Self-organization and the Process of Dynamic Learner Language Development

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Adopting Complex Dynamic Systems Theory (CDST) in Second Language Acquisition (SLA) is a testament to the revolutionary and evolutionary advancement in theory and empirical practice in the field. CDST is revolutionary for the fact that it warrants systems thinking of SLA phenomena that breaks the chain of dichotomous conceptualization on vital issues such as the mechanism of language acquisition and learning and the effectiveness of positive and negative evidence. The emergence of CDST, on the other hand, is an evolutionary product nurtured by the painstaking collaborations of SLA scholars for over two decades of scientific inquiry (see, e.g., Han, 2019; Hiver & Al-Hoorie, 2019; Larsen-Freeman & Cameron, 2008; Ortega & Han, 2017). To capitalize on CDST as a valid approach to scholarly work, it is necessary to grapple with its fundamental constructs. This forum piece accentuates a critical notion of CDST: *self-organization*. By first referring to the theoretical aspects of self-organization, this forum piece seeks to demonstrate the relevance of this notion in SLA. This piece will then review three sample studies homing in on learner language development with a CDST lens and a specific focus on self-organization.

Self-organization (SO) refers to a process where patterns at the global level of a system emerge from interactions among the lower-level components of the system (Kauffman, 1995). In essence, the emergent global features are consequences of system-internal influences rather than external factors. A frequently evoked SO example is a sand avalanche (Bak, 1996 cited in Evans, 2019). In particular, as grains of sand are continuously added to the pile from above, the size of the pile will grow to a critical point where it collapses and results in an avalanche. The process of a sand pile from a state of steady growth to abrupt changes is self-organized.

SO has been a construct that has intrigued scientists from all disciplines, including biology, mathematics, computer science, and cognitive science (Smith & Thelen, 2003). Despite the prevalence of SO in natural science, SO has also been noted by scholars in social science. For instance, van Geert (2011) contended that in alignment with other natural phenomena of growth over time, language development is a SO process. Larsen-Freeman and Cameron (2008) translated SO into the context of SLA by pointing out that an autonomous change of a system is not governed or directed by a specific force other than the internal dynamics of the system itself. In its simplest terms, instead of being other-mediated, the learner's language development system depends on the internal interplay of its subcomponents (Larsen-Freeman & Cameron, 2008).

The SO process pertains to unpredictable phase shifts from stability to changes characterized as highly variable, discontinuous, and chaotic (Evans, 2019). What happens during a period of phase shift is essentially triggered by the synergistic interaction of system components (Lewis, 2000). Provided that the system-internal changes could hardly be predicted, the SO process is deemed highly variable. To evoke the sand pile example again, the precise

moment of the avalanche is unpredicted even though its occurrence is inevitable. In Cameron's (2015) terms, "the new patterns of activity produced in the system after such a perturbation are said to have to emerge" spontaneously as the system iteratively adapts to new conditions (p. 36). Eventually, the tendency toward self-organization is materialized as a transition into "a more sophisticated arrangement of coordinated parts" (Lewis, 2000, p. 39).

An equally crucial concept relevant to SO is self-organized criticality (SOC), which was first coined by a group of theory physicists Bak, Tang, and Wiesenfeld (1987, as cited in Han et al., 2022). The layman's interpretation of SOC is "the edge of chaos" (Evans, 2019, p. 129) and "the tipping point" (Larsen-Freeman & Cameron, 2008, p. 67), which pinpoints the core of SOC. Specifically, systems with SOC adapt themselves to a critical state where a qualitative change is in place. Central to the concept of SOC is that change is endorsed by the system because "the avalanche is bound to happen, and if one particular grain does not cause it, some other grain will" (Larsen-Freeman & Cameron, 2008, p. 67). Therefore, proponents of SOC put a premium on the moment before the sand pile collapses, i.e., the critical and unpredictable segment of change occurring at the boundaries of attractor basins. Nevertheless, SOC has remained an uncharted area of research. To close this gap, de Bot (2008) proposed tracing learners' language experience to observe the likely continuous threshold for the critical points of qualitative changes and hence enable the potential of documenting a power law pattern in learner language development.

The unpredictability of such a shift in SO is attributed to the complexity of the interaction of the components. Therefore, what is worth noting is that the system components exhibit changes in tandem rather than in isolation. In other words, "a shift in one subsystem will necessarily occasion a shift in others" (Evans & Larsen-Freeman, 2020, p.10). Indeed, the action in tandem speaks to the connectedness of complex systems, for, by definition, a complex system comprises interdependent components (Larsen-Freeman, 2020; Cameron, 2015). That said, the impact of the process of SO emanates from multiple, if not all components of the system (Freeborn et al., 2022), and thereby CDST-inspired empirical endeavors ought to trace more than one element of the system to study the interconnectedness and mutual causality so as to delineate the features of SO processes.

SO and SOC seem to have attracted inadequate attention insofar as a presumably limited number of studies have yielded evidence of the presence of SO. Here are three. Larsen-Freeman (2006) reported moments of phase shift in the waxing and waning fluctuations of language development in her longitudinal investigation of five adult English learners who were learning English while residing in the US. Specifically, she noted that one participant used "in" and "at" in locative phrases interchangeably, indicating the instability of the learner language system preceding the self-organized criticality. By extension, the researcher suggested that such moments of edge of chaos are the prime time for interventions. Roehr-Brackin (2014) found that explicit instruction could drive a qualitative shift in L2 acquisition. The study tracked an adult learner of German for over three years for his use of gehen ("go", "walk") and fahren ("go by vehicle"), and found that his development of "gehen" was efficiently impacted by explicit instruction so that the system was kept away from undesirable attractor states. Similarly, Bragg (2018) investigated interactions between ESL instructors and learners and found that the synchronization between the dyads was emergent and self-organized. In particular, Bragg's study looked into verbal and non-verbal interactions and found that the tutor-learner dyads synchronized in their language, body positioning, and gaze. His findings indicated that once the

dyads were formed, the process of self-organization was automatic and socially driven so that the pairs' interactions continued to emerge in a new shared joint activity space.

In a nutshell, to study the emergence of self-organized processes, extensive attention should be paid to the interactions within the system, the search for variable and, at times, chaotic moments of qualitative change, and changes that arise in tandem in plural components of the system. Accompanied by the theoretical disentanglement and a brief review of three studies on this topic, this forum piece has attempted to take the construct of self-organization as a window to CDST and the process of SLA. By doing so, it hopes to inspire future work to further unravel the complex, dynamic, and self-organized developmental trajectory of second language acquisition.

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