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The Tao of Postmodernism: Computer Art, Scientific Visualization and Other Paradoxes [1]

Donna J. Cox

ABSTRACT

The author suggests that a paradigm shift must occur in art criticism to assimilate the nonlinear branching of aesthetic activities in our era. These activities include computer art and scientific visualization, and they reflect many issues addressed in postmodern dialogue such as our image-synthetic, "simulacrum" society. Postmodernism unexpectedly informs most disciplines, including the natural sciences, and is a cultural systemic norm that relates to our electronic information age. The Taoist concept of oneness is used as a metaphor for the interrelatedness of electronic-mediated societies, and this social connectedness explains the enfolding and complex nature of contemporary aesthetic activity. A cybernetic paradigm might provide a better model for criticism than modernism or postmodernism, since this paradigm presents a holistic view that concentrates on creativity and the organization of interrelated systems. The convergence of art with science is assumed as a logical interdisciplinary outgrowth of this electronic oneness.

All right, so you want a style out of America. Stick at it. but when it comes, it mayn't be where you are looking for it.

—Ezra Pound

The art that is coming will give formal expression to our scientific conviction.

—Franz Marc

Some enlightening philosophical and social ideas have emerged from postmodern art criticism. A brief review of the shift from modernism to postmodernism outlines some of the aesthetic consequences that include art market influence on artists. The second section of this paper elaborates critical issues that present problems to aesthetic activities such as the making of computer art and the production of photography. These issues include an unprecedented pluralism of artists' activities in this transition to postmodernism. The third section refutes the idea that postmodernism is merely a style; rather, it is a cultural norm that permeates many fields such as film, architecture and science. Finally, section four places postmodernism in a much larger context, based on Turchin's cybernetic approach to human evolution. Some contemporary cultural characteristics such as the recycling of aesthetic styles, interdisciplinary activity, and 'simulacra' are related to basic human creativity and the multiplicity of cultural systems.

FROM MODERNISM TO POSTMODERNISM

Artmaking since the beginning of the twentieth century has been recognized as a major break from artmaking prior to that time. Institutionalized, conventional analysis of art and its history proposes a kind of linear 'cause and effect', tracing lines of works and artistic styles'; this approach has provided a paradigm [2] to explain a transition that might cover trends from pre-renaissance to modern [3]. Art historical awareness and the age of mechanical reproduction are undeniable components in the development of modernism at the turn of the century; and this image production provides a gluttony for public consumption. "For inhabitants of industrialized societies (indeed, production and consumption of images serves as one of the distinguishing characteristics of advanced societies), it [mass produced image making] has become a principal agent and a conduit of culture and ideology" [4]. The suffering avant-garde, from Impressionists to Dadaists, were popularized in media and liberal arts education. During the twentieth century, the 'Shock of the New' was deformed into a lust for the avant-garde. Like alga and fungus that live symbiotically, the artist and the buyer have evolved a symbiotic relationship that must feed its soul and pocketbook with the new vanguard. This complex system of artists, galleries, museums, critics and art brokers has come to be known as the art market [5].

Fig. 1. Bea Nettles, *Metamorphosis*, altered and staged silver print, 7.5 × 7.5 in, 1988. The artist's fine art explorations have also involved alternative processes. This type of fine art photography was a radical change from traditional 'straight' photography.

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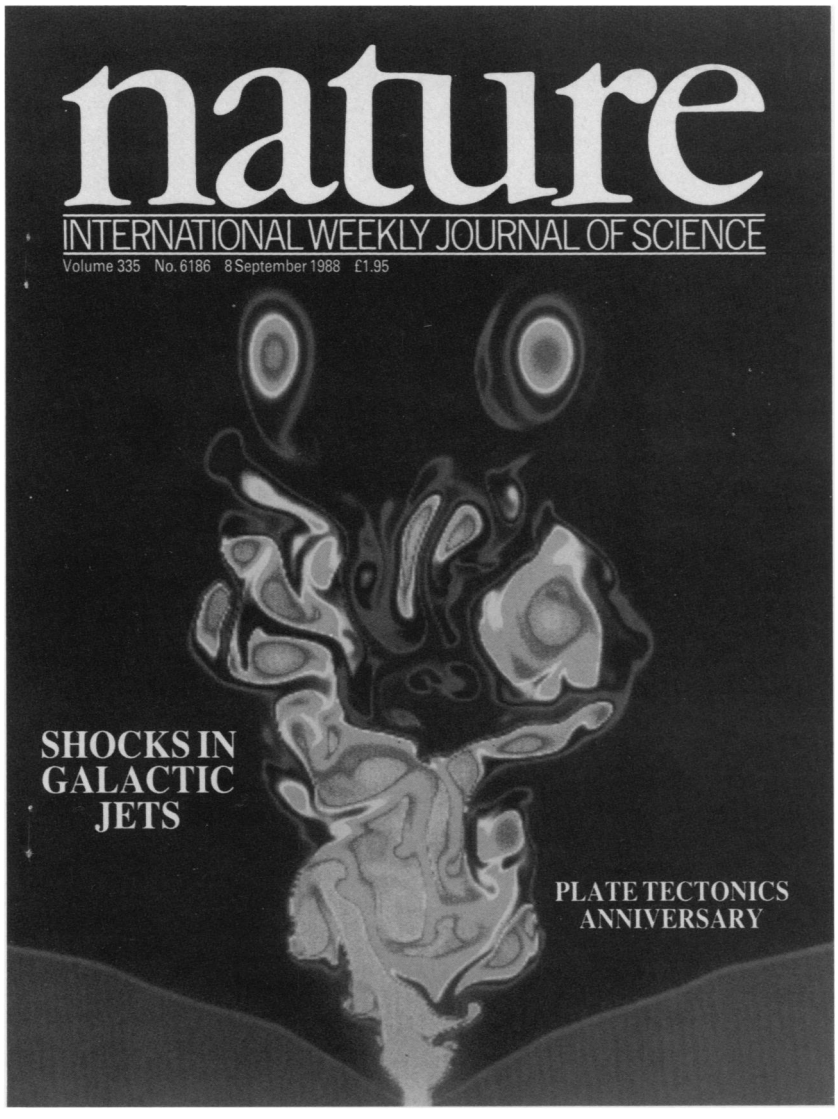

Fig. 2. Michael Norman, Jack Burns, Martin Sulkanen (scientists) and Donna J. Cox (artist), supercomputer simulation of a galactic jet used for the front cover of *Nature* magazine, 1988. This image is an example, developed in the hard sciences, of the 'simulacra' in our society. Such image 'simulation' is characteristic of our Postmodern electronically mediated culture.

By the mid-twentieth century, postmodern discourse exposed the art market search for the next avant-garde (the dog-seeking-its-avant-garde-tail). This convolution of thought has been called the 'transcendental historicism' of art. As Hal Foster explains: "No matter how 'transcendental' or radically new the art, it is usually recouped, rendered familiar by historicism. Late modernism only reworks the contradiction: art is avant-garde insofar as it is radically historicist—the artist delves into art historical conventions in order to break out of them. Such historicism (the New as its own Tradition) is both an origin and an end for the avant-garde; and one aim for postmodernism is to retain its radicality but be rid of its historicism" [6]. Thus, some refer to late postmodernism as post-historical.

Computer Art: An Orphan Child of 'High' Art Criticism

Historicism and the concept of 'style', reified from art-historical thinking, have led theorists to conjecture that artists tend to emulate older technologies with each new technology until they find a 'pure' form of expression. For example, historians and critics proposed that early nineteenth-century photographers emulated painting style with the camera [7]. Likewise, it is possible that computer artists are copying styles of older technologies as well [8,9]. However, if one closely analyzes the evolution of fine art photography from the Industrial Revolution into the postmodern era, one gains a different perspective.

In order to establish photography as a fine art, Alfred Stieglitz proposed that the artist exploit the camera for its unique qualities and create 'pure' photographs that did *not* resemble 'painterly' styles. He stated that the photographer should not manipulate photographs nor state allegories (as early photographers had done). Rather, he proposed, the pure photograph employs the camera for what it does best: capturing a slice of the real world from the personal viewpoint of the artist. Thus the artist's personal style and photography's pure form of expression emerged. Consequently, the pure photograph was completely divorced from painting by 1920. However, a transition to postmodernism resulted in the complete inversion of photographic 'purity' by 1970. Staged, altered (Fig. 1) and appropriated photographs have become the accepted market, not the adulteration that Stieglitz refuted with his 'straight' fine art photography [10]. As Abigail Solomon-Godeau has noted, "the properties of photographic imagery which have made it a privileged medium in postmodern art are precisely those which for generations art photographers have been concerned to disavow" [11]. Here we see a paradox that developed in fine art photography; such a paradox can also be found in the evolution of computer art.

> Virtually every critical and theoretical issue which postmodernist art may be said to engage in in one sense or another can be located with photography [and computer art]. Issues having to do with authorship, subjectivity, and uniqueness are built into the very nature of the photographic [and computer] process itself [12].

The computer artist represents a double risk to the art market, because the work is often twice removed from a personal style, authorship or uniqueness: first the art is made with a computer, then documented with a photograph. The computer art purist might argue that the 'interactive' mode or the 'artist-as-programmer' mode of the computer aesthetic is *sine qua non* [13,14]. That is to say, the pure form of expression from the computer is realized through interactivity or through the artist's personal software. However, interactive computer works

and electronic installations are intrinsically difficult to show and sell in the art marketplace [15]. These types of issues have left art curators and critics in a quandary and have contributed to computer art being outside the mainstream of 'high' art criticism. Interesting out-of-the-art-mainstream publications, such as SIGGRAPH [16] art show catalogues, *Leonardo* or articles from technical publications such as Prince's reviews of computer art [17,18], present critical information that cannot be gleaned from the art market coffers; because "artistic practices employing film or photography [or computer], as well as those using found objects, processes, or systems where creative labor is apparently absent, continue to problematize the transcendental imperatives which predominate in critical and historical literature on art" [19].

In addition to the above, interdisciplinary activity has become a key descriptor in the postmodern era and it prohibits the classification of works merely by the medium. Photography as well as traditional painting and sculpture experienced a radical realignment during the 1960s [20]. Painting and sculpture merged to create new hybrid forms. And, like photographers, many artists cast aside the purity of the medium [21]. Douglas Crimp states,

> the ease with which many artists managed, some ten years ago, to change media—from sculpture, say, to film (Serra, Morris, et al.) or from dance to film (Rainer)—or were willing to 'corrupt' one medium with another—to present a work of sculpture, for example, in the form of a photograph (Smithson, Long)—or abjured any physical manifestation of the work (Barry, Weiner) makes it clear that the actual characteristics of the medium, per se, cannot any longer tell us much about the artist's activity [22].

Other scholars submit that art based upon technology is just one possible mode of expression and that the medium should not claim to have any special status [23]. Alas, many late modernist or postmodern critics would be dismayed at the fact that computer art segregates itself via the medium rather than concentrates on the artist's 'aesthetic activities'. Here we see the computer art paradox: many computer artworks are shunned by the modernist for lack of purity, authorship or originality at the same time that they are shunned by post-

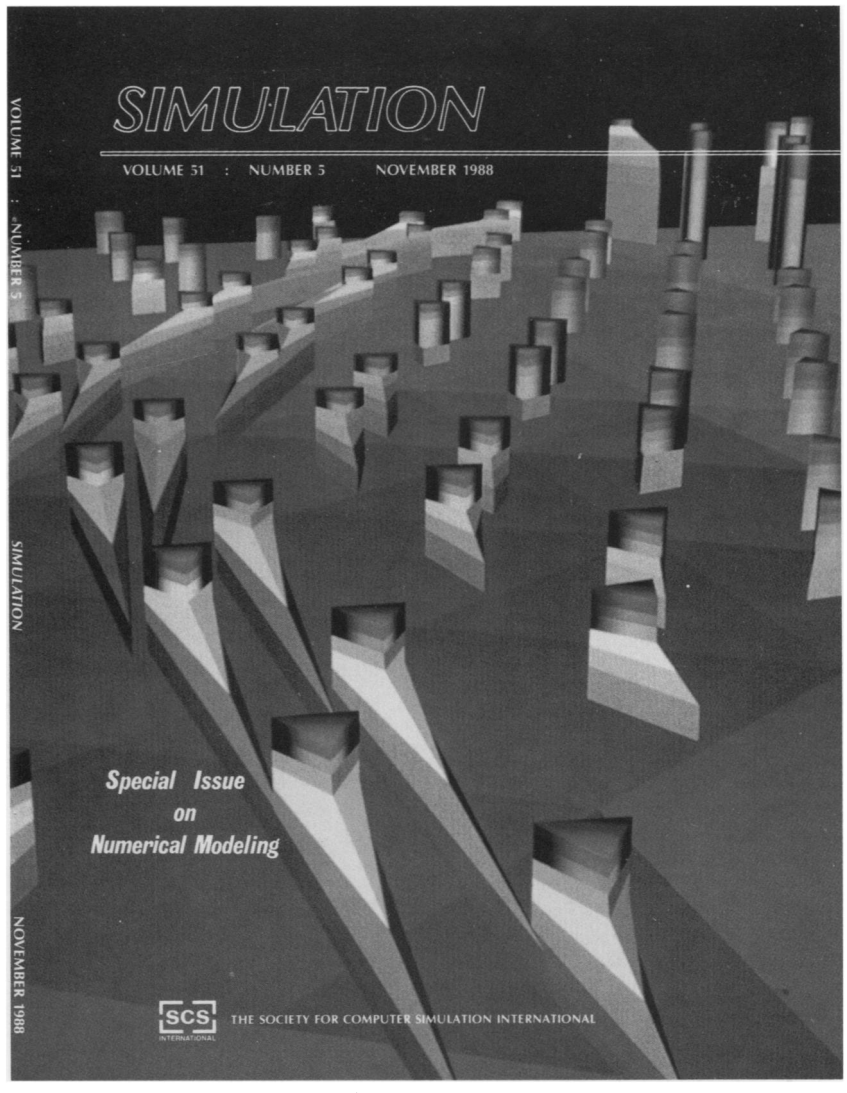

Fig. 3. Richard Ellson, Donna J. Cox and Ray Idaszak, cover image of a contemporary science journal, *Simulation*, 1988. This cover image, illustrating scientific simulacra, shows the use of computer techniques to visualize abstract numerical information from a supercomputer simulation of hot plastic polymer.

modern dialogue for computer art's 'media/technology identification'. Thus, computer art is like an orphan child to most current art criticism. In addition to analyzing these problems, the next section delineates other negative social criticism surrounding the making of computer images.

POSTMODERNISM IS A NEW SYSTEMIC CULTURAL NORM

It must be made clear here that postmodernism is *not* a so-called style; rather it is a "new systemic cultural norm" that informs other disciplines, including science fiction film, music, poetry, architecture [24] and the natural sciences (as I will later demonstrate). Postmodernism is like a force field in which very different kinds of impulses and forms emerge from cultural production [25]. Postmodernism is not a style; rather it points to a social and technological mechanism from which styles are being generated. Critics note the development of a society that has experienced a technological transformation of the social world where electronic artifacts such as computers, television and video constitute and symbolize the radical alteration of our culture's time and spatial consciousness [26]. Computer graphics and electronic image generation are viewed as contributors to the removal of the individual from direct experience of reality, resulting in a society of simulacrum, image simulation of the real world. Real space is distorted into an electronically mediated

space, a weightless polygonalization, as in *Tron*, *Star Wars* or *Star Trek II: The Wrath of Khan*. Real time is deformed in an electronic culture of televised instant replays, generic pastiche and interactive mouse control. Postmodern architecture and fine art are characterized by de-historicized collections of recycled aesthetic styles [27]. In the classic postmodern film *Bladerunner*, scenery resembles recycled international junk and costumes rehash fashions spanning many decades. In this film, genetically engineered replicants, artificial simulations of real people, have become more human than human.

Physics and other natural sciences have been affected by this electronically mediated postmodern milieu of simulacra. Scientific visualization is the use of computer graphics to visualize 'simulations that model reality'. Scientific observations of real data have been transcended in this electronic age where supercomputers can solve numerical equations that represent real physical models. These simulations are visualized with computer graphics to represent such natural phenomenon as an astrophysical jet (Figs 2, 3) that might be 100,000 light years in length [28]. While most of these models of reality cannot be experienced directly by human beings, they can be computed, digitally stored, recorded and electronically replayed on a VHS video tape deck, providing a vicarious view of invisible phenomena. Scientific simulations and computer-graphic visualizations can compress geophysical time from tens of billions of years to a millisecond and shrink a blackhole deformation to the width of a television screen [29]. Humans have technologically warped time and space and documented every possible visual image. "Now, more than ever before, different strata in our society have converged in their passionate interest in the image, in representation, in the very process of mediation and simulation" [30].

Thus, postmodernism is a dynamic, systemic cultural condition that informs most disciplines in electronically mediated societies and can be characterized primarily by the following:

1) *Historical hypersensitivity*—workers in many disciplines, media and art have an increased historical awareness, and their works reflect historical elements that have been recycled and recombined into new aesthetic forms

2) *Cross- and Interdisciplinary Activity*—in art, science and philosophy, people have dissolved many boundaries between traditional modes of behavior, expressions and concepts

3) *Simulacra*—in society, our age of mechanical reproduction and electronic media have collapsed time, space and matter into image synthesis, representation, simulation and electronic models of natural phenomena.

THE CYBERNETIC PARADIGM

The postmodern characteristics noted above can be related to cybernetics, the theory of information control in living organisms; this theory is based on the concept of systems and subsystems that are organized into hierarchies [31]. Cybernetic processes include use of memory, free association, visualization, but most importantly, the construction of new mental models of reality. Humans build mental models of reality through the association of representations. This modeling allows humans to create. When we re-associate concepts or representations, the models undergo reorganization or change; thus humans create and re-create models by this type of free association. Members of human society communicate on the highest level of their individual organization through this process. In this way, *people have contact by brain* because these models become a continuation of each individual brain [32,33]. Social systems and subsystems in culture are natural extensions of shared models and paradigms within our society. And people will utilize whatever technology is available to continue this creative process.

Twentieth-century technological advances in electronic communication and image production have resulted in an accelerated contact of the individual with an external world through television and other media. If people have contact by brain, then people are having more brain contact more rapidly than ever before. We are constantly bombarded with changing images and information that model the external world through media. Today, artmaking and other creative disciplines increasingly reformulate models, due to this efficient information flow and exposure of artists to a broader range of cultural associations. Thus, intense exposure to historic styles inevitably stimulates artists to produce re-associations and sometimes to recycle these styles in their aesthetic production. A natural outcome of this electronic information flow is more interdisciplinary activity. Simulacra, images synthesis, and the electronic production of visual models of reality are social extensions of individual creativity resulting from our electronic age.

Cybernetics provides a model of society as well as a model of individual thought that explains the complex dynamic systems in which culture itself is rapidly evolving. The whole of these social systems is like one big brain that moves toward greater complexity from which new levels of organization and creativity emerge. The evolution of collective consciousness takes place through the natural selection of the models that humans create [34].

> The necessary selection of variants for increasing the complexity of the organization of matter by trial and error now takes place in the human head. This process differs fundamentally from the process of [Darwin's] natural selection and takes place incomparably faster, but in both its function (constructing and using models of the environment) and in its results (growth in the total mass of living matter and its influence on nonliving matter) it is completely analogous to the earlier process [Darwin's natural selection] and is its natural continuation. The human being becomes the point of concentration for Cosmic Creativity. The pace of evolution accelerates manyfold [35].

This holistic interrelationship as a basis for creativity and life is evinced in other areas of twentieth-century science. The old simple mechanistic outlook has given rise to a holistic approach, a view that treats "the organism as a whole, a view which, incidentally, echoes the old Chinese picture of the universe itself as a self-dependent organism" [36].

SUMMARY

People think, understand and create by building mental models of the world about them. These models often develop into complex social systems that interact and influence others. For example, when Alfred Stieglitz proposed his pure photography as the appropriate modus operandi, he created a model that integrated fine art photography into the existing system of the art market. His rationale provided an acceptable

model for fine art photographers until a new model was adopted.

Another example of modeling is presented here regarding the transition from modernism to postmodernism. The first section proposes that an interaction among the cultural systems of art history, the art market, and mass media resulted in a hypersensitive art historical awareness, and this awareness influenced artists in their attempts to transcend history and create an avant-garde. This simple analysis provides a model of an interaction among several cultural systems and its effects upon art. Such an analysis reflects the cybernetic approach and recognizes the major influences that social systems and paradigms have upon artmaking.

The point here is that artists are inextricably immersed in culture; they are constantly attempting to operate within a multiplicity of social systems including the art market, mass media and academia. The complete analysis of an art object would recognize and include the multiplicity of systems within which the artist works. Artists have contact by brain with all parts of the world in today's electronically mediated culture. And to simply say that 'the art work speaks for itself' is to ignore the whole from which the work evolves.

The shift from modernism to postmodernism has been a transition from one paradigm to another. Postmodernism is more general than modernism because it subsumes many modernist concepts (e.g. aesthetic purity and lineage of styles) and re-evaluates them in a new context. It proffers a schema that clarifies interdisciplinary aesthetic activities. Likewise, postmodernism generalizes across social criticism and incorporates many aspects of our high-technological, electronic culture through such concepts as simulacra.

However, many postmodern critics, in their languid historicism, fail to recognize the 'real' 'new', and this period where the old is dying and the new cannot be born results in many morbid symptoms [37]. Many view electronic/computer media as evil, as a primary contribution to the negation of humanism. This technophobic attitude handicaps any emerging technological aesthetic. Unfortunately, computer art was born in the transition between modernism and postmodernism. While both paradigms broach computer art issues, for the most part these issues have been relegated to technological biases.

If one agrees that computer art is treated like an orphan child by mainstream art criticism, then one would also agree that a model is yet to be born that will assimilate scientific aesthetic activity such as scientific visualization. This type of artistic exploration attempts to cross an even greater chasm between two disparate social systems—that of science and that of art. Technological art is often viewed suspiciously enough, but art delving into both science and technology is too distant from the current imperatives of the art world. A shift in criticism must occur to assimilate such alien aesthetic activities as scientific visualization.

The cybernetic paradigm subsumes computer art, scientific visualization and other art paradoxes into a model of human evolution where technology, simulacra, historicism and eclecticism characterize intense cultural creativity. This approach encourages analysis of the complex network of systems and subsystems in an evolving, dynamic society. Artmaking crosses many of these subsystems, and this type of analysis might prove to be very enlightening. For example, a comparison between the current art market and SIGGRAPH might reveal interesting influences that these two economic systems have had upon computer art production. Likewise, this comparison might reveal the tensions and frustrations of those artists who attempt to operate between these two systems. This type of analysis—where the whole social organism is considered integral to individual artmaking—is characteristic of a cybernetic approach to art criticism.

Criticism should address art production within all aspects of culture, including economics, mass media, science and the whole interrelatedness of our heterogeneous cultural life. Jameson has negatively characterized current cultural production as schizophrenic and randomly heterogeneous. However, none of these eclectic features should be seen as random; rather they confirm one another in an intricate network of social systems and historical meaning that can be understood within the context of human creativity [38]. Electronically mediated societies are rapidly and collectively re-creating new models of reality because of the increased exposure to image and information. Metaphorically speaking, this continually evolving re-creation and modeling of reality can be symbolized by the "*Tao* . . . , the one ultimate, tireless activity . . . it inevitably retains the impression of an unlimited past and as surely moulds the ceaseless future, but is itself unconditioned by time, space, or matter" [39].

Glossary

association—in thought or information processing, association is the connection of concepts, images or models. When the brain 'associates' it brings together representations into a new association, and this process results in a new association of representations, a recombinant association. The latter is at a higher level of hierarchy in the organization of thought processes. Associating is a primary function in the process of modeling.

appropriation—in postmodernism fine art photography, this term refers to artworks exemplified by Sherrie Levine or Richard Prince, where the artists copy and exhibit other artists' works. Levine and Prince intended to make an artistic statement about authorship and originality and attempted to dismantle subjectivity in the art works. However, the art market, with its innate ability to commodify almost anything, has also marketed these plagiarized photographs as art.

art market—people, businesses and institutions who have an interest in normalizing and benefiting from avant-garde art (this category includes dealers, collectors, museum officials, directors of cultural programs, critics, artists).

art world—a term that is inclusive of the art market as well as university and other art educators, non-professional art students, artists who do not participate in the art market, public art exhibit attendees who do not generally buy art.

cybernetics—Norbert Weiner's cybernetics is the study of relationships and information control in the living organism. This term has come to mean a study of human control functions and of the mechanical and electric systems designed to replace them. This theory is based on the concept of systems and subsystems that are organized into hierarchies. Turchin outlines human cybernetic processes that include use of memory or history, free association, visualization, playfulness and the creation of models of reality; and he applies these ideas to society as a whole.

modeling—the creation of models is simply the mental interconnection of associations or representations that have a time coordinate and a resultant capability to foresee the future; this is the idea of constructing a model of the environment. For example, concepts such as 'season' or 'taxes' provide simple models that retain a sense of time and regularity and allow one to predict a continuation of the phenomenon. In this sense, a model both provides a mental representation and allows one to plan the future. Knowledge is the presence in the brain of a certain model of reality. In our brains, this model of reality is at a high level in the hierarchy of associations that enables us to foresee the results of our actions (Turchin, p. 73). A model that is shared among many people as a system of belief is a paradigm.

modern—characteristic of contemporary styles that reject traditionally accepted or sanctioned forms and emphasize individual experimentation and sensibility. Modernism is thought to have begun around the end of nineteenth century and to have peaked during the first half of the twentieth century.

paradigm—a model or standard; in this paper, paradigm refers to Thomas Kuhn's meaning (see Ref. [2]). At any given time, a discipline or specialty will disclose a set of recurrent and quasi-

standard illustrations of various theories in their conceptual, observational and instrumental applications. These are the community's paradigms, revealed in its textbooks, lectures, and laboratory exercises (Ref. [2] p. 43). Paradigm is used in two different senses: on the one hand, it stands for the entire body of beliefs, values, techniques and so on shared by the members of a given community. On the other, it denotes a single concept that is employed as a model or standard (Ref. [2] p. 175). Paradigm also refers to a model of reality that is shared by many people and that has evolved into a system of belief.

postmodern—an art and social-criticism term that originated in fine art photography and that describes the art that followed modernism; postmodernism developed during the mid-twentieth century. Postmodern criticism reveals a hypersensitive historical awareness, recognizes the print/electronic media as central to the conduit of culture and suggests that electronic media have created an isolation of the individual from direct experience of reality; critics observe that art from the postmodern era involves a pastiche of recycled styles.

simulacra—artifacts, images and cultural production that are created by electronic simulation to produce an artificial space and time or are produced in any synthetic manner to give the appearance of or represent some other thing, possibly from some other time or place. This type of cultural production often appears as a pastiche or collage of recycled historic styles. Also, simulacrum is any reproduced synthetic form that is made to give the appearance of some other thing or represent something else. Electronic simulacra often remove the individual from direct experience of reality (e.g. television, video, etc.).

Taoism—'the way' or perhaps 'the order of nature'; ancient Chinese religion and philosophy proposed the unity of nature and oneness of the universe. The universe was seen as an organism made from an interrelated network of hierarchical systems; nature must be studied as a whole, not reduced to its parts. The Taoists were among the first great scientists and artists of China; this philosophy began around the same time as ancient Greek science, fifth century B.C.

References and Notes

1. The title of this article is in the spirit of *The Tao of Pooh* by Benjamin Hoff and *The Tao of Physics* by Fritjof Capra, who is doing research in theoretical high energy physics at Lawrence Berkeley Laboratory and is a lecturer at the University of California at Berkeley.

2. T. S. Kuhn, *The Structure of Scientific Revolutions*, 2nd Ed. (Chicago: University of Chicago Press, 1962, 1970). Kuhn explains that science progresses through major paradigm shifts (e.g. from Ptolemy's geocentric solar system to Copernicus's heliocentric solar system; from Newton's classical physics to Einstein's Theory of Relativity). In art, from Kuhn's point of view, the shift from premodern to modern might be considered a paradigm shift. He notes that, in the past, scholars have shown the tendency to see the history of science as a linear or cumulative process. However, contemporary historiography raises serious doubts about this linear approach (pp. 2–3, pp. 138–139). I might add here that postmodern critics also question the validity of historical linear progression of aesthetic styles.

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31. V. F. Turchin, *The Phenomenon of Science* (New York: Columbia University Press, 1977) pp. 4, 315. The author is a physicist who outlines the way humans model reality in this book on the cybernetic approach to human evolution.

32. V. F. Turchin [31] p. 95. Language—seen as an extension of thought—comprises a system or model. Larger metasystems such as art, science, and philosophy are also viewed as systems or models that people create through thought and language. Language is not only a continuation of each individual brain but also a general, unitary continuation of the brains of all members of society. It is a collective model of reality on whose refinement all members of society are working, one that stores the experience of preceding generations.

33. V. F. Turchin [31] p. 92. Turchin notes that art is not a formalized linguistic language, like science; however, art does have a complex organization of concepts and objects that form cultural systems and subsystems, that are linguistically demarked, and that provide contextual models.

34. T. de Chardin, *The Phenomenon of Man* (London: Wm. Collins Sons & Co., Ltd, 1959). Matter and life have constantly moved toward greater complexity, and it is this observation that characterizes our biosphere.

35. V. F. Turchin [31] p. 98.

36. C. Ronan, *Science: Its History and Development Among the World's Cultures* (New York: Hamlin Publishing, 1982) pp. 489, 135.

37. A. Gramsci, quote from *Prison Notebooks* in B. H. D. Buchloh, "Figures of Authority, Ciphers of Regression", in *Art After Modernism*, M. Tucker, ed. (Boston: David R. Godine, Publisher, Inc., 1984) p. 107.

38. B. H. D. Buchloh, "Figures of Authority, Ciphers of Regression", in *Art After Modernism*, M. Tucker, ed. (Boston: David R. Godine, Publisher, Inc., 1984) p. 117.

39. L. Sickman and A. Soper, *The Art and Architecture of China* (New York: Penguin Books, 1971) p. 268; quote from John E. Lodge, "Ch'en Jung's Picture of Nine Dragons", *Bulletin of the Museum of Fine Arts, Boston*, **15** (December 1917) pp. 67–73.