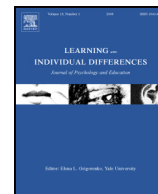




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Foreign language learning as a complex dynamic process: A microgenetic case study of a Chinese child's English learning trajectory

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ABSTRACT

The current study focuses on one child's (male, 3 years old) learning behaviors in an English as a Foreign Language classroom, and explores the coordination and developmental patterns of his nonverbal (gestures and body language) and verbal (verbal repetition and verbal responses) learning behaviors over time. Guided by the principles of the theory of Complex Dynamical Systems, the child's learning behaviors were analyzed over the course of four months, using (Cross) Recurrence Quantification Analysis and Monte Carlo permutation tests. The results show that the coordination between the child's nonverbal and verbal behaviors exhibited a rigid pattern at the beginning but got loosened over time, allowing the child to respond more flexibly to the teachers' instructions and to alternate more freely between his verbal and nonverbal learning behaviors. When focusing on the child's verbal learning behaviors only, we found that patterns of the verbal responses seemed to be more predictable than those of verbal repetitions, which suggests the varied influence of internal and external factors on these verbal learning behaviors.

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1. Introduction

In recent years, we have seen a substantial increase in the number of very young foreign language (FL) learners worldwide (Nikolov & Mihaljevic Djigunovic, 2011). These children, who are in their early childhood (2–7 years old as defined by Philp, Oliver, & Mackey, 2008; 3–6 years old as defined by Nikolov & Mihaljevic Djigunovic, 2011), receive FL instruction at bilingual schools or at private language institutes. In China, for example, 210 million children are taking English courses in >50,000 private English institutes (Li, 2013). Research on this growing number of young learners and the development of their language skills is, however, still rare (Zhou & McBride-Chang, 2009).

Young FL learners' initial classroom experiences could have a lasting effect on their learning motivation and outcomes on the long term (Nikolov, 2001), and the development of their learning behaviors therefore deserves special attention. Studying the development of a child's

learning behaviors is not an easy task, as these behaviors vary from moment to moment in complex interactions with the child's (proximal) environment (cf. Van Geert & Van Dijk, 2002). The most common way of analyzing the development (of e.g., language skills) is, therefore, to average the measurements taken from groups of children. This, however, comes at a cost. By definition, the average learning trajectory does not apply to the individual learner (cf. Molenaar, 2008), because development is a real-time idiosyncratic process (Molenaar, 2013; Molenaar & Campbell, 2009; Van Geert & Steenbeek, 2005) driven by bidirectional interactions with the environment. This is why researchers from the paradigm of Complex Dynamical Systems (CDS) have developed and used (non-linear) time series techniques to study developmental phenomena and the person–environment interactions from which they emerge (e.g., Cheshire, Muldoon, Francis, Lewis, & Ball, 2007; Cox & Van Dijk, 2013; Thelen & Smith, 1994; Van Geert, 1994; Van Geert & Steenbeek, 2005).

From a CDS perspective, development can be seen as a self-organizing process, in which the state of a system (for example, the child's language system) is shaped by multiple interactions (e.g., other children in class, the teacher, the child's motivation). Over time, the behavior of a system may evolve from fluctuating and unstable toward more adaptive stable behavioral states (i.e., attractor states) (e.g., Thelen & Smith, 1994). The term self-organizing process refers to a series of patterns that emerge from the successive interaction of all the subcomponents

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of a developing system at every level, characterized by fluctuation (i.e., variability) and stability. Before moving into a new stable state, the system usually demonstrates variable behaviors, making variability an indication of developmental change.

Despite the growing number of CDS techniques available, they have not yet been applied to early FL learning. The current paper therefore focuses on one three-year-old Chinese child during his first half year of English learning in a private language institute. The relationship between his verbal and nonverbal learning behaviors, as well as the developmental patterns of his verbal behaviors are explored in the context of an early childhood FL learning program. A (Cross) Recurrence Quantification Analysis, a non-linear time series technique, is used to study the coordination between several learning behaviors over time, allowing us to obtain an in-depth understanding of the tangible patterns in the child's learning behaviors, as well as their couplings.

1.1. Early stages of very young children's foreign language development

Sun, de Bot, and Steinkrauss (2015) followed a group of very young English as a Foreign Language (EFL) learners (three years old) for their initial five months of learning English, and found three general stages. During the first stage (the first two months), most children kept silent and relied on body language to respond to their teachers' instructions. During the second stage (the third month), the frequency of using English repetitions surpassed the frequency of using body language. Children repeated single words and formulaic language after their teachers as they became familiar with English pronunciation and the learning environment. In the third stage (in the fourth and fifth month), the average use of English responses and mixed use of English and Chinese grew steadily. In this stage, children tended to use single words or simple phrases to initiate or answer questions, and expressed themselves with more confidence and ease in English. At the same time, they seemed to be more aware of their limitations in English, and used more Chinese to express their thoughts as well.

It is worth noting that although the authors named the stages according to their most distinctive behaviors (in terms of frequency) that occurred, all of these behaviors occurred at each stage (cf. Siegler, 2000). For instance, English repetition was seen throughout these five months, only reaching its peak in the third month. It's also worthy of attention that body language plays an important role in children's language development. Children often combine gestures and speech during the early stages of first language production, several months before they produce combinations of words (Goldin-Meadow, 2015). One reason for this might be that when children have a restricted vocabulary, body language offers them "a way to extend their communicative range" (p. 2). Children's body language indicates that they are ready to learn new words, allowing adults to read their intentions clearly and to provide finely tuned language support in time (Goldin-Meadow, Goodrich, Sauer, & Iverson, 2007; Vygotsky, 1986). Therefore, body language bestows children great flexibility for meaning delivery and better adaptation to different learning environments.

Researchers such as Goldin-Meadow (2015) view body language and speech as an integrated synergistic system, since they share some underlying cognitive components, such as memory and attention (Wijnants, Cox, Hasselman, Bosman & Van Orden, 2012). During communication, there is a synchronization between body language and speech (McNeill, 1992), reflecting the self-organization of these shared cognitive mechanisms. If communication goes smoothly, this synchronization should be quite stable, and we could characterize this as an attractor state. However, if a person is exposed to a new or challenging context, such as a foreign language learning environment, the synchronization between gestures and verbal behavior could be greatly affected, forcing the synergy of verbal and nonverbal behaviors into great fluctuation.

Not only the relationship between verbal and nonverbal learning behaviors deserves our attention, but also the development of different

categories of verbal learning behaviors, which serve an important function in early EFL language development. Verbal repetition, for example, is one of the most pervasive behaviors during the initial period of early EFL learning (Duff, 2000; Bennett-Kastor, 1994). From a cognitive and linguistic perspective, verbal repetition helps young EFL learners to memorize, recite and decompose the new language at their own speed, and to gradually integrate the information into their linguistic repertoire (Duff, 2000; Rydland & Aukrust, 2005). From a socio-cultural perspective, verbal repetition indicates that something is internalized by the learner, allowing for social, intellectual and discursive cohesion during interactions (Duff, 2000; Cekaite & Aronsson, 2004).

1.2. Complex dynamical systems in EFL learning

In sum, both verbal and nonverbal learning behaviors are crucial for a child's early language learning (Goldin-Meadow, 2014, 2015). Previous studies, such as the one conducted by Sun et al. (2014), propose a general outline of children's initial EFL learning behaviors. However, it remains unclear how these behaviors evolve over time and how they interact with each other. Studying these interactions from a CDS perspective would extend our knowledge on the mechanisms of EFL learning that goes beyond these stage descriptions. This requires the use of microanalyses, allowing researchers to examine these behaviors for individual children in detail, and from moment to moment (Wallbott, 2003). Ultimately, combining this idiographic micro-approach with more general, nomothetic models of L2 language development allows researchers to construct models that are applicable to the individual level (cf. Nesselroade, 2001).

The theory of Complex Dynamical Systems (CDS) provides us with the theoretical framework and methods to analyze micro processes. It has not widely caught the attention of researchers of second language acquisition until recent years (e.g., de Bot, 2008; Larsen-Freeman, 2007; De Bot, Lowie, Thorne, & Verspoor, 2013). From a CDS perspective, EFL development should be considered an open system, consisting of a series of subsystems (e.g., different learning behaviors) undergoing continuous, as well as abrupt changes over time due to internal and external constraints (de Bot & Larsen-Freeman, 2011; Larsen-Freeman, 2007; Larsen-Freeman & Cameron, 2008). CDS assumes that an open dynamic language system has nine basic characteristics, including a dependence on initial conditions, complete interconnectedness, non-linearity, internal reorganization and environment interaction, internal and external resources, attractor states, iteration, variation and emergent properties (for details, see de Bot & Larsen-Freeman, 2011).

When introducing CDS to EFL studies, the research focus shifts. Instead of asking research questions that center around a unidirectional (linear) causal relationship between variables, the interconnectedness and non-linear development of different learning components are the central focus. CDS emphasizes the changes within a system over time, driven by the interactions between the system's internal process of self-organization and the external environment (cf. Vallacher, Van Geert, & Nowak, 2015). These interactions result in individual non-ergodic processes of change (Molenaar, 2013; Molenaar & Campbell, 2009). The term 'internal process' refers to dynamic (i.e. changing) variables within the learning individual, such as learning capacity and adaptability. The external environmental resources refer to dynamic variables outside the learner, such as EFL input of the teacher, in terms of both quantity and quality (De Bot & Larsen-Freeman, 2011). Under the realm of CDS, analytical approaches could inform us about the recurrence of certain behavioral states from the time series, revealing the stability and variability of the system. This goes beyond the power of a linear analysis, because we can assess non-stationary and non-linear development in a complicated situation, such as early EFL development.

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