Author(s): Karimi Aghdam, Saeed

Title: A Dialectical Reading of Dynamic Systems Theory : Transcending Socialized Cognition and Cognized Social Dualism in L2 Studies

Year: 2016

Version:

Please cite the original version:

Karimi Aghdam, S. (2016). A Dialectical Reading of Dynamic Systems Theory : Transcending Socialized Cognition and Cognized Social Dualism in L2 Studies. Language and Sociocultural Theory, 3(1), 55-82. https://doi.org/10.1558/lst.v3i1.27547

To cite this article, please use the following bibliographic specifics:

Karimi-Aghdam, S. (2016). A dialectical reading of dynamic systems theory: Transcending socialized cognition and cognized social dualism in L2 studies. *Language and Sociocultural Theory*, 3(1)

http://www.equinoxpub.com/journals/index.php/LST

A Dialectical Reading of Dynamic Systems Theory: Transcending Socialized Cognition and Cognized Social Dualism in L2 Studies

Saeed Karimi-Aghdam
Department of Languages
University of Jyväskylä
Finland
saeed.karimi-aghdam@jyu.fi

Abstract

Dynamic systems theory (DST) has affordances to be a quintessential metatheoretical architecture for the nuancing of the time-locked mechanisms and processes of the L2 system. The received construal of DST in L2 studies presumes the emergence of structural regularities and the cognitive organization of the L2 system as simply a function of lower-level language use in social milieux. Critiquing some of the bedrock assumptions anchoring the extant reading, this article sketches a complementary dialectical construal of DST. Explicating circular causality, a nexus of causality types, and self-organizational emergence and their attendant implications for an adequate description and explanation of L2 as an emerging, dynamic and complex system are discussed respectively. The article concludes with some interpretive remarks.

Keywords dynamic systems theory; dialectic; L2 development; causality; emergence

Introduction

This article seeks to propose a dialectical framework for the integrated totality of second language development, drawing upon dynamic systems theory (DST). Specifically, a novel dialectical construal of DST as a quintessential unifying meta-theory (i.e., a theory about dynamic systems theories) for L2 studies is advanced. The suggested dialectical DST addresses perceived differences from the current conceptual scheme of DST in L2 studies to bring them into constructive engagement with each other.

While I register qualified affinities with some aspects of the received reading of the DST perspective in L2 research (de Bot, 2008; de Bot, Lowie, & Verspoor, 2007a, 2007b; Larsen-Freeman, 2011, 2012a, 2012b, 2013a; Cameron & Larsen-Freeman, 2007; Verspoor, de Bot, & Lowie, 2011, among others), here labeled the *contextual DST*, the proposed dialectical approach to DST is counterposed with the extant reading of DST on various counts. Most broadly, the guiding concern in the present argument is, nonetheless, to refine and cast some complementary light on the 'use-equals-L2 system' reading of DST in L2 studies through a scientific critique rather than to take precedence over contextual DST en bloc.

Whereas contextual DST tends to pass over the cognitive and agentive aspects of L2 developmental processes and to relegate the main cause of L2 development to socio-interactional language use in real-time scales, dialectical DST specifically focuses on the study of causal transactions involving both *socialized cognition* (i.e., psychogenesis) and *cognized social* (i.e., sociogenesis) dimensions of L2 development over different timescales (for an extended discussion of psychogenetic and sociogenetic aspects of L2, see Karimi-Aghdam a, under review; Hulstijn et al., 2014).

In consequence, dialectical DST further eschews a neo-Cartesian sort of reductionism (i.e., one which views the genesis, functioning and development of the L2 system as nothing but language use, with its intrinsic properties existing independently and in isolation). On the other hand, dialectical DST avoids assuming L2 development to be a teleological maturation of an inborn inner language faculty and orderly differentiation of a preordained and internal *essence* which is triggered by external language input and contextual contingencies. Dialectical DST aims at nuancing the evolutionary (i.e., quantitative and incremental changes) and revolutionary (i.e., qualitative and abrupt transformations) processes of L2 development and their

dialectical interdigitation over time (e.g., see also van Geert, 2007) without divorcing the social and cognitive dimensions.

Furthermore, the dialectical construal of DST affirms the *emergent* complexity and *bottom-up* causality (from local language use to global language development) of the L2 system, while also invoking mental causality (top-down causal influence from global language development to local language use) to explain its developmental trajectory over time. This stance is summarized and sanctioned succinctly by van Geert (2009) where he argues that 'short- and long-term processes are intertwined, implying that the short-term dynamics of language production directly affects the long-term dynamics of language development, and the other way around' (p.73).

In fact, contextual DST, by positing that the causal direction is one way from language use to language development (i.e., L2 development is a bottom-up causality type and, by implication, is an epiphenomenal derivative of situated linguistic interactions and usage) (e.g., see de Bot & Larsen-Freeman, 2011; Larsen-Freeman, 2011), implies passive and purposeless receptivity of the extrasomatic world in the L2 learner's mind. The view advanced here, unlike that implicit in the contextual version of DST, seeks to foreground the inextricable dialectic of the L2 learner's ongoing active engagement qua language practices and sociocultural environment. Importantly, dialectical DST maintains that the L2 system simultaneously enfolds socioculturally situated interactions and unfolds in socioculturally situated interactions. The embracive unity and struggle of L2 learner and socially and historically constructed *umwelt* is actualized mainly in and through linguistic practices.

To sum up, contextual DST will be immanently critiqued on the substantive grounds that (a) it overlooks the philosophical and metatheoretical underpinnings on which DST is built, and hence, presumably relegates DST to the status of a mundane and purely *theoretic* pursuit; (b) it seems to trivialize the cognitive aspect of DST and, by implication, brushes over the L2 learner's agentive intentionality and emergent properties and structures, which have indispensable causal impacts on L2 development; and (c) it glosses over the entwined axiomatic constructs of DST, namely self-organization and emergence, in DST-oriented experimental research; *a fortiori*, it eviscerates the theoretical explications and empirical studies of the non-linear and circular causality discourses.

The main thrust of this article, which is to critique contextual DST and propose a complementary, dialectical modal of DST, is presented in detail in the first section. The ensuing sections then elucidate the notion of circular causality and the attendant nexus of causality types along with the pivotal concept of emergence within the framework of, and in reference to, DST-based L2 scholarship. Finally, the article evaluates the current state of the debate and draws some conclusions.

Dynamic Systems Theory in Relation to Second Language Development: A Dialectical Reading

DST is an emerging refrain or as de Bot (2015, p.87) worded it 'a real paradigm shift' in L2 studies interested in scrutinizing the time-dependent developmental trajectory of an L2 as an emergent, dynamic and complex system. Since its inception in Larsen-Freeman's (1997) seminal article, DST and its associated lineage of descent (i.e., chaos/complexity theory) (Beckner, et al., 2009; Larsen-Freeman, 2002, 2010; Lowie, de Bot, & Verspoor, 2009; for a candid critique of complexity theory and DST in L2 studies, see Gregg, 2010) have been appropriated by a number of second language development scholars as a conceptual framework for elucidating the nature of the multiplicity of mechanisms underlying language development processes.

These studies deal with a wide spectrum of L2 issues entailing writing fluency (Baba & Nitta, 2014), untutored development of complexity and accuracy (Polat & Kim, 2014), L2 writing (Verspoor, Schmid, & Xu, 2012), willingness to communicate (Macintyre, & Legatto 2011), accuracy and complexity in writing (Spoelman & Verspoor, 2010), intra-individual variability (Verspoor, Lowie, & Van Dijk, 2008), development of grammars (Plaza–Pust, 2008), emergence of complexity, accuracy and fluency (CAF) in written and oral production (Larsen-Freeman, 2006), multilingualism (Herdina & Jessner, 2002; Jessner, 2008), and language learning motivation (Dörnyei, MacIntyre, & Henry, 2015).

Looking synoptically since Larsen-Freeman's (1997) early formulation, it seems reasonable to assert that contextual DST has not been successful in formulating an all-encompassing theory of L2 development, and so redressing the conceptual hiatus among current L2 theories and models even though it has some achievements to its credit. Additionally, lashing empirical work to the concepts and constructs of DST, without

explicitly digging into the commensurability of their higher-level paradigmatic assumptions, underlying conceptual axioms and philosophical underpinnings (see, among others, Baba & Nitta, 2014; Churchill, 2007; Hohenberger & Peltzer-Karpf, 2009; Larsen-Freeman, 2006; Macintyre & Legatto, 2011; Polat & Kim, 2014; Spoelman & Verspoor, 2010) is likely to lead to a theoretical cul-de-sac and sinusoidal advances in the discipline.

The line of reasoning applied in the dialectical construal of DST selectively draws on wide-ranging discussions generated in the developmental science literature (e.g., Lewis, 2011; Overton, 1991, 2006, 2010, 2015; Overton & Ennis, 2006; Thelen & Smith, 1994, 1998; van Geert, 2000; Witherington, 2007, 2011, 2014) and related L2 literature. In this conceptual scheme, the ongoing fluidity of *Reality* with a capital R is taken up to serve as a monistic (as diametrically opposed to dualistic) ontology for nuancing the nonlinear, continuous, and process-based nature of L2 development.

On this view, the presupposed dualistic dichotomy between the sociocultural and cognitive dimensions of L2 development dissolves, since these different perspectives are considered as merely two aspects of one and the same unitary L2 developmental process. More to the point, dialectical DST embraces the science of ceaseless fluent flux (i.e., active and changing *Reality*) as its axiological principle vis-à-vis discontinuous static permanence (i.e., fixed and inactive *Reality*). Hence, this interpretation accommodates, to use Hegelian terminology (Ilyenkov, 1977), the *becoming* (i.e., process) rather than *being* (i.e., substance) of L2 development.

Furthermore, in this conceptualization, language development does not happen exclusively inside the learner's mind by virtue of differentiating its innate and intrinsic language faculty nor is language development reducible wholesale to socially-conditioned language practices and actualities (see also, Larsen-Freeman, 2013b). Contrariwise, dialectical DST views L2 development as a dynamic, time-irreversible and developmental system which *emerges* out of a time-evolving and infinite iterative process of dialectically united and mutually interpenetrating opposites (i.e., through an ongoing learner-environment dialectical synthesis).

It follows from these arguments that the suggested dialectical interpretation of DST refuses to conflate the two aspects of L2 development (i.e., the social and the cognitive patterning of L2 learner's subjective experience of language development) and to

reduce the one to the other, but instead attempts to examine their interplay and link over time (see also van Geert, 2007). On this view, L2 as a unified whole of interrelated parts assumes novel attributes and properties, whereby it is qualitatively transformed and reconstituted through its interactive mechanisms and in ongoing dialogue with social and interactional engagement. Likewise, the subsystems and constitutive parts of the L2 system in their diversity and complexity equally acquire novel properties by being mediated by, and being part of, the L2 ordered whole system.

To use yet another notion from Hegelian dialectical logic, L2 development, when viewed from the standpoint of the dialectical DST, is an *emergent Aufhebung* (i.e., a preservative sublation in a higher totality) that is generated by the incessant interaction between the L2 learner and that learner's environment. This emergent system preserves and ceaselessly transcends the properties of both the L2 learner's mind and the environment while also remaining irreducible to their constituent attributes and properties.

Dialectical DST, as mentioned above, subscribes ontologically to a monistic and emergent materialism (i.e., this doctrine holds that the ultimate reality of L2 development is in process and nothing exists but matter and material agency) and to epistemological pluralism (i.e., the credo of sanctioning the investigation of L2 development from either social or cognitive standpoints, thereby employing a pluralistic methodology).

Also, dehistoricizing the process of language development is typical of L2 development research conducted from the contextual DST vantage point. For example, by postulating that 'there is basically no distinction between *development* and *use*' (de Bot & Larsen-Freeman 2011, p. 6, italics added) and 'all development is in fact the accumulation of real-time actions' (Verspoor, Lowie & Van Dijk, 2008, p.215), time is considered to be *homogeneous* (i.e., discrete timescales that are the same quantitatively are also seen as identical in terms of their putative uniformly regimenting effects on the L2 system) and *spatialized* (i.e., the static, objective, quantitative, discrete, abstract, extensive, chronological and mathematical timescales are projected into space) (e.g., see also Larsen-Freeman, 2015, p. 12). Having said this, probably time for contextual DST means an independent dimension even though it intends to investigate L2 change and the temporal unfolding of L2 system. That is, for contextual DST, developmental time,

by implication, is assumed to be the same as chronological real time or at best is pegged to their summation. Therefore, it may be granted that different time-interval translations (i.e., time values), for contextual DST, have no effect on the L2 system and the past of an L2 system can be projected into the future of that system, making its onward developmental trajectory more or less predictable.

More to the point, disaggregating developmental time into simply the mereological sum of real times finitizes the L2 system. Simplifying somewhat, the new characteristics and regularities that arise in the whole L2 system (i.e., emergent terminus patterns across time frames), according to the contextual DST view, are seen to be mere algebraic summations of individual discrete tokens of quantitative changes over time. These incremental changes manifest themselves in task-specific contextual contingencies and immediacies of L2 experience. Likewise, contextual DST seems to neglect the role of 'history of events' in the current and future paths of L2 development whereby temporal evolutionary gradations and experienced specificities gradually are added to previous ones.

However, historic events, as Pepper (1942) maintains, do not necessarily characterize specific past events and chronicles but are relational activities which are undergoing continuous and recursive change including now, thereby prolonging the past into the present. Hence, historic events are ongoing and interpenetrating acts that in their respective contexts concatenate an L2 learner's past (no-longer present) and future (not-yet present) and presuppose the past and the future. Recently, some proponents of contextual DST, following Smith and Thelen (2003), have acknowledged that 'real-time processing uses the dynamic history of components, while the real-time action itself becomes part of the dynamic history of the system' (Lowie & Verspoor, 2015, p.73).

I more than agree with this position, but for the dynamic and specific history of L2 system**s** qua emergent properties to exercise causal influence on real-time language use, it should have ontological reality and causal independence above and beyond the gradual accumulation of real-time language use. Besides, considering the sameness of L2 use and development appears incompatible with imputing the history of the L2 system with ontological reality and, by implication, causal autonomy. Therefore, it may be argued that contextual DST places the role of *history* of L2 development on a lower rung than current situated language use, and so leaves out of the account the generative

potentials of emergent and nascent structures on the future developmental possibilities of L2 system.

Contextual DST, in principle, fails to describe, let alone exhaustively explain how and why macroscopic properties and transformative changes in an individual learner's L2 system develop over time. In contrast, dialectical DST countenances an understanding of L2 development where emergent qualities, which more often than not predate situated language use, causally condition current communicative and dialogic interactions and feed back to reconstitute those interactions in specific ways.

Dialectical DST contends that L2 development, a higher form of metamorphosis and qualitative change, is different from real-time L2 variation which is a lower-level and purely quantitative change. Therefore, for dialectical DST, the totality of the L2 as an integral system is accounted for by embracing evolutionary (i.e., gradual and quantitative variation in degree) and revolutionary (i.e., transformative and qualitative variation in kind) changes in that system over time in which the emerging L2 whole forges new attributes and patterns by virtue of dialogic interactions and situated language uses and *vice versa*.

The dialectical opposition between evolutionary and revolutionary changes results in neither linear nor cyclic but in an ascensionally spiral and concretely helical L2 developmental path. The L2 system's emergent structures and contents would carry and conflate, in a residual or modified cast, aspects of both pure continuity and sudden rupture in its processual trajectory. For reasons to be explained later, however, dialectical DST opts to forego (tacit) acceptance of the divisibility of developmental time to identical chronological timescales and the assumption of the additive and accumulative nature of mini-real-times in the developmental process of L2 professed by contextual DST (e.g., see Verspoor, Lowie & Van Dijk, 2008).

Stated briefly, the dialectical view of L2 development is divested of an idealistic kernel (i.e., that physical/material language uses are really mental). Instead, emergent monistic materialism (i.e., the doctrine that the L2 system primordially is an interconnected set of emergent processes, properties and structural functioning) is housed in the dialectical shell as its pluralistic epistemological and heuristic apparatus (i.e., way of knowing or apprehending L2 development as an emergent system).

Thus conceived, dialectical synthesis employing the dialectic triad (i.e., thesis, antithesis, synthesis), 'an empirical descriptive theory' (Popper, 1940), seems a fitting candidate to account for the complex dynamics of stability and flux in the L2 developmental process at a higher level of sublatory integration. Additionally, dialectical DST admits of both psychogenesis and sociogenesis in L2 development within a unified worldview and helps to dismiss reductionist atomism or reified holistic conceptualizations of the L2 system (for a pro-holism aim of DST, see Larsen-Freeman, 2002, p.40). Next section briefly examines the issue of reciprocal (i.e., circular) causality.

Arrow of Causality in L2 Development: One-Way or Two-Way?

To strike a trade-off between the contextual and cognitive aspects of L2 change from the dialectical DST vantage point, and to reject the ontological reductionist stance implicitly present in the contextual DST literature on L2, it seems reasonable to pry open the *Pandora's Box* of causality. Portraying the L2 learner as merely a passive and indifferent human being who adapts his/her L2 system to the pre-given objective conditions and essentially external perturbations or otherwise as an active actor whose emergent and dynamic L2 system exerts a (causal) influence, whether an enabling or a constraining one, on his/her language use and developmental process patently has noteworthy implications for L2 studies.

Contextual DST by vindicating bottom-up causality, from real-time language use to language development, appears to support the first contention. For example, Lowie, Verspoor and de Bot (2009), basing their modal of DST on the usage-based school in opposition to the generative school of L2 development (Hulstijn, 2015), hold that 'changes in the [L2] system are the result of changes in language use, and the other way around: use is change and change is use' (p.125). For dialectical DST, in contrast, language use and the orderly configuration of the L2 system do not exist in a vacuum and independently of the L2 learner's subjective and intentional embodied agency. Therefore, it affirms the role in communicating in the target language of relatively enduring attitudes or a complex of dispositions of the L2 learner that differentiate him/her from other learners and that react back upon his/her language use in a redirective or transformative way.

Consequently, contextual DST's conceptualization seems to do an injustice to the crux of L2 development (i.e., the learner's agentive experience) in that it disregards the L2 learner's agency and volition in initiating and/or acting back on exogenous interactional forces. To better address the role of mental causation and the L2 learner's agency on, and his/her active contribution to, actual language practices warrants closer scrutiny of the issue of causality in DST research. It is important to note that, as discussed below, not all the properties of the L2 emergent system have their origins in social language use nor are emergents mere *timeless* mélange and recombination of a string of uncoupled and arbitrary changes over time.

Dialectical DST does not merely reject the vantage point that the learner's unintentional agency, conscious experience or otherwise, does not generate changes in L2 use. Rather, language use is perceived to be co-constructed by the interlocked interdependence and coupling of the learner's agency, both intentional and unintentional, qua emergent patterns in the mind, with environmental aspects and circumstances in the world. The L2 system exists and persists only in virtue of the particular L2 learner's purposive agency and the learner's agentive activity is rooted in, and emerges from, that learner's uses of the L2 in social milieux.

Put otherwise, with regard to causality, dialectical DST holds that the L2 system is neither exogenously heteronomous (i.e., a completely determined product of the fragmentary, probabilistic, experiential and contextual forces) nor endogenously autonomous (i.e., univocally determined by the L2 learner's unconditional agency in actualizing and unfolding teleologically the language faculty with which s/he is genetically endowed) but that L2 learner and sociocultural context characteristically presuppose the presence of each other. L2 development as a system is dependent on external and contextual interactional processes but some causal influences, existing over and above language use, are *sine qua non* conditions to mold order out of chaos in L2 organization.

Yet, it is important to grasp that the bilateral ontological dependence between mental L2 structures and actual language use in the sensuous physical environment is viable if one accepts *sui generis* the causal power that the learner's mental linguistic structures exert downward on his/her language use. Given that L2 development and L2 use are dependent on one another for their very existence and actualization, and L2 use would

have been otherwise without presence of emergent L2 structures in a particular set of social circumstance, it is hard not to accept the *de facto* existence (i.e., ontically real) and autonomous causal influences exercised by the emergent mental L2 system. To put this yet another way, if the causal efficacy of mental structures has no influence on L2 development, then it may be reasonable to argue that contextual DST sees L2 cognizance as an epiphenomenal byproduct of, and a causally *upward* process from, language use. Larsen-Freeman (2010), for example, upholds the epiphenomenal and inconsequential nature of L2 development, 'structure in language is seen as an epiphenomenon of interaction' (p. 57).

This standpoint has, at least, three ramifications for L2 research. First, accepting the epiphenomenal nature of the L2 system compromises the role of the L2 learner's purposive intervening agency on the process of L2 development and adapting his/her L2 system to changing and complex environmental perturbations. Second, without any causal efficacy, inquiry into the existence or non-existence of the L2 learner's mental ability and emergent structures would be otiose. Third, the 2 system as a human-centered phenomenon functions as a purposeful and goal-directed system rather than as a structurally and mechanistically analyzed or aggregated assemblage of parts and structures.

But, if one accepts the causal reality and autonomy of previously developed language structures, the invocation of efficient causality offers no theoretical purchase on mental causality. Moreover, granting intentional agency to the L2 learner, attributing causality to the learner's mental functioning, calls for the refinement and modification of the efficient and linear causal explanations of L2 development. This vein of argument is extended below.

All That Causes is not Efficient Causality

Explanations of the substance and structurally atomized and essentially discrete elements of L2 'acquisition', to sound a scientifically objective note, have capitalized on efficient causality, which is only one of the four categories in Aristotle's nexus of causes, namely, *material*, *formal*, *efficient* and *final* causes: (a) a material cause is the matter out of which something is made and provides 'the passive receptacle on which the remaining causes act' (Bunge, 1979, p. 32); (b) a formal cause is the essential nature

of a thing which distinguishes it from other things and contributes 'the essence, idea, or quality of the thing concerned' (Bunge, 1979, p. 32); (c) an efficient cause is an external 'source of motion' (Bunge, 1979, p.31) and makes or does something; (d) a final cause is the purpose, goal or 'the end of every generative or motive process' (Bunge,1979, p. 32) for which something is done or made. The material and formal causes are used to investigate the nature of being while the efficient and final causes are invoked to examine the process of becoming (Bunge, 1979).

From the dialectical DST standpoint, examining the source, trajectory and nature of the L2 developmental process just in light of efficient and one-way causality is regarded as deficient. Distinguishing *language development* and *language use* as iterative heterochronic levels (i.e., interconnected levels over different timescales) of a syncretized organizational whole and, more importantly, vesting each category with causal potency, leads to considering the employment of other causality types (i.e., formal and final causations) in addition to the taken-for-granted efficient causality in current L2 explanatory formulations.

Confining explanations of L2 development to efficient causality alone - the view that contextual DST, unlike dialectical DST and contra its claim to 'bridge the gap between holistic and reductionist views on SLA' (de Bot, Lowie, &Verspoor, 2007, p. 18), tacitly chooses to maintain - partly echoes the linear thinking and reductionist scientific doxa of the natural sciences that have pervaded the L2 discipline.

The assumption that every learner's L2 system moves purposefully and intentionally, regardless of unique micropathways and variegated initial conditions, toward conformity with socially constructed norms of target language use is reminiscent of what von Bertalanffy (1968) has termed equifinality (i.e., reaching the same final state from different initial states and in different ways). This axiological principle - the species-specific disposition of an intentional sense of direction and goal-seeking activities (i.e., a communicative *telos*) and performing goal-directed and purposeful actions - amounts to admitting final causality into explanations of L2 development. It should be emphasized here that a communicative telos, both immediate and remote, is dynamic and subject to change. Hence, every L2 learner, in principle, has the potentiality to construct and adapt a multi-pronged communicative telos, according to

changing general conditions and particular sinuosities as s/he perceive them to be, ranging back and forth across different timescales.

Put differently, the invocation of efficient causality is not well-suited for explaining how and why an L2 learner's agentic movement, a temporal process, toward a future reference point and anticipatory goal may occasion transformative changes while the L2 system is simultaneously both unified and differentiated. The contextual DST account renders goal-oriented and purposive activities of the L2 learner as a human being in learning a language trivial; thereby sidestepping distinctive causal effects of the L2 learner's willed significations and purposive activities on the developmental trajectories of the L2 system. For example, de Bot and Larsen-Freeman (2011) maintain that 'from a DST perspective there is *no goal* or *direction* in development; there is only *change*' (p.13, italics added).

On the other hand, Larsen-Freeman (2014) rightly discredits the teleological progress of L2 development (see also de Bot, Lowie, Thorne, & Verspoor, 2013, pp. 211-213). This latter position in the sense of L2 development not having a preordained design and a biologically pre-wired blueprint to be specialized by the experiential contingencies is espoused by dialectical DST. Nevertheless, the view that the L2 learner does not intentionally and purposively envision, reflect on, and engage with the evolving guiding references, goal-seeking expectations, hypothesized future and anticipatory possibilities in the L2 developmental process is disapproved. Therefore, it seems the L2 system as a unified totality is not identical with the purpose-shorn sum of language practices; thereby any adequate explanation of the L2 system should take on board the intentional aspect of L2 development.

Against this backdrop, it may be also argued that causal explanations in the contextual DST and SLA lines of inquiry appear to be agnostic about Aristotle's conceptualization of a causal matrix and are confined to implicitly indexing (efficient) causes while quantitative observable changes (causal effects) in L2 performance are presumed to meet the criteria of necessity and sufficiency. Stated differently, cause-probing qualitative inferences about the efficiency of manipulative events and attributes in L2 research are concerned with describing and explaining causally efficacious features (i.e., a series of quantitative, discontinuous and observable changes at

comparable timescales instead of the processual trajectories and continuous flows) of treatments/interventions in classroom or non-classroom contexts.

Furthermore, the invocation of efficient causality for the purpose of explicating L2 change, roughly speaking, is premised on the dependability of L2 change on exogenously exerted simple cause-and-effect ascriptions, contingent pathways, proportionality of contextual language input and learning/acquisition outcomes, a unidirectional bottom-up causal relation between, and a fixed correspondence of, language acts and language development as well as on the discrete nature and additive character of L2 changes.

To sum up, some signature dynamics of L2 development namely, self-organization, non-linearity, emergence, organized complexity (de Bot & Larsen-Freeman, 2011; Karimi-Aghdam a, under review; Larsen-Freeman, 1997, 2007, 2011; van Geert, 2007; van Geert & Verspoor, 2015), the helically iterative process of L2 development, bidirectional and reciprocal conditioning between real-time changes and developmental-time emergent patterns, demarcating causality in explanatory discourse on L2 development into different categories including mental and final causalities, crediting the L2 learner with intentional and embodied agential power and vindicating the irreducibility of language development and use to one another (Karimi-Aghdam b, under review) appear incommensurable, in some decisive respects, with the efficient and bottom-up types of causality that appear implicitly to be taken for granted in empirical research conducted on the basis of contextual DST. In this connection, the next section discusses the causality issue from another perspective.

A Revised Understanding of Causality in L2 Development

As already noted, causality is another issue on which the dialectical understanding of L2 development proposed in this article naturally is at variance with that of contextual DST. A one-way causal explanation (i.e., linear efficient causal trains) of instructional intervention and/or environmental practices (external unconnected antecedent) on L2 development (internal consequent), such as that posited by contextual DST, is implicative of passivity, or at most of reactivity, on the part of the L2 learner.

Nonetheless, the nature of the human intellect as active and self-propelled is difficult to question. In contrast, it is argued here quite simply that language practice in a social

context is concerned with only one causal side of L2 development. The assumption that that causal influence only flows from social dialogic interaction and language use *upward* and that the L2 learner qua already apperceived and emergent structures is deprived of making any causal contribution unnecessarily restricts, rather than enhances, the explanatory power of DST.

Viewing DST through a dialectical lens acknowledges the influence of language use in bringing about L2 development; whereas the contention that L2 development is confined only to efficient causality from 'bottom-up' is withheld. The bottom-up view of causality (de)limits the L2 learner's mental ability and agency in shaping and allegedly constraining actual language use (for an extended discussion of causality in DST, see Karimi-Aghdam b, under review).

Alternatively, dialectical DST draws a distinction between bottom-up (i.e., from local language use to global language development) and top-down (i.e., from global language development to local language use) causalities. Additionally, it holds that their reciprocal but unequal interaction exhibits a causation in which an emergent mental structure or pattern exerts an influence on lower-level language use and the other way round. It is thus conceivable, from the dialectical DST perspective, that every developmental pattern of language is neither ontologically nor causally reducible to language use.

Conceivably one plausible reason for contextual DST's elision of top-down causal influence and for its privileging bottom-up causality, from language use to language development, is that efficient causality is normativeized in the so-called 'hard' sciences. Understood thus, it is conceived of as *unscientific* to explain a phenomenon without invoking temporally prior antecedent conditions. In other words, only that which gives rise to both possible and actual phenomena and is capable of being known empirically, especially through the sense-perceptions or through immediate experience in the external world (i.e., efficient causality), is accepted as *the cause*. Thus, any *scientific* clarification of L2 development, from the contextual DST standpoint, possibly strives to frame its explanations, implicitly or otherwise, in terms of efficient causality terms.

Yet, another ostensible line of argument espoused by contextual DST is that it is language use in a material environment that first induces leverage for change in the learner's L2 system (e.g., Ellis, 2008; Ellis & Larsen-Freeman, 2006). While dialectical

DST expresses affinity with this viewpoint, it also maintains that L2 development as a dynamic system cannot be understood as the motionless and ossified imprint of language use on the learner's mind. Rather, for dialectical DST, the L2 system is an emergent and dynamic system whose properties also possess causal potency alongside that of the social practice and language use which engendered them in the first place. Therefore, L2 development, 'cannot be understood purely in experiential terms' (Ellis & Larsen-Freeman, 2006, p. 576)

Indeed, every L2 system is a manifold of lower-level and higher-level interacting functions and entities that continuously contribute causal impetus to the L2 system. On this view, developed nomothetic regularities and structured organizational properties of an L2 system are residua of the process of genesis that are causally dependent on language use but also enjoy causal autonomy in that they influence lower-level language use and dynamics in one way or another.

The emergent systemic properties and instances of language use are interwoven and mutually reinforcing, with each providing the necessary enabling conditions (i.e., providing necessary, but not sufficient conditions) for one another, and hence subject to causal contingencies. The type of causal influence exerted by these emergents, however, is not the same as that of language use (i.e., efficient causality); nevertheless, it is better characterized in terms of final and formal causality categories, as discussed above.

Legitimating the reducibility of L2 learner's cognizance to discrete aggregates of language use, and as an implicit corollary, warranting the reducibility and divisibility of the causal power of the system-level emergent properties in their entirety to causal ascriptions of local language use is arguably another inadvertent trap lying in wait for the adherents of contextual DST. While owning the isomorphic nature of the current language use and language change/growth, Larsen-Freeman (1997) plainly endorses this interpretation by stating that 'language *grows* and organizes itself from the *bottom up* in an *organic* way, as do other complex nonlinear systems' (p.148, italic added).

Dialectical DST registers that the systemic emergent qualities of the L2 in terms of causality are nomologically dependent upon, yet not reducible to, the ascriptions and capacities of isolated language use in a social hull. Moreover, the attribution of inferred characteristics of collections of observable and quantitative changes in learners' linguistic outputs, termed synchronic variation (Gass, 1988), 'as an inherent property of

a changing system' (de Bot et al., 2007a, p.14), to the totality of language cognizance short-circuits exploring viable effects of the higher-level mental attributes on actual contextualized language use. This leads us squarely to the discussion in the next section, which affords some insights on the interdependent relation between causality and L2 emergence.

Causal Explanation of Self-Organizational L2 Emergence

'Emergence through self-organization'(Thompson, 2007), that is, the emergence of qualitatively novel patterns at the system level by dint of interactions among components operative at the lower level, is one of the metatheoretical axioms of DST (Ellis & Larsen-Freeman, 2006; Karimi-Aghdam b, under review; Larsen-Freeman & Cameron, 2008a, 2008b; Lewis, 2000; van Geert, 2008; Witherington 2011, Van Geert & Verspoor, 2015). In the broadest construal of emergence, Bedau (1997) underpins the centerpieces of emergence, i.e., 'novel and coherent structures, patterns, and properties' (Goldstein, 1999, p.49), as follows: '(1) Emergent phenomena are somehow *constituted by*, and *generated from*, underlying processes. (2) Emergent phenomena are somehow *autonomous* from underlying processes' (p. 375, italics in original).

Housed within L2 developmental studies, self-organizational emergence entails the coming into existence of structural regularities in the L2 learner's linguistic representations (Ellis, 2003) as a result of intentional and meaningful attention to experiential exposures to the L2 use. Hence, situational and localized L2 usage within the contingencies of the 'here-and-now' of the world is the driver of a dynamic nisus (i.e., tendency) toward organized complexification of the L2 system. Accordingly, self-organization accounts for the epigenesis of novelty, complexity and adaptivity of the L2 system (Beckner et al., 2009; Ellis, 1998; Ellis & Larsen-Freeman, 2006).

In the wake of such discourses in DST-oriented L2 research, it seems an oversimplification to impute first-person instantiations of underlying L2 knowledge in the development of an L2 solely to a single underlying causal mechanism (i.e., language use in vivo) without regard to the possible causal influence of already internalized mental structures. In response to concerns about divorcing human agency from the explanation of L2 development by dint of internal self-organizing changes in the guise of emergences, contextual DST has offered, as a plausible justification, the absence of

any conscious intentionality on the part of L2 learners in the transformation of individual language resources (Larsen-Freeman & Cameron, 2008a).

This line of reasoning belies the strong claims made in the literature for the notion of reciprocal or circular causality between the lower and higher levels of L2 as a dynamic complex system (Ellis & Larsen-Freeman, 2006; Karimi-Aghdam b, under review; Larsen-Freeman & Cameron, 2008a). By the same token, given the particular salience of intentional agency to a purposive transformation rather than a mechanistic translation of emergent linguistic structures into language use, it may be argued that the notion of circular causality has been bypassed by contextual DST.

Reducing the causal momentum of the emergent patterns of the L2 system at the global level, despite the asymmetrical relationship between the local and global levels in the causality nexus (Thompson & Varela, 2001) to fundamental causes of L2 use in social milieux is misguided. This becomes clear especially when qualitatively novel system properties are discussed in relation to a human-centered phenomenon such as language development. Vesting determinant causal power in one-way, local-to-global, bottom-up causal mechanisms through which local dialogic interactions synchronically and unidirectionally engender global system-level properties across various timescales is premised on the concept of *creatio ex nihilo* (i.e., creation out of nothing).

For example, Ellis (2006) considers language acquisition to be 'contingency learning, that is, the gathering of information about the relative frequencies of form–function mappings' (p.1). On the contrary, dialectical DST asserts that the causal connection between mental structures and language use moves in both directions across the local-global temporal hierarchy. More to the point, for dialectical DST the emergent mental structures are vehicles through which the L2 learner's communicative ability, in tandem with local circumstances and dialogic interactions, co-evolve, conterminously develop and are tested in practice.

The ontogenetic emergence of patterns in the L2 system should necessarily develop from recursive interactions among lower-level constitutive components, such as social interactions and emergent systemic properties and structures, which are already present in the mind of L2 learner. Accepting that L2 use alone brings about L2 development seriatim (i.e., in serial order) amounts to the argument that the mind of the L2 learner is a passive container into which each new language use is poured. In a similar vein, it

should be emphasized that, from the contextual DST persuasion, language use in social milieux is not an effect but a cause of language development. Larsen-Freeman (2011) advances this view which 'sees language as a dynamic set of patterns *emerging* from *use*. Over time, those [language uses] that frequently, saliently, and reliably *occur* become *emergent stabilities* in a complex system' (p. 52, italics added).

In flat contradiction to contextual DST, in the dialectical construal of DST, language use is seen as both medium and outcome (i.e., both cause and effect), since emergent properties and situated language use presuppose, and are constitutive of, one another. That is, mental causation à la emergent qualities and structures exercises causal influence on the instantiations of emergent properties, orienting them in fulfilling the communicative acts in the real world that gave rise to them in the first place. Additionally, dialectical DST sees that language use or the process of externalization is not the direct projection of emergent patterns into the real world. Alternatively, every instance of language practice is an emergent entity *sui generis*, which transpires through seamless negotiation between already-emerged patterns and contextual-social particularities.

By assuming, even in principle, that language use and language development are the same or that language development is reducible to language use, contextual DST cordons off L2 development from the kinds of causal influences which the emergent L2 system-endogenous organization and structures may have on the L2 developmental trajectory. Moreover, as mentioned above, the temporal precedence of language use, and its one-way influence on language development leads to the conclusion that language use is antecedent (i.e., causally efficacious) and that language development is consequent (i.e., causally ineffective). Hence, an argument that favors the supposition that language use by the L2 learner comes out of nothing and that L2 emergence, in which the language production of L2 learners, by drawing upon already developed knowledge, is unidirectional can have no role in explaining the emergence of novel developmental patterns.

Likewise, inasmuch as the dynamicity of the L2 system is bound to different timescales, distinguishing between diachronic and synchronic conceptualizations of emergence (Humphreys, 2008) seems inevitable. Diachronic emergence, Humphreys (2008) argues, 'primarily, but not exclusively, emphasizes the emergence of novel

phenomena across time' while synchronic emergence accentuates 'the co-existence of novel 'higher level' objects or properties with objects or properties existing at some 'lower level'' (p. 431). According to contextual DST 'they [real-time processing, development, learning, and evolution] are essentially the same, though at different time scales' (Lowie & Verspoor, 2015, p.73).

That said, taking the sameness of L2 use and development for granted, a stance to which contextual DST subscribes, results in conflating the diachronic and synchronic emergence of L2 patterns or in reducing one to the other - hence the metatheoretical *insouciance* (i.e., lack of concern) about time which is the linchpin of DST. One explicit corollary of assuming the sameness of language use and development or postulating one-way causal determination of the L2 system through language use is to consider the L2 system as an atemporal and acausal agglomeration of discrete and disparate changes.

Contextual DST, by positing that L2 development derives from the aggregation of individual language use, holds that diachronically emergent properties and patterns are the mere summation of synchronically precipitative emergent properties. In a similar vein, the temporal atomistic isolation of emergent properties over different timescales to real-time language changes at given points of time betokens that contextual DST overlooks the unpredictable time evolution or dynamicity of the L2 system as a nonlinear system. Instead, dialectical DST does not regard time as single, unrelated and isolated discrete points and instants but, rather as a continuously extending, heterogeneous and multiscalar flowing phenomenon which perdures from moment to moment. This enables dialectical DST to nuance the developmental emergence of the L2 system; that is, the emergence of complex qualitative changes from simple quantitative changes.

An open question to be addressed by contextual DST is how it is possible to explain the developmental trajectory of the temporal evolution and revolution of a time-dependent (i.e., dynamic) system such as the L2 solely by equating language use and language change (e.g., de Bot et al., 2007b). Importantly, if the developmental time of the L2 system is regarded as a montage of discrete real-time points, by implication, it seems to contradict the *dynamicity* (i.e., time-dependency) of the L2 system.

If the dialectical construal of DST introduced here with regard to the time-dependency of L2 development is considered perverse, insofar as contextual DST

contends that it avoids predicting and anticipating the future inductively in the sense valued in the natural sciences (Larsen-Freeman & Cameron, 2008a, 2008b), then retrospective scrutiny of the pathways of the L2 developmental process becomes redundant.

The retrospective investigation or 'retrodiction' (de Bot & Larsen-Freeman, 2011, p. 20) of the developmental trajectory of L2 pivots on distinguishing between real-time changes and developmental-time patterns in the L2 system. Otherwise, an aggregate of real-time changes within the L2 system that manifest themselves in actual language use would be sufficient to depict the contours of the L2 developmental trajectory. In a similar vein, cross-sectional probing of the discrete and piecemeal present-oriented changes and multiplicities betokened by actual language use in a social context sharpens the focus on the quantitative changes at the expense of qualitative transformative changes in the L2 system.

To steer clear of these conundrums, dialectical DST sees it as important to distinguish between developmental time and real-time language changes. Real-time changes in the L2 system are essentially quantitative while developmental changes are qualitative in nature. For this reason, developmental changes are *emergent* properties that have their origins in both self-organization and exogenously synthesized interactions in the L2 system. In contrast, for their coming into being, real-time changes depend on extra-system low-level dialogic interactions and uses. Furthermore, for dialectical DST, developmental time changes in the L2 system cannot be explained by the mere summation of real-time quantitative changes, even though real-time changes are constitutive of the L2 system.

As such, explaining emergent properties in developmental time requires other types of causalities in addition to efficient causality. Two critical implications for L2 studies can be drawn from this line of reasoning. First, the stability of an L2 learner's system in developmental time does not necessarily imply stability in real-time language use. The L2 system preserves some persistent qualitative attributes at the level of the whole ensemble despite the fact that the individual parts and structures are mutating incessantly. Second, real-time change and variability ineluctably increase the probabilities of change at the developmental level. Their effect on L2 as a contingent and therefore largely unpredictable whole, nonetheless, has yet to be determined by the

reciprocal and correlative, but not identical, interaction between the emergent patterns and contextual idiosyncrasies.

Yet another issue that contextual DST should address is the axiomatic notion of emergence, the importance of which cannot be overstated in L2 scholarship (Ellis, 1998; Ellis & Larsen-Freeman, 2006; Karimi-Aghdam b, under review; Larsen-Freeman & Cameron, 2008a, 2008b). Privileging bottom-up local-to-global emergence by equating language use and language development and by viewing 'grammar … as epiphenomenal, a by-product of a communication process'(Larsen-Freeman, 2002, p.42), a position which resonates with many aspects of contextual DST, not only implies subscribing to synchronic emergence but also to epistemological emergence (Silberstein & McGeever, 1999).

Epistemological emergent patterns are *prima facie* novel properties which are neither reducible to, nor predictable even in principle from lower-level components of the system or their respective relations. These *artifacts* are devoid of any causal influence, i.e., downward causation, on their constitutive parts and are only descriptively novel (Silberstein, 2002; Silberstein & McGeever, 1999). The type of L2 emergent patterns that follow from contextual DST (de Bot & Larsen-Freeman, 2011; Ellis & Larsen-Freeman, 2006; Larsen-Freeman & Cameron, 2008a, 2008b) falls squarely within epistemological emergentism or 'weak emergence' (Bedau, 1997), as 'the property is reducible to or determined by the intrinsic properties of the ultimate constituents of the object or system' (Silberstein & McGeever, 1999, p.186).

Strictly speaking, the view that the novelty of epiphenomenally emergent properties of L2 structures arises solely out of spatiotemporal language use, embraced by contextual DST, may be ascribable to a difference in the descriptive level at which macroregularities are accounted for. Therefore, the novelty of the L2 structure, on this view, is a relative novelty rather than a genuinely real novelty, owing to the fact that ontologically novel emergent properties are neither predictable nor reducible to properties of lower-level components and processes.

If L2 as a dynamic and complex system is a nested system (Larsen-Freeman & Cameron, 2008a, 2008b) of characteristic properties and processes in which every system is a subsystem of a higher system, and simultaneously a higher system on all lower-level subsystems, emergence, from the contextual DST standpoint, may be

pegged to the descriptive level of the L2 system and so have no real ontological status in that system.

On this view of L2 emergence, novel properties seem to be stripped-down causally leaving the lower-level processes and dynamic interactions in their subsystems as the only underlying causal mechanisms governing both the local components and global emergent properties, and thereby bracketing off the causal influence of previously emergent L2 structures on not-yet-observable structures. Still another resultant of ignoring the causal equipotency of lower-level language use and higher-level language developmental patterns and properties, one of the points at which dialectical DST most diverges from contextual DST, concerns the explanation of L2 developmental patterns and structures.

These explanations, according to contextual DST, are confined to the synchronic exposition of how the capacities of the L2 system depend on the capacities, structure and properties of its constituent parts (i.e., real-time language use), rather than addressing the coming into being of complex systems over a period of time and the relative mechanisms which subtend them (Schröder, 1998). Therefore, by historicizing the explanation of the L2 development process, dialectical DST also, consequently, safeguards the L2 system from turning into inexplicable disarray of agglomerative changes. Moreover, dialectical DST by invoking different types of causalities in Aristotelian nexus of causes salvages DST from turning into 'an ultimately *mechanistic metaphor* for [describing and ultimately explaining] language and language use' (de Bot, Verspoor, & Lowie, 2005, p.117, italics added).

DST in its dialectical stripe, as opposed to contextual DST, also sanctions circular causality (i.e., mutual adaptation) by accepting the causally reciprocal but disproportional influence of real-time language use on the emergent properties of the L2 system as a whole over time and vice versa. Therefore, both language use and the L2 system are simultaneously cause and effect and constant change is an inherent characteristic of the L2 system and language use at multiple levels and over different timescales.

With regard to downward causality, dialectical DST withholds the bestowal of the power of *efficient* causality upon patterns of L2 development. On the contrary, in accounting for the causal influence of emergent L2 attributes, dialectical DST embraces

the final and formal types of causality in Aristotle's causal nexus. In this way, without either reducing the emergence over time of L2 patterns to real-time language-use dynamics or their conflation, dialectical DST explains the developmental trajectory of the L2 system over time.

To sum up, to arrive at an adequate description and (causal) explanation of the mechanisms of L2 developmental process, it is necessary, in accord with the dialectical DST position, to entertain the role of final and formal causes in L2 studies. In a similar vein, by way of avoiding charitable explanations and conjectural inferences regarding the results and findings of empirical research, dialectical DST espouses the scientific legitimacy of two-way causality, upward from fundamental social dialogic interactions to emergent patterns and downward from mental properties that exert causal influence on the actual local dialogic interactions at the lower level.

Relatedly, for the dialectical reading of DST, language use and the self-organization of the L2 system effect emergent patterns and properties which are seen to be graced with causal influence in addition to those of their respective lower-level constituents. Thus, the L2 learner's agency can impinge on actual language use, while the causal influence between emergent patterns and local language use is bidirectional and non-linear. More to the point, because of the incessant causal reciprocity between emergent qualitative transformations and lower-level language use, the complexification of the L2 system not only becomes plausible but it can also be seen to be organized.

Conclusion

The central thesis of this article was to advance a dialectical construal of DST as a metatheory for L2 studies by unearthing its metatheoretical postulates and axioms. To distill an overarching theoretical edifice based on dynamic systems thinking, some threads of argument from neighboring disciplines such as psychology and philosophy were drawn together. Further, it was argued that by assuming a monistic and relational ontology (i.e., process of change), L2 research would be able to embody theories which are subsumed under the rubric of dialectical DST. Moreover, it was argued that contextual DST, currently the only construal in L2 studies, has obscured the cognitive dimension of DST. Underpinning this assertion is the fact that, to disentangle the mechanisms of change from the DST vantage point, cognitive aspects of development

historically have been grafted onto contextual facets and variations in other disciplines, such as developmental psychology.

It was asserted that the inchoate generalization, moving one-way from language use to language development, held by contextual DST, excavates the thrust of DST in seeking to account for the integral whole of L2 development. It was also claimed that contextual DST has (mis)interpreted, and appears to be bereft of explicit reference to, the putative ontological and epistemological axioms of DST. On the same score, it was concluded that despite the insights that the only dominant construal in L2 studies (i.e., contextual DST) has generated, DST is denuded of much of its theoretical weight.

Moreover, contextual DST was critiqued for relegating DST to metaphorical embellishments in experimental studies. It was also contended that dialectical DST parts company with contextual DST on five main counts: (a) by arguing for the unceasing flux and motion of L2 development with regard to both micro-real-time dialogic interactions at the social level and macro-developmental-time trajectories at the mental level; (b) by accommodating formal and final causalities as envisaged by Aristotle's framework in its explanatory holistic system; (c) by admitting that the causal explanation of L2 development is enriched by calling into play circular causality (i.e., reciprocal chains of causality) and, by implication, combining top-down macro-causation (i.e., emergent mental causality) and micro-to-macro bottom-up causation (i.e., efficient local environmental and instructional interactions) which enjoys bidirectional influences; (d) by nullifying the epiphenomenal conceptualization of L2 and ontological reductionism of L2 to social dialogic interactions; and (e) by vindicating L2 as an emergent, dynamic, purposive and complex system which is irreducible to either social dialogic interactions or human agency (i.e., acquired and/or endowed mental causal potency, purposive intentions, internal motivation, etc.).

Acknowledgments

I would like to thank Hannele Dufva for her guidance, many helpful comments and enormously constructive feedback in the preparation of the manuscript. I owe special thanks to the editor of the journal, James P. Lantolf, for his continual support and constructive comments. I also gratefully acknowledge useful suggestions, insightful comments and clarifying remarks from Diane Larsen-Freeman, Kevin R. Gregg,

Stephen J. Cowley, Brian MacWhinney, Jay Lemke and the anonymous reviewers on earlier drafts of this article even though it does not represent a consensus statement, nor have there been unanimous stances among these scholars. All remaining flaws, misconstruals and errors, needless to say, are solely mine.

About the author

Saeed Karimi-Aghdam is currently a Ph.D. candidate in Applied Linguistics at the Department of Languages, University of Jyväskylä, Finland. His current research interests include Vygotskian cultural-historical theory, dynamic systems theory, emergentism and second language development.

References

Baba, K., & R. Nitta. **(**2014). Phase transitions in development of writing fluency from a complex dynamic systems perspective. *Language Learning*, 64, 1–35.

Beckner, C., R. Blythe, J. Bybee, M. H. Christiansen, W. Croft, N. C. Ellis, & T. Schoenemann. (2009). Language is a complex adaptive system: Position paper. *Language Learning*, 59/s, 1-26.

Bedau, M. A. (1997). Weak emergence. *Noûs*, 31/s, 375-99.

Bunge, M. (1979). *Causality and modern science*. Dover Publications.

Cameron, L. & D. Larsen-Freeman. (2007). Complex systems and applied linguistics. *International Journal of Applied Linguistics*, 17, 226-40.

Churchill, E. (2007). A dynamic systems account of learning a word: From ecology to form relations. *Applied Linguistics*, 29, 339-58.

de Bot, K. (2008). Introduction: Second language development as a dynamic process. *The Modern Language Journal*, 92, 166–78.

de Bot, K. 2015. *A history of applied linguistics: From 1980 to the present*. Routledge.

de Bot, K., Verspoor, M., & Lowie, W. (2005). Dynamic systems theory and applied linguistics: The ultimate “so what”?. *International Journal of Applied Linguistics*, 15, 116-118.

de Bot, K., W. Lowie, & M. Verspoor. (2007a). A dynamic systems theory approach to second language acquisition. *Bilingualism: Language and Cognition*, 10, 7-21.

de Bot, K., W. Lowie, & M. Verspoor. (2007b). A dynamic view as a complementary perspective. *Bilingualism: Language and Cognition*, 10, 51-5.

de Bot, K. & D. Larsen-Freeman. (2011). Researching second language development from a dynamic systems theory perspective. In M. Verspoor, K. de Bot & W. Lowie (Eds.), *A dynamic approach to second language development*. John Benjamins.

de Bot, K., Lowie, W., Thorne, S. L., & Verspoor, M. (2013). Dynamic systems theory as a comprehensive theory of second language development. In M. Mayo, M. Gutierrez Mangado, & M. Adrián (Eds.), *Contemporary approaches to second language acquisition*. John Benjamins.

Dörnyei. Z., MacIntyre, P., & Henry, A. (Eds.) (2015). *Motivational dynamics in language learning*. Multilingual Matters.

Ellis, N. C. (1998). Emergentism, connectionism and language learning. *Language Learning*, 48, 631-64.

Ellis, N. C. (2003). Constructions, chunking, and connectionism: The emergence of second language structure. In C. Doughty & M. Long (Eds.), *The handbook of second language acquisition*. Blackwell.

Ellis, N. C. (2008). The dynamics of second language emergence: Cycles of language use, language change, and language acquisition. *The Modern Language Journal*, 92, 232-49.

Ellis, N. C. & D. Larsen-Freeman. (2006). Language emergence: Implications for applied linguistics—Introduction to the special issue. *Applied Linguistics*, 27, 558-89.

Gass, S. M. (1988). Integrating research areas: A framework for second language studies. *Applied Linguistics*, 9, 198-217.

Goldstein, J. (1999). Emergence as a construct: History and issues. *Emergence*, 1, 49-72.

Gregg, K. R. (2010). Review article: Shallow draughts: Larsen-Freeman and Cameron on complexity. *Second Language Research*, 26, 549-60.

Herdina, P., & Jessner, U. (2002). *A dynamic model of multilingualism: Perspectives of change in psycholinguistics.* Multilingual Matters.

Hohenberger, A. & A. Peltzer-Karpf. (2009). Language learning from the perspective of nonlinear dynamic systems. *Linguistics*, 47, 481-511.

Hulstijn, J. H. (2015). Discussion: How different can perspectives on L2 development be? *Language Learning*, 65, 210-231.

Hulstijn, J. H., Young, R. F., Ortega, L., Bigelow, M., DeKeyser, R., Ellis, N. C., Lantolf, J.P., Mackey, A., Talmy, S. (2014). Bridging the gap: Cognitive and social approaches to research in second language learning and teaching. *Studies in Second Language Acquisition*, 36, 1-61.

Humphreys, P. (2008). Synchronic and diachronic emergence. *Minds and Machines*, 18, 431-42.

Ilyenkov, E. (1977). *Dialectical logic: Essays on its history and theory*. Moscow. Pacifica, CA, USA: Progress Publishers.

Jessner, U. (2008). A DST model of multilingualism and the role of metalinguistic awareness. *The Modern Language Journal*, 92, 270-83.

Karimi-Aghdam, S. (under review a). Dialectical dynamic systems theory as a supertheory to second language development: Shifting sands or shifting paradigm?

Karimi-Aghdam, S. (under review b). Explaining emergence through self-organization in L2 development: Is efficient causality enough?

Larsen-Freeman, D. (1997). Chaos/complexity science and second language acquisition. *Applied Linguistics*, 18, 141-65.

Larsen-Freeman, D. (2002). Language acquisition and language use from a chaos/complexity theory perspective. In C. Kramsch (Ed.), *Language acquisition and language socialization: Ecological perspectives*. Continuum.

Larsen-Freeman, D. (2006). The emergence of complexity, fluency, and accuracy in the oral and written production of five Chinese learners of English. *Applied Linguistics*, 24, 590–619.

Larsen-Freeman, D. (2007). On the complementarity of chaos/complexity theory and dynamic systems theory in understanding the second language acquisition process. *Bilingualism: Language and Cognition*, 10, 35-7.

Larsen-Freeman, D. (2010). The dynamic co-adaptation of cognitive and social views: A chaos/complexity theory perspective. In R. Batstone (Ed.), *Sociocognitive perspectives on language use and language learning*. Oxford University Press.

Larsen-Freeman, D. (2011). A complexity theory approach to second language development/acquisition. In D. Atkinson (Ed.), *Alternative approaches to second language acquisition*. Routledge.

Larsen-Freeman, D. (2012a). Complex, dynamic systems: A new transdisciplinary theme for applied linguistics? *Language Teaching*, 45, 202-14.

Larsen-Freeman, D. (2012b). Complexity theory. In S. Gass & A. Mackey (Eds.), *The Routledge handbook of second language acquisition*. Routledge.

Larsen-Freeman, D. (2013a). Complexity theory: A new way to think. *Revista Brasileira De Linguística Aplicada*, 13, 369-373.

Larsen-Freeman, D. (2013b). Transfer of learning transformed. *Language Learning*, 63s, 107-129.

Larsen-Freeman, D. (2014). Another step to be taken: Rethinking the endpoint of the interlanguage continuum. In Z-H. Han & E. Tarone (Eds.), *Interlanguage: Forty years later* (pp.203-220). John Benjamins.

Larsen-Freeman, D. (2015).Ten lessons from complex dynamic systems theory: What is on offer. In Z. Dörnyei, P. MacIntyre, and A. Henry (Eds.), *Motivational dynamics in language learning*. Multilingual Matters.

Larsen-Freeman, D. & L. Cameron. (2008a). *Complex systems and applied linguistics.* Oxford University Press.

Larsen-Freeman, D. & L. Cameron. (2008b). Research methodology on language development from a complex systems perspective. *Modern Language Journal*, 92, 200–13.

Lewis, M. D. (2000). The promise of dynamic systems approaches for an integrated account of human development. *Child Development*, 71, 36-43.

Lewis, M. D. (2011). Dynamic systems approaches: Cool enough? Hot enough? *Child Development Perspectives*, 5, 279-85.

Lowie, W., K. de Bot & M. Verspoor. (2009). A dynamic view of second language development'. In K. de Bot & R.W. Schrauf (Eds.), *Language development over the lifespan*. Routledge.

Lowie, W., & Verspoor, M. (2015). Variability and variation in second language acquisition orders: A dynamic re-evaluation. [Special Issue]. *Language Learning, 65*, 63–88.

Macintyre, P. D. & J. J. Legatto. (2011). A dynamic system approach to willingness to communicate: Developing an idiodynamic method to capture rapidly changing affect. *Applied Linguistics*, 32, 149-71.

Overton, W. F. (1991). The structure of developmental theory. In H.W. Reese (Ed.), *Advances in child development and behavior*. *Vol. 23.* Academic Press.

Overton, W. F**.** (2006). Developmental psychology: Philosophy, concepts, methodology. In W. Damon, R.M. Lerner (Eds.-in-chief) & R.M. Lerner (Vol. Ed.), *Handbook of child psychology. Vol. 1: Theoretical models of human development* (6th Ed.).Wiley.

Overton, W. F. (2010). Life-span development: Concepts and issues. In W.F. Overton (Vol. Ed.) and R.M. Lerner (Ed.-in-chief): *The Handbook of life-span development: Cognition, biology, and methods.* Vol. 1. Wiley.

Overton, W. F. (2015). Process, relations, and relational-developmental-systems. In Lerner, R. M., Overton, W. F., Molenaar, P. C. M. (Eds.), *Handbook of child psychology and developmental science*, Vol. 1, *Theory and Method*, (7th Ed.), Wiley.

Overton, W. F. & M. D. Ennis. (2006). Cognitive-developmental and behavior analytic theories: Evolving into complementarity. *Human Development*, 49, 143-72.

Pepper, S. C. (1942). *World hypotheses: A study in evidence*. University of California Press.

Plaza–Pust, C. (2008). Dynamic systems theory and universal grammar: Holding up a turbulent mirror to development in grammars. *The Modern Language Journal*, 92, 250-69.

Popper, K. R. (1940). What is dialectic? *Mind*, 49, 403-26.

Polat, B. & Y. Kim. (2014). Dynamics of complexity and accuracy: A longitudinal case study of advanced untutored development. *Applied Linguistics*, 35, 184–207.

Schröder, J. (1998). Emergence: Non-deducibility or downwards causation? *The Philosophical Quarterly*, 48, 433-52.

Silberstein, M. (2002). Reduction, emergence and explanation. In P. Machamer & M. Silberstein (Eds.), *The Blackwell guide to the philosophy of science*. Blackwell.

Silberstein, M. & J. McGeever. (1999). The search for ontological emergence. *The Philosophical Quarterly*, 49, 201-14.

Smith, L. B., & Thelen, E. (2003). Development as a dynamic system. *Trends in Cognitive Sciences*, 7, 343-348.

Spencer, J. P., S. Perone & A. T. Buss. (2011). Twenty years and going strong: A dynamic systems revolution in motor and cognitive development. *Child Development Perspectives*, 5, 260-66.

Spoelman, M. & M. Verspoor. (2010). Dynamic patterns in development of accuracy and complexity: A longitudinal case study in the acquisition of Finnish. *Applied Linguistics*, 31, 532–53.

Thelen, E. & L. B. Smith. (1994). A *Dynamic systems approach to the development of cognition and action.* MIT Press.

Thelen, E. & L. B. Smith. (1998). Dynamic systems theories. In W. Damon (Ed.-in-chief) and R. M. Lerner (Vol. Ed.), *Handbook of child psychology:* Vol. 1. *Theoretical models of human development*. Wiley.

Thompson, E. (2007). *Mind in life: Biology, phenomenology, and the sciences of mind.* Harvard University Press.

Thompson, E. & F.J. Varela. (2001). Radical embodiment: neural dynamics and consciousness. *Trends in Cognitive Sciences*, 5, 418-25.

Van Geert, P. (2000). The dynamics of general developmental mechanisms: From Piaget and Vygotsky to dynamic systems models. *Current Directions in Psychological Science*, 9, 64–8.

Van Geert, P. (2007). Dynamic systems in second language learning: Some general methodological reflections. *Bilingualism: Language and Cognition*, 10/1, 47-9.

Van Geert, P. (2008). The dynamic systems approach in the study of L1 and L2 acquisition: An introduction. *The Modern Language Journal*, 92, 179-99.

Van Geert, P. (2009). A comprehensive dynamic systems theory of language development. In K. de Bot & R.W. Schrauf (Eds.), *Language development over the lifespan*. Routledge.

Van Geert, P. & Verspoor, M. (2015). Dynamic systems and language development. In B. McWhinney & W. O'Grady (Eds.), *The handbook of language emergence*. Wiley-Blackwell.

Verspoor, M., W. Lowie & M. Van Dijk. (2008). Variability in second language development from a dynamic systems perspective. *The Modern Language Journal*, *92*, 214-31.

Verspoor, M., K. de Bot & W. Lowie. (2011). *A dynamic approach to second language development: Methods and techniques.* John Benjamins Publishing.

Verspoor, M., M. S. Schmid & X. Xu. (2012). A dynamic usage based perspective on L2 writing. *Journal of Second Language Writing*, 21, 239-63.

Von Bertalanffy, L. (1968). *General system theory: Foundations, development, applications.* George Braziller.

Witherington, D. C. (2007). The dynamic systems approach as metatheory for developmental psychology. *Human Development*, 50, 127-53.

Witherington, D. C. (2011). Taking emergence seriously: The centrality of circular causality for dynamic systems approaches to development. *Human Development*, 54, 66-92.

Witherington, D. C. (2014). Self-organization and explanatory pluralism: Avoiding the snares of reductionism in developmental science. *Research in Human Development*, 11, 22-36.