

Marveling at the complexity of L2 development

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Abstract This contribution offers some reflections on Complex Dynamic Systems Theory, the theoretical framework with which Lowie and his colleagues at the University of Groningen study L1 and L2 development. Hulstijn wonders whether neural-network models will soon render grammar (in the narrow, formal sense) superfluous in the study of L2 acquisition. In the age of AI, the route of theory construction and theory testing remains as necessary as ever.

Keywords complex dynamic systems, L2 acquisition, metatheory, theory construction

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1 Introduction

It was an excellent idea of Marije Michel and Marjolijn Verspoor to devote this *View Points* in *DuJAL* to discussions of Wander Lowie's position paper (this issue), on the occasion of his retirement. In this contribution I place a few reflections on Complex Dynamic Systems Theory (CDST), the theoretical framework with which Lowie and his colleagues at the University of Groningen study L1 and L2 development.

2 CDST was part of a paradigm shift in cognitive psychology

From around the mid-1980s, dissatisfaction grew with the then dominant view of language as a decontextualized, highly abstract system. Many linguists returned to the study of authentic use of language (usage-based linguistics); cognitive scientists explored computational modeling (with 'neural' networks) of the representation and processing of language in the mind/brain; and other cognitive scientists explored the notion of complex dynamic systems (CDS) for the study of language development. CDS-thinking blossomed

up after the ground-breaking work of Thelen and Smith (1994).¹ Paul van Geert, professor of developmental psychology at the University of Groningen, extended the mathematical machinery of CDSs, and – importantly in the present context – inspired a group of ‘applied linguists’, around Kees de Bot, with Wander Lowie in their midst. De Bot adopted a CDS perspective on the study of L2 ‘development’, as the Groningers call their niche in the SLA (second language acquisition) field.

3 How I came across CDST

It must have been around the year 1990 that PhD student Diana Issidorides drew my attention to ‘connectionism’ (Rummelhart & McClelland, 1986) and the Competition Model of Bates and MacWhinney (1989). And it was a few years later that a relative of mine, a student of kinesthetics (the study of body motion), showed me the book *A dynamic systems approach to the development of cognition and action* (Thelen & Smith, 1994). Shortly later I read another seminal book, *The emergence of language* (MacWhinney, 1999). It was then clear to me that several big changes were taking place. But I had great difficulty with grasping their significance and impact. One reason was that I had also read how connectionist work was met by devastating critique of several influential scholars, among them Levelt (1990), whose voice had great authority for me.² And I had also noticed that Thelen and Smith (1994, pp. 41-43) were critical of the then non-dynamic approach of connectionism. Despite my latent doubts, I tried to paint an optimistic picture of this paradigm shift for the SLA field (Hulstijn, 2002).

4 CDST is a framework, a metatheory

For many years, I wondered: Can one derive falsifiable hypotheses from CDST? In the discussion period of the Round Table meeting on acquisition orders at EuroSLA 2013 in Amsterdam, Manfred Pienemann asked Lowie and Verspoor “How do you falsify DST”? Lowie then had only a few minutes to respond, which was obviously too short for addressing a fundamental issue. A few years later, the matter was discussed in two papers. I was glad when Gabriele Pallotti, philosophy-trained SLA researcher, formulated his concerns about CDST with respect to matters of falsifiability, generalizability, and reductionism (Pallotti, 2022). I was even more glad when, two years later, a reply came from our friends in Groningen (Van Dijk et al., 2025). Van Dijk et al. (2025) cleared up the confusion to which earlier papers could have given rise. They wrote (p. 5): “CDST is a metatheory, which implies that some of its assumptions cannot be falsified directly, nor do they need to be. It is not a ‘local’ theory as an explanation of specific observations or a solution to a problem.” Further down on the same page (p. 5), the authors write: “In Karl Popper’s critical rationalism, top-down rationalism and bottom-up empiricism are related in a

cyclical manner. The order Pallotti refers to in this regard is that theory leads to hypothesis formation, which can be tested empirically. We argue that the sequence actually consists of four steps: (1) top-down metatheory, (2) bottom-up guided explorations, (3) top-down theory/hypothesis formation, (4) bottom-up empirical testing (with eventually a fifth step of adaptation or rejection of the theory, etc.). Though the predictions in the first step should not be seen as falsifiable hypotheses (they are assumptions based on the general framework), testing the hypotheses in the third step is badly needed.”

5 SLA: Quo vadis?

The quotes from Van Dijk et al. (2025) in the previous section sound good. Equally convincing sounds to me Lowie’s distinction (Lowie, this issue, p. 5) between outcome-focused and process-focused research: “For example, outcome-focused studies might compare the impact of the age when L2 learning starts on L2 pronunciation quality (Derwing & Munro, 2013). In contrast, process-focused studies might examine how vowel production in an L2 learner evolves, initially fluctuating between L1 and L2 realizations before stabilizing toward target pronunciations (Verspoor et al., 2021).” However, I cannot stop thinking: When the metatheory is so plausible, how revealing or surprising can then the results of the proposed empirical work be? The findings of one bottom-up exploration (step 2) after another might simply support the CDST metatheory. Which fundamental problems, that CDST does not address, have remained? In a recent paper, six authorities in the field of L1 acquisition propose a two-by-two constraint-framework to guide theory construction (Rowland et al., 2026, p. 30): (1) the dimension of domain-general vs. domain-specific constraints on mechanisms for learning and adaptation (e.g., statistical learning vs. innate linguistic knowledge), and (2) the dimension of representational (knowledge based) vs. structural (architectural) constraints. This framework might be useful for SLA too.

The seeds that were planted in the last fifteen years of the previous century by scholars like McClelland, Elman, Bates and MacWhinney, and Thelen and Smith, now seem to have produced several fruitful trees, such as neural-network modeling and dynamic, multimodal perspectives of human development and learning. For decades, several prominent issues in SLA were guided by ‘formal’ linguistic theories of language, e.g., (1) formal constraints on acquisition and/or processing, (2) explanations of acquisition orders and sequences, and (3) explanations of crosslinguistic influences. These ‘formal’ theories conceive of language as a tripartite architecture (sound-grammar-meaning), in order to account for the mapping of utterances/sentences onto meaning, and vice versa.³ I wonder: Are we witnessing the end of this era in SLA? Will neural-network models render grammar (in the narrow, formal sense) superfluous in SLA? ChatGPT does not need a traditional grammar.

6 Marveling

When I was drafting this text, I was reading a book about the fascinating story of the universe and planet Earth, written by the German astronomer Heino Falcke (2025). On page 138 Falcke writes: “Ein Wunder ist etwas worüber ich mich wundere, selbst wenn es reiner Zufall ist” (approximately: a marvel is something I marvel at, even when it is pure chance). The author then discusses a pure-chance scenario for the origin of living cells. Up to the present day, this is still a hotly debated issue. Falcke (p. 138) refers to Albert Einstein’s famous phrase “Gott würfelt nicht” (God does not play dice)⁴ and concludes his discussion with a brief statement: “Daher braucht es am Ende das Experiment” (p. 141). The blessings and obligations for us scholars are that we may and must continue marveling and exploring – as Wander Lowie and his associates do with respect to this mysterious marvel called complex dynamic system. But in my view, perhaps outdated, it would be best to give priority to steps 3 and 4 in the quote above from Van Dijk et al. (2025): construction of ‘local’ theories and theory testing. As so often, I am probably too impatient.

Notes

- 1 The view of language as a complex system in linguistics itself, was voiced much later (e.g., Beckner et al., 2009; Mufwene et al., 2017). Surprisingly, the edited volumes of Sampson et al. (2009) and Newmeyer & Preston (2014) were focused on grammatical ‘complexity’, but not on language as a ‘complex system’. These two notions are fundamentally different.
- 2 McClelland (2015) illustrates how continued valid critique on ‘connectionism’ led him and his associates to overcome the shortcomings of successive distributed-neural-network models. See also McClelland (2022).
- 3 In most of the empirical studies conducted by Lowie and Verspoor and their associates since around 2015, holistic measures of language production are measured and compared. For example, in a longitudinal study, Verspoor et al. (2021), measured mean length of T-unit and Guiraud in L2 texts written by 22 L2 learners of English. Peng et al. (2022) measured the following “complexity measures” (p. 898) in the written production of 9 learners of L2 English: syntactic complexity (at the sentential, clausal, and phrasal levels) and lexical complexity (lexical variability, lexical rarity, and lexical disparity). The researchers did *not* count correct/incorrect occurrences of specific morpho-syntactic ‘target structures’. Thus, this kind of research is no longer guided by a particular theory of grammar.
- 4 “Gott würfelt nicht” is a rephrasing of the original sentence, which consisted of a main clause and a subclause. https://de.wikipedia.org/wiki/Gott_würfelt_nicht.

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Statement of technology use

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Supporting information

None.

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