Enhancing User Experience
Design workflow with Artificial Intelligence tools

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Abstract

This thesis explores the intersection of Artificial Intelligence (AI) and User Experience (UX) design, aiming to leverage AI capabilities to enhance the overall user experience design process. The research included user interviews, data collection, and the usage of AI tools to enhance efficiency. The collaboration with a company provided insightful information and directed the research toward investigating AI capabilities in UX design. The study clarifies the advantages of AI design tools, their impact on the UX design procedure, and the possibility of further developments. It ends by introducing the AIUX app concept, which provides a streamlined and collaborative approach to UX design. The results highlight the significance of a balanced approach, where AI enhances rather than replaces human creativity and invention. As AI technology develops quickly and is increasingly included in design tools, this thesis offers a starting point for further study.
Acknowledgments

I would like to express my sincere gratitude to all the participants who contributed their invaluable insights during the course of this project. Additionally, I extend my heartfelt appreciation to my supervisors, Tomas and Torbjörn, for their invaluable guidance and constructive feedback. I am also thankful to Renee, my examiner, for his expertise and helpful comments. Lastly, I would like to extend a special word of thanks to Amin for his consistent support throughout my master’s study.
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1 Introduction

The core concepts of this thesis will be covered in this chapter.

1.1 Context

This thesis is conducted in the master’s design program at Linköping University and Toyota Material Handling, located in Mjölby, is collaborating on this project.

1.2 Background

In recent years, technological advancement, and the rise of Artificial intelligence (AI) have revolutionized many industries. The field of AI has transformed from a theoretical concept to a practical application and is now deeply integrated into many parts of society. [6] The developments that happened in early 2020 are the fourth wave of the technological revolution which focuses on autonomy, generative and creative applications, where AI services act on behalf of humans. [7] For instance, using machine learning algorithms that analyze user data, companies can recommend new products based on the user’s preference and even assist them in chatbots.

1.3 Aim and goals

The purpose of this thesis is to explore the impacts of AI-powered tools on the user experience design process. To achieve this aim, the thesis will begin by providing an overview of the current state of the art in AI tools, their capabilities, and their limitations. The thesis will then examine the ways in which AI tools have been used in design, and provide insights into how designers can best leverage these tools in their design process.

In this research, I will delve into the world of AI image generation technology to gain a comprehensive understanding of how it works. Through this exploration, I will be able to realize the potential of AI image generation technology and how it can be utilized in various design applications. Ultimately, this will contribute to a better understanding of the capabilities and limitations of AI in the field of design. Incorporating AI into the design process can provide significant benefits in terms of efficiency, automation, and insights. By comparing the design process with and without the use of AI, I can identify the advantages and disadvantages of utilizing AI in design.

1.4 Toyota Material Handling

Toyota is widely recognized as one of the world’s largest and most influential vehicle manufacturers producing and selling automobiles and auto parts. Its three core business sectors are the development, manufacture, and sale of passenger cars, minivans, and trucks, as well as related accessories and services. Toyota also participates in the creation of intelligent transportation systems. Lease agreements are among the financing solutions that the Financial Services sector provides to Toyota dealers and customers. The All Others section includes housing, telecommunications, and other business activities in addition to its automotive operations. Kiichiro Toyoda began the business in 1937, and it is based in Toyota, Japan.
Toyota has been recognized for its leadership in designing and selling hybrid electric vehicles, such as the 1997 Toyota Prius. Today, the company sells over 40 hybrid car models globally. [8]

Toyota Material Handling is a world leader in the materials handling business, with roots in Japan. Approximately 4,000 people work in Sweden to design, manufacture, sell, and service material handling products. Manual hand trucks to innovative energy solutions and autonomous self-driving vehicles weighing up to 1.5 tonnes are among them. Toyota Material Handling has offices in Sweden’s Mjölby, Gothenburg, and Stockholm. [9]

1.5 User experience design

User experience (UX) design is the process by which design teams create products that provide meaningful and relevant experiences to users. User experience design involves the entire acquisition and integration process of a product, including branding, design, usability, and function. [10] Creating an experience entails not just making the software simple to use, but also creating extra product-related experiences such as marketing campaigns, packaging, and after-sales support. Ultimately, UX design is concerned with delivering solutions to issues and needs. [11]

1.6 Research question

The use of AI in different industries has had both positive and negative effects, which has raised curiosity about its potential impacts on the field of design. In this thesis, I aim to explore the answers to the following questions related to the impact of AI on design.

- How can AI design tools influence the User Experience design process?

1.7 Deliverables

The project’s deliverables include:

- A Figma prototype illustrating the idea
- A project report that describes the research methodology, the process, and the outcomes.

1.8 Delimitations

The following limits have been specified in order to more precisely define the scope of this project:

- The thesis will not be a functional application; rather, it will showcase the idea through a Figma prototype.
- It is crucial to note that the field of artificial intelligence is continually growing, and this research reflects the most up-to-date information available as of the end of April 2023.
2 Literature Review

In this chapter, the essential concepts presented in this thesis will be overviewed.

2.1 User experience design

User experience is a multidisciplinary discipline. UX designers come from a variety of backgrounds, including graphic design, programming, psychology, and interaction design. Designing for humans entails working with a broader scope in terms of accessibility and supporting various possible users’ physical constraints, such as reading small text. [11]

While the typical activities of a UX designer may vary depending on the company they work for or their project domain. However, they frequently include user research, persona creation, building wireframes and interactive prototypes, and testing concepts. The majority of UX designers employ some kind of user-centered work method, and they keep applying their best judgment to the problem at hand until it is fully and effectively solved. [3]
2.2 Creativity in Artificial intelligence

The implementation of artificial intelligence in creative practices has advanced recently. They have achieved success in generating images, music, videos, or stories. However, since creativity emerges from the complex interplay of conscious and unconscious cognitive processes, the creativity of AI still has some limitations and cannot replace the human mind. In addition, humans have a sense of purpose, meaning, sympathy, and emotional connection that allows them to design products or services that inspire, provokes thought, and resonates deeply with audiences. They may become far more capable and nuanced in the future or get better at mimicking the style and form of human creativity, but human creativity will always be needed to craft a vision, make depth meaningful connections, and design experiences that touch hearts and minds. [12]

2.3 Artificial intelligence in design practice

According to Aceto, Persico, and Antonio [13] and Lember, Brandsen, and Piret [14], digital technology enables access to new data forms via smart devices, provides novel communication and information exchange methods, enables innovative data collection, analysis, and decision-making via AI-based programs, cloud computing, big data analytics, and machine learning, etc. The incorporation of technological tools in design practice has become increasingly important in the modern era. Designers who leverage these tools are likely to be more productive, efficient, and creative. As technology continues to evolve, it is crucial for designers to stay up to date on the latest advancements to remain competitive in their respective fields.

Professionals in the creative business frequently experience issues with technology that does not operate as planned, resulting in project delays and inefficiencies. Any technology that can minimize effort and handle tiresome chores, such as image search or learning new features, is greatly sought after to boost productivity. The creative process includes several iteration, adaptation, and process management phases, which are sometimes considered as the most time-consuming aspects of the project. These jobs frequently require manual operations that can be streamlined with the help of AI and machine learning, which creative professionals regard as an area for major progress. To summarize, there is an increasing expectation that technology will benefit the creative business by simplifying complex procedures and eliminating human work. [4]

AI systems today have narrow, specialized capabilities such as generating variations and combinations within a limited scope. They can assist and enhance human creativity by suggesting new ideas, patterns, text contents and providing sources of inspiration and stimulation. With AI, designers can automate some types of tasks, allowing them to focus on more complex aspects of the design. It is essential to recognize that the use of AI in design also has its disadvantages. For instance, AI tools may not always reflect the designer’s intention, leading to a loss of control or distraction.

Gaining an understanding of machine learning can aid us in navigating the complexities, and capabilities of this technology.
2.4 Machine Learning

Machine learning is one of the approaches and subfields of artificial intelligence which can be used in numerous fields. Machine learning has the ability to use computational methods to learn from the analysis. These algorithms make use of data sets to identify and discover patterns that can be used to develop and improve robots’ capacity for autonomous decision-making.

Machines may form neural connections on several hierarchical data levels, similar to how the human brain does. These networks have given rise to deep learning, a new branch of artificial intelligence. [6] Machine learning offers advantages, but it also has substantial drawbacks, such as the need for a large amount of data—particularly high-quality training data. [15].

2.5 Text to image generators

One area where AI is having a significant impact is in the creation and manipulation of images. AI-powered image tools, such as generative adversarial networks (GANs), style transfer algorithms, and object detection models, have made it easier and faster to create visually appealing and realistic images. The use of AI in UI/UX design could have a lot of benefits and drawbacks.

It not only reduces the amount of time and effort needed to be spent to create images, but it has also enabled designers to explore new creative possibilities and generate realistic images which is time-consuming or impossible to create manually.

Dall-E 2, Midjourney, Stable Diffusion and other text to image software are rapidly developing, and every month provide new features. Nowadays, it simply works by writing a text as an input, and the output will be an image in a dictated style. Although the inputs are usually simple, the outputs can be extraordinary, and even win the art competitions award. [16]

Different models are used to generate images based on text prompts. The Generative Adversarial Networks-based model (GAN) is one of the elementary model's examples and DALL-E 2 is a newer model that benefits from contrastive Learning Image Pretraining (CLIP) and diffusion models. Even though errors may occur in some cases such as generating graphics with text or photorealistic human faces, it still creates aesthetic, accurate, and relatively creative pictures. [17]

At a more specific level, the utilization of diffusion-based techniques in text-to-image generators has garnered significant attention and interest across diverse fields. The process of diffusion involves providing artificial intelligence (AI) with a reference object, such as an image, along with contextual information that humans associate with it (such as "this is a black cat"). Subsequently, the diffusion algorithm introduces random alterations or “noise” to the image gradually, until the original image becomes indistinguishable. [16]

Image generators are AI models that are trained to create images from scratch, based on patterns and data they have learned from a dataset. To create an image, an image generator starts with a random set of values, and then iteratively adjusts these values based on the patterns it has learned from the dataset. The generator can also incorporate feedback from a user or a target image to further refine the generated image.

The process of creating an image using an image generator involves several steps, including encoding, synthesis, and decoding. During the encoding phase, the generator maps an input signal, such as a random set of values, to a higher-dimensional space where it can better
capture the features and patterns of the target dataset. In the synthesis phase, the generator uses this encoded information to create a new image. Finally, during the decoding phase, the generator maps the synthesized image back to its original, lower-dimensional form.

Image generators, also known as generative models, are AI algorithms that create new digital images based on patterns and features that they learn from existing images. These algorithms consist of two main components: a generator and a discriminator. The generator is responsible for creating new images based on random noise input that is fed into the algorithm. The discriminator, on the other hand, evaluates the generated image and compares it to the original image to determine whether it is real or fake.

The generator is trained through a process called backpropagation, where the algorithm adjusts its internal parameters based on the feedback received from the discriminator. As the generator becomes more skilled at creating realistic images, the discriminator becomes better at detecting fake ones.

Over time, the generator learns to create increasingly realistic images by mimicking the patterns and features of the original images. These generated images can then be used for a variety of purposes, such as creating new visual designs, improving image editing tools, or even generating realistic synthetic images for scientific research.

Given that text-to-image applications rely heavily on datasets containing large numbers of images and associated text for their model development, it is pertinent to inquire about the origins of these images. While the origins of such images may be unclear for certain programs, in several cases, known sources of these images raise ethical concerns. [16]
3 Method

This section outlines the methodology employed in this thesis and the methods that were used.

3.1 Methodology

The methodology employed in this research was Research Through Design (RTD), which involved conducting semi-structured interviews, focus group sessions, and workshops to address the research question. Artificial intelligence was studied, and existing tools that support design practices were experimented with. Throughout the research process, ideas were prototyped, tested, and iteratively developed to improve their quality.

3.1.1 Research through design

Research through Design (RtD) is an approach to research that involves using design actions as part of the knowledge generation process. This means that investigating, iterating, and evaluating concepts are integrated into the research process, leading to knowledge contribution. [18]

3.1.2 Design framework

The Double Diamond design process was introduced by the Design Council in 2004 and has since been widely adopted. This framework provides a structured approach for designers to follow and consists of two diamonds, each representing a different phase of thought: divergent thinking (exploring the issue extensively) and convergent thinking (focusing on a particular approach). The design process is broken down into four distinct phases, which are organized within the two diamonds: Discover, which involves investigating and determining user needs (divergent thinking), Define, which involves connecting findings to the problem (convergent thinking), Develop, which involves generating potential solutions (divergent thinking), and Deliver, which involves selecting the best solution and putting it into action (convergent thinking). [1]

The Design Council introduced an updated innovation framework in 2019, which replaced its previous Double Diamond model. The new framework features four key concepts that are crucial to consider during the design process. Unlike the linear nature of the old model, this updated version outlines 12 potential iterations and highlights the importance of a human-centered approach to design. Additionally, the framework underscores the value of using visual communication techniques and prioritizing cooperation and co-creation throughout the design process. [2]
Figure 3.1: Framework for innovation [1] adapted from Double diamond by design council [2]

3.1.3 Secondary research

To conduct this research, sources such as academic journals, trade publications, market research reports, and online resources are reviewed and studied to gain a comprehensive understanding of the field.

3.1.4 Web based survey

Online surveys are one approach to gathering data online which has become increasingly popular due to their various benefits, including time efficiency, cost-effectiveness, and the ability to reach a larger and more diverse pool of respondents globally. These surveys can be distributed via email, social media, or embedded into websites, making them easily accessible to a wide audience. They are particularly useful for collecting specific data from a targeted group of people, such as their preferences, opinions, behavior, or factual information. [19]

To achieve this project’s goal, I conducted a web-based survey to gather additional information from other members of Toyota’s design team about their attitudes toward AI tools and their impacts on UX design. Although the number of responses to the web-based survey was minimal, the insights collected from the survey were important in giving me a deeper knowledge of Toyota’s design team’s perspectives on AI technologies and their impact on UX design. The responses assisted me in identifying potential areas of concern and skepticism, as well as opportunities and potential benefits that might be realized by incorporating AI into the design process. Furthermore, survey respondents have emphasized the need for additional exploration and research into some critical areas connected to AI in UX design. The extent to which AI tools can increase the effectiveness and efficiency of the design process is one of these topics, as are ethical considerations, and the possible effects of AI on creativity and innovation in the design process.
3.1.5 Interview

Interviews are a useful means of gathering diverse information on a particular topic, including the interviewee’s personal opinions, perceptions, and attitudes, as well as their background knowledge or specialized expertise on the subject. It is not uncommon for interviews to encompass both types of information. The flexibility of this method and the level of control that the interviewer can exert over the respondent’s answers may vary depending on the situation. [20]

Semi-structured interviews follow a guide with predetermined questions, but the interviewer may ask follow-up questions to gather additional information based on the interviewee’s responses. This approach allows for an in-depth comprehension of the data gathered. [20]

To accomplish the goal of this project, I conducted a series of semi-structured interviews with four individuals, each from a different professional background. The first interviewee was a Senior UX designer employed by Toyota. The second interviewee was a junior visual designer who actively utilizes AI tools in his work. The third interviewee was a deep learning expert. The final interviewee was a mid-senior product designer who has been actively and curiously working with image generators for around one and half a years.

3.1.6 Focus group

Focus groups are a popular qualitative research technique in the field of design for collecting information from a group of people. A focus group is a "semi-structured group interview process that allows for a more interactive and exploratory discussion on a particular topic." Focus group participants are often chosen based on particular criteria and requested to discuss their thoughts, impressions, and experiences on the research issue. The approach can offer a plethora of data on how customers engage with a product or service, as well as insights into their requirements and preferences, making it particularly helpful in design research. Focus groups allow designers to better understand their target audience. [21]

To achieve this project’s goal, we conducted a focus group study with two design students in the first year of their master’s to draw the usual design process and figure out their mindset about AI tools. The feedback we received from the design students allowed us to make adjustments where necessary and ensure that it was tailored to meet the needs and expectations of the target audience. Overall, this was a valuable experience that helped us to identify any potential issues and refine our approach.

3.1.7 Workshop

Workshops are a design study technique that can be used to gather information and participant insights. Workshops have been a popular way of doing design research because they may give both researchers and participants a collaborative and participatory setting. It can be organized in a variety of ways and can include a variety of tasks like idea generation, prototyping, and testing. The objective is to involve participants in the design process and to establish a forum for honest and helpful discussion. [22]
4 Research process

4.1 Discover

During the discovery phase, I examined the available AI tools that support design practices, made a list of them all, and categorized them according to the design practices that each tool mostly supports. Meanwhile, I delved into researching the UX design process by running a workshop with design students and doing secondary research to explore how AI tools could be integrated into the process and what their impact might be.

4.1.1 Exploring current AI tools in design

I ran several experiments in numerous ways of prompting to identify the differences between various image generators and design tools. The purpose was to determine their distinguishing features, strengths, and limitations. Some of the tools I utilized in my research are listed in the table. I’ve also added a number of images that were produced from a single prompt in different models.

<table>
<thead>
<tr>
<th>Tool name</th>
<th>Description</th>
<th>Key features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midjourney</td>
<td>A tool for generating realistic images</td>
<td>Capable of generating a wide range of images</td>
</tr>
<tr>
<td>Dream studio</td>
<td>A tool for generating realistic images using AI and machine learning algorithms</td>
<td>Realistic image generation with a user-friendly interface</td>
</tr>
<tr>
<td>Playgroundai</td>
<td>A tool for generating realistic images</td>
<td>Capable of generating a wide range of images</td>
</tr>
<tr>
<td>Dell-E 2</td>
<td>An AI model developed by OpenAI for image creation</td>
<td>Capable of generating a wide range of images</td>
</tr>
<tr>
<td>BlueWillow</td>
<td>A tool for generating realistic images</td>
<td>Able to create different scenes from an input</td>
</tr>
<tr>
<td>Stable Diffusion</td>
<td>A tool for generating high-quality images using diffusion models and machine learning algorithms</td>
<td>Capable of generating a wide range of images</td>
</tr>
</tbody>
</table>

Figure 4.1: List of text to image generators
Figure 4.2: generated image by Gencraft, prompt: a futuristic design studio, innovative, working with AI tools:5, creative tools on the desk:2, glass walls, with natural light, cozy, green:3, warm, eloquent –no allwhite
Figure 4.3: generated image by Dall.E2, prompt: a futuristic design studio, innovative, working with AI tools:5, creative tools on the desk:2, glass walls, with natural light, cozy, green:3, warm, eloquent –no allwhite
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<table>
<thead>
<tr>
<th>Tool name</th>
<th>Description</th>
<th>Key features</th>
</tr>
</thead>
</table>
| Vizcom add pic example | A design and visualization tool for creating 3D models and environments | - Supports 3D model creation and visualization  
- Realistic lighting and material rendering |
| dreamfusion3d        | A tool for creating 3D models and animations using AI and machine learning algorithms | - AI-powered 3D modeling and animation  
- Realistic physics simulations |

Figure 4.8: List of text to 3D generators
<table>
<thead>
<tr>
<th>Tool name</th>
<th>Description</th>
<th>Key features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carrd</td>
<td>A drag-and-drop website builder with customizable templates and design options</td>
<td>-User-friendly interface</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Customizable templates</td>
</tr>
<tr>
<td>Framer</td>
<td>A tool for designing and prototyping interactive UIs and animations</td>
<td>-Supports interactive prototyping</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Real-time design collaboration</td>
</tr>
<tr>
<td>Uizard add example pic</td>
<td>An AI-powered design tool that can turn hand-drawn wireframes into high-fidelity designs</td>
<td>-Converts sketches and wireframes to high-fidelity designs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Gives you predicted heatmap for your design</td>
</tr>
<tr>
<td>Canva</td>
<td>A graphic design tool with a wide range of templates and design elements for various applications</td>
<td>Connects to image generators And other AI tools</td>
</tr>
<tr>
<td>Designer</td>
<td>A graphic design tool that allow you generate images by Dall-E instantly</td>
<td>Connects to image generators And other AI tools</td>
</tr>
<tr>
<td>Design.AI</td>
<td>An online A.I. design tool that generates creative graphic content</td>
<td>Instantly create templates and resize designs</td>
</tr>
</tbody>
</table>

Figure 4.9: List of AI-powered design tools
<table>
<thead>
<tr>
<th>Tool name</th>
<th>Description</th>
<th>Key features</th>
</tr>
</thead>
<tbody>
<tr>
<td>ChatGPT</td>
<td>A language model developed by OpenAI that can answer questions and generate text based on user input</td>
<td>Answering wide range of questions in various languages</td>
</tr>
<tr>
<td>Notion</td>
<td>An AI-powered language learning platform that uses personalized feedback</td>
<td>Assisting in text content</td>
</tr>
<tr>
<td>EILLA</td>
<td>An AI-powered tool for generating stories or text contents for different medias</td>
<td>Generating text contents, ideas</td>
</tr>
<tr>
<td>Tome</td>
<td>An AI-powered tool for generating stories or text contents for different medias</td>
<td>Generating stories</td>
</tr>
<tr>
<td>Fabrie</td>
<td>An collaborative whiteboard. You can generate ideas, make variation of image or sketch by AI magic tools connected to it</td>
<td>Providing templates, generating ideas</td>
</tr>
</tbody>
</table>

Figure 4.10: List of AI-powered tools that support text creation
<table>
<thead>
<tr>
<th>Tool name</th>
<th>Description</th>
<th>Key features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dreamer</td>
<td>Type in a text prompt or use images on the canvas use Stable Diffusion inside both figma and figjam</td>
<td>Capable of generating a wide range of images</td>
</tr>
<tr>
<td>Figma AI</td>
<td>ChatGPT can create text that fits your needs</td>
<td>Generating text contents</td>
</tr>
<tr>
<td>Conjure.ai</td>
<td>Helps you create visual assets for your designs based purely on text input and a few easy choices</td>
<td>Create visual assets</td>
</tr>
<tr>
<td>Clueify</td>
<td>Simulate user behavior with just one click</td>
<td>Pinpointing potential usability problems</td>
</tr>
<tr>
<td>GoQo</td>
<td>Generate clear and concise messaging that resonates with your audience Generate a persona Generate relevant questions for interview</td>
<td>Assist designers with giving them feedback, checklist, guidelines</td>
</tr>
</tbody>
</table>

Figure 4.11: List of AI-powered figma plugins
**Figure 4.12:** An example of QoQo and Cluify output that are AI-powered Figma plugins
Figure 4.13: An example of Dreamer output that is an AI-powered Figma plugin
Current abilities of AI  Some of the specific ways AI is currently being used in UI and UX design include:

- Generating low-fidelity prototypes
- Creating variations of a design for A/B testing
- Suggesting new fonts, colors, and other stylistic elements that fit within a brand’s guidelines
- Automating the production of assets like icons and illustrations
- Predicting the heatmap of the user’s interaction
- Analyzing how users interact with an interface and identifying potential UX issues
- Producing inspiration for designers to build upon
- Translating hand-drawn wireframes into polished user interfaces

Future possibilities of AI  Looking ahead, some of the ways AI may further integrate with and enhance the design process include:

- Generating interactive prototypes that designers can build upon
- Producing custom design assets like illustrations, icons, and imagery on-demand to match a designer’s needs
- Automating the production of design documentation like style guides, pattern libraries, and design systems
- Suggesting completely new design concepts and ideas that designers would never have thought of on their own
- Continuously analyzing how users interact with live interfaces and providing recommendations to improve their experiences
- Generating personalized design feedback for individual designers based on their skills, strengths, and weaknesses
- Collaborating with designers in real-time through conversational interfaces to brainstorm, get input, and refine designs

The future of AI in design is incredibly promising but will depend on how well designers can collaborate with these new tools. By developing a symbiotic relationship with AI systems instead of viewing them as a threat, designers can utilize them to push their creative capabilities even further and design experiences that are both highly functional and deeply human. The age of human and AI collaboration in design is here, and the possibilities are as endless as the imagination.
4.1.2 User experience design process

The infographic depicts a traditional user experience process that adheres to the Design Thinking methodology. However, because each project is unique, UX methods and tools must be tailored accordingly. [3]

To further our research, I have planned to map the current design process used by two of the design students. Additionally, I intend to experiment with several AI-powered tools with them, in order to gain a better understanding of their potential impact on the team’s workflow. Through this process, I hope to identify areas where AI tools could be beneficial and investigate the potential limitations of AI. By testing AI tools with the design team, I hope to gain a more practical understanding of the user’s insights as well. Overall, my planned experimentation with AI-powered tools will provide us with valuable insights into their potential benefits and limitations when used in the design process.
4.1.3 Focus group session with design students

To begin, I asked the participants to draw their own design process on paper, based on one of their recent projects. By drawing their process, the participants were able to visualize the steps involved in the process and gain a deeper understanding of their own design methodology. This activity also provided a starting point for the focus group study and helped to start a discussion among the participants about their workflow.
When participants completed their drawings, we discussed their workflow, and I introduced some AI tools that could be used in each step of the design process based on my experimentation with these tools and their features. The purpose of this activity was to help them understand how AI can enhance their design workflow. By discussing the various AI tools available, the participants were able to gain a better understanding of how AI can be integrated into their own design processes. This activity also provided an opportunity for the participants to ask questions and share their thoughts and concerns.

Following the introduction of AI tools that are useful in each stage of the design process, I asked participants to share their opinions about the tools and then invited them to try out some of the tools themselves.

By trying out some of the tools such as ChatGPT, Dall e, and Midjourney, the participants were able to see how AI could be used to generate images and answer some design-related questions. This activity also provided an opportunity for the participants to share their thoughts and feedback about the tools and discuss their potential applications in their own design work.

**Insights from participants**  Participants were amazed by the abilities of the AI tools that were introduced. This suggests that they are receptive to exploring new technologies and are open to evolving their work processes. As a moderator, it was important to cultivate this enthusiasm and highlight the full range of capabilities that AI tools can offer. By showcasing how AI can streamline repetitive tasks, inspire ideas, and optimize workflows, participants were able to recognize the potential of AI to enhance their productivity and efficiency. It’s understandable that some participants might be concerned about the impact of AI on their job security. As a moderator, it is important to address these concerns and help participants understand the potential benefits and limitations of AI in the design industry. One way to address these concerns is to emphasize that AI tools are not intended to replace human designers, but rather to augment their skills and ease their workflow. It’s important to highlight that AI can help designers work more efficiently, allowing them to focus on higher-level tasks that require human creativity, empathy, and critical thinking. Ultimately, it’s important to acknowledge and validate the concerns of participants while also providing a balanced perspective on the potential impact of AI in the design industry.
4.1.4 Semi-structured interviews

All interviews were conducted online and lasted approximately 40 to 60 minutes. The audio was recorded and transcribed afterward. All interviewees were asked identical questions, which included a brief introduction to themselves, their professional backgrounds, and inquiries about their present occupations. Additionally, I adjusted my questions to each interviewee’s occupation and familiarity with AI in order to elicit information and viewpoints relevant to my study objectives.
Interview A

- Academic background: Media and communication science
- Profession: Senior UX designer
- Location: Gothenburg, Sweden

How does the design process look like in your team? Firstly, we try to understand the need for a product and do interviews to research, then based on that do designs. After designing a prototype, we test them with our users and after some evaluations, we release it. So I would say that’s like a normal procedure.

What software do you use? We use only Figma.

Have you faced any issue that you think would be easier if it was supported by AI? We have a design library right now but it would be nice if Figma could go through the designs that you’ve done, and then make a design library out of that automatically.

Have you ever used AI tools for professional purposes? No I have not.

Have you used AI tools for other purposes? Yes, I have tried ChatGPT and Dalle once or twice, I was advised to test these tools by a buddy who is involved in 3D concept modeling.

Do you think AI can be used in a professional way in UX design? Yes, of course. AI may be highly helpful for things like benchmarking, recommending color schemes, and other UI design elements. I once requested a complimentary color from ChatGPT, and he suggested a very good answer to me, he said: “There is not a perfect color, you need to think about your context. I also think AI can speed up and simplify processes like crafting user stories or feature descriptions. The outcome may need some manual changes but still make your work faster and easier.

Which phase of the design process do you think artificial intelligence will be most useful? Having AI help in the final stages of the design process would be advantageous. It might study the design and make recommendations, for example, or it might examine user behavior patterns. For jobs like interviewing, documentation, and data analysis, AI is well suited. I guess it can do these kinds of tasks which are very time-consuming for humans to do.

If you wanted to use AI professionally, where do you think is the stage you would use it? I would use it for inspiration, or if I want to make any illustration.

What are the positive and negative impacts of AI tools in your opinion? In the short term, it is very positive but in the long term, it may change our way of working or cause job losses. Some tasks that are currently considered tedious could become automated, leaving only more enjoyable tasks for us to handle.
Interview B

- Academic background: Digital creative
- Profession: Visual designer
- Location: Stockholm, Sweden
- Have you used AI tools professionally? Yes, I frequently utilize them for inspiration and as a foundation for my illustrations.
- What kind of AI tools do you use? I’ve tried several image generators, but Midjourney is my favorite. It is, in my opinion, the best of all the tools I have used so far.
- How long have you been working with them? Around eight months
- Do you believe that the quality of the generated images is high enough to be considered as the final work for your job? Yes, Midjourney can produce extremely high-quality photos if the quality level is specified in your prompt. Recently, I showed one of the generated images for a project to my boss. He was amazed by the quality and requested minimal changes to that. Indicating that the image was of sufficient quality to be used as a finished product in my project.
- Have not you faced any issues with your team creating some of your design works with Midjourney?

Fortunately, my company is very open and receptive to it because they see the efficiency it brings to our work and the high quality of the images produced. However, we have used AI as an inspiration source until now. For instance, if the generated image by AI was perfect, we still have to edit and use it just for the foundation of our work. Probably this will change in the future.

- In which step of the design process do you believe AI can be most useful?

In my experience, AI can be a valuable source of inspiration and aid in designing storyboards or illustrating your ideas. Depending on the project, I have found various AI tools useful in all stages of the design process to fulfill different needs.
Interview C

- Academic background: Design for play
- Profession: Creative designer
- Location: Arhus, Denmark
- Have you used AI tools professionally? Yes
- What kind of AI tools do you use? Please identify a couple of them.
  Midjourney - Dall-e- Stylegan
- How long have you been working with them? one year now
- What kinds of changes have they experienced up to this point?
  Midjourney is a relatively new tool that is constantly improving its image generation capabilities, user interface, and other features. As it continues to develop, it is becoming more powerful and useful for product designers. As an example of its development, in addition to generating images from text, Midjourney’s mother company, Runway ML, has also developed Runway Gen 2, which can generate video from the text. These developments demonstrate the immense potential of AI-powered design tools and highlight the ways in which they are rapidly changing the design landscape.
- Which design field do you believe they are most powerful in?
  In my opinion, Midjourney is most powerful in the product design field. It can help designers quickly generate and visualize images of their ideas without the need for extensive 3D modeling skills. Product design often involves a lot of trial and error and iteration, and Midjourney can speed up this process significantly by allowing designers to quickly create and test out different design concepts. Additionally, it can help designers communicate their ideas more effectively to clients and stakeholders, which can improve the overall design process.
- In which step of the design process do you believe AI can be most useful? From a product designer’s perspective, AI can be useful in different steps of the design process, but in the case of Midjourney, it is most useful during the ideation phase. This is because it allows designers to quickly generate and visualize their ideas, which can help them explore different design concepts and iterate quickly. By using Midjourney during the ideation phase, designers can rapidly test out different design concepts and refine their ideas before moving on to the prototyping or production phases. This can save a significant amount of time and money, as it can help catch design flaws or issues early on in the process.
4.2 Define

During this phase, I conducted a web-based survey, reviewed literature related to users’ attitudes toward AI, and organized another workshop to validate the results from the survey and literature review. As a result, a persona was developed to better understand and define the user.

4.2.1 Web based survey

The design team at Toyota Material Handling in Sweden was emailed a web-based survey that was created through Google Forms. The survey questions were aimed to elicit information about the design team’s AI familiarity and experience, specifically whether they have utilized any AI-powered tools as a design supporting tool or not. The goal of these questions was to acquire a better idea of the team’s familiarity with AI as well as their level of willingness to utilize this technology in their professional activities. Unfortunately, the number of participants who offered their opinions was low, with only three individuals. However, it offered insightful observations and ideas that were helpful for pursuing more in-depth research. Despite the small survey size, the responses obtained can still contribute to the overall understanding of the topic and assist in guiding the direction of the project.

According to the results of my survey, participants are interested in learning more about AI tools and the benefits they may give. However, it seems that they are not yet using them professionally. While there is a willingness to investigate the possibilities given by AI, there may be some hesitation or lack of familiarity with these technologies that prevent their acceptance in a professional setting.
Figure 4.17: Design team’s answers to the web-based survey
After reviewing the responses to the web-based survey, I delved into an extensive literature review that focused on exploring designers’ attitudes towards the design support AI tools. The review was highly informative and yielded several insightful studies that shed light on the topic. These studies provided a more in-depth understanding of the designers’ attitudes toward AI and their impacts on design [4]. Overall, the literature review proved to be an excellent resource for validating the results of the web-based survey and provided a valuable perspective on the topic.

4.2.2 Exploring Designers’ Attitudes towards Artificial Intelligence support tools

According to a study, designers are willing to utilize creativity support tools, particularly for tasks that do not require a high level of creativity. They have expressed a positive attitude towards the potential of AI tools as collaborators in design projects. Although there may be a need for a shift in perceptions before designers fully embrace the idea of AI tools serving as co-creators, they seem open to accepting them in supportive roles such as assistant, researcher, or facilitator. Such positions would reinforce, rather than diminish, their role as a creative. [23]

In another study by Pfeiffer [4], respondents were asked about their thoughts on an AI-based creative assistant that would offer tailored assistance based on machine learning in this research segment. While some found the idea strange or unsettling, most were willing to try if two conditions were met. First and foremost, the assistant must outperform current voice assistants such as Siri or Alexa. Second, this must be on their terms and under their authority. Respondents stated a preference for call-in assistance rather than an always-on technology that could disrupt their job. Overall, AI-based creative supporters have potential, but they must fit certain requirements and be managed by the user.
Figure 4.18: Designers’ respondents to some questions in the Pfeiffer’s study [4]
According to a study [23], generally, designers are willing to use technologies that foster creativity, especially for projects that don’t call for a lot of it. As possible collaborators in design initiatives, AI technologies could potentially play a good and useful role in their opinion. However, how these intelligent creative supporting tools are described and positioned may play a significant role in their uptake.

They may be more open to employing these tools as assistants, collaborators, researchers, or facilitators, roles that complement their own creativity. This suggests that designers are interested in adopting AI to improve their work and are open to experimenting with new ways of working while maintaining their creative involvement in the process.

Designers frequently identify fixation and distraction as two potential obstacles when discussing the obstacles to creativity. This demonstrates the difficulty in defining creativity and locating chances to encourage it.

Ideation is a critical stage in the design process that demands high creativity. To explore the potential of AI tools in the Ideation phase, I organized a workshop with design students.

4.2.3 Workshop with design students
This workshop was conducted with two participants who were master’s students in Design. The concentration of the workshop was on the ideation stage of the design process. The goal was to assess the benefits and drawbacks of employing AI technologies for ideating approaches such as brainstorming or mind-mapping. Participants were first asked to describe their experiences with traditional ideation approaches, as well as any difficulties they had faced. After that, the participants were invited to use Eilla and ChatGPT which are AI tools that support language processing and text content creation. They produced a list of ideas with these tools and compare the results to their previous experiences using traditional approaches. Afterward, they were invited to examine the advantages and disadvantages of each tool and share their thoughts with the rest of the group.

Participants became aware of the possible limits of AI technologies in the ideation process. They discovered that a potential limitation is that many of the ideas generated by AI already exist, rather than being fresh ideas. They recognize that the automated idea-generation process relies on existing data and as a result, they give us outputs based on the existing concepts.

By the end of the workshop, participants had gained a deeper understanding of the benefits and limitations of AI tools in the ideation phase of the design process. They could determine which strategy best suited their individual or team needs. They believe these tools were ideal for speeding up the benchmarking process and offering a brief overview of the chosen subject. Additionally, the automated idea-generating tools offered a different viewpoint that would not have been possible with more conventional techniques.

While idea generation using AI tools can help generate more ideas, participants noted that it is important to consider the originality and uniqueness of ideas. They suggest that it would be most effective to combine AI-generated ideas with traditional idea-generation methods to provide a more diverse range of ideas while maintaining an element of creativity and originality with less time.

Overall, participants agreed that using AI tools to generate ideas can be beneficial to optimize their workflow and reduce the amount of time and effort required for traditional methods, but it is important to keep in mind its limitations and carefully consider how and when to incorporate these tools into the design process.
Figure 4.19: Picture of the workshop with design students
Furthermore, the participants also experimented with image generators to visualize a few ideas generated by automated idea-generating tools. However, they found that this tool was not as helpful as they had expected. While the images produced by the generator were visually interesting, they did not accurately represent the ideas in a meaningful way, making it difficult to fully understand or evaluate the ideas.

Despite the challenges they encountered with the image generators, they still recognized the potential benefits of using image generator tools in the design process. They suggested that further exploration and experimentation with different AI tools and methods may lead to more effective and efficient ways of generating and visualizing ideas.
4.2.4 Persona

Afterward, I created a persona. This persona helps me evaluate the user’s expectations and preferences when developing ideas at the next step. This project’s persona portrays a UX designer who is curious and creative and wants to maximize her productivity and creativity while saving time. She is open to testing new tools but tries to optimize her process with user-friendly and uncomplicated software.

Since the goal of this project is to promote the use of AI in the design workflow, I have personally experimented with several AI-powered tools in this project as well. I used the Persona template provided by Fabrie, one of the AI tools in design. However, I customized it to make it more suitable for my project’s needs. you can see the differences comparing Figures 4.21 and 4.22.

In addition to the persona, I took into account Toyota’s requirements for this project, which were focused on two key factors: feasibility and utilizing the advantages of AI.

Figure 4.20: Original Persona template provided by Fabrie
Figure 4.21: Customized persona for this project, using Fabrie template and Midjourney for picture.
5 Ideation

Throughout this stage, I began developing concepts based on the information I obtained previously. After considering all of the insights and literature reviews, I decided to create an AI design assistant specifically for UX designers and began the mind mapping and brainstorming process.

To investigate the feasibility of having an AI assistant for UX design practices, I integrated ChatGPT and Fabrie into my real project.

First, I asked ChatGPT to create a target audience and list their pain points, provide me an information architecture, a user flow, a copy of the hero section, and a FAQ section based on common questions the target audience might have. I used ChatGPT as my UX research assistant and compared all the data I gained with ChatGPT responses.

Although ChatGPT is not connected to the internet to search through all the updated data that exist there, it performed well, and the responses were reasonable to a great extent. I discovered that ChatGPT may actually serve as an assistant in the UX design process, offering useful recommendations especially if you give basic information about your project to that.

Meanwhile, I tested the mind-mapping tool given by Fabrie to see how well it understood the context and generated ideas. It worked nicely, although some additional adjustments were required to customize it for my specific project.

Taking into account the capabilities of AI tools and the desires of designers during their workflow, I came up with some ideas for AI assistant features.
Figure 5.1: Mind mapping after adjusting Fabrie’s version
Figure 5.2: Brainstorming

1. Automated design feedback: An AI-based assistant that can provide real-time feedback on design work.
2. Automated design suggestions: An AI-based assistant that can suggest design elements and color palettes to improve the look and feel of a design.
3. Automated design templates: An AI-based assistant that can generate design templates based on user preferences.
4. Automated design optimization: An AI-based assistant that can optimize design elements for better performance and user experience.
5. Automated design collaboration: An AI-based assistant that can facilitate collaboration between designers and stakeholders.

1. Automated design suggestions based on user preferences and style
2. Ability to search for design inspiration from a large library of images
3. Integration with popular design software for easy editing and manipulation
4. Ability to share designs with friends and colleagues for feedback
5. Real-time collaboration with other designers for projects and ideas
6 Prototype

6.1 Low fidelity prototype

To prototype some of the ideas, I requested ChatGPT to provide me with codes for two services: one that suggests AI-powered tools to help designers in each stage of the design process and another that generates ideas based on user prompts and generates an image for the chosen idea at the same platform. I then inputted these codes into JSFiddle to create visual demonstrations of the ideas, which can be viewed in Figure 6.1 and Figure 6.2, respectively. These were some of the initial ideas that I was thinking to combine with a project planning application, however, after speaking with experts and testing I realized that it doesn’t use all the capabilities that AI can offer, so I led to design an AI-powered assistant specifically for UX designers.

Afterward, I draw a wireframe version of an assistant application on paper and tested a combination of digital and physical prototypes with design students who had participated in previous workshops.
**Design Stages**

<table>
<thead>
<tr>
<th>Research</th>
<th>Ideation</th>
<th>Prototyping</th>
<th>Testing</th>
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<td><strong>AI tools in Research</strong></td>
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Figure 6.1: Prototyping a feature that suggests different AI tools to designers in each stage in JSFiddle
Figure 6.2: Prototyping Idea/image generator in JSFiddle
Figure 6.3: Participants testing wireframe sketches and Low fidelity prototypes
Although the workshop with design students resulted in insightful information, I was keen to get more qualified input from a seasoned UX designer working in this field. So, I conducted an online interview with an experienced UX designer to receive feedback on this project’s progress and to determine how to develop the prototype in a way that better meets the user’s needs. The interview proved to be incredibly instructive.

**Interview D**

- Academic background: Industrial design
- Profession: UX designer
- Location: Tehran, Iran

I described the process of the project briefly to the interviewee and asked for his opinion;

- What is your opinion about having an AI assistant on your team?

  It would be great. Nowadays, we use ChatGPT to answer many of our questions, but it is sometimes not accurate, since it requires back-and-forth communication to get the best output.

- What is your opinion of my prototypes? Do you think you will use them?

  Certainly, I appreciate the capabilities of AI, and having such a tool in our work makes our work much easier. However, I believe that a more consistent tool that is specifically designed to tailor to the mindset of UX designers would be preferable.

- How does a user experience design process look across various projects?

  I would say that for the most part, the process is similar across all projects, although there may be some differences in the details or methods used in each stage, depending on the context. Generally speaking, we start with research in order to gain an understanding of the context, the problems faced by users, and any other relevant data. The next stage involves defining the project’s scope, taking into account stakeholder requirements and our target audience. We also identify the main problems that we want to address and the values that we hope to bring to the product. After that, we usually move on to benchmarking or brainstorming sessions and then create a prototype. This process is repeated multiple times to continuously improve the product until we arrive at the best version possible.

- What challenges do you typically encounter during this process?

  One issue that arises during the design process is that certain tasks can be tedious and designers may not be willing to perform them, such as documenting data. Another challenge is prioritizing design over user needs, which highlights the importance of having someone check the product regularly to ensure it meets user expectations.

- In which stage of the UX design process do you think AI can be helpful?

  I believe AI can be helpful in all stages of the design process. We need a more user-friendly and specific tool for designers to streamline the design process.
6.2 Figma prototype

After testing my low-fi prototypes with design students, and speaking to a UX designer about my idea, I developed my prototype with a User flow and a high-fidelity prototype version using Figma.

Below are some pages of the prototyped application:
Say goodbye to design headaches.

Make your design workflow efficient. Doing some research and giving you suggestions, you can focus on more creative tasks and making the best decision.

Figure 6.5: Figma prototype, the landing page, commercial

Figure 6.6: Figma prototype, Login page
Figure 6.7: Figma prototype, dashboard page, creating new board

Figure 6.8: Figma prototype, data entry process, specifying the current stage of your project
Figure 6.9: Figma prototype, data entry process, discovery stage

Figure 6.10: Figma prototype, data entry process, define stage
Figure 6.11: Figma prototype, a holistic view of the board

Figure 6.12: Figma prototype, Discover stage on the board, AI suggest user to add another competitor
Figure 6.13: Figma prototype, AI suggestion accepted, Right clicking for more options AI can do, picking interview questions

Figure 6.14: Figma prototype, interview questions generated by AI is added to the board
Figure 6.15: Figma prototype, define stage, AI suggests a persona for your project

Figure 6.16: Figma prototype, user accepted that persona by AI be added to the board
Figure 6.17: Figma prototype, Ideation phase, AI suggests user to start by benchmarking.

Figure 6.18: Figma prototype, Dashboard page, introducing all the boards user have.
7 Evaluation

To evaluate the Figma prototype, I conducted a usability test with design students and forwarded the Figma prototype URL to two expert UX designers.

7.0.1 Usability test with design students

During the usability test, participants tried the prototype from the beginning to the end and then provided their comments and insights about it. I took note of the participant’s feedback to consider later.

Insights from the participants

Participants indicated their satisfaction with the platform’s data entry capabilities and their appreciation of the suggestions made along the way by artificial intelligence. They recognized the value of using this application as it enables them to organize all the project data in one place, with the added benefit of having an assistant constantly reviewing the information and alerting them to any inconsistencies or gaps. They believed that having dedicated software specifically designed for the field of design is preferable. This gives them a sense of professionalism and assurance that the tool is tailored to their specific needs and requirements. They also mentioned that the capabilities of AI integrated into this application can significantly speed up their design process and enhance collaboration with their teammates. By enabling them to work together on the same board and pursue their design process collectively, facilitates seamless teamwork and improves overall efficiency. The capability to generate images is the feature they would want to see added to this program.

7.0.2 Expert evaluation

During the online tests with expert UX designers, participants provided comments and feedback on the work within the Figma platform. While some of the mentioned problems can be addressed in the final product, I made adjustments to the prototype based on their feedback, resulting in an improved user experience.

Insights from the experts

UX experts mentioned some issues in the app, which have now been resolved. One of the improvements made is the ability to skip certain questions if the user is unsure or does not wish to answer at that moment, allowing them to proceed to the next step without filling in that specific question. Another issue raised by UX experts was the inability to view the entire board and see all the information added to it at a glance after answering the questions. This has been addressed by implementing a feature that allows users to have an overview of the entire board, providing them with a comprehensive view of the gathered information in a single glance.

The UX experts identified several areas for further development in the future product. One of the key points is creating a responsive application that can be accessed and used seamlessly on mobile phones and tablets. Additionally, they suggested streamlining the process of entering data, particularly for users who prefer to start with a blank board and complete it in their own way. Another important aspect highlighted by the experts is ensuring that all the key elements of the application have interactive functionality, providing a complete and engaging user experience. These suggestions will be valuable considerations for future iterations of the product.
Figure 7.1: Expert evaluation of the Figma prototype
Figure 7.2: Usability testing of the Figma prototype with design students
8 Discussion

8.1 Results

The research findings indicate that AI offers significant capabilities that enhance the workflow efficiency of UX designers across all stages of the design process. In the discovery phase, AI can provide interview questions tailored to the defined target audience, facilitating data collection. During the define phase, AI can process data, identify competitors, highlight potential technical issues, and even generate personas. In the ideation stage, AI tools accelerate brainstorming and visualization through text and image generators. Creating prototypes becomes more streamlined as AI can be prompted with code or step-by-step guidelines. Lastly, during the evaluation phase, AI can provide valuable feedback on designs, predict heatmaps, and analyze usability test data to offer development solutions.

Based on my research, I recommend the development of a dedicated application that caters specifically to the needs and workflow of UX designers, incorporating AI capabilities throughout the design process. This tailored application would leverage AI in various practices across different stages, allowing designers to maximize its benefits. By aligning the application with the unique requirements of UX designers, it would provide a more seamless and efficient experience, enhancing their productivity and enabling them to leverage AI effectively.

8.2 The Influence of AI on Design Education

The teaching of design is expected to be significantly impacted by the growing changes in the professional field of design, which have been driven by technological advances and the integration of AI. Design instructors will need to modify their courses to ensure students are given the essential information and skills as AI becomes more widely available in design tools and processes.

Design educators will be vital in educating students for a future in which AI is an integral part of the design profession. Design programs should encourage students’ ongoing learning and flexibility. By embracing these developments, design education can prepare students to gain the benefits of AI while keeping conscious of the field’s ethical, social, and cultural consequences. Furthermore, in the face of AI integration, design instructors must emphasize the need for critical thinking and human-centered design concepts. While artificial intelligence can automate certain jobs and provide significant insights, it is critical to maintain a user-centric approach and ensure that AI tools are used as promoters rather than replacements for human creativity and empathy.

in conclusion, the evolving professional area of design, as affected by AI breakthroughs, demands changes in design education. Design education could equip students with the skills and mentality needed for success in the growing design landscape by incorporating AI-related topics, facilitating interdisciplinary cooperation, emphasizing human-centered design principles, and supporting continuous learning.

8.3 Ethical concerns

Data management, processing, and computing are very necessary due to the importance of information and data in many industries, which are driven by the quick development of digital technology. Digitalization processes have the potential to alter society, but they must be carried out correctly. Because of our reliance on digital information and communication
technology, we may face new security and privacy threats. New human-machine interfaces demand ethical and anthropological issues. These changes may also have an influence on employment, inclusion, and distributive justice, potentially leading to societal unrest. To tackle these challenges, interdisciplinary approaches that consider social, political, and economic considerations, as well as technology assessment, systems analysis, innovation research, and ethics, are required. [24]

An analysis of 12 million images found that, of the 2.3 billion total images used by the system, nearly half came from 100 domains, including well-known websites like Pinterest, WordPress-hosted sites, Flickr, DeviantArt, and other photo art and blogging platforms. [16] These websites rely on user contributions rather than content from a centralized commercial source like Getty Images or newspaper archives. Even if AI doesn’t directly reproduce a user’s work, it may still produce photos with outstanding creative aspects, minute details, and vibrant liveliness that would otherwise be impossible to create without having access to the user’s work. As a result, assuming users were even aware of the terms, it is likely that they did not intend for AI to be used in this situation when they set the copyright conditions for their uploaded photographs. The use of websites like Pinterest, where many of the images posted may have come from somewhere else, and users’ actions further exacerbate the situation. [25]

A new tool has been created to assist users in determining whether an AI picture generator has copied their creative work without their consent, according to a recent article on the Ars Technica blog. The program is made to look for similarities between AI-generated images in a database and the original artwork by comparing the two. In circumstances when AI-generated images have been exploited to copy or alter original works, this can aid artists and creators in preventing unlawful usage of their creations. It is anticipated that the tool will be a useful resource for artists and creators who are concerned about the possible infringement of their intellectual property by AI algorithms [26].

Artists have expressed diverse reactions upon discovering their work on such platforms, and it is anticipated that future legal actions may arise to address questions around the legality of these methods and determine ownership of copyrights for artworks produced by these tools. [27].

This is further complicated by the fact that, unlike Stable Diffusion, other software technologies do not provide as much transparency regarding the origin of the images utilized to train their AI tools.

8.4 Method

On the one hand, my approach to this project was advantageous. I was able to iterate and enhance my designs thanks to a combination of research, brainstorming, prototyping, testing, and feedback. Including design students, interviewing AI users for design purposes, and UX experts during interviews resulted in the development of insightful and varied viewpoints. This method enabled me to produce a prototype that was in line with user requirements. Since this project aims to understand AI and its impacts on the UX process, using AI tools like ChatGPT and Fabrie was highly beneficial since they not only helped me better grasp how AI works in a UX design project but also made the project efficient. I was able to learn how AI may help with various areas of the design process and increase productivity by utilizing these technologies. Overall, my strategy enabled an extensive analysis of AI’s influence on UX design and offered insightful information for further use.

On the other hand, it is worthwhile to mention that due to my lack of strong background in AI, I had to spend extra time investigating and learning about it during this research.
As a result, my experience leads me to recommend that designers who are interested in this field team up with data scientists or other pertinent professionals to streamline their procedures. However, this approach may also present some challenges due to the differences in processes and mindsets. Consequently, a combined process that covers all aspects can be a valuable solution for both sides that is also resulting in a higher quality outcome. This is an interesting topic for further research and has been added to the future work chapter.
9 Conclusion

In conclusion, this study looked into the incorporation of AI technologies into the UX design process, with a focus on the potential impacts on efficiency. By utilizing AI tools such as Midjourney, ChatGPT, Fabrie, and Figma plugins, designers can potentially improve their productivity, foster creativity, and streamline different stages of the design process. However, a more tailored application designed specifically for their needs could be even more beneficial, as it would align with their thought processes and reduce the need for additional work.

Throughout the investigation, it became clear that AI has the potential to function as a beneficial design assistant, making suggestions, automating some tasks, and providing real-time feedback. Designers can utilize AI technologies to gather insights, create personas, establish information architectures, design user flows, and even generate content such as hero sections and FAQ sections. By using AI in these areas, designers may be able to save time and effort and concentrate on more strategic and creative aspects of their job.

However, there might be difficulties in incorporating AI into the design process since designers must embrace new technologies by transforming to AI-powered design-supporting software, learn the fundamentals of AI, and make sure the AI tools they use align with their specific needs and design mindset. To guarantee the integrity and human-centered approach of the design process, it is essential to strike a balance between AI support and maintaining the designer’s knowledge and creative input.

9.1 Knowledge contribution

The exploration of the integration of AI in the UX design process is the study’s knowledge contribution. This study contributes to a deeper understanding of how AI can enhance the user experience design process by describing the AIUX app concept, demonstrating the flow and features of the app, and highlighting the possible benefits and challenges involved in employing AI in UX design. The discussion highlights AI’s transformative potential in UX design, emphasizing its ability to supplement designers’ capabilities, enhance efficiency, and promote user-centric design methods.

The study recognizes AI technology’s rapid growth and its potential to revolutionize the design landscape, underlining the importance of ongoing research and discovery in this interesting sector. Furthermore, it emphasizes the value of human creativity, engagement, and invention in conjunction with AI capabilities, underlining the importance of a collaborative approach between designers and AI systems.
10 Future works

10.1 Collaboration of designers and data scientists

Working on this project has motivated me to read more about the collaboration between designers and data scientists. I have included the findings in this chapter as a suggestion for future work.

According to Zempekakis and Westra (2019) [5], the collaboration between data scientists and designers can considerably improve the efficiency and success of the design process by eliminating blind spots and decreasing miscommunication. This collaborative approach can also help to mitigate the issues that frequently develop during the design phase. Data scientists may be more focused on problem resolution without fully considering the needs of end users, resulting in solutions that may not meet consumer wants. Designers, on the other hand, may have high expectations for AI capabilities while lacking the technical skills to analyze the viability and implementation of their proposed solutions. Furthermore, the need of developing feedback loops to include fresh data over time is sometimes underestimated, and designers may feel excluded in the final stages of presenting the solution. As a result, a collaborative strategy that incorporates the skills of both designers and data scientists can solve these difficulties and lead to the development of more human-centered and effective AI-powered solutions (Zempekakis Westra, 2019). [5]

![Figure 10.1: The gaps between design thinking and AI science process](image-url)
Figure 10.2: AI by design approach which is a combination of design thinking and data science processes [5]
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