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Generative Systems for Art and Design

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Artist Sol LeWitt says of the functions of conception versus perception that “If the artist wishes to explore his idea thoroughly, then arbitrary or chance decisions would be kept to a minimum, while caprice, taste, and other whimsies would be eliminated from the making of the art.”[i] This statement about the nature of artistic authorship argues that the degree of pleasantness or awkwardness in a work of art matters less than its process of creation. LeWitt’s conceptual art would today be considered under the title of generative art, which is a creative process more than a genre unto itself. The debate regarding generative art — that which is generated by a computer — has its roots in the second half of the 20th century when the rise of artificial intelligence (AI) caused an uproar in the art world. The corporate and industrious social atmosphere of the 1960s caused some artists to embrace technology and explicitly emulate factory-like production. This is something that can clearly and consistently be seen in the work of Celestino Soddu, whose projects and general philosophy will warrant further discussion after more context has been established. LeWitt’s words about this era reflect that generative art may come from a programmable formula, yet it still blends processes that are under varying degrees of control by the artist, similar to an artist placing sticks in the water and observing their oscillations.[ii] While a machine can produce art, the intentional planning of the piece initiates from the artist’s idea. Thinking that the artist’s will is what completes the artwork reflects ego, not creativity.

Ideas fuel art, and a computer is a machine that helps undertake the process. When viewed from this perspective, generative art assumes a long history of tool and machine use that could be said to date back thousands of years. While this thesis does not ask whether there is a direct link, the research on generative artwork will focus on how art is made rather than what art is made, and the degree of autonomy exercised by the artist who expresses it. While AI-created art is different in its process from traditional art, it is also no different than other kinds of generative art. There is still a spectrum of “strong” and “weak” artwork that represents the amount of work done by the human artist who designed the system.[iii]

The definition of art has changed over the centuries. Fine arts were not included under the heading until the 17th century,

and it took another century or so to include painters as artists instead of referring to them as craftsmen or workers. Today, the tendency is to view and reinterpret older works of art through the lens of contemporary contexts and modern aesthetic standards.[iv] The terminology has evolved in parallel with the changing dominant styles, bringing us from romanticism and classicism to today's yet collectively unnamed inclusion of computer, generative, algorithmic, and evolutionary art. LeWitt's pioneering work in the 1960s featured collaborative wall drawings made by others who followed the artist's instructions.[v] This valued the creative process over the solitary effort to make something unique, and this process is what will be referred to as generative art, including AI-created artwork.

In distinguishing between these newer art forms and carving out a meaningful space for generative art, some emphasize clarity of language and proper framing of generative art's history. They include generative music and architectural design in their discussion of systems that create complex artworks using simpler components and allow for the discovery of new creative methods, stressing the how over the why.[vi] The controversy comes from asking whether and to what extent to program or procedure can be ascribed some creative autonomy. If the machine alone can create the artwork and make the necessary decisions as to what pieces to include and leave on the studio floor, then the artist/programmer has no autonomy and, therefore, no place in the creative economy. If, however, generative art includes a distributed process that cuts across the artist/programmer and their tool/computer, then the generative system itself contains the creative autonomy that values both contributors.

An understanding of embodiment is also necessary to address this question and distinguish between the artist's decision and intent to create and the process that ensues. Embodiment is the act of making an idea visible, bringing it to life through tangible expression. When an artist distributes authorship across their skillset and tools, it allows for a deeper introspection into the meaning of agency and creativity.[vii] A generative artist whose process includes machines outside of their body that help manifest an idea into physical presentation aligns with the interdisciplinary notion from cognitive science of extended cognition. In this field, theorists use the metaphor of a ship to illustrate distributed agency. A ship is not solely steered by the captain but rather accomplished all the way down the chain of command.[viii] Whoever creates the first command can claim agency just as the AI algorithm that works within the set parameters to create unimaginable outcomes can also claim agency in the process. Both agents can embody the artist's intent, which is what the audience resonates with and values.

Randomness, Computer Imagery, and a Philosophy of Realness

The literature on generative art points to the once-novel idea of electronically created art as cyberspace and technology came into the discussion and began to frame the present norm of the day. Taking inspiration from cognitive science and theories of emergence, evolution, embodiment, and the self-

organization of actual and artificial life, the 1960s saw the beginning of taxonomically classifying the yet unlabeled practice of what was synonymously referred to as generative, electronic, computer, process-based, digital, and AI art. A sufficient list of the important aspects of artwork is needed to categorize and evaluate artwork. Philosophers and AI experts Boden and Edmonds believe that a work of art involves appreciating it in terms of accepted conventions, for no object is inherently excluded from candidacy.[ix] The art world is also available to anyone who attempts to confer the status of "work of art" upon an object. As such, the art world is a social entity; an institution that serves as an extended tool for cognition and thinking about a work of art.[x] Cognitive scientists Gallagher and Crisafi see cognition as a distributed set of processes that loop in and out of brains and social institutions that are designed with cognition in mind.[xi] This applies to the art world.

Museum goers and art critics alike enact a work of art's candidacy along socially delineated aesthetical values. Critics compare contemporary works to past masterpieces to discern similar qualities or critique lacking components. Audiences resonate with an artwork's aesthetic value or not, positioning the work in question along their existing spectrum of experiences with other works of art. In both cases, whoever designates a work of art as such is acting on behalf of the art world as a social institution, and agreeing upon its bestowed status is a social act.[xii] Bachrach philosophizes that the artworld, as an institution, is open to anyone, and anyone who engages in deliberating its status is acting on behalf of that social institution. Since no object is excluded from candidacy, anything can be disputed as a work of art. The act of disputing takes place in a social context that builds naturally upon prior beliefs and definitions.

In other words, a "work of art" is not created in a vacuum or produced automatically by either an established artist or a machine. An artwork that is called "art" is the result of a distributive social practice involving the artist, the art world, and the audience. Generative art pushes the boundary a bit further to include AI algorithms and the computers that program them, but this too is a technological evolution of artistic tools and not a whole new concept. Generative art is "art" in that it is socially debated and defined, even though the randomness and chaos that accompany AI can cause critics to question its place in the art world. In response, art theorists reframed seemingly chaotic complex systems as unpredictable rather than random.[xiii] AI allows for algorithms to potentially produce all possible states of a programmed function, which introduces uncertainty as the artist does not know the specific outcome. AI systems mimic real life in their chaos and sense of cause and effect, so much so that they can feel more lifelike than reality. The outcomes are vast, but they are not random. The role of randomness in generative art is not new. Improv artist Paul Bley is a good example of a creator who has gathered inspiration from the random outcome of coin tosses or rolling dice, but such pure randomness is not the case with computers and programmed deterministic functions.[xiv] From this perspective, randomness

serves only to humanize the imperfections of a process by intentionally allowing space for incompletion when creating a work of art.

Early digital art was generative in its process and instruction-based approach. Just as LeWitt's conceptual art was generative in its execution in the 1960s when his hallmark wall drawing installation was completed by telling assistants what to do, pioneer digital artists in the same decade introduced computer-made artwork that was created from a machine-like process that happened inside of the computer rather than physically constructed outside by an artist.[xv] In simple terms, computers do what artists do, but they do it faster and with better precision, allowing many iterations in minutes that would take a human artist years to complete. Digital art used other objects than the artist to create the work of art, but it accomplished the same result as the artwork that came before it in the ongoing spiral of art and life in imitation of one another. Critics still pressed the issue of whether this kind of art was real even though real, biological life was also produced in the operational process of evolution. This step-by-step process responded to fitness, selection, and survival. The bothersome aspect, then, had to do with what philosopher Jean Baudrillard refers to as hyperreal works -- those that are made in hyperspace. These confound the idea of imitation and simulation, operationally substituting what was real with a digitized rendering of what was real.[xvi] Instead of real still-life art made up of tangible objects set upon a physical tabletop, there was digitized imagery of real-world objects cut and pasted into a hyperreal space. This format is imitation in the sense that the digital version is based on the actual version, but it is also simulation in the sense that Baudrillard meant where reality is usurped by a model.

To define generative art as real, there is an important distinction to make between what is simulated and what is not real or false. For the purpose of this thesis, "false" means that the artwork does not produce any kind of emotional resonance in the viewer, yet simulated artwork does in fact produce this effect.[xvii] Simulation-based artistic processes seem acceptable to the art world if they create the same set of responses in the audience as "real" artwork since "real" is a feature of artwork that emerges in the interaction between the viewer and the art. Interactivity becomes a possible source of criteria to judge the aesthetic value of a work of art, and rather than the typical separation of a work of art as either computer-generated and technological or aesthetically appealing, generative art becomes embedded in the same cultural and historic conventions of both art and science.[xviii] Artists who represent their experience of the world using advanced technology and computer modeling can create an imagined reality that may or may not unfold for viewers, just as human-made artworks can be relatable or not with a viewer.

Using the fable of a map of an empire that was so detailed it covered the land exactly to explain simulation, Baudrillard philosophizes that the hyperreal territory of today's digital focus does not require a real object to model, which illustrates their idea of simulacra.[xix] Critics question whether generative art is a

representation of real art or a mere simulation of the creative process. In defense of its artistic status, Baudrillard points to the utopian ideal of equivalence in the symbol and the true object that would accuse a simulation of being false. He claims that it is no longer a question of the work's ideology, as the more traditional ethic will "obscure the real process of work and the objective process of exploitation," but the question should be about the scenario of the work.[xx] Simulation in the generative sense of process encases the concept of representation as a simulacrum that lacks an original object to simulate. Consider the ancient drawings on the caves in Lascaux. Visitors are allowed to peek at the original but can only physically visit the replica site not far from the caves to preserve the art. In the socially extended and accepted mingling of real and replica, there is no difference regarding the act of experiencing this work of art. In the same way that no one would argue that the ancient artwork qualifies as such, the subjective experience of generative artwork is similar to that of a work of art created under a different process.

When generative art is taken as a process, a picture of reality emerges that captures the artist's intended imagery and emotional effect created in less time and with more accuracy than the artist's hand could accomplish alone and unaided by technology. The question of technology's place in the art world becomes a broader critique of capitalism and the embedded social demand to mass-produce things where it seems unfair to be able to produce a generative artwork so quickly, threatening to destabilize the art world. Such is not the aim of generative art, though, which offers the masses a transparent method of creativity that is powered by AI and programmed algorithms. From this viewpoint, the idea that the medium is the message implies for generative art not only "the end of the message but also the end of the medium" since there is no physical medium and no universal intended message.[xxi]

Authorship and Authenticity in Complex Systems and Algorithms

Having established generative art more definitively as a process that spans the artist, tool, and the social context that the work of art enters, the words of LeWitt ring true, "The idea becomes a machine that makes the art," and "the idea itself, even if not made visual, is as much a work of art as any finished product."[xxii] Critics bothered by the inclusion of this art form under the umbrella term of art and hesitant to confer such a status are perhaps concerned with the complexity of the algorithmic systems and computer programming that underly generative art.

Any complex system is made up of many smaller parts that integrate locally and self-organize without the need for a human agent to continuously control its unfolding.[xxiii] In this sense, complex does not mean confusing, and these systems have existed in art since primitive times. Consider the geometric patterns of Islamic textiles or repeating border designs in ancient art.[xxiv] The concept of generative art is old. The controversy comes from the seeming esoteric knowledge required to understand and properly utilize complex systems in computer programming. Here, too, an ancient idea is found where people use

graphics to understand complicated systems. Computer-assisted imagery happens quickly and with little input, and art enthusiasts have tended to stray from high-tech images constructed this way. Using this past trend to keep looking away from computer imagery, though, risks missing the development of new meaning in advanced technology.[xxv] It is no longer safe to assume that the efficiency of new technology makes art superficial.

The complexity of this art form is one of its most important characteristics in the eyes of the field's artists. Generative art, as embraced by the acclaimed architect, Celestino Soddu, represents a combination of the unpredictably creative with the rigorously structured. A key element of Soddu's art philosophy is the amplification of randomness within the design process. This randomness, rather than being an arbitrary occurrence, serves as a crucial foundation, laying the groundwork for conceptual requirements, personal expressions, and cultural references. In this context, randomness is not an accident but a deliberate act of introducing unpredictability to stimulate creativity.[xxvi]

The observed chaos, randomness, and algorithmic complexity can be understood as part of a new system that produces a new set of rules for artists to use. In the same way that algorithms swiftly compute a function one step at a time, the process of making art is also iterative.[xxvii] An artist begins, observes, corrects, and continues to work, mark by mark, in a stepwise process. The rules programmed into the algorithm act as constraints, much like an artist working at the moment would employ decision-making at each new mark. Critics argue that humans are more attuned to the complexity of form than a computer, which implies a machine could not match the creative process. Often, computer algorithms are trained on input images of existing artwork that inform its progression moving forward with its computations.[xxviii] Similar to an artist's sense of control with each mark that feels intentional, the computational network can learn to tend toward certain preferred solutions with each iteration.

From a philosophical standpoint, as highlighted by Soddu and Colabella, generative art's allure is deeply rooted in its capability to shift the creative paradigm from static occurrences to fluid transformations. This dynamic approach allows artists to engage in an iterative creation process, wherein they can recycle and refine previously established transformation rules to consistently produce high-quality artworks. The potential for creating an array of variations, each demonstrating different facets of an idea, underscores the essence of generative art. Such an approach, where the artists depict not just a singular perspective, but a spectrum of interpretations highlights the relationship between man and the cosmos.[xxix] This relationship is ultimately the product of algorithms.

An algorithm is a process. It is a procedure programmed by a human, trained on vast datasets, and left to compute within its constraints. The bulk of the work done by the computer is where questions of authorship and authenticity enter the critique of generative art. Because it is invisible to the outsider, internally manipulated, and

unapparent in the final work of art, critics question where the art comes from – the artist or the machine.[xxx] If it indeed comes from the human agent who initiates the procedure, then the question is whether technology can exist outside of the programmer's biases and prejudice. Not only can any novice with basic programming knowledge now sculpt generative art, but AI-powered art can perpetuate harmful internalized stereotypes that people possess.[xxxi] Careful analysis is needed here as the products of generative art can shape how people see the world. Even once authorship and authenticity are properly sorted by the art world, they will still be subject to human bias that could create an unequal experience among audiences and require monitoring to avoid propagating the damage of Western preconceptions.[xxxii]

An examination of autonomy in generative art begins with a suitable definition and understanding of different types of autonomy in the world. Technologically, there is physical autonomy, as observed in biological systems, and then there is mental autonomy which is characterized by free will. When discussing agency in generative systems, self-organization is the underlying aspect that critics point to. They ask if the system can operate independently and if a computer constitutes a "self" to self-generate results.[xxxiii] If a computer could learn beyond its programming and adapt and produce in ways that the programmer did not foresee or design, then the artist could concede authorship to the machine. This phenomenon is emergence, and if unattended to the discussion may cycle into further questioning about the authorship since it is the artist who creates a self-organizing process.

Artists like Jon McCormack argue that the existing language does not accurately capture the behavior of what some call generative art emergence.[xxxiv] The concept is appealing and requires further categorization that considers the complex artist-machine system on various levels. Gordon Monro, another generative artist, outlines simple-to-complex emergence, many-agent emergence, difficulty-of-prediction emergence, surprising emergence, and "Frankensteinean" emergence.[xxxv] In one sense, simple rules lead to complex actions such as in the game of chess. In another sense, the system can produce unanticipated results even though the creator has full knowledge of its work. Still, another perspective to consider is when a system outdoes the human creator and takes on human attributes and emotions. Consider an algorithmically programmed musical composition that has learned to trend toward the emotive properties it trained on. Generative art emergence would have to go beyond the system's rules and perform "on its own" to be truly autonomous, and this concept requires further research before a conclusion can be drawn.

Until then, critics will continue to survey the boundary that separates the artist from the tool just as they continuously question where to draw the line between an everyday object and a work of art. Recall the metaphor of steering a ship to understand extended cognition where the steering happens down a chain of command. Anyone or anything that contributes to the steering is part of the

process. Cognition is human-centered in that it happens inside the brain, but it extends beyond the internal cognitive core and across brains and bodies out into the environment. Functionally, concerning accomplishing a task, the external processes can do things that the internal ones cannot.[xxxvi] By letting the environment take care of some of the cognitive tasks, external supports are relied upon. While this assumes a stable external structure, it allows for cognition to extend infinitely. This notion from cognitive science informs the discourse on conferring the status of art to works created by a generative art process. Skin and bones, like hardware and software, become arbitrary boundaries that exist conceptually to maintain coherence between separate systems to understand them separately. However, when it is shown that the natural kind of processes that happen inside of a computer also happen inside of the head, then both kinds of processes hold meaning and value.[xxxvii] Functioning as an extension of the artist's brain, the computer is a creative assistant to realize the artist's vision.[xxxviii] Further, the computer expands the artist's reach into their own consciousness for what is possible to create and simulate in virtual worlds and realities.

The discussion of authenticity in generative art is worth distinguishing from that of autonomy and authorship. A study of creative adversarial networks (CAN) attempted to produce art that confused the human audience as to its style label (Renaissance, Baroque, Impressionism, Expressionism, etc.), which the network was trained on to discriminate between.[xxxix] The purpose was to create a system of generative art that people confused with modern artworks, and they found that subjects could not easily determine whether the creator was a human or a computer.[xl] They also often preferred generative art over traditional artworks. Aesthetic preference generally increases with familiarity as more viewings positively relate to strong emotional affect or preference.[xli] Another feature of fine art appreciation is novelty, which also relates to generative art and helps explain the viewer's preference for this kind of art. Aesthetically, it is both familiar and new. It is authentic. Unlike the average art enthusiast, though, experts might suppress their initial effect to intentionally reflect and evaluate the work of art's authenticity.[xlii]

The possibly suppressed transmission of feeling through generative art practices creates a new conflict for critics. Part of the struggle here is the general tendency to discredit emotional reasoning when determining an artwork's aesthetical value.[xliii] It is more acceptable to judge art from within its cultural context. Philosopher Arthur Danto believes that an object is "art" based upon a society's inherited body of knowledge regarding the history of art as discussed in the art world.[xliv] Computer-generated art seems to defy this perspective since it is both similar to and different from what modern culture has deemed as "art." For art to contain the assumed aesthetic essence, it must be from the social fabric and interpretable by the art world. It must be about things that exist in the physical world as well as the product of an artist's actions.[xlv] To be contemplatively appealing, though, an artwork only needs to be experienced from the attitude of having an aesthetic interest in its

viewing. The art world can still be said to have produced such creations by being a social institution designed with human cognition in mind, which might include the emotive effects that ensue. The art world itself is embedded in the social self that is influenced by its surroundings.

It is helpful to consider the art form's social nature to highlight its inherently valuable trait of uniqueness. The general fear that AI will replace human artistry is invalidated in light of how algorithms are trained. What makes generative art interesting and aesthetically valuable is that it blends the familiar and the unique, yet it still requires original traditional input to form a comparison. Part of its intrigue comes from experiencing something unexpected. In support of the contemporary social commentary that addresses issues of diversity and inclusion, generative art inspires new avenues of creation that are open to anyone who does not identify as an artist but who perhaps has computer programming skills. There could be a wave of aspiring artists who use computers to create and express, thereby adding to the spectrum of "strong" and "weak" art and forming a new basis for future comparison.

Related to the discussion of the social nature of generative art is that it yields unique problems. Machine learning can also take place across datasets comprised of AI-generated art, which poses a specific and immediate concern to concept artists given the rapid growth of online AI art generators.[xlvi] Since the technology has evolved faster than the relevant legislation that protects copyright infringement and intellectual property rights, artists face great unknowns regarding income potential and proper compensation for using AI-generated images that are in their particular style. An AI art-generating application can produce hundreds of thousands of images in the style of an artist that the artist did not actually create, and this is a difficult area for the artist while the courts decide how to proceed with these unprecedented issues. The valuable uniqueness inherent to generative art is easily mass-produced under current unrestricted online media culture practices. Some artists have taken AI to court to fight for the protection of their creative work, but there is presently no final decision.[xlvii] Regardless, this technological leap is forcing many in the art world to journey outside of the contexts with which they are accustomed.

The art journey undertaken by designers, as Soddu sees it, is layered with choices that set the trajectory of the design. Each choice made in the design process becomes an indelible part of the creation. These choices, while being deeply personal to the original designer, may present differently to each observer, which demonstrates the highly subjective nature of the design journey. Consequently, design decisions often deviate from linear thinking, and the designer might embrace inconsistencies or non-linear pathways to spur innovation.[xlviii] Furthermore, the design process involves embracing randomness and inconsistencies, where methodical deliberations might not always yield the quickest or most innovative outcomes. As established earlier, this apparent randomness is a major component in this field, and this is something that will seemingly always be present. These

perspectives challenge the traditional deterministic approaches in design, advocating instead for a process littered with unforeseen adjustments that push the boundaries of creativity.[xlix] These stretched boundaries can be seen in the work of Soddu.

In Soddu's seminal work, "Argenìa," he went beyond the conventional approaches of design to focus on crafting artificial species, such as cities, architectures, or industrial objects. Argenìa operates on a unique structure that combines transformational codes, reminiscent of the concept of DNA, with an organizational approach tuned to the evolutionary dynamics of a project. These transformational codes are instrumental in achieving a blend of artistic and scientific methods, channeling both beauty and balance.[l] Generative art, especially in the form presented by Soddu, is not just about the final piece but the very process that gives rise to it. Leveraging technology and artificial intelligence, Soddu's work, like his "Basilica" tool or "Argenia," is indicative of his vision to reshape the environment by harnessing the power of generative processes. Whether it is reimagining the DNA of a typical Italian town environment or crafting unique factory-made products, Soddu's approach to generative art epitomizes the blend of creativity, technology, and environmental consciousness.[li] The crux of Soddu's generative art lies in its capacity to reflect human creativity while simultaneously celebrating the unpredictability and uniqueness of each generated artwork.[lii]

Ultimately, Celestino Soddu's art philosophy and techniques in generative art advocate for an embrace of randomness, complexity, and iterative refinement. Rooted in a deep appreciation for the intricacies of design and the potential of artificial intelligence, Soddu's work stands as a testament to the infinite possibilities in the combination of creativity and technology.

Conclusion

Generative art holds great potential during the modern digital era when society is saturated with information from traditional and online media sources that imply a gap between the real world and their externally constructed hyper-reality. If this is a digital revolution, then it would mean all information could be reduced to numeric code that translates the simulated world through the human senses using AI technology.[liii] As machine learning integrates further into everyday life and continues to collect and categorize information, it also allows generative art to penetrate the arbitrary boundary that separates a person’s inner world of thoughts and feelings from their external reality. Media sources and art museums become extensions of humanity, existing because of and in support of cognitive evolution, and the art world becomes a place to explore and expand the understanding of virtual agents and where they contradict and overlap the real world.[liv] Audiences can experience works of art that are both detached from and created by an artist who exposes AI and ML as akin to natural processes.

In the broad sense of generative art being an ancient process of creation that includes the artist’s tools as part of the artist, generative art is older than AI and

ML. These came into the public realm with the advancement of the computer age in the second half of the 20th century. The various versions of generative art that have branched off from the central idea all offer a unique way to reinterpret current artwork rather than force AI art into a genre of its own.[lv] When generative art is seen more as a process-based lens than a contending category to traditional artwork, then it can enter the shared space of creativity. AI-assisted art simply organizes and processes information and then reproduces it through virtual media for an interactive audience experience. Computers are dynamically organized, which is also a distinctive trait of humanity, and this is no mere metaphor. Generative art often involves a thorough engagement with certain processes that create coded rules and systematic outcomes where "life emerges from the interactions of formal elements in a medium deliberately abstracted from nature."[lvi]

While true to their nature as abstractions of the physical world, generative art also extends its reach into the more spiritual aspects of humanity. Through art, humans have always tried to "raise something immortal and transcendent."[lvii] When all things can be reduced to simple numerical code, people can exist virtually anywhere given access to sufficient technology. In effect, generative artists such as McCormack and Ian Cheng create a computational "being" that generates creative output. This sort of artistic imitation is not an imitation of life, as ancient philosophers proposed. Instead, AI art imitates art. As creators, McCormack and Cheng infuse their creativity into the AI processes they use, and the art form surpasses its own medium.[lviii] This trend has been in motion and is expected to continue in various forms of interactive installations and networks that integrate real and virtual worlds. This is an evolution from machine learning to machine intelligence where the AI system assumes some of the work that human agents usually do by not only modifying its process but also self-reflecting as it grows.[lix]

The issue of granting creative power to generative systems is relatively new to the art world and a good reason to further explore how AI systems operate. This is especially true considering the innovative output and high "arousal potential" of some generative artwork.[lx] This term refers to the various patterns of stimuli that can be programmed for and tend to pique the interest of human viewers. For example, consider a generative system that is trained on a vast data bank of art images from the last several hundred years and coded to force the AI system to seek out an outcome that is similar enough in style to count as art yet unique enough to count as original. Researchers studied what happened when this kind of system was evaluated by people in an experiment to determine whether or not they could distinguish between the generated art and the human art. Results showed that people often confused the two and sometimes gave the generated art a higher rating on its novelty, complexity, unexpectedness, astonishment, and ambiguity – collective variables that constitute aesthetic value.

AI systems can learn to adapt their output continuously along these lines, which seems to imply that the system

would require a steady flow of new art to learn from. Abstract paintings, especially, are used to train AI and experiment with simplified duplication studies between real and generated images. A painting by Piet Mondrian from 1917, which is considered the artist's most accomplished work due to its thematic and specific use of vertical and horizontal space (abstracted into ideas of masculinity and femininity) was digitally rendered by computer software and used in a comparison study.[lxi] When translated to code, this picture becomes a series of attached and detached lines as the program calculates data points according to its instructions. In essence, every picture can be broken down and reverse-engineered in this way whether it is human- or machine-made. In the study, participants were shown both images and then asked which one they preferred and which was produced by which method. The computer-generated image was preferred, and the majority of participants could not correctly categorize which image was produced by which method.[lxii] The judgment was made solely based on different visual patterns, though, and no weight was given to any emotive effect. The computer acted as an extended medium for the programmer to use in completing the image, yet both images were conceived by a human agent, and no merit is detracted from Mondrian's work.

The full impact of AI and ML on the creation and perception of art where a digital copy can transport the human artist's emotional intention is still underway. As the field continues to clarify terms and refine developments in communication tools and technology, generative art systems move further away from facsimile-like copy art that was initially created in response to consumer demands and for the simple reason that some machines were invented to make copies.[lxiii] The term "generative" was meant to distance the field from these aspects of technological capability. Yes, a novice artist can produce a copy of their favorite image that looks sufficiently professional, and there may continue to be a wave of amateurs who lack the full understanding of the nature of their tools and creation. This, plus the previous discussion of misused AI art generators, is not a call to align with anti-machine efforts that work against creative impulses but rather an observable phase of what happens when new technology is adopted by society.[lxiv]

In light of the case studies herein that illuminate the complexity of the dynamic system that cuts across the artist, their tools, and the interaction with an audience, Baudrillard's notion of the hyperreal and simulacra can be revisited. The generative works of McCormack and Cheng do not represent any sort of external truth but rather a "symbolic exchange of signifiers" that refers back to coded input in the absence of an original model to simulate.[lxv] The issue is not about modern society and its artistic processes becoming artificial, but that people need to recover their ability to make a distinction between real and artificial. Generative art occurs on screens, which have infiltrated all layers of modern society. For some theorists, the output is both a simulation of reality – evolutionary processes, for example – and a simulation of the creative process, making both the content and the medium artificial.[lxvi] It has been argued, also, that even though generative artists make their

artifice explicit, the work has not sufficiently supported people's ability to distinguish between generative art and human art, and it has instead confounded the audience. People need to be told that an image is AI-generated to know that it is so. This marks the onset of transaesthetics where the value of generative artwork like McCormack's and Cheng's surpasses the usual categorizations and challenges the way people think about art and perhaps themselves.

In this hyperreal era where the algorithm has superseded the artist, concepts of real and artificial may matter less than issues of process and intent. In 2018, an AI-generated artwork, *Portrait of Edmond Belamy*, sold for $432,500 at auction, which was about 40 times greater than its estimated worth.[lxvii] Trained on 15,000 portraits from over seven centuries of artwork, a new image was created that had been cultivated according to programmed discriminatory rules. Machine art can be just as inspiring and thought-provoking as human art. In the past, the artwork was defined primarily by the aesthetic intent of the artist. To say something about the world and express emotions, there had to be a human agent steering the ship. Today, the artist is whoever has the idea to set in motion using generative techniques, and the machine is an extension of their creative process. When the whole chain of command is considered, the artist may be at the wheel, but it is the wheel and its connection to the vessel that gets the work done. The whole system is art, not just the image produced.

The sublimation of art to symbolic code brings new and greater value to the system. Technological advances in computers have solidified them as extensions of human cognitive processes with new potentials to explore. Among these, certain aspects of interpersonal communication and relationship dynamics are being emulated by interactive installations as computer scientists and artists work toward the dream of computers with human-like agency and reasoning enough to emote and engage with viewers.[lxviii] The transparency is refreshing and allows for models that demonstrate the opposite expectation as well. Some systems are designed to show how people fail to communicate by evading questions, stalling, or giving trivial responses.[lxix] In almost any case, creators work toward repositioning art's place in the broader social context where the final product is complete when the audience interacts with it, softening the divide between the artist, the machine, and the viewer in unprecedented ways.

Generative artists are like every artist who has gathered inspiration from past styles, physical sciences, and universal creative energy to understand the form and function of parts as they relate to the whole. They combine abstract symbols from artificial worlds into concrete images that embody natural and formal structures into artwork that evolves in its own direction.[lxx] AI's role in the process is as an extended tool for artistic abstraction onto a virtual medium that is capable of creating ever newer forms brought to life by the artist wielding the tool. AI art has a prehistory that is valuable in itself for destabilizing traditional notions about contemporary approaches to art. Generative art borrows from and applies computational

methods that center on natural physical processes and progress toward sometimes metaphysical expression that transforms the real world into an endless space for further innovation.[lxxi] From this perspective, generative art is like all art that is primarily concerned with creativity.

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