Chapter 1  Introduction 

“The noise is the signal” (Landauer, 1998)

This frequently-quoted phrase is the title of a groundbreaking article by Rolf Landauer, one of the key figures in information physics. It summarizes the discovery that seemingly random fluctuations in physical measurements over time, which are excluded by the averaging inherent to many measurement tools, hold valuable information about interactions between particles.

Although applied linguistics is undeniably a much “softer” discipline than physics in its subject matter and methodology, and thus deals with much “noisier” data, it has only recently begun to similarly consider the value of noise as indicative of underlying processes involved in language development. In the context of language development, noise is the nonlinearity and variability that accompany linguistic performance at any proficiency level. Language acquisition is markedly complex and elusive, involving numerous dimensions that develop at varied and often nonlinear rates, and a high degree of variation not only between individuals (inter-learner), but also within the performance of single learners over time (intra-learner) (de Bot, Lowie, & Verspoor, 2005). Inter-learner variability has been studied extensively, with numerous factors pinpointed as its determinants, although a large part of it remains unexplained (see R. Ellis, 1994 for a review). Investigating intra-learner variability in case studies of L2 acquisition, however, is a fairly new endeavor.

In broad terms, language development can be described as constant change or flux (Larsen-Freeman & Cameron, 2008). This definition may be intuitively appealing to many L2 learners: as a nonnative (and non-too-frequent) Dutch speaker, I experience days in which even a rudimentary dialogue feels like a struggle, while on other days speaking Dutch seems much less demanding. Certain aspects of my performance appear to stagnate or even deteriorate, for example verb conjugation or sentence word order, whereas others, like my vocabulary, seem to grow constantly. Improvement in one area often appears to be offset by decline in another. For instance, while my tense use may occasionally be quite accurate, another error such as using the wrong preposition might reemerge. Even my relative forte of vocabulary knowledge is not entirely reliable: whereas on some days I struggle to retrieve fairly
frequent words, on others I surprise myself by uttering words that I had no idea I knew.

These are, of course, strictly subjective anecdotes from a personal experience of L2 acquisition. Yet, as Larsen-Freeman and Cameron state, “everyone who has studied language acquisition knows that it is both systematic and variable” (2008, p. 21). This claim is expanded by Lowie, de Bot, and Verspoor:

There is sufficient evidence that second language development goes in leaps and bounds with periods of stability and instability and identifiable stages in the nonlinear developmental pattern. During the process of language acquisition, periods of rapid acquisition are followed by periods of delayed acquisition or even attrition (2009, p. 127).

However, the fundamental nonlinearity of language development is often a mere footnote in published studies. Most of these studies aim to establish static, linear connections between aspects of performance and factors that are presumed to influence them, usually across groups of learners. The accessibility of statistical software has contributed to the widespread application of linear analyses, originally targeted at large populations, to what is essentially a highly individualized and variable process. Such analyses are based on measures of central tendency, which exclude variability as error or noise. While there is no doubt that the linear approach has led to invaluable discoveries in applied linguistics, it invariably overlooks the multidimensional complexity of language learning.

In recent years, Dynamic Systems Theory (DST) has emerged as an alternative and complementary perspective to the cross-sectional and linear approach to applied linguistics. DST is “the most widely used, most successful, most thoroughly developed and understood descriptive framework in all of natural science” (van Gelder & Port, 1995, p. 328). It is concerned with describing change in complex systems over time in virtually any field, and has been applied to phenomena as varied as mineral crystallization, ecological equilibriums or epidemiological spread. DST defines and explores the ways in which processes unfold: how their developing components interact, and how these interactions yield unique and varied growth patterns. From this perspective, "far from simply reflecting noise in our measuring instruments or variability in low-level aspects of physiological maturation", variability patterns provide "a window onto the correlates and (by inference) the causes of developmental change" (Bates, Dale & Thal, 1995, p. 1). As a general and
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ecologically-valid paradigm, DST offers a way of reconciling general growth trends with individuated variability patterns, and accounting for both as inherent aspects of development.

The crossover of DST from the physical and natural sciences to ecological, developmental and cognitive psychology has revolutionized these fields, including their approach to language learning. Via cognitive psychology, DST has been extended to language acquisition, first of early L1 (van Geert, 1991), and later of L2 (Larsen-Freeman, 1997). The key principles of DST align with the noisy reality of language acquisition: constant interaction between co-developing aspects of knowledge and performance over time; shifts in these interactions that derive from the structure of language and the limited resources of learners and their environments; and ensuing nonlinear and nonparallel growth of various linguistic subsystems and their components (de Bot, Lowie & Verspoor, 2007).

The two empirical studies in this dissertation investigate the applicability of these basic dynamic principles to two areas of second language acquisition (SLA). The first study focuses on vocabulary knowledge, consisting of four levels that range from least to most productive. The second concentrates on writing performance, as expressed in the complexity and accuracy of its lexical and syntactic dimensions. Both studies examine longitudinal data from four case studies of advanced L2 acquisition. They combine analyses of central trend with investigations of local variability, and complement their results with models based on generic dynamic equations. Together, the studies are intended to explore the potential of the dynamic approach in supplementing the existing body of research in SLA.

This thesis begins with two background chapters. The first provides a theoretical overview of the key principles of DST and their applicability to L1 and L2 acquisition. The second chapter explains the methodology associated with DST, namely longitudinal case study design, variability analyses and mathematical modeling of dynamic processes. The third and fourth chapters describe the vocabulary and writing studies, respectively. The final chapter is a summary and discussion of the implications of the dynamic approach, its limitations and extensions.