

Dylan Cotton
Artificial Intelligence and the role of Art.

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Chapter 1

Introduction

Everyone, it would seem, has an opinion on Artificial Intelligence (AI) and many are inadequately informed on the subject; hardly surprising given that during the time I have been writing this paper the situation has advanced, new milestones been reached and fresh avenues of research discovered each day. For example, in January 2019 the discovery of a previously unknown human genome was made using an AI application. (Mondal, Bertranpetit and Lao, 2019) However, fear of AI technology is commonplace, with many unaware of its current proliferation or usefulness, imagining it is just something to do with fictional robots.

In this paper I intend to outline progress in AI thus far, particularly in relation to the Arts. I shall acknowledge the technological achievements of AI developers, demonstrating that the technology has arrived irrevocably, highlighting its availability, capabilities and potential. I shall also consider the question of computational creativity and hope to dispel some of the myths and fears surrounding it. I shall present an argument for working collaboratively with and growing alongside Artificial Intelligence, and discuss the pioneering artists doing just that.

Chapter 2

Artificial Intelligence: the contemporary situation

The term Artificial Intelligence (AI) was first coined by American computer and cognitive scientist John McCarthy in 1956. McCarthy was one of the founders of the discipline of artificial intelligence, spending much of his career at Stanford University. He received many accolades and honours including the 1971 Turing Award. (En.wikipedia.org, 2018a). McCarthy died in October 2011, just before many of the exciting new developments in AI technology emerged.

One such development was evidenced in the Go match played in South Korea in March 2016, between Lee Sedol, a South Korean professional Go player (ranked two in the world in 2016) and AlphaGo, an AI (Machine Learning) computer program developed by Alphabet Inc.'s Google DeepMind in London. Go is an abstract strategy board game for two players, in which the aim is to surround more territory than the opponent. The game

was invented in China more than 2,500 years ago and is believed to be the oldest board game continuously played to the present day. By 2009 there were over 40 million Go players worldwide. (En.wikipedia.org, 2018b). The contest proved a revelation: "more than 200 million people watched online as AlphaGo emerged the surprise 4-1 victor of The Google DeepMind Challenge match in Seoul, South Korea, with the consensus among experts that this breakthrough was a decade ahead of its time. Throughout the course of the tournament AlphaGo confounded the experts by playing several highly innovative moves which contradicted centuries of received Go knowledge." (DeepMind, 2018) Ke Jie, the world's top ranked Go player at the time, had this to say: "Humanity has played Go for thousands of years and yet, as AI has shown us, we have not yet scratched the surface." (Tegmark, n.d.)

AI technology has been beating our best players at their own games for much longer, famously defeating chess grandmaster Gary Kasparov in 1997. More recently a team from Carnegie Mellon University put on a spectacle in January 2017 when its Libratus AI system played 120,000 hands of No Limit Texas Hold'em against four poker professionals. (Newatlas.com, 2018) While the professionals spent every evening of the challenge discussing among themselves what weaknesses they could exploit in the AI, the machine also improved itself every day, patching holes in its game play and improving its strategy. The human brains were no match for the machine. Each of the four players was comprehensively defeated over nearly a month of play. One of the participants, a high-stakes professional poker player named Dong Kim, said "I didn't realise how good it was until today. I felt like I was playing against someone who was cheating, like it could see my cards...I'm not accusing it of cheating. It was just that good." (Newatlas.com, 2018)

The impact of Artificial Intelligence on competitive games has been significant. This underpins my belief that AI is a substantive game-changer across a variety of disciplines. Everyone should care about AI as it increasingly affects most areas of human life, and is being considered, researched and implemented at many levels in most fields of human endeavour. Google's CEO, Sundar Pichai, speaking at Davos in 2018, suggested that "Artificial Intelligence is probably the most important thing humanity has ever worked on. I think of it as something more profound than electricity or fire." (World Economic Forum, 2018)

Several prominent thinkers have issued stark warnings on Artificial Intelligence, even advocating a cessation of its development. Stephen Hawking, perhaps the most respected theoretical physicist and cosmologist of recent times, expressed deep concerns about the future of Artificial Intelligence. His open letter on AI, January 2015 cited a potential lack of control as a pitfall. (En.wikipedia.org, 2018c) Hawking cannot be described as a technophobe, especially given his own dependence on it in later life, so we should consider his concerns seriously. The prospect of losing control of AI does rightly instil a sense of foreboding. Were Hawking's misgivings related to Artificial Intelligence or the fear of the technology suddenly becoming conscious and therefore uncontrollable?

This paper does touch on the question of computational consciousness, but when I write about artificial intelligence or (AI), it is my assumption I consider just that, an AI. A computational system that has become self-aware or conscious is no longer artificial: it is real. Stuart Russel, Professor of Computer Science, Berkeley, wrote, "There's a common misunderstanding that Artificial Intelligence presents a risk because it will magically become conscious and spontaneously hate human beings. There's no reason to be concerned about spontaneous malevolent consciousness." (People.eecs.berkeley.edu, 2019) I also believe machine consciousness is not a concern. For me this notion is as likely as Art or Literature somehow morphing into autonomous entities.

Despite the reservations of Stephen Hawking, considerable revenue streams and scientific energy are being pumped into AI research. In October 2018 the Massachusetts Institute of Technology announced it would, in September 2019, open a College of Computing dedicated to the study of Artificial Intelligence. The focus of the new college is to study not just AI code, but interdisciplinary AI education and how AI can be used in fields as diverse as history and biology. The cost of a new faculty and buildings for the new college is expected upon completion to exceed \$1 billion. (En.wikipedia.org, 2018d)

Globally spending on AI research is forecast to grow from \$640m in 2016 to \$37bn by 2025, according to the market research firm Tractica. Tractica's research director, Aditya Kaul, says cases like image recognition, algorithmic securities' trading and healthcare patient data management, "have huge scale potential", as well in areas including business services, consumer products, industrial robotics, advertising, finance, media and defence. (Financier Worldwide, 2018)

it is clear that the overriding majority of technology-driven scientific opinion is firmly behind the ongoing, apparently unstoppable proliferation of Artificial Intelligence. But what of public opinion? Are these rapid changes a catalyst for uncertainty, confusion or even alarm?

I have analysed a 2018 survey of consumers conducted by ARM Technologies and summarise it here to raise some key issues.

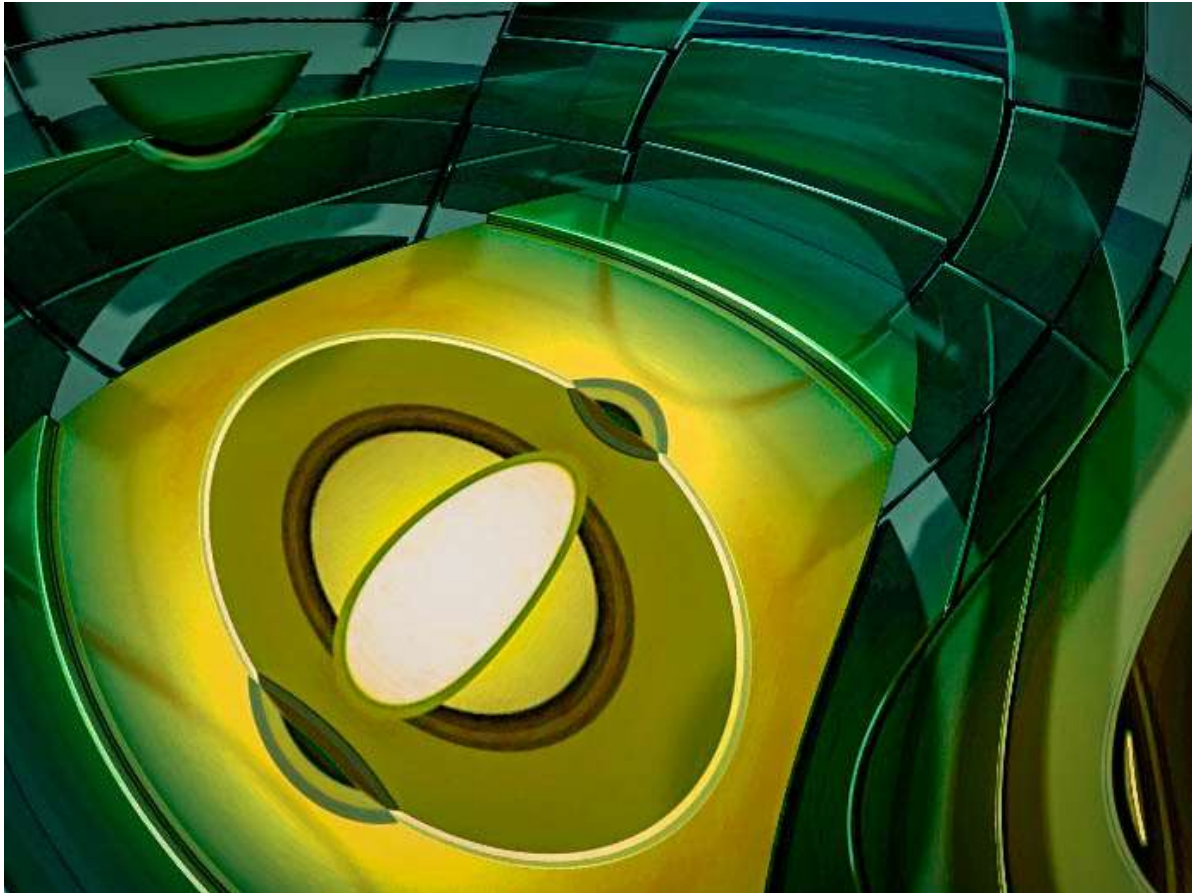
Most respondents were excited and optimistic at the possibilities of an AI-driven world but also concerned by some potential drawbacks. Nervousness was notable at the impact AI could have on employment: fewer or different jobs were considered a real possibility. The spectre of autonomous weapons systems, killer robots and unfeeling conscious computers did not escape brief inclusion in some sections of the surveys' report. The May 2017 WannaCry global cyber-attack (Ft.com, 2018) that held the world to ransom is just another reminder of the cyber threats faced today – with up to 150 countries thought to have been affected. Major attacks like this only compound consumer concerns of cyber security. The survey found such attacks become associated with the rise of Artificial Intelligence and the potential security challenges ahead. The polarising nature of AI means a significant minority of the population feel concerned or unsure about what the future may entail. Seismic change can be hard to comprehend and hence frightening. The idea of robots' controlling our lives, already part reality, results in mixed emotions. The survey also identified device-hacking and the loss of personal data as a widespread fear. Only 58% of respondents believed companies involved in creating AI machines are doing enough to protect against hacking. When asked if society will become better or worse from increased automation and Artificial Intelligence 17% expected little or no change, 22% believed our situation would become much worse, and 61% responded it would be much better.

The report came to a positive conclusion: "Artificial Intelligence is here to stay. Despite the many unanswered questions, people across the globe are hopeful the AI's impact will be positive and society will progress as a result. Expanding our forms of human expression by expanding our intelligence suggests the possibilities are endless." (Arm Technologies, 2018)

I too share this belief, and consequently my image making is beginning to interrogate aspects of AI, (See Figure 0). Max Tegmark, author of *Life 3.0a*, the best-selling book on AI, summed up the case in an interview with Andrew Anthony: "I feel every single way in which 2017 is better than the stone age is because of technology. Everything I love

about civilisation is the product of intelligence. So, if we can amplify human intelligence with machine intelligence, we have the potential to solve all these thorny problems that are plaguing us today.” (Anthony, 2018)

Figure 0. Dylan Cotton. Gan Tokamak. (Digital) AI is being used to construct virtual apparatus and environments, meaning that preliminary testing can take place safely and inexpensively. The image is my interpretation of a near future AI designed virtual Tokamak interior. (Tokamak: noun, experimental nuclear fusion reactor)



In his book “The Fourth Industrial Revolution” Klaus Schwab, founder and executive chairman of the World Economic Forum, claims “technology is evolving at an exponential rather than linear pace. This is the result of the multifaceted, deeply interconnected world we live in. New technology begets newer and even more capable technology. It builds on the digital revolution and combines multiple technologies that are leading to unprecedented paradigm shifts in the economy, business and society.” (Schwab, 2017)

Schwab is aware of the emerging technologies of artificial intelligence, quantum computing, Crispr, biotech, nanotech, blockchain, and sees these technologies merging, and doing so exponentially. Such merging will affect all aspects of human existence, and

so it is no surprise it has become a potent issue for the Arts too, in terms both of subject matter and of technical innovation. These are aspects I shall consider in the next chapter.

Chapter 3

Technology and Artists

There is nothing new about the link between art and technology. In his book 'Secret Knowledge: Rediscovering the Lost Techniques of the Old Masters' David Hockney looks at the various optical technologies used by the old masters. "It has often been suggested some artists, Vermeer and Canaletto in particular, might have used optical equipment." A startling discovery made by Hockney also describes a method from the late Middle Ages on. "All that is required is a concave mirror, in everyday terms a shaving mirror, which we know to have been something that could have been manufactured at the time. Its opposite, a convex mirror - which simply has the silvering on the other side of the glass - is frequently depicted hanging on the wall of early Netherlandish paintings such as Van Eyck's Arnolfini portrait." (Hockney, 2009)

Hockney himself has often embraced the technology of the day. In 1986 he made several experimental works with Xerox machines. Famously during the 1980's he would send "art faxes" to his friends. Some of the original faxes have come up for auction and fetched considerable prices, despite Hockney's describing them as worthless. More recently in 2012 he held a solo exhibition at the Royal Academy, London. Entitled: A Bigger Picture, it featured dozens of prints of paintings he had created with an iPad. (Royalacademy.org.uk, 2018) Of course Hockney is just an example; the co-existence of technology and art is enduring and more than ever evident today.

While researching this paper I have realised there is happening right now an explosion in the number of artists embracing AI technology as part of their practice. Good examples of are Mario Klingemann, Dr Libby Heaney RCA, Alexander Reben, Anna Ridler, Pierre Huygne, Robbie Barrat, Tom White, Helena Sarin, Gene Kogan, Samim Winiger, Sofia Crespo, Sougwen Chung, Shinseungback Kimyonghun duo, Sascha Pohflepp, Fabrizio Poltronieri, Mike Tyka and Pinar Yoldas. I have compiled a hyperlinked list of leading AI artists and uploaded it to my web server. (Cotton, 2019)

Mario Klingemann (Quasimondo.com) is considered a pioneer in the use of computer learning in the arts and winner of the 2018 Lumen prize. (See Figure 1) Following many months researching AI artists I have the distinct impression Mario Klingemann is

recognised by his peers and commentators alike as the leading contributor in the field. Klingemann, speaking in October 2018 explained, "The idea to me is these machines are augmenting my imagination. The algorithms involved take input data and recast it as vectors in something called Latent Space. Here, all data is of a similar nature, whether it be images, text, music, or any other material. Because of this zero-level of interpretation, the model can be a type of 'Universal Translator', and cross boundaries that humans could not. These processes will then inspire and inform artists in entirely new ways, allowing them to create completely original artworks." (Forbes.com, 2019)

Figure 1: Mario Klingemann. The Butcher's Son. Gold Award. Lumen Prize 2018
A neural network's interpretation of the human form. This image has been generated entirely by a machine using a chain of GANs (generative adversarial neural networks).



Mario Klingemann was also a guest on the BBC Radio 4 Front Row programme, (Front Row, 2018) entitled 'The arts and artificial Intelligence', aired in November 2018. Here Klingemann said, "I liken training an AI to training a child, I give the AI it's values then I wait for the moment where I can say, okay you seem to be diverse and versatile enough to keep on surprising me. This might be conceived as creative, but I am the creative, the machine is an inspirational machine that offers me something and I have to recognise if it's something worth sharing." This is an excellent analogy by Klingemann and it's a message integral to this paper, the understanding that control is ours, and ours alone, is also reiterated by Dr Libby Heaney RCA later in chapter 6.

Chapter 4

Art related Artificial Intelligence events and Exhibitions

On the 25th October 2018, Christies of (New York) auctioned a work of art created by Artificial Intelligence. The image fetched \$432,000, more than forty times its estimate. (Nytimes.com, 2018) A freely available AI algorithm had been used as a tool by a small team of French artists to generate the image. It was these artists that had chosen what information to provide to the AI and selected the final image from many produced by it (Elgammal, 2018). This auction certainly sets a good precedent for the future of AI art and may help draw attention to other artists working with the technology.

Galleries and art shows are beginning to curate entire exhibitions dedicated to AI technology and associated themes. August – September 2018 saw the internationally recognised gallery Nature Morte (www.naturemorte.com) present an exhibition of work made using Artificial Intelligence. It was curated by 64/1, an art curation and research collective founded by artist Raghava KK and economist Dr Karthik Kalyanaraman (64/1, 2019). The exhibition, called Gradient Descent, explored the intersection of artificial intelligence and contemporary art. It brought together artists who consider how contemporary art can create a dynamic human-machine relationship. Absorbing the contributions from the seven artists involved, my thoughts were directed towards the need for artists to consider the future, a future that is likely to be determined by our technology. This ground-breaking exhibition also provided us with a vision of what art could be in the age of artificial intelligence. (www.naturemorte.com, 2018)
(See Figure 2)

Figure 2: Anna Ridler, Untitled (from the First Training Set) from the series 'Fall of House of Usher' Drawings made from the GAN generated animation 2017. Gradient Decent Exhibition. Nature Morte, August-September 2018



Here is what Nature Morte had to say in the exhibition write up. "Our entire future - economic, political, social - is already being revolutionised by artificial intelligence. We commonly fear how this new technology will negatively impact our lives as we know it, yet we rarely consider the positive social possibilities created by its use. How can we reimagine creativity, human purpose, and society in this future world using artificial intelligence? The pioneering artists in this show grapple with these complex questions and prove creativity and human labour need not be replaced by machine but can be reinvented and evolve further with the rise of new technology, allowing artificial intelligence to become one of our greatest collaborators. Like every important paradigm shift in the history of art and art making before it, AI Art challenges us to rethink what art is and how it is made." (www.naturemorte.com, 2018)

In February 2018 the art museum Frankfurter Kunstverein, Frankfurt, Germany (Fkv.de, 2019a) hosted a group exhibition called "I'm here to learn" (Fkv.de, 2019b), also featuring adaptive technologies and artificial intelligence. The exhibition focused on perception and interpretation as human faculties, which machines can acquire through learning procedures. The Frankfurter Kunstverein presented 19 international artists

whose work thematises the processes involved in machine perception and autonomous action. With so many artists participating there was of course a multi-faceted quality to the exhibition; however, its central investigation focused on art's role in a world increasingly influenced by intelligent systems, and contemporary debate on this issue. A duo of Seoul-based artists calling themselves "Shinseungback Kimyonghun" used an algorithm (Google Cloud Vision API) that produced abstracted images based on machine interpretations of flowers. (See Figure 3) With this work the artists show a clear and controlled result from a computer algorithm that makes autonomous decisions on image generation. (Fkv.de, 2019) Of course, the artists themselves had the final say, in selecting the images they liked and rejecting those they did not. This example from the Frankfurter Kunstverein exhibition teaches us something important. AI systems may suggest improved or different ways of doing things, even viable solutions to mankind's most complicated problems such as disease, poverty and the environment, but it is the human judgments on implementation of such solutions that matter in the end.

Figure 3: Flower 02 by Shinseungback Kimyonghun. Created with (Google Cloud Vision API) I am here to learn: On Machinic Interpretations of the World. Frankfurter Kunstverein 2018



Mattis Kuhn (Kuhn, M. 2019) is an artist and curator at the Frankfurter Kunstverein, enquiring about the (above) "I'm here to learn" exhibition (Fkv.de, 2019b). I emailed him asking for his opinion. His kind reply included the view: "Contemporary art is art of now, dealing with what's important for now and possibly for the future. I think it's important for a lot of artists with different backgrounds to work with AI. To use AI programming tools is becoming easier and easier, even for artists, nevertheless I'd like

to see more artists dealing with AI without programming, e.g. in painting, performing, video and so on. There is a lot of work to do for artists." I cover his important point about AI programming in the next chapter, but as Kuhn suggests, it's necessary for a lot of artists to be aware of the role they might play in the development of AI. Kuhn also said, later in the email, "AI could also influence our understanding or common belief of what art is." Interestingly, with this view, the interaction between Art and AI is mutually informative and influential.

In December 2018 I attended an exhibition by AI artist Pierre Huyghe (See Figure 4) at the Serpentine, London. (Serpentine Galleries, 2019) The first curiosity was the title of the exhibition, "UUmwelt". This must refer to the word Umwelt which in ethology means: 'the world as experienced by a particular organism.' On entering the Serpentine lobby, I noticed a bluebottle fly walking around on the cash register, which I thought was rather odd given time of year. At 3pm precisely the other visitors and myself were ushered into the exhibition space, which was dimly lit and occupied by a large community of the very same bluebottle flies. I found this slightly unsettling and this feeling was compounded by a strange omnipresent sound track and peculiar collection of smells. Huyghe had installed large LED display walls throughout the interconnecting rooms that made up the space. The screens were showing thousands of flickering images, bizarre biological looking mongrelisms morphed in and out of existence, each living for just fractions of a second. We learned that these images had been generated by a *Deep Neural Network AI*, then manipulated by human brain waves and refined once more by the algorithm. This process was then repeated. Like the other elements I've already described, these images were also unsettling. Huyghe had used an orbital sander to strip back large areas of paint from the walls, layers of paint we were told that had accumulated over twenty years with each layer a previous exhibition. By exposing the dozens of paint layers Huyghe created forms quite similar to some on the screens, like the ringed patterns seen at the roots of a felled tree, denoting an elapsed and lengthy time period.

A few minutes into the experience it dawned on me that I too was part of the exhibition, as indeed were the other visitors. A cascade of realisations followed, now I could see every element of the exhibition in a well-defined co-existence. The human, the animal, the non-human and even time itself were combined and represented as a functional wholeness. For me the Pierre Huyghe exhibition gave rise to thoughts about the next level of human evolution and the arguably inevitable closer union between the biotic and abiotic. An informative video about Pierre Huyghe's "UUmwelt" show has been made and published on YouTube by the exhibition curator Rebecca Lewin. (Lewin, 2019)

Figure 4: Pierre Huyghe, UUmwelt. Serpentine Gallery, 2018. Photograph: Dylan Cotton



Chapter 5

Do artists need a doctorate in computer science to create Art using AI?

The answer is no. By its peak in late 2016 the free mobile app 'Prisma' had been downloaded 52 million times with over 4 million daily active users (King, 2018). The app is a neural network and artificial intelligence photo-editing suite. It transforms any image into an array of possible artistic effectual outcomes. Prisma arrived early, giving millions of users the tools needed to generate art made from a collaboration between human and Artificial Intelligence. By the end of 2016 it had processed more than 1.2 billion images. Prisma's algorithm is based on the more complicated open-source programming algorithms behind Deepart, which in turn has processed over 100 million user images. (Deeparteffects.com, 2018)

Many other competing programmes and web applications have come online, including the Deep Dream Generator from Google (Deepdreamgenerator.com, 2018) a convolutional neural network. Also, now available to everyone regardless of programming ability, are Generative Adversarial Networks. GANs are a class of artificial intelligence algorithm used in unsupervised machine learning, implemented by a system of two neural networks competing in a zero-sum game framework (En.wikipedia.org, 2018e). Free to use, these GANs have been put into a user-friendly format by several projects, including the web applications DeepArt.io (Deepart.io, 2018) and GanBreeder.app (Ganbreeder.app, 2018).

Thus, from the early days of Prisma to today with the much more advanced GanBreeder type applications, there is easy access to all. Anyone with a moderately recent device can create art using Artificial Intelligence and software ranging from basic to near cutting- edge. However, the GANs I have mentioned do come pre-trained with hundreds if not thousands of images which they use for reference purposes. Should one want to train a GAN with one's own images, one will need to understand a lot more about programming. Though the sector is moving quickly and I'm sure new user-friendly applications will soon arrive with user-image training capabilities built in. Anna Ridler, a British AI artist and one of the artists featured in the Gradient Design exhibition, (www.naturemorte.com, 2018), also says of image training, "Large tech firms are at the forefront but actually it is relatively easy to get hold of cutting edge code on places like github or arxiv. What is harder is to get hold of the data or information that's used to train AIs. Perhaps open-sourcing this would create new opportunities for artists." (Forbes.com, 2019)

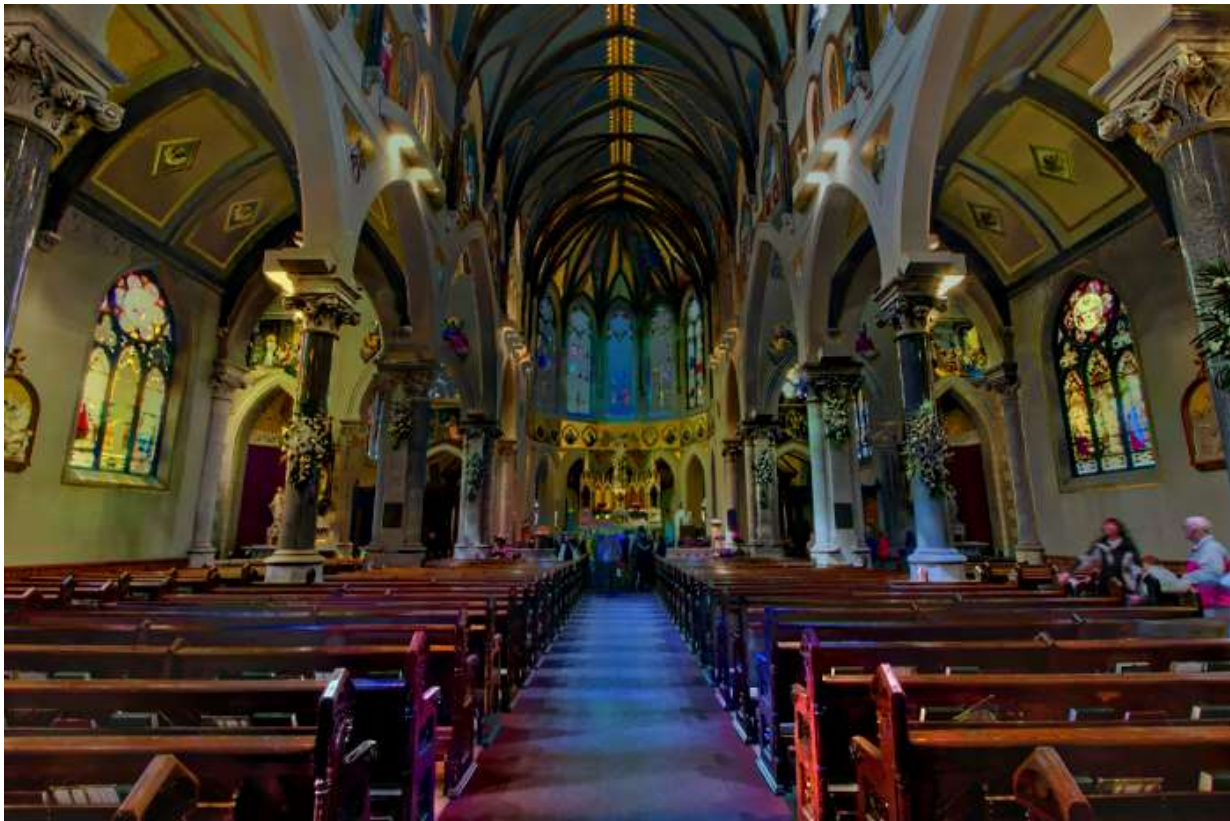
Mybridge AI is organisation that registers and evaluates open-source machine learning projects (Mybridge for Professionals, 2019). It registered 8,800 new projects in 2018. Ranked at number 2 was the freely available Deep-photo-styletransfer application (GitHub, 2019) developed by Fujun Luan, Ph.D. at Cornell University. The algorithm is fed two images, it applies the style attributes of the secondary to the primary image and outputs a third. The results can be extraordinary. (See Figures 5a, b, c)
Figure 5a. Primary Image. The image to be manipulated.



Figure 5b. Secondary Image, this is the style to be added to primary image.



Figure 5c. Output Image. Deep-Photo-Styletransfer.



Chapter 6

Could AI systems render human artists extinct?

I should like to tackle this question head on with a big gun, as I believe this issue is at the forefront of the debate and a cause for concern to many who worry about Artificial Intelligence. Of course, artists would be missed, (well most), but according to some this same question has a wider application to all human existence. The fate of artists may arguably present a parallel to this broader extinction scenario. Dr Libby Heaney RCA (Heaney, L. 2019) is an artist, researcher and quantum physicist working at the intersection of art, technology and science. She pioneers quantum computational methods both as tools and concepts in creative practices. At the Royal College of Art, she runs the Systems Research Group, has lectured and been a RCA tutor since 2014. She has published 21 internationally peer-reviewed research papers (Anon, 2019a) in physics and art.

In an interview for Forbes, Tabitha Goldstaub asked Heaney, "Should AI be an opportunity, that enhances artistic capabilities, or a threat, that could supersede human artists?" Heaney replied, "I believe AI can certainly enhance artistic capabilities, but I doubt it will supersede human artists as humans are required to choose the algorithm, what to train the algorithm on, the parameters of a neural net and so on. Of course, the outcomes of working with AI in art might be surprising, but this was often the case with early digital computer artworks by, for instance, Manfred Mohr (Emohr.com) who has stated he never knew what a machine would output. But this is different to a machine superseding human artists. In some sense we are still asking similar questions about machines and art to those asked by artists in the 60s and 70s. Perhaps this will always happen when there is a sudden leap with what is possible with a new technology." (Forbes.com, 2019). Heaney's powerful argument states that Artificial Intelligence is just another new technology and one that we control.

Chapter 7

Can an Artificial Intelligence be creative?

Simon Colton is professor of computational creativity at the University of London. One of his papers is entitled: "Creativity Versus the Perception of Creativity in Computational Systems". Colton says, "It's not just creativity that the art lover is looking for in the process, but also effort and skill. Even if this is not the case in general, we can still conclude the assessment of an artwork can include information about the artistic process behind it. This adds to many difficulties associated with computer-generated art."

(Colton, 2018). Colton has a point, one which does appear backed up by Professor Marcus Du Sauntoy's comments made on Radio 4's Front Row broadcast, describing AI algorithms as changing and mutating. He said, "We don't know what the algorithm is doing and we don't know why they make the decisions they do." (Front Row, 2018)

Moving forward AIs will have to explain and document every activity in greater than minute detail. In this way I'm sure AIs will explain what they do, but with the absence of consciousness I doubt they will ever explain why they do it. Absent a reason for creating something, is the automatous output of a machine really creativity? When asked about machine creativity, Mike Tyka (visual AI artist, sculptor, Google researcher - Seattle) answered: "As a computationalist, I'd say, yes, of course. But the machines that we can currently build? No, not strongly. However, eventually, I see no reason they couldn't; after all, we're also just machines. But I think it all depends on your definition of what exactly you mean by creativity. The recent AlphaGo matches against Lee Sedol featured many moves by AlphaGo which were missed by the human players and later led to wins by the machines. The moves were subsequently studied and described as "beautiful" by expert human players. That sounds like the machine had created something novel, surprising and of value; to me that's creativity." (Forbes.com, 2019). Mike Tyka makes a good point with his comments on novelty and value; however, it still must be asked, was there a motivating force or consciousness within the machine that won the AlphaGo matches? The answer is almost certainly not.

Mark Coeckelbergh is a Belgian philosopher of technology at the university of Vienna. In his 2016 paper, 'Can machines make art?' he asks, "Is what the machine creates, the artistic product, the work of art, really a work of 'art'? Is machine art really art?" (Anon, 2019b). I put the same question to several fellow artists, all whom said it was not art. Johnathan Jones, art critic for the Guardian, speaking on a BBC Radio4 Front Row broadcast, said "I think it's hype and a gimmick, the notion that a machine can be an artist is nonsense." (Front Row, 2018). Contrastingly in chapter 9 I quote artist Anna Ridler, she says the AI algorithms have given her alternative options, choices and ideas they might not have had without them. For an analogy let's consider the work of Jackson Pollock made by flinging paint and splattering it from various angles and heights. He did create something he would never have been able to do using any conventional painting technique. He was in part exploiting gravity and kinetic energy in much the same way as an artist working with AI exploits mathematical algorithms.

Was then Pollock the artist making the art or was it the gravity and kinetic energy? Or was it both? I doubt he ever consciously considered it, but I would argue Pollock did of course use these forces of physics as his unknowing collaborative assistant. That said, consider Mark Coeckelbergh's observation in his paper (Anon, 2019b) where he says: "Why do we humans insist on being the only artists? If machines were artists, would this be a problem, and why? For example, is this a matter of clinging on to power? But why do we want to colonise and dominate the artistic domain? It is not clear what keeps us from opening it up to non-humans such as machines or animals, or what keeps us from recognising that these are already 'invading' the domain. And can we talk about what is happening in a different language, or is the language of domination and hegemony itself something that resists the coming into being of a more diverse human/non-human artistic world?" (Anon, 2019). If I read correctly, Coeckelbergh is tentatively predicting and perhaps advocating harmonious collaboration between human and machine intelligences. Does this qualify the collaborating machine for consideration as an artist? Well, without the confirmed presence of consciousness on the part of the machine, I believe it does not. AI in art remains just like Jackson Pollock's unknowing collaborative assistant, with big differences. It is now configurable, pliable and artists, such as those in the following chapter, using the unknowing AI assistant are aware of its presence and potential as a creative tool.

Chapter 8.

Partnership with Technology

Anna Ridler, multi award-winning AI artist (See Figure 2) and researcher, describes the position of the artist Thus: "It is most definitely an opportunity! Using AI has allowed me to create work that is looser and wilder than I ever would have been able to make myself. It is my work but also not my work - recognisably me but nothing I would have been able to do by myself. Watching it is a very odd sensation, like catching a glimpse of yourself in a mirror before you realise it is you." (Ridler, A. 2019)

An individual whose work I also find particularly interesting is Alexander Reben. (See Figure 6) He is an MIT-trained roboticist and artist also working with Artificial Intelligence. His work compels us to confront and question our expectations of our creations and ourselves. The following can be read on Alexander's About Me page, www.aren.com: "Alexander Reben's work probes the inherently human nature of the artificial. Using tools like artificial philosophy, synthetic psychology, perceptual manipulation and technological magic, he brings to light our inseparable evolutionary entanglement to invention which has unarguably shaped our way of being. This is done

to not only help understand who we are, but to consider who we will become in our continued co-development with our artificial creations.” (Alexander Reben, 2019) Reben is exploring the relationship between people and technology - as we realise the potential of this new technology, artists, engineers, scientists and the like find new potential.

Figure 6: Alexander Reben. AmalGan. An AI (GAN) combines different words together to generate an image of what it thinks those words look like. The AI then produces variants of those images by “breeding” it with other images, creating “child” images.



Chapter 9

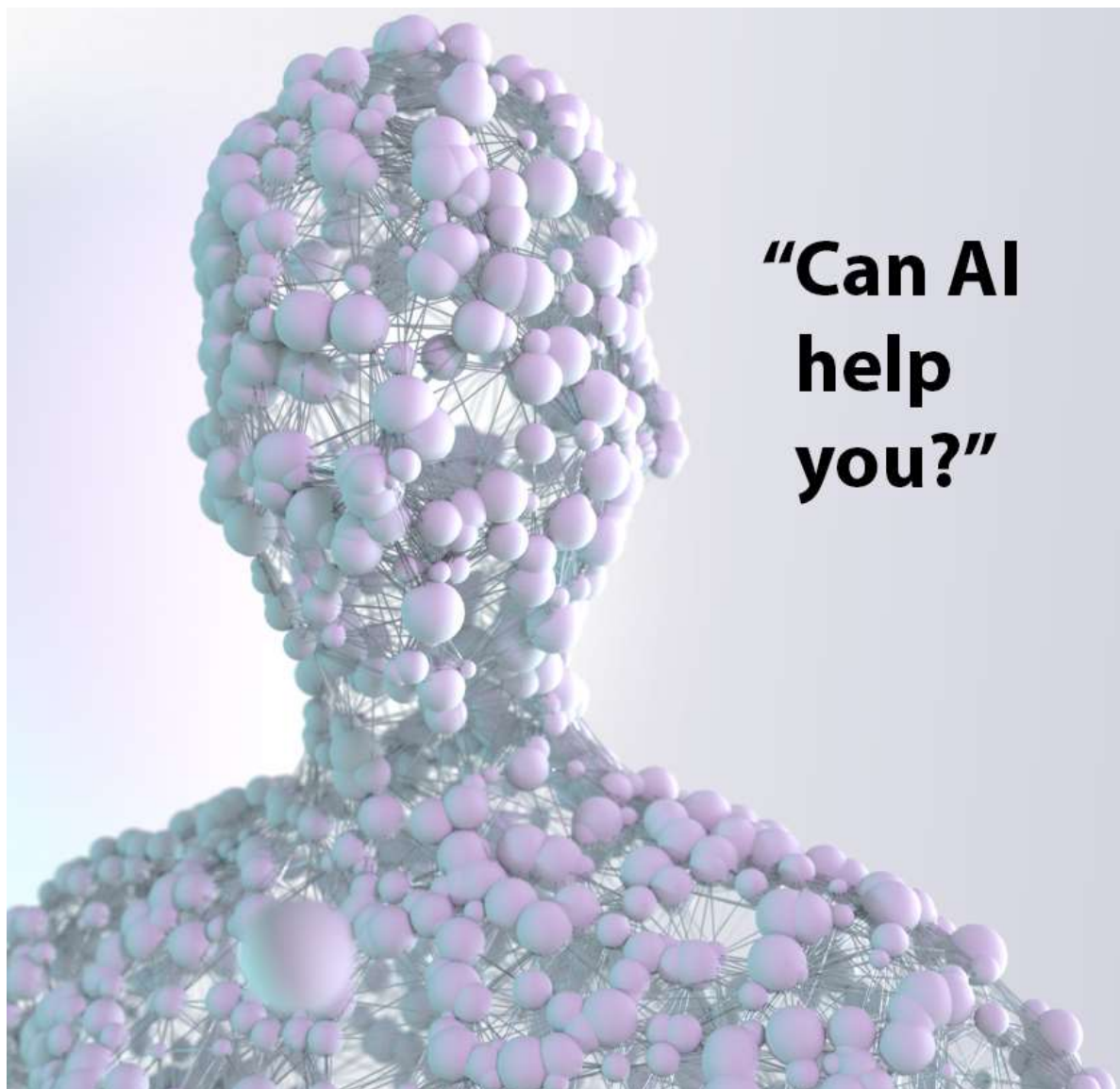
Conclusion and the future.

As I have researched this paper, it has become clear to me that our collaborative interaction with Artificial Intelligence will teach us more about ourselves than is currently knowable, because in developing this technology we shall force ourselves to reanalyse our whole existence in an entirely new way. The role of artists like Alexander Reben and others I have mentioned and quoted in this paper is, as always, an important one. Art has an influence on opinion, it translates and informs. As I've shown, the many artists now working with Artificial Intelligence are showing us today how we can use the technology tomorrow, working with it safely to augment and amplify our human intelligence, even creativity.

My research has lifted a lot of stones and I always see the same things. From the developers and scientists there is a good balance of caution and ambition. Safety is being built in with the degree of scrutiny you would expect from the aviation industry, for example. From new users of the technology, such as the artists I have mentioned, Artificial Intelligence is universally described as collaborative, a tool with which to augment their creative practice.

The previously unimaginable is happening and in proceeding conscientiously there is perhaps no limit to where AI technology can take us. Everyone, it would seem, has an opinion on Artificial Intelligence. I hope that offered by this paper has been helpful.
(See Figure 7)

Figure 7: Image courtesy of Artie.com The Platform for Intelligent Avatars.



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Figure 0. Dylan Cotton, (2019), Gan Tokamak [ONLINE]. Available at: <http://dylancotton.com/toko.jpg>[Accessed 21 January 2019].

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