

# Complexity Science

## A Worldview Shift

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One of the frustrations of working in the exciting area of “complexity science in organizations” is that there is no commonly accepted definition of what this term means (White *et al.*, 1997). Definitions have been offered, such as “complexity is a watchword for a new way of thinking about the collective behavior of many basic but interacting units ... complexity is the study of the behavior of macroscopic collections of such units that are endowed with the potential to evolve in time” (Coveney and Highfield, 1995: 7). Although this definition is very descriptive, it still seems general and unfocused. The purpose of this article is to offer a simple definition for complexity science and to demonstrate the shift in worldview necessary for complexity science to become second nature to people as traditional science now is.

Simply put, *complexity science is an approach to research, study, and perspective that makes the philosophical assumptions of the emerging worldview (EWV)*—these include holism, perspectival observation, mutual causation, relationship as unit of analysis, and others; see Table 1. Classical science, as practiced in the twentieth century, for the most part makes the philosophical assumptions that will be labeled here the traditional worldview (TWV)—which include underlying assumptions of reductionism, objective observation, linear causation, entity as unit of analysis, and others.

This TWV, which has allowed people to make significant achievements in many fields, is no longer serving as a reliable guide. Several brief examples illustrate the dysfunctional nature of TWV assumptions applied inappropriately:

- Rent control laws that were intended to maintain a stock of low-cost housing have resulted in a shortage of low-cost housing.
- The demise of the *Saturday Evening Post* and the Curtis Publishing Company has been attributed to “management essentially look[ing] for short and direct cause and effect linkages” (Jacobs and Jaques, 1987: 34). Computer simulations have suggested that this company could have been saved if a strategy incorporating complex, indirect linkages had been employed.
- “The largest building in the world, the space vehicle preparation shed at Cape Kennedy, generates its own weather, including clouds and rains. Designed to protect space rockets from the elements, it pelts them with storms of its own” (Gall, 1977: 20).
- Sick people go to the hospital to be made well. Twenty percent of all patients, however, *acquire* illness in the hospital as a result of their diagnostic procedures and treatments prescribed (Illich, 1977: 23).

The rise of complexity science has paralleled an increase in dissatisfaction with the TWV. Capra (1982: 15) labels this dissatisfaction a crisis of perception and says that it occurs when people hold to a mental model that no longer achieves their standards of accuracy. Other writers have called this same phenomenon a period of dislocation (Ackoff, 1981) or a time when we are between “stories” (Schwartz and Ogilvy, 1979). We do not yet know exactly what the new story will be. It is easier to see where we have been than where we are going. Consequently, the problems and dilemmas that have arisen are easier to critique than the specific details of a new worldview are to provide. Examples of these difficulties are TWV assumptions that work within a range of conditions, but beyond that range they no longer work.

Many have written about the change in worldview (Wishard, 1995; Dooley, 1997; Slife and Williams, 1995; Smith, 1982; Ackoff, 1994; Dent, 1995). In contrast to these works, however, the focus of this article is on the change in thinking that is required for organizational members to function effectively in postmodern organizations. I will suggest that if we are to continue to grow, develop, and thrive in this world we must adjust some of our most deeply held mental models about the world and our interactions with it. At the same time, I acknowledge that there is some suggestion (Wilber, 1998) and evidence (Dent and Powley, 1999) that the worldview shift may not be progressing as rapidly as some writers have claimed. The article will attempt to describe the most necessary shifts in thinking so that complexity science will be seen as “normal.”

Some of the underlying assumptions of the shift in worldview are becoming clearer. A difficulty in capturing the TWV and EWV underlying assumptions, though, is that the worldviews cannot be simply stated. One can use simple metaphors like the clock and the waterfall, but these do not capture the full essence of the worldviews. Table 1 contains a list of a number of differences in underlying assumption gathered from a variety of sources.

Most readers of this article will have been taught in a learning paradigm so that they will be more comfortable with the information presented in the form of Table 1 (Vaill, 1996). However, Figure 1, which still has limitations, is a more accurate visual representation of the differences in TWV and EWV underlying assumptions, for reasons discussed below. Including all of the information in Table 1 in Figure 1 would overwhelm the visual representation, so only the three constructs that best differentiate worldview (Dent, 1997) are presented. For clarity of understanding, the word “construct” is used to denote a phenomenon such as causality. The word “assumption” is used to indicate a selection within a construct. So, for the construct causality, the two assumptions labeled are mutual and linear.

## **TAKING THE TRADITIONAL WORLDVIEW “OUT OF RANGE”**

It is important to note that theorists are not suggesting that the traditional underlying assumptions are wrong. In fact, many of them seem to be useful in localized settings. For example, Prigogine and Stengers (1984: xxiii) see determinism and indeterminism not as irreconcilable opposites but “each playing its role as a partner in destiny.” Between bifurcation points, determinism is operative. At a bifurcation point, however, indeterminism takes over. Consequently, indeterminism (which doesn’t dismiss localized determinism) and the other emerging assumptions seem to be more useful abstract concepts. They reflect reality more accurately in a larger number of instances. Capra (1982) nicely captures the distinction:

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*Modern science has come to realize that all scientific theories are approximations to the true nature of reality; and that each theory is valid for a certain range of phenomenon. Beyond this range it no longer gives a satisfactory description of nature, and new theories have to be found to replace the old one, or, rather, to extend it by improving the approximation. (Capra, 1982: 101)*

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Emerging	leftTraditional
Holism	Reductionism
Mutual causality	Linear causality
Perspectival reality	Objective reality
Observer in the observation	Observer outside the observation
Indeterminism	Determinism
Equal focus on exteriors and interiors	Primary focus on exteriors (Wilber, 1998)
Adaptive self-organization	"Survival of the fittest"
Adaptive self-organization	"Lead or seed" (Resnick, 1994)
Focus on relationship between entities	Focus on discrete entities
Dialogical research methods	Monological research methods (Wilber, 1998)
Nonlinear relationships	Linear relationships
— Critical mass thresholds	— Marginal increases
Polarity thinking	Either/or thinking Johnson, 1992)
Focus on feedback	Focus on directives
Quantum physics perspectives	Newtonian physics perspectives
— influence occurs through iterative	— influence occurs as direct result of force
non-linear feedback	exerted from one person to another
— the world is novel and probabilistic	— expecting the world to be predictable
Postmodern	Modern
Dedifferentiation	Differentiation
Focus on heterarchy (within level)	Focus on hierarchy (between levels)
Understanding/sensitivity analysis/explanation	Prediction