

Artefact & Artifice : views on *life*

Alan Dorin

Centre for Electronic Media Art
School of Computer Science and Software Engineering
Monash University, Clayton
Australia 3800
aland@csse.monash.edu.au

Abstract.

The views of some artists on what constitutes “life” are explored, with the aim of challenging those within the artificial life research community to rethink and perhaps expand their own views about the term and its meaningful application. The focus is on the musical works of Steve Reich and the paintings of Wassily Kandinsky. The role of the observer in determining when it is appropriate to label a thing as living is also discussed.

Keywords: life, art, painting, music, emergence

Introduction.

This article inaugurates a new, occasional section in the *Artificial Life* journal examining creative arts and research, and its applications. The journal section will discuss selected works and writings based on, inspired by, or incorporating concepts from artificial life in audio, visual, sculptural or installation media, creative visualization and sonification, software, games and popular culture. The web site for the International Society for Artificial Life will be used in conjunction with the journal for the presentation of background material, imagery, sound and time-based works.

The aim of this article is to explore the boundary between *each* reader’s ideas about what constitutes “life”, and the beliefs of artists of various persuasions on the same issue. Rather than directly comparing a number of artists’ views with a number of views taken from the papers of artificial life research, a few remarks made by artists have been selected which the author hopes will be considered by many artificial life researchers as a little unorthodox. In particular the focus will be on two examples taken from the arts — the music of Steve Reich, and the paintings of Wassily Kandinsky.

It is assumed that the majority of readers of this journal are themselves artificial life researchers and that they have formed their own opinions about the application of terms from biology. It is hoped that the individual readers will explore the ideas

presented here from their own stance, without reference to (and without sheltering behind) the views of other researchers in the field.

An opening question.

From the beginnings of recorded history, human life has been intertwined with art and religion, and with it the construction of images, sculptures and other likenesses of living forms. With modern science, biology, engineering, mechanics and robotics, previously cybernetics and now artificial life, the interest in understanding, synthesising and simulating life continues unabated. Where does the division between the work of the scientist and that of the artist lie when it comes to representing, simulating or instantiating organisms? This is a question implicit in the article presented here, as it is also implicit in much art which is deeply dependent on technology. Such issues are especially pertinent for artificial life when the autonomous operation of an artefact is employed as an artistic device.

Life and Music

“Sometimes everything just comes together and suddenly you’ve created this wonderful organism”, Steve Reich [8].

Steve Reich is a contemporary American composer best known for his complex polyrhythmic music. His use of the term *organism* is unorthodox from an artificial life research perspective and therefore raises several issues of relevance to art, emergence and artificial life.

Much of Reich’s music, for example *Music for Eighteen Musicians* (18) composed in 1976 and the earlier piece *Drumming* from 1971, consists of simple repeated patterns. In isolation, each of these is quite unremarkable, however Reich rigorously defines and layers these elements at a very basic level. He shifts them into and out of phase with one another and coordinates their rise and fall in intensity, as well as variations in the timbres or voices that carry them. From this apparent recipe for disaster a remarkably organized, exceedingly intricate and delicate phenomenon materializes – the *music* as it is perceived by a listener.

Reich’s composition does not depend on the beauty or complexity of each phrase in isolation, nor on the skill of a single musician or composer to play or conceive of a complex rhythmic section. The elements themselves are relatively simple, yet the outcome of their orchestration is a coherent and multi-layered work of great depth.

In addition to music in which Reich manually arranges the elements, he has a particular interest in what will here be called *process-based* or *generative* art. This involves the production of an artwork utilizing process as a medium, as opposed to

employing it purely as a means-to-an-end or only in the production of the work. In this instance the process is an important part of the aesthetic. Typically it operates, to a greater or lesser extent, independently of the artist, rather than under their direct and fine control. Although the artist first establishes the initial conditions for the piece then programs or engineers the rules of interaction, eventually the system is released and left to take its own course. Reich writes, “Though I may have the pleasure of discovering musical processes and composing the musical material to run through them, once the process is set up and loaded, it runs by itself” [8].

Such works are of particular relevance to artificial life studies. Generative works implicitly reference our understanding of autonomy, the self-directed behaviour of the organism and the lack of control which we as creators hold over our creations. Of course this idea runs through many tales in which deities or humans release life which then acts against the wishes of its maker. The Replicants in Scott’s film *Blade Runner* (of Dick’s classic science fiction novel [3]) behave this way, as does the monster in Shelley’s *Frankenstein, the Modern Prometheus* [9]. This is an idea that all of us must come to grips with at some stage in our lives. It has been a human concern as long as people have been raising children.

It’s Gonna Rain (1965) is the generative musical work in which Reich first experimented with the patterns established by phasing. He set in motion up to eight looping mechanical tape players with identical tapes which, by their very nature play at slightly different speeds. The result is a musical outcome governed by the audible qualities of the tape loops shifting in and out of phase with one another. As with *18*, this work is perceived as a complex polyrhythmic piece.

The polyrhythm of the scored work *18* and that of the generative work *It’s Gonna Rain* are both the result of the phasing interactions of the multitude of simpler rhythms that underlie them. Here may lie one parallel between polyrhythmic music and the organism: perhaps both may be said to *emerge* from the interaction of their components, an idea which will now be discussed in relation to Reich’s works.

Whilst the phenomenon of emergence is itself subject to much debate (see for example [5]), as a starting point for this discussion, what will count as emergence will be a local interaction of components giving rise to a global outcome which is not explicitly coded in the components or their interactions, a whole which is “greater than the sum of its parts”. In some sense this loose definition conveys an aspect of the workings of an organism, even if it is far from clear that emergence is a defining characteristic of life. The concept of emergence also conveys something of, for example, a glider on John Conway’s *Game of Life*, this being frequently referred to as

a synthetic emergent phenomenon [2]. Leaving aside for now the exact nature of emergence, how might this fuzzy concept relate to music?

In the case of Reich's music, the simple components he uses to build his creations are rhythmic loops. In the case of Conway's game, they are the states of individual automata on the grid. Emergence, as we have loosely described it, requires some kind of local interaction between the elements. In the case of the *Game of Life*, the cells take as input the state of their direct neighbours and use this to determine their own state transitions. In the case of Reich's music, there seems to be no interaction between the rhythmic loops, at least none in the sense that artificial life research typically recognizes. In the first case Reich scores his loops, in the second, his tape players run quite independently of one another.

The perceptual requirements for emergence are not often considered, yet *emergence* (if it exists, even in the sense described above) must at least partly be a *perceptual* phenomenon. From Conway's grid, the glider emerges only because we *perceive* a pattern travelling across the grid. We *perceive* a glider's topology because of the mapping between positions in which a coloured pixel appears on the screen and the internal state of the machine, and importantly, the change of this state (and hence the pattern) over time. Similarly, we *perceive* interlocked patterns in Reich's music due to the temporal location of the sonic events, their tone colour (timbre) and their change in state (dynamics / envelopes).

If the cells of an automata grid (or indeed the pixels of a typical bitmap image) are lit to the appropriate level sequentially and one at a time, we would not expect any large-scale form to be apparent to a viewer. Comparisons (of position and colour in this case) need to be enforced within the scope of the eye [10]. Similar principles apply to music. If Reich's musical elements are played sequentially no sense of the music as a whole can be obtained. The sequential visual or auditory display of stimuli cannot substitute for their parallel presentation. The *perceptual* qualities of the phenomena in question (images or music) are completely lost when their elements are temporally separated.

If the elements of Reich's music are superimposed upon one another in patterns indicated by him or the processes he employs, the result is, in terms of physics, a new pattern which is the sum of the waveforms of the individual rhythms. This new waveform may be calculated using the principle of wave superposition – a linear summation. What results therefore seems to be exactly what was expected when one considered the basic elements of the simulation. That is, what appears does not seem to satisfy the criterion for emergence that some new feature arises that is “greater

than the sum of its parts". This then is where the position of the artist and the scientist regarding emergence may be expected to differ.

For the artist, or even the person experiencing a work, the result does not lie in physics, but in the biology of experience. As indicated above, the result *for a listener* hearing rhythms superimposed is not somehow the sum of the effects of the individual elements played sequentially. The resulting music has a polyrhythmic sense which is not at all apparent in the component parts. For the listener, the music emerges from the components because the listener is a non-linear biological system. If a listener hears two rhythms, and then the rhythm generated by their superposition, will the two experiences be subjectively the same? Will one be deducible from the other?

If one were to accept that emergence may occur by the superposition of two audio waves, does this also imply that the letter 'X' *emerges* from this page due to the interaction of the many printed dots that make it up? Or that in fact any musical work emerges from the interaction of the parts played by the instruments that produce it? This seems contrary to the usual way of thinking about emergence – that the interaction must take place outside the observer and between the elements (the dots or instruments in this case). In the case of the printed character or even a bitmap image, the elements don't seem to interact at all. If this is emergence, then any shape or pattern we perceive must count as an emergent phenomenon.

As far as artificial life is concerned, it seems far-fetched to make the above claims. Yet upon listening to Reich's music, or viewing a Pointillist painting, it seems equally difficult to explain how the resulting *experience* is somehow *not* due to the interaction of the components as we perceive them, and that it is *not* more than the sum of the components experienced individually. What then would count as an emergent phenomenon? Would any pattern we perceive in a group of elements be somehow emergent? Perhaps this is the case, at least in the sense that our perceptual systems *do* synthesize complex entities from simple components which themselves do not convey any sense of what they might permit. Until a clear understanding of what we mean by *emergence* is achieved, perceptual phenomena might all be classed in this category.

Even now, some sceptics (no doubt) remain unconvinced of the applicability of the term *emergence* in this instance. This is a good thing, I hope it will help to promote discussion! Nevertheless, I also hope that your interest has been sufficiently roused that you will pursue this a little further. Go and listen to Reich's music. Do this several times. Give yourself a chance to understand *emergence* in a new sense. If after repeated listening some sense of "organism" emerges from Reich's work for you,

perhaps you will agree that he has used an evocative metaphor to describe his music. You might even consider his remark relating music composition to the creation of organisms provocative and insightful.

Life and Painting

The Russian abstract-expressionist Kandinsky had a great influence on the course of 20th century art, not only through his paintings, but also through the theory he documented. In his text, *Point and Line to Plane* [4], appears a diagram of lines and points on a plane (Figure 2). Take a moment to consider the illustration. Note the compositional elements, their positions, orientations and their other salient characteristics.

Kandinsky's book begins by addressing what he considers the *proto-element* of painting, the point.

“As we gradually tear the point out of its restricted sphere of customary influence, its inner attributes – which were silent until now – make themselves heard more and more. One after the other, these qualities – inner tensions – come out of the depths of its being and radiate their energy. Their effects and influence upon human beings overcome ever more easily the resistance they set up. In short, the dead point becomes a living thing...

...Here it begins its life as an **independent being** and its subordination transforms itself into an inner-purposeful one. This is the world of painting.” (Kandinsky's emphasis) [4, pp. 26-27, p. 28]

Kandinsky leaves us with the seemingly impossible notion that the quintessential static, zero-dimensional, or as the artist himself puts it *dead* entity, may acquire “life”. To illustrate how this transformation may occur, Kandinsky conveys his personal view of the overlooked, and usually overshadowed, point. The transformation Kandinsky describes is not so much in the point itself, it is in the viewer's perception of it.

After a brief discussion of the point as it might be considered by a mathematician or geometer, Kandinsky delves into its properties as a signifier of silence in written language as a full-stop, before he takes it from this context into painting. He believes that the placement of the point in writing becomes so commonplace and habitual that its properties go unnoticed. The point's role as a “practical-useful” element is so dominant that its inner significance is usually masked by its outer. “The sound of that silence customarily connected with the point is so emphatic that it overshadows the other characteristics.” [4, p. 25]

However, “In the flow of speech, the point symbolizes interruption, non-existence (negative element), and at the same time it forms a bridge from one existence to another (positive element). In writing this constitutes its **inner significance**.” [4, p. 25]

To demonstrate his idea, Kandinsky displaces the point in such a way as to force its inner significance to the fore. He writes:

Let the point be moved out of its practical-useful situation into an impractical, that is, an illogical, position.

Today I am going to the movies.
Today I am going. To the movies
Today I. Am going to the movies

In these examples, the full-stop is successively pushed from its usual position to one in which it seems slightly misplaced, and then to a location which seems quite out of the ordinary. In the last of these sentences, the sound of the point is heard momentarily before the text once again overshadows it. Kandinsky continues:

Today I am going to the movies



before finally just producing the figure:



Figure 1. [4, Fig. 1]

It is in this final example that the point’s force makes an impact upon the page. Previously, in its practical-useful application, its character was drowned out by the point’s surroundings or overlooked due to its routine situation. In Figure 1, the point is no longer subordinate to the role it played in a sentence, but instead it holds back the emptiness of the plane alone. For Kandinsky, this is where the point’s life in painting begins.

To a person trained in the sciences, the particular content of this exercise, even the “argument” Kandinsky makes, might seem somewhat bizarre, possibly nonsensical. However, hopefully the method itself is not new to the artificial life researcher. Kandinsky’s aim was to present the point in an unfamiliar context, and so force the reader to perceive it afresh. Under these circumstances Kandinsky believes that the observer may clearly see the point as an “independent being” and that its “inner tensions” come to freely “radiate their energy”.

Kandinsky goes on to describe the point in terms of its sound in space, the way it is perceived and dominates a plane and also its relationship with other points and with lines. Noting that a point perceived is not a geometric point, but the result of a collision between an artist’s tool and a material plane, he discusses the dimensions and character of various points in art and their interaction with the plane – and so he establishes foundations on which to locate the point in the realm of art.

Although the point has a clearly-defined outer purpose in writing, Kandinsky does not believe the same to be true of the point in painting. Nevertheless, the point always has an *inner* purpose. It has energy which *it* directs in a self-determined way, hence Kandinsky’s reference to the organism. To him the point is neither static nor dead, it is an autonomous being which acts according to its own character and independently of its maker.

Take a moment now to reconsider Figure 2. Having read the text above, does the point’s role in the work seem to have changed since you last examined it? Can you hear the sound the point makes on the page or feel the pressure it exerts on the other elements?

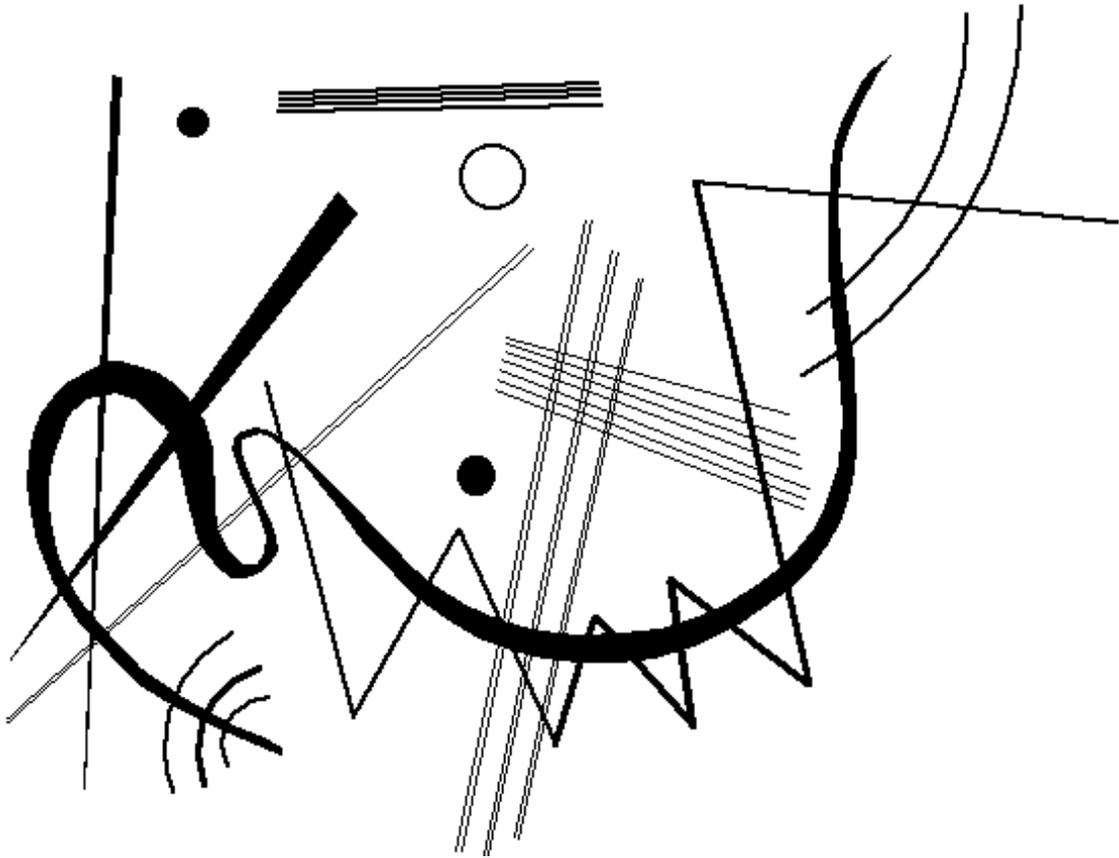


Figure 2. Kandinsky illustrates the use of points and lines, [4, Appendix, Diagram 17].

As with Reich's description of his music, Kandinsky's similar insistence will seem strange to many. Nevertheless, his intimate understanding of the point in art has caused him to label it unambiguously and emphatically as a living thing. Kandinsky gave a description of the process by which he came to understand the point and even detailed a means by which others may come to see it as he did. In this case, it is the way the *observer* perceives the point which will determine if it lives or not.

Life and Relationships

This close affinity Kandinsky feels for his medium is not unusual for those who spend their lives interacting with, in the presence of, or at the mercy of some element. For example, perhaps Kandinsky's relationship to the point parallels that which rock-climbers on Mt. Arapiles (pronounced Arap-il-ees but known as Djurid to the indigenous peoples) in Australia feel for stone, "Many of us who know Arapiles see it as a living, breathing place, where the rock is as much alive as the falcons that swoop from the highest recesses, and the ferns which grow out of the smallest cracks" [6, p. 10]. Renaissance sculptors of marble, practiced stone masons, ancient Greek mariners navigating the fearsome Scylla and Charybdis between Sicily and Italy, and the Anangu aboriginal people of the region around Uluru (Ayer's Rock) in Australia, also attribute spirit to stone and respect it accordingly.

Perhaps once any human becomes intimately attuned to the nuances of character of some entity, the complexity of the relationship is always described in terms of the similarly complex relationship between living things. Hence, to this writer two blocks of marble seem alike. Yet to a sculptor attuned visually to their vein structure, aurally to their resonance when struck, and through his finger tips to their texture and the response of a tool, the blocks have internal dynamics: a complex force or stress which can be sensed. This feeling he readily attributes to its “life”.

This idea, as exemplified by the seeming conflict between cold, hard, freshly quarried stone and the soft warmth of expertly carved marble, is perhaps nowhere better illustrated than in Jean-Léon Gérôme’s painting “Pygmalion and Galatea” (c. 1890). This work, housed in the Metropolitan Museum of Art, New York, depicts the sculptor Pygmalion embracing his creation, Galatea (Figure 3). What better way for the painter to capture the character of the stone and the sculptor’s personal relationship to it, than by reference to the organism he and his subject find most desirable? “The statue had all the appearance of a real girl, so that it seemed to be alive, to want to move, did not modesty forbid” [7, p. 231]. In his telling of the story from which the painting is derived, Ovid too references the many creation myths that tell of immortals breathing life into figures of earth and stone. It is fitting that Pygmalion should kiss his bride-to-be as a pulse is brought to her veins.



Figure 3 – *Pygmalion and Galatea* (detail), Jean-Léon Gérôme, 1824-1904,
Oil on canvas, 35x27, in The Metropolitan Museum of Art

An artist may describe his or her work as giving life to a canvas or a musical score, animating a character, a historical event, a block of wood or stone. The recent winner of the international Pritzker prize for architecture, the Australian architect Glenn Murcutt was quoted as saying, “A building should be able to open up and say ‘I am alive and looking after my people’ ... Buildings should respond... they should open and modify and remodify. That is part of architecture for me, the resolution of levels of light that we desire, the resolution of the wind that we wish for, the modification of the climate as we want it. All this makes a building live” [11].

An artificial life researcher may have similar aims regarding software, robots, molecules or abstract data structures. The ways in which life is “given” vary across media, but similarities carry across domains and into the vernacular use of the term. That is to say, if people are closely attuned to the attributes of an entity or are able to perceive complex dynamic or unpredictable traits that effect their interaction with it, they tend to resort to an explicit label of “life” or to anthropomorphize. Wrote the Antarctic explorer Sir Ernest Shackleton of his ice-bound vessel *The Endurance*, “Now, straining and groaning, her timbers cracking and her wounds gaping, she is slowly giving up her sentient life at the very outset of her career” [1, p. 89].

In poetic terms the entity is in possession of a magical essence, *élan-vital*, spirit... call it what you will. However, what is alive to a sculptor may not be alive to a biologist. What is alive to a chemist, an engineer or a computer programmer, may be quite devoid of life to a painter or a mariner. These differences of opinion are bound to occur because the aspects of the simulation, representation, artefact, concept or whatever else is being considered, which are essential to seeing *how* this thing lives, will be viewed or projected differently within each of these groups.

The idea that through projecting their own relationship with an entity or by assigning importance to properties of relevance to the individual, an *observer* is responsible for determining whether or not a thing lives, seems somehow awkward in the context of a science that seeks objective necessary and sufficient criteria for life. For science, a viewer-specified projection of “life” would count as a metaphoric application of the term. Yet, in the absence of a widely accepted definition of life, the boundary between metaphors and literal interpretations blurs depending on who is using the term and the context in which it is applied.

Within the artificial life research community, some software in particular has been presented by its creators as *examples* of (artificial) life. A healthy battle rages within the community about the accuracy of labelling software in this way — this discourse is a part of science. Without necessarily employing the tools of “objective” analysis favoured by science, but with no less insight, those in other specialist areas have

considered, and continue to consider, similar issues. Although artificial life researchers may “determine” that some particular properties are necessary and sufficient for life, artists may be expected to disagree. They may feel that something essential has been omitted, or that the researchers’ definition is irrelevant or inelegant. They may even feel that words are inadequate or inappropriate in this context, and that other methods are more truthful means of describing life. Such debate is to be encouraged and the discrepancies between views appreciated. There are many helpful perspectives from which the study of (artificial and natural) life can be approached. Carefully considered beliefs ought not be dismissed lightly: something which is easy for us to do if the views differ significantly from our own.

Conclusion

Although particular attention has been paid to the music of Steve Reich and his view of it as an organism, and Wassily Kandinsky’s discussion of the point as a living thing, life is also associated by some with stone in sculpture and in nature. Others associate it with marine vessels and architecture. This kind of remark is not thinly scattered through our literature, far from it. There are countless links made between life and the properties of the things we find around us every day, whether or not a biologist or artificial life researcher would agree to their legitimacy.

Whilst it might be tidy to put away the term *life* with a definition acceptable to all, the very cross-disciplinary nature of Artificial Life as a research field, ensures this is unlikely to occur. Further confounding this outcome, the study of life seems akin to the study of the point in painting: close examination reveals that its voice is heard and interpreted uniquely by each observer. Even though consensus may be elusive, at least through this study viewers may come to understand their own unique place in constructing the world.

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