Impact of Artificial Intelligence in Design

Abstract

Author(s)	Publication type	Completion year
Hien Nguyen	Thesis, UAS	2023
	Number of pages	
	39 + 1	

Title of the thesis
Impact of Artficial Intelligence in Design

Degree, Field of Study
Bachelor of Business Administration

Organisation of the client

Abstract

The thesis investigates the influence of artificial intelligence on the design industry, focusing on the implications for designers' roles and careers. The objective of the study is to ascertain the potential for designers to be replaced by AI technologies, as well as to explore the benefits and limitations that AI brings to the field of design.

The theoretical framework of the thesis gives an overview of AI and its applications in the design industry, along with a discussion on the future prospects of AI in design. In the empirical section, qualitative data is analysed, incorporating insights from a literature review and a survey. The findings are then synthesized and discussed in the final section of the thesis, encompassing diverse perspectives and viewpoints.

Through this research, a comprehensive understanding of the impact of AI on the design industry and the roles of designers will be attained, shedding light on the potential changes and opportunities that AI presents in the field.

Keywords

AI, design, AI-generated design, designers

Contents

1   Introduction

1.1   Research background

Living in the 21st century is an extraordinary experience, as we are witnessing the rapid transformation of our familiar world into a high-tech and aesthetically advanced realm that was once only found in science fiction literature and movies. A key driver behind this transformation is Artificial Intelligence (AI), a remarkable technology that is propelling us towards the realization of our futuristic dreams (Pradeep et al. 2018, 3-5.)

According to Narayan (2021, 34), AI has had a profound impact on our lives, transforming the way we work, communicate, and interact with technology. From voice assistants and recommendation systems to autonomous vehicles and personalized healthcare, AI has become an integral part of our daily routines. One significant impact of AI is its ability to streamline tasks and improve efficiency. Automated processes and intelligent algorithms enable faster and more accurate decision-making, saving time and effort. AI-powered technologies have also revolutionized industries such as healthcare, finance, and transportation, enhancing outcomes and providing better services to individuals. Moreover, AI has facilitated advancements in personalization, tailoring experiences and recommendations to individual preferences and needs. This level of customization has enhanced user experiences across various domains, from entertainment and e-commerce to education and healthcare (Boden 2016, 1-2). However, according to Walsh (2018, 36-39), the impact of AI goes beyond convenience and efficiency. It has also raised important ethical and societal considerations, such as privacy, bias, and the future of work. As AI continues to evolve, it is crucial to ensure responsible development and deployment, addressing these concerns and ensuring that AI technologies serve the greater good of humanity work. Overall, AI has become an influential invention, shaping our lives in numerous ways and holding the potential for even greater transformative impact in the future.

When it comes to design, Artificial Intelligence is revolutionizing the field of design by changing the design process, automating repetitive tasks, and enhancing collaboration work (Aswal 2022). With advanced algorithms and machine learning capabilities, AI enables designers to work more efficiently and generate innovative ideas (Karaata 2018, 184). According to Philips (2018), AI-powered tools can automate design recommendations, suggest color palettes, and provide layout suggestions, freeing up designers to explore new possibilities. Additionally, AI allows designers to analyze large volumes of data and extract valuable insights, resulting in more personalized and user-centered designs. Generative

design powered by AI generates optimized solutions based on design constraints and objectives. AI also facilitates seamless collaboration and co-creation among designers, regardless of geographical boundaries, leading to better design outcomes. AI has made a significant impact across various design industries, including graphic design, UI/UX design, animation, and so on.

As AI technology continues to advance in the design industry, companies are considering automated processes that can streamline work and improve efficiency. This development has led to concerns among designers about the potential replacement of their jobs by machines (Bustamante 2023). Researchers worldwide have also recognized the potential threat of AI to the creative industry. Consequently, AI has become a subject of debate within the design community, sparking discussions about the future of the field in light of AI's rapid progress (Pixel 2023.)

Therefore, the objective of the thesis is to explore the diverse effects of AI on the field of design in the modern world in different design areas such as user experience design, virtual reality and augmented reality, social media, and animation. This thesis seeks to address several key inquiries throughout the study, including the overall impact of AI on the digital design sector, the transformative role of AI in reshaping digital design practices, and the future prospects and trends of AI in the design field. To achieve these research objectives, a qualitative research methodology will be employed, enabling a comprehensive exploration and analysis of the subject matter.

To maintain transparency, I admit that I used the AI softwares, including ChatGPT and Grammarly for my thesis. I primarily used these tools to check for correcting grammar, improving sentence structure, and generate summaries. As English is not my native language, and I faced limitations in my writing skills and language barriers, making it difficult for me to express my thoughts clearly. Therefore, I used these AI tools to support my writing for clear structure, grammar and refining the tone of my sentenes. I recognized limitations and risks when using AI softwares. While using these tools, I encountered errors and challenges that AI produced repetitive data and that did not align exactly with my original ideas and opinions. And it also collected data and information without citation. Therefore, I believe I have to take the responsibilty for the content written in my research. I will make an effort to deeply review, edit, and rewrite any sections of my thesis that are the AI intellectual output to improve the quality and follow the academic writing rules without violating any copyright issues. Although AI software supported my thesis, it should not be regarded as a replacement for my own contributions. I did not take someone else's work and put it into my

own words. I did my own research and expressed my ideas, and I cited the sources and gave credit to the books and articles from which I collected data.

1.2 Research objectives

The central focus of the thesis is to investigate the influence of Artificial Intelligence on the design industry, both in the present and future contexts. This is accomplished by conducting a thorough examination of the advantages and disadvantages associated with the utilization of AI applications in design. By providing a comprehensive overview, the thesis aims to gain insights into the broad-ranging effects of AI on different aspects of the design field.

1.3 Research questions

Having a preliminary research question is essential as it serves as a compass, directing researchers towards relevant theories and research within their chosen field of interest. Without a clear focus, specifically a well-defined research question, it is easy to become overwhelmed by the extensive academic literature available and lose sight of your research objectives. By establishing a specific research question, researchers can effectively narrow down their scope and ensure that they stay on track during the literature review process, allowing researchers to find the most pertinent and valuable information for their study (Van et al. 2020, 38.)

The main questions of this thesis would be:

- What benefits does AI bring to design?
- What are the main risks and limitations of AI in the design industry?
- Is designer be replaced by AI?
- What skills or qualities do you think designers need to develop to protect themselves against AI?

1.4 Thesis structure

The structure of the thesis comprises five primary sections: Introduction, Overview of Artificial Intelligence, Impact of AI in Design, Research Methodology, Results, and Discussion & Conclusion. The first section explains the thesis background information, outlines the objectives and the research questions. The second and third section examines the relevant literature and theoretical frameworks to establish a conceptual foundation for the research. The fourth section presents the methodology utilized in the study is presented, encompassing the data collection methods and analysis techniques employed. The fifth

section presents the results of the research. Finally, the thesis concludes with a discussion and conclusion.

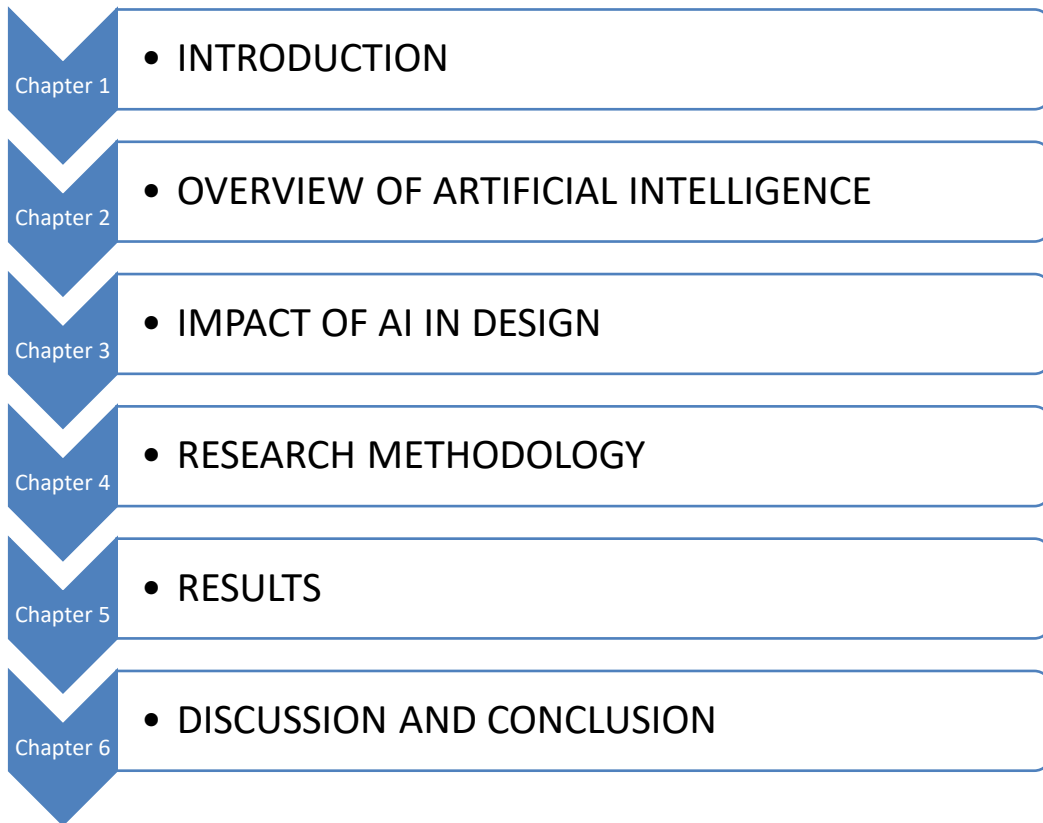| Chapter 1	• INTRODUCTION
Chapter 2	• OVERVIEW OF ARTIFICIAL INTELLIGENCE
Chapter 3	• IMPACT OF AI IN DESIGN
Chapter 4	• RESEARCH METHODOLOGY
Chapter 5	• RESULTS
Chapter 6	• DISCUSSION AND CONCLUSION

Figure 1: Thesis structure

2   Overview of Artificial Intelligence

2.1   Definition

According to Millington (2021, 3), Artificial Intelligence involves enabling computers to perform cognitive tasks that are typically associated with human and animal intelligence. Through programming, computers can exhibit exceptional problem-solving abilities surpassing those of humans, such as arithmetic, sorting, and searching. Initially, these tasks were considered challenges within the field of AI. However, as advancements have been made in solving these problems more extensively, they have gradually moved beyond the scope of AI developers.

2.2   History

AI has a dynamic and evolving history that spans numerous decades (Patrick D. Smith 2018, 6). The history of Artificial Intelligence dates back to the mid-20th century, when researchers began envisioning machines that could exhibit human-like intelligence. According to Rahman (2020, 31-32), The term "artificial intelligence" was coined in 1956 at the Dartmouth Conference, where John McCarthy, Marvin Minsky, Nathaniel Rochester, and Claude Shannon gathered to explore the possibilities of creating machines that could simulate human intelligence. During this period, AI research was characterized by optimism and ambitious goals.

The enthusiasm and dynamism of the 1950s paved the way for significant advancements in the 1960s, establishing fundamental theories that continue to shape the field of AI today. These breakthroughs propelled AI from a theoretical concept to practical applicability. Several notable advancements provided the necessary foundation for AI's progress, including the development of a generic systemic and programming approach that could be applied to solve a wide range of problems, the utilization of mathematical principles to address AI challenges, the introduction of robotics into AI research, and the remarkable achievement of enabling computers to understand and process human language. These crucial developments played a vital role in bringing AI from theory to practice and laid the groundwork for the ongoing advancements and innovations in the field (Al et al. 2020, 4-5.)

However, progress in AI faced challenges and setbacks, leading to a period known as the "AI winter" in the 1970s and 1980s, characterized by reduced funding and waning interest (Zimmerman 2018, 39-40). The resurgence of AI came in the late 1980s and 1990s, driven by advancements in machine learning and the availability of large datasets (Fan 2019, 38).

Techniques like neural networks and deep learning gained prominence, enabling breakthroughs in speech recognition, computer vision, and natural language processing.

In recent years, AI has experienced a remarkable surge in interest and applications, fueled by advancements in computing power, big data, and algorithmic improvements. AI is now being deployed across various domains, including healthcare, finance, transportation, and entertainment. (Lowe & Lawless 2021, 31-32). The history of AI reflects a cycle of excitement, disappointment, and subsequent advancements. Today, AI continues to evolve rapidly, with ongoing research and development pushing the boundaries of what is possible. As AI technologies become more integrated into our daily lives, the field holds tremendous potential to revolutionize industries and improve our quality of life (West 2018, 19-20.)

2.3   Benefits of AI

AI has become an integral part of our modern world, revolutionizing various industries and enhancing countless aspects of our lives. With its ability to simulate human intelligence, AI brings numerous benefits that range from improved efficiency and productivity to advancements in various fields. In this part, we will explore some of the significant benefits that AI offers as follows:

AI has the potential to significantly increase work efficiency by providing continuous and uninterrupted support (Walsh 2018, 16). Companies are increasingly adopting AI technologies to enhance their customer service teams (Narayan 2021, 41). For instance, the implementation of Chatbot software enables automated interactions with customers, allowing for quick responses to general queries without the need for real-time human intervention (Margie 2020). These AI-powered systems can learn and adapt to different customer inquiries, providing accurate information and even offering definitions based on specific keywords. By automating such tasks, AI helps businesses save time and resources while improving overall service quality (Burnett 2022, 38).

AI-powered virtual assistants have indeed made life easier and more convenient for users. For example, Apple's Siri, by simply using voice commands or typing, individuals can interact with virtual assistants to perform a wide range of tasks. Whether it's making phone calls, sending messages, setting reminders, checking schedules, solving math problems, or accessing information, virtual assistants like Siri provide quick and efficient solutions. These AI-driven technologies have transformed the way people manage their daily tasks and access information, contributing to increased productivity and convenience in their lives (Rahman 2020, 87-88.)

AI helps to improve customer experience by utilizing its ability to quickly and accurately analyze data, enabling it to provide useful information about each customer. Based on this information, companies can offer the most appropriate services and products tailored to each individual. A typical example of personalized experiences can be seen in streaming platforms like Spotify. Spotify offers users a personalized Discover Weekly playlist, which includes 30 new tracks that the platform believes they will enjoy (Marr 2019, 174.)

AI can help automate repetitive, tedious, and time-consuming tasks, leading to a reduction in errors and an increase in accuracy. AI systems can efficiently handle tasks that require high precision and attention to detail, minimizing the potential for human error. The utilization of AI technology enables individuals to allocate their human resources towards more creative and innovative aspects of their work. This not only improves productivity and efficiency but also allows for the exploration of new ideas and problem-solving.

Another benefit of AI is cost reduction. Since AI helps in the elimination of repetitive tasks, mundane administrative work and paperwork will be delegated to AI systems, allowing human resources to concentrate on more specialized and professional endeavors. Consequently, this leads to cost reductions for companies and empowers employees to devote their attention to skill development and growth (Aggarwal 2021, 126.)

2.4   Risks and Dangers of AI

Despite the numerous advantages it offers, Artificial Intelligence also comes with certain drawbacks. In her article, Duggle (2013) outlined several key disadvantages associated with AI:

The advancement of AI technology raises significant concerns about the impact on unemployment. As AI technology continues to advance, it has the potential to automate and replace numerous job roles traditionally performed by humans (Walsh 2018, 55). Tasks that involve repetitive or routine work, such as data entry, customer service, and even some aspects of manufacturing, can now be efficiently handled by AI systems. The increasing unemployment rate poses a significant economic challenge for the country (von Braun. 2021). Goldman Sachs also predicts that 300 million jobs will be lost or eliminated due to AI (Kelly 2023).

Another drawback of AI is its limited creativity. AI systems operate based on pre-existing data and are unable to generate responses or fulfill requests beyond their programmed scope. The fundamental algorithm of AI software involves finding, collecting, and creating content using available resources that have been previously posted by individuals. Consequently, the creative process of AI is constrained by the data it receives. This lack of

originality and creativity poses a risk when developing content with AI. Aggarwal (2021, 155) further noted that machines excel in efficiency rather than creativity. They can follow commands and instructions, but the capacity to think innovatively and beyond conventional boundaries will always be a unique strength possessed by humans.

According to Anderson and Jeffrey (2020, 46-47), one of the key limitations of most AI systems is their lack of empathy. This poses a particular challenge for chatbots and other AI applications designed for customer service and human communication. Unlike human representatives, AI struggles to establish a sense of trust with individuals. When users have negative experiences with chatbots or Interactive Voice Response (IVR) systems, their frustration and annoyance tend to intensify. AI is unable to replicate the warmth and welcoming nature that a human representative can provide. Instead, AI is better suited for service positions that involve frequently asked questions presented in different formats or phrasing. An example is in the field of design, effectively conveying the narrative and ideas of a business often extends beyond a mere set of keywords or specific requirements. The inclusion of emotional elements holds great importance in each design. For instance, in brand identity, the emotional aspect can be influenced by the business owner, the journey of its establishment and growth, or the essence of the business itself. To fully comprehend and capture these elements, human empathy and emotional intelligence play a vital role in the design process. However, an "AI designer" primarily relies on keywords to analyze and generate products, which often fail to evoke human emotions in the same way.

Finally, AI can contribute to making humans lazy. AI has the potential to foster a sense of laziness among individuals due to its ability to automate various tasks. With machines performing tasks faster and more accurately, many jobs have been replaced in sectors such as manufacturing and services. For instance, the use of AI chatbot tools like ChatGPT can handle a wide range of activities such as writing, research, and translation (Baker 2023, 14-15). While these virtual assistants offer convenience and efficiency, they can inadvertently contribute to a reduction in human effort and motivation. Relying too heavily on AI for mundane tasks may discourage individuals from actively engaging their own creativity and problem-solving skills. This can have a negative impact on humanity and future generations.

3   Impact of AI in Design

3.1   AI Design and Practices

3.1.1   Website and User Experience Design

The integration of AI-powered chatbots has revolutionized customer support in businesses. By leveraging AI technology, chatbots can deliver immediate responses to customer inquiries and provide tailored recommendations, all without the need for human involvement. This 24/7 support capability enhances customer satisfaction by ensuring prompt assistance at any time. Moreover, AI chatbots alleviate the workload for customer service teams, allowing them to focus on more complex issues that require human intervention (Batat 2022,123.)

Design automation using AI tools to analyze design trends and user preferences, generate design suggestions and automate repetitive design tasks. This empowers developers to effortlessly craft visually appealing and user-friendly websites. By leveraging AI-powered design tools, developers can examine user behavior and create website designs that align with their preferences. The integration of AI facilitates the seamless creation of personalized website designs tailored to users' specific requirements, preferences, and browsing habits. As a result, time is saved and efficiency is improved throughout the design process.

Recommendation and optimization tools offer valuable insights by leveraging customer search data. Through the use of extensions and plugins, these tools can track customer search and purchase history, allowing for the generation of personalized recommendations based on related searches. This enhances the customer experience by presenting relevant suggestions and optimizing the overall shopping experience.

Personalization tools offer valuable insights derived from customer search activities. Extensions and plugins can monitor and analyze customer search and purchase history, generating recommendations based on related searches. Netflix is a successful example of a personalization application, by analyzing user viewing habits, preferences, and historical data, Netflix recommends a curated selection of movies and TV shows that align with individual tastes. This personalized approach enhances user satisfaction and engagement, allowing users to discover content that matches their interests without the need to manually search for options (Marr 2019, 164.)

3.1.2 VR and AR

Augmented Reality (AR) and Virtual Reality (VR) have gained significant popularity and are integral components of the digital landscape (Bektic et al. 2020, 21). In a saturated market of customer experience-enhancing technologies, AR and VR have emerged as key differentiators, enabling businesses to distinguish themselves amidst fierce competition. Liu et al. (2022, 1) expressed the belief that VR and AR technologies will play a significant role in driving the emergence of novel trends in both gaming and daily life.

VR games utilize the capabilities of Virtual Reality technology, enabling users to engage with specialized VR devices such as headsets, game tools, and in-game weaponry. By donning a VR device, players are completely immersed in a virtual game environment, detached from their physical surroundings. This immersive gameplay offers users new feelings, exhilaration, and an unprecedented level of awe that traditional games were unable to achieve previously.

AR games, similar to VR games, are developed using augmented reality technology. However, unlike VR, these games are predominantly experienced on mobile devices, making them widely popular. Players engage with the game in their real surroundings, with game characters appearing on the smartphone screen alongside the physical environment, creating an exciting and intriguing experience. A notable example is the enduringly popular game Pokemon Go, developed by Niantic, which employs AR technology and features beloved Pokemon characters (Lanham 2017, 8). In Pokemon Go, players can locate, capture, train, and share virtual Pokemon characters within their actual real-life surroundings, using their current physical location as the in-game setting (Image 1).

VR and AR technologies have revolutionized consumer engagement by offering immersive and interactive experiences. In shopping, VR enables virtual try-ons of clothing and accessories, providing a realistic and interactive experience. According to Kipper et al. (2012, 14), currently, an increasing number of brands are capitalizing on the widespread use of mobile phones to incorporate augmented reality (AR) into their marketing campaigns. Leading companies like Nissan, Toyota, BMW, and Mini are utilizing magazine advertisements in conjunction with AR technology to offer viewers a comprehensive 3D experience of the showcased car. Moreover, the film industry has embraced AR as a promotional tool for movies such as Transformers, Iron Man, and Star Trek.

Image 1: Example of VR game - Pokemon GO (Source: Pokemon GO 2023)

3.1.3   Social Media

AI technology plays an important role in the functioning of the social networks that are widely used on a daily basis. Kenyon (2021) highlights several instances where AI is employed across various social media platforms:

- Facebook: Facebook employs AI technology, specifically Deep Text, to analyze user-generated content and gain valuable insights into language usage, slang, abbreviations, and punctuation. Additionally, the platform utilizes AI-driven facial recognition to simplify the process of tagging individuals in photos, enhancing user experience.

- LinkedIn: AI is leveraged by LinkedIn to provide personalized job recommendations, suggest relevant connections for users to connect with, and curate specific posts in their news feeds (Marr 2019, 157).

- Instagram: Instagram leverages big data and AI to enhance user experiences, combat spam, and improve targeted advertising. The platform also utilizes Deep Text to detect and eliminate instances of hate speech and cyberbullying, fostering a safer and more inclusive environment for its users (Marr 2019, 149.)

- Twitter: Twitter utilizes AI to provide users with relevant tweet recommendations and combat the presence of inappropriate comments. The platform employs IBM Watson and NLP (Natural Language Processing) to swiftly analyze millions of offensive and inappropriate messages, ensuring a safer and more positive user experience.

- TikTok: The platform applies AI algorithms to analyze user preferences, behaviors, and engagement patterns to offer personalized video recommendations. Additionally, AI-powered features such as filters, effects, and music suggestions empower content creators to produce captivating and engaging videos (Kang & Lou 2022.)

3.1.4 3D Modeling & Texturing

Using AI for 3D product model generation can save time and reduce costs by automating the process of creating 3D models. It can also improve the accuracy and consistency of the models, which can lead to better product design and showcase. Mattan (2023) highlights several advantages of utilizing AI in the field of 3D modeling:

- Speeding up the modeling process
- Simplifying complex tasks
- Enhancing creativity by generating new design ideas
- Reducing the need for manual intervention
- Making 3D modeling more accessible to non-experts.

3.1.5 Animation

According to AI World School, prior to the integration of AI into animation, the industry relied on labor-intensive methods where animators had to manually draw each frame to create a complete movie or story. This process involved a significant amount of repetitive clicking, overshadowing the creative aspect of the work. However, with the introduction of AI technology, the animation field has experienced significant advancements and attracted a wider range of professionals from various sectors, including industrial sectors, animators, filmmakers, and designers. The availability of AI animation software and AI animation generators has revolutionized the production process, enabling the creation of high-quality animations in a shorter time frame. These advancements have enhanced efficiency and productivity in the field of animation.

AI plays a significant role in enhancing the quality of animation, particularly in post-production and visual effects (VFX) for 3D animation videos. Through the utilization of AI algorithms, large amounts of data, including live-action footage and virtual scene data, can be effectively analyzed and processed. This analysis allows for the generation of lifelike and synthetic visual effects, elevating the overall realism and visual appeal of the animations. AI-driven processes enable the creation of accurate physics-based simulations, such as smoke, fire, water, and other dynamic elements, contributing to more immersive and

captivating VFX experiences. By leveraging AI technology, animators can achieve higher levels of precision and artistic excellence in their work, pushing the boundaries of what is visually achievable in animation (Marr 2019, 157.)

Another advantage of AI in animation is enhancing character creation with AI. Character creation is a time-consuming and complex process that demands considerable expertise and creativity (Duc et al. 2006, 135). However, AI can simplify this process by producing character designs based on designated parameters. This time-saving capability empowers animators to concentrate on fine-tuning and perfecting their characters. One instance is Adobe Character Animator, which employs AI to generate real-time facial animations, enabling animators to craft lifelike and expressive characters with heightened efficiency.

Motion capture is a powerful technique for capturing realistic movement in animation. However, the limitations of traditional motion capture systems can be expensive and time-consuming. Therefore, AI-powered motion capture systems can help streamline this process by reducing the need for specialized equipment and technicians. For example, DeepMotion's AI-powered animation software, Animate 3D, allows users to create realistic motion capture animations using just a standard 2D camera (DeepMotion 2020). This innovation not only simplifies the motion capture process but also makes it more accessible and cost-effective for animators.

Image 2: Example of generating 3D animation from video (DeepMotion 2020)

3.1.6 Graphic Design

AI technology, commonly referred to as sketch-to-art or text-to-image, offers graphic designers a powerful tool for transforming hand-drawn sketches into detailed illustrations across various styles and genres. This technology, exemplified by the remarkable capabilities of DALL-E, enhances the creative work of designers, particularly in the realm of digital artworks. DALL-E's ability to generate original and realistic images and art from text descriptions is truly remarkable (DALL-E). By combining concepts, attributes, and styles, it can create works that are often indistinguishable from those produced by human artists (Alvarez 2023). Leveraging machine learning algorithms and generative models, AI can analyze patterns and styles in existing art to generate new and original pieces (Grimes 2022). The AI algorithm carefully analyzes the hand-drawn sketch, identifies the intended artistic style, and applies suitable color schemes and composition techniques to create visually appealing and harmonious images (Image 3 & 4). Researchers Stancioli & Marques also noted that the use of DALL-E as an image bank resource holds favorable potential for design and advertising companies and agencies. They highlighted the system's extraordinary ability to replicate, transform, and synthesize images, as well as include and exclude elements based on the user's needs. Designers have the flexibility to customize various aspects of the generated artwork, opening up a wide range of possibilities and significantly saving time in the creative process (Stancioli & Marques.)

Image 3: Johnnes Vermeer's A.I.-generated work, "Girl with a Pearl Earring", Mauritshuis, The Hague. Credit.

Image 4: Text to Image (Source: Dall-E)

3.2   Future of AI in Design

Faisal (2022) made several predictions regarding the future of design, which are outlined below:

Firstly, with the advancement of AI in design, designers will transition from being mere creators to becoming curators. They will develop AI systems and train them to solve problems based on various goals and contexts. Designers will set parameters, constraints, and goals for AI models, fine-tune the designs generated by AI, and review them.

Secondly, AI-driven design platforms will make creative intelligence training and human-centered design training accessible to non-professionals. This accessibility will empower non-designers to develop their creativity and design thinking skills, enabling them to engage in design jobs without requiring formal design backgrounds.

Thirdly, there is a demand for specialists. While the barriers to entering the design profession may decrease with AI-driven tools, the demand for skilled designers will rise. Although amateur designers can quickly generate numerous design variations using AI, experienced designers will be needed to review and select the designs that best fit the context.

Lastly, the future of design will heavily involve working with AR/VR. The growth of AR/VR technologies will create a demand for specific skills in designing for virtual experiences. AI engines may not fully fulfill the challenges associated with virtual reality interactions and curating virtual experiences, making human designers essential in this domain.

3.3   AI-Driven vs Human-Powered design

Differentiating between AI-driven design and human-powered design can be challenging but important for understanding the underlying approaches. Some ways to recognize AI-driven design:

- Perfect Symmetry: AI algorithms tend to create designs with flawless symmetry, where elements are perfectly aligned and balanced. This precision and symmetry can be indicative of AI involvement in the design process (Mchunu 2023.)
- Same patterns: AI design follows a consistent pattern in processing various elements (Wilson 2023).
- Lack of Imperfections: AI-generated designs often lack the imperfections and subtle variations typically seen in human-designed work. The designs may appear too

precise, consistent, and mechanically flawless, lacking the organic touch of human creativity (Weber et al. 2023.)

- Repetitive Elements: AI algorithms can produce designs that feature repetitive elements, such as shapes, colors, or compositions. If we notice consistent patterns or recurring motifs throughout the design, it could indicate AI involvement (Weber et al. 2023.)

- Optimized for Metrics: AI-driven designs may prioritize optimization for specific metrics, such as visual appeal or engagement, rather than subjective or contextual considerations. This focus on data-driven optimization can result in designs that lack the nuanced understanding of human emotions or cultural context.

- Poor resolution and little detail: AI-generated designs and artworks are commonly characterized by low resolution and a lack of intricate details (Wilson 2023).

- Identifying various AI styles: AI image generators possess the capability to emulate diverse styles, including specific illustration styles or the distinctive approaches of renowned painters. Nevertheless, by default, these tools often exhibit a recognizable style that can be discerned by those familiar with them (Ivanovs 2023.)

4 Research Methodology

4.1 Research method

The research method for the thesis is qualitative, which involves employing various qualitative research methods to investigate and understand the intricacies of human behavior, opinions, and experiences. According to Creswell (2014), qualitative research focuses on exploring the underlying reasons, motivations, and meanings attributed to certain phenomena or events, providing valuable insights that quantitative methods may not capture. It emphasizes in-depth exploration and analysis of data collected through techniques such as interviews, observations, and textual analysis. Qualitative research allows for a rich and nuanced understanding of human perspectives and provides a deeper exploration of complex research questions.

The thesis will employ two qualitative research methods, namely a literature review and a survey, to address the research questions:

- What main benefits does AI bring to design?
- What are the main risks and limitations of AI in the design industry?
- Is designer be replaced by AI?
- What skills or qualities do you think designers need to develop to protect themselves against AI?

4.1.1 Literature Review

The nature of a literature review can vary depending on its purpose and serves multiple functions. According to Wang (2016, 59), one of these functions is to facilitate exploration and learning. Reviewing past and current research helps bring clarity to the research topic, and studying books and research papers provides a foundation for generating research questions. Intensive reading enables researchers to accumulate knowledge, offering not only comprehensive background information on the topic but also suggesting possible research approaches. In the context of this thesis, several topics were initially identified and discussed separately in the theory section. Subsequently, the interrelationships among these topics were explained.

4.1.2 Survey

The survey method is a widely used research technique that involves collecting data from a targeted group of individuals to gather information and insights on specific topics. Surveys typically consist of a series of questions, which can be administered in various formats such

as online questionnaires, telephone interviews, or in-person interviews (Sue & Ritter 2016). This method allows researchers to gather data from a large number of participants efficiently and quickly. Surveys are versatile and can be used in a wide range of fields, including social sciences, market research, and public opinion polling (Ball 2019). The survey method is an effective tool for understanding attitudes, opinions, behaviors, and characteristics of a target population, making it a valuable resource for researchers and decision-makers in various fields.

Survey questions can be categorized into two main formats: open-ended and closed-ended. In this study, an open-ended question format was utilized for the survey. The use of open-ended questions offers an advantage as it allows respondents to provide unrestricted responses without being constrained by predetermined answer options (Dillman et al. 2014, 110.)

The main goal of the survey is to gather a wide range of perspectives and approaches regarding the impact of AI on professional designers. It aims to gain an understanding of designers' thoughts and opinions on the integration of AI in design processes. Additionally, the survey intends to capture the participants' personal views on the impact they have encountered in their design careers due to AI. Furthermore, the survey also seeks participants' opinions on whether they believe AI has the potential to replace designers.

4.1.3 How the surveys were conducted

The four surveys were conducted using email as the virtual platform. The participants of the survey are seasoned professionals in the design industry, including graphic designer, art director, digital artist, and storyboard artist based in Vietnam. Moreover, they are actively engaged in teaching graphic design at various educational institutions and training centers in Vietnam. With their substantial experience and dual roles as both educators and practitioners, they bring valuable contributions to the study, providing insightful perspectives and drawing from their extensive knowledge and expertise in the field of design.

The survey questions are divided into two parts. The first part aims to gather general information about the participants' backgrounds and their experience in the creative field, as well as their familiarity with AI technology. The second part is designed to delve into the personal views and thoughts of designers regarding the impact of AI tools on their work processes and careers. Through their responses, the aim is to draw conclusions about designers' expectations regarding new AI design technology tools, their potential benefits and drawbacks, and how they may influence traditional design processes and the future of

the field. By doing so, designers can harness the opportunities presented by these new AI design tools while also addressing the challenges they may pose.

The table provided (Table 1) contains a list of participants. However, to protect their privacy, specific details such as names and other personal information have been excluded.

Table 1: Participants' Profile

Respondent	Job Title	Experience in field	Gender	Age
R1	Graphic Designer, Creative Director, Teacher	15 years	M	30-40
R2	Graphic Designer, Game Artist, Teacher	9 years	M	30-40
R3	Storyboard Artist Character Design Teacher	18 years	M	40-50
R4	UI/UX Designer	7 years	M	30-40

4.2   Data analysis

4.2.1   Literature Review Analysis

To conduct the literature review, databases and virtual search tools were utilized to search for specific keywords like AI and design, exploring various combinations of these keywords. The author compiled a list of relevant results, which can be found in the references section, and then categorized them based on their usefulness and subjects, such as an overview of AI or the impact of AI in design. Next, this information was gathered, organized and imported into a note-taking tool to identify similar points across different books, articles, and studies. These findings formed the basis of the theoretical framework for this thesis. Additionally, the author extensively read several books to enhance my overall understanding of the field and concepts before commencing the data collection phase. This ensured a comprehensive grasp of the subjects and facilitated smoother discussions throughout the thesis.

4.2.2 Survey Analysis

After conducting the surveys, the four transcript documents were merged into a single document. To facilitate the analysis process, different subjects such as Benefits and Limitations were identified within the surveys and assigned distinct colors to visually group them together. This color-coded approach helped in organizing the responses based on their corresponding subjects. Once the responses were grouped, a summary was created to capture the key information and insights contained within each subject. This summary provided a concise overview of the main points raised by the participants. Additionally, the grouped responses were further examined and analyzed based on their subjects to derive meaningful conclusions. By organizing the data in this manner, it became easier to identify patterns, common themes, and noteworthy perspectives across the survey responses. This systematic approach allowed for a comprehensive analysis of the data, ultimately leading to informed conclusions based on the collected information

5 Results

This chapter presents the findings and results from both the literature review and the survey conducted for this research. As mentioned in section 1.3, the main objective of the study is to investigate the current and future landscape of AI in digital design and address the following research questions:

5.1 What benefits does AI bring to design?

5.1.1 Save time

The utilization of AI in design offers significant advantages, including time savings. By harnessing AI algorithms, designers can generate multiple design variations quickly by extracting colors and patterns from the original design (Rafay 2021). This is particularly beneficial for product design creation, where abstract patterns and brand colors can be identified, enabling AI to generate a diverse range of distinctive designs within the desired aesthetic domain. AI not only helps overcome creative blocks but also provides abundant aesthetic options, making the selection process easier for designers and clients.

The time-saving potential of AI in design is crucial in optimizing resources and fostering innovation (Watkins 2023). AI, exemplified by tools like Midjourney, accurately identifies aesthetics and styles, producing impressive results when given specific design requests (Nicolaus 2023). Similarly, ChatGPT empowers designers to streamline workflows in tasks such as formulating marketing ideas, writing blog posts, and creating engaging social media content. The application of AI in marketing addresses the demand for substantial amounts of diverse content within time and resource constraints.

All four expert respondents in the survey addressed the significant advantage of time savings when using AI in design, particularly during the conceptual process. AI design technology plays an important role in swiftly transforming abstract ideas into tangible visual representations, expediting the overall production process. By leveraging AI algorithms and tools, designers can efficiently explore and iterate on design options, enhancing productivity and project outcomes. The time efficiency gained in the conceptual phase allows designers to allocate more resources to other critical aspects of the design process, ultimately streamlining and optimizing the overall workflow.

5.1.2 "Anyone can draw"

According to Expert 1, another significant advantage of using AI in design is:

> *Its ability to overcome the limitations often faced by designers. AI has the potential to remove constraints related to hand-drawing skills, extensive research, and specialized design tools.*

This inclusive approach allows anyone, regardless of their artistic background or expertise, to engage in drawing and design activities. By leveraging AI, individuals can access user-friendly tools and functionalities that facilitate the creation of designs, expanding creative possibilities for a broader range of users (Aela 2023). AI-powered visual programs like Dall-E and Midjourney have transformed the design landscape by instantly generating high-quality imagery that is truly remarkable. These programs are designed to be accessible and affordable, making them widely available to users. Midjourney, in particular, has gained recognition for its exceptional ability to generate hyper-realistic imagery across various styles, impressing both illustrators and photographers. One remarkable aspect of AI design is its empowerment of non-designers to create captivating designs. Tools like Midjourney allow anyone to generate compelling designs by simply providing text prompts. The efficiency of AI in generating illustrations and artwork is unparalleled, delivering quick and impressive results. Compared to manual creation, which would require significant time and effort, AI design offers accessibility and speed.

The accessibility and speed of AI design enable non-designers to engage in the creative process and produce professional-looking designs with ease. This not only expands the possibilities for individuals without traditional design skills but also accelerates the design process for experienced designers. AI serves as a valuable tool that enhances creativity, facilitates experimentation, and enables users to bring their ideas to life more efficiently than ever before.

5.2 What are the main risks and limitations of AI in the design industry?

5.2.1 The precision problem

According to Expert 3 and 4, one of the significant limitations of AI design is the precision problem. Expert 3 said:

> *The restrictions in design language, style, color, light, layout, shaping, anatomy, and logic can pose challenges for AI design software. As a result, AI-driven designs may lack accuracy and coherence, resulting in messy compositions. Despite the speed at*

which AI can generate designs, it may still behave like a machine and struggle to meet the desired standards.

This limitation is particularly relevant for design applications where precision is critical, such as architecture, industrial design, or medical illustrations. These fields often demand a deep understanding of complex design principles and meticulous attention to detail, which AI algorithms may currently struggle to replicate. Human designers with expertise in these areas can bring a level of precision and craftsmanship that is currently difficult for AI to match.

5.2.2 Lack of creativity and emotion

According to Acscreative (2023), AI predominantly relies on pre-existing data and patterns to generate designs. While this can be efficient and produce satisfactory results in certain cases, it lacks the ability to truly think outside the box and offer fresh, unconventional ideas. The human element in design adds the potential for serendipity and unexpected discoveries that can lead to groundbreaking and impactful designs.

Makin (2023) also addressed that while AI can generate unique and original designs, it may fall short in capturing the emotional and cultural context that human designers can seamlessly incorporate into their work. Design applications like branding and identity often demand a human touch to effectively convey a brand's values and personality (Kimp 2023). Human designers possess the understanding and sensitivity to interpret and incorporate nuanced emotions, cultural nuances, and subtle details that contribute to creating a strong and resonant brand image. They are able to infuse designs with the desired emotional impact and ensure they align with the brand's identity. While AI can assist in generating design options, the human element remains crucial in effectively conveying the essence and depth required for certain design applications. Expert 1 said:

I never thought about AI would help me or my colleagues be more creative in their work.

Expert 1 expressed a belief that AI design does not contribute to enhancing his creativity or that of his colleagues. While AI design may offer certain advantages and benefits, it does not seem to have a significant impact on fostering creativity in their specific work context. Although AI design tools may provide efficiency and assist in certain aspects of the design process, they may not stimulate or inspire the same level of creativity as human designers. The personal and imaginative aspects of creativity are still seen as distinct strengths of human designers in their work context.

Expert 2 stated:

> *AI tends to heavily follow prevailing visual styles by utilizing popular images as source material and generating secondary images of its own. While AI products may possess high quality, they are often associated with the label "AI" due to their origin and style.*

According to Expert 2, AI design often relies on popular images as a reference or starting point and generates new images based on those references. AI algorithms analyze existing visual styles and trends in order to produce designs that align with what is currently popular. While the quality of the generated designs may be high, they are often identified as being created by AI due to their origin and the characteristic style they exhibit. In other words, AI designs are often recognized as such because they closely resemble the style and aesthetics associated with AI-generated content rather than being perceived as products of unique and original creative expression.

5.2.3   Image copyright

The use of AI in art creation raises concerns related to privacy and data security. Expert 2 highlighted the issue of image copyright, particularly when AI utilizes internet-sourced images without obtaining the author's permission. This raises concerns about potential copyright infringement. Moreover, if the AI-generated output contains copied elements, it may also face copyright issues.

There have been cases where artists have claimed that AI has replicated their design work without permission, which has contributed to a negative perception of AI within the design community. This raises questions about the ethics and legality of AI-generated art. In the beginning of 2023, a collective of artists initiated a lawsuit against Midjourney and Stability AI, alleging copyright infringement. These companies had trained their AI systems using an extensive collection of internet images, and the lawsuit argues that the rights of numerous artists who originally created those images were violated. Determining whether AI art tools breach copyright law can be complex, especially considering the vastness of the training database comprising billions of images. However, it is evident that these AI tools generate new images based on the knowledge they acquire through the training proces (Babich & Kuznetsov 2023.)

Expert 1 said:

> *The problem of identity is the fact that many works of famous artists have been learned and created by AI, while carrying the right spirit and body of that artist, causing Google to misidentify, and give results in false suggestions, then in the long run,*

official information, original information, author's identity will be shaken. (Ex: Edward Hopper)

According to Expert 1, the problem of identity in relation to AI-generated design. As AI learns and replicates the works of famous designers and artists, there is a risk of misidentifying the original artists and presenting false suggestions. This can potentially undermine the authenticity and originality of art, as well as raise questions about the author's identity. The example of Edward Hopper illustrates how AI-generated designs can lead to confusion and potential implications for the recognition and reputation of artists.

These concerns highlight the importance of addressing privacy, data security, and copyright issues in the use of AI in art creation. It is crucial to ensure ethical practices and respect for intellectual property rights to maintain the integrity of the art community and protect artists' and designers' work.

5.3 Is designer be replaced by AI?

According to the experts' opinions, there are varying perspectives on whether AI can replace designers in the future:

Expert 1 expressed:

Possibly, if designers consider AI their best tool, and allow AI to take their place.

According to Expert 1, the possibility of AI replacing designers depends on the mindset and acceptance of designers themselves. If designers view AI as their best tool and willingly embrace its capabilities, they may pave the way for AI to take over certain aspects of their work. This perspective suggests that designers have agency in determining the relationship between AI and their role in the design process. It implies that designers can choose to leverage AI as a complementary tool or even delegate certain tasks to AI, potentially leading to a shift in the division of labor between humans and AI in the design industry. However, it's important to note that this perspective may not be shared by all designers, as opinions on the role of AI in design can vary widely.

Expert 2 believed:

While AI will not completely replace designers, there is a possibility that AI may replace certain aspects of their work due to its superior performance and speed. From this perspective, it can be argued that AI has the potential to replace emerging designers in the industry.

Creative work and visual design that doesn't need to be highly detailed are now fully possible with AI. The designers who specialize in these jobs are severely affected.

It is difficult for AI to completely replace designers; however, the arrival of AI will bring about significant changes in the work of designers and content creators.

This viewpoint acknowledges that AI can be a powerful tool in specific areas but may not completely replace designers. However, there is a concern that emerging designers in the industry might be more susceptible to being replaced by AI.

Expert 3 stated:

It is difficult to make definitive predictions about the future of AI and its potential to replace humans. But in my opinion, it is highly unlikely that AI will be able to fully replace humans in various domains. Humans will continue to be the masters of everything.

The viewpoint shared by Expert 3 emphasizes the unique qualities and capabilities that humans possess, such as creativity, critical thinking, intuition, and the ability to understand complex emotions and cultural contexts. These aspects of human intelligence and expertise are often seen as integral to the design process.

While AI can assist and augment the work of designers, it may not possess the same depth of understanding, originality, and human touch that designers bring to their craft. The subjective nature of design, the need for empathy and intuition, and the ability to navigate complex design challenges are areas where human designers excel.

Expert 4 said:

Teams and people who have critical thinking skills, or simply possess a high level of meticulousness and care, are difficult to replace.

Expert 4 believed that designers who possess critical thinking skills, meticulousness, and care bring unique value to their work. Their ability to think critically, pay attention to detail, and approach their work with care sets them apart and makes them difficult to replace in the design industry.

The experts from the theoretical part of the research have reached a unanimous conclusion regarding the main question of whether AI can replace designers in the future. Their collective answer is a resounding "no" at least not at present or in the near future. This consensus suggests that, based on their knowledge and analysis, AI is not currently capable of fully replacing designers in their various roles and responsibilities.

Kuznetsov and Babich (2023) argued that the current situation regarding the integration of AI in business follows a predictable pattern. They believe that businesses naturally seek more effective approaches to save costs. Drawing parallels to the industrial revolution, they mention how some textile workers in the 19th century feared being replaced by machines and even destroyed them. However, they point out that machines only replaced certain roles that involved heavy lifting or monotonous work, rather than replacing humans altogether. They extend this perspective to AI tools, stating that AI will not completely replace human ingenuity but rather complement human potential. According to them, the true power of AI lies in its ability to greatly enhance productivity, rather than replacing humans entirely.

Date from Etude Digital addressed that there is no doubt that AI can outperform humans in certain specific tasks with greater efficiency. However, there are aspects such as creativity, problem-solving, and human connection that are challenging to replace. Despite AI's capabilities, these human qualities and abilities play a crucial role in various domains and cannot be easily replicated by AI systems.

According to Aireplacing, while AI has the potential to revolutionize the industry and enhance the work of human designers, it is unlikely that AI will completely replace them in the near future. This is due to the immense value of human creativity and emotional intelligence, which cannot be overlooked. These distinctively human qualities hold significant importance in the field of graphic design and are not easily replaceable by AI. The combination of AI technology and human capabilities is expected to work in harmony, with AI augmenting and supporting the work of designers rather than entirely replacing them.

5.4 What skills or qualities do you think designers need to develop to protect themselves against AI?

When inquired about measures designers should take to safeguard themselves against AI. Expert 2 said:

> *Determining the optimal course for designers is currently difficult due to the early stage of AI development. AI is rapidly evolving, with each passing month bringing improvements, new functionalities, and the replacement of additional tasks.*

> *Personally, I believe that designers (or most people) should begin learning to utilize AI as a means of safeguarding their future. And make sure that, if everyone uses AI, then they (Designers, Digital artists, Content creators...) should be better users than their customers.*

According to Expert 2, determining the optimal course for designers in relation to AI is currently challenging due to the early stage of AI development. AI technology is rapidly evolving, with regular improvements, new functionalities, and the potential to replace additional tasks. Given this dynamic landscape, it can be difficult for designers to anticipate the exact impact of AI on their work. However, expert 2 suggests that designers, and most people in general, should start learning how to utilize AI as a way to safeguard their future. By becoming proficient users of AI tools and technologies, designers can ensure that they remain valuable and relevant in a changing industry. The idea is that if everyone is using AI, designers should aim to be better users than their customers, leveraging AI in ways that enhance their creative abilities and deliver unique value to clients.

On the other hand, Expert 3 emphasized that if designers want to secure their roles and careers in the face of AI:

> *You must be highly skilled and professional, as any inadequacy will naturally be filtered out.*

Expert 3 believed that any inadequacy or lack of expertise will naturally be filtered out in a competitive environment. This perspective highlights the importance of continuous learning, honing one's skills, and staying up to date with advancements in both design and AI technologies.

Both experts recognize the evolving nature of AI and its potential impact on the design industry. They suggest that designers should proactively adapt to this changing landscape by acquiring AI-related skills and being highly skilled professionals to thrive alongside AI rather than being replaced by it. By staying ahead of the curve and embracing the possibilities that AI offers, designers can position themselves for success in the future. On the other hand, Expert 1 expressed his opinion:

> *I have a concept about doing creative design, I would like to quote an excerpt from my favorite film Dead Poets Society: "We don't read and write poetry because it's cute. We read and write poetry because we are members of the human race. And the human race is filled with passion. And medicine, law, business, engineering, these are noble pursuits and necessary to sustain life. But poetry, beauty, romance, love, these are what we stay alive for." So if we over-exploit Ai in our creative work, we have no reason to do it.*

Expert 1 highlighted the importance of art and design in our lives. He emphasized that our engagement with art and design goes beyond mere aesthetic appeal or superficial enjoyment. As members of the human race, we are inherently driven by passion and

emotions, and art and design serve as powerful mediums to express and experience these aspects of our humanity. While professions like medicine, law, business, and engineering are essential for our survival and practical needs, it is through art, beauty, romance, and love that we find deeper fulfillment and meaning in life. Art and design awaken our senses, ignite our imaginations, and provide avenues for creativity and self-expression. They enrich our lives, evoke emotions, and inspire us to appreciate the beauty and richness of the world around us. In this way, art and design play a crucial role in nourishing our souls and reminding us of the profound aspects of our existence that go beyond the practicalities of everyday life.

6 Discussion and Conclusion

6.1 Discussion

Throughout the theoretical study and expert surveys, it is evident that AI brings significant benefits to the design field. It can enhance efficiency, automate certain tasks, and offer new possibilities for designers. However, it is important to recognize the limitations of AI. AI lacks the innate creativity, emotional intelligence, and cultural context that human designers possess. Designers should not view AI as a threat to their profession but rather as a tool to augment their work.

To protect themselves against the potential challenges posed by AI, designers should focus on developing complementary skills that AI cannot replicate. They should invest in areas such as creativity, empathy, and critical thinking. By nurturing these skills, designers can bring a unique perspective and human touch to their designs, setting themselves apart from AI-generated designs. Staying informed about AI advancements and embracing collaboration with AI technologies is crucial. Designers should actively explore AI-driven design tools and applications, understanding their capabilities and limitations.

6.2 Recommendations for further research

This research study focused on the impact of AI in the field of design, highlighting various opportunities and challenges from a specific perspective. However, it is important to acknowledge that the small sample size of only four participants may not fully represent the diverse range of viewpoints within the entire industry. Additionally, the use of AI design tools can vary significantly across designers and companies due to differences in operating policies, visions, and values. Furthermore, it is worth noting that the research primarily concentrated on the digital design industry and did not explore the potential impact of AI in other creative sectors.

Considering the rapid pace of technological advancements, it is challenging to accurately predict the future directions of AI in design and how it will be adopted and utilized by companies and designers across different creative industries. Therefore, the conclusions drawn in this research are based on the author's personal perspective and informed assumptions.

To further enhance our understanding, future research endeavors could delve into the long-term consequences of AI on the design industry, particularly in relation to the role of designers and the potential displacement of jobs. Conducting studies with a larger and more diverse sample size of participants, along with conducting in-depth surveys and interviews,

could provide a more comprehensive and nuanced understanding of the perspectives held by designers in the industry. Such research efforts would contribute to a more informed and holistic assessment of the impact of AI on the design profession.

6.3   Evaluation

Throughout my research journey on the impact of AI in design, I have acquired valuable knowledge and gained profound insights. It has been an ongoing process of learning and exploration. A significant finding from this research is the increasing importance of AI in shaping the design landscape. I have gained an understanding of the diverse applications of AI in design. Furthermore, I have deepened my comprehension of the opportunities and challenges that AI presents to designers. This research has broadened my perspective on how AI can enhance creativity, streamline processes, and optimize user experiences. It has also emphasized the significance of maintaining a harmonious balance between human creativity and the capabilities of AI technologies.

My thesis supervisor has played a pivotal role in guiding and supporting me throughout the research process. His expertise and knowledge in the field of AI and design have been instrumental in providing valuable insights and direction to my research. Whenever I faced challenges or had questions, he was readily available to offer guidance and clarification. His constructive feedback and suggestions have helped me refine my research methodology, strengthen my arguments, and ensure the quality of my work. His support and mentorship have been invaluable in shaping the trajectory of my research and enabling me to achieve a clear direction and focus. I am sincerely grateful for his contributions to my thesis journey.

References

Acscreative. 2023. Why AI will never replace creative design. Retrieved on 7 May 2023. Available at https://www.acscreative.com/insights/why-ai-will-never-replace-creative-design/

Aela, E. 2023. Artificial Intelligence: How AI is Changing Art. Retrieved on 6 May 2023. Available at https://aelaschool.com/en/art/artificial-intelligence-art-changes/

Aggarwal, C. 2021. Branding and ai : Leveraging technology to generate brand revenue. Business Expert Press. Retrieved on 10 May 2023. Available at https://ebookcentral.proquest.com/lib/lab-ebooks/reader.action?docID=6658957&ppg=151

AI Animation: Pushing the bounds of creativity. AI World School. Retrieved on 21 May 2023. Available at https://aiworldschool.com/research/ai-arts-3/

Aireplacing. Will AI replace graphic designers? The future of graphic design. Retrieved on 10 May 2023. Available at. https://aireplacing.com/graphic-designers/

AI, H. K., & Sinha, S. 2020. Reimagining businesses with AI. John Wiley & Sons, Incorporated. Retrieved on 1 May 2023. Available at https://ebookcentral.proquest.com/lib/lab-ebooks/reader.action?docID=6356192&ppg=19

Alvarez, I. 2023. DALL-E And The Future Of Art. Retrieved on 17 May 2023. Available at https://apiumhub.com/tech-blog-barcelona/dall-e-and-the-future-of-art/

Aswal, P. 2022. AI Revolution In Design. Retrieved on 14 May 2023. Available at https://www.iiad.edu.in/the-circle/ai-revolution-in-design/

Babich, N & Kuznetsov, G. 2023. How AI Technology Will Transform Design. Retrieved on 7 May 2023. Available at https://www.smashingmagazine.com/2023/03/ai-technology-transform-design/

Baker, P. 2023. Chatgpt for dummies. John Wiley & Sons, Incorporated. Retrieved on 7 May 2023. Available at https://lut.primo.exlibrisgroup.com/permalink/358FIN_LUT/b5ag28/alma992087920806254

Baker, P. 2023. Chatgpt for dummies. John Wiley & Sons, Incorporated. Retrieved on 2 May 2023. Available at https://lut.primo.exlibrisgroup.com/permalink/358FIN_LUT/b5ag28/alma992087920806254

Ball, H. 2019. Conducting Online Surveys. Journal of Human Lactation, 35(3), 413–417. Retrieved on 17 May 2023. Available at https://lut.primo.exlibrisgroup.com/discovery/fulldisplay?vid=358FIN_LUT:LAB&search_sc ope=LAB_CAMPUS_CDI&tab=Everything&docid=cdi_proquest_miscellaneous_22320249 92&lang=en&context=PC&adaptor=Primo%20Central&query=any,contains,Conducting%2 0Online%20Surveys

Batat, W. 2022. Strategies for the Digital Customer Experience: Connecting Customers with Brands in the Phygital age. Edward Elgar Publishing Limited. Retrieved on 11 May 2023. Available at https://lut.primo.exlibrisgroup.com/permalink/358FIN_LUT/b5ag28/alma99138046540625 4

Bektic, Bruns, D., Gabriel, S., Kelle, F., Pölsterl, G., & Schniz, F. 2020. Mixed Reality and Games Theoretical and Practical Approaches in Game Studies and Education (Bektic, D. Bruns, S. Gabriel, F. Kelle, G. Pölsterl, & F. Schniz, Eds.; 1st ed.). transcript Verlag. https://doi.org/10.14361/9783839453292. Retrieved on 4 May 2023. Available at https://lut.primo.exlibrisgroup.com/permalink/358FIN_LUT/b5ag28/alma99204843590625 4

Boden, M. A. 2016. Ai: Its nature and future. Oxford University Press, Incorporated. Retrieved on 6 May 2023. Available at https://ebookcentral.proquest.com/lib/lab-ebooks/reader.action?docID=4545415&ppg=13

Burnett, S. 2022. The autonomous enterprise: Powered by ai. BCS Learning & Development Limited. Retrieved on 13 May 2023. Available at https://lut.primo.exlibrisgroup.com/permalink/358FIN_LUT/b5ag28/alma99207959150625 4

Bustamante, D. 2023. Designing with Prompts: AI's Impact on the Creative Process. Retrieved on 15 May 2023. Available at https://www.reaktor.com/articles/designing-with-prompts-ai-s-impact-on-the-creative-process

Coveyduc & Anderson, J. L. 2020. Artificial intelligence for business : a roadmap for getting started with AI. Wiley. Retrieved on 10 May 2023. Available at Retrieved on 10 May 2023. Available at https://ebookcentral.proquest.com/lib/lab-ebooks/reader.action?docID=6173699&ppg=47

Creswell, J. 2014. Research Design : Qualitative, Quantitative, and Mixed Methods Approaches. 4th ed., international student ed. Thousand Oaks: SAGE Publications, 2014. Print. Retrieved on 16 May 2023. Available at

https://lut.primo.exlibrisgroup.com/permalink/358FIN_LUT/b5ag28/alma99138046540625
4

Date, K. Can Artificial Intelligence Replace Designers? Retrieved on 10 May 2023. Available at https://etude.digital/quick-reads/can-artificial-intelligence-replace-designers/#article

Dillman, D. A., Smyth, J. D., & Christian, L. M. 2014. Internet, phone, mail, and mixed-mode surveys: The tailored design method. John Wiley & Sons, Incorporated. Retrieved on 17 May 2023. Available at https://lut.primo.exlibrisgroup.com/permalink/358FIN_LUT/b5ag28/alma99194913500625 4

Duc, D. A., Dong, T. T. B., Ho, T., & Nguyen, D. T. (Eds.). 2006. Ictacs 2006 – proceedings of the first international conference on theories and applications of computer science 2006: The first international conference on theories and applications of computer science 2006. World Scientific Publishing Company. Retrieved on 9 May 2023. Available at https://lut.primo.exlibrisgroup.com/permalink/358FIN_LUT/1hujjmv/cdi_proquest_ebookce ntralchapters_1681080_78_148

Duggle, N. 2023. Advantages and Disadvantages of Artificial Intelligence. Retrieved on 14 May 2023. Available at https://www.simplilearn.com/advantages-and-disadvantages-of-artificial-intelligence-article

Faisal, F. 2022. How design will fare in the age of AI. Retrieved on 21 May 2023. Available at https://readwrite.com/how-design-will-fare-in-the-age-of-ai/

Fan, S. 2019. Will AI Replace Us?: A primer for the 21st century. Thames & Hudson, Limited. Retrieved on 10 May 2023. Available at https://ebookcentral.proquest.com/lib/lab-ebooks/reader.action?docID=6676466&ppg=1

Grimes, B. 2022. What is DALL-E? How it works and how the system generates AI art. Retrieved on 17 May 2023. Available at https://interestingengineering.com/innovation/what-is-dall-e-how-it-works-and-how-the-system-generates-ai-art

Ivanovs, A. 2023. 5 Tips for Detecting an Image Generated by AI. Retrieved on 10 May 2023. Available at. https://stackdiary.com/ai-image-detection/

Kang, H. & Lou, C. 2022. AI agency vs. human agency: understanding human–AI interactions on TikTok and their implications for user engagement. Journal of Computer-Mediated Communication, 27(5). https://doi.org/10.1093/jcmc/zmac014

Karaata, E. 2018. Usage of Artificial Intelligence in Today's Graphic Design. Retrieved on 10 May 2023. Available at

https://www.researchgate.net/publication/331431169_Usage_of_Artificial_Intelligence_in_Today's_Graphic_Design

Kelly, J. 2023. Goldman Sachs Predicts 300 Million Jobs Will Be Lost Or Degraded By Artificial Intelligence. Retrieved on 15 May 2023. Available at https://www.forbes.com/sites/jackkelly/2023/03/31/goldman-sachs-predicts-300-million-jobs-will-be-lost-or-degraded-by-artificial-intelligence/

Kenyon, T. 2021. How are social media platforms using AI?. Retrieved on 10 May 2023. Available at https://aimagazine.com/ai-strategy/how-are-social-media-platforms-using-ai?utm_source=pocket_reader

Kimp 2023. AI Graphic Design Vs. Working With Designers: The Future of Graphic Design. Retrieved on 10 May 2023. Available at https://www.kimp.io/ai-graphic-design/?utm_source=pocket_reader#g3a801f9f9b91

Kipper, G., Rampolla, J., Kipper, G., & Rampolla, J. 2012. Augmented reality: An emerging technologies guide to ar. Elsevier Science & Technology Books. Retrieved on 13 May 2023. Available at https://ebookcentral.proquest.com/lib/lab-ebooks/reader.action?docID=1073012&ppg=32

Kipper, G., Rampolla, J., Kipper, G., & Rampolla, J. 2012. Augmented reality : An emerging technologies guide to ar. Elsevier Science & Technology Books. Retrieved on 10 May 2023. Available at https://ebookcentral.proquest.com/lib/lab-ebooks/reader.action?docID=1073012&ppg=32

Kuznetsov, K & Babich, N. 2023. How AI Technology Will Transform Design. Retrieved on 12 May 2023. Available at. https://www.smashingmagazine.com/2023/03/ai-technology-transform-design/

Lanham, M. 2017. Augmented reality game development: Create your own augmented reality games from scratch with unity 5. Packt Publishing, Limited. Retrieved on 12 May 2023. Available at https://ebookcentral.proquest.com/lib/lab-ebooks/reader.action?docID=4790570&ppg=20

Lanham, M. 2017. Augmented reality game development: Create your own augmented reality games from scratch with unity 5. Packt Publishing, Limited. Retrieved on 10 May 2023. Available at https://ebookcentral.proquest.com/lib/lab-ebooks/reader.action?docID=4790570&ppg=20

Liu, Lulu, & Minh Tien Nhung. 2022. The Application of VR/AR Technology in Graphic Design Based on zSpace. Wireless communications and mobile computing, 2022, 1–7.

Web. Retrieved on 20 May 2023. Available at https://lut.primo.exlibrisgroup.com/permalink/358FIN_LUT/b5ag28/alma99138046540625 4

Lowe, A., & Lawless, S. 2021. Artificial intelligence foundations: Learning from experience. BCS Learning & Development Limited. Retrieved on 3 May 2023. Available at https://ebookcentral.proquest.com/lib/lab-ebooks/reader.action?docID=6480997&ppg=32

Makin, S. 2023. Will AI replace Graphic Designers? Retrieved on 14 May 2023. Available at https://www.linkedin.com/pulse/ai-replace-graphic-designers-sean-makin/?utm_source=pocket_reader

Margie, M. 2020. AI in Talent Development. Association for Talent Development. Retrieved on 4 May 2023. Available at https://lut.primo.exlibrisgroup.com/permalink/358FIN_LUT/1hujjmv/cdi_safari_books_v2_9 781950496327

Marr, B. 2019. Artificial Intelligence in Practice: How 50 Successful Companies Used AI and Machine Learning to Solve Problems, John Wiley & Sons, Incorporated. Retrieved on 16 May 2023. Available at https://ebookcentral.proquest.com/lib/lab-ebooks/reader.action?docID=5751846

Mchunu, S. 2023. How to Detect AI Content in 2023. Retrieved on 10 May 2023. Available at https://www.webfx.com/blog/content-marketing/how-to-detect-ai-content/

Millington, I. 2021. Ai for games. Taylor & Francis Group. Retrieved on 16 May 2023. Available at https://ebookcentral.proquest.com/lib/lab-ebooks/reader.action?docID=6716328&ppg=12

Narayan, R. 2021. Multiply your business value through brand and ai. Business Expert Press. Retrieved on 7 May 2023. Available at https://ebookcentral.proquest.com/lib/lab-ebooks/reader.action?docID=6679897&ppg=49

Patrick D. Smith. 2018. Hands-on artificial intelligence for beginners: an introduction to AI concepts, algorithms, and their implementation (1st edition). Packt. Retrieved on 3 May 2023. Available at https://lut.primo.exlibrisgroup.com/permalink/358FIN_LUT/b5ag28/alma99204009490625 4

Philips, M. 2018. The present and Future od AI in Design. Retrieved on 10 May 2023. Available at https://www.toptal.com/designers/product-design/infographic-ai-in-design

Pixel, P. 2023. Impact of AI on Graphic Design: Better Than Human?. Retrieved on 16 May 2023. Available at https://pivotedpixel.com/graphic-design/impact-of-ai-on-graphic-design/

Pradeep, A. K., Appel, A., & Sthanunathan, S. 2018. Ai for marketing and product innovation: Powerful new tools for predicting trends, connecting with customers, and closing sales. John Wiley & Sons, Incorporated. Retrieved on 8 May 2023. Available at https://ebookcentral.proquest.com/lib/lab-ebooks/reader.action?docID=5612944&ppg=29

Rafay, A. 2021. Understanding the Impact of Artificial Intelligence on the Design Industry. Retrieved on 4 May 2023. Available at https://readwrite.com/understanding-the-impact-of-artificial-intelligence-on-the-design-industry/

Rahman, W. 2020. AI and machine learning. SAGE Publications India Pvt, Ltd. Retrieved on 5 May 2023. Available at https://ebookcentral.proquest.com/lib/lab-ebooks/reader.action?docID=6304323&ppg=51

Rahman, W. 2020. Retrieved on 10 May 2023. Available at Ai and machine learning. SAGE Publications India Pvt, Ltd. Retrieved on 17 May 2023. Available at https://ebookcentral.proquest.com/lib/labebooks/reader.action?docID=6304323&ppg=107

Stancioli, A & Rodrigo Fonseca Marques. 2022. DALL-E 2 Artificial Intelligence and its impact on design. Retrieved on 12 May 2023. Available at https://www.aquare.la/en/dall-e-2-artificial-intelligence-and-its-impact-on-design/

Sue, V, M., & Ritter, L. A. 2016. Conducting online surveys (Second edition.). SAGE. Retrieved on 10 May 2023. Available at https://lut.primo.exlibrisgroup.com/permalink/358FIN_LUT/b5ag28/alma991655343906254

Van, D. G. K., Keestra, M., Koenders, L., Menken, S., & Post, G. 2020. Chapters on interdisciplinary research and research skills. Amsterdam University Press. Retrieved on 22 May 2023. Available at https://lut.primo.exlibrisgroup.com/discovery/fulldisplay?docid=alma992013026706254&context=L&vid=358FIN_LUT:LAB&lang=en&search_scope=LAB_CAMPUS_CDI&adaptor=Local%20Search%20Engine&tab=Everything&query=any,contains,research%20question

von Braun, S. Archer, M., Reichberg, G. M., & Sánchez Sorondo, M. 2021. Robotics, AI, and Humanity: Science, Ethics, and Policy. Springer Nature. Retrieved on 9 May 2023. Available at https://lut.primo.exlibrisgroup.com/permalink/358FIN_LUT/1hujjmv/cdi_askewsholts_vlebooks_9783030541736

Walsh, T. 2018. 2062: The World That AI Made. Black Inc. Retrieved on 5 May 2023. Available at https://lut.primo.exlibrisgroup.com/permalink/358FIN_LUT/1hujjmv/cdi_proquest_ebookce ntral_EBC5486298

Wang, G. T. 2016. Student research and report writing : From topic selection to the complete paper. John Wiley & Sons, Incorporated. Retrieved on 11 May 2023. Available at. https://ebookcentral.proquest.com/lib/lab-ebooks/reader.action?docID=7104287&ppg=75

Watkins, S. 2023. The Impact of AI on the Graphic Design Industry. Retrieved on 1 May 2023. Available at https://www.devstars.com/blog/the-impact-of-artificial-intelligence-on-graphic-design-
industry/#:~:text=AI%20has%20revolutionised%20the%20graphic,to%20specific%20audi ences%20and%20demographics

Weber, J. Wesolowski, K. Sparrow, T. 2023. Fact check: How can I spot AI-generated images? Retrieved on 10 May 2023. Available at https://www.dw.com/en/fact-check-how-can-i-spot-ai-generated-images/a-65252602

West, D. M. 2018. The future of work: Robots, AI, and automation. Brookings Institution Press. Retrieved on 2 May 2023. Available at https://ebookcentral.proquest.com/lib/lab-ebooks/reader.action?docID=5180008&ppg=37

Wilson, C. 2023. 8 Ways To Identify AI-Generated Art Or Images In 2023. Retrieved on 16 May 2023. Available at https://www.artificiallyintelligentclaire.com/identify-ai-generated-arts-or-images/

Zimmerman, M. 2018. Teaching AI: Exploring new frontiers for learning. International Society for Technology in Education. Retrieved on 1 May 2023. Available at https://ebookcentral.proquest.com/lib/lab-ebooks/reader.action?docID=5880832&ppg=40

Appendices

Appendix 1. List of questions for the surveys

- What is your current occupation and how long have you been working in the design industry?

- Can you provide a brief overview of your understanding and knowledge about AI in design?

- In your opinion, what are the main benefits and limitations of using AI in the design industry?

- Have you utilized AI in your design projects?

- Can you share an example of how AI has enhanced the efficiency or effectiveness in your design projects?

- Are there any limitations or challenges you have encountered when using AI into your design work?

- Do you believe that AI will eventually replace designers? Please explain your viewpoint and reasoning.

- From your perspective, what skills or qualities do you think designers need to develop to protect themselves against AI?