Should Human Artists Fear AI?
A Report on the Perception of Creative AI

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The question of whether a machine can be creative has been at the center of many scholarly debates. But what does the public think about the possibility for AI to gain a place alongside human artists? This paper presents the results of a survey conducted at the University of Nottingham which investigated the public reception of the application of Artificial Intelligence to the creative sector. The study examined the attitudes and beliefs of participants to the prospect of a future scenario where machines create art alongside and in collaboration with humans. The responses, collected both through an online questionnaire and a focus group, reveal that participants do not exclude the possibility that in the medium-term AI may earn the attribute 'creative'. Still, this does not mean that this scenario is welcomed.

1. Introduction

Artificial Intelligence (AI) applications relieve humans from the burden of tasks that would be too strenuous, too tedious, or that would require the elaboration of quantities of data that us humans would struggle to handle. In the last decades, however, AI has started entering also domains which we would comfortably describe as a prerogative of humans. Creativity is among these domains. In the last few years, AI has learned to write novels,[1] to draw,[2] and to animate pictures, not dissimilar from the portraits that hang on the walls of Hogwarts (*Zakharov et al*. 2019).

These state-of-the-art achievements by AI can without doubt intrigue and even bewilder the public. But how do people feel about the possibility for AI to be rightfully classified as 'artist' alongside humans in the medium-term future? In this paper I present the results of a survey conducted at the University of Nottingham in September 2019, aimed at testing how participants respond to the attribution of creativity to AI and to its application to the creative sector.

The survey consisted of an online questionnaire and a follow-up focus group, designed to discuss in more detail some of the prospects that emerged from the questionnaire. The results show a moderate agreement on the possibility for AI to develop creative qualities in the medium-term future (10 years from now), notwithstanding the fact that state-of-the-art AI is not deemed in possess of the necessary features to be at present deemed creative. These results, however, should not be taken as a mark of endorsement of the appropriateness of developing creative AI. On the contrary, the majority of participants expressed a feeling of concern and uneasiness at the prospect of a future creative AI entering a field that should remain exclusively human. I conclude the paper by pointing at some of the limitations of the study and at further research that may be conducted on the theme.

2. Survey on the Perception of Creativity
2.1. Background

There is a rich literature on the definition of creativity and on its application to various domains, such as the arts but also science, technology and the everyday life.[3] However, what is lacking in the literature is a consensus on what the nature of creativity is. The notion of creativity can indeed cover a wide spectrum of meanings and definitions. It can be described as a subjective property of the artist or as a quality that is assigned to the process or product in question by the audience. On the other hand, it can also be described as an objective property that can be developed through exercise and hard work. It does not come as a surprise that, when the discussion revolves around the attribution of creativity to machines, the struggle in finding a consensus becomes even greater.[4]

1. See, for example, the Japanese AI that passed the first round for the national literary prize https://www.digitaltrends.com/cool-tech/japanese-ai-writes-novel-passes-first-round-nationanl-literary-prize/.

2. See, for example, AI-Da robot, https://www.ai-darobot.com/ai-da-home.

3. For an overview on the theme of creativity in the literature and on the different definitions that can be given of it, see Boden 2004; Elton 1995; Gaut 2010; Glover, Ronning, Reynolds 1989; Moruzzi 2018; Newell, Shaw, Simon 1962; Runco, Garrett 2012; Keith Sawyer 2012; Simon 1985; Sternberg 1999; Weinberg 1993.

4. See Amabile 1996; Elton 1995; Kelly 2019; Newell, Shaw, Simon 1962.

5. Similar studies have been conducted, for example, by companies, governments, and teams of researchers, see AI Today, AI Tomorrow Survey 2020, Bristows 2018, Cave 2019, Robb 2004, Scheufele, Lewenstein 2005.

One of the aims of the survey that I will present, was indeed that of analyzing the different opinions regarding the possibility for AI to be creative and of investigating the reasons that motivate them. Not surprisingly, the survey conducted confirms the lack of consensus as to what creativity is. The results obtained from the study are nevertheless beneficial to contribute to the mapping of public perceptions regarding the application of AI to the creative sector and the consequences that it may bring.[5] A secondary aim of the project is to get a grasp of the level of familiarity that contemporary audiences have with the recent developments in AI and with its application to the creation of 'art'. The long-term aim of this survey is to inform other, similar, surveys on different areas of application of AI. The final scope would, thus, be of getting a wider sense of the public reception of AI which could potentially inform policies and regulations on safe and beneficial applications of AI systems.

The study has been conducted in September 2019 as part of the Research Priority Area project 'Audience Perceptions of AI Interaction in Different Modes of Engagement' conducted in collaboration with the Departments of Humanities and Medicine at the University of Nottingham.[6] The study consisted of two parts. The first was an online questionnaire of 60 questions that was completed by 203 participants. The second part of the study consisted of two focus groups aimed at discussing in more depth the topics explored in the questionnaire.

In what follows, I describe in more detail the method and procedure of the questionnaire and focus group, as well as reporting on the results obtained.

2.2. Online Questionnaire: Method and Procedure

The online questionnaire was hosted on the JISC online survey platform and it was advertised through newsletters, social networks, and posters distributed around the University of Nottingham campus. The questionnaire was completed by 203 participants, who had been asked as a necessary condition to continue with the survey to agree for their answers to be used anonymously for research purposes. The participants were mainly academics (67.5%) and students (33%), and 9.9% were professionals. The age group 25-44y was the one that was better represented (63.5%). The participants belonging to the group 45-64y were 18.7%, 65y or above 3.4% and 16-24y 11.8%. The 74.9% of participants declared to be of White ethnic background. The majority of participants were Male (56.2%), the 37.4% Female, 0.5% Transgender, 1% Other and the 4.9% preferred not to answer.

After a screening section, aimed at measuring the familiarity participants had with AI and their engagement with the art sector, participants were asked their opinion regarding the application of AI in a range of different sectors. The central part of the questionnaire asked participants to indicate the principal features of creativity and to give answers to targeted questions

about the use of AI in the creation of supposedly artistic products. Lastly, the questionnaire closed with some general questions on the participants' opinion regarding the possibility for AI to be creative. Some control questions have been included to try to minimize biases and to verify whether participants interpreted in a different way the terminology and concepts used in the questions. Most of the concepts discussed, such as creativity and its features, the concept of art, but also AI itself, can, in fact, be given different definitions and interpretations. Details of the relevant questions from the questionnaire are provided below in section 2.3..

At the end of the questionnaire, participants could enter a raffle prize of two £50 and two £100 Amazon vouchers as a reward for their completion of the questionnaire. They had also the option to insert their email address if they were interested in taking part to the follow-up focus group.

Given the diversity of the themes addressed and of the kinds of questions that were asked, the questions were of different kinds: binary questions, multiple choice questions, Likert scales, and one open question. With the exception of the open question, which was optional, answering the other questions was a necessary condition to proceed with the questionnaire.

2.3. Online Questionnaire: Results

The screening questions were aimed at having an idea of the background of the participants in regard to their engagement with the two fields on which the survey focuses, namely Artificial Intelligence and the creative arts.

Participants express quite a high level of confidence regarding their familiarity with AI systems. To the question 'How much do you know about AI?', the 75.9% replied 'Something' and the 18.2% 'A lot'. Despite the confidence displayed, though, the 32.5% of participants is 'Not sure' of whether they have been in contact or used an AI application, while the 8.4% declares not to have been in contact with any, which seems improbable given the pervasiveness of AI also in objects of everyday use such as the smartphone or the Internet (which participants had to use in order to fill in the questionnaire).

Getting closer to the theme at the core of the survey, to the question 'Are you aware of Artificial Intelligence systems that produce art?', the 66.5% of participants replied 'Yes', while the 14.3% is not aware of it. The 19.2% is instead 'Not sure'. As for the engagement with the creative sector, it is reassuring to note that only the 0.5% replied 'Never' to the question 'How often do you engage with creative arts (e.g. listening to music, going to the cinema, theatre, exhibitions, etc.)?', while the 78.8% engages with it 'Frequently'.

From the results, I believe it is safe to conclude that, from their own admission, participants are relatively familiar both with applications of AI and with the creative arts in general. What remains to be seen is how they react to the prospect of the interaction between these two fields.

The central task that the questionnaire presented to participants was to answer some questions about two paintings and two musical clips.
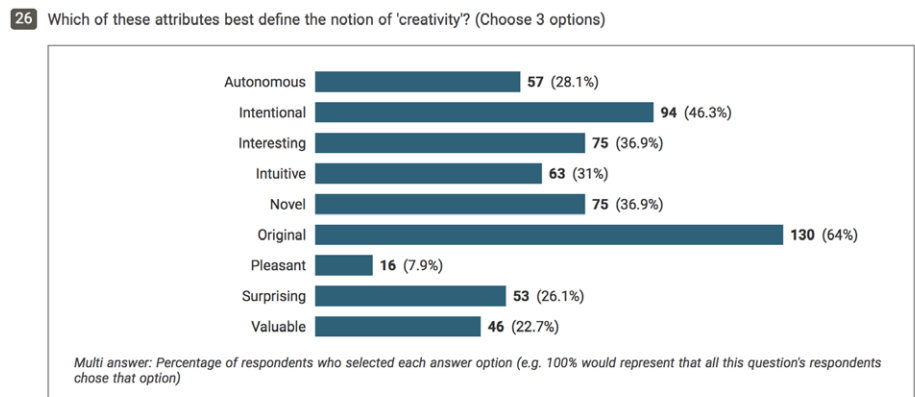
Fig. 1. Attributes of creativity.

Participants were not aware of the fact that one of the two paintings was created by an AI and one of the two clips was AI-generated. More precisely, Painting 2 was created by the generative algorithmic model Creative Adversarial Networks (CANs) while Painting 1 was *Oil on Canvas* by the Armenian artist Yura Harutyunyan.[7] Clip 1 was AI-generated through Recurrent Neural Networks (RNNs) while Clip 2 was human-generated: *Emotional Piano Solo Music #2* by Mattia Cupelli.[8]

Before engaging with the test, participants were asked to give their opinion regarding 'Which of these attributes best define the notion of "creativity"? (Choose 3 options)'. The participants' answers were as follows (Fig. 1. Attributes of creativity):

26 Which of these attributes best define the notion of 'creativity'? (Choose 3 options)

Attribute	Count
Autonomous	57 (28.1%)
Intentional	94 (46.3%)
Interesting	75 (36.9%)
Intuitive	63 (31%)
Novel	75 (36.9%)
Original	130 (64%)
Pleasant	16 (7.9%)
Surprising	53 (26.1%)
Valuable	46 (22.7%)

Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

The properties that are identified as the most defining features of creativity are: Original 64%, Intentional 46.3%, Interesting and Novel 36.9%. Not surprisingly, these are also some of the properties that are indicated in the literature as the essential characteristics of creativity.

After having the possibility to look at the two paintings and listening to the audio clips, participants were asked to reply to a number of different questions on a Likert scale that were aimed at testing which one of the two paintings/clips they preferred, and their level of confidence regarding the creativity, surprisingness, intentional creation, and pleasantness of the paintings/clips. Unaware of their provenance, 40.9% of participants agreed that Painting 1 (human-generated) was creative or very creative, while 28.6% claimed that Painting 2 (AI-generated) was creative or very creative. As for the clips, 35% of participants agreed that Clip 2 (human-generated) was creative or very creative, while only 20.2% claimed that Clip 1 (AI-generated) was creative or very creative. The results obtained are similar also in respect to the other parameters that participants were questioned on: the human-generated painting and clip obtained higher percentage of confidence as for their novelty, pleasantness, and surprisingness and participants liked them more than the AI-generated painting and clip.

As a last question, participants were asked which of the two paintings/clip they thought was created by a human. Most people recognized correctly

which painting/clip was created by a human (58.1% for the painting, 62.1% for the clip). When asked if they would still pay to see Painting 2 in an exhibition and to listen to Clip 1, after learning that they were AI-generated, 25.6% participants replied 'No' and 10.8% 'Not at all' for Painting 2. The 47.8% of participants replied 'No' and the 29.1% 'Not at all' for Clip 1. Percentages decreased when, instead of paying, participants were offered to go and see Painting 2 at a free exhibition (13.4% replied 'No' and 5.4% 'Not at all') or to download Clip 1 for free (38.4% and 22.7% respectively).

The replies given by participants to these questions clearly depend on the paintings and music clips at issue and, thus, in part also on their aesthetic quality. It is not possible, then, to generalize and to conclude that participants would judge in a similar way also other products created by AI. Other questions in the questionnaire, however, allow us to have a wider sense of the participants' reception of creative AI in general. Even in this case, AI does not seem to gain much support, though.

To the questions 'If you found out that the painting/music album you just bought was not painted/composed by a human but by an AI, how would you feel about it?', participants did not react with much enthusiasm. The 31% of participants would be positively surprised if the painting was created by an AI and 35.5% if the music album was composed by an AI, but almost the same number of participants would react in a neutral way (36.5% for the music album and 36.9% for the painting). The 28.1% and 32% would instead be disappointed in finding out that the music album and painting respectively were AI-generated.
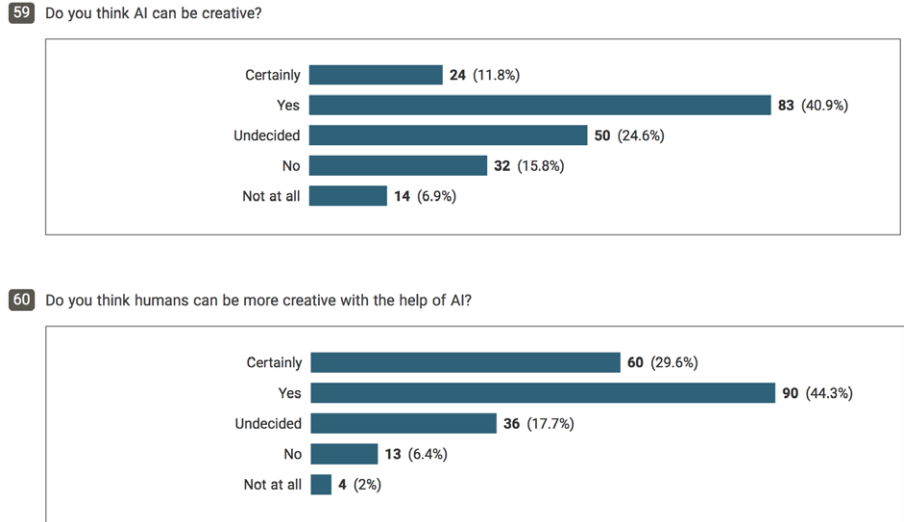
Even clearer is the participants' opinion when asked 'If you had the choice of buying a painting created by a human and one created by AI, which one would you buy?'. The 90.1% of participants would buy a painting created by a human and the 93.1%, when asked the same question but in relation to a music album, would prefer to buy an album composed by a human.

It should be noted that the disappointment that participants might have felt at the state-of-the-art AI-generated products presented as a case study in the questionnaire might have influenced also their reply to this question, since it was asked to participants after they carried out the test. The previous questions on the reaction they might have after finding out the origin of the product they bought was asked instead before they carried out the test on the human/AI generated paintings and music clips.

The questionnaire closed with a question that has been addressed numerous times in the literature on the topic and that stands behind the drive that motivated the design of the survey itself: 'Do you think AI can be creative?' (Fig. 2. Creative AI). Despite the disappointment expressed by participants in respect to the AI-generated painting and music given as example in the test, the majority of participants agreed with the possibility for AI to be creative: 40.9% of participants replied 'Yes', and 11.8% replied 'Certainly'.
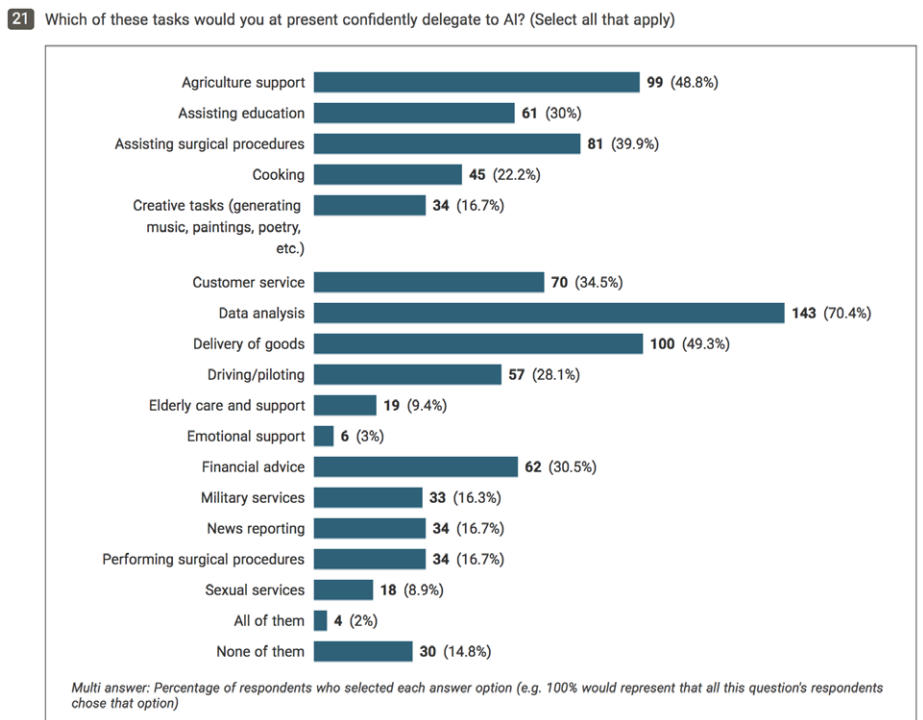
Even more optimistic is the reaction to the question 'Do you think humans can be more creative with the help of AI?'. In this case the 44.3% replied 'Yes' and the 29.6% is certain of the benefit that may come from the collaboration between humans and AI.

Fig. 2. Creative AI.

59 Do you think AI can be creative?

Certainly	**24** (11.8%)
Yes	**83** (40.9%)
Undecided	**50** (24.6%)
No	**32** (15.8%)
Not at all	**14** (6.9%)

60 Do you think humans can be more creative with the help of AI?

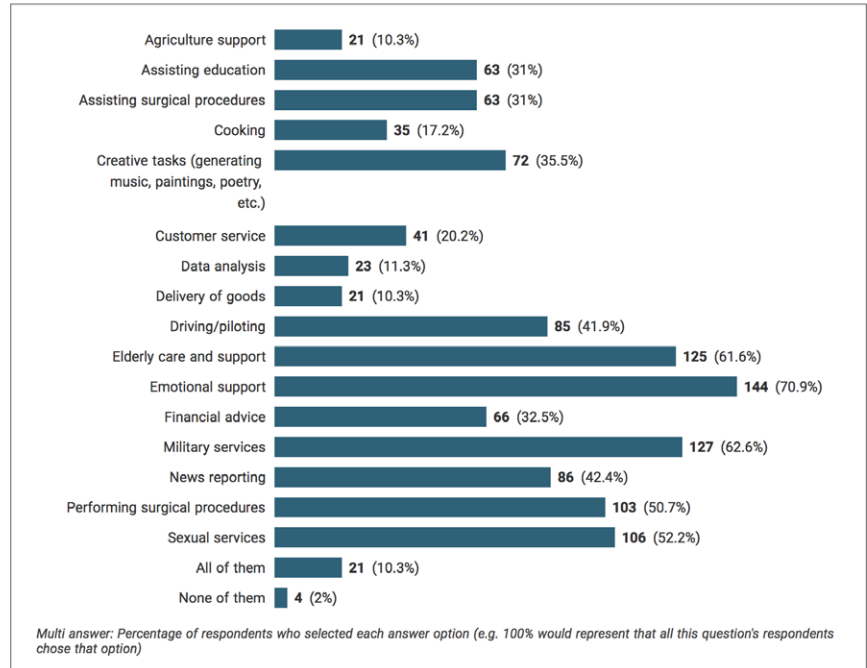|	
Certainly	**60** (29.6%)
Yes	**90** (44.3%)
Undecided	**36** (17.7%)
No	**13** (6.4%)
Not at all	**4** (2%)

In general, however, the confidence that participants seem to grant to AI applications to the creative sector is not very high in respect to other areas of application. In the first part of the questionnaire, participants were asked the following two questions: 'Which of these tasks would you at present confidently delegate to AI?' and 'Which of these tasks would you at present be concerned about delegating to AI?'. The results are as follows (Fig. 3. Applications of AI):

Fig. 3. Applications of AI.

21 Which of these tasks would you at present confidently delegate to AI? (Select all that apply)

Agriculture support	**99** (48.8%)
Assisting education	**61** (30%)
Assisting surgical procedures	**81** (39.9%)
Cooking	**45** (22.2%)
Creative tasks (generating music, paintings, poetry, etc.)	**34** (16.7%)
Customer service	**70** (34.5%)
Data analysis	**143** (70.4%)
Delivery of goods	**100** (49.3%)
Driving/piloting	**57** (28.1%)
Elderly care and support	**19** (9.4%)
Emotional support	**6** (3%)
Financial advice	**62** (30.5%)
Military services	**33** (16.3%)
News reporting	**34** (16.7%)
Performing surgical procedures	**34** (16.7%)
Sexual services	**18** (8.9%)
All of them	**4** (2%)
None of them	**30** (14.8%)

Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

Which of these tasks would you at present be concerned about delegating to AI? (Select all that apply)

Task	Value
Agriculture support	21 (10.3%)
Assisting education	63 (31%)
Assisting surgical procedures	63 (31%)
Cooking	35 (17.2%)
Creative tasks (generating music, paintings, poetry, etc.)	72 (35.5%)
Customer service	41 (20.2%)
Data analysis	23 (11.3%)
Delivery of goods	21 (10.3%)
Driving/piloting	85 (41.9%)
Elderly care and support	125 (61.6%)
Emotional support	144 (70.9%)
Financial advice	66 (32.5%)
Military services	127 (62.6%)
News reporting	86 (42.4%)
Performing surgical procedures	103 (50.7%)
Sexual services	106 (52.2%)
All of them	21 (10.3%)
None of them	4 (2%)

Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

The three areas of application that participants would more confidently delegate to AI are Data analysis 70.4%, Delivery of goods 49.3%, and Agriculture support 48.8%. The ones in relation to which participants expressed more concern are instead Emotional support 70.9%, Military services 62.6%, Elderly care and support 61.6%. It is clear from the results that the applications that people would be warier of delegating to AI are also those that involve emotional connection and empathy (in the case of Emotional support and Elderly care and support) or that require to take decisions that could have a relevant impact for global safety (in the case of Military services). On the other hand, more confidence is placed in respect to the application of AI to carry out tasks that are tedious or too time consuming to be carried out by humans. Application to creative tasks scored a 16.7% of confidence and a 35.5% of concern. The application of AI to the creative sector would in part also require the involvement of emotions and empathy, both from the side of the public and from the side of whoever produces art.

Still, the majority of participants is unsure about whether the increasing application of AI systems to different areas will be a valuable addition for our society. To the question 'Will society become better or worse from increased automation and AI', the 66.5% of participants declares to be 'Not sure', while only the 19.2% thinks it will become 'Better' (the 2.5% thinks it will not change, while the 11.8% thinks it will cause society to become 'Worse').

The concerns in relation to the use of AI systems for the creation of artistic products is expressed by many participants with clarity - and also with some vehemence - in reply to the open question of the survey. The question asked participants to motivate their reply in response to the question 'How likely do you think it is that AI replaces human artists in the next 10 years?'. 176

out of the 203 participants replied extensively to the open question, despite it being not compulsory for moving on with the questionnaire, thus showing the wish to engage with the topic. It is interesting to analyze the ideas that emerged from the replies in relation to the challenges met by AI in achieving a level of creativity which may be compared to human creativity.

The vast majority of replies can be grouped under two main categories: (i) those expressing the idea that AI cannot produce art/be creative since it lacks the necessary experience and 'personality' requested to a creative agent and (ii) those expressing the idea that AI cannot produce art/be creative since it lacks the necessary feelings and emotions. Some examples:

*****3819
'The personal narratives around artists are important. [...] Robots ain't gonna have any one trust that's worth listening to any time soon.'
*****8215
'The human subjectivity, intentionality and creativity can't be replaced by a machine, because a machine can only imitate the objective-formal thinking process.'
*****0222
'AI does not (any may never) possess the required emotional understanding.'

A third category that emerged in parallel to the two mentioned above is the category of responses that express a resolute distrust and instinctive aversion against the appropriateness of building a creative AI. Some examples:

*****3817
'Art created by AI will never be accepted within the entire population'
*****6582
'AI is a marketing sham'
*****1872
'What is the point of generative art if the greatest value of art (the process of artmaking by a human being) is left outside the equation?'

Similar feelings and opinions emerged also from the follow-up focus group that was conducted on similar themes. In the next section, I present the structure of the focus groups and its main findings, before moving on to the discussion on the conclusions that can be drawn from the results of the survey.

2.4. Focus Group: Method and Procedure

The follow-up focus group was designed with the aim of getting deeper into some of the issues that emerged from the questionnaire and to observe participants from different backgrounds interact through the discussion on the possibility for AI to enter the creative sector.

The focus group was advertised through newsletters and through posters in the University of Nottingham campus. People who were interested in

participating contacted me directly through the email provided. Participants to the online questionnaire who expressed their wish to be part of the focus group had been contacted by email to ask for their availability.

The two focus groups had 10 participants each and they lasted one hour each. Both focus groups had been conducted at the University of Nottingham campus in September 2019 before the start of the lesson period in teaching rooms that were booked beforehand. The day and time of the focus group was agreed by email with the participants who signed up for the participation to the focus group.

Participants were asked to sign a consent form where they agreed for their replies to be reported anonymously in research papers and for me to record the session. They also anonymously filled in a sheet with screening questions, the same ones asked also in the online questionnaire. The participants to the focus group were mainly students (35%) and academics (25%) and the 25% of participants worked in administrative roles. As in the questionnaire, the age group 25-44y was the one that was better represented (85%), while participants belonging to the group 45-64y were 10% and 16-24y 5%. The 60% of participants was of White ethnic background. The majority of participants were Female 65% and 35% Male. The totality of participants declared to know 'Something' about AI and to engage with the creative arts 'Frequently' (55%) or 'Sometimes' (45%). For the participation to the focus groups, each of the 20 participants received a £15 Amazon voucher.

The focus groups consisted of three parts: in the first part participants were given a form each with a set of questions on AI and they were asked to discuss about them in smaller groups (two groups with 5 participants each) for around 10 minutes. They were asked also to write their individual replies on the forms that they handed me at the end of the session. The questions of this first part were the following:

Set A
1. What is AI?
2. What is your attitude towards AI in general?
3. Do you think AI can improve the way we live or that it will make it worse?
4. Are you aware of applications of AI in the arts? Name a few.
5. Do you think art is a field where AI will be able to replace humans? Why? Why not?

In the second part of the focus group I showed participants two videos. The first was the presentation of the Next Rembrandt project, sponsored by ING Direct in collaboration with the Rembrandt museum and Microsoft and the result of which was to create a portrait in the style of Rembrandt with the use of neural networks and 3D printers.[9] The second was the music video 'Automatica' of the musician Nigel Stanford playing music together with robotic arms created by the company KUKA Robotics.[10] After each video I left the students 10 minutes to discuss in their group the impressions derived from what they had seen.

9. Accessible at https://www.youtube.com/watch?v=IuygOYZ1Ngo.

10. Accessible at https://www.youtube.com/watch?v=bAdqazixuRY.

In the third and last part of the focus group, participants were divided again in two smaller groups with 5 participants each and they were given to discuss the following questions:

Set B
1. Do you think you are biased in your judgement of AI?
2. Has the session of today changed your ideas in this respect? Why?
3. If you believe that we (humans) are generally biased towards AI, what is that makes us so? What can we do to avoid it?

A supplementary scope of the focus group was to test two hypotheses:

H1: The fact that the artificial system is endowed with physical features increases the probabilities for this system to be perceived as creative.
H2: The skeptical attitude expressed by participants in respect to the possibility for AI to be creative that emerged from the online questionnaire is in part motivated by biases that people have against AI in general and, in particular, against the appropriateness of AI entering the creative field.

As I will detail, H1 was tested through the discussion that followed the videos and H2 through the questions asked in the last part of the focus group.

2.5. Focus Group: Results

The results that emerged from the focus groups confirm the attitudes expressed also by the participants to the online questionnaire. Participants to the focus group welcome the support that may come from AI system for carrying out tedious tasks, but they remain wary of a wider application of AI to other domains. Some of the opinions expressed during the first part of the discussion include:

Participant n. 1
Question A.1: 'I like the idea of having robots perform tedious tasks in my place but I think we should limit this to a certain degree'
Participant n. 11
Question A.2: 'Can be used for good or bad but needs to be controlled/monitored; pace of change scares me; needs legal oversight'
Participant n. 13
Question A.2: 'I'm afraid that in same point artificial intelligence would attempt against human kind'
In particular, art is perceived as a field which is, and needs to remain, paradigmatically human:
Participant n. 5
Question A.5: 'Imagination and creativity can't be replaced by machines.'
Participant n. 7
Question A.5: 'Art to me is essentially a field to express humanity.'

The reactions participants had after watching the two videos confirm the opinion they expressed in the first part of the talk. Both examples - the recreation of a painting in the style of Rembrandt through algorithms and 3D printers and the performance of a human musician with robotic arms playing instruments - are judged as fascinating processes but lacking the individuality and emotional involvement necessary to be considered 'Art' or creative. In particular, the Next Rembrandt project has been described as a 'waste of money' and disrespectful towards the original painter (Participant n. 13).[11]

The music video with the performance of robotic arms by KUKA, had the aim of introducing a further variable in the discussion, namely a physical presence of the machine that actively performs on stage. The starting hypothesis was that this additional element should contribute towards a more favorable acceptance of the potential creativity of the artificial system. Indeed, the fact of being embodied should arguably be beneficial to the agent's perception of the contextual environment and to its empathic interaction with other agents (Goldman 1993; Edmonds 1994; Sharples 1994). However, the participants' reactions supported H1 only in part. Participants, in fact, reported perceiving a lack of interaction of the robots with the audience and of the individuality that characterizes human performances, despite the physical presence of robots on stage. Even if robotic arms had not been deemed sufficient to vouch in favor of a greater creativity of the system, though, the relevance of embodiment for artistic performances had been acknowledged. Indeed, some participants did not exclude the possibility for these artificial agents to build a better connection with the public if they develop and assume additional 'human-like' physical features.

Testing the impact of embodied features on the perception of creativity is a task that would require more in-depth studies and experiments with controlled variables. I, thus, do not have the presumption that the results obtained in this respect from the focus group count as evidence against or in favor of the relevance of embodiment. They do, however, suggest that further investigations on the theme are worth pursuing.

The last part of the focus group was aimed at testing H2, namely the hypothesis that, in general, human are negatively biased against AI. Biases can affect judgements in respect to AI as a whole and as applied to the creative sector. Given its nature and the subjectivity of the area to which the notion is applied, the evaluation of creativity is in itself prone to biases. And biases may emerge even more strongly when the creative product is generated by a machine.

A notorious example of the effect of the biases that we bear in respect to non-human art is the case of David Cope's music generation program EMI, a software that creates new music by deconstructing the structure of the music entered as input into the database. This software was not exempt from biases: 'A music critic published a damning "review" of the first public

11. In the online questionnaire, the 36.5% of participants declares to be 'concerned about the potential issues that AI could pose in matter of copyright', the 36.9% is undecided and the 26.6% is not worried about it.

concern of music composed by the Emmy program [...] - but he did so fully two weeks before the concert took place. [...] His preconceptions about the inadmissibly of computer-composed music [...] made any attempt at a TT [Turing Test] utterly pointless' (Boden 2010: 411). The lack of appreciation from the part of the audience ultimately led Cope to destroy the Emmy database (Boden 2010: 412).

The replies given by participants confirm the idea that we may be biased towards AI:

Participant n. 1
Question B.1: 'Yes! For me the reason is linked to ideas found in movies about the future. Those ideas are not necessarily true.'
Participant n. 4
Question B.1: 'Yes - as its [sic!] non human, we cannot form an emotional connection / relate to it. This is a bit barrier [sic!] for most people.'
Participant n. 14
Question B.1: 'Yes, biased against it to a large extent'
Participant n. 15
Question B.3: 'I think there's an instinctive aversion/suspicion to non-human tech - uncanny valley! Expectation of empathy with another human behind the art.'

Will this attitude change with the so-called 'digitally-conceived generation'?[12] Do these biases depend on the education of the individuals and on the context in which they are raised? Only time will answer the first question. As for the second, we can try to answer it by joining efforts in interdisciplinary research teams with the scope to analyze our perceptions and assumptions towards the diffusion of technology in our everyday life.

3. Discussion

From the results detailed above, some conclusions can be drawn regarding what do participants think regarding the possibility for AI systems to produce art alongside humans. Despite the fact that the examples used in the questionnaire - the painting generated through CANs and the music clip generated through RNNs - and in the focus group - the Next Rembrandt project and the 'Automatica' music video by KUKA Robotics - are not judged as displaying creativity, the majority of participants does not exclude the possibility that in the medium-term future AI may be creative. Even more positive is the attitude shown in respect to the possibility for AI to collaborate with humans to generate creative products.

This result, however, does not mean that participants agree at the same time with the appropriateness for AI to become creative. In other words, AI 'can' be creative but it 'should' not. This attitude emerges in particular from the replies given by participants to the open question in the online

12. The generation conceived by the digital natives generation born from the 1980 onwards.

questionnaire and from the discussions in the focus group. This is accompanied by a diffused sentiment of uneasiness and concern regarding the intrusion of AI in many aspects of our existence. While the support that may come from AI systems to carry out burdensome and tedious tasks is generally welcomed, less so is the participation of AI in domains that require emotional participation and empathy, and the creative sector is among them.

In conclusion, it is necessary to point out some limitations of the present survey. The first limitation comes from the relatively small sample of participants and from a lack of diverse occupational background. Given the nature of the survey and the means that have been used to advertise it, in fact, most of the participants came from an academic background. It would be beneficial to repeat the survey with a more diverse pool of participants to examine whether it would entail also a change in the results. With a larger sample it would also be interesting to perform cross-tabulations between the age group of participants and the replies given to key questions in the survey. In the present survey, the sample size of some of the age groups is <20 participants, so it is not possible to relevantly apply statistical models to this kind of analysis.

A limitation of the survey that is less easily avoidable comes from the vagueness that is intrinsic to some of the categories that have been object of analysis. 'Creativity' and 'art' can indeed often be confused and, although it is difficult to totally exclude overlaps between categories whose definition is vague and which have many aspects of similarity, it could be helpful to conduct a survey that tries to isolate the two categories. Similarly, participants may not all agree on the use and meaning of notions such as 'intention' and 'autonomy'. This condition could eventually be controlled by adding questions in the questionnaire, giving participants the possibility to clarify their use of terms.

Lastly, the test conducted in the questionnaire and the videos that sparked discussion in the focus group were limited to examples in the fields of painting and music. However, creativity can be displayed in a variety of other domains, from science to technology, to the everyday life. For the sake of completeness, thus, the discussion should be extended to other fields where AI can display creativity.

Many are the themes that emerged from this survey and that would be worth exploring in more detail. As already mentioned, the investigation of the role of embodiment for our perception of creativity would be beneficial both to better understand whether being endowed with physical properties is a necessary feature that a creative agent should possess but also to provide suggestions that can be useful for researchers in robotics to develop systems that can build a better interaction with users.

From the discussions during the focus group, it clearly emerged the idea that we are often biased in our judgement towards AI systems. This is

a vast and complex theme that a single survey could not certainly exhaust. Further research would thus be welcome to explore the motivations that stand behind the mental models that we use when approaching topics such as the creative potential of AI. Although not a tool for acting directly toward a solution to the problem of biases, conducting further analysis and gathering data from participants coming from a variety of ethnic and occupational backgrounds would be beneficial to gain inputs that feed into a research path aimed at developing AI in a responsible and beneficial way.

References

AI Today, AI Tomorrow Survey.
2020. "The Arm 2020 Global Survey"
[accessed: 16-04-2020] https://pages.arm.
com/artificial-intelligence-survey.html.

Amabile, Teresa.
1996. *Creativity in Context*. Boulder:
Westview Press.

Boden, Margaret.
2004. *The Creative Mind: Myths and
Mechanisms* (2nd ed.). London: George
Weidenfeld and Nicolson.

Boden, Margaret.
2010. The Turing Test and Artistic
Creativity. *Kybernetes* 39: 409-413.

Bristows.
2018. Artificial Intelligence: Public
Perception, Attitude and Trust Survey
[accessed: 16-04-2020] https://www.bristows.
com/viewpoint/articles/artificial-intelligence-
public-perception-attitude-and-trust/.

Cave, Stephen et al.
2019. *"Scary Robots: Examining Public
Responses to AI", Proceedings of AIES*.

Edmonds, Ernest.
1994. "Introduction: Computer-based
Systems that Support Creativity", in
*Artificial Intelligence and Creativity, Studies in
Cognitive Systems*, ed. Terry Dartnall. Vol. 17
(pp. 327-334.

Elgammal, Ahmed et al.
2017. "CAN: Creative Adversarial Networks,
Generating "Art" by Learning About
Styles and Deviating from Style Norms",
arXiv:1706.07068v1.

Elton, Matthew.
1995. "Artificial Creativity: Enculturing
Computers," *Leonardo,* Vol. 28 (pp. 207–213).

Gaut, Berys.
2010. The Philosophy of Creativity.
Philosophy Compass, Vol. 5 (pp. 1034-1046).

**Glover, John, Royce Ronning, and
Cecile Reynolds eds.**
1989. *Handbook of Creativity*. New York:
Plenum Press.

Goldman, Alvin I. ed.
1993. *Readings in Philosophy and Cognitive
Science.* Cambridge, MA: MIT Press.

Keith Sawyer, Robert.
2012. *Explaining Creativity: The Science
of Human Innovation*. New York: Oxford
University Press.

Kelly, Sean Dorrance.
2019. "A Philosopher Argues That an AI Can't
Be an Artist", https://www.technologyreview.
com/s/612913/a-philosopher-argues-that-
an-ai-can-never-be-an-artist/.
Accessed on 5th August 2019.

Moruzzi, Caterina.
2018. "Creative AI: Music Composition
Programs as an Extension of the
Composer's Mind", *Philosophy and Theory of
Artificial Intelligence 2017,* ed. Vincent Müller.
Berlin: Springer.

**Newell, Allen, John C. Shaw and
Herbert A. Simon.**
1962. "The Process of Creative Thinking",
in *Contemporary Approaches to Creative
Thinking*, eds. Howard Gruber, Glenn Terrel,
and Michael Wertheimer (pp. 63-119). New
York: Atherton Press.

Robb, David et al.
2004. *"Robots in the Danger Zone:
Exploring Public Perception through
Engagement"*, arXiv:2004.00689v1.

Runco, Mark A. Garrett J. Jaeger.
2012. "The Standard Definition of
Creativity", *Creativity Research Journal.* Vol.
24 (pp. 92–96).

Scheufele, Dietram, Bruce V. Lewenstein.
2005. "The Public and Nanotechnology:
How Citizens Make Sense of Emerging
Technologies", *Journal of Nanoparticle
Research*. Vol. 7 (pp. 659–667).

Sharples, Mike.
1994. "Cognitive Support and the Rhythm
of Design", in *Artificial Intelligence and
Creativity, Studies in Cognitive Systems*, ed.
Terry Dartnall. Vol. 17 (pp. 385-402).

Simon, Herbert.
1985. "What We Know About the
Creative Process", in *Frontiers in Creative
and Innovative* Management, ed. Robert
Kuhn (pp. 3-22). Ballinger, Cambridge.

Sternberg, Robert J. ed.
1999. *Handbook of Creativity*. Cambridge:
Cambridge University Press.

Weisberg, Robert.
1993. *Creativity: Beyond the Myth of Genius*.
New York: W.H. Freeman.

Zakharov, Egor et al.
2019. *"Few-Shot Adversarial Learning of
Realistic Neural Talking Head Models"*,
arXiv:1905.08233v1.