Chapter 8
Complexity Theory Revisited

ABSTRACT

The fact that creativity is rationally unaccountable plagues design theory, and it tends to exclude the education done in design studios from the reputation of intellectual rigor enjoyed throughout most of the university. Design begins as a rational linear process of convergent thinking in which a problem and a task are defined, but then – often suddenly – a divergence of thinking happens as imagination visualizes an unforeseen creative solution. The problem is, no satisfactory account has ever been given of creative imagination. It just happens – more often in some people than in others. Creativity is a paradoxical combination of analytic and synthetic thinking, and this fact alone precludes computers from making successful designs. Computers cannot be programmed with sufficient algorithms to represent the full complexity of variables inherent in the design problem, and computers cannot make creative leaps of imagination to envision a creative solution, so they are irrelevant to the deepest work of design thinking. It has been suggested recently that a satisfactory theoretical accounting for design creativity might be provided by complexity theory, principally because the central concept of this theory is autopoiesis. Certain systems, such as those of living organisms, exhibit great internal complexity united with a single external goal, and the systems themselves, through interaction with the environment, create unique ways of achieving that goal.

INTRODUCTION

Biological evolution is the dominant metaphor for complexity theory. This sounds something like design creativity, but because there is no place for either an executive agent or the vision of imagination in such systems, complexity theory must remain a dubious explanation for design creativity. The history of complexity theory, beginning in the 1940s with such ideas as Shannon and Weaver's information model of communication and von Neumann's theory of artificial intelligence, is firmly based on rationality, especially the 19th century mathematician George Boole's "laws of

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thought." For this reason alone it is doubtful that complexity theory will ever explain imaginative creativity.

Randall Teal (2010) castigates the practice of design education for relying far too much on traditional positivistic assumptions about the nature of learning, whereby design is taught as a linear, rationalistic, and convergent process that begins with the definition of a problem, moves to the scientific or artistic application of principles to the problem, and concludes with a logical solution to the problem. According to Teal, such a pedagogical approach to design teaches the wrong things:

Such a system promotes memorization as learning and specialized knowledge as higher than multifaceted understandings; it has infected design practice and education with mechanistic reductivism and a general inability to cope effectively with the ambiguities of creativity. In short, emerging out of this background, students are more likely to treat design as calculative problem solving than responsive making. As a result, a-rational knowledge, like the embodied, intuitive and emotional, becomes mistrusted and relegated to a place of secondary importance. In this way, design thinking becomes not a new manner in which to engage the world, but instead is simply an extension of old habits. Here the workings of design become skewed, promoting design as a simple instrumental process, which tends to eliminate the complexities, accidents and flows that are basic to a dynamic and vital existence (p. 294).

We have seen this complaint time and again throughout our investigation of design education in this book. In fact, as we noted in Chapter 4, such an attitude to education in general can be traced to the pedagogical writings of John Dewey (1897, 1929, 1938) who emphasized the importance of what has come to be called experiential learning. Put in its simplest terms, Dewey's educational theory attacks rationalistic or positivist assumptions of learning and promotes a more individualistic and "creative" approach to learning that is firmly integrated with the learner's life story and personality. Dewey's beliefs can be found in such contemporary pedagogical paradigms as constructivism and phenomenology, as well as in such pedagogical concepts as Guilford's "divergent thinking," Schön's "reflection-in-action," and the general assumption that the liberated imagination of the learner embodies an unlimited power of creativity. In short, Teal's comments above are exactly what one would expect in the current milieu of design education.

Although Teal does not refer to it specifically, complexity theory has often been evoked in recent times as an alternative to scientific positivism in various fields of research, including design. I recently published an article considering the possibility of replacing both positivism and critical theory, its usual alternative, with complexity as a new paradigm for design education (Wang, 2010). In Chapter 4 of this book some of the same points and issues and possibilities were raised. The principal value of complexity theory as a paradigm for design appears to be its respect for *autopoiesis*, a concept presented by Varela *et al.*(1974), signifying the observation that complex systems tend to organize themselves from within, resulting in the emergence of unpredictable properties. It was suggested in Chapter 4 that this alone – the recognition of a mysterious creativity at the core of the design process – might be enough to consider complexity as a paradigm for design. It is certain that neither positivism nor critical theory provides a clear explanation of how imagination fuses disparate elements to create new visual designs.

This lack of rigorous clarity has plagued *technē* since the Classical Age of ancient Greece. Plato doubted that making really resulted in any true knowing, while Aristotle recognized that making could result in knowledge, but he too preferred the rational knowledge of the intellect to the uncertain and only partially articulated knowledge provided by technical activities. The central epistemological issue for both Plato and Aristotle is located in the