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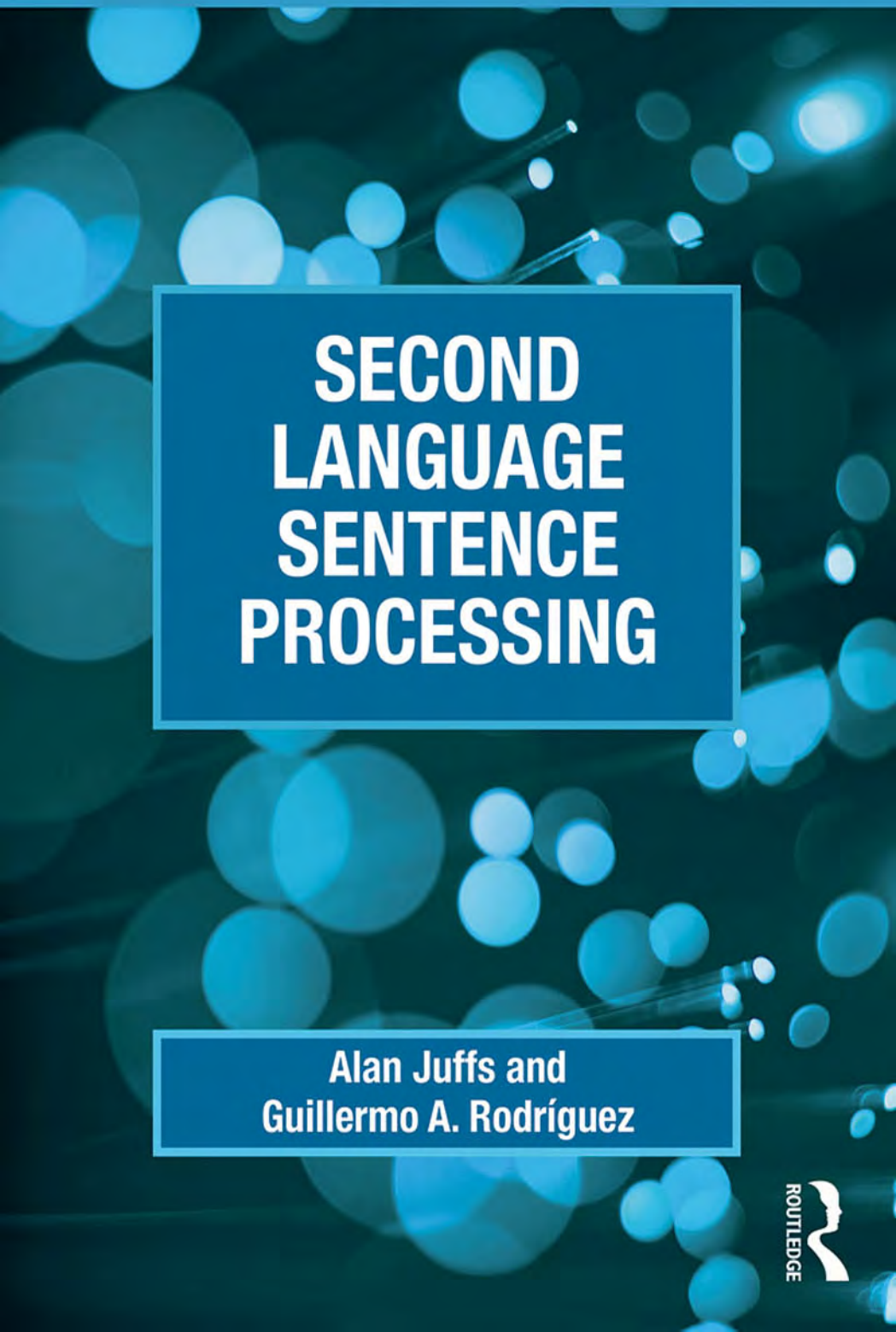

SECOND LANGUAGE SENTENCE PROCESSING

Alan Juffs and
Guillermo A. Rodríguez

ROUTLEDGE

SECOND LANGUAGE SENTENCE PROCESSING

Second Language Sentence Processing presents a comprehensive review of the latest research findings on sentence processing in second language acquisition. The book begins with a broad overview of the core issues of second language sentence processing research and then narrows its focus by dedicating individual chapters to each of these key areas. While a number of publications have discussed research findings on knowledge of formal syntactic principles as part of theories of second language acquisition, there are fewer resources dedicated to the role of second language sentence processing in this context. *Second Language Sentence Processing* acts as the first full-length literature review of the field on the market, serving as an ideal resource for students in courses in applied linguistics, second language acquisition, and cognitive psychology.

Alan Juffs is Professor of Linguistics at the University of Pittsburgh.

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SECOND LANGUAGE SENTENCE PROCESSING

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SERIES EDITOR'S PREFACE

The Cognitive Science and Second Language Acquisition (CS&SLA) series is designed to provide accessible and comprehensive coverage of the links between basic concepts and findings in cognitive science (CS) and second language acquisition (SLA) in a systematic way. Taken together, books in the series should combine to provide a comprehensive overview of the conceptual and methodological intersects between these two fields. This means the books in the series can be read alone, or (more profitably) in combination. The field of SLA is related to, but distinct from, linguistics, applied linguistics, cognitive psychology, and education. However, while a great many published book series address the link between SLA and educational concerns, SLA and linguistics, and SLA and applied linguistics, currently no series exists which explores the relationship between SLA and cognitive science. Research findings and theoretical constructs from cognitive science have become increasingly influential upon SLA research in recent years. Consequently there is great reason to think that future SLA research, and research into its educational applications, will be increasingly influenced by concerns addressed in CS and its subdisciplines. The books in the CS&SLA series are intended to facilitate this interdisciplinary understanding, and are grouped into four domains: (1) Knowledge Representation; (2) Cognitive Processing; (3) Language Development; and (4) Individual Differences.

Alan Juffs and Guillermo Rodríguez's book, *Second Language Sentence Processing*, offers an in-depth review of research which seeks, as they explain in chapter 1, to understand the cognitive representation of second language processing and grammar from the perspective of formal theories of morpho-syntax, specifically, the formalisms of Universal Grammar and Principles and Parameters theory. While the focus of the research they describe throughout their book is on issues raised by generative accounts of language and processing, they do briefly refer to alternative emergentist, functional approaches such as the Competition Model, at the outset, in chapter 1, and look ahead, in chapter 8, to potential insights into sentence processing from

research in cognitive neuroscience, and the techniques adopted there. There are also valuable summaries of methods, such as eye-tracking and self-paced reading, as well as of measures of working memory, that have been used to examine issues of sentence processing. The issues involved in the study of second language sentence processing are fundamental to our understanding of second language acquisition, and the extended treatment of them offered here makes this book a very welcome addition to the CS&SLA series.

Peter Robinson
Series Editor

PREFACE

This book project grew out of Juffs' research on second language sentence processing that was inspired by work with Lydia White at McGill University and subsequently by conversations and collaboration with Brad Pritchett and Michael Harrington, who were both at Carnegie Mellon University in the early 1990s. Since the mid 2000s, Juffs has worked with Rodríguez as a graduate student and project director. Parts of chapters 3 and 4 derive from Rodríguez's (2008) dissertation. Rodríguez also worked as a research assistant for the relative clause study reported in chapter 5. In this book, Juffs is principally responsible for the present form of chapters 1–5 and chapter 8, while Rodríguez had primary responsible for chapters 6 and 7. We commented on each other's sections as needed and developed chapter 8 together.

The book is intended to be a broad overview of research from a generative perspective. It would be useful as a basic text for a course on second language sentence processing for very advanced undergraduates in psycholinguistics or a graduate course in second language acquisition that is then supplemented by more recent articles on the topics presented. After reading each chapter in one class session, the instructor could add recent articles in a follow-up class that takes the chapter as a point of departure or as a counterpoint to it. By using the book this way, students can understand the assumptions of current articles in refereed journals or work from competing frameworks that addresses some of the same issues. The book could also be a point of departure for a course that might consider how parsing and parsing breakdown is related to acquisition, but it is not intended to be a book about how parsing drives language acquisition because some of the 'structures' investigated relate to very abstract properties of grammar that are by definition not 'learned.'

Hence, the readership of the volume will be advanced undergraduates in SLA, linguistics and cognitive psychology, and graduate students and researchers in the same areas. We hope it will be a single first 'go-to' source for a literature review

for anyone interested in the current state of research in this area who is hoping to build on the current body of knowledge in second language sentence processing from a generative perspective. The book will be of interest to students in SLA in general and also to specific audiences due to the inclusion of research on east Asian languages, German and Spanish, as well as learners of English as a second language.

As far as we know, no volume contains an overview of second language processing research that provides the range and depth of structures presented. Although several edited volumes are available (e.g.,VanPatten & Jergerski, 2010; van Gompel, 2013a), none of these contains reviews that go into as much depth in the discussion of the linguistic and online experimental issues as we are able to in this volume.

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I am deeply grateful to Brad Pritchett and Michael Harrington for encouraging me to continue this line of research and for helping me along the way with discussions, criticism and ideas. Sincere thanks are also due to Harald Clahsen and Claudia Felser for inviting me to Essex in 1997 and for moving the field forward with cogent arguments and carefully crafted experiments that have challenged the whole field to do better work. I am also indebted to Lydia White, my dissertation advisor, for the training and support at McGill University. I would also like to thank Peter Robinson for the invitation to write this book.

This book could not have been written without the support of my colleagues in the English Language Institute at the University of Pittsburgh. They have provided the context in which both theoretical and applied SLA research can take place since my arrival in Pittsburgh over 20 years ago.

The University of Pittsburgh's Central Research Development Fund provided support for the research reported in chapter 5. The analysis and writing has also been supported by a grant to Alan Juffs from the Pittsburgh Science of Learning Center (www.learnlab.org), which was funded by the National Science Foundation award no. SBE-0836012. Previously, it was funding NSF award no. SBE-0354420.

I would also like to thank Robert L. Kacsmar for his support in life outside academia and especially in the final stages of writing in the late spring of 2013.

Alan Juffs
Pittsburgh, Pennsylvania, USA
May 2014

I am grateful to those who pushed me forward at the very beginning stages of my career, including professors at Universidad Nacional de Cuyo, and particularly Robert DeKeyser, whom I had the great fortune of working with at the beginning of my graduate studies at the University of Pittsburgh. I am also indebted to Alan Juffs, whose passion for the topics outlined in this book was fundamental to my decision to pursue similar research interests. It has been a pleasure to work with him during my graduate studies and the years beyond. I am also grateful for the colleagues and students I have worked with at the University of Pittsburgh, as well as my current institution, the University of Vermont, for their support and enthusiasm. No puedo dejar de reconocer el esfuerzo y la dedicación de mi familia, Carlos, Cristina y Laura, que allanaron siempre mi camino. Finally, I would like to thank Maeve Eberhardt, whose presence in my life has made all challenges and joys more meaningful. Y debo agradecerle también el poder compartir mi vida con su más hermosa creación, Leandro.

Guillermo A. Rodríguez
Burlington, Vermont, USA
May 2014

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INTRODUCTION

This book is a summary of research on second language sentence processing from the perspective of formal theories of morpho-syntax and how such theories might shed light on second language development (Chomsky, 1981, 1995; White, 2003). The book is intended to describe and summarize research that has already been published as well as some of our previously unpublished work. Within a formal framework, we address how adult users of a second language process language at the level of the sentence (usually during reading tasks), focusing on whether and how they deploy their knowledge of grammar to build a representation of the morpho-syntax of the clause being processed. Our goal is not to present a complete comparative overview of competing first and second language theories of sentence processing and acquisition. However, because the field finds itself so sharply divided, where appropriate we do refer to work in other frameworks that the interested reader should consult. We refer the reader to the excellent introduction to the edited volume by van Gompel (2013b) and papers in that volume for additional discussion on current issues in the field of sentence processing in general.

One might ask why researchers should investigate second-language processing at the fine-grained level of detail that we will present in this book. One fundamental reason is that such research is consistent with an approach to language learning that sees theories of language structure, language acquisition, and language processing as inextricably linked. It is an approach that is consistent with views of first language development that see processing breakdown as a trigger for acquisition (e.g., Fodor, 1998). White (1987), in her paper maintaining that comprehensible input alone was not adequate for language acquisition, has also suggested that processing breakdown is *one* component of a transition theory for second language acquisition. Moreover, processing is the basis for VanPatten's

(1996) approach to reconciling the competition between form and meaning in classroom instruction that can lead to successful learning.

In spite of this link between processing and acquisition, the book is *not* intended as a deep examination of how processing breakdown is *the one key* to understanding second language acquisition. Indeed, we do not consider that SLA can be explained by any one set of procedures; on the contrary, an understanding of SLA requires complementary theories of different scope as implied by Long (2007, p. 27). Instructed SLA is even less amenable to single, simple theoretical accounts because language itself is complex. For example, the development of pragmatic inference (Bardovi-Harlig & Hartford, 2005) will require a different set of conceptual tools for an explanation to the development of constraints in syllable structure. Moreover, language learning in classrooms depends on a wide variety of input types and output practice in different cultural contexts. Hence, this is not a book about how sentence failure 'causes' SLA, but rather a review of the issues that second language researchers who work in formal approaches to processing have worked on. The book is, however, a useful background for researchers who may wish to include processing failure in a theory of learning.

Second, a more profound understanding of second language sentence processing may afford insight into one of the three components of Sharwood-Smith's and Truscott's (2005) requirements for an overall theory of language acquisition: a theory of X, a theory of the development of X, and *how X was produced or comprehended*. This view provides the framework for discussing how and when processing can account for non-native performance and whether second language performance proceeds according to routines suggested by linguistic theories that have been proposed for first language performance. In other words, studying second language *performance* is a goal in itself, independent of its role in the performance process.

Ultimately, the knowledge from the study of second language processing *may* be applicable to pedagogical interventions such as input enhancement Sharwood-Smith (1986, 1993) and processing instruction (VanPatten, 2007), but the goal of this book is not to recommend such direct applications. It is up to scholars in pedagogy to adapt teaching to incorporate insights from processing indirectly, given the complexities of second language classrooms.

Many studies of language processing involve processing of written texts rather than spoken input. Reading sentences or texts is of course one step removed from language processing based purely on sound-structure. Moreover, anyone who has learned to read a deep orthography like English knows the challenge of mastering the imperfect relationship between phonemes and graphemes, and so text-decoding ability should factor more into our understanding of processing experiments. In spite of these decoding effects, processing performance in reading does allow researchers to infer how a learner's grammar is used in real time, thereby providing insight into the learner's grammar itself. Thus, the goal is

to better understand the cognitive representation of second language processing and grammar. Finally, from behavioral measures such as reading experiments, it is possible to lay the groundwork for additional future work in the rapidly developing field of cognitive neuroscience of second language knowledge.

Research in second language sentence processing requires the integration of several components of language study. In SLA research, White (1989, 2003) among others has largely convinced the field that a theory of *what* is being acquired (a property theory) is necessary if we are to understand adult SLA. Moreover, Gregg (1989, 2003a) has made it clear that a theory of *how* acquisition is achieved (a transition theory) is also necessary. Thus, a fine-grained theory of the syntactic representation of their second language that the learners have, or seek to have, is necessary. Indeed, some of the major questions in this area concern precisely the nature of the syntactic representations learners use when they comprehend sentences in the second language in real time. Research has focused on whether second language grammars are as complex and detailed as the grammars of native speakers of a language and whether such abstract representations are used to build syntactic structure online so that comprehension can be successful.

The theory of the target of learning, the property theory, in much SLA research has been that of Chomsky's Principles and Parameters theory (Chomsky, 1981; 1986). This approach to language proposes that knowledge of language consists of universal constraints, a set of abstract features that may be realized in different languages in an arbitrary set of morpho-syntactic or morpho-phonological ways (e.g., Case and Agreement), a universal interpretive component (Logical Form, LF), a phonological component (Phonological Form, PF), and a lexicon.

Principles and Parameters theory developed from earlier versions of transformational formalisms of syntax that had already introduced the idea that superficially long-distance dependencies between elements in a clause or clauses were in fact 'covertly' local. The formalisms developed in the course of this research were shown to generalize beyond specific structures to a range of phenomena including anaphoric reference, wh-movement, and quantification. (For a useful summary see a textbook treatment such as Carnie, 2003). Part of the formalism for this covert locality included a set of general constraints on the association between two or more non-adjacent positions in syntactic representations. Such constraints referred to the features associated with functional projections (e.g., WH features or *tense* features) and the (relative) position of nodes bearing such features in a non-symmetric configuration. Second language acquisition researchers have used these formalisms to investigate knowledge of a second language since the mid 1980s. Hence, the research discussed in this book is couched in the well-known formalisms of Principles and Parameters theory. Each chapter includes a review of the basic syntactic phenomena that form the basis of the processing experiments.

Second, processing research needs a theory of how incoming linguistic information—either from speech or a text—is related to the existing mental grammar so that successful comprehension can occur. This requirement bears

repeating: every time we read or hear language, the brain must use a system to compare that input to the existing system in order to understand it. If that system is deficient or makes the wrong analysis, then comprehension cannot occur. This question can be considered from two points of view: (i) how is incoming text processing related to the second language (L2) grammar? (ii) What is the influence of the first language when processing a second language? These are the key questions related to processing. One might ask whether there are totally separate 'processing principles' for parsing that are totally independent of the grammar. Such principles might be analogous to 'learning principles' such as the Principle of Contrast for word learning (Clark, 1987) or the Subset Principle for structure (e.g., Wexler & Manzini, 1987).

A third, and of course related, reason that processing is important relates to its role in acquisition. Any theory of (first) language development has to account for the relationship between the linguistic input that learners encounter (first through listening and later through reading) and the development of syntactic representations. In formal theories of language acquisition, processing is considered to be important because failures in processing have been said to 'trigger' grammatical development (Fodor, 1998). The idea here is that if the existing grammar cannot parse the input and therefore assign a meaning to it, then a conflict is set up between the grammar and the input. Gibson and Wexler (1994) considered *how* the appropriate feature values provided by Universal Grammar (UG) are learned for specific languages. They propose that properties of the target language are accessed through parsing the input, and that learning occurs when the grammar fails to parse the input with the existing grammar. The problem that Gibson and Wexler address is that some surface word orders present data that is ambiguous as to the underlying syntactic structure. German provides an interesting example because of its variable word order in main and embedded clauses. A simple German sentence is SVO, e.g., *die Katze sucht die Maus*, 'the cat looks for the mouse,' with the finite lexical verb before the object. But when a modal is introduced, e.g., *will* = 'want,' the lexical verb is sentence final, *die Katze will die Maus suchen*, 'the cat wants to look for the mouse.' Hence, the learner must determine on the basis of this conflicting evidence, whether to set the headedness of the verb phase to V initial [V [NP]] or V final [[NP] V]. Additional evidence for the verb final nature of the verb phrase in German comes from sentences where the lexical verb is in sentence final position with compound tenses, e.g., *die Katze hat die Maus gesucht*, 'the cat has looked for the mouse,' and embedded clauses *die Frau glaubt daß die Katze die Maus sucht*, 'the woman thinks that the cat is looking for the mouse.' Hence, the data available to both a first and a second language learner show that the verb and the object may appear either to the left or the right of the lexical verb. Crucially, in main clauses, the finite lexical verb always precedes the object.

Fodor (1998, p. 13) also addresses this problem and suggests that acquisition consists, in part, in avoiding *ambiguous* triggers, and relying only on unambiguous triggers. Thus, for German, the learner would focus on the majority of clauses

that are verb final and avoid using the simple clause 'the cat looks for the mouse' as a definitive indicator of the headedness of VP. The key points from Gibson and Wexler (1994) and Fodor (1998) here for our argument are that successful L1 learning consists of (1) parsing the input; (2) avoiding ambiguous evidence; (3) never giving up on a superficially successful grammar, but only one that fails to license the input; (4) only shift to the *new* grammar if it successfully parses the input. Presumably, there is a tension between 3 and 4. For example, children learning German as a first language start off with a verb-final VP structure. The V-final parser might fail with an SVO sentence, but no shift to the new grammar will occur unless it is successful with other clauses too. The conflicting data will be an indication that a deeper property of German is at play—namely, that finite verbs in German 'move' in a simple finite main clause for tense reasons. Indeed, German children only start using consistently correct VO word orders with subjects when they start using subject-verb agreement productively (Clahsen, 1990, p. 381). Hence, learning deeper properties of language from surface input turns out to be quite easy as long as you focus on key properties of the language being processed and ignore potentially misleading data. Hence, learning the structure of the German VP requires learners to ignore potentially misleading data until they discover the relationship between tense and the position of finite verbs. It seems that German children do exactly this.

A reviewer points out that parsing failure as an engine of acquisition is paradoxical—that is, "how can a learner make use of unparsable sentences if the learner cannot process them in the first place?" One possible answer to this is that the learner comes equipped with some knowledge concerning what is possible and not possible—the standard UG argument from the poverty of the stimulus perspective (White, 1989). White (1987) illustrates this point with an example from passive. If a learner who does not know passive in English encounters a sentence such as 'the rabbits were eaten,' the fact that 'eat' is optionally intransitive might allow the learner to skip the morphology, 'the rabbits [⋆] eat[⋆]' and assume that the sentence means 'the rabbits ate something,' comparable to the grammatical sentence, 'the rabbits eat at dusk.' In contrast, 'the rabbits were killed,' does not permit an 'end-run' around the grammar by ignoring morphology. The verb 'kill' is obligatorily transitive in English and so an argument is missing, which is a violation of the theta criterion. In this case, the learner would be compelled to reassess the input and seek an alternative to the parse, incorporating the morphology that allows a grammatical function change of the Theme from a syntactic object in the VP to the subject of a passive. Such failure driven parsing requires the consultation of fundamental principles in grammar (in this case the theta criterion and NP movement). It should be noted that opponents of generative theory are unwilling to accept such UG-based parsing accounts of acquisition, e.g., see Kidd (2004) and other reviews of Crain and Thornton (2000).

Based on these considerations, some questions for a transition theory of adult SLA would thus seem to be: (a) Are learners sensitive to structural ambiguity?

(b) Do they use their L1 grammar to parse L2 input at the inception of L2 learning or do they start from scratch? (c) Can they successfully shift parameters by parsing input with a grammar that fails, and then switching to one that does the job? (d) Do learners not parse the input using grammatical principles at all, thus showing that their knowledge and processing of the L2 is quite different from L1 grammar and processing systems? The same questions arise in third language acquisition where the input may be deficient in some ways, cause processing breakdown that triggers development, or is misprocessed leading to incorrect grammar development (Corder, 1967; VanPatten, Dvorzak, & Lee, 1987; White, 1987). This concept is already familiar to L2 researchers in the distinction that is made between input and intake, but the focus here is on how input is processed in order to become intake in real time. Moreover, in instructed SLA, processing failures based on L1 influence and too much reliance on semantic cues have both been thought to be a cause of errors in comprehension (VanPatten, 2007).

In sum, then, understanding the nature of processing in second language acquisition has the potential lead to insights into developmental processes and to the establishment of better instructional treatments. As mentioned already, however, this volume is not intended to be an account of processing-driven acquisition but a review of existing research that explores the relationship between the grammar and the parser. If it can be established that adults can use abstract principles, then the existence of such principles in an overall theory of acquisition will have to be accounted for. Let us consider these three issues in more detail.

A Theory of Grammar

In a series of articles, Gregg (1989, 2003a) and White (1987, 1989, 2003) among others have argued that a theory of second language acquisition requires two elements. First, a theory of the target of acquisition—a property theory—and second, a theory of how that grammar is acquired—a transition theory. In second language acquisition, as in linguistics in general, competing property theories exist that propose completely incompatible views of the nature of language itself. This situation is simply one that second language researchers have to deal with. To some extent, one might consider the phenomenon being considered and choose the most appropriate theory for a particular research question as alluded to earlier in the reference to Long (2007). Obviously, it is not possible for a book such as this to determine which is actually the right theory for each subcomponent of the grammar. Our view is that the range of linguistic phenomena to be accounted for—pragmatics, the lexicon, phonology, and abstract constraints on syntax—will require several theories that are separate modules of language knowledge. In formal linguistics, this view is fairly uncontroversial (Jackendoff, 2002) and indeed the recent focus on interfaces in second language acquisition reflects this view (e.g., Sorace & Serratrice, 2009; Sorace, 2011, and commentary on that paper). In addition, to some extent, the choice of framework will depend on disciplinary

training. In this brief introduction, we will consider the strengths of two models and explain our focus on the first of the two.

Formal Approaches to Language and Language Processing

It is fair to say that the overwhelming majority of research in the domain of first language syntactic processing is based on some version of formal linguistic theory. Hall (1995, p. 171) states that a formal grammar is an explicit description of a speaker's knowledge of his or her language(s). An explicit description means that all the properties are stated completely and precisely as a system of operations on linguistic categories. Formal theories proposed by generative linguists (e.g., Chomsky, 1981) have dominated mainstream north American linguistics since about 1965, but several alternative proposals have been made that are equally fine-grained (e.g., Head-Driven Phrase Structure Grammar, Pollard & Sag, 1994). Formal theories have typically covered the widest range of morpho-syntactic phenomena including simple clauses, complex sentences, and relations among non-adjacent clause elements (e.g., question formation 'Who does Mary think John saw __?' and anaphora 'John thinks *Bill* admires *himself* too much'). However, other theories exist that take complexity seriously and meet the 'formal' definition. They include Van Valin and La Polla's (1997) role and reference grammar and proposals made in O'Grady (1987, 2005, 2012) and O'Grady et al. (2009). The difference between these theories and Chomsky's theory is that Chomsky's theories have been used to explore a wider range of constructions and also in more languages than these other theories (e.g., Baker, 1988; 1996) and so the operation of these principles is perhaps better understood than competing theories. Hence, rather than a matter of 'taste,' as suggested by one reviewer, our focus is on a theory that has been shown to be able cover a wide range of phenomena and languages.

The reason that generative formal theories have dominated processing research is that from the outset these theories provided enough *explicit* detail in their analysis of language and at an appropriate grain-size (Freidin, 2009, p. 454) for processing researchers to formulate testable and falsifiable hypotheses about how language comprehension proceeds. For example, the simple sentence in (1) 'Mary shot the man with the pistol' is globally ambiguous—either Mary or the man had the pistol.

(1) Mary shot the man with the pistol.

As can be seen in Figures 1.1 and 1.2, the ambiguity can be 'explained' by attaching the adjunct 'with the pistol' the NP (the man has the pistol) or to the VP (Mary has the pistol). We also have to understand that 1.2 is the preferred reading. Obviously, shooting is usually done with a pistol, so to some extent pragmatics is involved, but structural considerations may also be at work, as we shall see.