*IGI PUBLISHING* **ITB15289**

701 E. Chocolate Avenue, Suite 200, Hershey PA 17033-1240, USA
Tel: 717/533-8845; Fax 717/533-8661; URL-http://www.igi-global.com

This paper appears in the publication, **Intelligent Complex Adaptive Systems**
edited by A. Yang and Y. Shan © 2008, IGI Global

## Chapter I

# From Reductive to Robust: Seeking the Core of Complex Adaptive Systems Theory

Steven E. Wallis, Independent Consultant, USA

## Abstract

*This chapter seeks to identify the core of complex adaptive systems (CAS) theory. To achieve this end, this chapter introduces innovative methods for measuring and advancing the validity of a theory by understanding the structure of theory. Two studies of CAS theory are presented that show how the outer belt of atomistic and loosely connected concepts support the evolution of a theory; while, in contrast, the robust core of theory, consisting of co-causal propositions, supports the validity and testability of a theory. Each may be seen as being derived from differing epistemologies. It is hoped that the tools presented in this chapter will be used to support the purposeful evolution of theory by improving the validity of intelligent complex adaptive systems (ICAS) theory.*

# What is the Core of CAS Theory?

Where other chapters in this book may use intelligent complex adaptive systems (ICAS) theory as a framework to understand our world, we strive in this chapter to understand theory, itself. Through this process, the reader will gain a new perspective on the theory that is applied elsewhere in this book. To gain some perspective on ICAS, we will study the literature of complex adaptive systems (CAS) as developed in the field of organizational theory. As such, this chapter may be of interest to those discussing organizational theory and organizational change, multi-agent systems, learning methods, simulation models, and evolutionary games.

CAS theory originated in the natural sciences as a tool for understanding non-linear dynamics (Kauffman, 1995) and has gained popularity in organizational studies through the efforts of many authors (i.e., Axelrod & Cohen, 2000; Brown & Eisenhardt, 1998; Gleick, 1987; Stacey, 1996; Wheatley, 1992). As CAS expanded into this discipline, every author seems to have placed a personal mark by revising CAS for interpretation and publication. Indeed, in researching the literature, 20 concise, yet different, definition/descriptions of CAS theory were found.

Within these 20 definitions, "component concepts" were identified. For example, Bennet & Bennet (2004) note (in part) that a CAS is composed of a large number of self-organizing components. The concepts of "self-organization" and "large number of components" may be seen as conceptual components of CAS theory as described by those authors. These conceptual components might also be thought of as the authors' "propositions." It is important to note that among the 20 definitions, no two contained the same combination of component concepts. This raises a serious question: When we talk about CAS theory, are we really talking about the "same thing?" After all, if one author states that a CAS may be understood through concepts "a, b, and c" while another author states that the relevant concepts are "c, e, and f," there may be some conceptual overlap but there are also inherent contradictions.

In the social sciences, this issue has been of concern for decades. In one attempt to make sense of the issue, theory has been described as consisting of a "hard core" of unchanging assumptions, surrounded by a more changeable "protective belt" (Lakatos, 1970). When a theory is challenged, a theorist may rise to defend it with a new proposition that changes the belt, but presumably leaves the core intact. Phelan (2001) suggests that complexity theory has its