EVOLUTIONARY SPACE:

LOOKING AT ARTISTIC PRACTICE IN A DISPARATE ART ECOLOGY

Research Statement

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Abstract

The disparate but interconnected nature of contemporary artistic practice is examined in the cases of cell automation, computer-generated life, and ceramic sculpture. It is argued that creative systems involve the encoding and implementation of pure information into perceptible modes, manifested, propagated, and proliferated in a process involving the flow of information. This is arrived at, in the context of Dennett's concept of algorithm, Olson's ideas on computer-generated life, and biological and cultural systems. A distinction is made between phenotype and hardware, and symbolic or virtual life and organic life subject to physical laws. The possibility of physical life as opposed to symbolic life being generated by computers of the future is speculatively touched on. This in turn leads to the suggestion that there is a symbolic correspondence between art practices and life processes. An artwork in design space within a given ecosystem is seen as a step in the development of a practice arising from what is called here evolutionary space. Evolutionary space is presented as a way of looking at art practices in terms of how they develop, adapt, and operate, in a dynamic relationship with an ever-changing environment. It extends Esslin's artist-centric approach to evaluating artistic practice consistent with Anderson's anthropological, and Bayles and Orlando's sociological notions of art. Evolutionary space may be a way of mitigating some of the complications that subjective criteria might cause when discussing differing practices. In conclusion, evolutionary space offers a flexible and adaptable means of considering art practices, their taxonomies, processes, and outcomes, forming a starting point for further discussion and research into the nature of artistic practice and the role of artists.

Key words: evolutionary space, ecosystem, artistic practice, information, aesthetics.

Introduction

Artistic practices have become widely divergent and disparate in recent years, particularly since the arrival of digital means and artificial intelligence which are opening new possibilities. Different taxonomies representing often varied paradigms, methodologies, themes, mediums, and contexts, have given rise to an increased heterogeneity of approaches as to how art is discussed. A new way of looking at the generation of art could be considered helpful in fostering a unified view amid diversity. This paper introduces an approach which is hoped will contribute to this endeavour, to facilitate cogent and integrated discussions regarding artistic practices and the role of artists.

This is a complex area to analyse in a short paper. Taking the view of George Polya (1957, p. 121), that a general problem is often easier to solve than a more specific one, three different cases are considered, focusing on the interpretation and implementation of pure information in the material world. These examples of cell automation (CA), computer-generated art (CGL), and traditional ceramic sculpture, are explored qualitatively. A working model arises in the context of biological, cultural, and computational environments which touches on ideas that invite further study. Artistic practices are seen as evolving, living systems, subject to continual change, in which interrelated elements are open to the exchange of information and having to constantly adapt to internal and external environments in continual flux.

Part 1 begins with the nature of information in the context of John Dewey and Eric Olson's ideas regarding where information resides in art and computing respectively, in conjunction with process philosophy's proposal that being is a state of continual change.

This prepares the way for considering the roles of abstract and material elements in the implementation of algorithms that give rise to simulations of life. In the context of Daniel C. Dennett's concept of an algorithm, John Conway's *Life* and William Latham's *Mutator*, examples of CA and CGL respectively, explore the apparently purposeful behaviour that can arise out of the implementation of algorithms. Comparisons are made with biological and cultural modes of coding referencing Richard Dawkins, and a distinction is made between phenotype and hardware with its implication on the possible traversal of symbolic life to actual life. The teleology of aesthetics is also considered regarding the understanding of creative practice as a symbolically living process.

Part 2 considers creativity in the light of Margaret Boden's popular notion of what it might entail and continues the analysis of the role of aesthetics in creative processes. The relationship between an artwork and its environment or ecosystem is considered as a step in the evolution of successive works in time, giving rise to the term *evolutionary space*. These ideas are seen to be consistent with Andrew Lord's very different practice in ceramic sculpture. Finally, it is suggested that the ideas discussed extend Martin Esslin's approach to the evaluation of art practice in view of Richard Anderson's anthropological view of art and David Bayles and Ted Orlando's analysis of its social impact.

Part 1

The Object and Nature of Being

Tropes are very much a part of how artists work, linking disparate systems of knowledge. This requires the exchange and manipulation of information to create new

streams of information. If art does not reside in the object or event but in experience (Dewey, 1934), where does the information on which a given experience engendered by an artwork reside? The idea that it resides in some sort of symbolic world, an abstract metaphysical cloud beyond the constraints of the physical world is not ontologically consistent with what happens in the material world (Olson, 1997). For information to have effect in the physical world two things are needed: for it to be encoded in an interpretable form which can be subsequently implemented by hardware or a phenotype. What information, and how it is encoded, depends on the context: bases in replicating molecules in organic life; writing and visual representation in cultural ideas (Wengrow, 2014), binary base and computational languages in the digital environment.

The implementation of information implies change which in turn reflects on the notion of being. Process philosophy provides an alternative to the Platonic and Aristotelian ideas of being as static, only altered by an external force acting on the thing in question. It posits that reality is based on change in which existence is constant becoming (Rescher, 1996). This idea is consistent with contemporary physics which states that for anything to be perfectly constant and unchanging it needs to be at a temperature of absolute zero. As nothing ordinarily exists at this temperature it could be said that constant change is the natural-state-of-affairs.

Life

Computers are now capable of simulating life in such a way that for some, it appears inevitable for the digital environment to generate life within it sometime soon, if it has not already done so, Ray (1992) commented nearly twenty years ago that. A computational

environment that appears to bear the characteristics of life was brought to public attention by Gardner (1970). Conway devised a mathematical modelling of simple ecosystems during the sixties using pencil and paper. The full implications of his work were not discovered until Bourne and Guy implemented Conway's work using computer language in 1970 (ibid). The resulting visual demonstration enabled discoveries about the behaviour of the algorithms that would have otherwise been much more difficult to achieve (ibid). This implementation called *Life*, shows squares on a grid behaving in ways as though they are a living populations denoting births, deaths, migrations and so on, played over time. The events appear to possess purpose, but they are the result of spontaneous algorithmic behaviours which are non-teleological but nevertheless give the sense of being alive (Numberphile, 2014).

Dennett (1995), describes three characteristics of algorithms: substrate neutrality, underlying mindlessness, and guaranteed outcome. In *Life*, the perceived purposefulness is due to the guaranteed results which, however brilliant they might appear, are the result of step by step instructions which can be carried out by anyone or any device capable of following the instructions. The algorithms are substrate neutral, i.e. whether implemented on a grid drawn in the sand or a computer screen, the result is the same. Such cell automation can simulate aspects of life but not be life (Olson, 1997).

Capable of handling large amounts of data with relatively little information, cell automation is used in many fields where group behaviour is studied such as, population dynamics, epidemiology, economics, etc. However, aesthetics plays no part in the algorithm itself, aesthetics is a perceived, emergent property of such processes. Nevertheless, this approach has led to further systems being devised by artists in which aesthetics do play a

significant role such as, McCormack's creative ecosystem 'Eden' (McCormack, 2001) and various drawbots (Bird et al, 2008).

What Life

Life introduces a fundamental problem when looking at more complex CGL. What life is one talking about ontologically, the information of which each computer iteration is an instance (Olsen, 1997) or the information contained within? Early workers in the field stated the possibility of creating artificial life by means of programming alone (Ray, 1992). This hypothesis has been shown to be flawed by Olsen (1997)) on the grounds that CGL requires information to be coded into some form of programming language and executed by corresponding hardware. The information coded in a language that is expressed through a computer's hardware is analogous to that of a biological phenotype's developmental instructions coded in DNA and RNA; or ideas recorded and distributed in written and spoken language and art in human society (Dawkins, 1976). These different systems undergo processes of transmission, replication, mutation and adaptation found in biological systems. Dawkins (1976), draws a parallel between the behaviour of genes in controlling phenotypes and memes controlling social and cultural behaviours in human society.

It can be argued that a photocopier while replicating does not replicate itself thereby not fulfilling one of the essential criteria for life and therefore cannot constitute life itself. This exemplifies the distinction between phenotype and hardware. A phenotype expresses and embodies the code that contains its own making, and which can be passed on to future generations of phenotypes. Hardware, on the other hand, only implements code without

producing physical progeny. Our own bodies are both phenotype and hardware whereas computers today only serve the latter function, as hardware.

For something to be alive it needs to embody a complex of interdependent processes, including the reproduction of phenotypes. Such criteria could be applied to other forms of life existing in symbolic worlds or virtual environments independent of the laws of physics of this world (Pattee, 1987). Olsen compares such life with that of lives in literary fiction pointing out that the lack of complexity in both information and hardware, prevents the possibility of such life characters from responding to changes in the environment of themselves (Olson, 1997). Life is dependent on the inseparability of information, code, and the body that contains and executes that information.

In the case of memes and genes or culture and nature, the survival of the fittest (passing on inherited information to the next generation) works as a substrate neutral algorithm implemented mindlessly whose results are guaranteed (Dennett, 1995). Can the same idea of survival and inheritance be said of CGL?

Mutator

The algorithms for Conway's *Life* are simple enough to be demonstrated on a grid drawn on paper. On the other hand, substrate neutral coding for CGL, is on account of its complexity, dependent on ever increasingly complex and powerful hardware as the complexity of algorithms and the quantity of information increases.

William Latham's *Mutator* is an evolutionary computational environment in which organism-like three dimensional objects continually change on screen (Mutator V. R., 2019). Iterations of *Mutator* have progressively increased in complexity to the point where they

are being used to model the way proteins behave in the Protein Docking Games with Imperial College (Imperial College London, 2014).

Whatever impression of being alive *Mutator* might give on screen, it does not fulfil the criterion for life of replication of its hardware as a phenotype would. The computer may replicate code, but as with the photocopier, these information offspring do not give rise to baby hardware: there is no *in silico* life (Olson, 1997). The semblance of reproduction and life is simply that, an onscreen visualisation of the programme's process and informational development, not a material addition to the world which itself can continue the process into future generations.

The generation and development of forms in *Mutator* is determined by algorithms whose aesthetic characteristics are pre-determined by the artist. New variants are produced through 'breeding' creating evolutionary trees. In later versions of *Mutator*, selection filters automate the interbreeding of variants according to aesthetic rules also set by the artist (TEDx Talks, 2015). There is an aesthetic teleology to the process which is not the case in biological systems where predetermined goals only appear to be so *a posteriori* (Dawkins, 1976). Opening out the aesthetic selection process to gallery audiences, creates a greater population diversity but does not change the question of self-activation. The pure information, which of itself does nothing (Olson, 1997), implemented via the algorithms, gives rise to a symbolic life in a virtual world not subject to the laws of physics. The outcome in *Mutator* is qualitatively directed by the artist's aesthetic sensibilities. Cell automation on the other hand is an automatic, quantitative process teleologically closer to biological natural selection. It could be said that in both cases, some kind of natural selection is taking

place, subject to the internal workings of the algorithm in CA and dependent on human input in *Mutator*.

Are there any computers with the impetus for reproduction and capability of traversal across complexity barriers and could machines break out of the virtual environment into the physical one? AI offers the possibility of increases in complexity and data control thereby enhancing the simulation of life to the point where it might be indistinguishable from actual biological life. However, it could be said that for phenotypic propagation of machines to become a reality, a practopoietic computer system would be needed (Nikolic, 2019) in which a computer would not only be self-reliant and autonomous in its functioning, but also be capable of synthesising new hardware that functions as an autonomous phenotype. This speculation on the idea of moving out of design space, set in a symbolic world, is still a matter for science fiction. Nevertheless, this forms the basis for considering art as operating in a symbolic living space.

Part 2

Creative Space

Creativity is hard to pin down to one definition and any discussion on the nature of creativity in the context of art and aesthetics lies beyond the scope of this paper. However, taking Boden's (2010) popular definition that creativity involves the generation of ideas or artefacts that are "new, surprising and valuable", it could be said that any system that gives rise to such an outcome is being creative. Creativity can be algorithmic, that is to say, not requiring teleological control (Dennett, 1995), as seen in cell automations such as *Life*. This

could be taken as meaning that aesthetics is not a prerequisite for creativity. For aesthetically pleasing or desirable results to emerge from a creative process, either spontaneously or by selection, human input is needed at some stage (McCormack, 2012). For there to be an aesthetic element, or any other value judgment, human involvement is needed, the outcome of which is in turn dependent on context. McCormack argues that in today's contemporary arts environment, aesthetics is often downplayed in importance in the making and appreciation of a work (ibid). However, this ignores the circumstances where algorithmic outcomes are given an aesthetic judgement *a posteriori*. Whatever the case, human input is needed for an aesthetic appreciation.

The conceptual design space in which human creative activity takes place, corresponds to some extent with the idea of fitness landscape in biology which sets the limits or parameters of what is possible and viable in the evolutionary design space (Dawkins, 1996). The main difference lies in that with human creativity, the survival of an outcome and its propagation has some aim applied to it either at the outset of the process or at some other stage. In biological systems, however, there is no applicable teleology to the idea of survival of the fittest (Dawkins, 1976).

Artistic creativity does not occur in a vacuum. It is highly contextual, subject to constant exchanges of information in some form or another such as, influences, requirements, etc. The design space from which an artwork arises exists within this ecosystem of interconnected behaviours which also includes the artist. This is not a static arena but one in which information and its implementation is in constant flux as posited by process philosophy.

Dennett (1995) gives a clear account of how a design space works in biological evolution which is applicable to artistic output. It is worth considering the hierarchy of outcomes within such a design space. Firstly, outcomes will include all those that are possible, from the most improbable to the most probable. Secondly, a smaller number of outcomes are defined by those that are possible under a given set of conditions. There is a third tier which are those that become actualised and finally those that are viable, i.e. survive into future iterations.

An artist works within ecosystems that include their aims, limitations, social and professional context, history and so on. Each work or idea produced, is an actualised outcome which is may be viable within that system. That work is either discarded forthwith, eventually, or used further in the artist's practice at some stage. It perhaps moves beyond the artist's immediate sphere of activity and experience into the wider world. There is an evolutionary sense to all this in that the process leads to some sort of viability, involving experimentation and selection within the ecosystem in which that practice is exercised.

Evolutionary Space

An artistic practice is constantly adapting to the ecosystem in which it operates. This adaptation involves the flow of information. That information is encoded in some way through method, technique, programmes, ideas, and so on. It is implemented by hardware of some sort, whether the artist themselves, medium, tools or a combination of these. Each iteration is part of a process responding to the ecosystem, which includes the artist(s) in an evolutionary process. The conceptual space in which this step by step process takes place Is here called *evolutionary space* (ES).

If the relationship between the context-environment and the practice that evolves within it, is seen as taking place within it or indeed actually forming an ES, where information flows, it becomes a question of looking at: a) the information, b) the coding, c) the implementation, d) the manifestation, e) the propagation and proliferation of that manifestation or expression resulting in a new flow of information. This can then be tested for its viability against the conditions or criteria set by the ecosystem in which the practice takes place and evolves. This resembles Dawkins' meme idea as it is set in a cultural-societal environment.

Art and Change

The anthropologist Richard Anderson defines art as, 'culturally significance meaning, skilfully encoded in a sensuous, affecting medium' (Anderson, 1990, p. 238). Although anthropologically derived, this broad description can be correlated with the ideas discussed so far in formulating the notion of evolutionary space. The cultural significance lies in the ecosystem itself, in the form of behaviours, values and so on. The encoded meaning, or information, is interpreted and expressed in a given modality, be it image, sound, text, etc, which affects the receiver. This effect on the individual also ties in with Balyes and Orlando's (2001) idea that artistic process alters art practitioners and their world in some way, whether personally or socially.

A Very Different - Not So Different Case Study

Life and *Mutator*, implement information within the parameters set by the coding and hardware used. All design possibilities arise out of those constraints except for human

intervention from outside the system which can extend the design possibilities. In more complex systems such as computer neural networks, human culture, and biological ecosystems, there is a greater flow of information and it would follow that the design possibilities are much greater due to the larger amounts of information, greater complexity, and the interrelations of algorithms at work.

Andrew Lord works in a very different way to Latham, using his hands and clay to fashion objects. His work may appear very different to that of Latham's in methodology, concept, and outcome. However, he processes coded information which is in turn implemented into coded objects, his artistic intention, being that of reclaiming objects from still life painting into a tangible, solid form from where they were originally taken (Griffin, 2011). The aesthetics are very different but information of cultural significance is nevertheless, skilfully encoded in an effective sensuous medium with the intention to alter perception. This matches Anderson's definition of art and Bayles and Orlando's analysis of art's social impact in all three cases considered.

Looking at artistic practice in terms of its ES, is also consistent with Esslin's contextualised approach to evaluating an artist's work, i.e. does the work fulfil the artist's criteria (Esslin, 1961)? Esslin's attempt to circumvent the possible biases imposed by the critic, places the stress on the artist's intentions. It is nevertheless limited in considering the artist as the principle source from which the work springs. With ES, an artwork is causally related to its ecosystem as a step in the evolution of an artistic practice which itself integrates to a greater or lesser extent with other practices and the wider world.

Aesthetic considerations are still important to both Latham and Lord in creating unique and surprising, i.e. creative (Boden, 2010), and aesthetically pleasing artefacts. At

critical points each respective artist makes an aesthetic choice that results in a work that fits to a greater or lesser extent criteria that are determined by both the artist and the context in which they function. The success with which this is done can be viewed as the work's fitness in the ES of the practice. Each iteration is an evolutionary step in the process of developing a practice.

The very different ecosystems in which artists work can make it difficult to evaluate their practices integrally. However, by looking at the ecosystem in which they operate, practices can be evaluated as evolutions of information and implementation, determined by largely identifiable causes (if the information is available). Possibilities, actualities and viabilities coexist as part of a design space within an ever-changing ecosystem which a practice constantly adapts to in some way. Methodology, context, technique, personal circumstances and the social environment form part of this evolutionary space. It is worth noting at this point that the primary source records of artists' thoughts and events become ever more relevant in enabling a full survey of a given evolutionary landscape. In this way given works and practices can be more fully compared against artists' intentions, theses and a constantly changing fitness landscapes (Dawkins, 1996) in which they have arisen.

Conclusion

The qualitative approach taken lacks the statistical rigour of quantitative analysis, however, the arguments presented may give enough impetus for further research into several areas. Further work is needed in how to identify the most salient components at work in a given ES. Otherwise, things would become all-encompassing in which everything is connected in

one vast, unwieldy conceptual space. These elements may change from practice to practice, but it may be possible to group them under inclusive taxonomies.

In Part 1 the possibilities of self-generated or spontaneous artificial life arising from computers are touched upon. What is needed is for a form of metabolism that can give rise to new machine hardware. As Olson points out, computers are good at simulating life and its processes, but they are not life. Machine processes are currently locked within the algorithm and implementing hardware and cannot traverse from one level of complexity to another where phenotypic behaviour is possible. Computers do not contain their own means of reproduction. However, considering the symbolic or virtual life in computational environments forges a link between the idea of life and art. A given artistic practice can be seen as the implementation of information, developing, adapting and changing in an evolutionary space, and subject to mutation and undergoing propagation. It can therefore be seen as functioning as a living system with a symbolic phenotype .

Evolutionary space is a concept or way of thinking with which disparate artistic practices can be looked at in an integral way, both within the environment in which they function and their impact on the world at large. Methodology, influences, contexts, paradigms and so on become fluid and interlinked ideas with behaviours across time, constantly changing, adapting, mutating, propagating and proliferating by means as suggested by Anderson and having the effect of changing themselves, the artist, the artistic, and the wider environment.

ES does not limit discussion to a particular point or perspectives, static and bounded, but rather includes the evaluation of a practice as a changing in an evolving ecosystem with which it also evolves. For example, the subjective question of aesthetics becomes a part of a

larger discussion making it possible to consider differing paradigms contextually mitigating the limitations and problems that can arise when placing a given practice's subjective paradigm as a principle premise in opposition to another practice's criteria. Instead, such a paradigm would be a functional part of an evolving ecosystem that constitutes its evolutionary space and be evolving itself. This would be especially valuable when considering more than one practice which may lie in different cultural, historical, political, and or social contexts.

Evolutionary space forms the basis for future discussion and research, opening out onto many areas that have a bearing on the consideration of artistic practices and roles of artists in today's increasingly heterogeneous art landscape.

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