# Reductionism Versus Holism: A Perspective on Perspectives

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November 1, 2002.

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In 1964, Thomas Kuhn presented a pivotal analysis stating that nature is understood in terms of the currently accepted paradigm (Raymo, 2000). Kuhn defined a paradigm as a system of beliefs or assumptions about the world supported by a group. Paradigms are defined by ontology (the way in which the nature of matter is explained), epistemology (uses and limitations), axiology (criteria of values) and methodology (processes used to study nature) (Van de Vijver & Braeckman, 2002).

According to Foryng (2001) two significant scientific paradigms are reductionism and holism. Reductionists attempt to explain the functioning of the whole by reducing it to its smallest components (Autumn, 1995; Capra, 2002; Pigliucci, 2000). It developed out of a reliance upon Cartesian or mechanistic interpretations of the world (Capra, 2002; Emery, 2001; Pigliucci, 2000) in which Newtonian physics dominated (Cameron, 2000; Capra, 2002). It represents the current scientific paradigm (Autumn, 1995, Emery, 2001; University of Groningen, 2002) and has been extremely successful in explaining most phenomena (for example, genetics and medicine) (Capra, 2002; Pgliucci, 2000). Cameron (2000) further pointed out that the scientific method itself implies a reductionist approach and has greatly influenced how science is conducted.

Capra (2002) noted that there has been an over-reliance on the reductionist approach such that other views such as holism are deemed less scientific. Whereas reductionism implies that nature is nothing more than a collection of individual components (University of Groningen, 2002), holism is an integrative approach (Autumn, 1995) stressing the relationship between the component parts and the whole (Cameron, 2000) such that the whole could never be reproduced

by simply recombining those parts (Cameron, 2000; Emery, 2001). Holism stems from Complexity theory, a branch of Chaos theory, which emphasizes that the apparent randomness of component parts results in unpredictable, emergent consequences. It is this lack of predictability which is considered unsettling (Chavons, 2002; Pigliucci, 2000). It is synergistic in that the properties of the whole are greater than the sum of the properties of the components (Autumn, 1995; Chavons, 2002). For example, the wetness of water does not directly come from the properties of either the oxygen or hydrogen atoms present in a water molecule (Chavons, 2002). There may be a need to embrace holism due to complexity of nature (Emery, 2001). Capra (2002) identified other examples of holistic theories such as the Theory of Relativity, nervous system functioning, tissue repair and embryogenesis.

Although both reductionism and holism attempt to explain the structure and function of nature and actually rely on the same methodologies (Autumn, 1995; University of Groningen, 2002) and epistemology (University of Groningen, 2002), they differ markedly by their causalities (reductionist causalities are one-dimensional; whereas, holistic relationships are very complex and dynamic). As a result the two paradigms are often thought to exist as a dichotomy (Autumn, 1995). Dichotomies may falsely imply one paradigm is wrong (Capra, 2002), as it is possible that theses paradigms exist on a continuum rather than as two discrepant ideologies (Foryng, 2001). Furthermore, it may be that each paradigm simply represents a model used to study different levels of organization of nature (Bax, 2002, Cameron, 2000, Capra, 2002; University of Groningen, 2002) and as models are limited in application by their inherent weakness (Cameron, 2000).

The difficulty accommodating both paradigms may stem from the fact that in attempting to understand the component parts, there is an oversimplification of the interaction of those components. The views may actually be cooperative and mutually dependent in that one provides context for the other. For example, the functioning of the components is only relative to the functioning of the whole and vice versa ( Bax, 2002; University of Groningen, 2002) and as such it would be ridiculous to suggest that the whole is nothing more that the additive sum of its parts (University of Groningen, 2002).

Levins (1998) identified one other view, stemming from Systems Theory, such that holism may be just be an extension of reductionism. Underlying organizing principles for holistic phenomena may exist which would then make emergent properties orderly and predictable. However, this view is problematic in that there is no way to know if the holistic system has been fully defined or simply reduced to the point that it is no longer realistic.

It may well be that neither theory can fully account for all scientific phenomena. Moving beyond the reductionist paradigm will fundamentally alter how science is understood and conducted (Capra, 2002).

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