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Artists, Artificial Intelligence and Machine-based Creativity in *Playform*

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Abstract

Artificial intelligence researchers and artists have trained machines and generative processes to produce visually interesting and novel works, thereby devising machinic means of creativity. At Artrendex, *Playform* was developed as an easy-to-use programme specifically to be used by a broad range of artists, from beginners to those with advanced technical skills. This essay focuses on the motivations behind the development of *Playform* and the early reception and use of it by some artists. Our aim is to better understand both human and machine-based creativity at their intersection in an art-generating system such as *Playform*.

Keywords

artificial intelligence, creativity, generative art, Playform

Artistas, inteligencia artificial y creatividad basada en máquinas en Playform

Resumen

Los investigadores y artistas de inteligencia artificial han entrenado máquinas y procesos generativos para producir obras visualmente interesantes y novedosas, dando lugar a una obra creativa "maquínica". Playform es un producto desarrollado por Artrendex pensado para que sea una herramienta fácil de usar por diferentes tipos de artistas, desde los principiantes hasta aquellos que cuentan con habilidades técnicas avanzadas. Este artículo se centra en las motivaciones que hay detrás del desarrollo de Playform y la recepción y uso que ha tenido en algunos artistas. Nuestro objetivo es comprender mejor la creatividad, tanto si viene de seres humanos como de máquinas, en su intersección en un sistema generador de arte como Playform.

Palabras clave

inteligencia artificial, creatividad, arte generativo, Playform

The Use of Artificial Intelligence in Art Making

As AI becomes incorporated into more aspects of our daily lives from our phones to driving our cars, it is only natural that artists would start to experiment with artificial intelligence. However, this is not an entirely new trend. Since the dawn of AI more than 50 years ago, artists have been writing computer programs to generate art, in some cases incorporating intelligent elements. The most prominent early example of such work is by Harold Cohen and his art-making programme AARON, which produced drawings that followed a set of rules Cohen had hard-coded. But AI has evolved over the past couple of decades to incorporate machine learning technology. One result is a new wave that uses AI in different ways to make art. In contrast to traditional algorithmic art in which the artist had to write detailed code that specified the rules for the desired aesthetics beforehand, now algorithms are set up by an artist to "learn" aesthetics by looking at many images using machine learning. The algorithm only then generates new images that follow the aesthetics it has learned. The most widely used tool in this class is Generative Adversarial Networks (GANs), introduced by Goodfellow in 2014 (Goodfellow 2014), which have been successful in many applications in the AI community. It is the development of GANs that has sparked this new wave of AI art.

Figure 1 charts the creative process involved in making art using GAN-like algorithms. The artist chooses a collection of images to feed the algorithm (precuration). These images are then fed into a generative AI algorithm that tries to imitate these inputs. In the final step the artist sifts through many output images to curate a final collection (post-curation).

At Artrendex we developed *Playform* (www.Playform.io) as an AI art studio for artists to use generative AI systems in their creative process. Our goal is to make the technology accessible to artists, solving several problems and reducing challenges that face artists

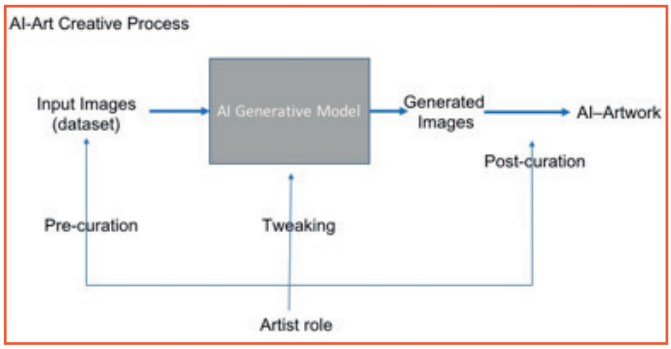

Figure 1: A block diagram showing artist's role using AI generative model in making art.

and creatives when attempting to use this technology. We wanted artists to be able to explore and experiment with AI as part of their own creative process, without worrying about AI terminology and without the need to code or to run open-source code that is meant for experts. We also wanted to help artists avoid navigating unguided through the vast ocean of AI- and GAN-like algorithms.

Most generative-AI algorithms are developed by researchers in academia or large corporate research labs to push the boundaries of the technology. Artists are not the target audience of these algorithms. However, an artist's use of these algorithms is an act of creativity. Every artist must be imaginative and highly adaptable to adopt, bend and apply such non-specialised tools for their purposes. *Playform* fits the creative process of different artists, from looking for inspiration, to preparation of assets, all the way to producing final works. Figure 2 shows the workflow in *Playform*.

On the research and development side, we had to address the problem that GANs require large numbers of images and long hours of training. So we developed proprietary optimised versions of GANs that could be trained with tens of images instead of tens of thousands, and could produce reasonable results in a matter of one or two hours.

For the design our focus was on making an intuitive user experience free of AI jargon. All of the AI is hidden under the hood. Users choose a creative process, upload their own images and press a button to start training. Within minutes results will start to pop up and evolve as the training continues. Within an hour or a bit more the process is done and the system will have already generated thousands of images. Users can navigate through these iterations to find their favourite results. Users can also continue the training process as needed to achieve better results.

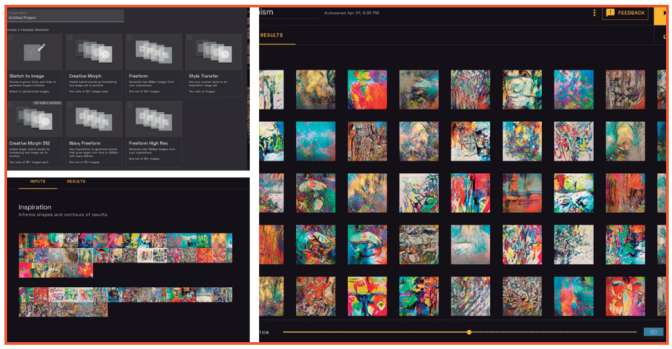

Figure 2: Example workflow in *Playform*. User chooses a creative process (Top Left). User then uploads inspiration images and influences (Bottom Left). As the training progresses, user sees and navigates through results.

Challenges in Using AI in Art Making

Since the introductions of GANs in 2014, there has been an explosion in research in the AI community for developing new types of GANs, and addressing limitations and extending the capabilities of GANs as a generative engine for images, language, and music. The sheer volume of research activity makes it nearly impossible for an artist to even know where to start to use this technology. For example, going to the code repository GitHub where developers deposit their open source codes, if you search for the term "GAN" you will find tens of thousands of GAN variants available, X-GAN, Y-GAN, Z-GAN. Artists can be overwhelmed by this ocean of GAN-like algorithms, left wondering where to start and how to find an algorithm to suit their creative processes.

Even with the availability of open-source codes several challenges still face artists. If you are not a code developer who is familiar with today's programming languages and up to date with the latest AI libraries, it is very unlikely that you would be able to benefit from existing open-source codes. Moreover, running such sophisticated AI programs requires the availability of GPUs (Graphical Processing Units), specialised hardware boards that accelerate processing speed many times (10- to 100-fold) to train AI models in hours or days instead of several weeks. The price of a GPU board that is able to run state-of-the-art AI algorithms starts at around $2000. Some platforms allow users to use cloud-based GPUs to run open-source codes with hourly charges, but these charges quickly add up to a substantial bill if you are not sure what are you doing. There are other experimental software systems available to users which offer a variety of tools to a broad range of creatives and designers with capabilities for text, audio and image generation/manipulation. *Playform* was built exclusively for visual artists to create works of art, and designed by a team whose principal area of research is machine learning of images in the context of fine art.

Another challenge for artists is that GAN-like algorithms require a huge set of training images (numbering in the tens of thousands) to generate reasonable results. Most algorithms are trained and tested on the available image datasets typically curated for AI research. Instead, artists generally prefer to use their own image collections in their projects. With *Playform* we noticed that artists choose to train their AI algorithms with sets of less than 100 images. Such a small number of images is not sufficient to train any off-the-shelf AI algorithm for creating desired results. Also, as a non-AI expert one is faced with mastering a vast number of technical terms to achieve the minimum level of understanding necessary to be in control of the process. These include terms/concepts such as training, loss, overfitting, mode collapse, layers, learning rate, kernels, channels, iterations, batch size, and additional artificial intelligence jargon. Artists might try experimenting with these systems to gain interesting results, but too often quit because of the sheer difficulty of the technology. Given the cost of GPU time and the lengthy process, this approach also results in frustration and many hours of wasted time and resources without generating anything useful or interesting.

Playform in the Context of Contemporary Art

Some artists build and implement their own generative systems to make art, but for the reasons outlined above, most do not have the means nor the time to learn the requisite computer science skills to experiment with generative systems and artificial intelligence. *Playform* may be used by artists of any skill level and is designed with a simple interface that fronts a powerful generative system. For those with limited skills the interface can be easily learned, there are databases of imagery already built into the system, and experimenting with the generative process results in outputs within an hour or two. Artists may also import their own image databases. Results will reflect the quality of what is put in, but a first step is learning how generative systems work and experimenting with the results. Time spent and more sophisticated inputs will produce higher quality work over time. On one level *Playform* facilitates discovery and experimentation and eases novice practitioners into the rapidly changing field of AI use in art. Artists who continue to use *Playform* should expect greater mastery and control of how their art is developed with AI.

Some quick context for readers who may have less familiarity with contemporary art follows. Many artists, whether they use com-

putation or not, do not necessarily handcraft their works and also use already-existing imagery taken from somewhere other than their own imaginations. In the context of contemporary art what matters is what imagery you select, how you manipulate it, and how you present it to an audience to see it. That is the heart of the creative enterprise, and is the process that *Playform* facilitates. Devising the means to manipulate and output imagery at considerable volume is a familiar tactic in contemporary art reaching back at least to the 1950s. From Rauschenberg and Johns forward artists have been using repetition rendered through technological processes to multiply imagery, most often found imagery. The pop artists amplified the practice by using silk screening, stencils and mass production techniques to make many versions and variations of any one image. Viewers were trained to recognise pattern and variation in an example such as Marilyn Monroe in cherry red, turquoise, or yellow. Conceptual art practices led viewers to expect word and imagery in text, photography, Xerox-copy and all other forms of printed and mass-produced formats on gallery walls, on the page, and on our screens. Now when computer-repeated imagery is presented, viewers are expected to detect repetition (pattern) and variation (parameterisation) produced via a generative system such as *Playform*. In addition, conceptual art and earth/land art development from the 1960s forward had led artists to think about 'systems': systems of language and imagery, systems of nature and culture and how systems have rules, logic and methods that artists can either manipulate from within or disrupt from without. Because they are a part of our contemporary world, computational image systems should be part of our art as well. It falls to artists both to learn to create from within the AI generative systems and perhaps disrupt and forge new patterns of creativity in these systems.

Artists' Experience of *Playform*

Over the first six month of testing *Playform* beta version, about 300 artists have been exploring different innovative ways to integrate AI in their work through *Playform*. Some artists used *Playform* as a mean of looking for inspiration based on AI uncanny aesthetics. Other artists fed in images of their own art, training models that learn their style and then use these models to generate new artworks based on new inspirations. VR artists used AI to generate digital assets to be integrated in virtual reality experiences. *Playform* has also been used to generate works that are upscaled and printed as a final art product. For this study we focused on artists using *Playform* for some time and/or who already had substantial experience with using technology in their art making. What we present here are admittedly preliminary results given the newness of the *Playform* platform. We selected a few artists to interview, focusing on those who have experimented with the system and its capabilities in depth over the past six months, resulting in work that has appeared in exhibition. Our goal was to gather qualitative responses to questions about why they chose to work with AI and a system such as *Playform*, how it has impacted their creative practices, and how they would characterise the experience of creating art while using artificial intelligence. Some of the artists surveyed for this essay include Domenico Barra [http://www.dombarra.art], Tom Brown [https://www.41xrt.com/art], Qinza Najm [http://qinzanajm.com], and Anne Spalter [https://annespalter.com]. We conducted interviews online, via email and by phone, and guided the discussions with three key questions: Why do you choose to work with AI? What is the role of AI in your art making: a tool, a medium, or as a partner/collaborator?, and how has *Playform* affected your creative practice, if it has? We wanted to hear directly from artists about their experiences. The following is a qualitative summary of key concepts the artists focused on in their conversations with us.

There was consensus on the positive creative aspects of the generative capabilities of the *Playform* system. Beyond the obvious of using such a system to create lots of work, it seems critical that this is done extremely quickly and with minimum effort. The advantages of this are several: an artist can rapidly decide what to keep and what to dispose of without regret for time/resources spent (since that is low) and the artist can decide to continue or quickly terminate a trend in the imagery without much loss. One artist pithily described this as having 'lots of shots on goal'. Artists also report a higher number of surprising or unexpected results than they first anticipated. This may be the result of expecting a high degree of predictable and routinised results because *Playform* is a computational generative system; we assume computers will repeat at great length and number but we may not expect much deviation beyond what is anticipated in the variation structures in the programming. For all of the artists discovering unanticipated, unexpected, even unpleasing results ['failures'] was a positive surprise. The surprises, both positive and negative, inspired another round of creativity from the artists in response. Here we veer close to something akin to a discussion or dispute, when both participants in the conversation (human artist and generative system) have the propensity to respond to the other, even in unexpected ways.

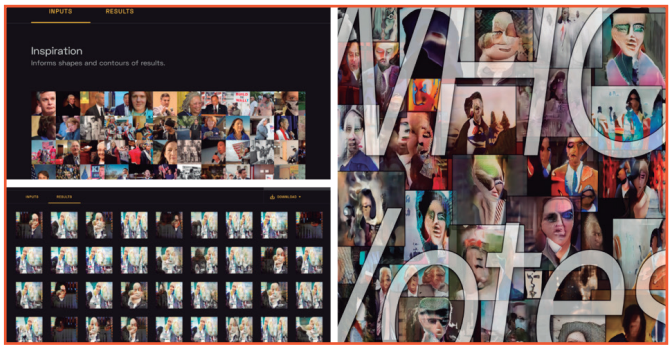

Figure 3: Example of the creative process of artist Thomas W. Brown in *Playform*. Top Left: sample of inspiration images of a project. Bottom Left: a snapshot of some results out of hundreds of thousands of iterations. Right: A final artwork "Who Votes IV – 2019", exhibited at Nails in the Wall Gallery, Metuchen, NJ, February 2019.

There is also an important distinction to draw here. Although artistic media can fail to cooperate and even make 'happy accidents', the inert physical material is not responding in any calculated or intelligent way. It merely and truly is an accident. However, computers are programmed to operate on their own pathways of choice and intelligence, and the 'accident' is less an accident and more an unanticipated result from the human viewpoint.

Human artists also must take on an expanded role within the feedback loop developing between them and a generative system such as *Playform*. Some artists describe the expanded role as being like a curator in that the artist is making qualitative and discriminatory decisions about which imagery to use and which imagery to continue to develop within the system. Another analogy is to a DJ, sampling, mixing and manipulating imagery choices and combinations with another level of remixing what the generative system is itself mixing. *Playform* allows artists to choose from databanks of images within the system, and to import their own data of other images or works of their own art. The choices any one artist makes about importing data (or not) and using pre-existing databanks (or not) is another (meta) level of the curatorial or DJ selection process. There is a complicated choice of data, and there is a complex action of data manipulation.

In both cases we can detect an expanding role for the generative system as a more active participant in the creative process. Choices are being made by the system which the human artist is responding

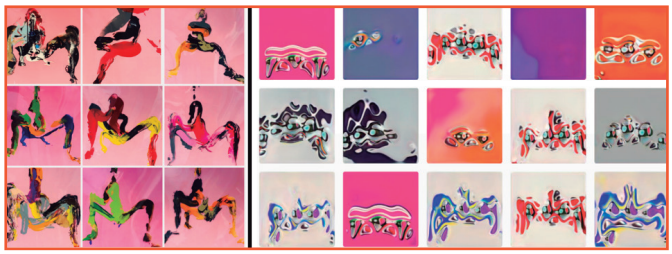

Figure 4: Example of work by artist Qinza Najm in *Playform*. The artist used images of her own artworks "reclaiming space" (left) as the inspiration source. Examples of the generations are shown at the right panel. Selections of this project were exhibited at the National Museum of China, Beijing, in November 2019 as part of an exhibition on art and science.

to, and vice versa. The feedback loop can continue with each half of the dynamic responding and remixing. Artist Qinza Najm likened the presence of the AI system as an alien eye, something that is seeing, but seeing very differently (see Figure 4). It has a role to play in that it responds to choices and datasets in a surprising or perplexing way, revealing new choices or options. It makes the artist see their work differently as a consequence. It is almost an estrangement from one's own familiar work choices.

The greatest diversity in responses was to the question about AI being a tool, a medium or a creative partner in some capacity. For Tom Brown the system is a tool, a machine-based generator of lots of possibilities, but it is the artist in the role of choice maker

Figure 5: Examples of how artist Anne Spalter integrated AI in different areas of her work. Left: an inflatable inspired by results which the artist created in *Playform* (exhibited at the Spring Break Art Fair, LA, 2020). Right: Pastel drawings created by the artist inspired by results created in *Playform* (exhibited at the Spring Break Art Fair, NYC, 2020).

and selector that is wholly responsible for the art creation. Najm and Spalter were willing to shift a little closer to acknowledging in the system some level of agency, especially when unexpected and truly surprising results were generated, seeing those results as evidence of a creativity not wholly of the artist's own origin. Najm characterises this quality as the system's 'alien eye', and the results as demonstration of the AI's different gaze. Spalter also recognises within the process some moments of partnership when unexpected results are generated, and considers this quite valuable in that it spurs the artist to another bout of creativity in response, creating a productive feedback loop (see Figure 5). Both artists understand AI as a major impetus to their own creative processes in allowing them to generate lots of imagery very quickly, and suggesting new paths of manipulation and disruption of data to create images. For both it is a vital step in leading them to seeing their own artwork differently. Barra is comfortable with describing the relationship as a partnership, believing there is real value and potential in pursuing that model. The biggest gains are to be found in creative inspiration and creative volume. Barra is confident that our relationship to computational systems (as human beings) is only going to become more critical, and that artists need to understand that relationship, be involved in it (developing a literacy), and hopefully shaping the relationship. Collaboration and competition are both critical to creative life and can be accessed AI art development (see Figure 6).

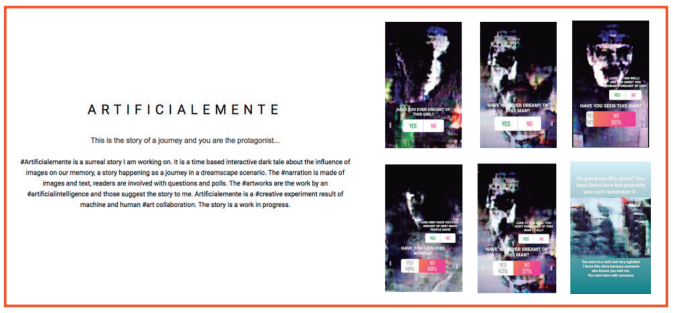

Figure 6: Sample of "Artificialemente" a conceptual work by artist Domenico Barra, where *Playform* was not only used to generate images used in the work, but actually was part of the inspirations of the work (http://www.dombarra.art/artificialmente).

Limits and Conclusion

As the uses of AI continue to expand in our world, computational systems will be taught to model certain human thought processes such as creativity. Playform was developed as a way to make AI-assisted art more accessible and functional for all creators. The system is six months into development and we currently host over 1800 hundred users. The interviews with early adapters suggest some immediate gains for artists in scale of imagery generation, surprising prompts for new imagery ideas, and overall efficiency of creative output. Also interesting is the variety of responses to how the artist conceptualises their relationship to the AI system, as tool, as medium, as some degree of partner. Artificial intelligence is a means to better study and understand art by training AI systems to be creative. And as we have demonstrated, creative AI systems can expand and inspire human creativity in turn.

Notes

Goodfellow, Ian, Jean Pouget-Abadie, Mehdi Mirza, Bing Xu, David Warde-Farley, Sherjil Ozair, Aaron Courville, and Yoshua Bengio. 2014. "Generative adversarial nets." In *NIPS '14: Proceedings of the 27th International Conference on Neural Information Processing Systems Volume 2*, 2672-2680. Montreal: MIT Press.

For Further Reading

Agüera y Arcas, Blaise. "Art in the Age of Machine Intelligence." *Arts* 6, no. 4 (2017): 18. https://doi.org/10.3390/arts6040018

Hertzmann, Aaron. "Can Computers Create Art?" *Arts* 7, no. 2 (2018): 18. https://doi.org/10.3390/arts7020018

Mazzone, Marian, and Ahmed Elgammal. "Art, Creativity, and the Potential of Artificial Intelligence." *Arts* 8, no. 1 (2019): 26. https://doi.org/10.3390/arts8010026

McCorduck, Pamela. *Aaron's Code: Meta-Art, Artificial Intelligence, and the Work of Harold Cohen*. New York: W. H. Freeman and Company, 1991.

Miller, Arthur I. *The Artist in the Machine: The World of AI-Powered Creativity*. The MIT Press, 2019.

CV

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Dr. Ahmed Elgammal is a professor at the Department of Computer Science and is part of the Executive Council Faculty at the Center for Cognitive Science at Rutgers University. He is the founder and director of the Art and Artificial Intelligence Laboratory at Rutgers, which focuses on data science in the culture domain. Prof. Elgammal has published over 160 peer-reviewed papers, book chapters, and books in the fields of computer vision, machine learning and digital humanities. He is a senior member of the Institute of Electrical and Electronics Engineers (IEEE). He received the National Science Foundation CAREER Award in 2006. Dr. Elgammal's research on knowledge discovery in art history and AI-art generation received wide international media attention, including several reports in the Washington Post, New York Times, NBC, CBS News, the Daily Telegraph, Science News, and many others. Dr. Elgammal received his M.Sc. and Ph.D. degrees in computer science from the University of Maryland, College Park, in 2000 and 2002, respectively.

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