ARTIFICIAL CONSCIOUSNESS - ARTIFICIAL ART

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Abstract

The electronic arts derive their energy and fascination from the relationship between artist and machine. Attempts to automate art are increasingly successful as developments take place in artificial intelligence, artificial creativity and artificial life. However, it may take artificial consciousness to create a totally artificial life. This in turn requires the resolution of a the question: is quantum mechanics inextricably linked with consciousness? If it is, then a computable consciousness may be impossible — and the future of a totally artificial art may hinge on this.

Introduction

James Gleik points out in *Chaos*[1] that the 20th century will probably be remembered for three great scientific revolutions: relativity, quantum mechanics, and chaos theory. We are seeing, in embryonic stage, the first scientific revolution of the 21st century: studies in consciousness. The claims for chaos theory are that, unlike for the preceding two revolutions, it relates to the more immediately tangible world of our experience. Studies in consciousness relates in turn to an intangible but infinitely more intimate world: our being. The discoveries by Copernicus, Galileo, and Kepler that showed the Earth to revolve around the Sun became a metaphor for the growing realisation that Man was not at the centre of the Universe, but an insignificant by-product of the forces of nature. One can characterise the universe that grew from this classical physics as anthropo-*eccentric*, that is a universe in which man is no longer at the centre, in contrast to the previous anthropo-*centric* universe. The more recent discoveries of chaos theory show a less ordered universe, with room for 'emergent' properties, however — rocks, weather, organisms, society, the economy: these become non-linear systems with unpredictable developments, but they are still *deterministic*. The individual is a *system* of organs and cells, the result of a gene pool *system*, embedded within social and economic *systems*. The individual is still alienated. Until quantum theory. Quantum theory completes the cycle of scientific revolution and renders the universe anthropo-*centric* once more.

1. Chaos Theory and Quantum Mechanics

Chaos theory involves the study of phenomena whose developments are highly sensitive to small fluctuations in starting conditions. Non-linear systems are, in principle, *deterministic* (or computable) meaning that the same starting conditions will give the same end conditions, and, if we have computers powerful enough, we can predict the outcome. In practice, because of the extreme sensitivity to the starting conditions, it may be very difficult to predict the outcome. Non-linear systems, however, are classical systems, and hence, despite the relative richness of the universe they describe and the fruitful consideration of emergent properties, they remain part of the anthropo-*eccentric* universe defined above. Quantum theory grew out of a seemingly innocent debate over whether light consisted of waves or particles, but, in the last century, it became clear that light behaved as a wave under some experimental conditions and as a particle under other experimental conditions. This simple fact was obstinately unresolveable and its unwanted (by classical science) implications were twofold: firstly that the observer's behaviour could not be removed from the experiment — thus challenging traditional notions of 'objectivity' — and secondly that science was going to have to live with the unthinkable: paradox. Quantum theory as we now know it gives a terminology for the wave/particle paradox, but does not remove the paradox, or the problems of quantum indeterminacy and quantum holism. One view of quantum theory, prompted by Niels Bohr, is that the precise mathematical formulations of quantum theory are successful as a model for prediction, but the wider implications can be ignored. A middle ground, perhaps, was the stance now called the Copenhagen interpretation, which admits that quantum theory is a theory of observations, rather than a theory of objective independent realities. The more radical position is that quantum theory places the human act of observation as essential for the existence of the universe. Some use quantum theory to argue the existence of God; however, we are not arguing here that quantum theory gives us back a theocentric universe, but an *anthropo*-centric one.

2. Consciousness: an overview of current theories and debates

The study of consciousness has only recently become a respectable academic pursuit, as shown by the number of recent books on the subject and the establishment of the International *Journal of Consciousness Studies*[2]. A good introduction to the debates around consciousness is to be found in Daniel Dennett's *Consciousness Explained*[3]. His emphasis throughout is on perception, though oddly, he avoids attempting a solution of the 'qualia' problem (how are we to account for the redness of red for example). He shows that the problems with Descartes' view of consciousness lie in the mind-body split or dualism that it is based on: the dualistic view is not consistent with classical physics, because for any perception to impinge on the mind there must be a chain of energy transformations that reach from the material world to the non-material (upward causation), and another chain from the mind to the body (downward causation). Descartes proposed a location in the brain where perceptions come together for the mind to view them as a whole; this is done by a homunculus. This Cartesian theatre then presents us with the problems of a reasonable description of the homunculus, and the danger of infinite regress: has the homunculus got a homunculus within it?

While Dennett's emphasis on perception is to some extent reductionistic, it is the work of Francis Crick that takes this to an extreme. His recent book *The Astonishing Hypothesis*[4] claims that all aspects of human experience, including consciousness, are to be understood in terms of neuronal activity. This leads him to discuss the *neural correlates* of perception, and to postulate that one day we shall discover the neural correlate of consciousness itself. One could characterise the view of reductionists on consciousness as being epi-phenomenal, i.e. it is a side-effect. The view of chaos theorists could be described as emergent-phenomenal, i.e. that consciousness arises from complex systems as a whole that is greater than the sum of its parts.

It is no surprise to find that many thinkers on consciousness have sought to relate consciousness to quantum theory. There is a growing sense that quantum indeterminacy may allow a window in the deterministic universe for free will (downward causation), and that quantum wholeness is directly related to the binding problem of perception (upward causation). One of the chief protagonists of a quantum mechanical view of consciousness is Roger Penrose, interested in the extent to which computers can prove mathematical theorems. Building on the work of Gödel, who demonstrated the unprovability of a certain class of theorem, Penrose has argued that computers are therefore unable to 'think' about a certain class of entities that the human mind can. From this Penrose extrapolates a proposition that mind is essentially non-computable, at least by our current technology. Penrose devotes much of *Shadows of the Mind*[5] to an explanation of quantum theory and argues that quantum effects must translate into the 'classical' world of chemicals and neurons in the brain. He is supported in his approach by neurologists and biologists in their discovery of 'microtubules', structures within the neurons that could be the seat of quantum coherence effects.

Dana Zohar's books, *The Quantum Self*[6] and *The Quantum Society*[7] explore quantum theory firstly as a range of metaphors, but also as evidence for the holistic nature of the universe and the self. Her views derive partly from quantum theory itself, and partly from interpretations leaning to the mystical such as that of Bohm,[8] and that of Fritjof Capra[9] and Gary Zukav[10]. However, her interpretations are more accessible than Bohm's, less populist and mystical than Capra's and Zukav's, and less radically paranormal than Jahn's.

3. Creativity: the link with consciousness

The philosopher Mary Warnock has had a life-long interest in the imagination, stating that its cultivation should be the

chief goal of education[11]. For Warnock, imagination is the key to perception and all our values, as well as the driving principle behind creativity. In *Imagination*[12] she charts the developments of our understanding of this faculty, from Descartes through Kant and Hume and Schelling to Sartre and Wittgenstein. For Hume imagination is linked to the everyday ability to receive an interrupted and chaotic sequence of sensory impressions and derive from this a belief in the continuous existence of objects. Kant called this faculty the transcendental imagination to distinguish it from an empirical imagination, the fiction-making power which varies from person to person. Warnock's work has been to seek out the common ground in the different forms of imagination, in particular the creative sense and the world-ordering sense. Margaret Boden is another philosopher with an interest in imagination, but in the narrower sense of creativity. Her work, based in computational psychology, involves an investigation of creativity via attempt to simulate it with computers. Her book *The Creative Mind*[13] covers many aspects of research into creativity, especially those debates around Artificial Intelligence. For Danah Zohar the main question in the creative act is the selection of one outcome from all the possible outcomes, a process that she links with the collapse of the wave function, which in turn is the function of consciousness. One could see this as a special case of a quantum interpretation of the creative world-ordering imagination of Kant and Hume. From both the Hume/Kant tradition expounded by Warnock and the emerging quantum consciousness position of Zohar et al. we can assert that consciousness is at the heart of creativity.

4. Automated Electronic Art

Since the 1950s artists and scientists have been experimenting with electronic devices in the production of imagery the visual arts. These developments are well documented in books such as Franke's *Computer Graphics - Computer Art*[14], and Cynthia Goodman's *Digital Visions*[15]. The author looks at the use of programming for artists and animators in a recent article in *Leonardo*[16]. Evolutionary electronic art is a branch of algorithmic art that uses the concepts of Darwinian evolution to generate family trees of images or forms that are then selected by the artist for further breeding. Karl Simms[17] and William Latham[18] are two computer artists who have been working in this field, and who have been extensively commented on by Margaret Boden. The problems of selection have been avoided in the work of Harold Cohen, originally a successful modern painter, who set out to incorporate his own rules of composition into an artificial intelligence program called AARON. In evolutionary art the selection mechanism becomes paramount: Latham's and Simms' work fails to automate this as a parallel to the natural survival function. For other forms of automated art, such as Cohen's, there must be algorithms at the outset that control design, composition and aesthetics. The field of algorithmic aesthetics has its origins outside of the electronic arts — Franke[19] gives a good introduction to the German thinkers in this area, including Wilhelm Fuchs and Max Bense. Stiny and Gips suggest a computer-based method for evaluating aesthetics in specialised domains.[20]

We are now approaching the point where we can ask what would be a totally artificial art? Clearly it would involve computers and the simulation of both a creative and a critical function. Cohen's work is based on his ability to formalise his own compositional rules; what is lacking is the spontaneous generation of work beyond his own formulations.

5. Artificial Consciousness and the Electronic Arts

Artificial Life or a-life for short, while not originating as an art-form, has been explored as such by computer artists such as Steve Bell[21] and Clifford Pickover[22]. By abstracting from the physical world simple rules and constraints governing entities that live, breed, consume energy, fight for resources, and die, biologists have programmed a-life systems that have given them valuable insights into living systems. Steven Levy[23] gives a good overview of the emergence of a-life, including its applications and philosophical implications. A-life theory is firmly located in the debates around chaos and non-linear systems: the attributes we normally associate with 'life' are seen as emergent phenomenon. There has been little attempt to endow a-life entities with artificial creativity, perhaps because of an intuition that the parallels between evolution and creativity are rather weak, and to date there has been only one serious attempt to create an artificially conscious entity — this is the goal of Igor Aleksander at Imperial College, where he has created an artificial neural net (ANN) called Magnus, designed to be conscious in the sense of being able to tell us what it is like to be Magnus[24]. Nadia Magnenat-Thalmann and Daniel Thalmann, in their quest for synthetic actors have picked up on the work of Aleksander in the hope that it will provide a missing element in their simulations: autonomy. In the Thalmanns' book *Artificial Life and Virtual Reality*[25] Aleksander contributes an article called "Artificial Consciousness?"26 in which he sets out his emergent-phenomenon position on consciousness. The development of autonomous programmes is a recent development in software generation, described in another article in *Artificial Life and Virtual Reality*[27]. A further article in the same book gives an account of how algorithms for autonomy are developing from work in artificial intelligence[28]. The Thallmans believe that for computer simulations to generate truly artificial art, the will have to incorporate some aspects of consciousness; creativity, intelligence, will, and autonomy. It may be that other aspects such as identity, perception and awareness will also be essential, if the artificial art is to have any status alongside human art, leading us to the position that we require not just artificial life, but artificial beings at least as complex as humans. This plunges us into the chaos versus quantum debate: is mere complexity sufficient for artificial art to come forth as an emergent property, or is a quantum dimension required?

6. Conclusions

The attempt to hand over part of the creative act to machinery has a long tradition going back to musical compositions based on the throwing of nails[29]. Algorithmic art on digital computers represents a substantial move in this direction,

while progress in AI, a-life, and artificial autonomy bring together more of the components of a truly artificial art. In the context of chaos theory, no radically new developments are required to reach this goal: only a certain level of complexity. However, in the context of quantum theory and proponents of quantum consciousness as the ultimate creative principle in the universe, artificial consciousness is, at present, the missing ingredient. Some of the best thinkers of our time believe that this is non-computable, but if it were (perhaps with technology not yet dreamed of) quantum mechanics would not just have restored to us an anthropo-centric universe, but also a cyber-centric one.

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Notes

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[27] ibid, pp. 84 - 95
[28] ibid, pp. 97 - 114
[29] ref 33, p.31