Draft Report 2

How can we ensure that in 7 years regardless of how prevalent generative AI is, designers can continue to nurture their creative potential within the ideation phase?

Abstract

Bpmrc framework:

The abstract should be a concise (200 words or less), standalone summary of the paper, with 1–2 sentences on each of these topics:

Background: What issues led to this work? What is the environment that makes this work interesting or important?

Aim: What were the goals of this work? What gap is being filled?

Approach: What went into trying to achieve the aims (e.g., experimental method, simulation approach, theoretical approach, combinations of these, etc.)? What was actually done?

Results: What were the main results of the study (including numbers, if appropriate)?

Conclusions: What were the main conclusions? Why are the results important? Where will they lead?

The abstract should be written for the audience of this journal: do not assume too much or too little background with the topic.

Ensure that all of the information found in the abstract also can be found in the body of the paper.

Ensure that the important information of the paper is found in the abstract.

Avoid: using the first paragraph of the introduction as an abstract; citations in the abstract; acronyms (but if used, spell them out); referring to figures or tables from the body of the paper; use of the first person; use of words like “new” or “novel,” or phrases like “in this paper,” “we report,” or “will be discussed.”

Introduction

The aim of this research project is to investigate how digital designers can effectively integrate artificial intelligence (AI) into their creative process to enhance collaboration with other designers while safeguarding their creativity. Specifically, the study aims to create an understanding among digital designers regarding the potential benefits of AI in promoting certainty and creativity within the design process and to address any apprehension or misconceptions that may exist regarding AI's role in the creative field. This research seeks to establish a healthy union between the ethical use of AI and human creativity, with a focus on ensuring that younger generations of designers are equipped with the knowledge and skills necessary to leverage AI tools without compromising their creative output.

The research will involve a combination of qualitative and quantitative methods, including interviews, surveys, and experimentation between traditional human methods and AI-driven techniques within the sketching process. The target audience for this study includes digital designers across various industries, with a particular emphasis on those working in fields where AI integration is becoming increasingly prevalent.

While this research aims to provide valuable insights into the effective integration of AI into the creative process, it is important to acknowledge the limitations of this study, including potential biases in the sample population and constraints in accessing certain AI tools or resources. Nonetheless, the findings of this research are expected to contribute to the ongoing discourse surrounding the intersection of digital design and artificial intelligence, ultimately benefitting the wider community of designers and creative professionals. t

What is generative AI?

The world of design is large and fast-paced, and yet a new competitor is already on the rise; the use of generative AI, specifically to support or even replace aspects of graphic design [1]. However, the rise of AI does not guarantee that everyone will use it, and there are a lot of designers who refuse to use it, or do not understand how to do so. For example, studies show that humans are more likely to view AI as a tool than a teammate, misusing it and not unlocking its full potential [2]. Additionally, overuse of AI can lead to creativity blocks and a lack of inspiration [5].

In order to fully explore the potential ramifications of using AI in the future or the refusal thereof, it is vital to first explore the current presence of AI within the design industry. Generative AI is being used to edit typography, resize objects based on layout, text prediction, and generate images based on surroundings [3]. As such, the notion of an AI takeover is not entirely accurate; AI has been around for an extended period of time already. However, the rise of generative AI's ability to produce sophisticated and detailed images has made a lot of designers nervous about job security. For example, Photoshop AI is able to remove features, generate backdrops, and alter photographs to become more visually appealing [4]. Although this is ideal for amateurs as it saves them both time and money, it jeopardizes the careers of designers who would have normally been hired to do so for clients [6].

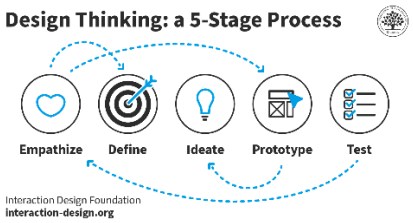
Additionally, Adobe Firefly and Midjourney provide options for interesting and stimulating visuals, created in the blink of an eye. AI is slowly taking over traditional designer jobs, such as the Nutella unique jar design, in which AI was able to generate 7 million unique designs for each Nutella jar, which immediately sold out [3]. However, the designs in question were based on patterns made by human designers, and AI ensured the originality and uniqueness of each pattern; it can be argued that the designs were in fact made by humans. As such, AI can improve a lot of work that designers

before considered tedious. For example, AI can assist in automatic resizing and translating in order for the design to be able to be transferred to various countries and mediums. This can allow designers to focus on other aspects, such as creating iterations to perform more extensive user tests [3].

How is the ideation phase defined, and where does generative AI fit in?

To gain an understanding of how we can help designers nurture their creativity within the ideation phase, it is important to define the ideation phase and research where generative AI fits in this part of the design process.

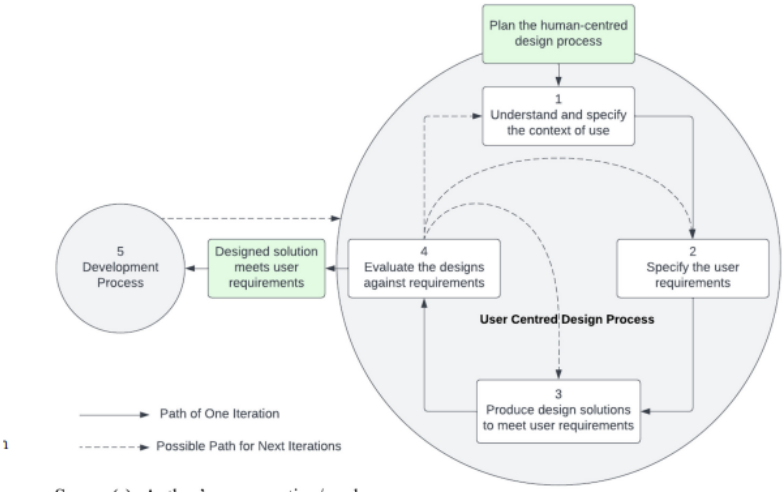
Within Interaction Design, the ideation phase is considered the third step in the so-called Design Thinking Process. The ideation phase is the creative process of designers generating ideas in sessions, using techniques like brainstorming and 'worst possible idea'[7]. An ideation phase aims to generate as many different ideas as possible, filter through them, and select the best accordingly, which will ultimately turn into the final product [9].



The goal of an ideation phase is to support designers [8] in asking the right questions and innovating with a strong focus on the users and their needs. It also encourages designers to step beyond the obvious solutions, increasing their innovative potential. Furthermore, it also helps bring together perspectives and strengths between team members, uncovering unexpected areas of innovation, creating volume and variety in innovation options, getting obvious solutions onto paper, and thinking beyond the obvious. [8]

Using generative AI in this part of the design process is interesting, as it has the potential to improve efficiency and accuracy while creating more innovative and creative solutions. AI is mostly integrated for producing the design solution (step 3), so creating the final design based on user requirements that are specified.

How can designers integrate AI into their creative process to speed up the workflow or to improve design decisions by providing skills the designer is lacking? Talking about Human- AI interaction



AI and the digital design process, placing AI in the process

Often, information of the context (entailing understanding of target users, how they may use the digital solution and what might be done to improve their experience), is analyzed by user personas. Furthermore, it can be used for the lo-fi prototyping of interfaces. Switching between various fidelities of prototypes can be confusing and time consuming (Suleriet al. (2019). This can be minimized through using AI, as it is quickly able to switch between the various types and able to showcase iterations, such as how a User-Interface will look based on a preliminary sketch. (Christoforakos and Diefenbach, 2019). However, the abundance of choices within AI can cause the designer to get lost within the various options and create a lack of focus on the initial goal.

Ethical concerns regarding the use of generative AI by designers.

Using generative AI in design seems perfect, as it can support innovation and efficiency in the design process. However, generative AI is a powerful digital tool, and with power comes responsibility. Various ethical concerns regarding the use of generative AI in the design process became apparent while brainstorming and researching AI ethics. In *From Promise to Practice: The Risks and Governance Approach of Generative AI* [10], an extensive list of ethical concerns was published. An example is accountability for the design. Generative AI models are often black boxes, meaning it can be challenging to understand how they arrive at their outputs. This lack of transparency can raise concerns about accountability if the generated designs have negative consequences or unintended biases. Other examples are addiction to AI, designers limiting their creativity by using AI, and misuse of AI for malicious purposes. A complete list of ethical concerns can be found in Appendix A. In this section, the ethical concerns that are most relevant to the research question are explored and digested, to determine whether or not these concerns pose a considerable risk to the design world and the design process as we know it.

Accountability, ownership, and attribution.

When a designer uses generative AI in their design process, can the designer still claim ownership? Who should be attributed, and who is accountable when the generated design has a negative consequence or unintended bias? To answer these questions one must start looking into general AI ethics to get an understanding of how these concepts apply to designers.

Who should be held responsible for the actions of an AI system? In his *paper Artificial Intelligence, Responsibility Attribution, and a Relational Justification of Explainability* [1], Coeckelbergh discusses this question using existing ethical frameworks. According to Aristotle, you are responsible for those actions that affect others or the world at large. That is, "[…] if you have agency and if you can decide, you should take responsibility for your actions". However, as AI neither has free will nor any possibility to foresee the consequences of its actions, it can be said that it cannot be held morally responsible. As such, the person or persons responsible for the AI also become responsible for its actions. However, this is problematic as an AI system can be developed in one context, but used in another, which gives rise to the question of who should be held responsible for its actions when used in the second context. Moreover, this is another relevant aspect of responsibility, which has to do with the ability to provide reasons for one's actions. In the case of humans, we are expected to know what we did and provide reasons for why we did so, which is not the case for artificial intelligence. AI does not "[…] 'know' what it is doing, in the sense that it is not conscious and hence not aware of what it is doing [11]. As Coeckelbergh [10] points out, the weight of responsibility is not put on children or animals as they are not capable of reflecting on their actions, but rather on their parents or caretakers. Therefore a strong argument to not hold AI responsible for its actions exists.

If AI is not responsible for its actions, one could argue that the ownership of the work created with an AI tool like generative AI belongs at least partly to the designer using the design tool, although the AI can be attributed. In this case, the AI is merely viewed as a tool, and not as a creator of its own. Although the AI does do some of the creating for the designer, the designer would still have (partial) ownership, and would just have to attribute the AI in an appropriate manner.

(Limiting) creativity, communicating ideas, and addiction to AI

AI is capable of many things, like creating images, telling jokes, and even offering companionship. Alongside its undeniable benefits, AI also poses a significant challenge: the looming specter of addiction, with negative effects on human cognition, creativity, mental well-being, and critical thinking. The growth of AI-powered tools has fostered a culture of dependency, where individuals increasingly rely on AI not only for tasks but also for the emergence of emotional bonds and other dependencies [14]. In a design context, one can imagine the consequences of AI addiction, especially involving generative AI. What is a new generation of designers going to look like if they cannot do their work without the use of (generative) AI? Will their creativity be limited to the database of their AI tool of choice, or will AI merely assist them in their work, exploring a new kind of unlimited creativity?

A lack of research on this topic shows how new to society this problem is. One can only speculate about the actual effect of AI on a new working and studying generation, as there is no predicting the future. Is this problem even a problem? In an article in the Harvard Business Review [12] generative AI is explored for the opportunities it provides rather than challenges. Their research has shown that generative AI can support companies in coming up with novel yet feasible ideas. It can augment the creativity of employees, help them generate and identify novel ideas, and improve the quality of raw ideas. The researchers observed that the use of generative AI in this context promotes divergent thinking, challenges expertise bias, assists in idea evaluation, supports idea refinement, and facilitates collaboration with and among users. “Generative AI’s greatest potential is not replacing humans; it is to assist humans in their efforts to create hitherto unimaginable solutions.”

In conclusion, the integration of AI into various aspects of human life, including creative endeavors like design, raises important questions about the potential for AI addiction and its impact on creativity and autonomy. While AI offers significant benefits in supporting creativity and idea generation, the line between assistance and dependency is blurred. As we navigate this new territory, it is essential to continue exploring the ethical and practical implications of AI integration, particularly in fields where creativity and human expression are paramount. By fostering a nuanced understanding of the relationship between humans and AI, we can harness the potential of AI to augment human creativity while safeguarding against potential pitfalls such as overreliance and loss of autonomy. Further research and dialogue are necessary to navigate these complex issues and ensure that AI serves as a tool to enhance, rather than diminish, human creativity and innovation.

Plagiarism, originality, and intellectual property

Manipulation and misuse of AI for malicious intent

The utilization of AI in the industrial design field poses an important question: can it be manipulated or misused for malicious intent? The potential for such misuse is indeed a concern, as evidenced by several factors.

Firstly, AI's capability for generating vast amounts of content facilitates the spread of misinformation on an unprecedented scale. Propaganda campaigns, akin to those witnessed on social media platforms or through unattributable websites, can be amplified significantly with minimal cost, courtesy of AI's content generation power [18].

Furthermore, while model providers make efforts to restrict the generation of harmful content, loopholes exist. Researchers have demonstrated that AI-generated code, obtained from platforms like ChatGPT, can be modified for malicious purposes without explicitly using incriminating keywords [16]. This could potentially lower the technical barrier to creating malware.

Targeted phishing scams represent another avenue for exploitation. Malicious actors can leverage AI to craft tailored messages aimed at duping individuals into divulging sensitive information or credentials [16].

Inadvertent exposure to harmful content is also a concern. Despite filters in place to block explicit or inappropriate material, users may still encounter such content inadvertently. Moreover, AI lacks the empathetic capabilities inherent in human interactions, potentially leading to feelings of isolation when individuals rely solely on AI-generated responses for emotional support [17]. In the realm of education, debates persist regarding the effects of Generative AI. While some argue that it could enhance learning, others fear negative repercussions on students' abilities [18].

In conclusion, while AI offers immense potential for innovation and efficiency in industrial design, its susceptibility to manipulation for malicious ends underscores the importance of ethical considerations and robust safeguards in its implementation.

Ethical implications of technology-driven unemployment

Artificial intelligence (AI) is reshaping how work is perceived, influencing the meaningfulness of tasks. In *The Ethical Implications of Artificial Intelligence (AI) For Meaningful Work*, this transformation is described through three possible future pathways: task replacement, human task supervision, and skill augmentation.

In the first pathway, AI assumes tasks, potentially altering workers' experiences. This can be positive, as work can be done more efficiently and precisely, but can also be negative as work becomes monotonous and less challenging.

The second pathway involves new human work focused on managing or minding the AI, affecting task integrity and skill cultivation differently. Instead of creating fewer job opportunities, AI creates more jobs, as it needs monitoring and management.

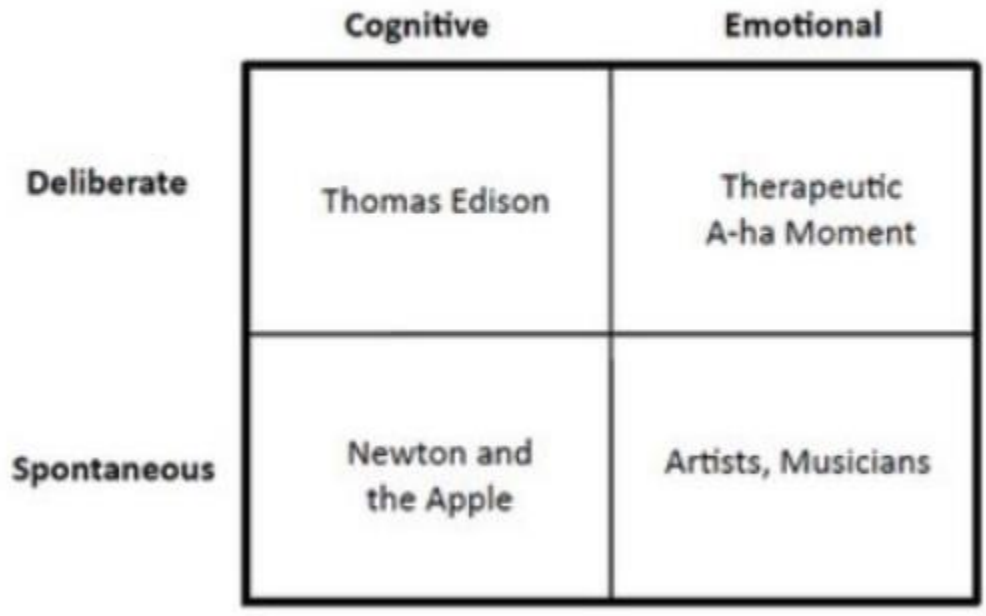
Lastly, AI can amplify workers' abilities in existing tasks, impacting task significance positively. This means that the limitations of AI become more apparent, underscoring the importance of human

intervention. However, AI's opaque nature may hinder skill development, as the workforce becomes too used to using AI. This leads to 'addiction to AI', meaning that people will not be able to do their work without AI anymore. Understanding these dynamics is crucial for assessing AI's ethical implications on meaningful work dimensions, such as task significance. Overall, integrating AI into the industry presents opportunities and challenges for meaningful work experiences, and the future of the industry is in our own hands. [19]

Creativity

Limitations of measuring creativity

It is difficult to define creativity, and insofar there has been no true agreement on the definition of the term. Additionally, it can be challenging to quantify creativity, which is why no common framework exists, and any single instrument cannot measure it. "Researchers generally agree that creativity involves the production of something that is both new and suitable for a particular purpose or use," "In other words, creativity is the ability to be different in a useful way." [20]. For this report, the definition utilized will be the definition provided by California State University; "Creativity is defined as the tendency to generate or recognize ideas, alternatives, or possibilities that may be useful in solving problems, communicating with others, and entertaining ourselves and others." The various types of creativity can then by subcategorized following the framework provided by Arne Dietrich; it sorts creativity into four types. These types include: Deliberate and Cognitive, Deliberate and Emotional, Spontaneous and Cognitive, and Spontaneous and Emotional.



Each of these quadrants represents what Dietrich calls a type of creativity, and these types relate mostly to the process of arriving at the final idea. For example, for some creativity comes from sitting quietly and reflecting on their situation. Dietrich calls this type of creativity Deliberate and Emotional. These types of creatives have "a-ha" moments where they seem to pull a solution out of thin air. However, this idea is in truth created through time spent pondering and asking questions, as

opposed to research and time spent studying. This type of creativity comes from the cingulate cortex; an area of the brain that connects our emotions to the prefrontal cortex, which regulates thoughts and actions. In opposition to this, the key aspect of Deliberate and Cognitive creativity is having an already formed body of knowledge to combine existing information in new and innovative ways. Additionally, someone within the Spontaneous and Cognitive category is said to require time to do something else, allowing their subconscious to keep working on the problem. When explaining this type of creative thinking, an example is how Isaac Newton thought of gravity while watching a falling apple. Lastly, the type of creativity that is considered the most elusive and something one either "has or does not have" is the Spontaneous and Emotional creativity type. Great artists and musicians such as Mozart and Baudelaire, or even rap singers like Eminem are often these types of creatives and therefore experience powerful and emotional creative moments that seem like an epiphany or even a religious experience. These moments are primarily experienced in the amygdala, adding to their felt potency.

Survey results ☺

In order to get an accurate portrayal of the current workplace use of AI, we sent out a survey to ten employees of various design companies located in Eindhoven, asking each participant to answer questions before, during and after use of generative AI within projects. The full list of questions can be found in the appendix. Although not every participant fully completed the survey, we were able to gather data on those that did in regard to their thoughts and feelings of using AI, as well as frustrations and potential fears. We were able to gather that the majority of participants viewed AI positively in the lo-fi aspects; when more complicated needs arose, participants felt frustrated and delayed by the lack of coherence and clarity the generated models provided. One participant stated “image generation requires well thought out prompts. […] it is hard to determine which key words will affect the result. Some text outputs are sub-par and fail to meet the detail that was asked for “, which stands parallel to our expectations of rigidity and its effect on creativity and possibility. Due to the lack of more responses, no definitive conclusions will be drawn based on the probe study.

Using speculative design to create awareness of the future of generative AI within the design community.

In order to create something that will evoke reflection and deep thought, we wanted to create a speculative design; something that is meant to spur public debate in contrast to reproducing and reinforcing contemporary perceptions [10]. To do so, it is paramount to further understand how speculative design can be harnessed to evoke debate whilst still creating an immersive experience. Speculative design can even be at the forefront of physical design later on. For example, the 1960s saw an influx of sci-fi imaginings which can be seen in the real world today, such as conversational interfaces, tablets, and telecommunication [22]. Additionally, speculative designs can help to include the users within the design direction, as it encourages design-user dialogue and public debate [21].

For our speculative design direction, we want to stimulate the user to think about the future and the role of AI within that future. As it stands, our aim is to design 3 futures which are generated by the user- they can choose which direction they want to head to. These futures will have varying degrees of AI usage within the workplace, from none to only AI. Through this, secondhand consequences will

be generated, such as lack of job availability due to slow turnover (for those who refuse to use AI), or a lack of originality and creativity (when using too much AI). Through this, we aim to allow the user to understand the current presence of AI, and, through the dramatized version of the future, allow them to actively reflect on their stance on AI as of now. This can then spur them to change, or embrace their relationship with AI.

How can generative AI support designers in their design process? / conclusion

The key takeaways are that AI can be used in generative design, where it may lead to ''innovative and optimized solutions that may not be immediately apparent to human designers.'', allowing designers to create concepts that would otherwise not be possible or limited by their own mind. However, it also may lack creativity, intuition, and emotional understanding in design. Furthermore, it also may have a bias in algorithms, have data privacy issues, and might question the responsible use of AI-generated content. More importantly, overreliance may ''lead to a loss of essential design skills and a diminished understanding of the underlying principles.'' Also, transparency is brought into question, regarding the decisions AI makes and how this can be ethically monitored.

Appendix

A - List of ethical concerns regarding the use of AI, resulting from a brainstorming session and literary research.

- Accountability - Generative AI models are often black boxes, meaning it can be challenging to understand how they arrive at their outputs. This lack of transparency can raise concerns about accountability if the generated designs have negative consequences or unintended biases.
- Ownership and attribution. If a designer uses AI, who owns the work, and who should be credited?
- Plagiarism and originality
- Limiting creativity by AI datasets
- Communicating your own ideas and compromising on how AI translates those ideas
- Addiction to AI, not being able to work without AI – talent?
- Bias in data and algorithms, can lead to unfair or discriminatory outcomes
- Who owns the intellectual property of these designs? Can those rights be protected or enforced?
- Generative AI can be used to create realistic but fake designs, such as counterfeit products or misleading visual content, which can lead to manipulation and misuse of generative AI technology for fraudulent or malicious purposes.
- Can designers lose their jobs to AI? This raises questions about the ethical implications of technology-driven unemployment and the need for retraining and support for affected workers.

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