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REVIEW

Lourdes Ortega and Zhaohong Han (eds): *COMPLEXITY THEORY AND LANGUAGE DEVELOPMENT: IN CELEBRATION OF DIANE LARSEN-FREEMAN*. John Benjamins, 2017.

As a fast growing approach to language development, complexity theory (CT) explicates how variables of a complex language system interact and give rise to the system's collective behavior and how such a system interacts with the environment at the same time. Larsen-Freeman (1997) first introduced CT to the field of applied linguistics to explore complex language phenomena. After 20 years' trailblazing expedition, the CT approach to language and language development is 'cool enough to explore in a research project and hot enough to inspire new ideas' (MacIntyre *et al.* 2015: 428). Therefore, the volume *Complexity Theory and Language Development: in celebration of Diane Larsen-Freeman* is a timely contribution, offering a wealth of insights that promise a reconceptualization of language theory, research, and practice.

The book consists of 10 chapters, in addition to Introduction. The introductory chapter by Ortega and Han (the editors) pays homage to Diane Larsen-Freeman, specifically her works on CT, for her profound intellectual impact on second language acquisition (SLA) and applied linguistics. It also prepares the ground for the following chapters that explore the complexity thinking theoretically and methodologically. In Chapter 1, Larsen-Freeman argues that CT as a metatheory has broad transdisciplinary implications for language—its learning and use. In rejection of traditional reductionism in applied linguistics, the CT approach acknowledges language and its development as emergent, open, adaptive, interconnected, and context-dependent. She summarizes the CT-inspired thinking in 30 aphorisms spinning language, language learners/users, and language learning/teaching. The chapter concludes with elaboration on three issues that challenge CT: dichotomous thinking, boundary problem, and generalizability.

In Chapter 2, De Bot endeavors to distinguish two labels/theories used in applied linguistics: CT and dynamic systems theory (DST). By presenting the history and use of the two theories, he explains that they share compatible assumptions and a way of researching language systems. CT is closely related to Larsen-Freeman's work, whereas DST is more Groningen University based. As such, De Bot proposes to employ a cover label complex DST to refer to the theories combined.

Chapter 3 (Schumann) focuses on the complex relationships among brain, mind, and language systems. The author notes that many-to-one mappings of brain structure to function (also known as degeneracy) are common in neuroscience. The situation becomes more complex when the neural degeneracy

encounters the synonymy of the language used to label and explain the brain. One way to ameliorate this complexity, according to Schumann, is to distinguish a mental process from the brain networks that produce it. He shows how CT can help account for the interlocking relationship among brain, mind, and language systems. The brain–mind–language relationship is also investigated by Köpke in Chapter 9. Therefore, readers may like to read these two chapters together.

In Chapter 4, Dörnyei presents a CT-inspired discussion on individual difference (ID) in language learning. He embraces the idea that ID displays contingency, variation, multi-level interaction, and contextual dependence. This complexity shift challenges ID research theoretically and methodologically. Dörnyei's chapter constitutes a theoretical endeavor in line with CT. By drawing on two psychology theories (New Big Five model of personality and narrative identity), Dörnyei advances a three-tiered framework of learner characteristics, which takes into account dispositional traits, characteristic adaptations, and integrative life narratives. He draws on anxiety research to illustrate how learner characteristics could be reframed with a CT lens. Chapter 5 continues the discussion of ID but focuses on methodological challenges. In keeping with Dörnyei's complexity paradigm shift (Chapter 4), MacIntyre, MacKay, Ross, and Abel reviewed 12 specific methods for studying learners' IDs, including several qualitative designs, longitudinal cluster analysis, Q methodology, the trajectory equifinality model, the idiodynamic method, latent growth modeling, and change point analysis. This review largely closes the gap between CT-inspired theory and CT-informed methodology that often deters L2 researchers interested in CT. Similar efforts are made by Lowie (Chapter 6). He discusses the complementarity of two research dimensions (product-based vs. process-based) in applied linguistics, and argues for the necessity of conducting the CT-informed process-based research wherein inter/intra-individuality and multi-level interactions are accentuated. Different research methods are proposed: multiple case studies for inter/intra-individual variability and computer simulation for modeling changing relationships. Readers who are interested in CT will find the methods discussed in Chapters 5 and 6 exceedingly useful, considering that CT has long been viewed as a metatheory and that many researchers lack the knowledge of conducting CT-inspired research with appropriate methods.

In Chapter 7, Verspoor applies CT to language teaching. By linking CT to usage-based theories, she discusses the teaching issues concerning what and how to teach with a dynamic usage-based (DUB) view. The DUB instruction adopts Form-Use-Meaning-Mappings as teaching units and emphasizes authentic language exposure, meaningful interaction, and individual interests. She further showcases a film and language integrated learning program to illustrate how CT could be successfully applied to L2 teaching.

Chapters 8 through 10 provide a multidisciplinary account of complexity thinking in relation to language development. Opitz in Chapter 8 examines multilingual destabilization and relearning employing CT as a post hoc

theoretical prism, findings of which provide empirical evidence for CT claims such as the nonlinearity, the contextual dependence, and the interconnections of language systems. Köpke (Chapter 9) approaches language destabilization and attrition from a neuropsycholinguistic perspective. By gaining insights from neuroscience, Köpke demonstrates brain's natural and functional adaptation to structural disorganization and environmental changes, echoing Schumann's (Chapter 3) discussion on the intricate brain–mind–language relationship. Chapter 10 (Han, Bao, and Wiita) explains L2 development by drawing on energy conservation theory (ECT), a fundamental physics law. Key parameters (i.e. aptitude, motivation, L2 input, and L1-TL distance) of L2 attainment are identified, and the systematic interplay among the four parameters is revealed. Unlike CT's focus on variability and constant change, ECT sees regularity in L2 differential attainment. The authors argue that CT and ECT provide a micro- and a macro-scopic perspective on language development, respectively, and can complement each other. However, Han *et al.* do not explain their choices of the four parameters. Although they are all attested influential factors of L2 differential attainment, there may be other potentially effective variables worthy of consideration, such as age of onset and learner emotion.

To summarize, this volume features current complexity thinking about language and language development. Compared to other books on CT in applied linguistics, this book exhibits the multidisciplinary power of CT and offers a general set of patterns, outcomes, and descriptions that are applicable to many sorts of language systems. Moreover, consistent efforts have been made in this volume to balance the CT-*talking* and CT-*doing*. For the past years, researchers spent much time talking about exploring language systems rather than actually conducting CT-informed empirical research. The gap has been noticed and suggestions are offered, as synthesized in Chapters 5 through 7. The methodology review in Chapter 5 will greatly benefit the reader, as it not only provides a toolkit for conducting CT-inspired research but also holds great potential for positively impacting cognitive SLA researchers' use of quantification and statistics, as 'CT probably stands the closest. . . to interests pursued from traditional cognitive perspectives' (Ortega 2011: 173).

Like many other edited volumes with multiple contributors, this book is organized in a loosely thematic manner without a clear, unifying thread to follow. A commentary chapter in the end might be helpful in this regard, particularly in terms of the complementarity of CT and ECT in L2 development. In addition, it would be inspiring to incorporate more discussions on human agency, though it has been slightly touched upon by Larsen-Freeman in Chapter 1. It appears that the self-organization nature of complex systems denies human's agentive role in language learning. The apparent opposition between self-organization and human agency has increasingly been questioned by researchers who intend to apply CT to research technology-mediated language learning in informal settings, where learners are taking more control of their own learning.

Collectively, in a balanced and in-depth manner, this volume provides a comprehensive and interdisciplinary understanding of language and language development with a CT lens. Given its wide-ranging and rich content, it is undoubtedly an important work of reference for researchers and graduate students in SLA and applied linguistics in general.

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