include analysis, generating ideas and generating designs.

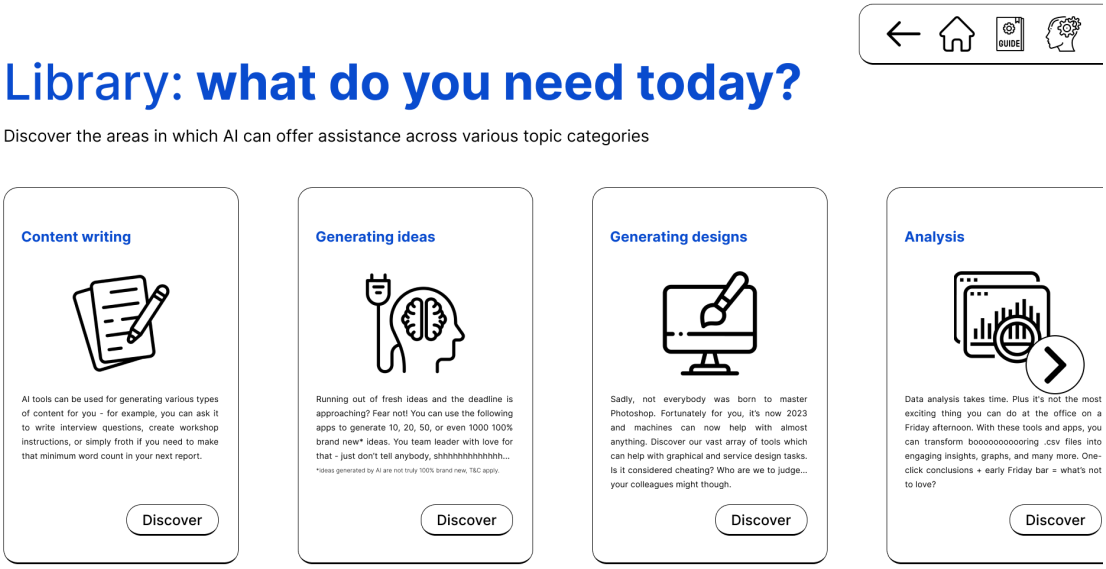

FIGURE 9.6: Toolkit 2.0 - Library screen. Image by the author.

The second new addition to version 2.0 of the toolkit - the AI search - makes it easier for users to search for the right tool. In the future, the toolkit can include dozens, if not hundreds different tools and browsing them one by one could be time-consuming. Therefore, which the help of AI, users can tell the app what they need to do and the AI will showcase the most suitable tools for the tasks. By clicking on the *Learn more* button, the user can learn more about the specific tool.

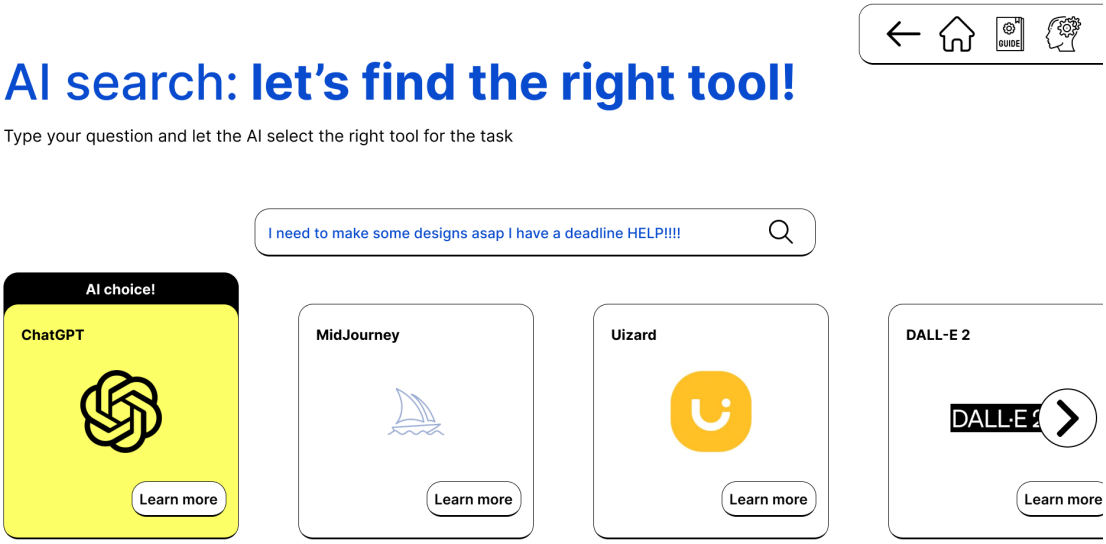

FIGURE 9.7: Toolkit 2.0 - AI search screen. Image by the author.

The third new addition included in version 2.0 of the toolkit is app-specific pages.

During the evaluation, test participants expressed concerns about both the specific AI apps and use instructions. This page is meant to remedy these issues. The user can read detailed information about the app, see general use instructions as well as is presented with a use warning - what to be mindful about when using it or feeding data to it.

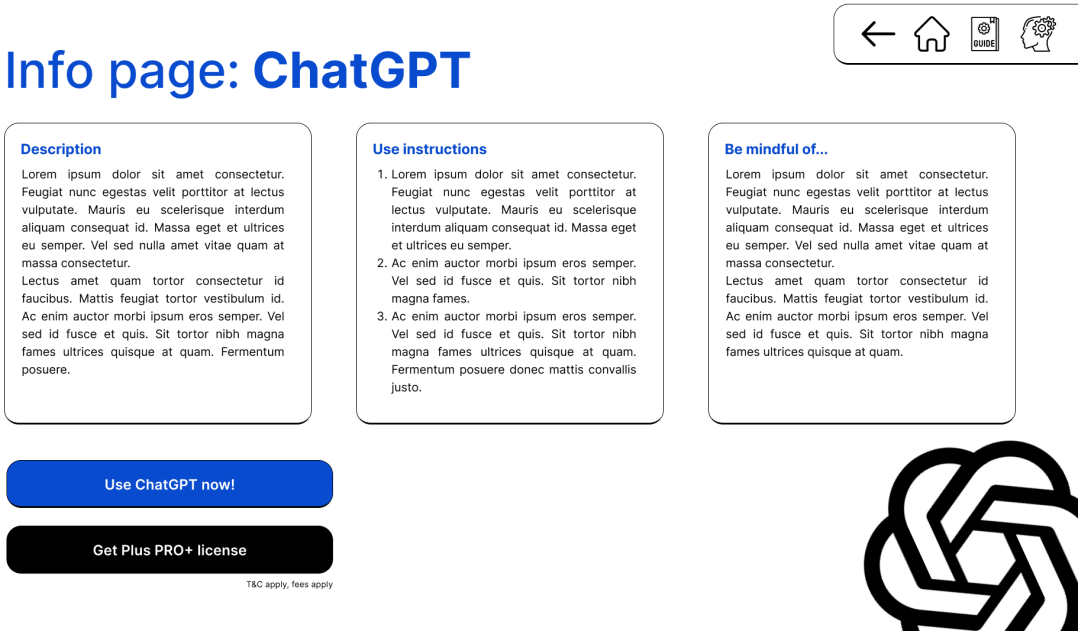

FIGURE 9.8: Toolkit 2.0 - App info page screen. Image by the author.

The last significant addition to the 2.0 version is the so-called *Personal space*. Here, the user can take a moment and reflect on the use of the toolkit, as well as the work they have been doing in connection to AI. First of all, users can send feedback to the toolkit's developers. Moreover, the user is able to express their feelings, problems, and thoughts about working with artificial designers. Additionally, it is possible to save a draft of each message. The page is accessible from the navigation menu in the top right corner of each page.

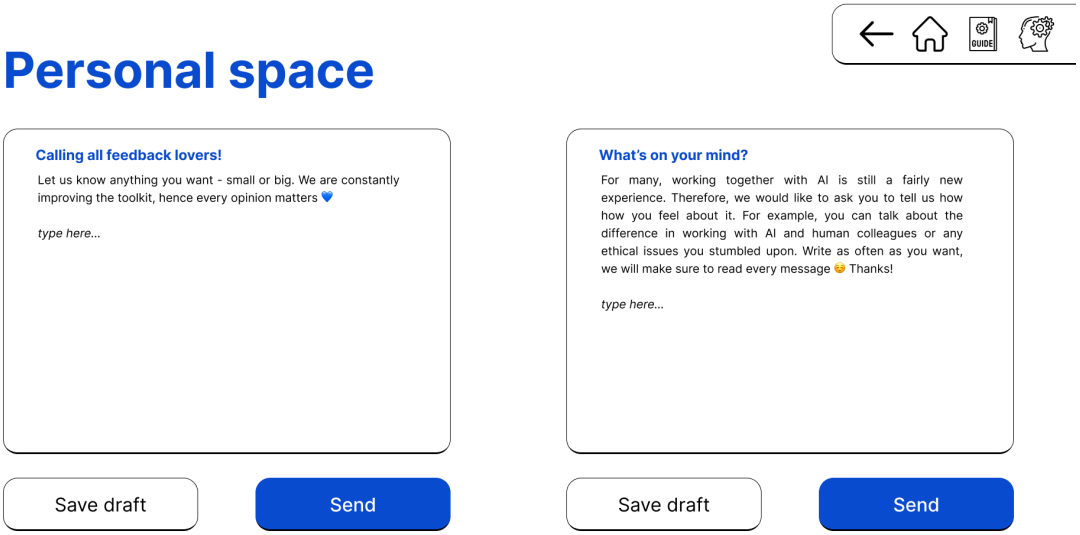

FIGURE 9.9: Toolkit 2.0 - Personal space screen. Image by the author.

It is important to note that all content in the interactive Figma prototype is original except for: the icons featured throughout the screens[2] and illustrations featured in the welcome and instructions screens[3].

9.3 Future works

Even though this iteration of the toolkit is much improved compared to its first version, there is more room for further improvements and innovations:

- **App verification procedure** - it must be acknowledged that not all AI apps are trustworthy - or that their developers have good intentions. While testing the first version of the toolkit, one participant expressed their concern about the Synthetic Users app - app that allows replacing real user research with AI-generated ones, cutting down on time spent on user research and generally providing the money-saving benefit to any design team using it. Other apps might collect sensitive user data and sell it to third parties. Therefore, there would be a need for a mandatory verification procedure for each app before it is featured in the toolkit. What is more, specific evaluation criteria would need to be developed. Possible examples could include data handling, impact on users, and adherence to ethical guidelines.
- **More apps added to the toolkit** - with time, more AI applications will be developed and their uses will expand to new territories. It is crucial to keep the toolkit up-to-date for designers to fruitfully harness the full potential of AI. New developments, or even breakthroughs, will be happening regularly. This will surely revolutionise the way designers work and think. With the incorporation of new tools and apps in the toolkit, more complex problems will find solutions.

[2]The icons were downloaded from `https://www.flaticon.com`.
[3]The illustrations were downloaded from `https://storyset.com/people`.

- **Implementation** - currently, the toolkit 2.0 exists as *a click-dummy*. In the future, there would be a need to program and develop a fully functional, possibly web-based app to harness its full potential. Moreover, additional user research would have to be conducted to ensure the interface is actually user-friendly, simple to use, and error-free. Furthermore, a more robust user guide would have to be developed - especially with the expanding functionality of the toolkit.

- **New use cases and user-suggested content** - as AI evolves and advances into new territories, novel opportunities for its utilisation will be presented to the design community. In consequence, there will be a great chance to develop a vast array of novel use cases (even ones that cannot be thought of today). Here, the design community should be able to help develop - or propose - said use cases, as they have the best understanding of various user needs, (service) design requirements, and general wants. All in all, within the toolkit app, there should be an option to propose new use cases, tools, or other features users might need.

- **Expanded information categories within use cases** - even though evaluation participants were pleased with the amount and variety of information each use case contains, there was room for improvement. These could include questions and prompts to ask AI about, various examples of using AI for said tasks, instructional videos, and more. Furthermore, detailed variants of specific use would be created. Some interviewees complained that certain use cases were too general, resulting in problems with their effective use.

- **More real-life examples of AI use** - given the variety of presented information in the toolkit and the premise that it can help designers in their work, there is a need to make it more grounded. This can be achieved through, for instance, presenting specific examples of the use of AI in real-life scenarios. Two categories can be distinguished here - real-life projects and academic, peer-reviewed papers. One example of said use is presented in the toolkit 2.0. However, it is acknowledged that there is a need for more of these, also to give readers ideas of the best AI applications.

Section 9.3 concludes the report.

Appendix A

Survey results as an Excel file

Full results of the survey can be found here `https://docs.google.com/spreadsheets/d/1nFsY68efGnFlBOzxTtkm333xSGAsU2cw2PGdgiCEkI0/edit?usp=sharing`.

Access as of the 23rd of May, 2023.

Appendix B

Audio recordings on the interviews

All audio recordings of the interviews can be found here: `https://drive.google.com/drive/folders/18CsnrODBCZ3v53iP4b76ir2k3v7OXXzd?usp=share_link`.

Access as of the 23rd of May, 2023.

Please note that due to a technical error, the recording of the interview with Amalia is incomplete.

Appendix C

Evaluation sessions audio recordings

Full audio recordings of the evaluation interviews can be accessed here: `https://drive.google.com/drive/folders/1WVQd88q7FecSsyan27MUt_g9zM_hURyJ?usp=share_link`.

Access as of the 23rd of May, 2023.

Please note that there is no recording of the interview with Julia, as she provided her feedback in written form. There is no recording of the interview with Troy due to a technical issue.

Bibliography

3GEM (Jan. 2022). *Employees want more AI in the Workplace*. URL: https://www.snaplogic.com/resources/infographics/employees-want-more-ai-in-the-workplace.

Akkio (n.d.). *Modern business runs on AI: No code ai*. URL: https://www.akkio.com/.

Amershi, Saleema et al. (2019). "Guidelines for human-AI interaction". In: *Proceedings of the 2019 chi conference on human factors in computing systems*, pp. 1–13.

Apple (n.d.). *Human Interface Guidelines | Machine Learning*. URL: https://developer.apple.com/design/human-interface-guidelines/technologies/machine-learning/introduction/.

Asilomar (Oct. 2022). *Asilomar AI Principles*. URL: https://futureoflife.org/open-letter/ai-principles/.

Bass, Dina (Jan. 2023). *Microsoft to invest $10 billion in Chatgpt Maker openai (MSFT)*. URL: https://www.bloomberg.com/news/articles/2023-01-23/microsoft-makes-multibillion-dollar-investment-in-openai.

Beaney, M. (2010). *Imagination and Creativity*. Open University Worldwide. URL: https://books.google.pl/books?id=0Zj2zgEACAAJ.

Beun, Robbert-Jan, Eveliene De Vos, and Cilia Witteman (2003). "Embodied conversational agents: effects on memory performance and anthropomorphisation". In: *Intelligent Virtual Agents: 4th International Workshop, IVA 2003, Kloster Irsee, Germany, September 15-17, 2003. Proceedings 4*. Springer, pp. 315–319.

Bjørner, Thomas (2015). *Qualitative Methods for Consumer Research*. Hans Reitzels Forlag.

Bono, Edward De (2016). *Six Thinking Hats - The multi-million bestselling guide to running better meetings and making faster decisions*. Penguin Books Ltd.

Britannica (n.d.). *Alan Turing and the beginning of AI*. URL: https://www.britannica.com/technology/artificial-intelligence/Alan-Turing-and-the-beginning-of-AI.

Burg, Vera van der, AA Akdag Salah, and RSK Chandrasegaran (2022). "Ceci n'est pas une Chaise:: Emerging Practices in Designer-AI Collaboration". In: *Proceedings of Design Research Society International Conference (DRS2022), Bilbao*. Design Research Society.

Camburn, Bradley et al. (2020a). "Computer-aided mind map generation via crowdsourcing and machine learning". In: *Research in Engineering Design* 31, pp. 383–409.

Camburn, Bradley et al. (2020b). "Machine learning-based design concept evaluation". In: *Journal of Mechanical Design* 142.3, p. 031113.

Cartwright, Amber (2016). *Invisible Design: Co-Designing with Machines*.

Cautela, Cabirio et al. (2019). "The impact of artificial intelligence on design thinking practice: Insights from the ecosystem of startups". In: *Strategic Design Research Journal* 12.1, pp. 114–134.

Chrastina, Jan (2018). "Meta-Synthesis of Qualitative Studies: Background, Methodology and Applications." In: *NORDSCI*.

Colby, Charles L, Sunil Mithas, and A Parasuraman (2016). "Service robots: How ready are consumers to adopt and what drives acceptance". In: *The 2016 Frontiers in Service Conference, Bergen, Norway*.

Collins (2023). *toolkit*.

Cross, Nigel (2023). *Design thinking: Understanding how designers think and work*. Bloomsbury Publishing.

Dam, Rikke Friis (Apr. 2022). *The 5 Stages in the Design Thinking Process*. URL: https://www.interaction-design.org/literature/article/5-stages-in-the-design-thinking-process.

Design_Council (May 2019). *Framework for Innovation: Design Council's evolved double diamond*. URL: https://www.designcouncil.org.uk/our-work/skills-learning/tools-frameworks/framework-for-innovation-design-councils-evolved-double-diamond/.

Dilhac, Marc-Antoine, Christophe Abrassart, and Nathalie Voarino (2018). 2nd ed.

Dorst, Kees and Nigel Cross (2001). "Creativity in the design process: co-evolution of problem–solution". In: *Design studies* 22.5, pp. 425–437.

Dove, Graham et al. (2017). "UX design innovation: Challenges for working with machine learning as a design material". In: *Proceedings of the 2017 chi conference on human factors in computing systems*, pp. 278–288.

European_Group_on_Ethics_in_Science_and_New_Technologies (2018). "Statement on artificial intelligence, robotics and 'autonomous' systems". In: *Retrieved September* 18, p. 2018.

Figoli, Fabio Antonio, Lucia Rampino, and Francesca Mattioli (2022). "AI in design idea development: A workshop on creativity and human-AI collaboration". In.

Floridi, Luciano et al. (2018). "AI4People—an ethical framework for a good AI society: opportunities, risks, principles, and recommendations". In: *Minds and machines* 28, pp. 689–707.

Forlizzi, Jodi (2018). "Moving beyond user-centered design". In: *interactions* 25.5, pp. 22–23.

Giaccardi, Elisa and Johan Redström (2020). "Technology and more-than-human design". In: *Design Issues* 36.4, pp. 33–44.

Girardin, Fabien and Neal Lathia (2017). "When user experience designers partner with data scientists". In: *2017 AAAI Spring Symposium Series*.

Gozalo-Brizuela, Roberto and Eduardo C Garrido-Merchan (2023). "ChatGPT is not all you need. A State of the Art Review of large Generative AI models". In: *arXiv preprint arXiv:2301.04655*.

GURL, Emet (2017). "SWOT analysis: a theoretical review". In.

Howard, Chris and Andy Rowsell-Jones (Jan. 2019). In: *2019 CIO Survey: CIOs Have Awoken to the Importance of AI*. URL: https://www.gartner.com/en/documents/3897266.

Huang, Ming-Hui, Roland Rust, and Vojislav Maksimovic (2019). "The feeling economy: Managing in the next generation of artificial intelligence (AI)". In: *California Management Review* 61.4, pp. 43–65.

Huang, Ming-Hui and Roland T Rust (2018). "Artificial intelligence in service". In: *Journal of Service Research* 21.2, pp. 155–172.

— (2021). "Engaged to a robot? The role of AI in service". In: *Journal of Service Research* 24.1, pp. 30–41.

International, SAE (2018). *SAE International Releases Updated Visual Chart for Its "Levels of Driving Automation" Standard for Self-Driving Vehicles*. URL: https://urlzs.com/2HaK.

Kanade, Vijay (Feb. 2022). *What is Artificial Intelligence (AI) as a service? definition, architecture, and Trends*. URL: https://www.spiceworks.com/tech/cloud/articles/artificial-intelligence-as-a-service/.

Kaplan, Andreas and Michael Haenlein (2019). "Siri, Siri, in my hand: Who's the fairest in the land? On the interpretations, illustrations, and implications of artificial intelligence". In: *Business horizons* 62.1, pp. 15–25.

Kayacik, Claire et al. (2019). "Identifying the intersections: User experience+ research scientist collaboration in a generative machine learning interface". In: *Extended Abstracts of the 2019 CHI Conference on Human Factors in Computing Systems*, pp. 1–8.

Kazi, Rubaiat Habib et al. (2017). "DreamSketch: Early Stage 3D Design Explorations with Sketching and Generative Design." In: *UIST*. Vol. 14, pp. 401–414.

Kuijer, Lenneke and Elisa Giaccardi (2018). "Co-performance: Conceptualizing the role of artificial agency in the design of everyday life". In: *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems*, pp. 1–13.

Legg, Shane, Marcus Hutter, et al. (2007). "A collection of definitions of intelligence". In: *Frontiers in Artificial Intelligence and applications* 157.

Leigh Star, Susan (2010). "This is not a boundary object: Reflections on the origin of a concept". In: *Science, technology, & human values* 35.5, pp. 601–617.

Marshall, K Scott, Richard Crawford, and Daniel Jensen (2016). "Analogy seeded mind-maps: A comparison of verbal and pictorial representation of analogies in the concept generation process". In: *International Design Engineering Technical Conferences and Computers and Information in Engineering Conference*. Vol. 50190. American Society of Mechanical Engineers, V007T06A010.

Martinetti, Alberto et al. (2021). "Redefining safety in light of human-robot interaction: A critical review of current standards and regulations". In: *Frontiers in chemical engineering* 3, p. 32.

Matejka, Justin et al. (2018). "Dream lens: Exploration and visualization of large-scale generative design datasets". In: *Proceedings of the 2018 CHI conference on human factors in computing systems*, pp. 1–12.

Microsoft (n.d.). *Turn your data into immediate impact*. URL: https://powerbi.microsoft.com/en-au/.

Mollman, Steve (Dec. 2022). *CHATGPT gained 1 million users in under a week. here's why the AI chatbot is primed to disrupt search as we know it*. URL: https://finance.yahoo.com/news/chatgpt-gained-1-million-followers-224523258.html?guccounter=1&guce_referrer=aHR0cHM6Ly93d3cuZ29vZ2xlLmNvbS8&guce_referrer_sig=AQAAALBUp5Ouf2Vjrzg5aEAi9csQ_JMWdoXbRsle8Q92BWjbeSzaQsdiHpPX6wWJytyXsr
4T-l_wgX4tCJfT2w-TESubCEm3okmkkzyVr7d_rKbIduivTA4xe9RWiynEEMIqW_9ecP_Gsl4pCdV8V.

Morelli, Nicola, Amalia De Götzen, and Luca Simeone (2021). *Service design capabilities*. Springer Nature.

Najibi, Alex (Oct. 2020). *Racial discrimination in face recognition technology*. URL: https://sitn.hms.harvard.edu/flash/2020/racial-discrimination-in-face-recognition-technology/.

Network, Service Design (Feb. 2023). "Consulting AI about Smart Service Design. A conversation with OpenAI's ChatGPT". In: *Touchpoint*.

Oh, Sangeun et al. (2019). "Deep generative design: Integration of topology optimization and generative models". In: *Journal of Mechanical Design* 141.11.

OpenAI (June 2021). URL: https://openai.com/.

— (Apr. 2022). *Dall·E 2*. URL: https://openai.com/dall-e-2/.

O'Neill, Thomas et al. (2022). "Human–autonomy teaming: A review and analysis of the empirical literature". In: *Human factors* 64.5, pp. 904–938.

Pandya, Ravi et al. (2019). "Human-AI Learning Performance in Multi-Armed Bandits". In: *Proceedings of the 2019 AAAI/ACM Conference on AI, Ethics, and Society*, pp. 369–375.

Partners, NewVantage (2022). "The Quest to Achieve Data-Driven Leadership. A Progress Report on the State of Corporate Data Initiatives". In: *Data and AI Leadership Executive Survey 2022. Executive Summary of Findings*.

Paterson, Barbara L et al. (2009). "Conducting qualitative metasynthesis research: Insights from a metasynthesis project". In: *International Journal of Qualitative Methods* 8.3, pp. 22–33.

Rafaeli, Anat et al. (2017). "The future of frontline research: Invited commentaries". In: *Journal of Service Research* 20.1, pp. 91–99.

Ramaswamy, Venkat and Kerimcan Ozcan (2018). "Offerings as digitalized interactive platforms: A conceptual framework and implications". In: *Journal of Marketing* 82.4, pp. 19–31.

Rogers, Yvonne, Helen Sharp, and Jennifer Preece (2023). *Interaction design: beyond human-computer interaction*. John Wiley & Sons.

Rosenblatt, Frank (1961). *Principles of neurodynamics. perceptrons and the theory of brain mechanisms*. Tech. rep. Cornell Aeronautical Lab Inc Buffalo NY.

Salesforce (n.d.). *Business Intelligence and Analytics Software | Tableau*. URL: `https://www.tableau.com/`.

— (2019). "State of the Connected Customer". In: *Salesforce research*.

Samuel, Arthur L (2000). "Some studies in machine learning using the game of checkers". In: *IBM Journal of research and development* 44.1.2, pp. 206–226.

Sawhney, Mohanbir (2016). "Putting products into services". In: *Harvard Business Review* 2016.September.

Schelble, Beau G et al. (2022). "Let's Think Together! Assessing Shared Mental Models, Performance, and Trust in Human-Agent Teams". In: *Proceedings of the ACM on Human-Computer Interaction* 6.GROUP, pp. 1–29.

Shahriari, Kyarash and Mana Shahriari (2017). "IEEE standard review—Ethically aligned design: A vision for prioritizing human wellbeing with artificial intelligence and autonomous systems". In: *2017 IEEE Canada International Humanitarian Technology Conference (IHTC)*. IEEE, pp. 197–201.

Sivasubramanian, M (2021). "Artificial Intelligence's Impact on Our Everyday Lives". In: *Learning Outcomes of Classroom Research*. 1st ed. L ORDINE NUOVO PUBLICATION, 1–9.

Stoimenova, Niya and Rebecca Price (2020). "Exploring the nuances of designing (with/for) artificial intelligence". In: *Design Issues* 36.4, pp. 45–55.

Susnjak, Teo (2022). "ChatGPT: The End of Online Exam Integrity?" In: *arXiv preprint arXiv:2212.09292*.

Uizard (n.d.). *Ai Design assistant: Ai Ui Design Tool*. URL: `https://uizard.io/design-assistant/`.

Vargo, Stephen L and Robert F Lusch (2008). "Service-dominant logic: continuing the evolution". In: *Journal of the Academy of marketing Science* 36.1, pp. 1–10.

— (2014). "Evolving to a new dominant logic for marketing". In: *The service-dominant logic of marketing*. Routledge, pp. 21–46.

Wedel, Michel and PK Kannan (2016). "Marketing analytics for data-rich environments". In: *Journal of Marketing* 80.6, pp. 97–121.

Wickramasinghe, Chathurika S et al. (2020). "Trustworthy AI development guidelines for human system interaction". In: *2020 13th International Conference on Human System Interaction (HSI)*. IEEE, pp. 130–136.

Xplane (Nov. 2016). *A brief history of co-creation: A powerful amp; collaborative idea*. URL: https://xplane.com/a-brief-history-of-co-creation/.

Xue, Haian and Pieter MA Desmet (2019). "Researcher introspection for experience-driven design research". In: *Design Studies* 63, pp. 37–64.

Yang, Qian, Nikola Banovic, and John Zimmerman (2018). "Mapping Machine Learning Advances from HCI Research to Reveal Starting Places for Design Research". In: *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems-CHI*. Vol. 18.

Yang, Qian et al. (2018). "Investigating how experienced UX designers effectively work with machine learning". In: *Proceedings of the 2018 designing interactive systems conference*, pp. 585–596.

Yang, Qian et al. (2019). "Sketching nlp: A case study of exploring the right things to design with language intelligence". In: *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems*, pp. 1–12.

Yang, Qian et al. (2020). "Re-examining whether, why, and how human-AI interaction is uniquely difficult to design". In: *Proceedings of the 2020 chi conference on human factors in computing systems*, pp. 1–13.

Yang, Rayoung and Mark W Newman (2013). "Learning from a learning thermostat: lessons for intelligent systems for the home". In: *Proceedings of the 2013 ACM international joint conference on Pervasive and ubiquitous computing*, pp. 93–102.

Yannakakis, Georgios N, Antonios Liapis, and Constantine Alexopoulos (2014). "Mixed-initiative co-creativity". In.

Zhang, Guanglu et al. (2021). "A cautionary tale about the impact of AI on human design teams". In: *Design Studies* 72, p. 100990.

This is the last page of this document.