Introduction: Investigating Written Dyadic Interaction through a Complex Dynamic Systems Theory Perspective

Shafinaz Ahmed[1]
Teachers College, Columbia University

Anna Ciriani Dean[2]
Teachers College, Columbia University

Since its inception in the late 1960's, the field of Second Language Acquisition (SLA) has undergone many transformations. As pre-existing theories have been expanded upon and new theories introduced, researchers and practitioners have come to a deeper understanding of the second language (L2) learning process. The past two decades, in particular, have seen a shift in the way that L2 learning is conceived. Ever since Diane Larsen-Freeman published her seminal article on complex systems and L2 development (Larsen-Freeman, 1997), the theory known as Complex Dynamic Systems Theory (CDST) has brought a new orientation into SLA discourse. Since then, researchers have transferred their attention from acquisition to development, linearity to nonlinearity, and stability to variability. It is this shift that provides the impetus for this special issue of the Teachers College Working Papers in TESOL and Applied Linguistics.

In this issue, four studies apply CDST concepts and various methods of data analysis to a single, naturalistic dataset, which consists of an asynchronous, dyadic written e-mail interaction between a native speaker (NS) and non-native speaker (NNS) of English. The findings within the different studies are varied and together provide a complex, yet not entirely complete, view of intercultural interaction and developing interlanguage as dynamic systems.

This introduction will provide some historical background for CDST, followed by a discussion of the characteristics of dynamic systems. Prior empirical research within the CDST framework will also be discussed. Finally, the context of the special issue will be described in more detail along with a brief summary of the four studies that comprise this special issue.

HISTORICAL BACKGROUND

Prior to the shift in orientation described above, much SLA research assumed that L2 acquisition was the product of a linear process: all learners begin at the same place, go through

[1] Shafinaz Ahmed is pursuing her Ed.D in Applied Linguistics at Teachers College, Columbia University. Her research interests lie in second language reading comprehension and second language grammar acquisition. Correspondence should be sent to Shafinaz Ahmed, 316 Zankel, Teacher College, Columbia University, 525 W 120th Street New York, NY 10027. Email: sa2796@tc.columbia.edu.

[2] Anna Ciriani Dean is a graduate of the M.A. Applied Linguistics programs at Teachers College, Columbia University. Her current research interests include second/foreign language acquisition, writing-to-learn, task-based language teaching, and writing center pedagogy. Correspondence should be sent to Anna Ciriani Dean, 316 Zankel, Teacher College, Columbia University, 525 W 120th Street New York, NY 10027.
Email: anna.cirianidean@gmail.com.

clear, static stages, and can reach a definitive end state (De Bot, Lowie, & Verspoor, 2007). This Information Processing (IP) model sees the mind as a computer, with information processed, stored, and transformed in a linear, predictable manner (De Bot et al., 2007). Emergentist and usage-based theories of SLA, however, recognize that interlanguage (IL) systems develop as the result of interactions between cognitive and environmental factors (Larsen-Freeman, 2011; Verspoor, De Bot, & Lowie, 2011). Language development does not occur in a vacuum, but is inextricably linked to language use. Every time language is used, its system is reconfigured and transformed; language use is considered equal to language change.

CDST constitutes an innovative yet natural segue from previous SLA theories. It recognizes that, within a single interlanguage (IL) system, myriad interconnected subsystems mutually influence each other and follow nonlinear developmental trajectories (De Bot et al., 2007). Both internal and external resources determine the system's evolution, and each change in a subsystem, no matter how small, may greatly impact other subsystems, leading to variability and fluctuations (De Bot et al., 2007). According to Larsen-Freeman and Cameron (2008), CDST "aims to account for how the interacting parts of a complex system give rise to the system's collective behavior and how such a system simultaneously interacts with its environment" (p. 1).

However, CDST itself does not derive from SLA theory; instead, it has antecedents largely in the sciences and mathematics. Biologist von Bertalanffy (1950) was among the first to discard reductionism in favor of a systems approach, in which understanding the relationships among components of a single system helped explain the functioning of the whole. Later, chemists Prigogine and Stengers (1984) studied "dissipative systems," or systems that, in response to external energy, self-organize into complex patterns. Around the same time, biologists Maturana and Varela (1972) came to the conclusion that living organisms, a type of complex systems, are autopoietic, maintaining a single identity while constantly in flux.

In parallel to Complexity Theory in the physical sciences, Dynamic Systems Theory, better known as Chaos Theory, began to develop within the field of mathematics, in particular thanks to mathematician Henri Poincaré (Larsen-Freeman & Cameron, 2008). René Thom (1972, 1983) was the first to investigate the sudden, unpredictable changes typical of continually shifting dynamic systems. These systems are highly sensitive to initial conditions, meaning that local perturbations can result in significant, unexpected shifts in the greater system. This idea owes its popular name, the "butterfly effect," to meteorologist Edward Lorenz's (1972) example of how the flapping of a butterfly's wings might affect a chain of events leading to large-scale weather phenomena (Larsen-Freeman, 2011; Larsen-Freeman & Cameron, 2008).

These theories were eventually applied to developmental psychology, in which human cognition was no longer seen as a computer, processing information mechanically, but rather as a dynamic system in constant mutation, affected by both biological and contextual factors (Spivey, 2007; Thelen & Smith, 1994). Mental activities were seen as "emergent from the activities of everyday life" (Thelen & Smith, 1994, p. 329). In this vein, these theories were imported into the field of Applied Linguistics, when Larsen-Freeman (1997) explicitly invoked Complexity and Chaos Theory to characterize language as a system at multiple levels: from the language used by a discourse community, to classroom interactions, to individual language users.

CHARACTERISTICS OF COMPLEX DYNAMIC SYSTEMS

So how exactly does CDST apply to SLA? A first consideration is the difference between acquisition and development. CDST researchers argue that the term "acquisition" implies a constant upward progression towards an idealized end state, or ultimate attainment (Verspoor et al., 2011, p. 6). Acquisition equals steady growth; it does not account for decline and fluctuations over time. Thus, phenomena such as attrition, in which a learner's proficiency deteriorates due to lack of use, are not possible within an acquisition framework (Verspoor et al., 2011, p. 6). This view clearly clashes with the tenets of CDST. For this reason, CDST has adopted the term "development" to discuss patterns of IL change over time (Verspoor et al., 2011, p. 6). Embedded in this term is the assumption that "there is no one point at which it can be said that a language is completely acquired" (Verspoor et al., 2011, p. 6). Development does not cease at some predefined point, nor can it be differentiated from the use of language itself. Indeed, CDST researchers see language use as synonymous with language development, in that every application of the language entails some level of IL restructuring.

As a general definition, "[s]ystems are groups of entities or parts that work together as a whole" (Verspoor et al., 2011, p. 8). They consist of several components, known as subsystems, which "interact in particular ways to produce some overall state or form at a particular point in time" (Larsen-Freeman & Cameron, 2008, p. 26). These subsystems are heterogeneous, meaning that each one is very different from the others, thus leading to highly diverse interactions and outcomes (Larsen-Freeman & Cameron, 2008). Each subsystem forms an entire system unto itself, with its own sets of complex subsystems and internal and external resources (Larsen-Freeman & Cameron, 2008). Indeed, systems have been said to reflect the characteristics of fractals, meaning that the complexity seen at the greater system level is reproduced at all sub-levels, down to the smallest subsystem.

Complex dynamic systems are omnipresent in everyday life, from biological systems, to social systems, to cities, to computers, to language, and more (Larsen-Freeman & Cameron, 2008). To illustrate, within "language," one could study, for example, an entire discourse community. Within this community, there would be several agents—values, organizations, individual people, etc.—who impact the development of the community. Beneath this greater discourse community, there may be a sub-community, possibly a classroom system, which would be impacted by individual learners, the teacher, the interactions and relationships between them, institutional constraints, etc. The interactions between two individuals would then also be impacted by several subsystems, such as personality traits or language proficiency, the context of the interaction, the relationship between the interlocutors, etc. And within each individual, features of proficiency, affective factors, sociocultural factors, and other internal and external stimuli would impact their IL development.

Thus, systems can be approached at several different levels, with one level nested within the next (Larsen-Freeman & Cameron, 2008). Starting from the individual, the system can be expanded to interaction between two or more people, which can then be expanded to a larger group and then to an even larger discourse community. Besides level, systems also exist within different timescales, spanning from a few seconds or minutes, to days, weeks, months, years, and so forth (Larsen-Freeman & Cameron, 2008). In this sense, they are heterochronous, as each event in the system, no matter how local, has an effect on longer timescales in one way or another (Larsen-Freeman & Cameron, 2008).

Another essential characteristic of complex dynamic systems is their sensitive dependence on initial conditions, or, as mentioned above, the "butterfly effect" (Verspoor et al., 2011). Minute features of the initial system had a great impact on its evolution later on. Minimal differences between two learners, for instance, can lead to entirely different learning outcomes (Verspoor et al., 2011). Additionally, complex dynamic systems are particular for their complete interconnectedness: "all parts are connected to all other parts" (Verspoor et al., 2011, p. 10). Within a single language learner, for instance, the lexical system, phonological system, and syntactical system are all interconnected, and as a result, a change in one will have repercussions for all. As a result, systems are constantly self-organizing: as one element changes the others reconfigure themselves, triggering more changes to other subsystems and leading to a continuous cycle of evolution working harmoniously to form a unified whole. Properties that were not initially present, called emergent properties, may start to become visible as the system evolves.

Complex dynamic systems, however, are not self-contained. Instead, they are open to outside energy and resources, meaning that they are impacted by external systems in contact with them but also impact the other systems in turn (Larsen-Freeman & Cameron, 2008). An open system can only continue to self-organize if it is nourished by external energy. Self-organization and adaptation are thus a response to this interaction. It is therefore impossible to extricate complex dynamic systems from the context in which they exist. For this reason, in the realm of language learning, sociocultural theory is seen as closely linked to CDST, as the sociocultural environment can greatly influence the mental processes involved in learning (Larsen-Freeman & Cameron, 2008; Verspoor et al., 2011). Cognition is seen as situated, meaning that "the setting in which cognitive functions have been carried out are part of the cognition itself" (Verspoor et al., 2011, p. 17). Additionally, cognition is seen as embodied, as "there is no clear boundary between the cognitive system and the rest of the human system," or the body (Verspoor et al., 2011, p. 17).

The ideas of interconnectedness and interaction with the environment lead to yet another tenet of CDST: systems' dependence on internal and external resources (Verspoor et al., 2011). In terms of language learning, internal resources include features within the learner herself, such as internal motivation, aptitude, memory capacity, and proficiency. External resources instead exist outside of the individual: material resources, external motivation, instruction, opportunities for practice, etc. A combination of these resources is what stimulates changes in a learner's IL. It is important to note, though, that these resources are limited and therefore support subsystems in unequal ways (De Bot et al., 2007). While some subsystems may act as support for other variables, leading to connected growth, others may be in competition with one another (De Bot et al., 2007).

As a result of these complex ties, it is clear that complex dynamic systems are not static. In fact, they are defined as "dynamic" because they are in constant flux (Larsen-Freeman & Cameron, 2008; Verpoor et al. 2011). Change does not proceed in distinguished steps; rather, it is fluid and impossible to break down into stages, as has been done with L2 acquisition in the past. Dynamic interactions among internal and external elements of a system are what lead to another important characteristic of complex dynamic systems: non-linearity (Larsen-Freeman & Cameron, 2008). While most SLA studies in the past have focused on linear relations between independent and dependent variables, CDST recognizes that these relationships may not be so straightforward, as no single variable can determine the trajectory of a learner's IL (De Bot et al., 2007; Verspoor et al., 2011).

An offshoot of non-linearity and a central tenet of CDST is variability. Due to the multitude of complex, nonlinear relationships at play in a single system, performance varies greatly from one moment to the next (De Bot et al., 2007). Unlike the traditional fixed-stage view of second language (L2) development, CDST does not reject variability as "noise," but rather considers it an essential property of systems (De Bot et al., 2007). In fact, both intra- and inter-individual variability are considered the drivers of change; variability is highest when the system is reorganizing and lowest when the system is most stable (Verspoor et al., 2011).

As a system develops, its subsystems tend to oscillate between periods of high variability, called repeller states, and periods of low variability, called attractor states (De Bot et al., 2007; Verspoor et al., 2011). Attractor states vary in their length, and they indicate that a system has temporarily settled into certain behaviors. In L2 development, this may correspond to fossilization (Verspoor et al., 2011). Systems and subsystems tend to alternate between attractor states and repeller states, and a dramatic transition from one attractor state to the next is called a phase shift (Larsen-Freeman & Cameron, 2008). To enter a phase shift takes a significant amount of energy, as the attractor state tends to be preferred (Verspoor et al., 2011). It is important to point out, though, that attractor states do not represent periods of complete stasis, but rather of relative stability compared to turbulent repeller states and phase shifts (Larsen-Freeman & Cameron, 2008). A completely static state would not lend itself to further development.

Dynamic patterns of language use are manifest through what Thelen and Smith (1994) termed "soft-assembly" (Larsen-Freeman, 2011; Larsen-Freeman & Cameron, 2008). Soft-assembly is an adaptive, instantaneous process in which each action taken by a language user is influenced by aspects of context and of the speaker in formulating output (Larsen-Freeman, 2011; Larsen-Freeman & Cameron, 2008). Within interaction, when two or more interlocutors are involved, soft-assembly depends on a process of co-adaptation (Larsen-Freeman, 2011; Larsen-Freeman & Cameron, 2008). A change in one system is catalyzed by a change in the other system, which in a conversation is manifest as interlocutors accommodating to each other in their subject or manner of speaking (Larsen-Freeman, 2011; Larsen-Freeman & Cameron, 2008). In a coupled system like this, co-adaptation and soft-assembly can be observed on the smallest timescales (e.g. milliseconds or microgenetic timescales) but also on a much larger scale crossing several discourse events (Larsen-Freeman & Cameron, 2008).

Naturally, as the number of interconnected, interacting components within and outside a system increases, the more difficult it becomes to predict the outcomes of change (Verspoor et al., 2011). When studying complex dynamic systems, then, researchers are not interested in explaining and predicting developmental trajectories, but rather in describing and observing the visible behaviors of a system. They investigate changes in variability as indicators of development and avoid averaging and generalizing results so as not to gloss over emergence (Verspoor et al., 2011). This way, CDST attempts to a step away from reductionism towards a holistic view of systems (Verspoor et al., 2011).

EMPIRICAL RESEARCH ON CDST AND SLA

Empirical research into CDST and its intersection with SLA has sought to describe the iterative, variable, and unpredictable nature of language development over time (De Bot et al., 2007; Van Geert, 2008). Researchers also recognize that a cross-sectional sampling of data

cannot fully capture the changes and variability within language development; thus, longitudinal data are considered necessary to reveal the dynamic nature of language learning (De Bot et al., 2007). Furthermore, the data need to be dense, meaning that samples are collected frequently over the time span investigated in order to monitor in detail that changes that develop over time (De Bot et al., 2007). Framing research under this approach, studies have taken several different aspects of language development into consideration, investigating their interaction with both linguistic and nonlinguistic systems.

Various studies focusing on language development have described learners' developmental trajectory in terms of complexity, accuracy, and fluency (CAF). Within the CDST literature, these three aspects of language performance have been considered separate yet interrelated subsystems within a larger linguistic system. A possible justification for looking at these subsystems is that learners tend to prioritize and utilize one aspect of the L2 performance over another. This may create a trade-off relationship in which a learner might allocate her primary attention to one aspect of language performance at the expense of another. Thus, examining this trade-off relationship may be fruitful from a CDST perspective because the relationship between certain subsystems may change from one state to another within a learner's developmental trajectory (De Bot et al., 2007; Van Geert, 2008; Ellis & Barkhuizen, 2005).

Yang and Sun (2015) expected their confirmatory study of the development of lexical and grammatical CAF of multilinguals' written output, to yield four findings, which had been observed in previous research. The first expected finding in Yang and Sun's study, was that while multilingual learners may show stable and level patterns in their L1 writing development, these same learners will exhibit a downward pattern in their L2 and L3 writing development in terms of complexity, accuracy, and fluency. The second and third findings would reveal that non-linear dynamic developmental processes and variations are present in inter-individual's (between individuals) and intra-individual's (within the same individual) L1, L2, and L3 written production when analyzed for complexity, accuracy, and fluency. The fourth finding would conclude that complexity, accuracy, and fluency do not develop in insolation, but frequently interact and compete with each other, regardless of language.

The five participants in Yang and Sun's (2015) study were multilingual third year university students with L1 Chinese, L2 English and L3 French. Throughout the study, participants received instruction in their L2 and in their L3 but with differing degrees of exposure to the respective target language. Data were comprised of five untimed writing tasks collected once every two months over a ten-month period. Participants were asked to write narrative essays on various topics in their first language Chinese. After a week, they wrote in English, and after another week, they wrote the essay in French. A word length requirement was provided for the written essays-500 words for the L1 and 200 words for L2 and L3. The topics of the narratives differed for all five data samples, but the genre of the written text, narrative, remained the same. The results of their study revealed that three of the four proposed expectations were met. The only expectation that was not met was the first, as multilingual learners failed to show stable or regular patterns in their writing, regardless of which language they wrote in. Thus, CAF developed in a non-linear, dynamic fashion within and between participants irrespective of the language they used.

The results of Yang and Sun's study (2015) indicate that language development can occur dynamically and iteratively within instructed multilingual learners. The primary aim of Polat and Kim's (2014) study, instead, was to provide an in-depth look into the dynamic nature of language development that can happen within a naturalistic learning environment. Through a series of

unstructured oral interviews conducted over the course of a year, the researchers sought to explore the untutored learning of English by their advanced Turkish participant. By focusing on CAF and lexical diversity, the study revealed that development occurred in lexical diversity with considerable variability, some development occurred in syntactic complexity, but accuracy showed no development, although it showed the most variability. Two measures of accuracy were used in the study, one global and one specific. Global accuracy was determined by error analysis whereas obligatory occasion analysis was used to measure specific accuracy (simple present tense).

Unlike Polat and Kim (2014) who investigated the language development of an advanced learner of English, Spoelman and Verspoor (2010) looked at how language developed in an absolute beginner of Finnish. The study participant was a female with Dutch as her L1 who was studying Finnish as a foreign language as a minor in university. She had never been to Finland and knew nothing about the Finnish language prior to the study. Data were comprised of 54 samples of the learner's written production collected over three years. Approximately 100 words were analyzed from each writing sample, and the focus of analysis was accuracy and complexity. Accuracy was determined by error analysis and by target-like use. Complexity was measured as morphemes per word, words per noun phrase, and the difference between the average sentence length in morphemes and the average sentence length in words. As the study focused on intra-learner variability, results showed that early in the study, accuracy and complexity seemed to be in competition. However, as the study progressed, the relationship between the accuracy and complexity appeared to be less competitive. The greatest degree of variability happened at the earlier stages of acquisition with degrees of stabilization occurring as the learner's proficiency increased.

In addition to examining CAF alone, CDST studies have also attempted to describe how internal and external resources affect the development of both linguistic and non-linguistic elements. MacIntyre and Legatto's (2011) study looked at Willingness to Communicate (WTC) among six college students at a French immersion program in Canada. WTC is a speaker's willingness, and therefore, intention to participate in a conversation. This willingness is contingent upon the speaker's self-assessment of her ability to effectively communicate in a particular situation with a specific person. The study employed a mixed methods approach to investigate the relationship between WTC and oral task performance. The study also endeavored to identify how learners articulated the changes within their WTC on various tasks. Data consisted of self-reports with regard to WTC trait level, anxiety level, and extraversion after the completion of eight communicative tasks with varying degrees of topic difficulty. Using a novel idiodynamic approach to analyzing the data, the findings revealed that the WTC amongst participants did fluctuate from task to task as well as within a single task; WTC seemed to decrease in more challenging tasks when learners lacked the requisite vocabulary knowledge to respond and fully participate. The results indicated that WTC may be a component of a dynamic system, as learners demonstrated change in language development overtime, and language use revealed an interconnectedness between subsystems.

As these studies (Spoelman & Verspoor, 2010; MacIntyre & Legatto, 2011; Polat & Kim, 2014; Yang & Sun, 2015) show, language learning is indeed a dynamic process, in which development is characterized by progression and regression, by iteration, and by complex interactions amongst variables. Within the field of L2 research, there appears to be a consensus that L2 acquisition is a dynamic process. However, there is also debate about whether L2 development is also a systematic and rule governed process. As some approaches to L2

development view language acquisition as a highly variable and non-predictable process (De Bot et al., 2007), other approaches view L2 development as dynamic and rule governed. One such strand of this research examines the intersection between CDST and Processability Theory (Pienemann, 2015; Lenzing, 2015). Processability Theory attempts to explain the ways in which L2 learners restructure their interlanguage systems. The theory states that language learners restructure their L2 linguistic systems in an order which is aligned or compatible with their developmental readiness and capabilities (Pienemann, 1998; Pienemann, Di Biase, & Kawaguchi, 2005). Thus, investigating L2 development from a processability perspective may account for language development that is both dynamic in nature and rule governed.

Baten and Hakansson (2015) compared CDST with Processability Theory to investigate the development of subordinate clauses within two groups of students learning two different second languages, German and Swedish. The German L2 data came from spontaneous oral production from Dutch L1 speakers over 2 years, and the Swedish language data came from two groups-one learning Swedish as an L2 with various L1s and one group learning Swedish as a foreign language in Australia. Written and oral data were elicited from both Swedish groups. Subordination ratios were used to measure linguistic complexity from a CDST perspective and emergence criterion for Processability Theory for both language groups. Results from the CDST analysis of the data showed that subordination ratios varied and fluctuated. Results using the emergence criterion showed that although the use of subordination was present, albeit to varying degrees, the development of the internal structure followed a clear sequence. Subordinate clause word order in L2 German and L2 Swedish was analyzed further by differentiating between auxiliaries and modals. Learners of both languages used subordination at earlier stages, but complexity of usage differed as they progressed in their language development. When analyzing the data using the different theoretical approaches, each approach revealed something different regarding the use and acquisitional development of subordinate clauses, thus highlighting the non-liner variable nature of language development.

Lenzing (2015) also looked at CDST through a Processability Theory perspective to show that L2 development can be both dynamic and rule based. This study looked at the extent to which key tenants of CDST, Processability Theory, and Multiple Constraints Hypothesis intersect, to highlight the regularities and variation that occur as part of L2 language development. The study looked at the oral speech production of beginning L2 learners of English with a German L1. The participants, elementary school children aged 8-10 years old, engaged in different communicative oral tasks that they completed in pairs. All tasks included vocabulary and class content that learners had been exposed to throughout classroom instruction. Cross section and longitudinal data were collected after one year and two years of formal language instruction. An analysis of the data revealed that there were developmental regularities in L2 acquisition that were common to all learners, and that the learner variation that occurred was consistent with the constraints of the developing L2 system. After two years of instruction, the majority of the participants (22 out of 24) had progressed in their language development. Their progression was consistent with the Processability Hierarchy for the English language and followed the trajectory predicted by the Processability Theory (Pienemann, 1998; Pienemann, Di Baise, & Kawaguchi, 2005; Pienemann 2015). This study illustrated that both L2 morphosyntactic development and L2 variation in early language development are shaped by processing constraints on the initial L2 mental grammatical system. Although there is development, that development varies within the same learner and amongst different learners at various stages of the language acquisition process.

Although these studies (Spoelman & Verspoor, 2010; MacIntyre & Legatto, 2011; Polat & Kim, 2014; Yang & Sun, 2015; Baten & Hakansson, 2015; Lenzing, 2015) discuss the merits of examining and researching second language development through a CDST lens, CDST research methodology may have some limitations, especially in regards to using longitudinal data. While the aforementioned studies do attempt to incorporate longitudinal data, researchers need to investigate development over longer periods of time, with data being collected more frequently (e.g., weekly, bi-weekly, or monthly). Examining longitudinal data will provide greater insight into a learner's developmental trajectory.

As complex systems are affected by and interact with external systems, another factor to consider when looking at language development from a CDST perspective is the role that language instruction and language learning in a formal environment may have on language development. The quantity, quality, and context of language instruction are important variables that might affect the success of L2 development. Although the relationship between language instruction and language learning is complex, looking at L2 development from a CDST perspective could provide helpful insights into the nature of language development, which in turn could possibly influence L2 pedagogy.

CONTEXT OF THE CDST SPECIAL ISSUE

The four studies included in this special issue were final projects from an Interlanguage Analysis (ILA) course held during the Spring, 2016 semester at Teachers College, Columbia University. Using CDST as the theoretical framework, the ILA final project required students to analyze a dataset (provided by the course instructor) using three different methods of L2 data analysis. The dataset was comprised of 24 email correspondence between Belinda, a Chinese L1 speaker and L2 English learner, and Michelle, a Spanish/English bilingual speaker. Belinda and Michelle wrote to each other over a period of nine weeks. Michelle wrote a total of 13 emails to Belinda and Belinda wrote 11 emails to Michelle. The content of their emails varied and they discussed topics such as movies, city life, food, and national holidays and celebrations.

The interaction between Belinda and Michelle occurred as part of an intercultural class project where participants were paired up with someone from a different culture. The purpose of the project was to gauge how intercultural communication happens and what can be learned about oneself and others via intercultural communication. Although motivated by a class project, the interaction between Belinda and Michelle occurred quite organically, as both participants were not given specific directions regarding what to say to each other (e.g., particular topics to discuss) or how to communicate with one another (e.g., length of the emails, number of emails to write, etc.). Rather, the interaction developed as it would with anyone who endeavors into a new relationship with someone from a different culture.

Using various methods of data analysis, the four papers included in this special issue speak to the potential using a CDST framework might have in describing learner IL. All four papers looked at the language produced by Michelle and Belinda, investigating both inter-individual and intra-individual variability over time. In her study, Jordan Van Horn used error analysis, measures of linguistic accuracy and complexity, and qualitative methods to look at the variability of error production within and amongst language users. In particular, she explored the nature of the kinds of errors produced, the relationship between complexity (measured by major

and minor idea units) and error rate. Instead, focusing on one specific linguistic feature, the preposition *in*, Shafinaz Ahmed used target-like use analysis, functional analysis, and metaphor analysis to analyze how the use of *in* varies in the language produced by Michelle and Belinda. The fluctuation in how *in* is used over time indicates that an individual's literal and conceptual engagement with and production of a language develops in a non-linear manner. Ann Tai Choe's paper focused on the intersection between topic selection, Willingness to Communicate (WTC), and writing development. Her analysis showed that WTC can be a dynamic variable, one that fluctuates over time, depending on the topic of the written exchange. Like Choe, Anna Ciriani Dean also looked at topic as a variable in written language production. However, she explored linguistic and non-linguistic variables as dynamic systems, showing that they vary over time in a learner's L2 developmental trajectory. Ciriani Dean primarily focused on syntactic complexity and article accuracy and how they vary situationally as they relate to topic.

Through this special issue, we hope readers will gain insight into CDST theory, which might help to inform both research into L2 acquisition and pedagogy. With a greater understanding of CDST, L2 researchers and practitioners will see that language is not a stable system, and therefore it may not be possible to make exact predictions regarding L2 development. Rather, a CDST framework could be useful in understanding the non-linear, adaptive, interactive, and resource-dependent nature of language learning, further reiterating that language learning is dependent on any number of interacting factors.

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