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Generative Systems: Authorship, Obsolescence and Production With Relation to Brian Eno's 77 Million Paintings

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I declare that this thesis is all my own work and that all sources have been fully acknowledged.

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INTRODUCTION

In this thesis, I aim to provide a historical and theoretical context for generative art as a method of art-making, with specific reference to Brian Eno's 77 Million Paintings. I chose this work as an example for a number of reasons: Eno's own interest in systems and processes are firmly rooted in the history of indeterminate art of the 20th century, going back to his college tutor Roy Ascott who was an early adopter of cybernetics and systems in his own art. Secondly, in 77 Million Paintings we can find much of the challenges and potentials posed by generative art in relation to the art institution, and perhaps the reasons why it is relevant to contemporary society in general. It raises questions of the preservation of digital information for future cultural examination, it problematises the notion of the author, and it has the potential to be at once a mass artform yet provide a unique experience on an individual basis. For the purpose of this thesis, I refer to generative art as a digital method of creating: essentially an autonomous indeterminate system, automated by the use of a computer so that it does not require any further human input after the system is initialised. Generative art is not a movement - there is no organised 'generative art' collective with a specific agenda - it is rather a tool, or a mindset, with which to approach the art-making process.

As Edward Shanken says of the history of technology and science's effects on art: 'In the absence of an established methodology [...] and a comprehensive history that would help clarify the interrelatedness of [art/science/technology] and compel revision, its exclusion or marginality will persist.' (2007: 44) In the first chapter, *Systems Art*, I elaborate further on a definition of generative art, while connecting it with a history of systems and technology. I suggest that it is rooted in the aleatory experiments of the Dadaists and Marcel Duchamp at the beginning of the 20th century, and trace its development through the indeterminate systems of John Cage, and the rise of computer-art exhibitions in the 1960s. In the second chapter, titled *Authorship/Obsolescence*, I introduce Brian Eno's 77 Million Paintings as a generative system and discuss its problematic relationship with time and obsolescence. I juxtapose these ideas with Jack Burnham's theories of software/hardware and the concept/object in order to articulate the divergence between author and system. The reproducibility of generative art is discussed in the third chapter, titled *Digital Reproduction*, with relation to Walter Benjamin's *The Work of Art in the Age of Mechanical Reproduction.* The potential for digital generative art to create a mass audience yet provide a unique, non-reproducible experience is contrasted with Adorno and Greenberg's views on 'kitsch'.

Jack Burnham and Roy Ascott's views on the potential of sculpture in the 1960s was for it to envisage adventures into a post-human condition through the use of technology. In their visionary writings, we can see the imagined effects of telematics, disembodied experience, and cyborg systems artworks co-authored by man and machine, on art and society. In elaborating on these topics in relation to generative art, I hope it will illuminate its relevance as an artform that provides a commentary on a systems-oriented culture.

SYSTEMS ART

In this chapter, I aim to provide a context in which to critically examine and understand generative art with relation to the art institution. In order to do so, I will discuss a select few artworks and exhibitions that were influential in the development of an indeterminate systems art in the 20th century, from early dadaist aleatory experiments to the algorithmic artworks of the 1950s influenced by the rise of importance of the computer. Firstly, I must clarify the meaning of 'system' with reference to systems art. In systems art theorist Jack Burnham's essay Systems Esthetics, he provides the following:

> In as much as a system may contain people, ideas, messages, atmospheric conditions, power sources, and so on, a system is, to quote the systems biologist, Ludwig von Bertalanffy, a 'complex of components in interaction', comprised of material, energy, and information in various degrees of organization.
>
> (Burnham, 1968)

Thus, we can understand an indeterminate system as one that has a variable in its material, energy, or information, creating a variability in its organisation. Of course, all artworks are variable in so much as they are open to to 'full emotional and imaginative resources of the interpreter' (Eco, 1989: 9), but in the case of systems art which Burnham talks about, this variability is integral to the individual artwork's meaning. It is a relatively modern approach: the interest in the application of indeterminate systems to the process of making art is really a 20th century idea, at least in terms of the western art institution. Pre-1900, Mozart's *Musikalisches Würfelspiel* dice compositions and the colour theory of pointillist artists such as Seurat give an early indication of the artist's curiosity of the role of the rule-based procedure in the creation an artwork. Despite these experiments, it was only in the european avant-garde of the early 20th century that indeterminate systems really influenced the way western art was created through the emphasis of a conscious use of processes.

In Dadaist anti-art, aleatory systems were used as a method to disrupt the habitual and meditated modes of creation that were being practiced elsewhere in the artworld, simultaneously critiquing the idea of the artist/author by lessening their own role in the creation of the artwork. Despite Dada's paradoxical denouncement of logic, order, and rationality, simple systems with open parameters were used as a tool to create spontaneous works of art. (Kristiansen, 1968: 3) Harriet Ann Watts, in The Fictions of Chance, discusses why indeterminate methods were an attractive model for the Dadaists to critique the art insitution. She writes: 'The Dada artist freed himself from the rule of reason and causality by welcoming chance into the creative act itself[...]Through chance, the artist can destroy old aesthetic habits as well as create new patterns of perception.' (1980: 1)

Works such as Hans Arp's *Collage Arranged According to the Laws of Chance* conveyed a simple, loose system with very few rules - as the title suggests, Arp dropped the cut-ups, allowing the unpredictable falling motion of the paper to decide the composition, providing a spontaneous and absurd method of making art. Dada's motivation for indeterminacy was subversive and oppositional, its revolution discarded the methods of the old and recent masters for avant-garde indeterminism in their attempt to satirise and provoke a reaction from what they saw as a dull and bourgeois artworld: 'The Dadaists aimed to juggle away, to parody, and to ridicule all 'accepted ideas,' all forms of social activity.' (Frey, 1936: 12) The goal was to use the accidental openly as a means to abstraction, and to undermine the importance of the artist-as-author rather than utilise mathematical and procedural systems as a tool to explore numerical harmony and permutational possibilities.

'Make a painting: of *happy or unhappy chance* (luck or unluck)'
(from Duchamp's notes in relation to *The Large Glass*, in Sanouillet and Peterson, 1973: 23)

The influence of indeterminate processes as in the aforementioned *Collage Arranged According to the Laws of Chance* found their way to the New York Dadaists, in particular Marcel Duchamp's *The Bride Stripped Bare By Her Bachelors, Even*. Also known as *The Large Glass*, it is a dense two-panel creation in which a bride, seven bachelors and various futurist miscellanea are described on metal and glass as a series of impenetrable contraptions and nonsensical machines. When in transit from New York to Connecticut, the panes of glass were shattered. Duchamp describes how the damage was an addition to the work:

> I like the cracks, the way they fall....But the more I look at it the more I like the cracks: they are not like shattered glass. They have a shape. There is a symmetry in the cracking, the two crackings are symmetrically arranged and there is more, almost an intention there - a curious intention, that I am not responsible for, a ready-made intention, in other words, that I respect and love.
>
> (Duchamp, as in Sanouillet and Peterson, 1973: 127)

The fact that the damage was completely unanticipated mirrored Duchamp's approach to using chance operations throughout the creation of the work. He had previously left The Large Glass out in his loft to gather dust, and had used simple systems such as his *Standard Stoppages* - dropping a piece of string in order to describe a curve which he would transcribe with a pencil - in his notebooks for *The Large Glass*.[1]

[1] The Standard Stoppages also appeared as a separate piece in the form of lengths of wood, cut to the curvature indicated by the dropped string.

In the works of Duchamp and the european Dadaists at this time, we can see a balancing in the hierarchy between the undetermined and the predetermined. In the use of processes with variable outcomes, it could be argued that the artist is using chance as a collaborator, and a method to move away from cliché derived from practice - ie the habitual tendencies of the artist embodied by their original idiosyncratic style. As Watts states:

> Chance offered a fruitful context in which to articulate experience which could not be expressed in traditional modes; it helped the artist free himself from the restrictions of established Western aesthetic traditions.
>
> (1980: 156)

The attraction for the Dadaists was the possibility of removing the artist's authoring hand - and therefore the identifiable imprint of a specific artist's style - from work, and creating something that lies outside the sphere of conscious human experience. The aspiration was that perhaps using indeterminate systems can help artists drop the baggage of history, experience, and education, thus formulating new and original works of art separate from anything that has been made before it.

This radical point was taken up again by John Cage in the 1950s, particularly in his chance system of generating a musical composition based on the *I-Ching*, titled *Music of Changes.*[2] According to Duckworth (1999: 4), 'Cage came to believe that Western music during the Renaissance had taken a wrong turn, becoming too egocentric and making itself ineffective in the process.' Similar to the Dadaists, it was the concept of the relinquishing of the artist's ego by using indeterminate systems that interested Cage:

> It is thus possible to make a musical composition of which is free from individual taste and memory (psychology) and also of literature and 'traditions' of the art. The sounds enter the time-space[...] centered within themselves, unimpeded by service to abstraction.
>
> (Cage, 1961, as quoted by Nicholls, 2002: 230)

In Brandon laBelle's survey of sound art, titled *Background Noise*, he discusses how Cage's indeterminate style of composition was in rebellion to 'classical tradition': 'In the experimental "open work," musical arguments are replaced by *processes* that result in "music", and the writing of music is supplanted by the creation of situations.' (2006: 7) He continues to quote Michael Nyman, who describes how the classical system is a system of priorities, where one 'thing is defined in terms of its opposite.' (2006: 7) The idea of the 'open work' that laBelle mentions in the above quote is derived form an Umberto Eco essay titled *The Poetics of the Open Work*. Eco's own definition of the concept is a work that is 'quite literally "unfinished": the author seems to hand them on to the performer more or

[2] The *I-Ching (Book of Changes)* is an ancient Confucian text, containing 64 Hexagrams - each representing a particular concept. As Jung says in the preface to the Richard Wilhelm translation: 'What we call coincidence seems to be the chief concern of this mind, and what we worship as causality passes almost unnoticed.' (1951: xvii)

less like a construction kit.' (Eco, 1989: 4) As in Arp and Duchamp's work, there is an emphasis on the idea that the work comes into being through the interpretation of a procedure, and in this interpretation we can find a multitude of possibilities.

In *Music of Changes*, Cage had developed an open system of musical composition focused around chance selections of the 64 hexagrams in the *I-Ching*. Fragmented compositional phrases were to be played if a series of coin tosses indicated an odd-numbered hexagram was to be played, whereas if an even-numbered hexagram was selected the performer would remain silent. His equal distribution of silence and sound over the odd and even-numbered cells resembles the relationship of yin and yang - two halves in an infinite state of balanced transformation. Dynamics, timbre, and tempo are controlled within the system, so with every arrangement the piece could have an original-sounding result. The use of chance in this piece does not decide exactly what is to be played, but how it is to be played.

> The result of all these techniques was a score of directions that was so unspecific that no two performances of the same Cage piece would ever be as recognisably alike as, say, two inept or even eccentric performances of Beethoven's Fifth Symphony.
>
> (Kostelantz, 1996:10)

In the use of indeterminate systems in the performances and composition of his works, Cage enabled himself to explore the inbetweens of sound, noise, and silence. He places himself alongside chance as a co-composer: the composition remains unfinished and in a constant state of transformation through its performance. There is no singular result, but many permutations that will remain silent.

Despite Cage and Duchamp's similar intentions for using systems to develop their respective artworks, their approach to the use of indeterminism is quite different. Duchamp's method of applying chance to *The Large Glass* is completely open and with little boundaries: it is intended as aleatorical, discordant, ugly. The chance occurrence of the shattered glass was re-appropriated after the event, critiquing the desirable pristine aesthetic favored by the art institution at the time. On the other hand, Cage's *Music of Changes* has a clearly defined series of parameters which are worked through by the performer as part of the composition. Cage's method is probabilistic and binary, reflective of the rising importance of the computer at the time, whereas Arp and Duchamp's works exist outside such limitations. The distinction between pre-controlled chance and appropriated chance (that is, instigating a system where indeterminism plays a somewhat calculable role, or allowing the entirely unplanned the permeate an artwork) is what marks the major difference between generative art and other indeterminate methods of creating

art. If we can define generative art in light of the examples given already, we could describe it as a systematic, non-determinist approach to creating an artwork, with the aim of enabling it to manipulate itself autonomously on a physical level over an extended time period. These rules can be followed and reinterpreted indefinitely, constantly creating new permutational possibilities, constantly in the process of becoming something else. The most important distinction between generative art and the systems art that went before it is its automation - the procedure is generally initiated and followed by a computer, although the necessity for a manmade machine to provide the automation is arguable.[3]

'Out of this technological complexity, we sense the emergence of a synthesis of the arts.'

(Ascott, 2003: 233)

Investigations into space, international communication systems, and military technology put electronic advancements firmly in the spotlight of a nervous cold war culture. The art world's 1960s response to the rapidly globalising importance of technology such as Nam Jun Paik's *Electronic Media* in New York in 1965 and *9 Evenings* in 1966, *Cybernetic Serendipity* curated by Jasia Reichardt three years later at London's Institution of Contemporary Art (ICA), and Jack Burnham's *Software* in 1970. The ICA show, as its title suggests, focused on cybernetics - defined by its influential theorist Norbert Wiener as 'control and communication in the animal and the machine.' (1961) The art on display was, in a way, about reappropriating the unstoppable stream of newly invented electronic objects and readjusting their potential as art objects that could be subverted, disrupted and disconnected, fed back, and generally meddled with. These elements of public interactivity provided the importance of indeterminism and the accidental the show's title suggested. In 1968, the ICA's Leslie Stack stated:

> We want people to lose their fears of computers by playing with them and asking them simple questions....So many people are afraid that computers will take over, but in this show they will see these machines only do what we want them to...Happy accidents can happen between art and technology
>
> (as quoted in Usselman: 2003)

In the press release for Cybernetic Serendipity, Jasia Reichardt describes how the repurposing of these new technologies led to unexpected occurrences: 'Through the use of cybernetic devices to make graphics, film and poems, as well as other randomising machines which interact with the spectator, many happy discoveries were made.' (1968) Much of the artists using machines in the exhibition used them as indeterminate tools - artists played the role of programmers, inventing algorithmic systems in order to take

[3] In David Toop's *Haunted Weather*, electronic music producer Marcus Popp suggests that 'if you dispensed with computers as a component of [generative art] then things like wind chimes and Aeolian Harps might fall into that category.' (2006: 182)

control of a computer. The automative power of the computer was key in creating an autonomous cyborg artwork - part invented by the invention of a system by the artist/ programmer, part invented by the computers response to the system. The hugely optimistic undertaking was not without installation problems typical of contemporary media art:

> The ICA found themselves in charge of extremely fragile computer soft- and hardware, which proved difficult to set up and run. Interactive systems in neighboring exhibits interfered with one another, and sound insulation proved a major problem.
>
> (Usselman, 2003: 390)

In his essay The Future of Responsive Systems, Jack Burnham discusses similar technical issues occurring at the first festival of art and technology (titled *9 Evenings: Theatre and Engineering*) in New York, 1966. In reference to the poor reviews of the *9 Evenings*:

> Few [critics] if any had the prescience to appreciate the events for what they were: man-machine systems with a completely different set of values from those found in structured dramatics or the one-night predetermined spectacular.
>
> (Burnham, 1968b: 2)

Burnham raises an important issue in the above quote that, over forty years later, still has not been completely resolved - by what framework is it possible to critique this alternative 'set of values' to be found in systems art? From an administrative and curatorial perspective, *Cybernetic Serendipity*, *9 Evenings,* and indeed Burnham's own *Software*, were wrought with difficulties - budgetary, technical, interference between technologies, insufficient understanding of the technology being used, lack of rehearsal, and so on.[4] From a critical perspective, Burnham saw the paradigms of the object-physical and the systems-information emerging as two distinctive sculptural formats - generative artworks of course falling into the latter category.

Surprisingly, Burnham's utopian optimism for systems art were to fade drastically by the mid 1970s - instead describing his own systems art survey Beyond Modern Sculpture as a work that 'erred gravely', and how cybernetic art in the 1960s was 'little more than a trivial fiasco.' (Burnham, as in Whitelaw, 2003: 32) Nevertheless, Cybernetic Serendipity went on to become one of the ICA's most successful shows in terms of visitor numbers.[5] Bad reviews were described as 'rare,' although some criticised its lack of engagement with wider political and military issues:[6]

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[4] With respect to the $150,000 cost of showing *9 Evenings*, Burnham says: 'For the critics this was akin to an elephant's going through two years' gestation and then giving birth to a mouse.' (1968: 3)

[5] Cybernetic Serendipity attracted an audience of between 45,000 and 60,000. According to Usselman (2003: 389), Reichardt claimed there to have been upwards of 60,000 visitors, whereas a later Guardian interview with Michael Kustow, the ICA's director at the time, said there was 45,000 visitors.

[6] Usselmann describes a negative Guardian article about Cybernetic Serendipity as 'rare' (2003: 392)

> When we ignore the total social context in which they work, and begin to accept the afterhours fun and games of IBM technicians as art, we are not all that far from admiring the aesthetic surface of thermonuclear mushroom clouds and ballistic missiles.
>
> (from New Society, (8/8/68) as in Usselmann, 2003: 392)

The wide critical acclaim the show received has attracted retrospective suggestions that perhaps the novelty of seeing the future up-close blinded much of the art critics - also reiterating a contemporary critique of electronic media art: perhaps the novelty of a futuristic experience lacks from any inherent conceptual message? In the aleatory systems used in Dadaist works and in Duchamp's Large Glass, there is a clear agency of dissent that engages directly with the politics of the art institution, whereas it could be argued that the systems art shows of the 1960s were mere experiments in the possible.

Roy Ascott, another writer who played an important role in the development of a theoretical understanding of systems art, provides a potential answer to this critique. He describes cybernetics as being responsible for 'unprecedented changes in the human condition' (2003: 100), outlining cybernetics-induced shift in western society from controlling to effecting. Undoubtedly, the ubiquity of electronic media (and by extension the systems it is based on) has the power to socially engage a mass audience - an action in which by its very nature has political implications. Ascott's theories of a 'telematic embrace,' that is 'the technology of interaction among human beings and between the human mind and artificial systems of intelligence and perception' (2003: 232), provide a framework for understanding the ability for a mass audience to experience a digital systems-artwork without a loss in information as you might lose the tempero-perceptual through a telematic experience of an object-sculpture.[7] As Burnham suggested the idea that the materiality of a system lies in its information, the possibility for digital generative systems to exist in the 'inbetweens' cyberspace, contemporaneously accessible for anyone with an internet connection, provides it with a political edge that provides the art institution with a new concept of experience.

> In the past our technologically conceived artifacts structures living patterns. We are now in transition from an *object-oriented* to a *systems-oriented* culture. Here change emanates, not from *things*, but from the *way things are done*.
>
> (Burnham, 1968a: 3)

The readjustment from the idea of a complete artwork to the indefinite process of *making* an artwork coincides with a similar readjustment in western society, as in the above quote.

[7] Ascott provides a definition of telematics as 'computer-mediated communications networking between geographically dispersed individuals and institutions [...] and between the human mind and artificial systems of intelligence and perception.' (2003: 232)

In The Poetics of The Open Work, Umberto Eco describes how art's structure has always been reflective of how 'science and contemporary culture view reality.' In particular, he theorises how contemporary creative shifts towards indeterminate creative methods reflects an uncertainty in worldviews, from quantum physics to theology:

> The notion of 'possibility' is a philosophical canon which reflects a widespread tendency in contemporary science: the discarding of a static, syllogistic view of order, a corresponding devolution of intellectual authority to personal decision, choice, and social context.
>
> (Eco, 89: 14)

The increasing computational approach to the creation of art developed throughout the 20th century mimics the rise to dominance of the computer and the more recent concepts of networked consciousness. From Duchamp's illogical systems behind the creation of the *Large Glass*, to the noise/silence binary present in Cage's Music of Changes, and from cybernetics and the introduction of technology into art, we are left with generative art. It is perhaps a logical conclusion to all has gone before it: removing the artist's presence from the piece by displaying it on a mass produced screen, and leaving it to reconfigure itself through self-automation. The artwork has become software, and as Burnham defines it: 'an attempt to produce aesthetic sensations without the intervening "object". ' (Shanken, 157: 1999) The result of the 20th century art's preoccupation with the system has been the reduction of an artwork to immaterial data - a mere electronic difference capable of defying the limitations attributed to a physical artwork.

AUTHORSHIP/OBSOLESCENCE

In this chapter I will discuss Brian Eno's *77 Million Paintings* as an example of a generative artwork in relation to the concepts of system art presented in the first chapter. I will also examine the effects of the dynamic, time-based nature of the work as oppositional to the temporary life of its medium, and discuss the tensions between the idea of the author/ artist and the role of the machine in the generative artwork. *77 Million Paintings* could be seen as a conclusion to a lot of Brian Eno's work: the early interest in systems art and cybernetics after his art school tenure as student to Roy Ascott; the oblique strategies developed with painter Peter Schmidt designed to disrupt artistic habit; ambient music as a 'tint' and the Quiet Club as a calm thinking environment in noisy urbanised areas; light paintings and pure colour; his involvement with the Long Now Environment and its central message of 'thinking in the long term'; and of course the dynamic and unpredictable possibilities of a digital generative art. This long and eclectic list of biographical interests are strung together to create one work that will probably outlive its audience, and problematically, even the hardware it is designed to be displayed on.

Eno's interest in systems became his signature method of creation after studying with Roy Ascott at Ipswich Civic College during the late 1960s. As he describes it, he '[...]was very into ideas of instructions, scoring and processes that didn't repeat.' (Eno, in Gray, 2006: 19) Ascott's radical teaching style explored ideas of cybernetics and systems in a dadaist manner, using them as ways of disrupting habitual thinking patterns in order the examine the process of making art. Eno continues: 'That first term was specifically designed to dismantle the damage that had been done by the education that everyone had gone through before.' (Sheppard, 2007: 33) The 'damage' Eno refers to was their 'natural behavioral instincts,' (ibid: 33) which were challenged with the use of systems encouraging students to think counter-intuitively. Much of his later work concerns this dialogue between habit and unpredictability. The Oblique Strategies, designed with painter Peter Schmidt, follows Ascott's educational concept of prescribing ambiguous rules or prompts to a given situation, and engaging with it in order to make a creative decision.[8] The Oblique Strategies messages, chosen randomly from a pack of 'over one hundred', potentially offer a disruption in thinking that might motivate an alternate way of solving a creative problem.

[8] Peter Schmidt had previously 'served as the musical adviser to curator Jasia Reichardt' for Cybernetic Serendipity. (Dayal, 2009)

'Do nothing for as long as possible'

(from the Oblique Strategies: Eno, Schmidt, 2003)

77 Million Paintings consists of multiple components: firstly, a database amounting to 300 of Eno's own light paintings provide the raw material for the software.[9] The light paintings themselves exist in a virtual space: the original slides that had been painted, scratched, and printed on with the original intent of them being projected onto a wall as pure light are instead digitally scanned onto the computer, their unique idiosyncrasies converted into binary ones and zeros. Secondly, the software system then manipulates these images, fading randomly selected paintings in and out in order to build up a number of layers, therefore producing new complex works of art. As the name suggests, the maximum amount of new paintings the software can generate is 77 Million. The third aspect to consider is the ambiguities regarding medium and site-specificity. *77 Million Paintings* was made commercially available as a software package that could be installed on a computer in order to, as Eno put it, fill the void left by big black television screens. (Gray, 2006: 19) Because the piece was intended as much for the domestic environment as the gallery space, this re-situating of the work brings about questions of a mass audience and the mass production of an artwork.

'Generative Music is like trying to create a seed, as opposed to Classical composition which is like trying to engineer a tree.'

(Eno, as quoted in Toop: 186)

Eno's composition reference is obviously intended musically, but it is also relevant to classical painting. In the latter, realism is engineered with the use of complex painterly techniques, tonal effects and mathematical precision in creating virtual perspective. The complexity involved in such "classical paintings" is derived from skill, experience, and technical style, whereas with generative art complexity arises out of the automation of indeterminate systems - the rules of the system being the DNA from which the seed's development is governed by. Such organic analogies lend themselves to generative art - in fact many naturally occurring phenomena have inspired algorithms used to generate artworks. Lindenmayer systems are algorithms that define growth in plants and trees, Penrose systems can be used to describe snowflakes, and Perlin noise algorithms have been used to compute randomness, to give a few examples. The idea of creating a strand of

[9] According to an interview with Eno in *The Wire*: 'The program began with 300 slide images that Eno made [...]' (Gray, 2006: 18)

digital DNA when setting the initial parameters of a generative artwork is not an uncommon analogy:

> Such form generators may be likened to biological genotypes since they obtain the code for generating forms. The procedure for executing the code, somewhat analogous to biological epigenisis, grows the form.
>
> (Verostko, 2002: 132)

As in the above quote, it can be understood that the artist is creating behavioral patterns which the piece will develop in. Artificial life systems such as John Conway's *Life*, or William Latham's 'sculptures' have been hugely influential to the development of systems in Eno's own music and artworks, as he readily admits.[10]

Eno's interest in the process of emergence - the interaction of simple components to produce complex, lifelike results (Whitelaw, 2004: 7) - arise from his preoccupation to 'create parameters, set it off, see what happens.' (Sheppard, 2008: 435) For example, much of his ambient series were created using a compositional systems called 'phasing', in which a number of 'simple melodic cycles of different durations separately repeat and are allowed to overlay each other arbitrarily.'[11] (Eno, 1996: 330) This technique is generally attributed to Steve Reich with his works *Come Out* and *It's Gonna Rain*, in both of which a vocal part is played on two separate tape players and allowed to run out of sync with each other, creating 'implied polyrhythms and taking on "ghostly" musical overtones in the process.' (Sheppard, 2008: 41) It is a completely deterministic method of composing, but the variables and levels of complexity are great enough to be incalculable without a computer. Eno summarises:

> One of my long term interests has been the inventions of 'machines' and 'systems' that could produce musical and visual experiences. Most often these 'machines' were more conceptual than physical: the point of them was to make music with materials and processes I specified, but in combinations and interactions I did not.
>
> (Eno, 1996: 330)

The following Eno quote is taken from an essay titled *Generative Music*, outlining his ideas of the new possibilities for systems art and music offered by software:

> I thought this made composing into a kind of genetic activity - in the sense that the compositional 'seeds' were actually interacting sets of rules and parameters rather than precise musical descriptions. I imagined the piece evolving out of the

[10] Cambridge mathematician John Conway's *Game of Life* is a cellular automata system, which was 'revelatory' for Eno,(Sheppard, 2008: 304) comprising of the following three rules: 'Survivals: Every counter with two or three neighboring counters survives for the next generation. Deaths: Each counter with four or more neighbors dies (is removed) from overpopulation. Every counter with one neighbor or none dies from isolation. Births: Each empty cell adjacent to exactly three neighbors--no more, no fewer--is a birth cell. A counter is placed on it at the next move.' (Gardner, 1970: 120)

[11] On Eno's graphic score on the reverse sleeve of the Ambient 1: Music for Airports LP, he visualises how these melodic blocks are allowed to run out of sync with each other.

> interaction of these probabalistic rule-sets - and therefore evolving differently in each 'performance.'
>
> (ibid: 331)

Eno's realisation of this idea came in 1995 with an album of generative music, titled *Generative 1*, based on software called Koan in which he prescribes loose rules and the computer develops a composition in response.

Apart from the distinction between the musical and the visual, the main difference between his album *Generative 1* and *77 Million Paintings* is that with the latter he supplied the source material (the database of light paintings) - in this way it is more like a phasing system as it concerns the development of source material rather than the evolution of completely new material. To refer back to his idea of 'machines' and 'systems', he has provided the materials and processes, but the computer is returning unexpected combinations and interactions. In Eno's diary *A Year With Swollen Appendices*, we can perhaps see where the inspiration for the rules of 77 Million Paintings has come from:

> I've noticed that all these complex systems generators (such as 'Life'[...]) have something in common - just three rules each. And these three rules seem to share a certain similarity of relationship: one rule generates, another reduces, another maintains.
>
> (ibid: 189)

The central parameters governing the progression of the imagery are: a new image is introduced (generation); different images are given separate random lifetimes on the screen after which they fade away (reduction); and there can be a maximum of four layers on screen at once (maintenance).

77 Million Paintings is a different approach to generating artwork than cellular automata systems such as the aforementioned *Life* in the sense that there is no element of 'learning' or evolution. The software is unable to determine which combinations of layers achieve some kind of aesthetic unity, instead it is simply manipulating digital data and outputting the results to a screen. Not even Eno knows which images are going to come up next: 'I have had it running for days on end, and not only do I see new combinations all the time, but also individual images that I have never seen before.' (Gray, 2006: 18) Eno himself, aware that he is unlikely to recognise all images generated by his software, is not overly protective of the potential permutation: 'In the cover text [to the program], it says you can take any pictures you like, but I'd be very grateful if you mentioned the source.' (ibid: 19) This attitude to the output of *77 Million Paintings* is indicative of a wider issue with generative art. It brings about a new set of questions in terms of authorship - the attraction for many artists (as aleatory systems were to the Dadaists) is the effacement of intentionality and the relinquishing of control to indeterminate possibilities. It shifts the

paradigm from the authorship to the facilitation of a work of art - or as Eno puts it, a change of thinking about how things are made. (Toop, 2006: 186)

> When you make a garden, of course you choose some of the things you put in, and of course you have some degree of control over what the thing will be like, but you never know precisely. That's the wonderful thing about gardening. It responds to conditions during its growth and it changes and its different every year.
>
> (Eno, as in Toop, 2006: 186)

In Jack Burnham's theory of software/hardware, we can find a metaphor for the aesthetic decisions and conceptual processes involved in creating a work of generative art. A gardener's decisions on what to plant and where are the intangible decisions - the software, whereas the physical, tangible result of the garden is the hardware - the 'formal embodiments of the actual art objects' (Shanken, 1999: 156). We can apply this analogy to *77 Million Paintings* also: Eno literally created a digital version of Burnham's software, using it as a tool to co-govern the process of realising and rendering the hardware - almost like a second brain that decides which images will be overlaid together and in what order. This software/hardware duality can be further understood by returning to Duchamp's *Large Glass*.[12] As Burnham says, the lower pane of the work represents the cool mechanistic objectivity of hardware, whereas the upper panel is the subjective 'intuition, love, internal consistency, art, beauty and myth itself.' (Burnham, as in Shanken, 1999: 159) This divergence between the subject and the object in *77 Million Paintings* is exaggerated through the use of the computer in the decision-making process. Eno obviously made certain subjective decisions in relation to the programming of the software and deciding the ruleset of the system, but the formal embodiment of the work is unprecedented - even to Eno himself. Thus, it could be argued that the author is experiencing the work as a member of its audience, neither having quite seen the work in a given state exactly the same way before.

Generative art not only problematises the concept of the artist/author through the intervention of the computer, but it also interrupts ideas of a singular, static artwork. With such a large number of possible permutations, *77 Million Paintings* is highly unlikely to offer two identical experiences. In fact, if you wanted to be sure to see any repetition, you'd have to watch 'for 450 years.' (Eno, as in Sheppard, 2008: 435) In contrast with a film or a painting with which you might expect to remain in physically the same state over time (setting aside variations in our subjective act of looking or hearing), *77 Million Paintings* will be very likely to look and sound significantly different with each visit - the paradox is that

[12] *The Large Glass* actually 'served as an architectural model for the actual installation' of Burnham's *Software* exhibition in 1970. (Shanken, 1999: 159)

in repetition its variety is exaggerated.[13] By extension of this, the potential for a generative artwork to detach itself from any one location - through telematic experience or through the mass-production of the artwork (as in the case of *77 Million Paintings*) - enables a given user to have a distinctly separate experience of the artwork than any other user.

With its existence rooted in a virtual space, it also has the ability to detach itself from a specific permanent manifestation:

> This long-term, intangible nature of the work is something that interests Eno. There's no dedicated environment for the program. It's something that raises questions about human agency. It is, he says, a new place between TV, painting, and cinema.
>
> (Gray, 2006: 19)

The imagery changes almost imperceptibly slowly, providing a distinctly separate pace to the typical catalytic qualities of technology. Charlie Gere, a prominent writer on electronic media, describes the temporal tensions between technology and art: '[...]If art is to have a role or a meaning at all in the age of real-time technologies it is to keep our human relation with time open in light of its potential foreclosure by such technologies.' (2006: 2) Eno's involvement with the Long Now Foundation and other long-term art pieces certainly follows this idea, with projects such as *The Clock of the Long Now* and Jem Finer's *Longplayer* project operating with a lifespan of millennia rather than years.[14]

The long-term nature of the piece is contrary to the disposable nature of electronics as technology advances. The software's creative output is claimed to potentially go on for centuries, whereas the technology needed to display it has a lifespan of decades at best. This poses a question that is relevant to electronic media in the wider art institution: for how long can a given artwork, dependent on the technology contemporary to its creation, actually be displayed for? The difficulties of archiving such massive streams of data in the face of obsolescence are complex. Jem Finer's *Longplayer* project, for example, has a lifespan of 1000 years that will be overseen by the Longplayer Trust - essentially a group of individuals that must envisage new ways for the work to continue its existence as the advancement of technology makes its current state impossible. Similarly, if Brian Eno claims *77 Million Paintings* will last for 450 years without repeating itself, the likelihood is that it will never truly exhaust the full possibilities it is capable of. It will most likely reach

[13] 'The variety of a system is its total range of outputs, its total range of behaviour.' (Eno, 1996: 334)

[14] The Long Now Foundation was founded in '01996 to creatively foster long-term thinking and responsibility in the framework of the next 10,000 years.' (Statement from the Long Now website - http://www.longnow.org)

the limitations of its hardware before the software completes its random cycle through to anywhere near its 77 millionth painting.

It's not only generative art that faces a potential future disappearance from the archives - the entire history of art's existence is of course finite in the sense that watercolours fade, frescoes crumble and so on. A work of generative art thrives on and is failed by the rapid pace of technological advancements: it would not be an exaggeration to say a work designed to run on contemporary operating systems will be unlikely to remain functional in one or to decades due to the obsolescence of such operating systems. To return to Charlie Gere's statement - how can a generative work keep our human relation with time open if its hardware is in a state of disintegration? Perhaps generative art at once embodies the paradoxical qualities of 21st century culture in the sense that it is at once temporally liberated and imprisoned by technology. The digital information that makes up a generative artwork is dislocated from time or space - allowing it to exist simultaneously all over the world without any degradation in quality, and still provide individual audience members with a unique experience of the work. There is no original, and no copy: hierarchies of an editioned work of art do not apply in the same way as they do to a print or photograph.

'One might add that increasingly the very preservation of art objects depends upon the uses of safety and atmosphere control *systems*.'

(Burnham, 1968b: 7)

With 77 Million Paintings we can experience this contradiction in potential, and the time in which this potential can be achieved: the promising title of the work is a near-impossibility. It will only contain as many paintings as your hardware will allow for before it succumbs to its inevitable obsolescence. In applying Burnham's thoughts on the preservation of art historical's fragility to generative art, we are faced with a fractal series of contingency systems, each ensuring the previous is being perpetuated. Alternatively, we can recognise a generative artwork as a performance of the techno-culture it was developed in by resisting the need to archive it, and allow it to become inoperable. 77 Million Paintings certainly provides a new and exciting experience of an artwork through the denigration of the singular artwork and its problematic notions of an author - but as with all generative art, it must address its temporariness as an artform for it to be provide a serious commentary on its technological relationship with time and obsolescence.

DIGITAL REPRODUCTION

In this chapter I will apply Walter Benjamin's theories of reproducibility and his concept of the 'aura' of an artwork to generative art (again with specific reference to Brian Eno's *77 Million Paintings*) in order to gain a better understanding of its potential to create a mass audience, yet still offer a unique experience on an individual level. Benjamin's text *The Work of Art in the Age of Mechanical Reproduction* (1935) is key to understanding the philosophical and political implications of this, as it was written in reaction to previous advancements in media technology at the beginning of the 20th century that similarly altered the way a wider audience can access and interpret an artwork. As Benjamin says: 'Every day the urge grows stronger to get hold of an object at very close range by way of its likeness, its reproduction.' (2007: 222) At the beginning of the 21st century, this urge remains in the form of telematic experience. We again are faced with a widespread new method of reproduction, causing an irrevocable change in how media is presented to its mass audience: for example, *77 Million Paintings* has been shown as an installation in multi-user domain *Second Life*, allowing users to have a telematic experience of the artwork by presenting it in a virtual gallery space. The digital nature of generative art allows it to exist in such virtual locations as well as be manifest in reality - in the gallery space or the home. This widespread availability raises an institutional question: in the case of an art institution that places huge monetary values on *unique* works of art rather than *available* works of art, how does the infinitely reproducible yet individualistic nature of generative art challenge this? Also, with reference to the views of Clement Greenberg and Theodor Adorno, is generative art 'kitsch' in its formulaic approach to art creation, and its disruption of the idea of a singular artwork?

Walter Benjamin begins his essay *The Work of Art in the Age of Mechanical Reproduction* by stating that an artwork has always, 'in principal, been reproducible.' (2007: 218) He continues to describe the technological advancements from founding and stamping in ancient Greece to 19th century techniques of lithography, and then into the contemporary analog formats of photography which could 'perceive more swiftly than the eye could draw.' (ibid: 219) Benjamin talks of how paradigm-shifting this was:

> Around 1900 technical reproduction had reached a standard that not only permitted it to reproduce all transmitted works of art and thus to cause the most profound change in their impact upon the public; it also had captured a place of its own among the artistic processes. For the study of this standard nothing is more revealing than the nature of the repercussions that these two different manifestations - the reproduction of works of art and the art of the film - have had on art in its traditional form.
>
> (ibid: 218)

The effects of the ability to accurately capture and re-present reality with the photograph, and by extension the ability to capture it in real-time with the film reel, forced artists to re-examine art's relationship with time and representation. When Benjamin discussed how photography and film can perceive quicker than the hand can draw, he was writing at a time when negatives had to be sent to a darkroom to be processed, and the appropriate routine had to be followed in order to review the information they contained. We can take these ideas one step further with the advent of digital technology and the internet, as information can be disseminated to a global audience in real-time, as an event is happening. The digital age can be largely accounted for the centralisation of information through networked consciousness, and the infinite reproducibility of this information without any degradation whatsoever.

'Even the most perfect reproduction of a work of art is lacking in one element: its presence in time and space, its unique existence at the place where it happens to be.'

(ibid: 220)

Benjamin's discussion of the effacement of the aura of an artwork - that is, the almost sacred reverence afforded to the experience afforded to unique works of art - again becomes an important method for understanding the analog between the desensitisation of the audience and the reproduction of digital media. The result of this image-saturation is (to take the example in Robert Hughes documentary *The Mona Lisa Curse*) the distinction that when daVinci's Mona Lisa arrived for exhibit in New York's Metropolitan Museum in 1962, over one million people went to 'have seen it, rather than to look at it.' (Hughes, 2008) The value of the singular masterpiece is in conflict with its ubiquitously reproduced image - becoming obscured from examination through its repetition. As Adorno says: 'The work of art becomes its own material and forms the technique of reproduction and presentation, actually a technique for the distribution of a real object.' (2001: 63) Today, a google image search for the keywords 'mona lisa painting' yields over a quarter of a million results: on the first page of the results, 21 almost identical copies of the image stare blankly back. It is a static work of art in the sense that it will, in principal, remain motionless and unchanging. In contrast, the same search made for 77 Million Paintings returns 21 significantly different manifestations of the work, a reminder of its formal multiplicities.

In the second chapter, I discussed how the allowances for indeterminate diversions in a generative system's ruleset can produce multiple variations on the same artwork. Benjamin's theories of the aura of an artwork being effaced as it is continuously reproduced is problematic when relating it to generative art: in reproducing a generative work, we are

exaggerating the possibilities of direction the work can develop in. The tension lies in the infinite potential to create a mass audience through the replication of the rules of the generative system, but the 'formal embodiments of the actual art object' (Shanken, 1999: 156) will most likely always be different. In this sense, there is no original version to reproduce, but a multiplicity of separate parallel existences - a substitution of 'a plurality of copies for a unique existence.'(Benjamin, 2007: 220) Generative artworks such as *77 Million Paintings* provide a major deviation from the kind of experience we have when looking at a photograph or a watching a film as it never tends toward a state of stable completion: it is at once finished and unfinished, constantly discarding old images and recreating new images. As Eno says of his own generative music:

> I gave a talk about self generating systems and the end of the era of reproduction - imagining a time in the future when kids say to their grandparents, 'So you mean you actually listened to exactly the same thing over and over again?' Interesting loop: from unique live performances (30,000BC to 1898) to repeatable recordings (1898-) and then back to - what? Living media? Live media? Live systems?
>
> (Eno, 1996: 250)

14 years later, and Eno's optimism for generative music's revolutionary potential still hasn't quite been realised. The hypothesis he suggests is one that is now shared by an active but marginal underground network of software developers and creative coders using generative music applications such as *Pure Data*, *SuperCollider*, and *Max/MSP* among others, but is unlikely to create a dent in the tradition of recorded music any time soon.

'The cathedral leaves its locale to be received in the studio of a lover of art; the choral production, performed in an auditorium or in the open air, resounds in the drawing room.'

(Benjamin, 2007: 221)

Reproducibility allows for the disconnection of a sense from it place, as in the above quote. The idea that we can hear the sound of musicians we'll never see and experience the natural acoustics of a room we will never be in is little more than a banal fact of technology rather than a feat. For the North American premiere of *77 Million Paintings* at the Yerba Buena Center for the Arts in San Francisco, Brian Eno spoke about the work to a couple of hundred members of The Long Now Foundation. In parallel, an event was run on multi-user domain *Second Life*, allowing users to virtually experience the work without having to actually visit the exhibition. Using their 'avatars' (a virtual 3d model of a body signifying a user's presence), they could explore the exhibition space and discuss the work, a mirror of what was happening at the real-life event but without the reverence of a direct embodied experience. If a work of generative art can be experienced telematically without any loss or distortion in the art-information, what are the implications for a telematic audience for generative art? As Ascott questions, 'where is the mind located when identity

is as much bound up in an avatar, or across a group of highly differentiated avatars, as it is in the material body?' (2009: 22)

To begin to answer these questions, it is useful to contrast an installation of *77 Million Paintings* in a gallery space with a synthesis of the installation (as it was displayed in *Second Life*). In the former instance, an experience of the artwork could be described as 'embodied' - a term used by Claire Bishop in her book *Installation Art* as a way to emphasise the participatory and multi-sensory nature of such works. She says: '...this introduces an emphasis on sensory immediacy, on physical participation (the viewer must walk into and around the work), and on a heightened awareness of other visitors who become part of the piece.' (Bishop, 2005: 11) In this way, the act of moving around the installation and all its associated sensations puts our mind firmly in the gallery space. With *77 Million Paintings*, it is sometimes installed in gallery spaces titled *Constellations*, in reference to the patterned display of monitors - perhaps suggesting that Eno sees it as a separate artwork from the commercial release or the online version. In the case of the latter, our mind is very much dislocated from the artwork. As Roy Ascott says in his essay *Towards a Network Consciousness*, networking 'puts you, in a sense, out of body, linking you into a kind of timeless sea.' (2003: 187) Reflective of the differentiation in title, it is a much different experience of the work, although in essence the actual generative system remains unchanged. The user negotiates the gallery space not through our own body, but a projection of it - the avatar. By occupying two situations simultaneously, the user is in a state of 'double consciousness.' (Ascott, 1999: 67) They receive a limited synthesis of the work: purely audio/visual. Bishop's idea of the 'embodied viewer' in installation art becomes a 'disembodied user' in such telematic art, our mind located at the end of a terminal.

The potential for a mass audience to experience generative art in this way - as is largely the case already due to the ease of uploading such artworks coupled with the large userbase one can attract - again provides problems for art historical's archive, and interrogates current methods of understanding contemporary experiences of art. We can take what Benjamin said presciently of film and its mass implications as being relevant to recent movements in networked experience: '[it can even provide] a revolutionary criticism of social conditions, even of the distribution of property.' (2007: 231) With generative art, this criticism of the distribution of property is a result of a clash of reproducibility and the inability to actually own the 'products' of the generative system, which will forever remain fleeting and unlikely to be recreated.

A conflict arises in this instance: in the creation of a mass audience through varying mediums such as the internet, pirated software and domestic consumption, and/or the gallery space, it is arguable that simultaneously it is the creation of a kitsch product rather than an avant-garde artform. Theodor Adorno and Clement Greenberg, writing on early 20th Century European art, differentiated between the avant-garde and a kitsch sub-art grown out of mass production and a german middle class with a mistaken concept of high culture. Greenberg describes kitsch:

> Kitsch is mechanical and operates by formulas. Kitsch is vicarious experience and faked sensations. Kitsch changes according to style, but remains always the same. Kitsch is the epitome of all that is spurious in the life of our times. Kitsch pretends to demand nothing of its customers - not even their time.
>
> (1989: 10)

Much of Greenberg's description is applicable to tendencies of generative art, and in particular *77 Million Paintings*, on a literal level at least. The fundamental basis of generative art suggests a kind of ambient intelligence that is automated by a system of algorithms and formulas (and with *77 Million Paintings* Brian Eno of course introduces his own concepts of ignorable 'ambience' in order to facilitate the creation of an environment for thought), kitsch is also 'turned out mechanically [as part of] our productive system.' (ibid: 11) By this argument, generative art could be considered as a microcosm of a mass production system - the computer becomes a factory, the generative system's rulesets become an assembly line, dictating the manifestation of a series of artworks.

With *77 Million Paintings* one can purchase the generative system as a consumable 'product'. It can be owned and exhibited/displayed on a computer system in a domestic situation as a kind of ambient wallpaper - as intended by Eno.[15] The components of the computer (which make up the hardware/medium) needed to display the software are mass-produced and inextricably linked to the pace of upgrading and obsolescence that has defined the computing industry:

> Probably more than any other medium for art, the digital is embedded in various levels of commercial systems and technological industry that continuously define standards for the materialities of any kind of hardware components.
>
> (Paul, 2007: 254)

To read *77 Million Paintings* as a microcosm of this production system, the paintings it generates are also individual 'products,' but ones that are transient. They exist only in passing, cannot be owned, and may never be seen again. To refer to Adorno's ideas on the 'product' as a capitalist concept: 'The poetic mystery of the product, in which it is more than itself, consists in the fact that it participates in the infinite nature of production and

[15] 77 Million Paintings was released commercially with the aim of filling the 'void left by big black television screens.' (Eno, as quoted in Gray, 2006: 19)

the reverential awe inspired by objectivity[...]' (Adorno, 2001: 63) In this respect, generative art is inherently a critique of the mass-production culture it is made manifest within: the 'poetic mystery' of the product is subverted by its existence being specific to a moment unlikely to ever be recreated. It is not possible for an individual image to become 'property' as it will inevitably disappear, to be replaced by another image. The software does not respond to the whims of an owner - it exists separately and autonomously.

When contextualising *77 Million Paintings* within the nascent generative art medium (which in its use of computers is interlinked with the production systems of the computer industry), this relationship between mass-production and mechanised creation must be considered. If *77 Million Paintings* could be criticised, it would be made on the same terms that a minority of critics wrote negatively on Cybernetic Serendipity: it does not force its audience (telematic or otherwise) to knowingly confront these issues of mass-production, tensions in authorship, or the obsolescence of the technology. It does not provide an 'obstruction or difficulty exceeding an individual's existing values, skills and knowledge.' (Bermudez, 1999: 17) On the other hand, Eno's intention was to provide a space that did not challenge its audience or attempt to force, or even suggest, any particular political agenda. Its purpose is to exist as a calm space to think in - a near-silent shelter from the noise of urbanisation and media.

The ambience of *77 Million Paintings* masks an ongoing paradigmatic change in how digital art is accessed and understood. While it is perhaps foolish to attempt to anticipate what effects generative art might have on future art movements or styles, it can be said that it disrupts the traditional relationship between author, audience, and artwork. Eno talks of how the online mass audience has produced a need for authentic and unique experiences in reproduction:

> I notice that, as the Net provides free or cheap versions of things, 'the authentic experience' — the singular experience enjoyed without mediation — becomes more valuable. I notice that more attention is given by creators to the aspects of their work that can't be duplicated. The 'authentic' has replaced the reproducible.
>
> (Eno, 2010)

For generative art, there is no singular authentic work, but a great variety of parallel works that remain unique in reproduction. If the digital basis of generative art allows for its potential to significantly reduce the subjective presence of an 'author', exist in unlimited virtual spaces simultaneously, and allow an artwork to have no singular and complete manifestation, then this basis also shatters its potential - it's existence in a virtual space renders it vulnerable to the rapid pace of obsolescence in the computing industry. In its mimicry of a mass produced good - a critique of a formulaic kitsch artform that is slowly

descending into a state of obsolescence - generative art has the potential to engage with us socially and critically, while also raising important institutional questions of the author and the archive, both of which are integral to the course of contemporary art.

CONCLUSION

> But for our time the emerging major paradigm in art is neither an ism nor a collection of styles. Rather than a novel way of rearranging surfaces and spaces, it is fundamentally concerned with the implementation of the art impulse in an advanced technological society.
>
> (Burnham, 1968a: 13)

This technological implementation of the art impulse is central to the function of generative art. It is clear what is to be gained for the art world by nurturing a digital, generative art form: a type of systems art that creates the paradoxical analog between the mass-production of the artwork and the exaggeration in variation; an artwork that can be experienced by the masses but individually and uniquely. It provides a critique for the post-human condition: the author/machine, the telematic experience, the digital product. It at once promises to deliver all: in the case of *77 Million Paintings*, we are promised a prolific output of new images every moment for approximately 450 years. The generative artwork becomes a factory for the culture industry, producing new variations from the same formula. It can escape the traditional limits of narrative, completeness and stasis, instead entropically collapsing into itself in forward motion with no preconceived goal - or any real definitive beginning either. Yet of course it can never deliver all of its potential 77 million, as it remains slave to a greater system: the driving force of the computer industry which is based on relentless progression.

The problems it poses to the art institution are becoming increasingly important for the preservation of digital artifacts for future cultural review. The effects of *77 Million Paintings*, for example, can not be captured by a snapshot of its installation in a gallery space or in a virtual space in *Second Life*. In fact, its total effects can never really be comprehended due to its incompletion. The size of the work expands beyond the limits of human experience.

> I have identified a major aesthetic shift which has taken place in our century, from the art of appearances, classically concerned only with the static order of things, to an art of apparition, concerned with dynamic relationships and processes of coming-into-being.
>
> (Ascott, 1999: 70)

Ascott's views mirror Burnham's on the change from an object-oriented to a systems-oriented culture. In this fundamental change in how society thinks, comes a change in how art 'thinks' about society. If generative art can be considered as being an important movement in contemporary art history, it is so through providing a commentary on the recent emergence of a procedural, systems-oriented culture.

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