

How can designers use human/computer co-design to
encourage artificial intelligence systems to access
creativity?

Student Number: 1900741

Course Title: BSc Product Design & Technology

Word count: 5006

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AI or Artificial Intelligence is a computer/machine that can have a self-thinking process, analyse, and suggest solutions based on data or an algorithm given by humans. In the advancement of new technology, Artificial Intelligence is one of the main developments. Many industries utilise AI in various ways, for example, security, health, or agriculture. As Criddle (2021) states, "AI works through machine learning, where a computer is trained by processing existing information." AI could outperform its human counterpart and operate more efficiently by absorbing information gathered. Chess is an example of the AI advancement that could overtake human capability, such as "AlphaZero, the game-playing AI created by Google sibling DeepMind, has beaten the world's best chess-playing computer program, having taught itself how to play in under four hours" (Gibbs, 2017). This is possible because, unlike the human brain, AI can simulate multiple possibilities in a short amount of time. For this case, "AlphaZero took an "arguably more human-like approach" to the search for moves, processing around 80,000 positions per second in chess" (Gibbs, 2017). This shows that AI overtakes human capability, which results in the idea that it is better than humans. My question regarding this development is whether AI can learn to be creative in its own right and become an artist or designer and therefore create its own work. This could develop new opportunities, although it might also result in replicating an existing artwork, which

may have been input into its data. One of the arguments made in IBM (2021) suggests that art and design are “more subjective”, which is difficult when teaching AI. Giving them a programme about ‘I think this is beautiful because’ is not objective data, as each person has their own idea of beauty. Unlike replicating exact things, it will be hard to tell it to make something “beautiful from scratch”. There is a difference between humans and computers when it comes to being creative. As AI is acting upon a subjective, this is a challenge but potential for AI to have its sense of creativity. There are several meanings within 'creative'. The standard definition from the Cambridge dictionary (2021) is that a person who produces a new and usual idea would not come up with it. The purpose of this dissertation is to discuss and ascertain whether AI can be a designer of the future and have its own creativity. Furthermore, can it be encouraged by co-design between humans and computers.

Ethical side

Creating efficiency comes with a cost

The idea of whether AI is creative there must be a consideration of the ethical side. Firstly, bringing AI into the design process will increase efficiency. However, there always comes a cost of this development. It is a question of ‘What are the sacrifices that this efficiency brings in?’ Whether that is an AI applied to art and design. It can

bring both benefits and drawbacks to the industry. Although by creating efficiency within the design, 'how this could make the process lose its identity, soul, or individuality?' Generally, AI brings advantages to industries, such as efficiency. The benefits of bringing AI into the general industry are described by Kumar (2019); it can help industries by reducing human error, taking more risks, being available 24 hours 7 days a week, and assisting in a repetitive job. Therefore, their task will be easier with its support. An AI algorithm can improve the design process by introducing AI changes in product design, which Ratsimbazafy (2020) described. This is because it can enter the required data. Using AI for the projection mapping will allow designers to visualise new methods to improve product resilience and responsiveness. This is one of the benefits that AI can give to the design industry. There are other advantages, like creating multiple design variations by using an algorithm that has been drawn from a database. For example, "dozens of patterns and colours to create seven million different versions of Nutella's graphic identity, which have been splashed across the front of jars in Italy" (Aouf, 2017). Therefore, this gives an example of co-design between humans and AI as there are advantages of having AI in design and other industries in general. However, there are always drawbacks that come with advantages, which are that generally, AI costs highly for both maintaining and updating. This includes machines as well. Such advanced

technology like AI can make humans lazy, which people will rely on this automation. Automation will lead to unemployment, in which AI is replacing repetitive jobs. Even it helps with the task, which will cause a problem with employment on human individuals. Moreover, the difference that AI has compared to its human counterpart is that it lacks emotions or feelings, which “Machines cannot develop a bond with humans which is an essential attribute when comes to Team Management” (Kumar, 2019). However, it could be taken as a cost of being efficient. Nevertheless, such disadvantages could diverge ideas on whether AI will improve the process or overcome limitations and overtake human limitations. There would be a loss of identity or individuality. As AI is efficient but emotionless and it could replace humans. This could affect losing some abilities and motive to be creative. This would be a difficult challenge for human-AI co-design as there are benefits and drawbacks of creating efficiency by bringing AI. The human/computer co-design is up to their relationship.

Who is going to take ownership of AI-generated design?

If AI can be a designer, another issue that comes with it is the ownership of AI-generated designs. This is the question, and you would think that if we treat AI as an employee, then the ownership of work goes to the employer. There are laws about

ownership of AI-generated design, and this is stated by Stephens (2019) that the UK has already made the law when investing in AI in the 1980s. "Parliament created a category of "computer-generated works" in section 9(3) of the Copyright Designs and Patents Act 1988 (CDPA)." This applies to a computer-generated piece that any human author does not do. Thus, the author will be held as an essential person in the creation process. Up to the present time, there has been an argument that whether there is originality, and it should be objectively judged, to meet the criteria of the section 9(3) as there was no precedent that happened. So that there is a law to allow AI to have ownership of its work, this gives some form of environment for AI to be creative by treating AI as an 'author', but they cannot conclude to define its 'originality' has become the issue of the act. There are the same issues that happened in North America. This argument is made by Paquette (2021, pp. 192-193) that under "the Copyright Act of Canada³⁹ at section 5(1), copyright subsists in every" aspect of creativity, and this indicates that there should be human authorship to originality demanding that when the work is done, the author must either be a natural person or a citizen. However, the idea of originality is required legally "for the existence of copyright in work", and this is restricted "upon human authorship", but this does not show any definition of neither "originality" nor "authorship".

Furthermore, looking into "the United States Copyright Act", even though they are

dependent on and believe in the concept of originality and authorship as being essential for protecting works, it also presents a similar problem which omits any explanation of originality and authorship “(human or otherwise)”. “The common law” can interpret what the “statutory law” has failed to describe, therefore, leading to “respect to understanding these key legal concepts of copyright from one jurisdiction to the next”, which causes “variability and uncertainty”. The poorly communicated legislation can make it difficult for AI to have its right to ownership. In general, I believe that there is a potential in a law like this that will make AI have ownership of its creation. Thus, AI will be treated as a 'person' rather than a 'machine' and be given some form of independence. This also lets AI receive acknowledgement for its creativity by being the part or primary author of the work. This leads to a new relationship between humans and computers, equal rather than the 'user' and the 'tool'. Therefore, this encourages co-design equally.

Does it take away something rather than give something?

As we explore the sacrifice this development will bring on the industry, We might consider taking away instead of giving them something. It could be whether it will give doubts of overtaking human capability. For example, Wang (2019, p. 62) explains that increasing the development of AI does have a “positive influence” on

designers. However, this does also give anxiety and doubt. While increasing advancement gives an inspiration, there is a fear, which could be that it might be taking their job. There is a "scientific issue, a philosophical issue", and an ethical issue when it comes to accepting the development of AI. These effects the "knowledge system" and "value system". Humans are not ready to face both the impact and challenges of the new "technological revolution" on human ethics, behaviour, and beings. One of the considerations of technological advancement is the increasing anxiety that AI may replace its human counterpart. This explains that there are considerations that humans have problems with accepting AI. It may be common sense that AI will take every human job, but the reality is "AI will not replace but rather will supplement humans in the workforce. Employment is one of the most basic social and political necessities in every society in the world today." (Toews, 2021) This means that it could result in loss of opportunity "for any technology or business." (Toews, 2021) Even the government will not let the unemployment rate increase. On the creative side, a question is that 'if AI becomes designers, does creativity lose something out of it?' I would say 'no' to this answer. For example, there is a technology called 'Generative Design', of which the example model made by its process is shown in Figure 1 from Autodesk (2021). computer creating models "and optimised by computer software. A user sets up requirements for the model,

such as manufacturing process, loads, and constraints, and then the software offers designs that meet those requirements." (McClintock, 2020) These benefit designers by solving problems, such as differentiation, overall results, product costs, and optimised reliability, which then designers can consider this solution. Although they must also "think about weight limits, physical constraints, availability of materials, and so on." (McClintock, 2020), this shows the co-design between humans and computers. that artists and designers use tools within the automated programme rather than a person. This also shows that human designers are less likely to be replaced because they will decide or improve the generated design. However, as I have explained before, this will improve the whole process and get more efficient, making humans less motivated to be creative. In other words, they would be lazier. This is because when every process becomes automated, people rely on it and put less effort into their work. This is stated by Jeet Mukerji, whom IT Pro interviewed:

AI has the potential to make us lazy in the workplace if we agree on three things. The first is that the original work, now done by AI, is worth mastering by humans. We choose to not do this, however, so will eventually lose this skill set – empathising, or doing mental maths, for example.

Secondly, we choose to consistently spend the time and energy, freed up by AI, in lower value moments such as deciding to scroll social media without an aim rather than read a book or to learn a new skill.

Finally, we choose to not understand the limits of AI we are using, expect too much of it, shirk our responsibility entirely on it and don't engage the outputs of the AI correctly – by this I mean we think it is incapable of error, so don't sense check the outputs."

(IT Pro, 2021)

Therefore, relying everything on AI becomes lazier that they become less productive, leading to losing the necessary skill set and wasting valuable time and resources. Furthermore, not engaging with AI's outputs means that they will lose their sense of responsibility. This means that humans would blindly trust AI for every process. This could lead to losing their own opinion, thoughts, and judgements.



Fig 1: *Generative design* (Autodesk, 2021)

Creativity side

Can emotions or consciousness link to creativity in AI?

In the introduction, I have explained the definition of 'creativity'. It can be applied to

AI if we take 'person' from the definition because AI does bring its original work.

Therefore, it should be considered creative. One of the main questions for this

dissertation is 'whether AI can be creative?' currently, AI cannot wholly be

independently creative. Another argument is stated by Vandergrift (2016) which he

comments that algorithms within AI only do within its programme. Thus, it cannot be

creative. Programmers do the creativity within the algorithm of any product than

machines. If AI can be creative, its design must have emotional power, creative

individuality, and artistic value. AI is programmed to think itself based on the

outsources. Before we discuss each aspect, we must consider whether AI has

consciousness. The word 'consciousness' is defined as

"the state of understanding and realising something, the state of

being awake, aware of what is around you, and able to think" (Cambridge dictionary,

2021). With this definition, I think AI can have consciousness as it can think and

understand. The idea about consciousness in AI is commented by Schneider (2019,

p. 16) that we living beings have conscious experiences with five primary senses:

hearing, taste, smell, touch, and sight. If the computer cannot feel conscious, then "they would lack inner mental lives." Intelligence and consciousness exist simultaneously in the perspective of biological life. Sometimes, that intelligence holds complex as well as nuanced inner experiences. However, the question is 'what about non-biological intelligence? Does this apply to them as well?'. This gives a complex view that AI possesses consciousness, as it lacks the five senses. The question we must ask regarding AI is whether it can have physical experiences and or feel emotions. The definition of the word 'emotion' is "A strong feeling deriving from one's circumstances, mood, or relationships with others." (Oxford dictionary, 2021).

Although AI cannot have its emotions, it does not get driven by intense feelings, as already mentioned in the previous chapter. This is stated by Brookhouse (2020), "AI and neuroscience researchers agree that current forms of AI cannot have its own emotions" so that this could be a disadvantage for AI to be creative at the moment.

However, it can show or understand forms of emotions. For example, there are technologies called 'emotion AI', which developed at MIT Media lab in 1995.

According to Somers (2019), "Emotion AI is a subset of artificial intelligence (... that measures, understands, simulates, and reacts to human emotions. It's also known as affective computing or artificial emotional intelligence." So that even though AI cannot have its own emotions, it can understand human emotions, and as it "can

mimic emotion, such as empathy.” (Brookhouse, 2020). Nevertheless, it is not capable of having its own emotions. Psychologically, emotions are required in creativity. This is according to Kaufman (2015), "The long-standing view in psychology is that positive emotions are conducive to creativity because they broaden the mind, whereas negative emotions are detrimental to creativity because they narrow one's focus." Therefore, it is recognised whether emotions, both positive and negative, can affect creativity. However, this does not affect if it is in the design process. This is because I make design decisions based on my research, and no emotions have been involved. Even the generative design produces multiple creations, which is done without emotions. Thus, not every aspect of creativity is affected by emotion, and this is then AI can create without having emotions.

Does personality influence AI in creativity?

In the previous sub-chapter, I have talked about emotion and consciousness. This section is about whether AI can have personality if so, how does this influence creativity in it. The definition of the word 'personality' is "the various aspects of a person's character that combine to make them different from other people" (Oxford Learner's Dictionary). As the definition shows, this is how each human have a personality. However, as the definition said 'person', I wonder if it is possible that,

like 'creativity', if we take 'person' from the definition, this applies to AI. Personality is one of the aspects that influence creativity. For example, research that has been done at a North American business school to test an individual's creative performance and results were that:

extraversion and openness to experience had significant positive effects on creative performance. Analysis also revealed that the positive relationship between openness to experience and creativity was stronger when the person possessed strong extrinsic motivation.

(Sung and Choi, 2009, p. 941)

Although this only shows a few aspects of personality, this proves that personality has an influence on creativity as creativity is reflected in each person's personality, so that people should consider developing AI to have its own personality. I also thought that AI is usually referred to as 'it' but instead, refer it as 'they', 'their' or 'them', then AI would count as a person with a personality. For example, having a sounding voice that is in both genders in AI make humans refer to it as either 'he' or 'she', such as “referring to Apple’s artificial-intelligence (AI) assistant as “she” feels natural because of Siri’s female-sounding voice. Although Siri herself will tell you she is neither male nor female” (Waddell, 2015). Despite that Siri is categorised as gender-neutral, this brings an idea of gender identity in AI. As this is due to that Siri

is usually with female-voice, this influences people to refer to it as 'she'. This could be different if the voice of Siri is male-sound, people will refer to it as 'he'. I believe that this creates some personality in AI.

Does its design create emotional power, creative individuality, and artistic value?

In order to determine whether AI can be a designer, the question would be whether it can have its own style within the design and whether it brings emotional power, creative individuality, and artistic value. If so, how do they define originality within AI-generated objects? The word 'originality' is similar to 'creative' as well. The definition of 'originality' is "the quality or state of being original, freshness of aspect, design, or style, and the power of independent thought or constructive imagination."

(Merriam-Webster, 2021). Therefore, 'creativity' and 'originality' share similarity in their meaning and therefore, AI-generated object should be considered 'originality'.

This is stated by Wang (2019, pp. 61-63), who uses art as an example that objects which were created by AI could be "associated with the concept of 'art'", that achieves "both objective and subjective criteria", AI can make products which the determination of art is the objective criteria. If there is a "subjective judgement", anything AI created would be art. Thus, the question 'Can AI create art?' should be

differentiated from the question 'Can AI create good and worthy art?' So that, one question that must be questioned is whether AI-generated objects should be treated the same as artificial artwork and if it is, 'how does knowledge of the artist's identity (AI or human) affect participants' evaluation of the artwork?' If AI is involved in artistic creation, it will not be "limited to vision". This is because it is a part of "human thinking. It simulates the human visual thinking mechanism and performs image learning, analysis, recognition, and even artistic image creation." Creativity has been known as the unique ability possessed by human beings. However, due to the "development of science and technology", this uniqueness of the ability will be challenged. This is, therefore, an AI-generated object could be described as creativity. Because of the development of science and technology, it will be possible that AI will be able to have its originality, which is evolving through development. We will see emotional power, creative individuality, and artistic value. Perhaps, AI can show emotional power by reflecting on an object. This also shows that creative individuality and artistic value are made within AI-generated objects. The influence of AI that brings to art creation is commented on by Hong and Curran (2019, p.3) which they state that the digital art industry is giving its attention towards the AI. Many people have tried to "create art using AI, and some of its ambitions have been realised by Google's DeepDream project and the Creative Adversarial Networks

(CAN)." A project such as DeepDream is to analyse patterns and shapes of a specific image and create a new psychedelic image. There is a similar project called *Next Rembrandt*, which is analysing the paintings of Rembrandt and creating new portraits with its data. This leads to a new style of art by using AI. Therefore, this brings AI originality by creating new pieces and showing creativity in the AI-generating process. It proves that AI is not perfectly creative, but by learning each aspect of creativity, its work will have creative individuality and artistic value. Although this is only just one aspect of creativity, there are various ways of being creative, whether artistic, literature, programming, or business. Overall, being creative is how you solve the problem, and "something novel can be formed when data science meets engineering, industrial design and social science" (Moltzau, 2019). Therefore, this is how they could apply the potential creativity of AI to those fields.

Future side

What kind of designer must we be in the future?

While AI develops to have design thinking, we must consider what kind of designers we must be in the future. The advancement of AI can cause the replacement of human resources, which could lead to unemployment. This could apply to designers

as well. For example, the term fourth industrial revolution is related to this development because this is the idea that "smart factories in which machines are augmented with web connectivity and connected to a system that can visualise the entire production chain and make decisions on its own" (Bawany, 2019). It means this change how designers have done in their design process, which the process would be automated and uses machine learning method to improve the design. Therefore, this could affect designers, replacing them as AI finds them unnecessary. However, product designers can work with AI, such as when it comes to creating a prototype of new technology. AI designers are the example, which Linden (2019) comments that the AI tech team will cooperate with product designers if they need "a prototype, demo, or visualisation of their technology." While AI designers will make what is possible with AI, it is valid for people to see it. If AI functions well, they show how people use specific technical capabilities by making prototypes. For example, they could create a demo of AI, which will advise with a caption for posting or find a place to buy a pair of shoes displayed in the post. It shows that product designers can cooperate with AI technologists to develop new AI technology. Thus, it is one way for designers to collaborate with AI in the future. In the design industry, designers currently use AI algorithms to produce multiple design variations and choose one choice out of it. This is a human: AI: human design process in which,

human inputs data, then computer designs the combinations, and then human pick one variation. This process would be ideal for using AI for the next half-century. Basu (2019) stated that "the avalanche of AI" guarantees manual tasks to be mechanised and produce updated cognitive decisions. However, designers usually use AI in programs "with presets to determine the margin width or select colours, typefaces and layouts". Commonly, this could have forgotten that it is even occurring. It needs every living, breathing, and creative person to use these basic capabilities towards more sharp ends. Thus, designers cannot be entirely removed from the design process by algorithm-based tools. The meaning is that it is necessary to co-design between humans and computers as this process requires each other.

How can there be co-design between humans and AI?

It could be possible if human designers treat AI as a colleague. One viewpoint suggests that AI would take over designers' jobs, but it could help them instead of replacing them; thus, co-design between humans and AI can happen. The idea that AI will not replace designers is proven from an interview with Adel Zakout and Tom Mallory. They are the founders of Furniture-sourcing platform Clippings, which Zakout comments that:

I actually think it'll be the opposite. I think artificial intelligence will empower designers. I think that AI, especially for repetitive work, is incredibly powerful. But fundamentally, the creative process that designers go through will be quite difficult to replace with AI.

(Fair, 2021)

Furthermore, He also added that "I think technology will do a lot to enhance the process but I don't believe that I will replace the designer." (Fairs, 2021) This shows that designers would not be replaced. They still need it in the design process. This is where the co-design could be introduced. By referring to the term Co-creativity, Co-design is described as "introduces a computer into this collaborative environment as an equal in the creative process" (Davis, 2013, p. 10). How this is works is that "a situation in which the human and computer improvise in real time to generate a creative product. Here, creativity emerges through the interaction of both the human and the computer" (Davis, 2013, p. 10). An equal interaction between humans and computers rather than everyone performing their task and computer as a tool will show that designers can work with AI as they did with each other to create or improve the design. Therefore, there is no need to be concerned about being replaced, because there will be co-design between human and computer.

What is the future of AI in general?

I have explained the current situation with AI, and now we must consider the future that is up ahead. We should consider how we live with AI in the future. The question that must be asked is whether humans will be able to live in the future where AI takes over a majority of the jobs. Even in the job market, "AI and machine learning are at the top of many lists of the most important skills in today's job market" (Stahl, 2021). Therefore, it is essential to consider how people can live without getting a job, as not everyone can have technical knowledge in AI or machine learning. There was a nationwide research experiment that occurred in Finland. In this experiment, "2,000 randomly picked, initially unemployed people received a guaranteed, unconditional, and automatic cash payment of a modest €560 per month instead of a basic unemployment allowance in similar amounts." (Allas et al. 2020). The purpose of this experiment is to inform universal basic income. The results were that "small increase in employment, significantly boosted multiple measures of the recipients' well-being, and reinforced positive individual and societal feedback loops." (Allas et al. 2020)

This research shows that there would be possible that humans can live in the future where AI takes a majority of the job. With the vast increase in well-being, the results show colossal statistics on Mental health and trust due to stable household income. Therefore, they could focus on seeking more creative activities. This could lead to

people "fueled more positive feelings. The recipients' trust in their own abilities and their positive outlook seem to have acted as self-fulfilling prophecies." (Allas et al. 2020) This proves that humans can live positively without getting employed and having paid by the government. This can be a possible solution to a problem where AI or other automation takes over employments and increases unemployment. However, some people may prefer being productive rather than sitting at home watching TV or playing games. After all, this varies in people's financial status, where some people would still look for a job to get more money as the income might not be enough. Back to the subject, although AI will take most of the jobs, at the same time, it also creates new jobs, as AI will push innovation massively, and this will boost many existing industries and could potentially "create many new sectors for growth, ultimately leading to the creation of more jobs." (Stahl, 2021). This brings potential jobs that humans can still get employed, which shows that despite most operations will be automated, there is a way that people can live and cooperate with Artificial Intelligence.

Conclusion

I have researched each aspect of co-design between humans and computers/AI. I believe that AI can perform creatively despite not possessing emotions. Even if not in

the field of design, there are various ways that AI could utilise its creativity.

Sometimes, personality influences creative performance, so I suggest that AI should be developed to have its own personality, thus influencing how people refer to AI.

Therefore, there will be an equal relationship in co-design between humans and AI instead of one of 'user' and 'tool'. There are issues in understanding the originality in AI-generated work. Therefore, people should review and develop on copyright or patent for AI so that that AI will be credited as an 'author'. Despite this, AI would not take over the majority of the jobs in the workplace. Both advantages and disadvantages come co-design with AI, especially regarding the ethical side.

Nevertheless, humans can be able to live in an AI-automated future. Overall, this is about how far can we trust AI. After all, I think AI can have its creative thinking, which does not affect designers; it will help them improve the design and its process.

Therefore, co-design between humans and AI is possible in the future.

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