Cybernetics and Systems Theory in Management: Tools, Views, and Advancements

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Alex and David Bennet offer solid research that is cogent and well presented. Their approach interweaves emerging understandings of the human brain with multiple forms of knowledge, theory, cybernetics, and complexity to gain new insights into the decision-making process. Their clear and effective definitions provide readers with a solid foundation for exploring the new frontier of neurology as it relates to human behavior and organizational effectiveness. By viewing the decision-making process through multiple points of view. We learn what is going on from the view of inside the decision-maker, as well as the view from outside the decision-maker. And, significantly, we begin to understand the importance of the pattern similarity between inside the human brain and the surrounding environment. Only by understanding the complex relationships between mind, environment, and the spectrum of theories available to the decision-maker can we move toward the ability to make more effective decisions in complex situations.

Chapter 3

This chapter presents a wealth of thought-provoking ideas. With depth and precision, Richardson explores opportunities for drawing insightful connections between complexity theory and management theory. And, to the purpose of advancing management science, he describes three schools of thought for applying complexity to organizations: metaphor, neo-reductionism, and critical pluralism. Taken as a set, these three schools present a range of possibilities for engaging, thinking, and applying complexity in management. From an applied perspective, Richardson suggests that managers (and other members of organization) should, to some extent, become philosophers. That is to say managers should spend some time contemplating deep questions from multiple perspectives. This view is combined with a new challenge for managers to find the openness needed to address deep questions and the courage to do so in humility and collaboration with others.

Chapter 4

In this readable and thought-provoking work, Hodgson offers timely insights into decision-making theory. He addresses the difficult issue of decision making from a nonlinear perspective in a profound way. First, he revisits von Foerster's idea that the only decisions we can make are those that are actually about undecidable questions. Because, in a sense, the easy decisions have already been made for us by our way of framing them. Then, Hodgson introduces the rich idea of "decision integrity." This approach requires that the decision maker should understand the relationship between learning and deciding, as well as addressing important ethical concerns. An understanding of cybernetic feedback and systemic relationships is required for this big picture approach – which has intriguing implications for practice.

Most managers seem to work from a perspective of Cartesian reduction. Such management often involves the use of simple, linear, models such as the classic organizational chart. In this chapter, Donald Mikulecky shows how this approach is ultimately ineffective. This rich collection of concepts and insights are combined to challenge the reductive philosophy that has trapped managers in the Cartesian mode of thought. While all managers create mental models, Mikulecky effectively argues that the habit of Cartesian reduction has led managers to "manage the model" rather than manage the real complex system in which they are embedded. By updating our philosophical foundations, Mikulecky suggests a path towards more complete understanding, and more effective management practices. Advancing "relational systems theory," this chapter suggests a more effective approach is for managers to identify the complex causal relationships as a way to understand and manage the real system more effectively.

Section 2
Research, Theory, and Metatheory

The focus of this section is to provide scholars with a suite of methodologies for conducting research that are innovative, rigorous, and effective. The methods suggested here will prove very useful for scholars who want to develop, apply, and advance theoretical models toward greater insight and effectiveness. Individually, each of these chapters contains ideas that will have a profound effect on the larger paradigm of management science. Together, they have the potential to shape that science for a decade or more.

In this chapter, the authors describe their participation in a process of academic and managerial collaboration for benchmarking best practices in business. This is an important new approach with major implications in several areas. First, in response to calls for more engagement between academic and business circles, this chapter provides an example that scholars and practitioners should both follow. Second, this chapter helps researchers answer the call for better theory by providing a useful process for gathering data and buidling theory. That process suggests the opportunity for creating more complex theory – grounded in a new paradigm of conscious and purposeful collaboration between business and academia. Third, Schiele and Krummaker point the way for academia to develop theory that is more relevant to business. And, this process results in the creation of theory that is more likely to work in practice. Importantly, this chapter sets a standard for "next generation" case study research by overcoming many of the biases and limitations of existing case study methodology.

Working to understand complex and systemic nature of disruptive organizational change requires metatriangualtion – the use of multiple lenses to better understand a complex situation. Lewis applies a set of lenses in a case study analysis to investigate the implementation of Advanced Manufacturing Technology (AMT). In an excellent example of this kind of metatheoretical approach, she describes that change through four separate lenses and identifies "paradox" as an important and common theme. Lewis provides a useful description of management practices that will support these change efforts. Finally, this chapter provides readers with suggestions for future research. One important direction is found in the difference between linear change theories, and change theories of plurality and paradox. These suggestions open the door for further innovation and advancement in the theory and practice of organizational change.

Citing the need for better metatheory as a prerequisite for the development of better theory, Mark uses a metatheoretical discourse to gain a clearer view of management theory. He describes four general forms of transformational management theory; and, importantly, Mark steps out of the either-or debate between the benefits of self vs. organization, or top-down vs. bottom-up theories of management. In doing so, he transcends those debates to integrate and extend the extremes by looking through the metatheoretical lens of relationality. This broad and radical reframing of management theory will be very useful to scholars studying corporate social responsibility, spiritual leadership, ethics, sustainability, and more. Management scholars will find this list of concepts very useful as they frame and reframe their investigations. Edwards' chapter is more purposefully metatheoretical than most in this book. And, as such, provides a useful guide for scholars interested in exploring the newly revived (and more rigorously applied) metatheoretical conversation.

In response to specious claims of revolutionary improvements in management theory, this chapter investigates the relationship between Kuhnian paradigmatic revolution and the objectively measured, inter-propositional structure of theory. Here, propositional analysis is applied to determine the formal robustness of a set of theories spanning 1,500 years of history. The results show that increasing robustness seems to be a useful predictor of Kuhnian paradigm revolution. This, in turn, suggests that scholars who are interested in developing revolutionary theories should develop theories with a high level of

formal robustness. Further, these results suggest that the measure of robustness may be an effective tool in evaluating the potential efficacy of theories. This chapter has profound implications for the advancement of management science toward true paradigmatic revolution.

Section 3
Cybernetics and Organizational Evaluation

In this section of the book, our focus is two-fold. First, these chapters present new and intriguing ideas for advancing cybernetics and systems theory. As such, they are more suited for advanced thinkers. Second, the chapters in this section suggest innovative forms of organization analysis. For researchers, this section provides new lenses for investigating organizations.

Taking note of some fundamentals of complexity theory (including logical openness, cybernetics, and coherence), we see human social systems as multiple systems or collective beings that are generated by human elements simultaneously interacting in different ways. To manage complexity, Minati, presents his approach: Dynamic uSAge of Models (DYSAM). DYSAM is a meta-approach that should be of great use to scholars investigating complex systems because it provides a framework for integrating approaches, models, and theories. The goal of DYSAM is to represent every aspect of the system at all of its levels. Intriguingly, DYSAM investigates the acquisition of properties, rather than investigating the changes to the values of existing properties of existing systems. This approach is used to gain new insights into growth, development, sustainability, non-reductionist management techniques, and emergence.

In this chapter we are treated to a deep and challenging exploration of knowledge cybernetics. Yolles' approach begins with the ideas of Stafford Beer, and adds the insights from Eric Schwarz, then extends those ideas to create a more complete model of socially viable systems (SVS), which is capable of modeling more complex social relationships than previously possible. His model is then applied as a social frame of reference to understand organizational patterning, personality type, and knowledge profiling. Maurice shifts the conversation on knowledge cybernetics from one of epistemology to one of ontology – an important step. And, in the process, extends and deepens Beer's viable systems model (VSM) developing a lateral ontology (where a systems is understood as a contextual domain consisting of sub-contextual domains or sub-systems) and transverse ontology (relating to emergence and higher-order control of the system) to better understand and redefine the paradigm and develop new tools for analyzing organizations for their system pathologies.

Section 4
Multiple Levels and New Perspectives

For decades, the "micro-macro question" has haunted the social sciences as large. In management theory, as well, the question persists: "Does the individual control the group, or does the group control the individual?" Such questions raise serious questions of agency and effectiveness in business organizations. By understanding the relationships between multiple levels (data, theory, individuals, teams, departments, organizations, nations) we may be able to increase our human and organizational efficacy at all levels. Yet, despite the apparent importance of the topic, these questions remain unanswered. In this section, we look at multiple levels of interaction from DNA to work teams – views that promise new paths of research for management scholars.

In contrast to the traditional understanding of evolution guided by external forces of selection, Dr. Riegler investigates how a cybernetic theory of evolution suggests that evolution is channeled by internal constraints based on the reciprocal dependencies of the genetic material. In short, where the normal view is "top-down," Dr. Riegler provides us with a new, "bottom-up" view of evolution. This Batesonian view of evolution challenges, and perhaps compliments, the more common approach of understanding evolution in terms of "fitness landscapes" by developing a better understanding of an "epigenetic landscape." This new view lets us realize how our top-down view may easily skew our understanding of management and the creative change in work teams. Indeed, by gaining the ability to understand developmental paths, we may gain the ability to predict the development of a team, or an organization.

Dr. Hansson takes a new approach to the question of human agency with an investigation into the nature of human interaction in organizations. While some authors consider how supervisors acquire agency at the expense of employees, Hansson avoids such dualisms by investigating from a dialectical perspective – where both employees and supervisors gain agency through the process of social co-construction. He investigates the combination of individual and social influences to develop a new theory of learning object creation. Interestingly, he finds support for these views by applying an innovative research technique involving a facilitated group working both live and networked, so the researcher can capture interactions as well as reflections. These insights into social construction shine a new light onto an age-old question – and open the door for a new path of investigation.

Section 5
Metamodelling and Mathematics

Just as metatheory is the analysis of theory (to gain greater insights into theory), so too metamodelling and mathematics are used to gain better insights into modeling. The similarity is not a coincidence. Computer models are the dynamic software equivalent of management theories discussed in the previous chapters. In this final section of the book, we explore innovative advances in mathematics and computer modeling. The contributions of the brilliant scholars in this section suggest exciting opportunities to develop more effective computer models. After all, there can be a synergistic benefit where better computer models can lead to better management theories, and better management theories can lead to better computer models.

This author uses Petri nets to develop metamodelling insights into multi agent systems. He considers multiple levels of interactions of agents, their interfaces, and the related environment. He presents examples from inter-personal cooperation, inter-organizational negotiations, supervisor-system relationships, supervised-agents, and relationships in an environment of limited resources. This last (limited resources) is of particular importance, as limited resources will limit productivity and is often a cause of conflict. His results suggest opportunities for understanding paths for avoiding conflict and improving productivity in a wide variety of situations.

In this chapter, the author accepts an impressive challenge – to improve our ability to predict the accuracy of models. He shows how alternative approaches to prediction (deterministic and probabilistic) are limited. His approach looks at the model parameters as, "...time-varying but bounded variables, which are characterized by an interval of real numbers. Since the model parameters are intervals, the predicted system's response at any instant is not anymore a real number but an interval of real numbers. The set of predicted intervals at different instances generates a tube through time called *wrapping envelope*." This innovative metamodelling approach can be used to identify (and so limit) modeling error. In short, he opens the door for the creation of more effective models.

Readers are presented with the problem of "subset selection" (or, variable selection) – that arises when attempting to model the relationship between a topic of interest and the multiple, potential explanatory variables. This kind of problem is common in many decision-making or strategic planning situations where there is no easy answer; indeed, there are multiple possible answers with no way to be sure which one might be best. These authors submit new, simple, variable selection criteria. Their ambitious goal is to select the smallest number of decision-making criteria that can be used without losing **any** explanatory power. Their approach is tested with chemical processes, manpower allocation, housing prices, corporate profitability, supervisor performance, and more. The potential importance of this approach should be evident to anyone who has had to make a difficult decision.