

Re-orienting CALL through the lens of complexity theory

Robert Godwin-Jones¹

Abstract. Complexity Theory (CT) provides a useful framework for understanding Second Language Acquisition (SLA). Using an ecological model, CT studies the dynamic processes of change and emergent outcomes over time, tracing back how trajectories may have been affected by changes in and interactions among multiple variables and subsystems. Language learners do not follow linear learning paths, but rather their progress depends on a variety of interlocking variables. Developmental trajectories will look different for each learner. That is particularly the case for informal language learning, in which learners co-adapt from a wide variety of resources, leading to divergent outcomes (Godwin-Jones, 2018a). A CT approach emphasizes the dynamics of the interplay between learner variables and the people, artifacts, and services constituting the L2 learning system. It aligns well with usage-based linguistics. Viewing language learning from a CT perspective has a number of consequences for Computer Assisted Language Learning (CALL) research, explored here.

Keywords: complexity theory, SLA, CALL.

1. Introduction

SLA theories have difficult issues to account for (Atkinson, 2011). Some students make steady progress in the L2, but many will learn by fits and starts, feeling they have made insufficient progress compared to the time and effort spent. Those same learners may then have a positive encounter with a native speaker and suddenly realize that they have actually made a leap forward in proficiency. Learners might have mixed records in the classroom, but bloom with online L2 use through engagement with appealing content (video streaming, gaming, fanfiction) or

1. Virginia Commonwealth University, Richmond, VA, United States; rgjones@vcu.edu; <https://orcid.org/0000-0002-2377-3204>

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appealing peers (social media and fellow learners/L2 users). Language instructors are well aware of the reality that teaching does not necessarily lead to learning. Despite our best efforts and well-crafted curricula and lesson plans, some learners will prosper, and some will fail in the same classroom. At times, a teacher's random comment or slight word of praise will turn the motivational tide, which may come as an immediate reaction or occur much later. In summary, see below.

- SLA is highly variable with widely divergent individual learning trajectories even more so today than ever, due to access to a wealth of online materials, communities, and services.
- SLA is nonlinear, affected by myriad, shifting internal and external factors, with a complicated interplay between instructed and autonomous learning.
- SLA is unpredictable in its outcomes, with success or failure emerging over time through the intersections of learning goals, available resources, personal language history, external factors, and individual skills/knowledge/effort.

2. CT

The characteristics above align with a framework known as CT, also complex dynamic systems, which account for:

- the variability of learners (divergent 'initial conditions') and the uneven progress dependent on different dynamics of the learner with the learning environment;
- the peaks and valleys of SLA, through learners assembling resources on the fly and adapting them individually ('soft assembly' and 'co-adaptation'); and
- the unpredictability of SLA, with individually emergent learning outcomes over time.

The application of CT to SLA is not new, with [Larsen-Freeman \(1997\)](#) pioneering its use in applied linguistics. It has since been used in many areas within SLA, most recently for understanding the dynamics of L2 development through informal online resources ([Kusyk, 2017](#); [Sockett, 2014](#)). A CT framework is also

attractive because of its compatibility with views on the nature of language and language learning, which have been increasingly embraced by SLA researchers, namely usage-based linguistics (Ellis, 2017). This approach emphasizes patterns over rules. Supported by findings in corpus linguistics, usage-based views assert that L2 development occurs through the perception, use, and reuse of chunks of language, i.e. frequent combinations of lexis and syntax such as collocations, fixed expressions, or sentence frames. L2 users in the ‘digital wilds’ engaging in video streaming, gaming, or social media encounter multi-word constructions repeatedly in different contexts. Language and language learning are from this perspective open systems, with vocabulary and patterns learned over time (Godwin-Jones, 2018b).

3. Implications for CALL research

Assuming that language development is usage-based and that growth/interest in informal language learning will continue, a CT approach to CALL research might involve these realigned practices.

3.1. Emphasizing the learning context

Viewing language learning from such an ecological perspective places equal importance on learner characteristics and on the learning context, recognizing that their interaction is a constantly moving target, thus moving away from metaphors of linearity or mastery. CALL studies in naturalistic settings need to recognize the myriad intervening factors at play. Projects which focus on one particular online tool or service should take into consideration the likelihood of L2 learner-users engaging at the same time in other online L2 activities. Lin, Warschauer, and Blake (2016), for example, show gains in listening/speaking for users of LiveMocha, but the study does not take into account possible other online activities such as streaming L2 videos or engaging in private L2 chat. Furthermore, the learning context is crucial, i.e. a second language or foreign language context, providing or not local L2 affordances. Surveying study participants or collecting learning diaries on all L2-related activities would have supplied wider contexts for measuring L2 gains through LiveMocha.

3.2. Questioning simple causality

Rather than looking for cause-and-effect, CT calls for identifying emerging patterns within a wide realm of possible trajectories, affected by shifting variables

and interactions. Results of pre- and post-tests need to be interpreted cautiously, as multiple factors beyond those assumed may exist. Task-based studies need to recognize that “a perfectly designed task cannot be seen as a closed system where learners follow a pre-ordained path to completion and learning” (Levy & Moore, 2018, p. 2). From a CT perspective, studies examining progress in complexity-accuracy-fluency might optimally treat these L2 features as interrelated subsystems, with learners alternatively allocating primacy to one or another of those aspects of language development. CT helps to recognize and document such trade-off dynamics (see Yang & Sun, 2015, for an example).

3.3. Focusing on individuals

CT places primacy on documenting and describing individual learning histories over time and tracing successful trajectories back to see patterns of emergence – discovering different enabling, disrupting, or inhibiting learner behaviors and resource uses. Narrative, qualitative, and mixed method research approaches are best suited for analyzing learning trajectories. These can be aggregated to point to patterns and possible best practices, always keeping in mind how contextual dynamics can affect individual outcomes. This entails a new approach to replication studies. In naturalistic settings where conditions cannot be duplicated, varied initial conditions and environmental factors can be examined instead, and their outcomes traced. However, such an emphasis on the diversity of individual development paths poses a research difficulty in CALL. The typical procedure is to examine variables in relative isolation and seek cause-and-effect relationships between isolated factors. General tendencies observed in a group may not yield useful information in terms of individual outcomes. That is demonstrated in a recent study on listening comprehension, in which a traditional L2 study was re-conceptualized using a CT approach, yielding more informative results (Becker & Sturm, 2018).

3.4. Drawing themes from data

CT approaches CALL for collecting rich data over time and using a grounded approach to discover themes as they emerge from the data, rather than starting with a pre-defined set of research questions. Purely quantitative approaches can be helpful in providing a broad overview, but may not uncover individual development patterns. One option is to use clustering techniques to find revelatory sets of behaviors/outcomes. This can illuminate significant individual or group differences. Lee, Warschauer, and Lee (2019) re-examined a study by the same authors and this time used data-mining techniques to “shed light on unidentified learner types overshadowed by the average obtained through data analysis at the

group level. The two learner types had distinctively different learning patterns, so combining them produced a poorly defined ‘one-size-fits-all’ conclusion” (p. 144). The conclusion was informative, namely, that in fact the different groups “might require different accommodations to maximize their L2 vocabulary learning potentials” (Lee et al., 2019, p. 146). Thus, the application of CT in CALL may lead to practical applications.

4. Conclusions

A CT/CALL approach to instructional practice echoes these themes, allowing for differentiated language goals over time, enabling individualized exploration of extramural resources, combining explicit/in-person instruction with implicit/online learning, and encouraging self-reflection through personal narrative.

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