

A Review of The Science of Leonardo: Inside the Mind of the Great Genius of the Renaissance

The contemporary growth of complexity and computational social science may call for a systematic look into the historical roots of systems thinking and complexity. Capra's book on the life and science of Leonardo da Vinci provides such a historical exploration.

The book consists of two tightly coupled parts, the first focusing on the life and the second on the science of Leonardo.

Leonardo was the prototypical 'Renaissance man' or 'Universal man' with innovative contributions to science, art and engineering that reflect a great diversity of knowledge, interests and capabilities. Capra argues that Leonardo da Vinci was a systemic thinker and a complexity theorist, aware of the interrelatedness of things, and interested in discovering fundamental patterns (archetypes) across diverse phenomena. As Leonardo wrote in one of his famous notebooks "for a man who knows how, it is easy to become universal..." (p. 34). He was "deeply aware of the fundamental interconnectedness of all phenomena and of the interdependence and mutual generation of all parts of an organic whole" (p. 168).

Leonardo's life and thought are dominated by synthesis of art and science. The historical context of his life was characterized by creative turbulence: fierce conflicts among wealthy Italian renaissance cities that kept brilliant engineers like Leonardo busy in defensive and offensive military projects, geographical exploration, discovery of the printing press, and rediscovery of the classics and humanism, all achievements celebrating human capabilities.

Capra suggests that Leonardo developed through his studies the approach to knowledge that later became known as the scientific method. Leonardo "always seemed to be more interested in the process of exploration than in the completed work or final results" (p. 165). Capra goes as far as claiming that Leonardo is "the true founder of modern science" (p. 6). To Leonardo, contrary to his contemporaries who resorted blindly to authority, the root of science was first *experience*, through detailed observation and experiment, and second *explanation*. His scientific explorations involved the flow of water and rivers (fluid dynamics), the nature of light, the functioning of the eye and other

elaborate anatomical drawings, and many other natural phenomena. Mostly influenced by Aristotle and Euclidean geometry, his lucid scientific mind was complemented by powerful drawing skills. He used drawings as conceptual models, since the math of his time were not sufficient to describe complex dynamic phenomena, like fluid dynamics and turbulence, that attracted Leonardo's intellectual curiosity. His science was uniquely dynamic portraying "a world in development and flux, in which all configurations and forms are merely stages in a continual process of transformation" (p. 172).

Leonardo believed that soul (mind) and body formed one indivisible whole in contrast to the mind-body divide introduced later by Rene Descartes. He did not pursue science "to dominate nature, as Francis Bacon would advocate a century later" (p. 11), but he was always amazed by nature's ingenuity "with a deep awareness of ecology and systems thinking" (p. 12). As Capra emphasizes, this insight is indispensable today, because "as our century unfolds, it is becoming increasingly apparent that the major problems of our time—whether economic, environmental, technological, social or political—are systemic problems..." (p. 264).

This delightful book aims at establishing Leonardo as a father of complexity and system science, through recent findings based on the analysis of Leonardo's Notebooks and a rather novel interpretation of Leonardo's life and scientific exploration. This interpretation might be biased by Capra's own philosophical and scientific positions, but it still has significant merit as an exploratory step toward the historical roots of complexity and system sciences. This type of exploration could ultimately provide useful epistemological and ontological insights, informing and shaping the future trajectory of system sciences.

After Leonardo's death, his Notebooks, consisting of 6,000 pages of notes and 100,000 drawings, were scattered all over Europe and remained unexplored. Capra keeps wondering that western science could have followed a more systemic approach, if Leonardo's notebooks were published and studied at that time. Paradoxically, attempting to predict an alternative scientific history might be less safe than predicting that the future of science, including social science, will be a tribute to Leonardo.