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Book Review

*Discovering Hidden Temporal Patterns in Behavior and Interaction: T-Pattern Detection and Analysis with THEME™ b*y Magnus S. Magnusson, Judee K. Burgoon, & Maurizio Casarrubea (Eds.). Springer: New York, 2016, xviii + 333 pp., ISBN 978-1-4939-3248-1.

The title of this book accurately depicts the material within its covers; indeed, this edited volume provides articles from researchers, from numerous domains, who apply T-Pattern Detection and THEME™ software to study temporal patterns in their data. The 17 chapters are organized into two distinct sets: Human Behavior (11 chapters), and Animal and Neuronal Behavior (Non-Human Behavior; 6 chapters). In its entirety, the research reports emanate from 50 contributing authors, predominately based in Europe.

The T-system methodology discerns behaviors and interactions amongst entities (human or non-human) by capturing the temporal nature of such actions as recurrent, self-similar tree structures, collectively referred to as T-patterns. T-Data is a collection of T-series, which represent the occurrences of specific events within a specific observation period. Any statistically-consistent reoccurring set of events is referred to as a T-pattern. Different T-patterns can overlap with other T-patterns, which makes analysis problematic without advanced methods and a software aid. Applying complexity principles, e.g., fractals, T-patterns are arranged into a hierarchical binary tree (one with a fixed left and right node, corresponding to paired starting and ending events) formed from the bottom up—paired beginning and ending events, called T-Data and which occur recurrently, form patterns which can be detected temporally. Those patterns are then scrutinized for a repeated, higher-level pattern of the patterns. Recursively forming such a tree can reveal a self-similar, fractal-like formation. The process broadly resembles other cluster analysis techniques, such as hierarchical clustering analysis, though the T-system is oriented toward detection of patterns over time, rather than clustering according to other abstract characteristics. Moreover, specialists in symbolic dynamics and event pattern analysis may see similarities and subtle differences with ORBDE analysis (see Guastello, Peressini, & Bond, 2011).

A preface to the book, penned by University of Barcelona-based Professor M. Teresa Anguera, sets a humanized, but scientific tone for the chapters that follow. Her commentary reaches across the breadth of the chapters within and is effective in setting the stage for appreciating the relevance and power of the T-pattern detection method. She also adeptly contributes as co-author to two of the books chapters.

Next, the book's one-page introduction by its three editors, delves into

some of the socially- and software-oriented background and history of T-pattern detection. They introduce the THEME™ software to the reader, which serves to the needs of a newcomer as an inaugural introduction to T-pattern terminology and foretelling the necessity of access to T-pattern enabled software.[1] The editors point out that this book "can be seen as a sequel" (p. *xi*) to the book entitled, *The Hidden Structure of Interaction: From Neurons to Culture Patterns* (Anolli, Duncan, Magnusson, & Riva, 2005). At its conclusion, the book supplements the research chapters with a combined 732-entry name and topic index,

Moving to the core of the book, the opening chapter is solo-authored by co-editor Magnus S. Magnusson, who is the creator of the T-pattern model and author of the THEME™ software. This first chapter lures the reader into the merits of T-Patterns by presenting the basics ideas, terminology and practice of T-pattern analysis; however, a reader entirely new to the concepts might benefit from more direct pedagogical treatment in this starter (though Magnusson may not be intending the chapter to be a primer for the novice). Regardless, the opening chapter does successfully orient the reader towards analytically thinking about patterns and provides a basic sense of what T-pattern detection can do. The idea and value of T-pattern detection and analysis is captivating, though this chapter seemed an insufficient introduction. To supplement better understanding, a quick pivot to Magnusson's (2000) article would provide a mildly better explanation of the terminology, underlying ideas and procedures. Obtaining and exploring the THEME™ software is an obvious next step.

Each chapter, which range from 10 to 26 pages, stands on its own and showcases the applicability of T-pattern detection and analysis over a broad spectrum of research disciplines and subject matter. By comparison, Magnusson's chapter 1 is 35 pages, which is fitting, given it presenting the foundation of the book's subject matter. There is little consistency in the presentation style of the chapters, supporting the independent nature of the content. It would contribute to the cohesiveness of the book if even a rough template was used; as a result each chapter is a unique reading experience, though the message from most of the chapters is quite clear that T-pattern detection and analysis is productively applied in scientific data analysis in their respective domain. The reader does benefit from some chapters' expanded explanation of the methodology. For example, the Micol et al. (chapter 17) study on spike patterns in olfactory bulb neuronal networks distinguishes T-pattern analysis from the synfire detection algorithm, used in neuron pattern research and deals with *very short* intervals of the *same* length—T-pattern analysis accommodates *varied* intervals of *any* length. Other chapters merely mention their use of T-pattern detection without much pedagogy. For example, the Jonsson et al. (chapter 16) study on the location and movements of Atlantic cod merely indicates the explicit use of THEME™ and makes reference to the software's associated website; the chapter provides no constructive elaboration on the characteristics or benefits of T-pattern methods.

For me, given my research interest in organization behavior and computational modeling of communications within an organizational network,

the chapter that resonates the most is chapter 2 by Burgoon et al., which demonstrates the use of T-pattern detection and analysis in the context of deception in verbal communications: "Interpersonal deception is a dynamic process in which participating individuals adjust and adapt their behaviors as the deception proceeds" (p. 37).

The most evocative contribution this book makes—beyond offering an starter to T-pattern detection and analysis—is the opportunity it provides for the reader to purposefully delve into areas of scientific research that reach well outside the usual breadth one's academic range; this is the source of fresh ideas that can be adapted into one's own research domain. In terms most NDPLS readers can appreciate: I view this book as a butterfly flapping its wings (see Dooley, 2009) and serving as a *bridge* between the reader and *other* worlds, as nonlinear as this diffusion process may be.

As Magnusson points out and with reinforcement by the science and words of the 47 other contributing authors to chapter in this book, "the broadness of the concept of *pattern* is considerable (p. 3)". So, if a research project involves[2] group decision-making, detecting lies, paraverbal communications, self-injurious behavior, dementia, judo, facial movements, film art, video games, personal style, rodent behavior, nausea, red-rapped mangabeys, captive vervet monkeys, Atlantic cod, or olfactory bulbs, T-pattern detection has been demonstrated as useful. Of course, most research centers on something other than what is listed above; nevertheless, many research projects involve a recurring pattern of some kind. Behavioral-oriented research on any dynamic subject might benefit abundantly from T-pattern detection analysis; therefore, if a nudge is necessary: this is a book that every reader of NDPLS should explore, either by way of selected chapters or in its entirety.

NOTES

[1] See http://www.patternvision.com/

[2] This is a listing of research subjects studied using T-pattern analysis and correspondingly reported in the book's chapters

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