BOOK REVIEW

A review of *Collapse of Chaos: Discovering Simplicity in a Complex World*, by Jack Cohen and Ian Stewart, 1995. New York: Penguin Books, 512 pp. ISBN 0-140-17874-0. $14.16 USD.

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Biologist Jack Cohen and mathematician Ian Stewart, experts in their respective fields, wrote a simple and coherent book for general readers that encourages further appraisal. A fun and interesting read, the authors are careful to explain information presented, and use numerous analogies to aid their reader's understanding.

The authors argue against the traditional reductionist approach to science, the methodology employed for the past 300 years. Instead, they advance a more holistic approach, one that does not break problems down in the assumption that they will eventually become part of a contiguous whole. Under the reductionist approach, nature is hypothesized to be a vast entity in which parts can be separated out and examined at leisure.

The first half of the book is easily read by those interested in science but have no desire for technicalities. Chaos is described as complexity beyond our normal comprehension that has a naturally emerging simplicity. As order is established through the cause and effect of simplicity, researchers are needed to examine the emerging order. The collapse of chaos is able to predict a path of movement for thinking patterns, going from chaotic to simplistic, intertwining the two phenomena in a fantastic fashion. The authors commit to explanations of biology, chemistry, and physics in a rich manner, giving clear and concise explanations of scientific foundations. Simple theories on the genetic code and Darwin's theory of natural selection are discussed with respect to the interaction between genes and the environment. For chemistry, Medeleev's period table is a subject of interest, and is particularly well supplemented with explanations of electron shells and the adaptability of the carbon atom, which work together to form complex hydrocarbon molecules. Newton's laws of motion and gravity, Einstein's

theory of relativity, and basic quantum mechanics are further explained, allowing the reader to return to the beginning of life with the Big Bang theory and traverse into the world of atoms and subatomic matter. Eventually however, the authors conclude that what we know can be summed up as tiny islands in a sea of ignorance, becoming self limiting as other significant questions are ignored.

Within the world, there are many lucid demonstrations of complexity. As scientists, we have made up laws of nature, using simple rules to define the laws. However, each is also resplendent with exceptions, observations that do not conform to these simple rules. This allows us to live within a world that is full of chaotic, complex events without fully understanding all the events. We further are only capable of explaining very few of the events that happen to fit within our preconceived natural "laws".

Scientists view complex events as a series of interactions, a wide range of possibilities that can be explained by simple causes interacting to form foreseeable complex effects. These so called "laws of nature" are able to explain these predicted interactions, which result in complexity. The laws can also be considered to be underlying simplicities, where simple causes result in simple effects, despite complexities that appear to be involved. Further, the laws ignore the fact that they produce inexplicable complexities.

The authors conclude that reductionism, while enjoying great success with advances in biology, chemistry and physics, has now exhausted its potential forcing it to be time for new sets of questions. However, up to this point the authors were clear and concise. The midpoint of the book expounds upon chaos and complexity theories in order to prove the shortfalls of our so called "laws of nature." Chaos theory suggests that simple causes produce complex events, while complexity theory suggests that complex events produce simple effects.

At this point, further detail in produced on the topics of the complexity of evolution, embryology, and in turn, consciousness and intelligence development. The authors also embark on a conversation between space ship crew and aliens, in order to have the reader fully appreciate the differences in culture and the laws of nature between individuals who belong to different worlds. This conversation acts to further suggest that Earth is not as unique as previously believed, suggesting that life forms of different worlds may develop along a completely different paths, resulting in minute changes such as atom composition. I found this conversation to be both humorous and somewhat inspiring.

However, the downside to the second part of the book is the vagueness that is introduced, as the authors become increasingly reliant on speculation and anecdotes. As Cohen and Stewart leave the paradigm of reductionism behind, new terms are introduced: simplexity and complicity. Simplexity refers to simple effects to emerge from complex events, where large order simplicities come directly from complexities. Complicity involves interactions taking place between systems that are co-evolving, supporting emerging complexity. It is comparable to convergent evolution, where different situations lead to similar results. Both simplexity and complicity lead to a collapse of chaos. As well, the ability to view events within context of their happening is

of crucial importance to avoid reductionism of the events. Instead of a law governing how the end result of a series of events occurs, the law instead is made to fit the facts of observations. Although this is a subtle distinction, it becomes quite an important one within the book.

As a whole, the book is based on the overall inadequacy of the reductionist effort currently in place. It builds toward the authors' newly coined terms of simplexity and complicity, which are able to explain effects where both the content of the situation and the context of the situation are critically important. They fail to truly introduce a new paradigm however, remaining rather incoherent on the final state of the information they attempt to pass on. Different points of view are consistently introduced without attempting to persuade the reader to fall into a specific belief. It ultimately takes on a questioning stance of why simple structures exist at all, as reductionism does not give the whole picture, but rather a brief snapshot of how something happens instead of why it happens. This change in stance allows the re-examination of scientific "knowledge" from a different viewpoint, concentrating on the emergence of simple events through the collapse of chaos.

About the Reviewer

Stephanie C. Tait received her B.Sc. (Hons) and M.Ed. from the University of Windsor. While obtaining her Masters, she focused on the comparison between traditional teaching styles and problem based learning styles, in addition to the impact of the human-animal bond within the classroom. She is currently attending the Ontario Veterinary College at the University of Guelph, with aspirations of a career in teaching veterinary medicine or becoming a specialist in the field of veterinary medicine.