AI in Co-Creation: The usability and impact of AI tools for co-creation in participatory design to generate innovative and user-centric design solutions

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Figure 1: Participatory design co-creation workshop with the use of GenAI programs

ABSTRACT

The current study focuses on applying generative Artificial Intelligence (AI) in participatory design processes, specifically scrutinising the interactive dynamics between AI and human actors during the creative endeavour. Practice-oriented workshops and including a real, complex application example constituted the methodological framework. The analysis sought to investigate Artificial Intelligence's impact on the produced design outcomes and the dynamics of group interactions within participatory design environments. Obstacles and potential benefits in dealing with AI were thoroughly analysed, with the investigation targeting the potential for significant time savings and efficiency increases due to AI deployment. Simultaneously, a comprehensive evaluation occurred, assessing the quality of co-creative human-AI design solutions.

The study identified important capabilities that influence the quality of generative AI solutions. The author termed them the "Effectiveness Trilogy", consisting of *Expertise, Experience* and *Usability*. The findings suggest that current generative AI systems must still be sufficiently equipped for handling complex tasks. The resultant solutions frequently exhibited superficiality and needed more efficacy to generate substantial time savings, as observed in our analysis.

CCS CONCEPTS

• **Human-centered computing** → *Interaction design process and methods;* **HCI design and evaluation methods.**

KEYWORDS

AI, generative machine learning, co-creation, participatory design, human-centred design

1 Intro

Artificial intelligence (AI) has arrived for the general population. What was once only imaginable in fantasy or science fiction films has now entered our everyday lives, for example, operating our homes, computers, mobile phones or work programs [23]. Natural Language Processing (NLP), Large Language Models (LLM), Machine Learning (ML) and Deep Learning (DL), sub-fields of AI, in particular, have undergone enormous technological development in recent years. Developing algorithms that enable the understanding, analysing and generating human language is the core area of NLP (Natural Language Processing) [20]. These Natural Language Processing (NLP) methodologies are the backbone for various applications within artificial intelligence. These applications span from text analysis to automatic translation and even chatbot interactions, illustrating the broad-spectrum utility of AI programs that harness NLP techniques. The chatbot "ChatGPT" is prominent with its remarkable AI language model [7, 30, 36]. Any user can access these complex LLM functions by simply sending a message to ChatGPT, and it automatically generates a response based on source codes and datasets [6]. This skill enables the program to facilitate seamless interaction with users, a feature that garners significant interest due to its minimal coding knowledge requirement. The user-friendly nature of this program broadens its appeal and accessibility, inviting engagement even from individuals with little to no foundational understanding of coding. Creating new requirements should blur human behaviour with machine behaviour into a functioning human-AI system (HAIS) [2]. In this way, AI-supported programmes should make people's lives easier and better [23]. The potential benefits of such AI-supported programs may particularly enhance the work of creative individuals [11]. Emerging generative machine learning algorithms possess the capacity to assist throughout various stages of the design process, thereby augmenting possibilities for design endeavours [32]. In parallel with the development of these algorithms, in recent years, concepts such as digital and computational creativity received social attention [1], which shed light on the phenomenon of AI-driven creativity. In the context of these innovative possibilities opened up by AI, the study of AI creativity not only promotes an understanding of the possibilities of AI in the creative sector but also contributes to the efficient and effective use of these technologies to enhance human creativity [35]. In particular, AI programmes can support the design thinking process by enhancing and accelerating human capabilities. A notable example of using AI programs in design thinking is generative AI systems for idea generation in co-creation workshops [35]. By generating and expanding concepts and designs, these programmes can promote creativity and enable novel approaches to solutions. Furthermore, these tools actively facilitate designers in conceiving and developing genuine products and services. When integrated into the initial stages of the design process, AI systems can effectively function as dependable collaborators alongside human designers [8].

This study investigates AI programmes' influence on the initial creative design process and to what extent human-Ai co-creation is possible or problematic. Here, the focus is primarily on the development of co-creative design ideas. To obtain these outcomes, it becomes imperative to comprehend users' usage and application of AI systems and their assessment of the resultant outputs. For this purpose, several participatory design workshops were conducted, where participants actively engage with AI systems to derive suitable solutions. To ensure comparative analysis, participants will tackle a specifically designed case. By employing this methodology, we can actively explore the degree to which AI algorithms possess the capacity to decipher and solve more complex problems. The results of this study should provide insights into the following points:

I. to what extent are AI programmes helpful or a hindrance in the creative design process for solving complex problems?

II. Can AI programmes shorten the time participants typically spend on the design thinking method, and

III. how does co-ideation with AI in the participatory design process affect the design results compared to analogue forms of idea generation?

2 Background

2.1 The GenAI Era

Artificial intelligence (AI) is understood as the core of computer science [18], whose goal is to automate human tasks. According to a survey conducted in 2022 by McKinsey [22], the use of AI has more than doubled in the past five years. Investment in AI is increasing rapidly because, since the release of OpenAI in November 2022, many know that generative AI programmes such as ChatGPT and DALL-E have the potential to change the way a range of activities are performed [22]. The skills AI can promote can be divided into constituent parts into learning, pattern recognition, reasoning, problem-solving, visual perception and language understanding. Businesses, healthcare, industry, and the military sectors are already actively applying this technology [18, 33]. To understand what an AI can do, we need to look at the following subcategories: Natural Language Processing (NLP), Machine Learning (ML), Deep Learning (DL) and Generative AI (GenAI).

While AI systems generally deal with the cognitive ability to learn and solve problems, it requires NLP to translate the natural human language into a computer language [7, 21, 31]. NLP functionality facilitates the execution of tasks such as translation, topic classification, and keyword extraction, among others, by enabling the system to comprehend written or spoken texts. However, to automate processes and maintain the quality of the answers, NLPs need machine learning. Using historical data and predefined algorithms configure machines for autonomous learning from their experiences, effectively emulating the human learning process.

In contrast, Deep Learning is a subcategory of machine learning trained to develop a model to solve complex, real-world problems at the level of a human brain. DL thereby supports ML in training its algorithm to recognise correlations and unknown patterns [18].

Generative AI (GAI or GenAI) is also a subset of machine learning but trained to generate solutions independently. They work by learning the underlying distribution of data points and then generating new data points from this learned distribution. Generative Adversarial Networks (GANs) and Artificial Intelligence Generated Content (AIGC) serve as typical examples, actively employed in the generation of digital content encompassing realistic images, music, speech or text [36]. AIGC aims to make the content creation process more efficient and accessible, facilitating the rapid production of premium content. As the volume of data and the complexity of models increase, these models can have a broader and more realistic distribution, producing more authentic looking and higher-quality content [36].

The ability of AI to generate artistic products through GAI and ML has led to changes in the design industry. The introduction of these new capabilities has redefined traditional design processes. These technologies have enabled more efficient workflows, personalisation and a broader scope for creativity [3]. GenAI has created a scenario where both a human and a non-human part can proactively contribute to a solution.

2.2 AI as a Teammate

Nevertheless, how does the relationship change when a machine AI tool becomes a team member? Hence, the present research endeavours to ascertain the extent to which artificial intelligence (AI) can establish its position as a potential collaborator within a creative design process concerning a multifaceted subject matter. History proves that collective human effort can lead to remarkable achievements. Especially when accompanied by advanced technology is capable of drawing interferences from data, generate new insights and learn from past experiences [14]. We are seeing a shift beyond the assumption that AI systems need only serve as substitutes for human labour [28]. Instead of adapting our world to the demands of computers or bowing to their judgements, we see the approach of doing our jobs together [14, 21]. This shift in the relationship, where AI goes from being an instrument to an almost equal partner, leads to a continuous exchange between the parties involved and a change in the human-machine relationship to a human-human one [8]. This new form of relationship also positively influences the trust that an AI or computer can create [4, 10]. Recent years have witnessed the execution of several Turing tests [9] aimed at exploring the degree of discernibility between AI-generated products and those created by humans. The results speak for themselves that humans are not able to detect differences [10].

Recent research indicates the creative contributions of generative AI agents to the design world. Consequently, the hypothesis suggests the feasibility of developing a system that merges human and computational initiatives, thereby integrating creative AI agents as active entities within collective idea spaces [11]. The only question is how generative AI can help support mixed initiative-creative interfaces to strengthen human-AI collaboration [32]. Assuming an approach where the strategic participatory design is actively employed, stakeholders, developers, designers, and others are additionally involved. In that case, the AI or GenAI is also involved in a project's initial discovery, subsequent ideation phases, and beneficial user-centred outcomes could emerge [25]. Given that GenAI incorporates deep learning and machine learning, enabling AI to emulate human cognitive processes [8, 21] the perspective emerges that these generative AI programmes could aid designers or general users in solution discovery, mimicking human problem-solving approaches [14, 32]. The derived benefits include utilising AI programmes as a tool for one's work, as a source of inspiration or as an additional creative collaborator [4, 11]. Weiwen Chen reports on a dynamic-passive AI-human interaction, which states that the AI acts more as a helper in the background [34]. The human artist still generates the creative mechanism within the work. The artist enters many data into the GenAI tool, which triggers a series of prompts, such as asking the program to generate text and images. This handling makes the AI a passive observer, as it has no active interaction with the audience. Many researchers are investigating this human-AI co-creation relationship and whether it can benefit or harm society in the future [11]. Furthermore, to what extent does this relationship help, hinder, or change how we see creativity?

2.3 AI function on Creativity

Is it possible to attribute creativity to an AI? Can an entity without consciousness be considered creative? Is AI even possible to provide deeper insights into the meaning of creativity? We first need to understand what creativity is and what constitutes it. According to Margaret Boden, a British cognitive scientist and artificial intelligence author, creativity is the ability to generate new and valuable ideas [19]. So, if people can develop machines, programmes or even systems through their creativity, why shouldn't it also be possible for them to be creative?

The rapid development of AI technology is progressively permeating diverse domains with the objective of investigating the boundaries and approaches of utilizing digital computers to simulate, enhance, and extend functions performed by the human brain. They allow virtuality and reality to merge, enabling them to communicate and interact with users and viewers in a human-like manner [34]. Machine learning and generative AI allow designers and users to broaden their creative perspective and enable time savings in drafting initial design drafts by generating new content from existing data patterns [13]. This tool provides a unique source of inspiration, allowing designers to focus more on fine-tuning solutions. In visual art or music production, we see examples of AI programmes that have already produced new artistic works that did not exist before. MidJourney, DALL-E and other text-to-image tools are just one way AI has entered the creative process [29]. An AI can be programmed to produce something unexpected or surprising, in which it can also change the rules to produce a transformative effect [19]. Considering that not all artists create revolutionary works of art, the lack of a transformative aspect in AI-generated works does not necessarily mean a lack of creativity. With each additional scientist, engineer and other resource contributing to implementing AI technologies in more products, AI creativity expands and enhances more and more fields [35].

3 Methodology

3.1 Study set-up

In order to answer the questions, the planning and organisation of three structurally identical co-creation workshops followed the participatory design strategy. The aim was to develop a user-centred solution for a specific use case using design thinking methodologies [6]. Through the utilization of a case study, the extent to which AI tools can accomplish user-centred solutions for distinctive and intricate cases will be investigated. Comprehending how these programs effectively address individual challenges facilitates the acquisition of insights and experiences. [6, 26]. In this research, the case study is about revising a menu guide on a club website of a German football club. Focusing on a German football club allows for investigating context-specific factors, such as the club's organisational structure, culture and fan base, which can provide valuable insights into how these factors influence user behaviour and experience in that particular environment [6]. At the same time, it makes it easier to establish measurable outcomes and key performance indicators (KPIs) that can help evaluate the effectiveness of the research findings and recommendations in achieving the desired outcomes in the context of the club. For this purpose, different stakeholders were invited for one workshop each: Designers, football club staff and fans. In total, 14 participants were involved in the research.

The first workshop, the Pilot Test Workshop, took place with six students from the Strategic Design programme. This general test reflected less on the choice of methods and more on the structure of the workshop and the integration of AI tools in the methods. The students were well suited for this, as they were already familiar with the design thinking process and its methods. The reduced necessity for instruction in individual tasks enabled the students to engage more intensively with the AI programmes. The pilot workshop facilitated the determination of practical approaches to instructing participants on the handling, potential use, and usability of the AI programs in subsequent workshops. The second workshop took place with only five employees of the football club. The third workshop took place with four fans of the club. The division of the other workshops into fans and employees makes sense because the employees deal more intensively and daily with the website's problems than the fans, who, on average, only go to the site through the newsletter notifications. The long-term employees also have the experience and knowledge of why the menu structure has developed the way it has, compared to the individual fan. However, because the fan is less involved, they focus on other aspects and prioritise differently than the employee.

3.2 Workshop set-up

The workshops entailed the division of participants into two groups, namely Group A and Group B. Group A was the one that went through the process exclusively in analogue. Group A represents the participants who underwent the process exclusively in analogue form. At the same time, Group B had to use AI tools and was allowed to work on a prefabricated Miro board (see figure 2).

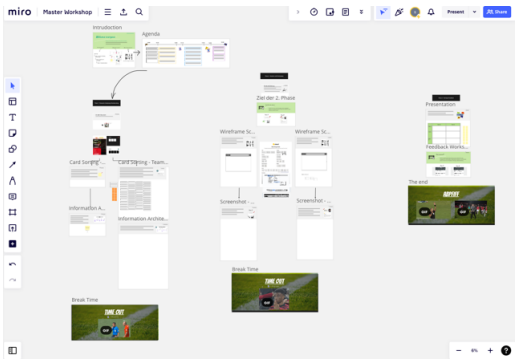

Figure 2: Miro Board Overview for the workshop tasks

Miro is a digital, visual collaboration platform designed to work hybrid with teammates on tasks. It is a virtual whiteboard, also called RealtimeBoard, developed by Andrey Khusid in 201. Grouping occurred through a general query to determine participants' prior experience with AI programmes and distinguish those with experience from those without experience. Attention was also paid to age, gender and long-term experience with the association to balance the groups' expertise, experience and gender. Thus, in one of the groups, there was an experienced person who had known the association for a long time and a person who had been part of the association for a short time, and in group B there was at least one person with moderate experience in dealing with AI and one person with no previous experience with AI programmes.

Both groups had 3 hours to develop a possible solution for a new club website menu structure through the guided design thinking methods. They went through four methods: Analysing, Defining, Ideate, Prototyping, + Testing. After a 5-minute mental warm-up, the participants started with card sorting. Group A received 60 handwritten cards, each with a current underside, while Group B worked on 60 digital cards on a Miro board.

Figure 3: Team A working on the first task: card sorting

Within 20 minutes, both groups had to sort these cards into categories/themes. It was up to them how many categories they could develop. Group B also had the task of using ChatGPT (GPT-

3.5). The program presents the potential to engage in a communicative exchange comparable to that of human interaction, providing avenues for meaningful dialogue and interaction. However, how they used this AI programme was up to them. Afterwards, both groups had to put the categories they had found into a possible structure (information architecture) within 15 minutes. Again, group B had to use ChatGPT and create the structure on the Miro board, while Group A only had to lay out the cards. After completing this task, the first two process stages, "Analysing" and "Defining", were completed so that the "Ideation" phase could start with the scribbling of a low-fi prototype.

Using guidelines, both teams had to draw a menu structure for the desktop as wireframes. Team A received paper, pens, prefabricated snippets, and an A4 sheet as a desktop screen as aids. They could place the snippets like puzzle pieces on a desktop screen prototype. Group B also received the same guidelines but was asked to create a low-fi prototype on the Miro Board. They also received prefabricated digital snippets as puzzle pieces. For this task, it was up to the AI group whether they wanted to use ChatGPT or another programme to complete the task. The important thing here was that both groups should use the "proper" wireframing guidelines. Afterwards, both designs were to be developed and tested as a Hi-Fi prototype. The development took place using the AI tool "uizard", which can render a digital prototype from a wireframe screenshot. The design drafts of both groups were transferred to this programme and rendered so that the other team could test and evaluate the idea. In the end, two variants per workshop resulted in a total of 6 design proposals.

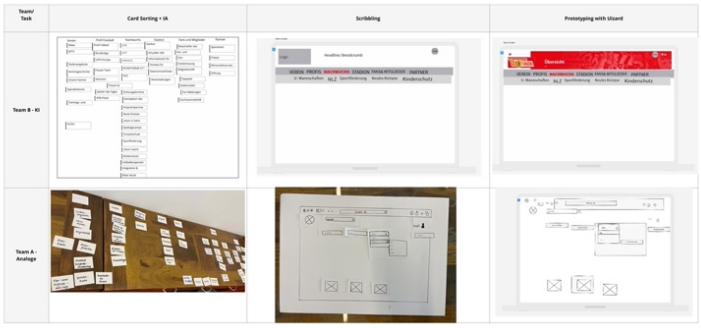

Figure 4: Example results from workshop 1 – Staff members. First row shows solutions from Team AI, below from Team analogue. The columns show solutions from each activities.

During the sessions, Cameras are employed and recorded to actively observe and film the participants while simultaneously capturing their voices through audio recording. In addition, each participant was asked to fill out a feedback survey at the end of the workshop, adapted for groups A and B, respectively. Group B's questionnaire also contained questions about the use of AI programmes.

4 Results

4.1 Workshop Discoveries

As a result of the workshops, the participants generated six potential menu options, three of which were developed with the assistance of AI programs. However, the design variants came about differently than the football club could and would have coded. The observations during the workshop and the feedback surveys came to the same conclusion: as of today, the AI programmes are helpful in the initial brainstorming, but there is still room for improvement in the creative implementation, and the suggestions that came from ChatGPT are very superficial and too general for such a particular case. When asked whether the AI programmes helped or hindered the process, the majority answered "hardly helpful", "completely useless," and the programmes were "overwhelmed by the specificity or complexity of the task".

> *P1: "The programmes are not yet able to process complex content and present contextual solutions".*

Group B transferred the given task 1:1 into the AI programme to receive a suggestion for the solution. This action meant that the first two tasks could be solved quickly, but the staff and the fans felt that the answers were too "universal" and "general". At the same time, they found that ChatGPT "made up" answers. Consequently, the team undertook the evaluation of ChatGPT's responses and independently contemplated potential satisfactory solutions. So they took the answer instead as a well-intentioned suggestion.

> *P1: "If you have no idea how to approach the task, it is not wrong to let the AI give you a suggestion. It is easier to evaluate this suggestion, what does not work, and come up with a solution than to think about it first.*

Due to the additional independent work, no group in any workshop could solve the tasks in the given time. All of them needed 5-10 minutes more per task. In group B, observations showed that after the first result of the AI programmes, they fell into just as heated discussions as the analogous group A. In the survey, all participants in group A stated that they felt at a disadvantage compared to the other group because they were not allowed to use an AI programme. However, they also stated that this disadvantage did not limit them in their group dynamics. Since they had heard the other group's discussions, this negative appearance faded during the process. Group A was not disadvantaged because the AI team was not faster than them and encountered problems with the AI programmes. Group B stated that they saw AI programmes more as another teammate that did not limit the group dynamic but could not replace a human teammate.

> *P2: "Scribbling, pushing or thinking together is better than writing input into a chatbot."*

In terms of time, group B invested a lot in trying out the AI programmes to make the suggestions more precise. The observation revealed no substantial differences between users experienced in AI and those without prior experience. The

experienced users showed much more about using this programme, making inexperienced ones dare to experiment. Due to the intuitive usability of the AI programmes, especially ChatGPT, it was easy for the participants to play around with the programmes and test the limits. In the survey (after the pilot test), the inexperienced users said they would have liked more intensive onboarding in the respective AI programmes.

> *P8: "A quick 5-minute trial with ChatGPT would suffice as you are to play around with it and get more comfortable asking questions."*

Participants were asked to use prompts for ChatGPT when they got to the point where they were not getting the desired results. Prompts are instructions that large language models (LLMS) consider as rules, ensuring certain qualities and quantities when generating output [16, 17]. They often lead to more effective exchanges between the user and the program [17]. By specifying the prompt, the programme knows what context it is moving, what information is essential, and how the results should be delivered. In the workshops, observation showed that even among the experienced AI users, not all were familiar with the most common prompts. Two out of six participants used prompts but have not gotten any further regarding UX or UI design. They just found out that there were already prompts for web design.

> *P8: "I struggled to get comfortable with ChatGPT in the context of web design as other than asking for prompts about what a website needs, I could not come up with any follow-up questions. Uizard was utterly new, so it took me a while to get my head around it.*

After the observations and conversations of the pilot workshop, possible prompts variants were made available to the participants in the subsequent workshops (see figure 5). With the help of these, the participants were able to refine the previous initial results of ChatGPT. However, these prompts could only be used for LLMS, not for programmes such as uizard.

Prompt	Input example
Define AI's role	Act as a *user* ...
	Act as a *non-football fan* ...
	Act as a *general football fan* ...
	Act as a *Union fan* ...
	Act as a *user researcher*...
Chained prompting	Write *a list*
	[output]
	Add *X*
	[output]
	...
POV	Wirte from the POV of *an UX/UI Designer* ...
	Write from the POV of *a traditional football fan* ...
	Write from the POV of *a worker from the football club* ...
	Create a user flow for ...
Define tasks	Generate examples of...
	How can I design...
	Create a table view of...
	Can you provide me with some ideas...
	Develope a code for ...
	Create a checklist...

Figure 5: Table of prompts to use for ux/ui webdesign

4.2 Realisation

In summary, through the thematic analysis method, it was possible to identify a scheme that enables the creation of qualitative solutions with the assistance of AI programs. The workshops' observations, feedback surveys and individual user interviews conclude that three components must be acquired as skills so that AI programmes can produce high-quality and usable results. The author termed these three components as *Expertise, Experience and Usability.*

Figure 6: Relationship between "Expertise", "Experience" and "Usability"

Expertise means the users should be familiar with the subject area. Consequently, users aiming to utilise an AI programme should comprehend the field they intend to apply, such as understanding the constituents of a proficient menu through UX/UI or web design knowledge. In this case study, this phenomenon was observed in that those who knew the subject matter, however marginal, could evaluate the results of the AI regarding quality and functionality. They could respond and reduce the unimportant information or let the AI construct new solutions that were more relevant and functional for the case study.

The initial experimentation with the programmes and the later use of the prompts led to the participants gaining *Experience* of how to use, e.g. ChatGPT. They understood how to use the programme, which enabled them to start new tasks with more specific and detailed prompts. This practice made producing the first high-quality or more applicable results possible.

> *P6: "The better you can prompt the better the results will be."*

This experience is closely related to the *Usability* of the programme. Insofar as it is intuitive to use without requiring intensive onboarding, the "experience" gained can be applied. This realisation saves enormous time, enabling the user to reach the goal more efficiently.

> *P7: "People unfamiliar with the tool might find it difficult to adjust to or adapt to".*

These three core elements, *Experience, Expertise,* and *Usability* (see figure 7), represent the essential skills that every user should have in order to create qualitative solutions with the help of an AI successfully. They are related to each other at all times. If a user has only one of these skills, he or she will not achieve the desired results using an AI programme. With the simple, intuitive and relatable user experience of other well-known programmes, it is easier to get started using the tool. A good example is the Adobe suite, where the tools always look the same, and the structure of each programme always stays the same. This similarity allows the user to learn one programme and, when another is needed, to apply his or her experience due to the similar usability. However, to know what the user wants to create, they need to know what result they want to achieve. Here, *Expertise* is again connected to *Experience* and *Usability*. The user should already have experience with which tools to use and how to apply them, i.e. which path to take to achieve the result. Even if AI can convert large amounts of data into meaningful information and knowledge with the help of all kinds of sensors and networks and offer humans an expanded view in terms of both perception and rational aspects [37, 39], in the end, the user must still evaluate the results for usability and functionality. An AI can only ever answer the question posed, but whether the answer is purposeful or not can only be judged by the individual.

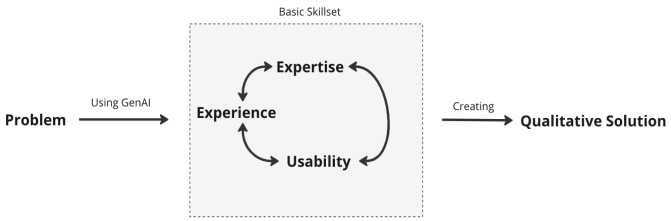

Figure 7: Conceptual Framework "Effectiveness Trilogy"

4.3 Inconsistencies and errors

However, it is also vital to mention problems and errors that occurred during the research process. In order to maintain transparency and to be able to evaluate the results comprehensively, it is essential to know that the workshops and the data collection did not run optimally. Due to the lack of experience in conducting a workshop and being the sole facilitator, it was not possible to consistently check the video and audio recordings. The technical device sometimes went into sleep mode and interrupted the recording. Taking notes of observations was only sometimes successful, too, as the participants needed help completing the tasks. These explanations took time away from recording the observations and from the participants, who had to ask for additional minutes for each task.

Similarly, logging in to the individual programmes of the respective team members took up time; here, a pre-registration or extra account created only for the participants would have been much more helpful. Especially in the "uizard" programme, there were time delays and technical problems due to the registration. However, the biggest challenge was the solo moderation. Acting as moderator, mediator, assistant to the groups and observer simultaneously in the workshops ultimately led to the fact that during the study, the focus was mainly on the use and handling of AI by the Group B members. As this data was necessary for this study, it was unfortunately lost at the end of the workshops to have "worked out concrete contents and solutions". This recognition led to frustration among the participants, which was observed and mentioned in the survey by all participants.

4.4 Reflection and learning

The findings that qualitative AI-created results are only possible through applying three skills would have needed to be more evident through the participatory design process. As Olga Elizarova stated about this method," these activities revealed an unexpected depth to the problem that would not have been apparent with simple quantitative data or structured interviews" [25], this case study can only confirm this. The observation and communicative exchange with the participants led to interesting insights. This topic offers much scope for further research in the future, for example, how different users operate the AI programmes and evaluate the results or to what extent the AI could replace a human colleague. In this study, we worked with several smaller groups, allowing for unique and personal insight, but the statements and observations apply to a particular case. It would be advisable to conduct a further study, building on the findings but independent of the case, to prove that the model "Skillset for using ai-tools effectively" also has general validity.

5 Discussion

This study shows that generative AI programmes are nothing more than additional tools for creating creative works. They can be used during the respective design processes to quickly achieve results. However, to attain a certain level of quality in these results, it is beneficial for the user to possesses prior experience in handling the GenAI system and possess specialized knowledge to assess the applicability of the AI solutions created. The concept of artificial intelligence requires both a cognitive orientation (AI thinking) and certain skills, both of which are indispensable components for tapping into the creative capacities of AI. AI thinking is responsible for selecting appropriate strategies, while skills enable appropriate tactics. These two aspects are interdependent and condition each other in their application and effectiveness [35]. Artificial intelligence systems serve as valuable tools when the user clearly understands the desired objective and the requirements to impose on the AI system to generate meaningful solutions. The system can only provide general and superficial answers if the user lacks such a clearly defined expectation. It requires intensive use of additional training and resources, especially if the user does not have a technical background, to gain the ability(s) to deal efficiently with AI technologies [24]. Conversely, if the AI system is not yet sufficiently developed to handle more complex tasks, the results will also be superficial and may not be applicable. In such scenarios, neither time gains nor inspiring ideas for the user emerge.

5.1 Human-AI Co-Creation

The multi-faceted field of research on the creative capacity of artificial intelligence (AI) confronts us with several essential questions that affect both the nature of human creativity and the potential and limitations of AI. Is it even relevant whether an AI can be creative if it can produce good design? [19] Shouldn't the goal be to develop machines that have their intelligence and creativity, like human individuals, instead of machines imitating human creativity? Looking at the status quo today, it is clear that AI has strengths in handling repetitive and predictable workflows. Humans, on the other hand, excel in flexibility, creativity, deep knowledge and strategic thinking [9, 35]. With these capabilities of AI, it can enhance the creative potential of designers, as demonstrated in the findings. AI can bring broader and deeper knowledge to the design process through its inherent capacity to access and process vast amounts of data, enhancing the designer's idea development [8]. Furthermore, AI can effectively collect and structure helpful knowledge for the design process [8] with, for example, universally valid options. The integration and collaboration of AI in the initial design processes thus offer significant added value and advantage [21]. As can be seen in the results of the study, one advantage, for instance, was to get a first, quick draft. The symbiotic relationship between humans and (AI) enables the individual strengths of each actor to optimally utilise and achieve more comprehensive exploitation of the available opportunities [4, 35]. A human-AI co-creation can only be successful if the machine has more capabilities than the human. Fabio Antonio Figoli calls this the AI>human rule of thumb, which also states that human-AI collaboration can only be most productive when the AI is more capable than the designer [8, 15]. If the machine has only equal or low capabilities compared to humans, then no qualitative results and efficient collaboration between humans and AI can emerge. Thus, the study demonstrated that subject matter experts possess greater expertise than AI for the more complex case study. If the potential of effective human-Ai co-creation is achieved, in the future, designers can hand over complex and time-consuming tasks to the AI and focus on reviewing the creative part [8, 35]. The participants in this study accurately reported that they found it easier to evaluate and polish the AI's output and took the hurdle out of taking the time to write a first draft. This collaboration allows for consistent complementarity throughout the creative process, which helps to increase productivity and inspire innovation processes [15]. For example, in his study of the co-creation of participants, musicians and AIs, Cheng-Zhi reported that one participant stated no difference between an AI and another musician when jamming [12]. The results produced by AI can subsequently be understood by designers as a new form of design knowledge and used in a new, original and cost-effective way [8, 35]. Another example of this is the works of AICAN, which, through a creative adversarial network (CAN), fed 80,000 images from five centuries of Western art history to an AI, which generated not only new artworks but also new styles from them. Although it simulated the styles and characteristics of the earlier artists and their works, it also created styles equally diverse in stylistic range [20].

However, with the human inputting the data into an AI, it could independently create creative work [20]. It needs the input of prompts, instructions and what to do. An AI would not begin to perform an activity on its own. As observed in this study, so too in the example of AICAN or the painting "Portrait of Emond Belany" [20] which is an AI-generated painting consisting of a database of 15,000 portraits from the 14th to the 20th century, it required this very maintenance of the data, allowing AI to generate "art". The main difference between a conventional machine or system and an AI is that the latter strives to become more and more like a human's mental, creative capacity [8]. Creativity, however, requires that what one creates can be understood and judged [35]. However, an existing system currently needs to possess this ability. The results an AI creates today still are determined by the human input of data and prompts. These can come about by chance or multiple attempts or by copying and adopting other prompts or commands from other artists [27]. Whether an AI will ever acquire the ability to be "creative" is not a scientific but a philosophical question, which cannot be answered at present because it involves further ethical and philosophical questions. For example, the right to one's image, copying or imitating other artists' styles, or who can judge what creativity is or what constitutes it [19].

5.2 Prospects

Artificial intelligence tools in the arts have proven productive and problematic for diverse user groups in many ways. In the following, some of the positive aspects and challenges are highlighted within the context of AI art.

Jonas Oppenlaender argues that AI and GenAI will change our society like the World Wide Web (WWW) once did. Interaction and how we interact with digital media will transform by the ability to use natural language in the future digital society [27]. AI not only opens up a vast creative space and interactive structure for creating work but also influences the role of the participants within the creative process. It offers opportunities to transition from being a mere consumer of information to becoming a steward of works and an interactive selector of works [1]. The rapid development of technology opens up beneficial user experiences and enables the general public to participate directly in the creative process. This phenomenon manifests itself, particularly in interactive works. In this respect, even individuals from the general public could take on the role of artists [1]. When the New York Times reported in an article about an AI winning an art competition with the painting "Edmond De Belamy" in 2022, it triggered a debate among artists. Some were against an AI winning such a prize, while others favoured the artist Kevin Rosse and his work. They argued that AI is nothing more than a tool for the artistic, creative process, just as Photoshop is. The artist himself would have thought about the exact choice and use of the prompts and not the AI itself [24]. However, such debates are not uncommon in art history. With the introduction of the first cameras into society, the artistic merit of photography became a subject of debate among painters and artists [6]. The art landscape encompasses various artists - from 2D and 3D artists to conceptual artists, illustrators, and animators. Using advanced AI technologies, generating a complete image in a fraction of a second is now possible by entering simple commands, keywords or phrases. This development has far-reaching consequences for manually working artists, including digital and traditional artists, as creating a detailed image takes considerable time [24]. Due to the speed and efficiency of AI systems, designers

and illustrators can experience reduced workloads and stress levels, as they are independent of space and time [24].

Mastery and a deep understanding of the latest advances in Artificial Intelligence are necessary conditions for interactive art design [18]. In the context of prevention strategies against possible misuse of this technology, it is imperative that we continuously synchronise ourselves with technological developments and, in an ideal scenario, master this technology. Numerous documents exist regarding the misuse of AI, including, but not limited to, unauthorised facial recognition processes, unwanted calls by automated systems and the creation of fake videos. Each of these incidents has the potential to put victims in awkward positions. As access to various AI applications within the population increases, so does the potential for their misuse [26]. Applications such as DALL-E 2 and Midjourney access millions of photos from the public internet and train computer algorithms to recognise relationships and patterns in these images, enabling them to generate new images with similar aesthetics. In this context, artists who post their work online may inadvertently contribute to their computerised competitors' training. This brings to light significant issues related to the value of art, the appreciation of the creative process and the meaning of authorship [20, 24]. An exemplary situation was revealed in the imitation of Disney illustrator Hollie Mengert's style by a Canadian engineering student. Mengert herself expressed that she felt violated by this unauthorised appropriation of her artistic work. Given the current lack of a legal framework for AI-generated art and its growing popularity, more and more artists and designers are raising concerns. They argue that AI-generated art often needs more due recognition and appropriate remuneration while it is essentially based on the work of human artists [24].

So, instead of getting lost in the question of whether designers might lose their jobs in the future due to AI automation, the primary focus should be on how to use the creativity enabled by AI for personal enrichment and to inspire and develop future generations, and how to create and exist in symbiosis with AI [4, 35]. In addition, the issue of copyrights would need to be clarified and rules, if not laws, would need to be introduced to deal with AI to prevent misuse and infringement as much as possible.

6 Conclusion

Frictionless collaboration between human actors and artificial intelligence is not a given constant; thus, it falls under the designer's responsibility to critically evaluate the outputs of AI critically, ultimately making an informed decision whether to consider or dismiss these results [8]. Integrating AI systems into design-oriented processes represents a complex and hitherto superficially explored domain. Elements potentially impeding the efficacy of human-AI collaboration, such as dynamic team processes, the practicability of AI, and ethical inquiries, necessitate further scientific scrutiny [8].

The present research marks an initial approach towards the qualitative examination of interaction dynamics between humans and artificial intelligence within collaborative design processes. It provides insights into the reciprocities of embedding AI-based systems as team members and the resulting evaluations of the functionality of generated outcomes. Broadly, this study aims to contribute to the discourse on deploying AI systems in a design context and unveil the potential for future developments. Subsequent research could develop a conceptual framework for understanding human-AI collaboration within the design process and thoroughly investigate the function of the design arbiter, thereby sensitising new professionals for handling such technologies.

Artificial intelligence is a field of study, a testament to human innovation, and a window into our future. As we continue to advance, refine, and expand AI technologies, we must persist in advocating that these advancements enhance human life, uphold our ethical standards, and contribute positively to societal progress. The destiny of AI intertwines with our future, and the potentialities are limitless, driven by our collective imagination and ambition.

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