MORPHOSYNTACTIC PROCESSING, CUE INTERACTION, AND THE EFFECTS OF INSTRUCTION: AN INVESTIGATION OF PROCESSING INSTRUCTION AND THE ACQUISITION OF CASE MARKINGS IN L2 GERMAN

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ABSTRACT

Sentence comprehension is among the most fundamental elements of second language (L2) acquisition, but it is also incredibly complex because L2 learners have to develop the ability to detect multiple types of cues in the input and interpret them in context. This is particularly difficult given that L2 learners have limited knowledge of these cues and have limited resources to process them. As a result, L2 learners employ a variety of strategies to help them make sense of complicated input. These strategies include attending to simpler or more salient cues in the input, such as lexical items, semantic cues (e.g., animacy, plausibility), or word order (VanPatten, 2004a). Consequently, other cues, such as morphosyntax (e.g., tense or case information) are not processed readily, and learners have difficulty acquiring these forms. Thus the presence of more salient forms that encode the same semantic information, may present a significant barrier to acquisition. On the other hand, there may be situations where certain cues support each other and promote acquisition. For example, current research (e.g., Grünloh, Lieven, & Tomasello, 2011) suggests that prosody (e.g., stress, pitch) may support the processing of morphosyntactic forms.

The goal of this dissertation is to explore the psychological principles that underlie learners’ interactions with lexical-semantic, morphosyntactic, and prosodic cues in an input stream and to investigate how these processes impact the acquisition of morphosyntactic forms. Furthermore, this dissertation seeks to examine whether instructional interventions such as Processing Instruction can take advantage of these psychological principles in order to change processing behaviors and promote the acquisition of morphosyntactic cues. In order to address these issues, the present research tests the offline and online (i.e., real-time) effects of Processing
Instruction on the acquisition and subsequent processing of German accusative case markers, which signal subject-first and object-first word orders as in (1):

(1a) *Der Kellner küssst die Frau im kleinen Restaurant.* (Subject-First)
    TheNOM waiter kisses theACC woman in.the small restaurant.
    "The waiter kisses the woman in the small restaurant."

(1b) *Den Kellner küssst die Frau im kleinen Restaurant.* (Object-First)
    TheACC waiter kisses theNOM woman in.the small restaurant.
    "The woman kisses the waiter in the small restaurant."

In Experiment 1, two groups of third semester learners of German received two types of training: Processing Instruction (PI), in which lexical-semantic and reliable word order cues were explicitly removed from the input; and Traditional Instruction (TI), in which cues were not manipulated. Offline effects of the treatments were measured by sentence interpretation and picture description tasks following a traditional pre-test/post-test design. Changes in real-time processing strategies were assessed via a self-paced reading (SPR) task using sentences like those in (1). During this task, reading times for individual phrases were measured, and it was expected that learners would read object-first sentences slower if they processed the accusative case-markings. The results indicated that the PI group outperformed the TI group on the posttest offline comprehension task and equaled their gains on the offline production task. However, results from the SPR task provided no evidence that either group was slower to read object-first sentences.

The goal of Experiment 2 was to improve the methodology of Experiment 1 and investigate whether the inclusion of prosodic cues in the training could facilitate acquisition and processing of the target form. Thus, three training groups were under investigation: TI, standard PI, and PI that includes prosodic cues (PI+P). The effects of instruction were again measured using the online and offline tasks used in Experiment 1. The results indicated that the PI and
PI+P groups outperformed the TI group on the posttest offline comprehension measures and that all three groups improved equally on the production measures. Results from the SPR task indicated that none of the groups processed the experimental sentences in a native-like way and that participants had difficulty comprehending sentences in this task. However, there is evidence to suggest that the PI and PI+P groups directed more attentional resources towards case markers after training. Furthermore, evidence from the SPR task suggests that the PI+P group did process object-first sentences with more effort after reading the entire sentence.

Taken together, the pattern of results for these experiments suggest that Processing Instruction did have a significant impact on the acquisition of the target form. Furthermore, it appears that Processing Instruction does influence processing strategies, but that its effects are mediated by other factors (e.g., working memory, or the speed of lexical access) that prevent rapid and efficient integration of morphosyntactic information. These data suggest that lexical-semantic cues hinder the acquisition of morphosyntactic cues, but that prosodic cues can play a facilitative role in the acquisition and processing of these forms. These findings are discussed within the context of the Input Processing model (VanPatten, 2004a) and the Competition Model (Bates & MacWhinney, 1987), and pedagogical implications are discussed within the context of research on Processing Instruction (VanPatten & Cadierno, 1993).
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LIST OF ABBREVIATIONS

**CM**: Competition Model

**DMC**: Double-Masculine Construction

**EI**: Explicit Information

**ERP**: Event-Related Potentials

**F0**: Fundamental Frequency

**IP**: Input Processing

**L1/2**: First/Second Language

**NP**: Noun Phrase

**NP1/2**: First/Second Noun Phrase in a sentence

**NVN**: Noun-Verb-Noun

**OOVS**: Object-Object-Verb-Subject

**OVS**: Object-Verb-Subject

**PI**: Processing Instruction

**PI+P**: Processing Instruction with prosody

**RT**: Reading Time

**RQ**: Research Question

**SD**: Standard Deviation

**SI**: Structured Input

**SLA**: Second Language Acquisition

**SPR**: Self-Paced Reading

**SVO**: Subject-Verb-Object

**TI**: Traditional Instruction
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CHAPTER 1: Introduction

1.1 Description of the Problem

Among the most fundamental elements of second language (L2) acquisition is the ability to comprehend sentences in the second language. Yet, comprehension is an incredibly complex task, owing largely to the fact that natural language contains a vast set of linguistic information, including phonological, morphological, lexical, semantic, and syntactic forms (or cues). Given that learners often have limited knowledge of these cues—and given that they have limited resources to process them—the language processor must make use of an imperfect system for comprehension, relying on strategies that simplify the task by attending to known cues and limiting the amount of information that is processed at one time (VanPatten, 2004b). While these strategies are efficient, they are often inaccurate and lead to erroneous interpretations of the input. Perhaps more importantly, these strategies, while useful during early stages of acquisition, may make it difficult to acquire complex or non-salient grammatical cues because they are not attended to during comprehension. In other words, the strategies that learners use to understand sentences have a significant impact on the acquisition of grammatical forms and how they operate within the context of other forms.

In order to construct meaning and comprehend sentences efficiently, learners need to develop at least three kinds of knowledge. The first of these is knowledge about individual forms and their real-world meanings. Thus, an important facet of acquisition is that it depends heavily on a learner’s ability to develop form-meaning connections during sentence processing (Fodor, 1998b; MacWhinney, 1987; VanPatten, 2004b). This, of course, is not an easy task given that learners may not even be aware of which cues are available in the input, much less which ones are relevant for a specific function. For example, in order to recognize that the word played
denotes past tense, learners must first recognize that the –ed ending is a functional morpheme separate from the root lexical item *play*. Then they must recognize that –ed is only present when verbs refer to actions occurring in the past; only then can they connect the morpheme to the past tense and actively use it to distinguish past events from non-past events during sentence comprehension. This task is complicated by the fact that some cues may ‘hide’ others. In particular, learners tend to use lexical items and semantic cues (e.g., animacy, plausibility, probability) strategically to understand sentences, rather than taking advantage of available morphosyntactic cues (e.g., tense and case morphemes). In essence, lexical-semantic cues can either ‘block’ attention to these forms or make it difficult to isolate their functions since meaning is given redundantly by other cues (N. C. Ellis, Hafeez, Martin, Chen, Boland, & Sagarra, 2012; Ibbotson & Tomasello, 2009; VanPatten, 2004b). As a result, knowledge of individual cues and their functions is slow to develop, and difficulty putting this knowledge to use in real time persists beyond early stages of acquisition, particularly with respect to morphosyntax (Jackson, 2008; Jiang, 2004; Keating, 2009).

The development of form-meaning connections for individual cues, however, is only one layer of knowledge that learners need to understand sentences; they must also have knowledge of how cues relate to one another and how the presence of multiple cues affects meaning. For example, for English simple transitive sentences, preverbal positioning of a noun phrase (NP) suggests that a noun is the subject or agent of the sentence. However, when a verb is marked for passive voice, preverbal positioning denotes that it is the direct object or theme of the sentence. The same word order cue (preverbal positioning) can therefore have the exact opposite meaning depending on verbal morphology. As a consequence, learners must develop a complex network of cues that represents the interdependent nature of forms in the target language.
In addition, learners need to develop knowledge of which cues are most reliable for structure building. Because cues often conflict with each other and suggest different interpretations, it is important that learners be able to recognize which cues reliably carry the meaning intended by the speaker. For instance, in German, preverbal positioning typically suggests that a NP is the subject of the sentence, just as in English. However, German marks case primarily through articles in the NP, and these cues are used reliably to assign grammatical role when they are available.\(^1\) When an NP is marked for accusative case in German, it is interpreted as the direct object of the verb, regardless of its position in the sentence. Consequently, L2 learners need to know that case markers are the most reliable cue to assign grammatical roles in German, not word order.

One important question in SLA concerns how these knowledge sets develop during acquisition. How are learners able to connect forms to meaning? How do they recognize that cues may interact to change meaning? How do they come to use the most reliable cues in the target language, even when this conflicts with what cues are most reliable in their native language? Current research on sentence comprehension and cue use suggests that this knowledge develops out of continued processing of cues in circumstances where input can be interpreted unambiguously and form-meaning connections are easy to identify. Specifically, these circumstances tend arise under two conditions (1) when meaning is not redundantly represented by multiple cues in the input, or (2) when cues suggest different interpretations of the input and the parser is forced to reanalyze input strings to accommodate new structures (Dekydtspotter & Renaud, 2014; Fodor, 1998b; VanPatten, 2004a). Unfortunately, the occurrence of such input

\(^1\) Due to case syncretism, case markers can only be used to assign grammatical roles unambiguously when a simple transitive sentence contains at least one masculine NP (see section 2.1.1.4.1).
strings may be relatively low in natural language, depending on the structure that is to be acquired. As a consequence, learners need massive amounts of input to develop the full network of cues in the target language.

Given that learners are not often in a position to receive the amount of quality input needed, cue knowledge is often slow to emerge, and in fact, many learners never attain native-like control of L2 grammatical structures. This is particularly true for classroom learners, who are often limited to three to four hours of exposure a week. Thus, it is important to understand how learners comprehend sentences, what type of input is useful for acquisition, and how input can be optimized to promote the acquisition of targeted cues. Current research on input processing (e.g., VanPatten, 2007) and Processing Instruction (e.g., VanPatten & Cadierno, 1993) seeks to do just that. Input processing research is primarily concerned with which parts of the input (i.e., what linguistic data) learners use to understand sentences, and what constrains or guides processing behaviors (VanPatten, 2012). Using principles derived from this research, Processing Instruction seeks to structure input and change learners’ processing strategies such that they are more likely to attend to targeted morphosyntactic cues and connect these cues to their underlying semantic meanings. This technique has traditionally been used to promote the acquisition of morphosyntactic forms such as case-marked nouns and pronouns (Henry, VanPatten, & Culman, 2009; VanPatten & Cadierno, 1993; VanPatten & Collopy, 2012) or verbal inflections (Benati, 2001, 2005; Cadierno, 1995), and it has been found to be successful for increasing both comprehension and production of targeted forms.

Despite continuing research on both input processing and Processing Instruction, there are still many open questions in the field. With respect to input processing, much research has shown that learners selectively attend to cues in the input and that the presence of lexical-
semantic cues may act as a barrier to the processing and acquisition of morphosyntactic cues. Yet, it is still unclear whether other cues in the input, for example prosody, might call attention to morphosyntactic forms and aid the development of form-meaning connections. Thus, how the quality of input (i.e., the presence or absence of cues) affects acquisition is only partially understood. With regard to Processing Instruction, although numerous studies have investigated its effectiveness for comprehension and production, nearly all of these have used traditional offline pretest and posttest designs. Therefore, Processing Instruction’s central claim—that it influences the strategies for processing linguistic information online—has not yet been systematically investigated; thus development in learners’ processing strategies have not been observed directly (but see Dracos, 2013).

In short, the present research seeks to add to these bodies of research by exploring the qualities of linguistic input that lead to the acquisition of morphosyntactic cues and their use during L2 sentence comprehension. This dissertation presents two studies in which third and fourth semester L2 learners of German were trained on the use of masculine accusative case markers and tested using both offline (pen and paper) tests and online measures that tap into the processes underlying real-time sentence comprehension. In the first of these studies, two types of training were compared: (1) traditional instruction, in which surface cues are not manipulated to promote processing of the target form, and (2) standard Processing Instruction, which structured input so that lexical-semantic and consistent word order cues were removed from the input. In the second of these studies, a third training was included, which was identical to the standard Processing Instruction training, but also added prosodic cues to the input. By measuring the effectiveness of these trainings, the present study hopes to show how the presence or absence of lexical-semantic and prosodic cues affects the acquisition and real-time use of case markers in
German. Furthermore, because Processing Instruction is the primary vehicle for this investigation, the observed effects of training provide detail to research on Processing Instruction itself, particularly in regards to whether it changes processing strategies as claimed in the Processing Instruction literature.

1.2 Layout of the Dissertation

This dissertation is organized as follows. Chapter 2 will present the background literature that serves as the primary theoretical basis and motivation for the present study. This overview includes a review of the Input Processing model (VanPatten, 2004a) and insights gained from the Competition Model (Bates & MacWhinney, 1987), followed by a discussion of cue interaction (i.e., cue competition and additivity), and its implications for L2 acquisition. I then review the research on Processing Instruction, highlighting its major findings and addressing the major gaps in the literature. This chapter concludes with a discussion of the motivations and goals for the present study. Chapter 3 presents the research questions, methodology, and results of the first experiment. This is followed by a discussion of the findings, which also motivates the second experiment. In Chapter 4, I present the major research questions and describe the methodology used in the second experiment, focusing on methodological changes made from the first experiment. I then present the results and discuss the key findings in relation to the trainings used in the experiment. Chapter 5 summarizes the results, discusses the major theoretical and pedagogical implications of these studies, and draws conclusions relevant to the issues raised throughout the dissertation. To conclude, I discuss some potential limitations of the current study and pose questions that can inform future research.
CHAPTER 2: Background

2.1 Input Processing

As a field within the broad scope of second language acquisition (SLA) research, input processing is primarily concerned with how learners make the initial connections between a language’s surface features (forms) and their underlying semantic notions (meanings) (VanPatten, 2012). Thus, research on input processing provides critical information about how the processor makes use of an underdeveloped grammatical system for the purposes of comprehension and acquisition. Historically, the field developed out of research showing the importance of input and sentence comprehension during second language acquisition (see Krashen, 1982), which is tempered by the fact that learners seem to filter input and misinterpret sentences (VanPatten, 2012). In other words, it seems that internal psycholinguistic factors play a significant role in the way sentences are interpreted.

While the field of input processing is necessarily narrow in its scope and is concerned with only a small slice of the acquisition process, the ability to connect form to meaning serves as the underpinnings for grammar acquisition more broadly because it affects knowledge of individual cues and the cue networks in a particular language. Thus, understanding how learners filter input and detailing the psycholinguistic conditions under which form-meaning connections are made is critical to understanding the development of grammatical competency.

2.1.1 VanPatten’s Input Processing Model

The most well-known model that attempts to address the internal mechanisms and strategies that learners use to process sentences is VanPatten’s Input Processing (IP) model (VanPatten, 2004a). In essence, this model provides a “psycholinguistic explanation for the
widely-observed fact that early in development, L2 (and L1) learners often encounter difficulty with certain grammatical forms, particularly bound morphemes (e.g., case markers in Japanese) and ‘little’ words carrying grammatical information (e.g., auxiliary do in English)” (Harrington, 2004, p. 82). This explanation comes in the form of a set of principles and their corollaries that describe processing strategies and detail which linguistic cues are processed more easily—or more readily—than others when cognitive resources are limited.

The principles that serve as the backbone of the IP model are well founded within the psycholinguistic literature, and they have found widespread support in a range of research studies that have used traditional offline tests (e.g., LoCoco, 1987), behavioral methods such as self-paced reading and eye-tracking (e.g., Cameron & Charleston, 2013; Keating, 2009), and neurophysiological approaches such as event-related potentials (ERPs) (e.g., Hahne & Friederici, 2001; Reichle, Tremblay, & Coughlin, 2013). Some of this research has been conducted in the domain of sentence processing, which in recent years has seen spirited debate over ultimate attainment and the end-state of L2 processing mechanisms (Clahsen & Felser, 2006a, 2006b). However, it is important to recognize that the principles of the IP model are not meant to comment on L2 sentence processing more broadly, and they do not necessarily characterize its final state. Rather, these principles refer to constraints on processing that may be active during acquisition (VanPatten, 2004a), and they are focused specifically on early stages in L2 development. Thus, while research on L2 sentence processing—and particularly those studies that test beginning or intermediate learners—provide evidence for the IP model, the reverse is not necessarily true.

Finally, it is worth briefly mentioning that, although the principles of the IP model provide a descriptive framework, they also make predictions about acquisition. Because the
model suggests that certain cues are privileged over others (i.e., that certain cues are more likely to be processed than others), it also suggests that learners are less likely to make certain specific form-meaning connections. Thus, IP predicts the types of structures that should pose greater difficulties for learners, and it predicts that these more difficult forms should be more easily acquired when privileged cues are absent from the input. This will be discussed in detail in sections 2.3 and 2.4.

2.1.1.1 The Primacy of Meaning

At the core of the IP model lies the notion that the primary goal of sentence processing is to derive meaning and that linguistic exchanges are fundamentally communicative in nature. Thus, the model inherently suggests that the need to extract grammatical information from the input is secondary to the need to extract meaning. This concept is reflected in one of the fundamental principles of the IP model, the Primacy of Meaning Principle:

(1) The Primacy of Meaning Principle: Learners process input for meaning before they process it for form.²

As the principle implies, the focus on global meaning and communicative intent inevitably leads to instances where some surface forms—morphosyntax in particular—are not processed for acquisitional purposes (VanPatten, 2004a). That is, some individual forms are not connected to their specific meanings. Of course, grammatical structures in the input must eventually be attached to meaning in order to serve acquisitional functions (Sharwood Smith, 1986). The Primacy of Meaning Principle simply hypothesizes that—because comprehension plays a

² Each of the model’s principles stated explicitly in this section are quoted directly from VanPatten (2004) unless otherwise noted. Although the language of the principles has been updated more recently (e.g., in VanPatten, 2007), these are the most commonly cited version of the principles and this reference provides the most recent comprehensive view of the IP model to date.
fundamental role in communicative functions and because of limits on cognitive resources (e.g., working memory)—the extraction of meaning must be privileged relative to the processing of linguistic form (VanPatten, 2004a).

The Primacy of Meaning Principle is aligned with current SLA theory, which emphasizes the importance of making specific form-meaning connections (N. C. Ellis, 2007; Gass & Mackey, 2007) rather than simply noticing grammatical forms in the input (Truscott, 1998; VanPatten, 2009; but see Schmidt, 2001 for counterarguments). The principle is also compatible with multiple strains of psycholinguistic research. Within the psycholinguistic literature, sentence processing that makes wide use of lexical-semantic cues (e.g., lexical items, animacy, plausibility, etc.) and surface-level syntactic cues (e.g., word order) is referred to as shallow processing (e.g., Clahsen & Felser, 2006a). As VanPatten (2012) notes, this reflects a “good enough” processing strategy that bears a strong relationship to the primacy of meaning principle. As will be discussed in section 2.1.2, this strategy is well-documented in the L1 processing literature (Christianson, Hollingworth, Halliwell, & Ferreira, 2001; Ferreira, Bailey, & Ferraro, 2002; Ferreira & Patson, 2007), and it has been hypothesized that shallow processing may play a more important role in L2 sentence processing (Clahsen & Felser, 2006b) and ultimate attainment.

2.1.1.2 Cognitive Resources

A principle subsumed under the Primacy of Meaning Principle, but which deserves almost equal attention, is the Availability of Resources Principle. While the former speaks directly to what it is learners try to do during sentence processing, the latter addresses why they follow a “primacy of meaning” strategy during L2 comprehension in the first place. According to the Input Processing model, processing resources are limited during L2 comprehension:
The Availability of Resources Principle: For learners to process either redundant meaningful grammatical forms or nonmeaningful forms, the processing of overall sentential meaning must not drain available processing resources.

As Harrington (2004) rightly states, limitations on processing capacity are one of the most important factors in determining what forms are processed in the input. When coupled with real-time processing demands, the need to comprehend sentences dictates that some information is inevitably left unprocessed, most notably, grammatical information that is either non-meaningful or redundant. However, an oft overlooked aspect of the Availability of Resources Principle is that it allows for learners to direct processing resources towards information relevant to the task demands (VanPatten, 2004a). That is, learners could selectively attend to parts of an input stream if it is useful for performing a specific task.

Support for the Availability of Resources Principle comes largely from research in the psycholinguistic domain that has detailed relationships between working memory capacity and comprehension processes (see e.g., Just & Carpenter, 1992; Waters & Caplan, 1996a, 1996b). In L2 acquisition, working memory has been shown to play a role in reading comprehension (e.g., Harrington & Sawyer, 1992), writing (e.g., Adams & Guillot, 2008; Leeser, 2007), speaking (Fortkamp, 2000; I. O’Brien, Segalowitz, Collentine, & Freed, 2006), and syntactic processing (e.g., Miyake & Friedman, 1998). Yet, direct evidence for working memory effects in L2 processing—especially with regard to morphosyntax—is not robustly attested (Dracos, 2013; see Juffs & Harrington, 2011, for a recent review). It is, however, clear that the deployment of cognitive resources plays some role in the ability to use syntactic information, because distance and complexity affects are robustly attested in L2 processing (e.g., Keating, 2009; Marinis, Roberts, Felser, & Clahsen, 2005; Pliatsikas & Marinis, 2013; Wen, Miyao, Takeda, Chu, &
Schwartz, 2009; but see Jackson & Bobb, 2009 for counterevidence). As sentences become more complex, they inevitably require learners to hold more information in working memory until it can be integrated into the parse (Gibson, 1998). Consequently, these effects provide a window into memory effects.

One study that clearly shows the effects of distance was conducted by Keating (2009). In an eye-tracking study, Keating tested whether beginning, intermediate, and advanced L2 learners of Spanish were sensitive to noun-adjective agreement errors. The experimental stimuli were made up of sentences in which there was a gender mismatch between a noun and its modifying adjective found at three hierarchal distances: (1) within the determiner phrase, (2) within the verb phrase, and (3) across a clause boundary. The results showed that the advanced learners were sensitive to gender agreement that took place within the determiner phrase, whereas the beginning and intermediate learners were not. This result indicated that the advanced learners had developed an underlying grammatical competence and a degree of online processing ability that allowed them to compute gender agreement locally; yet, as a group, they were not sensitive to agreement errors that crossed phrasal boundaries. Thus, Keating concluded that “L2 learners may not have the processing resources necessary to hold information about gender in working memory while processing material that intervenes between nouns and adjectives” (p. 527). Keating also noted that individual participants did appear to process gender ungrammaticalities within the verb phrase and across clause boundaries, suggesting that there are individual differences in processing resources that may allow some learners to process gender agreement more effectively.

While these effects show that the availability of resources can lead to difficulties when learners must process complex linguistic elements, there is also evidence that processing
capacity can affect the processing of local grammatical elements. For example, McDonald (2006) investigated how reduced processing capacity could affect grammaticality judgments in English native speakers. In two experiments a control group of native English speakers and a group of L2 speakers completed a grammaticality judgment task under normal conditions. Five additional groups of English native speakers performed the same task under various conditions that added stresses to working memory, time constraints, or a degraded speech signal. McDonald found that the stressed native speakers often failed to reach the accuracy of the L1 controls, and that—particularly when processing sentences with an overlay of white noise—these L1 speakers performed similarly to the L2 learners with respect to their judgments on article omission, tense formation, subject-verb agreement, and word order.

As the studies described above illustrate, processing capacity is clearly an important factor in determining what information L1 and L2 speakers can use online. Critically, if resources are drained by phonetic decoding, lexical processing, or holding information in working memory, speakers seem to adopt processing strategies driven by lexical-semantics. Though the aforementioned studies show that processing resources are an important factor at the highest levels of L2 proficiency, and even in L1 speakers, this point can be extended to learners who have not yet acquired native-like competence. For example, Miyake and Friedman (1998) found that Japanese learners of English with lower working memory capacity tended to rely on animacy as a cue to identify agents, whereas high-span learners were able to use word order cues. As they point out, cues that can be put to use without considering other words or phrases in the sentence are more easily identified and put to use than cues that refer to other parts of the sentence or discourse; thus when there are not sufficient resources, lower-proficiency learners will also tend to rely on these lexical-semantic cues rather than on (morpho)syntactic cues.
2.1.1.3 Communicative Value and Ease of Processing

A direct implication of the need to get meaning and the limited capacity of the processor is that learners will tend to rely on the most salient information in a sentence to derive meaning. Because a great deal of an utterance’s meaning is carried in the content words, L2 learners know intuitively that these words are necessary for communication. That is, they know that content words typically carry more semantic weight and they are driven to look for the meanings of words that they do not already know. Thus, the IP model proposes that L2 learners will prioritize content words:

(3) Primacy of Content Words Principle: Learners process content words in the input before anything else.

Of course, content words are not the only information in the input with semantic value, and so building an accurate representation of the input will require that learners process grammatical information as well. For example, the sentence *I played baseball in the park* contains the semantic value [+past], carried by the morpheme –*ed* found on the verb. But verbal morphology is not the only cue in English that is [+past]: there are numerous lexical items that not only denote [+past], but also provide more gradient detail that the past-tense morpheme cannot convey. For instance, *yesterday* and *last night* are both lexical cues to past tense that provide specific information about the time an event took place, whereas –*ed* simply denotes “before now”. Many sentences therefore contain both a time adverbial and a morphological cue to tense. Indeed, even sentences where only the morphological cue is available often belong to a larger discourse context, in which pastness is explicitly identified through a lexical item or through the larger discourse context.
There are many cases where lexical and grammatical cues are redundant; that is, they express the same semantic information. This situation highlights a larger issue in input processing, namely the notion of communicative value, which the IP model defines along the parameters [+/- semantic value] and [+/- redundancy] (VanPatten, 2004a). Whereas the presence of semantic value increases a particular grammatical form’s communicative value, redundancy reduces the communicative value of this form, and makes it non-essential for communicative purposes as long as the semantic meaning is processed elsewhere in the sentence. For example, in the sentence *Yesterday I played baseball in the park*, both *Yesterday* and the past tense morpheme *-ed* redundantly encode the same semantic information, reducing their relative communicative values. Under such circumstances, the IP model predicts that lexical items will be favored, as described in the Lexical Preference Principle:

(4) *Lexical Preference Principle:* Learners will tend to rely on lexical items as opposed to grammatical form to get meaning when both encode the same semantic information. In principle, learners could rely on either the grammatical or the lexical cue to understand the sentence accurately; but as content words are more salient and easier to process, they are favored during online processing. Thus, added to the parameters [+/- semantic value] and [+/- redundancy] can be [+/- ease of processing], where lexical items are assumed to be easier to process than are grammatical forms.³ As a result, in the example *Yesterday I played baseball in the park*, both *Yesterday* and the *-ed* morpheme on the verb *play* encode the past-tense (and are both [+semantic value] and [+redundant]); but because *Yesterday* is [+ease of processing], it will be processed before the *-ed* morpheme.

³ Ease of processing is stated here is a binary parameter for the internal consistency of the model, but in reality ease of processing would be gradient and depend not only on factors in the input (e.g., type of cues, sentence position, complexity, distance, frequency, length etc.), but also learner factors (working memory capacity, proficiency, etc.)
The main empirical support for the Lexical Preference Principle comes from studies which look at what information L2 learners rely on when two cues are in conflict with each other. In one such study, VanPatten and Keating (2007) measured reading times on sentences such as *Ayer el hermano de Juan hace la tarea de biología* (“Yesterday James’s friend does his biology homework”), in which time adverbials and verbal morphology conveyed different tenses. L1 Spanish speakers and three groups of L2 Spanish speakers (beginning, intermediate, and advanced) read these sentences while their eye-movements were recorded. As a measure of their final interpretation, they then answered an offline comprehension question in English in which there was no tense conflict. Results from both the eye-tracking and comprehension data indicated that, while the L1 and advanced L2 speakers preferred to rely on verbal morphology, the lower-proficiency learners relied on the time adverbials when comprehending the target sentences. These results corroborated findings by Sagarra, Cravetz, and Pfursich (2006) who found that L1 Spanish speakers spent more time reading verbs than adverbs in conflict situations, while L2 speakers did not. In two separate offline experiments, VanPatten and Keating also found that both L2 English and L2 Spanish speakers preferred to use time adverbials to determine tense, indicating that lexical-preference is a universal strategy for low-proficiency learners.

Further support for the Lexical Preference Principle comes from Cameron (2011), who used a self-paced reading task to test L1 and L2 speakers of Spanish on their sensitivity to form or meaning mismatches. The target-form in this experiment was Spanish subjunctive morphology, which is required in subordinate clauses governed by certain trigger phrases (e.g., *it’s possible that*…). Participants first saw a picture depicting an action, and then they read sentences that were matched or mismatched for form (i.e., ungrammatical use of the indicative
when the subjunctive was required) or meaning (i.e., the picture did not match the action in the sentence). Cameron’s results indicated that L1 speakers only treated the sentences as ungrammatical when there was a mismatch in form, but that L2 learners at all proficiency levels were only sensitive to sentence-picture mismatches. Cameron argues that these learners derived epistemic modality from lexical expressions, and not from verbal morphology. In conclusion, he also states that the insensitivity to form exhibited by the L2 learners in his study may be a result of distance effects rather than a broad preference for lexical items over verbal morphology. But his results clearly demonstrate that when cognitive resources are taxed, these learners relied on lexical items to determine mood.

As these studies show, the issue of redundancy in L2 processing can play an important role in whether or not grammatical information is processed for meaning, especially when the same semantic information is encoded via lexical items and grammatical forms. It should be emphasized that this general preference for lexical items stems primarily from their communicative value, their salience in the input, and the ease with which they can be processed. Thus, these studies provide a perfect example of how the need to get meaning, redundancy effects, and economic use of resources interact to encourage lexically-driven processing during the initial stages of L2 learning.

### 2.1.1.4 Cues to Grammatical Roles

#### 2.1.1.4.1 The Use of Word Order and Morphosyntax

One of the most fundamental parts of understanding sentences is determining agent-patient relationships in simple transitive sentences (i.e., figuring out who does what to whom). Yet this can present a significant challenge to learners because thematic and grammatical roles are assigned in a variety of ways. In English, for example, grammatical roles in active sentences
are assigned through word order; on the other hand, they are assigned through case-assigning articles in German and through suffixes on nouns in Russian. In order to use systems like those in German and Russian, learners must have detailed representations of case markers, which are often highly dependent on complex gender systems. Before these representations are built, learners must use different cues to determine grammatical roles; as might be expected, one of the most salient cues readily available to learners is word order.

One of the first studies to investigate how learners use linguistic structure to interpret grammatical roles was Bever (1970), who was specifically interested in L1 acquisition and the interpretation of active and passive sentences in English. On the basis of evidence showing that passives require more complex comprehension processes (MacMahon, 1963; Savin & Perchonock, 1965; Slobin, 1966), Bever argued that learners may assign grammatical roles by using a “lexical ordering strategy,” in which “any [Noun-Verb-Noun] sequence is assumed to correspond to actor-action-object in the underlying structure” (p. 299).

In later work, Slobin and Bever (1982) refined this hypothesis. In order to account for cross-linguistic differences, they hypothesized that children use canonical sentence schemas as a starting point for interpretation, and that, “if word-order strategies are basic, all languages should initially be approached as fixed-word order languages” (p. 232). To test if L1 acquirers would show evidence of a word order strategy, they tested children learning English and Italian—which assign roles primarily based on word order—and Turkish and Serbo-Croatian—which are both inflectional languages with flexible word order. During the main task, the children were given instructions consisting of actor-action-object combinations of varying word orders and asked to act out the scene using toy animals. While Slobin and Bever found that the children were attuned to language-specific cues and built language-specific schemas early on in acquisition, they also
found evidence that the children around 3.5 years old displayed evidence for a word order strategy, regardless of the language they were learning. This strategy was particularly evident in English, Italian, and Serbo-Croatian where word order is a relevant cue for some sentence types, leading to the overgeneralization of word-order strategies.

VanPatten (1984) later conducted research on first and second semester Spanish learners that followed up on Bever's (1970) word order strategy and research that supported it (e.g., LoCoco, 1982). In this study, VanPatten presented the participants with sentences that contained direct and indirect object clitic pronouns, both of which appear as the first noun in a sentence. Participants listened to these sentences and indicated which one of four pictures matched the sentence they heard. The data indicated that these learners did indeed misinterpret these sentences at a very high rate, as much as 70% for some sentences, and that direct object clitics were misinterpreted more frequently than indirect object clitics. This pattern of results indicated that learners ignored both the object marker a, as well as verbal morphology indicating the number of the subject (i.e., singular vs. plural). VanPatten concluded that these errors were attributable to an NVN=agent-action-object strategy, as described by Bever (1970), and he suggested that this strategy may be an active component of L2 acquisition, regardless of the comprehension strategies used in a learner’s L1.

Later research by LoCoco (1987) investigated the use of word order strategies L2 German, which is also the focus of this dissertation. In contrast to English, which has a relatively strict SVO word order in simple transitive sentences, grammatical roles are assigned not by word order, but by case-marking information that appears on determiners and adjectives preceding the noun. Therefore, German allows OVS sentence structures, and sentences with identical word order can have the opposite meaning, as in examples (5a) and (5b):
The ability to use case-marking information for grammatical role assignment is complicated by the fact that case markings for feminine, neuter, and plural nouns are ambiguous in the nominative and accusative due to case syncretism. Thus, as can be seen in Table 1, only the case markers for masculine nouns provide an unambiguous cue to grammatical role assignment in the nominative and accusative case. 4

<table>
<thead>
<tr>
<th>Grammatical Gender of Noun</th>
<th>Masculine</th>
<th>Neuter</th>
<th>Feminine</th>
<th>Plural</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominative</td>
<td>der/ein Kuli</td>
<td>das/ein Auto</td>
<td>die/eine Lampe</td>
<td>die/keine Autos</td>
</tr>
<tr>
<td>Accusative</td>
<td>den/einen Kuli</td>
<td>das/ein Auto</td>
<td>die/eine Lampe</td>
<td>die/keine Autos</td>
</tr>
</tbody>
</table>

When clear and unambiguous morphological information is present in the input, it reliably indicates the subject of the sentence regardless of the other cues in the input (Kempe & MacWhinney, 1998), but due to the ambiguity of the case-marking system, this information is not always available, and other cues serve as a cue for role assignment. Thus, German speakers

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4 Although German does have a dative and genitive case (which are also marked on the determiner), this dissertation focuses on the distinction between nominative and accusative case; thus the dative and genitive will not be discussed.
often use word order and animacy cues (MacWhinney, Bates, & Kliegl, 1984), as well as prosodic information (Weber, Grice, & Crocker, 2006) to determine grammatical roles.

Lococo’s (1987) study specifically investigated the use and non-use of case markers, word order, and animacy by L1 English L2 German learners. The stimuli consisted of subject-first and object-first sentences in several categories: (1) sentences in which both nouns were plausible agents; (2) sentences in which only one noun was animate and thus only one noun could be interpreted as the agent; and (3) sentences with a prepositional phrase, in which all three nouns were human and any noun could be interpreted as the agent. During the experiment, the participants heard subject-first and object-first sentences and were asked to choose a picture that represented their understanding of the sentence. Lococo’s results showed that learners consistently interpreted the first animate noun as the agent of the sentence. Thus, learners had difficulty with object-first sentences that belonged to type (1), but not type (2). With sentences belonging to type (3), groups were able to eliminate the object of the preposition as the agent, but used a word order strategy to interpret the rest of the sentence. Thus, she concluded that word order is an important cue for comprehension regardless of language or task, and that, even though semantic cues are helpful, they provide only limited aid for decoding the input.

Taken together, this research shows that learners tend to rely on word order cues when assigning grammatical roles; in particular, they seem to adopt a subject-first (or agent-first) strategy. In the IP model, this strategy is described by the First-Noun Principle:

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5 LoCoco does note, however, that learners do not always detect relevant cues in aural tasks, and perceptual abilities may heighten the importance of word order in listening comprehension. This was particularly evident concerning the Spanish accusative marker a, as well as prepositions that were less phonetically distinct.

6 This assertion appears to be made on the basis that semantic cues like animacy are only reliable when there is a mismatch between NP1 and NP2 (i.e., an animate NP2 can only reliably identified as the agent if NP1 is inanimate).
(6) First Noun Principle: Learners tend to interpret\textsuperscript{7} the first noun or pronoun they encounter in a sentence as the subject.

This first-noun or subject-first strategy seems natural given that world languages tend to be overwhelmingly subject-first (VanPatten, 2004); yet, even in languages where flexibility in word order is allowed, subject-fist biases are often present.

In German, corpus studies show that the first noun of the sentence is also the agent in 80%-95% of sentences beginning with a full NP (Kempe & MacWhinney, 1999; Schlesewsky, Fanselow, Kliegl, & Krems, 2000).\textsuperscript{8} Consequently, the ability to use case independent of other cues emerges as late as seven years of age during L1 acquisition (Dittmar, Abbot-Smith, Lieven, & Tomasello, 2008). Moreover, adult native speakers exhibit increased processing demands on object-first word order (Hemforth, Konieczny, & Strube, 1993; Schlesewsky et al., 2000; Schriefers, Friederici, & Kühn, 1995), and they display a strong tendency to predict subject-first word order initially (Hopp, in press; Kamide, Scheepers, & Altmann, 2003; Weber, Grice, et al., 2006).

While L1 speakers are able to use morphosyntactic cues to overcome their initial subject-first interpretation and comprehend OVS sentences accurately online, L2 learners of German have an extraordinarily difficult time recovering from this bias, and the incorrect interpretation often persists even after the sentence has been completed (Jackson, 2008). Even when lower-

\textsuperscript{7}In VanPatten et al. (2013), the First Noun Principle substitutes the word “interpret” in place of “process” as appeared in VanPatten's (2004) description of the principle. For clarity and because of its emphasis on comprehension, I have used the more recent phrasing.

\textsuperscript{8}Kempe & MacWhinney's corpus study is based on 250 active transitive sentences from contemporary novels, newspaper editorials, and children's books. They identified three word order types for German transitive sentences: NVN and VNN—which are both used in main clauses—and NNV—used in subordinate clauses. For NVN sequences, the first noun was identified as the agent 85.8% of the time, while in VNN sequences it was 94.3%. In subordinate clauses (NNV sequences), the first noun was the agent 79.8% of the time. The corpus study conducted by Schlesewsky et al. is based on 2,826 randomly selected sentences from a larger corpus. Their data shows that 90.15% of sentences beginning with full NPs are subject-first in spoken language. In non-fiction writing, the first NP is the subject 95.33% of the time, whereas it is the subject 92.19% of the time in fiction.
proficiency learners are able to integrate morphological information into the parse, research has suggested that they often do so in a different way from native speakers, only showing increased reading times on OVS sentences at the end of the sentence (Hopp, 2006; Jackson, 2008). Thus, it seems that, whereas L1 speakers assign grammatical roles incrementally, intermediate L2 learners may wait until the end of the sentence. Alternatively, this could reflect the fact that they are not able to integrate the morphosyntactic information quickly enough to recover in real-time from misparses related to subject-first biases. Either of these interpretations indicates a lack of automaticity and greater wrap-up costs associated with integrating the lexical and morphosyntactic information (Jackson, 2008).

2.1.1.4.2 The Use of Semantic and Contextual Cues

Despite the abundant use of word order cues for both L1 and L2 sentence processing, research has also shown that word order biases can be mediated by the use of other cues, including context and lexical semantics. VanPatten and Houston (1998) specifically looked at whether sentence-internal context can guide Spanish learners’ comprehension of sentences. The experimental stimuli for the sentence interpretation task were complex sentences consisting of a main clause with OVS word order, and a preceding clause. As illustrated in (7a) and (7b), the context condition contained a preceding clause that constrained contextually appropriate interpretations; in the no-context interpretation, it did not.

(7a) [Roberto está en el hospital porque] lo atacó María con un cuchillo.
[Roberto is in the hospital] because OBJ-m attacked MaríaSUBJ with a knife.
“Roberto is in the hospital because Maria attacked him with a knife

(7b) [Gloria contó a sus amigas que] la atacó Ramón en su casa.
“Gloria told her friends that Ramon attacked her in her house.”
In (7a), the sentence is constrained by sentence context, because the introductory clause *Roberto is in the hospital* suggests that he was attacked, not Maria; on the contrary, the preceding clause in (7b), *Gloria told her friends*, does not suggest an interpretation of the main clause. Participants first listened to the sentences and then filled out a worksheet to indicate who did what to whom. VanPatten and Houston found that the sentences in the context condition were comprehended more accurately than the sentences without context. They also found that, although context was an important cue for some participants, not all participants used context to constrain their interpretations, and even those who did, did not rely on it exclusively. Thus, they concluded that “the presence of context does not obliterate the use of the first noun strategy, but rather attenuates it” (p. 66). This conclusion is codified in the IP model:

(8) Contextual Constraint Principle: Learners may rely less on the First Noun Principle (or L1 transfer) if preceding context constrains the possible interpretations of a clause or sentence.

In a similar vein, Jackson (2007) explored whether lexical-semantic information could override the subject-first bias. Specifically, she tested whether intermediate L2 learners of German were influenced by animacy cues while processing embedded clauses. The participants read sentences in which the order of the nouns and the animacy of the subject were manipulated (the object was always animate), resulting in four experimental conditions (subject-first, animate subject; subject-first, inanimate subject; object-first, animate subject; and object-first, inanimate subject). After reading the sentence, participants were presented with two statements reflecting possible interpretations of the sentence, and they chose the statement that best reflected the meaning of the original. Jackson reported that, on the whole, subject-first clauses were easier to understand, but that animacy was a significant factor in guiding decisions, regardless of word
order. As in LoCoco’s (1987) study, Jackson’s participants were significantly more accurate in both OVS and SVO sentences when only one noun was animate. In fact, object-first clauses with one animate noun were better understood than subject-first clauses with two animate nouns, suggesting that animacy cues can override word order biases under some circumstances. This study provides clear support for another of the IP principles:

(9) Lexical Semantics Principle: Learners may rely on lexical semantics, where possible, instead of the First noun Principle (or an L1 parsing procedure) to interpret sentences.

Although there is agreement in the literature that learners use a variety of different cues to assign grammatical roles, the origin and realization of these cue preferences is still the subject of some debate. While VanPatten has maintained that there is a universal subject-first preference, MacWhinney (1987, 1992, 1997, 2005) has argued that research supports the view that processing strategies (i.e., cue-preferences) are transferred from the L1. Gass (1989) found that, while English L2 learners of Italian used word order as the primary cue for interpreting sentences, Italian L2 learners of English were more likely to use animacy cues. Thus, it seemed that they were transferring processing strategies from Italian, in which animacy cues are used more widely than in English (Gass, 1987). Recently, two studies with mixed findings have attempted to test explicitly whether processing strategies are universal or transfer from the L1. Isabelli (2008) tested L1 English and L1 Italian learners of Spanish on their interpretation of two types of object-first sentence structures (OVS and OOVS). She found that the English L2 learners of Spanish consistently assigned the first noun the role of subject, but the Italian L2 learners of Spanish did not, suggesting that they transferred processing procedure from their L1. However, because the Italians were not as accurate on the object-first sentence as they were on SVO sentences, Isabelli’s results still left open the possibility that the Italian L2 learners of
Spanish begin with a first-noun strategy. After enough exposure to the L2, the parser could then recognize similarities between the L1 and L2 and trigger the transfer of L1 parsing strategies. In a similar study, Seibert Hanson (2012) tested L1 English and L1 Romanian learners of Spanish on their interpretation of OVS and SVO structures. She found that the Romanian L2 learners of Spanish were no more accurate than the English L2 learners of Spanish on OVS structures, even though they were more accurate overall. Thus, she concluded that, though the L1 did indeed play a role in overall accuracy, it was not a strong determining factor in the interpretation of OVS sentences, and may play a limited role in L2 processing for these types of sentences.

At lower levels, then, it seems that learners are able to use a variety of cues to assign grammatical roles, and that they do not readily use morphosyntactic cues when interpreting who does what to whom. In other words, just as L2 learners tend to prefer lexical items for tense assignment, it seems that they also prefer word order, contextual, and lexical-semantic cues over morphosyntax. In light of the research conducted by Seibert Hanson (2012), these patterns seem to be stable among low-level learners, suggesting that these processing principles characterize L2 processing and parsing in its beginning stages, regardless of the L1/L2 language pairing.

### 2.1.2 Input Processing as Shallow Processing

Taken together, the research on input processing—as well as supportive research from the L2 sentence processing literature—seems to point towards the conclusion that L2 learners tend to rely on lexical-semantic cues, word order, and real-world knowledge during L2 sentence comprehension. In other words, the research suggests that L2 learners are drawn towards shallow processing. As mentioned previously, there has recently been much debate about whether the full range of syntactic processing mechanisms is available as they are in the L1. The vast majority of this debate has focused on the *Shallow Structures Hypothesis* (Clahsen & Felser, 2006a, 2006b),
which argues that L2 speakers are “largely restricted to [shallow processing strategies],
computing representations for language comprehension that lack syntactic detail and attempting
more direct form-function mappings instead” (p. 34). Over the last decade, however, it has been
shown that highly advanced L2 speakers can, in fact, compute full syntactic parses online under
certain circumstances, and that they can build representations incrementally (e.g., Hopp, 2006,
Pliatsikas & Marinis, 2013; Rossi, Gugler, Friederici, & Hahne, 2006; Trenkic, Mirkovic, &
Altmann, 2013; Witzel & Witzel, 2012). L2 processing strategies, therefore, may not be limited
as the Shallow Structures Hypothesis suggests; rather when learners reach extremely high levels
of proficiency, it seems that (morpho)syntactic information can be used efficiently and
automatically enough to build complex structures online, and the option to compute a more
detailed parse becomes available. Thus, it is worth considering both what role these processing
strategies play in the acquisition of grammar, and why they persist after they are no longer
needed.

2.1.2.1 Representationally-Driven Shallow Processing Strategies

As the mechanism for acquisition, the language processor has two primary jobs: (1) to
create a representation of the input for communicative purposes, and (2) to make form-meaning
connections that will lead to acquisition. As discussed in section 2.1.1.1, the ability to make
form-meaning connections is heavily dependent on global comprehension. Without it, none of
the data from the input can be used for acquisition. The lack of necessary grammatical
representations drives the need for shallow processing strategies so that the processor can extract
meaning and fulfill its communicative goals.
Shallow processing may also have a role in the development of grammar. Taking the view that the language processor (or parser) is the language acquisition device (Dekydtspotter & Renaud, 2014; Fodor, 1998b), the language processor is charged with attending to a variety of linguistic information in the input during sentence comprehension. This information must be held in working memory so that it can be linked to a semantic interpretation. The part of the input that is attended to and processed in this way—referred to as intake—becomes critical data that can be used to create mental representations in the developing system. As Fodor (1998b) argues, the creation and subsequent use of intake must proceed in a principled way to ensure reasonable levels of efficiency, accuracy, and processability. Fodor proposes that the learner computes one analysis at a time, and that he or she makes use of unambiguous input only. This would ensure accuracy, minimize processing costs, and reduce the number of times parameters would need to be changed after being set. Yet, it would also make acquisition proceed very slowly at the beginning stages since the grammar cannot parse morphosyntactic information unambiguously. Shallow processing, as it is described in the IP model, may provide a way out of this since it constrains the number of possible interpretations for a given input string, and thus reduces its ambiguity—in turn, this could allow the parser to use the data in the input for acquisition.

To illustrate this point, take the acquisition of the German accusative case, which differs from English in that grammatical roles are assigned by case-marking articles, and not by word order. When confronted with a sentence such as (10) below, the learner needs to create a semantic representation of the input.

(10) Den Kuchen isst der Mann im Restaurant.
    The cake eats the man in the restaurant.
    “The man eats the cake in the restaurant.”
Using animacy cues alone, the learner can assign “the man” the role of agent and derive the meaning that the man ate the cake, and not the other way around. Assuming that cognitive resources have not been depleted following this process, the parser could then use this information to connect the articles *der* and *den* to their meanings and posit their underlying functions as nominative and accusative case markers as seen in (11):

(11) Den<sub>ACC</sub> Kuchen<sub>THEME</sub> isst der<sub>NOM</sub> Mann<sub>AGENT</sub> im Restaurant.

“The cake eats the man in the restaurant.”

This form-meaning connection is only possible because the parser used animacy and plausibility information to reduce the ambiguity presented by German's variable word order (i.e., it is plausible that the man would eat the cake, but it is impossible for a cake to eat a man).\(^9\)

Even as shallow processing enables comprehension and provides valuable information to the processor, it is also the case that representations built on shallow processing are often not as reliable as the example provided here. First, representations derived via shallow processing may still present the parser with too much ambiguity, and thus not provide sufficient information for acquisition. More importantly, shallow processing often results in false interpretations, as seen in the word order studies described above (e.g., LoCoco, 1987; VanPatten, 1984); thus shallow processing can feed the processor bad information. These strategies also leave open the possibility that morphosyntactic information is never analyzed at all. Consequently, the processing strategies described in the IP model represent a catch-22: they are useful for comprehension and may therefore aid the development of grammar; on the other hand, they may reduce the probability that grammatical forms are processed, or provide the developing system with bad intake. As a result, they may be detrimental to the acquisition of forms that are

\(^9\)Except in Soviet Russia, where cake eats you.
particularly susceptible to misinterpretations. I will return to this issue in more detail in section 2.3.

2.1.2.2 The Persistence of Shallow Processing Strategies

Even though shallow processing strategies can play an important role in L2 development, they are also responsible for an array of comprehension errors. Nonetheless, these strategies persist even after learners have achieved high proficiency and acquired the requisite underlying representations for the forms in the input (e.g., Cameron, 2011; Keating, 2009; Marinis et al., 2005). In other words, L2 learners ‘hang on’ to these strategies after they are needed from a developmental point of view. Why might this be the case?

Assuming that L2 learners are not fundamentally limited to shallow processing, the most obvious reason these strategies persist is that L2 speakers are influenced by the same factors that cause shallow processing by L1 speakers. In the L1 processing literature, the idea that speakers use the easiest and most salient cues for comprehension has been advanced by the aptly named Good Enough Processing approach (Christianson et al., 2001; Ferreira et al., 2002; Ferreira & Patson, 2007), which attempts to explain why L1 speakers routinely misassign thematic roles. For example, in three experiments, Ferreira (2003) compared the comprehension of active sentences (e.g., *The man bit the dog*), passive sentences (e.g., *The dog was bitten by the man*), subject-cleft sentences (e.g., *It was the man who bit the dog*), and object-cleft sentences (e.g., *It was the dog the man bit*). Ferreira found that passives and object-clefts were understood much less accurately and with more difficulty than active and subject-cleft sentences (as measured by reaction times). Similar studies have addressed the comprehension of garden-path sentences like *While Anna dressed the baby played in the crib*, where local ambiguities can lead to misinterpretations (Christianson et al., 2001). This research has also found that these
misinterpretations often persist past reanalysis stages, and speakers retain the incorrect representation of the input (e.g., Christianson et al., 2001; Ferreira, 2003; Slattery, Sturt, Christianson, Yoshida, & Ferreira, 2013). Thus, research on Good Enough Processing supports the notion that even L1 speakers may not always use full syntactic analyses during comprehension.  

This line of research has argued that syntactic parsing mechanisms are not always put to use because of three main factors: (1) because the memory system may be taxed so that it no longer functions efficiently; (2) syntactic cues need support from elsewhere in the linguistic system (Ferreira & Patson, 2007); and (3) the input may not provide enough detail due to imperfect audio signals, background noise, speech errors, or distractions. To adjust for these circumstances—all of which are a normal part of language comprehension—the parser may rely on a representation derived from contextual, frequency, probabilistic, pragmatic, and prosodic information (Christianson et al., 2001; Slattery et al., 2013).

It seems that L2 learners may rely on lexical-semantic cues to a larger extent than L1 speakers because they are particularly susceptible to the factors listed above. As discussed in section 2.1.1.2, working memory and computational complexity have both been shown to affect L2 learners, and several researchers have identified these factors as the origin of differences between L1 and L2 processing. As Hopp (2010) explains, the use of morphosyntactic information in full syntactic parses may be “subject to earlier breakdown under stress than in native speakers” (p. 924). Further, L2 learners may need extra support to build accurate syntactic representations, particularly because they have less experience with the forms and as a result, L2

\[10\] Although the Good Enough Processing approach suggests that speakers do not always use the full syntactic parse for comprehension, it does posit that speakers compute the syntactic parses. Misinterpretations arise when there is a conflict between lexical-semantic and syntactic parses, and speakers fail to complete a reanalysis of the input.
morphosyntactic representations may be less robust or harder to access. Indeed, several recent studies have shown that morphosyntactic cues are easier to process when they are supported by other cues in the input (e.g., Grünloh, Lieven, & Tomasello, 2011). L2 learners should also be more susceptible to auditory factors because phonetic decoding is a difficult task in the L2, particularly when the L1 and L2 phoneme inventories differ with regards to phonemic contrasts (Best, McRoberts, & Goodell, 2001). In addition, it may be more difficult for L2 learners to correct for speech errors or adjust to inter-speaker variations such as dialectal differences (Doughty, 2003). These auditory factors no doubt have an effect on the amount of cognitive resources available for processing forms in the input.

Aside from the linguistic and cognitive factors that influence both L1 and L2 processing, shallow processing may also result when L2 learners simply do not switch processing strategies. Even when a more detailed syntactic parse is licensed in the grammar and sufficient processing resources are available, learners may still have little motivation to switch comprehension strategies because shallow processing is so useful in earlier stages of acquisition—and because shallow parses often result in successful comprehension of L2 input. For example, an L1 English learner of German might have a full representation of the case system, but still rely primarily on a combination of word order and animacy cues to assign grammatical roles since this strategy can be employed with a high degree of accuracy (Kempe & MacWhinney, 1999) and minimal processing cost. Consequently, shallow processing strategies may persist even after the learner is ready to adopt processing strategies that fully utilize morphosyntactic representations in the underlying grammar.
2.1.3 Interim Summary

As the discussion to this point has shown, the ability to make connections between morphosyntactic forms and their underlying meanings during L2 comprehension is complicated by the fact that learners have a tendency to rely on processing strategies that favor lexical-semantic and word order cues. While these strategies may serve a vital role during L2 comprehension, they may also hinder acquisition by reducing the analysis of certain L2 morphosyntactic forms and feeding the processor incorrect information when misinterpretations occur. After form-meaning connections have been made and are represented accurately in the grammar, L2 learners may still favor lexical-semantic and word order cues as a result of at least two factors: (1) a depletion of cognitive resources, caused in part by a lack of support for syntactic cues in the input; and (2) a failure to recalibrate cue preferences in the L2. Thus, both the acquisition of grammatical forms, as well as the use of these cues in online sentence comprehension is affected by an interaction between learners’ comprehension processes and the cues present in the input.

2.2 Insights from the Competition Model

2.2.1 Introduction to Key Concepts

The Competition Model (CM) (Bates & MacWhinney, 1987) provides a useful framework for discussing how cues interact with each other, how learners deal with multiple cues in the input, and how this affects the acquisition and subsequent processing of grammatical forms. The CM is a connectionist model of language processing and acquisition that seeks to explain cross-linguistic variation in both language acquisition and the end-state reached by adults. Within CM theory, second language acquisition is described as a three-way interaction between the input, the learner, and the context (MacWhinney, 2001). Regarding the input, the
CM is primarily concerned with how learners use linguistic data to acquire forms in the new language, and it emphasizes the role of the statistical properties of the input. Specifically, the CM argues that language comprehension (and sentence processing) requires speakers to detect cues from the input, link these cues to their underlying meanings, and interpret them in the context of the input. As an illustration of this process, MacWhinney (2001) focuses on agent identification in the example “The boy is annoying the parrots.” In such a sentence, “the boy” is marked by several cues related to agent identification: (1) preverbal positioning, (2) verbal agreement morphology, (3) sentence initial positioning. At the same time, passive morphology on the verb is absent, as is the preposition “by”, which marks an agent in the passive voice. Thus, the cues for agency are weighted strongly towards “the boy”, and it is selected as the agent over the other viable competitor “the parrots.” Similarly, “the parrots” is marked for the role of patient through post-verbal positioning, the lack of verb-agreement, and the presence of active morphology on the verb.

In the above example, the cues work together to form an interpretation because they all point to a single interpretation of the sentence. In this case, the relationship between forms and meanings form a “coalition” and are relatively straightforward. However, cues in natural language often conflict with one another, as seen in the word order studies described in the previous section. In such circumstances, statistical tracking and the ability to map forms to functions during sentence comprehension is more complicated. Specifically, the CM argues that the acquisition of form-function mappings and the development of cue networks are influenced by cue validity, which is defined along four primary dimensions: task frequency, cue availability, simple reliability, and conflict reliability.
Task frequency refers to how often learners must perform a specific linguistic task such as determining agents, or locating an object in space. In other words, it describes how often learners may encounter a specific set of cues. Cue availability describes the overall frequency with which a particular cue appears in the language when learners perform this task; contrast availability refers to how often that cue can be used to adjudicate between alternative interpretations. For example, in the sentence “The boy ate the cake,” animacy is contrastively available since cakes cannot be the agent of the verb “eat” (but are undeniably yummy patients); in the sentence “The lion ate the tiger” animacy cannot be used to determine the agent of the sentence and is therefore not contrastive. The two most important of these four major constructs are the related concepts of simple reliability and conflict reliability. Simple reliability is defined as the correlation between a particular cue and a particular function, and it is expressed as a ratio between the cue’s accuracy and the total availability. For example, in English, in active sentences, nouns positioned preverbally in simple transitive sentences are always identified as the agent of a sentence, and thus the cue has a reliability of 1. A particular cue’s reliability can also be defined by its reliability when in the presence of other cues that may suggest different interpretations; this is referred to as the cue’s conflict reliability, or its weight. For instance, in German simple transitive sentences, preverbal positioning is a very reliable cue to agentivity when case is ambiguous; but when case markers are unambiguous, they determine the assignment of grammatical roles irrespective of word order. Therefore, case has high conflict reliability relative to word order.

Together, these factors contribute to a cue’s overall cue validity, which is hypothesized to play a significant role in the acquisition of grammatical forms. Cue validity is particularly important during acquisition because it affects how often a cue is available for processing, and
how often learners can rely on a given cue during sentence comprehension. If a cue is readily available and always reliable, then its form-function mappings should be easier to identify, and these mappings should be reinforced through repeated accurate usage. Thus, the CM predicts that these forms should be acquired sooner than infrequent or unreliable cues. In fact, Kempe and MacWhinney (1998) found support for this hypothesis in a study that compared the acquisition of the German and Russian case systems. In contrast to German, the Russian case system employs a more complex paradigm, but—based on Kempe and MacWhinney’s analyses—the cue validity of nominative and accusative case markers are higher in Russian than in German. Therefore, the CM would predict that the Russian case system is acquired sooner than the German case system. Indeed, the results of a forced-choice picture selection task with SVO and OVS sentences indicated that the Russian learners understood the sentences more accurately than the German learners. The results therefore supported the notion that cue validity is an important factor in determining the relative speed and ease of acquisition.

2.2.2 Cue Weights and Recalibration

In the CM literature, there have been a number of studies that attempt to establish cue strengths for agent-identification (see MacWhinney, 2001). In these studies, researchers have asked participants from a variety of language backgrounds to interpret sentences that contain multiple cues. MacWhinney, Bates, and Kliegl (1984) investigated the comprehension strategies of English, Italian, and German native speakers when four cues for agent assignment were in competition: word order, subject-verb agreement, sentence stress, and animacy. The researchers were primarily interested in whether speakers of these languages would use these cues to varying degrees based on the features of their language; in particular, they were concerned with whether morphology, contrastive sentence stress, and animacy would play a larger role in languages with
more flexible word order (i.e., Italian and German) since word order is a less reliable cue. Participants with L1 English (n=24), Italian (n=24), and German (n=20) read 81 test sentences consisting of a third-person verb with two full noun phrases. These sentences varied with regard to their word order (NVN, VNN, and NNV), animacy (both nouns animate, only first noun animate, and only second noun animate), sentence stress (neutral, first noun stressed, and second noun stressed), and agreement conditions (ambiguous, first-noun agreement, and second noun agreement). The participants simply indicated which of the two nouns in the sentence they thought was the agent or actor. The researchers found that the most reliable cue for English was indeed word order. For Italian, agreement marking on the verb was the most reliable cue, but animacy, word order, and sentence stress were all used to varying degrees, particularly in transitive sentences with full noun phrases. In German, speakers tended to rely on animacy cues, but also used word order and sentence stress to a lesser extent. However, it is important to note that this study did not include case as a variable since English and Italian do not mark nouns for case. Thus, the results for German represent cue use when case is ambiguous; when case is marked unambiguously, it outranks each of the other cues. But aside from this qualification, the order of cue strengths displayed in this study is what would be expected based on a typological review of the languages and their cue networks; it also corresponds to text counts that seek to establish cue reliability and cue strengths (e.g., MacDonald, 1987, see MacWhinney, 2001).

In a similar vein, several studies have tested L2 learners to see if they use cues similarly in their L1 and L2. This line of research has found widespread support for the transfer of cue rankings from the L1. As described in section 2.1.1.4, Gass (1989) found that Italian L2 learners of English transferred their cue rankings from Italian and tended to use animacy cues to determine the agent in the sentence more strongly than L1 English speakers do in English. Using
an experimental method similar to the MacWhinney et al. (1984) study described above, Harrington (1987) investigated Japanese-English bilinguals' interpretation of sentences when word order, animacy, and contrastive stress were set in competition. A control group of native English speakers showed the usual tendency to rely heavily on word order; the Japanese-English bilinguals, on the other hand, did not use word order to interpret the target sentences, but overwhelmingly used animacy to determine the actor when it was contrastively available (i.e., when the sentence contained one animate and one inanimate noun), as would be expected given L1 Japanese processing preferences.

This research on cue preferences and transfer in the L2 illustrates what MacWhinney (2001) has referred to as a “syntactic accent”. As Harrington (2001) points out, the acquisition of implicit grammar knowledge must be viewed not only as the acquisition of cues and their underlying meanings, but also acquisition of their relative strengths in a given L2. That is, the use of grammatical cues requires not only the creation of form-meaning connections in the developing L2 system, but also the availability of appropriate processing mechanisms to deal with the cues during sentence comprehension. Consequently, L2 acquisition must involve some degree of “weight tuning” or a recalibration of cue strengths based on the reliability and validity of cues in the L2.

McDonald (1987) provides a clear demonstration of how cue strengths are recalibrated during the acquisition process. Using a cross-sectional research design, she asked English-Dutch and Dutch-English learners of varying proficiency levels to interpret sentences with conflicting word order, animacy, and case-marking cues. She found that the English learners of Dutch relied heavily on word order (the strongest cue in their L1) at lower proficiency levels, but used case inflection at higher proficiency. Conversely, the Dutch learners of English relied on case
inflection at lower proficiencies, but had developed an English-like word-order strategy at higher proficiencies. These results clearly show that cues are calibrated during acquisition, and that the reliance on variable cue types changes during development.

As discussed in the previous section, one reason that lexical-semantic processing strategies (as described by the IP principle) may persist into later stages of language learning is that learners are slow to recalibrate these cue weights, and thus retain their “syntactic accent”. It is important to state explicitly that VanPatten’s IP model differs from the CM with respect to the source of the syntactic accent. Whereas IP attributes it to universal processing strategies leading to the overreliance on lexical-semantics, the CM posits a strong role for L1 transfer. Each model, then, differs in the predictions it makes with regards to the strategies employed at the initial stages of L2 learning: while IP predicts universal overreliance on lexical-semantic cues (no L1 transfer), the CM predicts overreliance on lexical semantic cues only if they are also important in the learner’s L1 (L1 transfer). Regardless of this difference, however, each model is parsimonious with the claim that L2 learners have difficulty recalibrating cues and switching processing strategies, even at later stages of acquisition.

2.2.3 Coalitions as Prototypes and Cue Support

One important facet of the CM is the observation that mappings between form and function are not random, but rather reflect a natural organization in language. For instance, the functions of agent, actor, or topic prototypically map onto surface cues that indicate the subject of the sentence (MacWhinney et al., 1984). As described above, the statistical co-occurrence of forms and functions results in coalitions, which form prototypical constructions in a language (Bates & MacWhinney, 1987). Although the utility of coalitions is balanced by circumstances
where they are broken up and cues are in competition with one another, these coalitions can be readily put to use during sentence comprehension.

This concept has been investigated most thoroughly in the domain of L1 acquisition, where several studies have shown that children are able to interpret sentences much more easily when multiple cues in the input converge to point towards the same meaning. Dittmar et al. (2008) investigated the use of word order and case-marking cues by German children, with the goal of determining when children start to rely primarily on case-marking for grammatical role assignment. In this study, two groups of children (2;7 and 4;1 years old) used puppet animals to act out their interpretation of sentences. These sentences varied by word order and the availability of disambiguating case information, resulting in three experimental sentence conditions: (1) unambiguously marked subject-first sentences; (2) unambiguously marked object-first sentences; and (3) ambiguously marked sentences. The results indicated that the older group of children was able to successfully interpret the sentences with novel verbs when word order did not conflict with case marking (conditions (1) and (3)), suggesting that they had developed word order as a relevant cue. But the findings also showed that the children performed at chance when word order conflicted with case. Thus, the data suggested that they had not developed case marking as a cue independent from word order. In a follow-up experiment, however, an older group of children (7;3 years old) was able to correctly interpret all three sentence-types. Even so, they were far less accurate when word order and case marking conflicted. Therefore, the researchers concluded that children begin by attending to coalitions of cues and prototypical constructions, and only later attend to cues independently of one another.

In a similar study, Chan, Lieven, & Tomasello (2009) tested English, Cantonese, and German speaking children in three different age groups (2;6, 3;6, and 4;6 years old) with respect
to their interpretation of agent-patient roles. The test sentences varied the presentation of word order and animacy cues, marking the agent and patient in three conditions: (1) redundant marking (i.e., both word order and animacy suggesting the same interpretation); (2) marking with word order only; and (3) conflicting marking (i.e., word order and animacy suggested different interpretations). Across the languages, the results indicated that the youngest children comprehended sentences in which word order and animacy formed a coalition, and did not seem to prefer one cue over the other when they conflicted. Both groups of older children were able to interpret sentences in the redundant condition with a high degree of accuracy, but tended to rely on word order cues when they were in conflict. Like the findings reported by Dittmar et al. (2008), these data suggest that the coalition of cues provides a support network, allowing the cues to be used more efficiently together than separately.

When several cues indicate the same function, they support each other and provide a robust set of information that the learner can use to understand the sentence. As shown above, language learners may use coalitions as a valuable starting point for the acquisition of complex or abstract grammatical forms, such as case. It may also be the case that, since cues are supported by each other in coalitions, they are helpful in sentence processing after individual cues have been developed. Recall that one claim made by the Good Enough Processing approach (Christianson et al., 2001) is that syntactic representations are difficult to put to use precisely because they are less-stable and need support from other domains (i.e., from lexical-semantics). Put in terms of the CM, Good Enough Processing predicts that it should be more difficult to interpret syntactic cues when the information is unsupported by—or when it conflicts with—other cues in the input. In fact, this claim is backed by a variety of research on sentence processing (some of which has been reviewed in previous sections) in which participants exhibit
higher processing costs in the presence of conflicting information (e.g., when word order and case marking suggest different interpretations) (e.g., Hopp, 2006; Jackson, 2008). The other side of this is that when converging cues are found in the input, comprehension and sentence processing are facilitated. As will be discussed in section 2.3.2, there is an emerging body of research that suggests that this is the case.

2.3 Implications for the Acquisition of Morphosyntactic Cues

One of the central questions put forth at the outset of this chapter centered on how processing strategies (and other cognitive factors) impact the acquisition of grammatical form. The literatures described above begin to answer these questions in that they speak to the conditions under which form-meaning connections are made and suggest that the constellation of cues in the input impacts whether morphosyntactic cues are used in sentence comprehension. In particular, when redundancy in the input leads to forms being under-processed, the acquisition of these forms is delayed. In the following sections, I refer to these cues as being *competitive* in the sense that they compete for processing resources (and thus I depart from Competition Model’s use of the term\textsuperscript{11}). On the other hand, if learners are able to use multiple cues in the input to support each other, processing and acquiring these forms should be facilitated. In this case, I refer to the cues as *additive*, or *supportive*.

\textsuperscript{11}The use of term *competitive* in the Competition Model refers to how cues compete for assignment to a given function (MacWhinney, 2001), whereas I use the term to describe cues that redundantly encode semantic information and therefore compete for cognitive resources (assuming that these are limited). The term *competitive* should also not be confused with the term *conflicting*, which describes whether cues suggest similar interpretations of an input string.
2.3.1 Competitive Cues

When it comes to making connections between morphosyntactic cues and their underlying meanings, the presence of redundant cues in the input presents several challenges for L2 learners. As discussed at length, some cues are less salient and require more processing resources to identify and interpret. While “constructions redundantly marked with multiple cues could have a special status as a nucleus around which the prototype forms” (p. 59), this redundancy “makes it difficult for [language learners] to isolate the functional significance of each cue” (Ibbotson & Tomasello, 2009, p. 59). In other words, when two cues present the same semantic information, the more salient cue can mask the less salient one, such that the meaning is associated only with the more salient cue. This is certainly intensified by the effectiveness of shallow processing strategies at early stages of development, which may lead learners to develop incorrect form-meaning connections. For example, as noted previously, if an L2 learner of German misinterprets an OVS sentence as SVO, the accusative marker *den* and the agent function could be linked erroneously.

Consequently, redundancy in the input can create a situation in which cues compete for attentional resources. This competition decreases the likelihood that certain forms will be connected to their meanings during sentence comprehension, and, as a result, acquisition of these forms may be delayed. Put succinctly, the competition between cues interacts with learners’ comprehension strategies and acts as a barrier to acquisition (Gillon Dowens & Carreiras, 2006; VanPatten, 2004a).

As should be clear from the description of the IP model and the discussion to this point, morphosyntactic cues face extraordinary competition from lexical-semantic and word order cues, which stems largely from their decreased salience and lower communicative value relative to
lexical items. As would be expected, several areas of SLA research have identified morphosyntax as particularly problematic for L2 learners (Hopp, 2010). In particular, it seems that the ability to use morphosyntactic forms develops very late relative to other features of language. For example, Lardiere (1998) reported on the speech of a native Chinese speaker, Patty, who had been living and working in the United States for approximately 18 years. Despite the fact that she had been completely immersed in English for at least half of this time—and despite the fact that she had acquired other syntactic forms—Patty supplied past tense markings in English in only 34% of obligatory situations.

2.3.2 Additive Cues

The interaction between morphosyntactic and lexical-semantic forms shows that there are clearly instances where redundant forms compete for processing resources and limit the learner’s ability to connect forms to meaning. However, there may be other types of cues that are more easily processed side-by-side and therefore do not interfere with each other. Recently, researchers have explored the relationship between prosody and syntax, which seems to fit this description. Particularly relevant for the current discussion are those studies indicating that prosodic cues can be used to (1) identify constituents and detect grammatical cues in the input (2) order constituents hierarchically and make form-meaning connections that depend on this ordering, and (3) resolve ambiguities and build complex syntactic structures during sentence comprehension.

2.3.2.1 Prosody and Salience

In early stages of language acquisition, prosodic cues are helpful for identifying structural constituents and segmenting speech streams into sentences. Although there is debate concerning whether complete novices are able to identify clause boundaries based on prosodic information
(Henderson & Nelms, 1980; Pilon, 1981; Wakefield, Doughtie, & Yom, 1974), there is evidence that even learners with very limited amounts of exposure can use prosody to identify constituents in a new language. Wakefield et al. (1974) gave learners 27 minutes of exposure to Korean and afterwards tested their ability to identify how 'natural' test sentences were when a pause had been spliced into them. They found that the participants were able to correctly identify the sentence with the pause placed between structural components about 71% of the time. They also found that the participants were more accurate when the pause was between constituents than when it was between words. Similarly, Pilon (1981) found that participants could correctly identify constituents in a novel language (also Korean), suggesting there is a strong relationship between prosody and syntax. More importantly, these results suggest that sensitivity to prosody can lead to sensitivity to syntactic boundaries.

With respect to the detection of individual cues, it may be that prosodic information is useful to L2 learners because it can reveal which portions of the input string are important. Carroll (2006) points out that information structure—to which prosodic prominence is tied—can have the effect of making parts of an utterance perceptually salient. She also points out that some L2 learners actively search out portions of an utterance with focus, which can be given through phonological prominence. These processes may allow learners to narrow in on words, phrases, or forms that are particularly important to the comprehension of the discourse. As a result of the increased salience, then, learners may be able to detect forms in the input more efficiently and thus begin connecting forms to their meanings more rapidly.

2.3.2.2 Prosody and Constituent Order

Prosody may also be useful in organizing language hierarchically. Cross-linguistic descriptive analyses have shown that the realization of phonological phrase stress is variable
based on whether a constituent is the head or the complement of the phrase. In German, for instance, direct objects have been found to be higher in pitch and intensity, regardless of whether they are found first or second in the phrase (Nespor, van de Vijver, Schraudolf, Shulka, Cinzia, & Donati, 2008). This may provide language learners with reliable cues to constituent order. Indeed, Langus, Marchetto, Bion, and Nespor (2012) presented evidence that adult learners of an artificial language were able to use prosodic cues to learn long-distance dependencies that occurred at the ends of phrases and sentences. The participants were first presented with 180 sentences of the language in which these dependencies were signaled by both prosodic cues and high transitional probability between adjacent syllables (i.e., high probability that two of the artificial language’s syllables will be adjacent to each other in the input). With regards to the prosodic cues, at the phrasal level, dependencies were signaled by phrase-final lengthening, while they were signaled by pitch declination at the sentence level. Critically, both types of rules were structured such that hierarchical organization of the language was required to perform above chance during the testing phase. The results showed that when participants were presented with these prosodic cues, they were able to learn the rules, but when they did not receive the prosodic cues, they performed well below chance. Thus, these findings suggest that prosodic cues could be important for recognizing hierarchical structure, identifying constituent order, and for acquiring grammatical properties, for which such constituent ordering is important.

One area in which constituent ordering is necessary is grammatical role assignment and the acquisition of case. Fundamentally, the ability to assign grammatical roles relies on the ability to recognize noun phrases as verbal complements. As discussed in section 2.1.1.4.1, reading studies have shown that L1 German speakers have a strong preference for SVO word order and demonstrate increased processing difficulty when processing sentences with
unambiguous OVS word order. Traditional accounts for these processing difficulties have revolved around the fact that object-first word order is computationally more complex and, in the case of topicalization, occurs less frequently. But more recently, L1 researchers have hypothesized that the lack of discourse and prosodic information in these tasks may also contribute to the difficulties L1 speakers have assigning grammatical roles when processing OVS word order (e.g., Kaiser & Trueswell, 2004). Because OVS word order in German declarative sentences is generally reserved for situations in which the object is the focus of the utterance (e.g., when the object is new information), it is highly marked in the absence of a larger discourse context or strong prosodic cues which give the object focus. Consequently, some of the difficulties processing OVS sentences may stem from the lack of context or prosodic cues in the stimuli (Féry, 2005).

Recently, research conducted with the visual world paradigm has supported the hypothesis that prosody is an important cue for the ordering of constituents and assignment of grammatical roles. In particular, Weber and Grice, et al. (2006) investigated whether adult L1 German speakers use prosody to predict upcoming referents in a sentence when unambiguous case-marking morphology is absent from the input. The experimental stimuli for this study consisted of SVO and OVS sentences that were initially disambiguated only through pitch accents; as shown in Figure 1, the pitch accent was placed on the verb in SVO sentences, while it was placed on the object (the first NP) in OVS sentences.
While listening to the sentences, the participants were presented with a visual-world, as shown in Figure 1. Each scene consisted of four referents: a base NP (the cat), a potential agent of the verb (the dog), and a potential patient of the verb (the bird). While listening to the sentences, the participants’ eye movements to each of the potential referents in the scene were tracked. An analysis of the fixations showed that, when listening to the verb, the speakers fixated on the potential patient in both the SVO and OVS sentences, indicating that they initially posited an SVO interpretation. By the next word in the sentence (the adverb), the speakers had adjusted their initial interpretation, fixating on the patient in the SVO conditions and on the agent in OVS sentences. These findings indicate that the participants were able to attend to the prosodic cues and used this cue to predict the second NP in both SVO and OVS sentences. Thus, in the absence...
of unambiguous case markers, prosody was used to accurately identify the NP1 as an object in OVS sentences and facilitate sentence comprehension.

In a similar study using the visual-world paradigm, Henry, Hopp, and Jackson (2014) investigated prosody’s role in sentence comprehension and explored whether prosody leads to a predictive advantage in L1 processing when morphological cues are contrastively available (i.e., unambiguous). The results from this study showed that if prosodic cues are presented consistently and reliably during the testing phase, L1 speakers use prosodic cues additively to predict upcoming referents both sooner, and more confidently. In fact, prosodic cues may even train speakers to identify relevant cues in a given task and allow them to process sentences efficiently, even after prosodic cues are no longer present in the input.

Because prosody can facilitate sentence comprehension among adult L1 German speakers, could it also act as a catalyst for the development of form-meaning connections during language acquisition? Grünloh et al. (2011) provide evidence that this is the case. This study was conducted in part as a response to the study conducted by Dittmar et al. (2008), which found that German-speaking children had developed a subject-first bias by the age of two, and that even by age five, German-speaking children have yet to overcome this bias (for a full description of this study, see section 2.2.3). Like Dittmar et al. (2008), Grünloh and colleagues presented children 4;1 years old with SVO and OVS sentences that contained unambiguous word order. The stimuli in this experiment were manipulated such that half of the sentences contained a contrastive prosodic cue on the first NP which suggests a patient-first (OVS) word order, while the other half did not. During the test-phase, the children listened to a sentence and pointed to a picture to indicate which sentence they thought they heard. The analysis of responses showed that the children only selected the first noun as the patient (or object) when both unambiguous case
marking and contrastive cues were present. In other words, the children were able to utilize the prosodic cues to correctly identify agent-patient roles in OVS sentences and overcome their more general SVO word order bias. This suggests not only that contrastive prosodic cues work to reveal constituent order, but also that they can play an active role in multiple-cue coalitions. Importantly, the recognition and use of these coalitions may contribute to the ability to make form-meaning connections and isolate the function of independent cues. This can set the stage for the acquisition of grammatical forms like case-marking morphology.

2.3.2.3 Prosody and Structure Building

Further research on the relationship between prosody and syntax has found that prosody is useful for other (often more complex) structure building operations, and that L1 speakers are able to exploit structural links between syntax and prosody to constrain possible sentence interpretations and build the syntactic structure of an utterance in early stages of processing (see Wagner & Watson, 2010 for a review of this literature). Using event-related potentials, Steinhauer, Alter, and Friederici (1999) found neurophysiological evidence to suggest that prosodic breaks facilitate the processing of so-called garden path sentences (e.g. Since Jay always jogs a mile and a half seems like a very short distance to him) and that mismatches between syntactic and prosodic structures can induce garden path effects even at the earliest stages of processing.

A number of studies in the L1 processing literature have also shown that prosodic information can influence the resolution of attachment ambiguities. Fodor (1998a) presented evidence that differences in prosodic packaging (i.e., the location of prosodic breaks) could explain cross-linguistic differences in relative clause attachment ambiguity preferences. Consider the following English sentence and its Spanish translation equivalent in (12):
(12a) Someone shot the servant of the actress who was on the balcony.

(12b) Alguien disparó contra la criada de la actriz que estaba en el balcón. (Fodor, 2002)

In English, the relative clause (underlined in the above sentences) is usually taken to modify the lower noun in the main clause, the actress. In Spanish, on the other hand, it is taken to modify the higher noun, la criada (the servant). Fodor’s proposal was that “language-specific interface constraints may encourage or discourage the prosodic separation of a [relative clause] from the preceding noun,” (Fodor, 2002; p. 122) which could influence the interpretation of these clauses. Empirical research within the sentence processing literature has since shown that these structures are indeed sensitive to prosodic cues. For instance, Stoyneshka, Fodor, and Fernández (2010) showed that the location of a prosodic break in the sentence significantly impacted Bulgarian speakers’ ability to resolve relative clause ambiguities. Similar effects have been shown in German (Augurzky, 2006), English (E. M. Fernández, 2007), Hebrew (Shaked, 2009), and Spanish (Teira & Manuel, 2007).

In the L2 literature, it has been shown that L2 learners often have non-native-like representations of prosodic structures that, in turn, can impact their ability to link prosody and syntactic structure building during L2 production and comprehension. Production research in particular has shown that L2 speakers may have difficulty producing prosodic cues related to information packaging (Ramirez Verdugo, 2002), and they do not always signal syntactic structures (e.g., phrase boundaries) appropriately (Wennstrom, 1994). Research has also suggested that the development of prosodic representations might be constrained by the L1 (Goad & White, 2006). Even so, production studies show that even intermediate L2 learners can use prosodic cues appropriately for some structures (Jackson & O’Brien, 2011; Ramirez Verdugo, 2002), and there is evidence from the comprehension literature that L2 speakers are
able to use prosodic cues to build even complex structures (Dekydtspotter, Donaldson, Edmonds, Fultz, & Petrush, 2008; Liljestrand Fultz, 2009). Dekydtspotter et al. (2008) investigated whether second- and fourth-semester English L2 learners of French could use the length of relative clauses (i.e., phonological weight) as a cue to relative clause attachment. As described above, English generally prefers low-attachment for relative clauses; French tends to pattern with Spanish and prefer high-attachment (Fodor, 2002). Although the group of second-semester learners did not display sensitivity to this prosodic cue and used their L1 English attachment preferences to process the target sentences, the fourth-semester learners did attend to the phonological weight of the target constituents during L2 French comprehension. This split shows that prosodic cues are available to L2 learners as a mechanism to guide processing decisions, but that this availability is influenced by L2 proficiency.

Given that non-native prosodic representations can persist into later stages of acquisition, some researchers (e.g., Dekydtspotter, Schwartz, & Sprouse, 2006; E. M. Fernández, 2010) have suggested that lexically-driven (i.e., shallow) processing strategies used to interpret complex structures may stem from L2 learners imposing the incorrect prosodic structure on the input. However, because the research on L2 use of prosodic cues has focused on attachment ambiguities, it is uncertain whether this would apply to other syntactic domains—such as subject-object ambiguities—where processing difficulties are also evidenced in the L2 sentence processing literature.

2.3.2.4 The Additive Use of Prosody

In the preceding sections, I have shown that prosody can often be used in conjunction (morpho)syntax to understand sentence structure and build syntactic representations. Therefore, prosody may be an important additive cue that can aid the acquisition and processing of certain
grammatical features. As Jackson & O’Brien (2011) state, “there are situations in which even novice and intermediate L2 learners understand the relationship between prosody and meaning, and can exploit this relationship when interpreting or producing L2 utterances” (p. 8). Yet, in order to acquire complex grammatical cues, such as case-marking morphology, prosodic cues must be used additively. That is, they must not compete for attention in the same way that lexical-semantic cues do. Currently, it is unclear whether low-proficiency L2 learners are able to recognize prosodic cues and use them as part of a supportive coalition, or if they would instead choose to rely on them entirely. If they are indeed able to use prosody to identify important morphosyntactic information, then less-proficient L2 learners may be able to use prosodic cues to bootstrap form-meaning connections onto morphosyntactic forms, and acquisition would proceed more quickly as a result. In addition, online processing and structure building could be eased as learners learn to use the cues in conjunction with one another. If, on the other hand, they only attend to prosodic cues, then they could act as a barrier to acquisition, much like lexical-semantic cues do.

2.4 Processing Instruction (PI)

A review of the L2 acquisition and input processing literatures leads to several broad conclusions about L2 learners’ interactions with linguistic cues:

1. The need to get meaning and the ability to process sentences (i.e., the availability of resources) drive which cues are processed in the input.

2. Lexical-semantic and word order cues are more likely to be processed during sentence comprehension than morphosyntactic cues.

3. The availability and reliability of cues in the input have a significant impact on L2 learners’ ability to connect form to meaning.
4. In order to comprehend sentences accurately, L2 learners need to learn which cues are the most reliable in the L2 (i.e., they must adjust cue strengths and processing strategies to match that of the target language).

5. L2 learners have difficulties isolating the functions of individual cues when they frequently co-occur.

6. Competition between cues in the input may prevent learners from connecting forms to meaning, and may therefore act as barrier to acquisition.

7. When cues support each other, learners may use them additively, allowing them to connect form to meaning more rapidly and facilitating processing.

Taken together, these suggest that the quality of input is a significant factor in the acquisition of the L2 grammar. In particular, learners should be most likely to connect morphosyntactic cues to their meanings when the cues: (1) are easy to identify and have low processing costs, (2) have a high communicative value for a given utterance or task, (3) do not compete with other cues, (4) are seen as reliable, (5) are easily associated with their meanings independently of their coalition, and (6) can be processed additively with supportive cues.

Based on the research presented in this chapter, input of the quality described above should provide the optimal situation for making form-meaning connections, and repeated interaction with this type of input should lead to acquisition over the long term. One might therefore ask if instructional interventions can be designed that take advantage of quality input and facilitate or speed up the acquisition of grammatical forms. This question is at the heart of an instructional intervention known as Processing Instruction (VanPatten & Cadierno, 1993; VanPatten, 2004b).
2.4.1 The Structure of Processing Instruction

Historically, PI grew out of the Input Processing Model as a theory-driven instructional intervention. The intervention typically focuses on one targeted cue and is directed at changing learners’ processing behaviors in order to compel them to make form-meaning connections that might not be made under normal circumstances. At the core of PI interventions is the identification of the “processing problem,” which is defined as a particular comprehension strategy (or a combination of strategies) that leads learners to under-process the targeted form (Wong, 2004). Naturally, the processing problem typically relates to specific principles of VanPatten’s IP model. As an example, take the acquisition of the German accusative case, which is marked on the articles that precede the noun. There are three primary processing problems associated with this form: learners are likely to simply assign the first noun as the subject (the First Noun Principle); animacy and plausibility cues may bias an interpretation (the Lexical Semantics Principle); and context may make the meaning of the sentence clear (the Contextual Constraint Principle). In other words, the processing problem is that learners can rely on word order, lexical-semantic, and contextual cues to interpret sentences, instead of processing case markers for meaning.

As a type of focus-on-form instruction, PI interventions typically consist of two major components: explicit instruction (EI) and Structured Input (SI) activities (see Appendix E for an example of PI training as used in this dissertation). The EI given during PI consists of both grammatical information about the targeted cues as well as information about the processing problem. Usually, the grammatical information is given in textbook-like descriptions of the targeted forms. In some instances, this information may be very similar to explanations found in traditional foreign language text books. The key difference is that PI focuses principally on one
form at a time. Thus, while traditional materials may present an entire grammatical paradigm at one time (e.g., masculine, feminine, and neuter case markers in German), PI focuses on only one specific aspect of the paradigm (e.g., masculine accusative case markers only). The second aspect of the EI in PI involves providing information about the processing problem. Ordinarily, this comes in the form of a warning at the end of the EI, like “Learners often assume that the first noun of the sentence is always the subject, but this may not be!”

The heart of any PI intervention is the SI activities (see Farley, 2004), which seek to provide quality input that promotes learner engagement with targeted cues while minimizing interference from non-target cues. Thus, these activities are primarily concerned with increasing the possibility that learners make form-meaning connections. In order to achieve this goal, PI interventions and SI activities contain six critical design features, each of which is guided by the IP model and related SLA research (Lee & VanPatten, 2003; Wong, 2004).

The most important design feature of SI activities—and the feature that separates them from other types of input activities—is that learners’ processing strategies should be considered above all else. The key to this is identifying the processing problem and structuring input so that learners are pushed away from non-optimal processing strategies and compelled to process the target form. As Wong (2004) states, “if the activity is not constructed to preempt an inefficient processing strategy, then it is not an SI activity” (p. 42, emphasis in the original). Structured input is principally created by either removing non-targeted cues from the input or ensuring that cues are not contrastively available. In the example of German accusative case markers given above, this would mean that sentences should be decontextualized and presented with varied word order to avoid a first-noun strategy. Additionally, animacy and plausibility cues should be controlled so that they do not bias an interpretation of the target sentences. In this way, PI
accounts for two of the conclusions discussed at the outset of this section: learners typically exploit non-morphosyntactic cues for meaning (point 2), and the competition between cues causes interference, leading L2 learners to underuse morphosyntactic cues during comprehension (point 6).

Because they attempt to push learners to create form-meaning connections, SI activities must keep meaning in focus and have learners do something with the input they are processing. This means that activities should be designed to highlight the meaning of a particular cue, and that successful processing of the form should be essential to the task they are asked to perform. If meaning is task-essential, learners will be pushed to connect individual cues to their meaning, precisely because the activities demonstrate its function clearly. SI activities therefore tend to utilize forced-choice tasks in which learners match sentences to pictures or answer simple questions about the input (e.g., when did this event take place?). In addition, SI activities often contain an element of feedback to let learners know if they have processed the sentence correctly. Without this feedback, learners may not realize that their preferred processing strategy led to an erroneous interpretation and they would be less likely to begin processing the target cue for meaning. Thus, by making meaning task-essential and informing learners when they arrive at the incorrect interpretation of the input, PI accounts for the fact that communicative needs influence which cues are processed in the input (point 1).

A critical aspect of keeping meaning in focus is presenting cues one at a time and concentrating on one form of these cues (e.g. in German, focusing on the specific alternation between masculine articles in the nominative and accusative cases). Without targeting one cue—and only one cue—SI activities run the risk of introducing cue competition, reducing the communicative value of each individual cue, or introducing complexity that distracts from one-
to-one form-meaning connections. As discussed in relation to the Competition Model, the presence of cue coalitions can make it difficult to isolate the functions of individual cues in the input. By focusing on one cue at a time—and by keeping its meaning in focus—SI activities maximize the chance that learners recognize the function of a specific cue; it also increases the availability and reliability of the cues in the input. That is, if the targeted cue is the only relevant cue in the input, and this cue is the only one involved in changes to meaning, then learners can come to understand that it is reliable and adjust cue strengths for the L2 accordingly. Thus, PI accounts for observations 3, 4, and 5 as outlined at the beginning of this section.

In addition to these defining design components, SI activities typically contain two additional design features. First, activities should use both aural and written input. This guideline comes primarily from the observation that learners often have very different learning styles and skills. Moreover, prosodic and phonological aspects of a language may make some cues particularly difficult to process in aural input (LoCoco, 1987), and individual learners vary greatly with respect to their ability to identify and decode cues in aural input (Díaz, Baus, Escera, Costa, & Sebastián-Gallés, 2008). As a result, there are some cues, for which certain learners may need written input in order to receive maximum benefit from the task. Written input may also decrease the demands on processing resources because learners can process the input at their own pace and reread sections as often as they wish. Secondly, because of limits on processing resources, SI activities should move from sentences to connected discourse. At the beginning of a PI intervention, focus on short sentences should ensure that learners are able to process the target grammatical forms efficiently; as learners make relevant form-meaning connections and have practice with the optimal processing strategies it should be easier for them to use the cues in
connected discourse. This progression gives learners key practice using cues in a larger and less predictable context than in sentence-level interpretation tasks.

In sum, acquisition can only proceed when linguistic forms are identified in the input and connected to their meanings, but a complete understanding of these forms can only be developed when cues are attended to routinely, so that robust representations can be incorporated into the developing L2 grammatical system. Further, real-time use of these representations requires that learners adjust cue weights and processing strategies effectively. In principle, PI is involved in each of these steps: SI activities seek to increase form salience and highlight meaning by structuring input and compelling task-essential interaction, thus ensuring routine processing of the cues and a change in processing strategies.

2.4.2 A review of PI research

The seminal study in Processing Instruction research was conducted by VanPatten and Cadierno (1993). The goal of this study was to introduce Processing Instruction and compare it to traditional methods of instruction, which are primarily output-oriented. The instructional interventions in this study targeted clitic object pronouns in L2 Spanish, which appear preverbally, resulting in OVS word order as illustrated in (13).

(13) La sigue el señor.
   HerOBJ follows the manSUBJ.
   “The man follows her”

Previous research on Spanish (e.g., LoCoco, 1987; VanPatten, 1984) had shown that L2 learners typically use a first noun-strategy to understand these sentences, and, thus, this was identified as the primary processing problem. Two groups of second-year university-level L2 Spanish students received either traditional instruction (TI), in which the participants completed mechanical drills and meaningful output practice, or PI, in which they practiced interpreting the
target form. Before training, the participants completed a pretest consisting of a comprehension measure (a picture identification task) and a production measure (a sentence completion task); different versions of the pretest were administered as posttests immediately, one week, and one month after instruction. The results revealed that the PI group was significantly more accurate than the TI group and a control group on the posttest comprehension measures; furthermore, the gains made by the PI group were sustained on the delayed posttests. The TI group did not improve relative to the control group. On the production measures, there were no differences between the TI and PI groups, but both groups improved relative to their pretests and a control group, who received no instruction. Again, the gains were sustained throughout the testing period. Based on this pattern of results, the authors argued that PI altered the way that the participants extracted information from the input, providing intake for the developing system and creating underlying competence useful for both comprehension and production. On the other hand, because the TI group only improved in the production of the target form, the authors argued that TI results in explicit language knowledge or a learned competence that is separate from the implicit language system (as per Krashen, 1982).

Further work on PI has showed a similar pattern of results for other structures with different processing problems. Cadierno (1995) investigated L2 acquisition of the Spanish preterit, which is marked through verbal morphology. Thus, the processing problem associated with this form is that learners tend to rely on temporal adverbs or context to understand temporal reference (the Lexical Preference Principle). As with VanPatten and Cadierno's (1993) seminal study, Cadierno compared PI with output-focused TI and a control group that received no instruction. The pretests and posttests (immediate and two delayed posttests) consisted of a comprehension measure (a forced-choice tense assignment task) and a production measure (a
sentence completion task). The results again indicated that the PI group was significantly more accurate on the comprehension measure than the TI and control groups, and that these gains were sustained through the final delayed posttest test one month later. On the production measures, the PI and TI groups outperformed the control group on all three posttests, and there were no differences between the PI and TI groups. These results mirrored those of the original study conducted by VanPatten and Cadierno (1993). Subsequent research on the acquisition of the Italian future tense (Benati, 2001) and the English past tense (Benati, 2005) have also replicated this pattern of results, indicating that PI is useful for the acquisition of multiple forms that span several languages and multiple processing problems.

It should be highlighted that PI’s effects have been shown to be durable over the long term. Both VanPatten and Cadierno (1993) and Cadierno (1995) showed that the effects of PI were sustained a month after training, and Benati (2001) showed sustained effects three weeks after training. Other studies have also shown positive effects for PI over longer periods. For example, VanPatten & Fernández (2004) conducted a conceptual replication of VanPatten and Cadierno (1993) that included a delayed posttest completed eight months after training. The results and showed that, while participants did not sustain all of the gains they had made in immediate posttests, they were still significantly more accurate in both comprehension and production than they were on the pretest.

While these studies suggest that SI activities lead learners to change processing strategies—resulting in better intake and increased acquisition—one of the primary criticisms of VanPatten and Cadierno (1993) was that the EI for the PI and TI groups differed. In order to test whether the EI made a significant contribution to the treatment in that study, VanPatten & Oikkenon (1996) conducted a conceptual replication in which one group received the same PI
training as in VanPatten and Cadierno’s study, one group received only the SI activities, and one
group received only the EI. The results showed that both the PI and SI groups improved
similarly on comprehension, while the EI group did not improve at all. On the production
measures, the PI group improved the most, followed by the SI only and EI only groups. While
this suggests that EI plays a role in enhancing production performance, the data indicate that,
overall, the SI activities are the active component in PI trainings, and that meaningful interaction
with cues is sufficient for acquisition to occur.

Even so, several recent studies have found that EI can allow learners to begin processing
targeted cues sooner in a PI treatment, depending on the particular structures under investigation.
These studies have found positive effects for EI in the processing of German accusative case
markers (Culman, Henry, & VanPatten, 2009; Henry et al., 2009; VanPatten & Borst, 2012a),
the faire causative in French (VanPatten & Price, 2012), and the Spanish subjunctive
(C. Fernández, 2008). But these positive effects are also balanced by findings that EI is not
beneficial for Russian case markings (VanPatten & Collopy, 2012) or Spanish object clitics
(C. Fernández, 2008; VanPatten & Borst, 2012b). Furthermore, even when EI is beneficial, given
enough practice with the SI activities, EI does not appear to be necessary for correct processing
of any of these target forms. In a review and comparison of EI’s effects on case assignment in
Spanish, German, Russian, and French, VanPatten, Collopy, Price, Borst, & Qualin (2013)
agreed with the findings of these individual studies and concluded that the effects of EI are
significantly influenced by the portability of the EI (i.e., the ability of learners to hold EI in
memory so that it can be put to use during real-time comprehension).
2.4.3 Gaps in the PI Literature

Despite two decades of research on PI and rather robust effects of training, the PI literature lacks detail in two essential areas. First and foremost, the central claim made in the PI literature is that PI leads to changes in processing strategies, leading L2 learners to process morphosyntactic forms more readily. Although the preponderance of the evidence points towards this conclusion, nearly all of the data used support this claim is comes from pen and paper tests. While these tests serve as a useful measure for assessing learning gains and knowledge of a structure, they do not actually test changes to processing behavior, and they provide no detail about how learners process sentences outside of a structured input task, when language is “unstructured.” This is surprising given the importance of this claim to PI and its underlying theoretical basis. Consequently, PI needs to be investigated using online (real-time) processing measures. This would provide direct evidence for changes in processing behavior as result of instruction.

Indeed, at the time of writing I am aware of only one study which employs a PI-like training and tests its effects using online measures. Using an innovative training that followed the guidelines of SI activities, Dracos (2013) found that instruction did affect the comprehension and production of verbal morphology in Spanish. However, a self-paced reading task indicated that, when learners were directed to read sentences for meaning instead of focusing on grammar, training did not influence sensitivity to the forms under investigation. Given that the online and offline effects of training were seemingly at odds with each other—and given that one study cannot hope to address all of the relevant issues (e.g., whether changes to processing strategies depend on the form or processing problem)—this is still an area in the PI literature that deserves more attention and would benefit from greater focus and a more detailed understanding.
Secondly, the PI research has focused entirely on the competition between cues and the effects of removing these cues from the input. This focus is natural given that PI grew out of the IP model, which itself is focused on competitive interaction between cues during sentence processing. Yet, implicit in this focus is the assumption that all cues in the input are fundamentally competitive. While the literature on PI and input processing has validated this assumption with regard to lexical-semantic cues, little attention has been paid to other cue types, most notably prosody.

Because the principles of PI and SI development dictate that all non-target cues to meaning be removed from the input, the current research leaves aside the possibility that prosodic cues can be used additively and support the development of morphosyntax. The fact that the potential additive benefits of prosodic cues have been overlooked in the literature is perhaps unsurprising since much PI research has focused on verbal morphology, for which contrastive prosodic cues are not available. In addition, PI studies on word order have often been conducted in Spanish, where subject-first and object-first word orders receive the same prosodic contours. As discussed in section 2.3.2, however, prosody’s relationship to syntax is well-established (e.g., Fodor, 1998a; Steinhauer et al., 1999), and there is evidence to suggest that prosody and syntax can be used additively in L1 sentence processing (Grünloh et al., 2011; Henry et al., 2014). Thus, it is necessary to establish if the exclusion of prosodic cues is necessary to ensure processing of targeted morphosyntactic forms as previously assumed, or if the incorporation of prosodic forms can support and enhance acquisition.
2.5 The Present Study

2.5.1 Motivations and Goals

The review of the literature presented in this chapter has illustrated current theories of how L2 learners interact with input during sentence processing and how this interaction affects the acquisition of grammatical forms in an L2. It also raises questions that center on issues related to cue additivity and the effects of instruction on processing behaviors. Thus, this dissertation examines these issues and has three main goals:

1. To further explore the interaction between lexical-semantic and morphosyntactic cues and the effects of cue competition on the acquisition of grammar
2. To investigate the interaction between prosodic and morphosyntactic cues and explore the possibility that these cues can be used additively during acquisition
3. To explore the effects of instruction on processing behaviors using online assessment measures

In order to address these issues, I present two studies that test the effects of PI on the acquisition of German accusative case markers and object-first (OVS) word order. In these studies, I compare standard PI—in which only the targeted morphosyntactic forms are present in the input—with TI (which does not explicitly manipulate surface cues) and a new PI training that includes prosodic cues. For each type of training, the effects of instruction will be discussed in terms of gains made both on a traditional offline pretest and posttest, as well as an online self-paced reading task, which is designed to measure changes in real-time processing behavior. Using this side-by-side comparison, the studies in this dissertation provide detail about the central claim in PI—that it changes how learners interact with input.
Because targeted and principled manipulation of the input is at the heart of the PI training paradigm, it also presents a unique and valuable vehicle for understanding how learners interact with singular and multiple cues in the input, and how these cues contribute to the acquisition of L2 morphosyntactic forms. Thus, research on PI is not only useful in gauging the effectiveness of focus-on-form interventions and SI—it also provides valuable information on input processing. Therefore, through an investigation of PI, the studies in this dissertation are poised to provide insight into the interaction between competitive and (potentially) additive cues. In the following sections, I will discuss each of this dissertation’s main goals in more detail, addressing how the studies in this dissertation seek to add to the literature discussed in this chapter.

2.5.1.1 Understanding the Role of Cue Competition

As described in this chapter, it is reasonably well understood that lexical-semantic and morphosyntactic cues compete for attention, and that L2 learners tend to under-process and under-use morphosyntactic forms during L2 comprehension. This observation has been made repeatedly and within the input processing and L2 sentence processing literatures there is broad agreement that L2 learners do employ some degree of shallow processing at lower proficiency levels (e.g., Clahsen & Felser, 2006a; VanPatten, 2004b). What is less clear is how—or indeed if—learners eventually adopt native-like morphosyntactic processing routines and how processing strategies change over time. It seems likely that these strategies are affected by the quality of the input and lack of competition. That is, morphosyntactic processing routines likely change as the result of repeated exposure to input where successful negotiation of meaning requires attention to the morphosyntactic cues, and where learners recognize the meaning and importance of a particular cue.
By employing a training with input structured to promote the creation of form-meaning connections (as in PI), the present study presents learners with an abundance of input devoid of competition, which is hypothesized to be useful for developing these processing strategies. This training is proposed to speed acquisition and change processing behavior as a result; thus the online measures in the present study may provide a window into development that usually happens very slowly. What’s more, positive effects for the training would support the notion that the quality of input—and the presence of cue competition—is a significant factor in acquisition.

2.5.1.2 Understanding the Role of Prosody

In contrast to lexical-semantic cues and the resulting competition, the role of prosody as a potential additive cue is not well understood. In the L1 literature, prosody has been all but ignored until recently (Grünloh et al., 2011), but research has progressed quickly to include studies about prosody’s role in interpreting structural ambiguities (Augurzky, 2006; Fodor, 1998a; Nakamura, Arai, & Mazuka, 2012; Schafer, Carlson, Clifton, & Frazier, 2000; Steinhauer et al., 1999), topical focus (Ito, Bibly, Wagner, & Speer, 2013; Ito & Speer, 2008; Weber, Braun, & Crocker, 2006), and morphosyntax (Grünloh et al., 2011; Pappert & Pechmann, 2012). In the L2 literature, these issues have been much less studied. While there is an expanding literature around L2 acquisition and the use of prosody in comprehension (e.g., Dekydtspotter et al., 2008; Dekydtspotter, Edmonds, Liljestrand, & Renaud, 2010) and production (e.g., Jackson & O’Brien, 2011; M. G. O’Brien, Jackson, & Gardner, 2014), there is surprisingly little about the relationship between prosody and morphosyntax. The present study addresses this gap in the literature by exploring the potential benefits of input that includes converging prosodic and morphosyntactic cues. Within this context, acquisition gains and processing changes that occur when prosody is present in the input could indicate that the cues are used additively and that
prosody supports the acquisition of L2 grammatical forms, as shown in the L1 acquisition literature (Grünloh et al., 2011) and suggested by the Competition Model’s coalitions-as prototypes proposal (Bates & MacWhinney, 1987; Dittmar et al., 2008; Ibbotson & Tomasello, 2009).

The present study also provides a unique testing ground for the suggestion by Dekydtspotter et al. (2006) that the use of non-target prosodic patterns on syntactic structures could be partially responsible for observed non-native processing patterns that seem to support the Shallow Structures Hypothesis. As many of the studies supporting the Shallow Structures Hypothesis were conducted with online tasks similar to the ones used in this dissertation (i.e., self-paced reading), the present study can speak to this issue directly. If the PI training with prosody results in sensitivity to the target structure—and if the other trainings do not—then the data will provide evidence that the ability to reference and activate target-like prosodic patterns contributes to native-like processing patterns. Furthermore, because the target structure in this dissertation is morphosyntactic in nature, and is not related to structural ambiguity and attachment preferences, this pattern of results would show whether the development of native-like prosodic patterns can facilitate the processing of morphosyntactic structures—not just attachment ambiguities, which serve as the foundation of Dekydtspotter’s proposal.

2.5.1.3 Understanding the Effects of Instruction

As Processing Instruction serves as the testing ground for the major theoretical issues outlined above, the PI trainings are under direct comparison as well. Previous research has shown a division between language learning and acquisition (Krashen, 1982) and shows that language acquisition is fundamentally guided by natural processes that cannot be circumvented regardless of instruction (R. Ellis, 1989; Pica, 1983; Pienemann, 1987; but see DeKeyser, 2007).
It is therefore important to understand how instructional methods may support these processes and maximize learning gains (for a thorough discussion of teaching methods and their effectiveness in instructed SLA see Norris & Ortega, 2000; Spada & Tomita, 2010). This is especially true given that most adult L2 acquisition starts in a foreign language classroom context and the amount of input in an L2 classroom is often limited to a few hours a week. The present study addresses this issue by testing the effectiveness of PI against traditional instruction methods.

Additionally, the present study will address two gaps in the PI literature. First, the present study will explore whether prosody may play an additive role in PI. Though some current research has investigated ways to improve the effectiveness of PI—for example, Agiasophiti (2011) explored the effects of textual enhancement in PI—no studies have tested the role of additive cues to see if PI could be improved by carefully including redundant, but potentially supportive, linguistic information. Thus, the present study could expand conceptualizations of “structured input” and could inform future research on PI by highlighting areas where prosody and morphosyntax can support each other. Secondly, the present study provides a direct and principled investigation of its central tenet—that it changes processing strategies—using online methods to measure changes to processing strategies used for comprehension. This research therefore provides insight into whether learners revert to shallower processing strategies after instruction, as suggested by Dracos (2013).

Finally, the inclusion of prosody in one of the experimental groups can address one concern that has been raised repeatedly in PI research—that the use of structured input results in the presentation of unnatural language. These concerns are driven in part by the decontextualized
nature of sentence-level structured input activities\textsuperscript{12}—something that this study does not address—but has also centered on the lack of prosodic information. This is particularly true with object-first sentences in German, which are infelicitous if they do not contain the appropriate intonational patterns (Grünloh et al., 2011). Despite this, previous research on German accusative case-markers has used neutral intonation for the presentation of sentences, based on the assumption that learners will rely on prosodic information and not attend to the case-marking articles (see Culman et al., 2009). For the reasons outlined in this chapter, this assumption may not be accurate, and therefore the inclusion of unnatural intonation cues may not be necessary to the task.

\textsuperscript{12} See Kaiser & Trueswell (2004) for a similar criticism of online research that has made conclusions about processing patterns based on the presentation of decontextualized stimuli. In this study, the researchers show that the presentation of discourse context can also modulate the difficulties associated with processing OVS sentences in Finnish.
CHAPTER 3: Experiment 1

3.1 Introduction and Research Questions

In the previous chapter, I outlined several areas of interest surrounding the acquisition of morphosyntax and the development of native-like syntactic processing routines. Principle among these issues is how linguistic cues interact with each other when they compete, and whether the presence of competing cues delays the acquisition of under-processed forms, including case-marking morphology. The first experiment of this dissertation seeks to investigate this topic through a comparison of two trainings completed by third semester learners of German: Processing Instruction (PI)—which manipulates surface cues so that learners must process the target form to understand meaning—and Traditional Instruction (TI)—which does not. Specifically, this study examines the offline and online effects of training on the acquisition of German masculine case markings. Together, the combination of offline interpretation tasks, offline production tasks, and a self-paced reading task (a measure of processing behavior) provides a window into whether the training has a significant impact on (1) the strength and availability of form-meaning connections during offline language use; and (2) the ability to use morphosyntactic information online. As such, the present experiment has two primary research questions:

RQ1: Does Processing Instruction lead to more accurate comprehension and production of accusative case markers in German than Traditional Instruction?

RQ2: Does Processing Instruction lead learners to process morphosyntactic forms more readily than Traditional Instruction (TI)?

The following sections will outline the experimental methods that were used to answer these questions. I first begin with an overview of the experimental approach, including a full
description of the participants, training mechanisms, and assessment measures used to evaluate the offline and online training effects. Section 3.3 describes the data scoring methods and results of the experiment. The chapter concludes with a discussion of the results and establishes the motivation for the second experiment in this dissertation.

3.2 Overview of Experimental Approach

3.2.1 Experimental Design and General Method

The experiment was conducted in four intact German classrooms over two sessions that took the place of regularly scheduled class meetings; both sessions were conducted in a computer lab on the campus of Penn State University. During these two sessions, participants completed a total of four screening and proficiency measures (language background questionnaire, working memory task, vocabulary test, and proficiency test), training on the target form, and two main assessment measures (an offline pre-test/post-test and a self-paced reading task). After consenting to the use of their data, the participants completed four of these tasks in the first session as indicated in Figure 2: a language background questionnaire, a working memory task, the pretest, and a proficiency test. During the second session, the participants completed the training, the self-paced reading task, the posttest, and a vocabulary test.
For both of these sessions, participants were seated at individual computer stations that were configured to run the computer-based tasks and had keyboards labeled with the relevant response keys using colored stickers. At the beginning of each session, participants were given general instructions for the experiment; they then received an experiment packet that included the materials and step-by-step instructions for each task. When the participants were ready for a computer task, the packet directed them to notify the experimenter, who pointed out the appropriate response keys and started the task at their computer. The participants proceeded through the tasks at their own pace and were given the opportunity to ask any questions they had about the instructions.

### 3.2.2 Participants

The participants in this experiment were 61 L2 German learners enrolled in a third-semester German course at Penn State University, who completed the experiment as part of their
regular coursework. The participants were drawn from four sections of the course that were taught by two instructors and employed the same textbook and general curriculum.

Of the 61 total participants, three were excluded because they reported having an L1 other than English; three additional participants reported having high proficiency in a language other than English or German and were excluded from data analyses. Eight participants were excluded because they scored above chance on the interpretation portion of the pretest (described in section 3.2.5.1) and were therefore assumed to have an established knowledge of case markings and OVS sentence structure. After these exclusions, there were 47 participants who met all of the criteria for inclusion in the study; however an additional three participants were removed from analyses due to a technical failure that resulted in corrupted data. Thus, the final data analyses included a total of 44 participants.

As the experiment was conducted in the classroom, participants were divided into groups based on the course section in which they were enrolled. Each of the four sections was assigned to either the Processing Instruction (PI) or Traditional Instruction (TI) group before the beginning of the experiment. In order to control for the effect of instructor and variations in course material, the course sections were divided such that the instructors’ two sections were in separate groups. Of the 44 participants included in the study, 16 were in the PI group and 28 were in the TI group. Details about the participants' language background, working memory, and proficiency, and vocabulary scores are outlined in Table 2 (section 3.2.3.2).

3.2.3 Screening and Proficiency Measures

As mentioned above, the experiment included four screening and assessment measures. Taken together, these tasks establish whether the TI and PI groups were comparable with respect to their language background, L2 knowledge, and working memory capacity.
3.2.3.1 Materials and Data Scoring

The language background questionnaire (Appendix A) consisted of both multiple choice and open-ended questions designed to collect information about the languages that the participants knew, as well as basic demographic information, such as age and gender. Of primary importance for the present study, the participants provided information about their native and home languages, and they gave a detailed account of their language learning history, including which foreign languages they spoke, when they began learning these languages, how much instruction they had in the language (measured in years), and whether they had any experience living or studying in a German-speaking country (measured in months). Additionally, the participants rated their proficiency in German with respect to reading, spelling, writing, speaking, and speech comprehension. These ratings were given on a 10-point Likert scale, where a score of 10 indicated “very proficient” and 1 indicated “not proficient”. The data from this questionnaire was used to make the exclusion determination described under section 3.2.2.

The proficiency test (Appendix B) was based on the Wisconsin Placement Exam for learners of German. It consisted of multiple-choice items testing a wide range of grammatical structures, including case, tense, subject-verb agreement, word order, and preposition use. As illustrated in (14) and (15) below, the items consisted of a sentence with a word or phrase that had been deleted; the participants chose from one of four answer choices to complete the sentence.

(14) Der Komponist, _______ heute spielt, kommt aus Berlin.
   a. den
   b. der
   c. dem
   d. des
(15) „Warum bist du gestern nicht zur Party gekommen?“ „Gestern __________.“
   a. ich habe nicht kommen können
   b. ich kann nicht kommen
   c. könnte ich nicht kommen
   d. konnte ich nicht kommen

For each item, there was exactly one answer that would complete the sentence grammatically.

This proficiency test consisted of 30 questions in total; questions were given 1 point for each correct answer and 0 points for any incorrect answer. Thus the possible range of scores was 0-30.

The working memory task employed in this experiment was derived from Waters and Caplan (1996) and was adapted to run on the computer program E-Prime (Schneider, Eschmann, & Zuccolotto, 2002). In this task, participants first see a sentence in their L1 (English) and decide whether or not it is semantically plausible. At the same time, they try to remember the last word of the sentence. Sentences are presented in sets such that participants see between two and six sentences at a time; after they see the last sentence in each set, they type all of the last words that they can remember. The working memory task was scored using two methods: (1) absolute score, and (2) set size. For both methods, words were counted as correct if they were recognizable as the target word (i.e., typos and misspellings were counted as correct), or if they were clear morphological variants of the target word (i.e., the response “spill” was counted as correct for the target “spilled”). The absolute score was calculated by counting how many of the 89 target words were remembered correctly. Thus, the range of possible scores for this measure was 0-89. “Set size” was defined as the largest grouping of sentences, for which the participant correctly identified all of the words in at least half of the trials. The participant was given an extra half point if he or she correctly identified all of the target items in more than one trial in the next largest set size. For example, if participants remembered all of the words in four of the five trials with three sentences, they would receive a score of 3. If they also remembered all of the
words in two of the five trials with four sentences, they would receive a score of 3.5. The smallest number of sentences presented prior to recall was 2, and the largest was 6; thus the possible scores associated with this task were 0 and 2-6.

The vocabulary test (Appendix C) was a translation task used to evaluate the participants’ familiarity with the words used in the self-paced reading task (described in section 3.2.5.2). The test contained a total of 136 German words (81 nouns, 48 Verbs, and 7 time adverbials) pulled from the self-paced reading task, including the 24 experimental items and several filler items. The verbs were presented in the third-person singular form in order to ensure comparability between the participants’ performance on the vocabulary task and the self-paced reading task. Participants were instructed to provide an English translation of each German word. To assess whether the participants knew the genders of the nouns used in the task, the nouns were presented without their articles, and participants checked a box to indicate each noun’s gender (masculine, feminine or neuter). Only vocabulary words taken from the experimental sentences in the self-paced reading task were considered for analysis. For the nouns, words were scored as correct and given 1 point if both the correct translation equivalent (or a synonym) and the correct gender were supplied. Nouns in which either the gender or the translation were incorrect were given a score of 0.5. Nouns for which neither the translation, nor the gender were supplied correctly were given 0 points. Verb translations were given 1 point if they were translated correctly and 0 points if they were translated incorrectly. There were a total of 48 nouns and 24 verbs included in the data analysis, and thus the range of possible scores was for the vocabulary test was 0-72.
3.2.3.2 Results

The means and standard deviations (SDs) for each of the screening and proficiency measures described above are included in Table 2.

<table>
<thead>
<tr>
<th>Variable (Range of Possible Scores)</th>
<th>Training group</th>
<th>Traditional Instruction</th>
<th>Mean (SD)</th>
<th>Processing Instruction</th>
<th>Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (Range of Possible Scores)</td>
<td></td>
<td>Traditional Instruction</td>
<td>Mean (SD)</td>
<td>Processing Instruction</td>
<td>Mean (SD)</td>
</tr>
<tr>
<td>Time Spent Abroad in Months</td>
<td></td>
<td>Traditional Instruction</td>
<td>Mean (SD)</td>
<td>Processing Instruction</td>
<td>Mean (SD)</td>
</tr>
<tr>
<td>Years of German Instruction</td>
<td></td>
<td>Traditional Instruction</td>
<td>Mean (SD)</td>
<td>Processing Instruction</td>
<td>Mean (SD)</td>
</tr>
<tr>
<td>Years of instruction in a 3rd Language</td>
<td></td>
<td>Traditional Instruction</td>
<td>Mean (SD)</td>
<td>Processing Instruction</td>
<td>Mean (SD)</td>
</tr>
<tr>
<td>Self-rating: Reading Proficiency (1-10)</td>
<td></td>
<td>Traditional Instruction</td>
<td>Mean (SD)</td>
<td>Processing Instruction</td>
<td>Mean (SD)</td>
</tr>
<tr>
<td>Self-rating: Spelling Proficiency (1-10)</td>
<td></td>
<td>Traditional Instruction</td>
<td>Mean (SD)</td>
<td>Processing Instruction</td>
<td>Mean (SD)</td>
</tr>
<tr>
<td>Self-rating: Writing Proficiency (1-10)</td>
<td></td>
<td>Traditional Instruction</td>
<td>Mean (SD)</td>
<td>Processing Instruction</td>
<td>Mean (SD)</td>
</tr>
<tr>
<td>Self-rating: Speaking Proficiency (1-10)</td>
<td></td>
<td>Traditional Instruction</td>
<td>Mean (SD)</td>
<td>Processing Instruction</td>
<td>Mean (SD)</td>
</tr>
<tr>
<td>Self-rating: Listening Comprehension (1-10)</td>
<td></td>
<td>Traditional Instruction</td>
<td>Mean (SD)</td>
<td>Processing Instruction</td>
<td>Mean (SD)</td>
</tr>
<tr>
<td>Working Memory- Set Size (0, 2-6)</td>
<td></td>
<td>Traditional Instruction</td>
<td>Mean (SD)</td>
<td>Processing Instruction</td>
<td>Mean (SD)</td>
</tr>
<tr>
<td>Working Memory- Words Remembered (0-89)</td>
<td></td>
<td>Traditional Instruction</td>
<td>Mean (SD)</td>
<td>Processing Instruction</td>
<td>Mean (SD)</td>
</tr>
<tr>
<td>Proficiency Task Accuracy (0-30)</td>
<td></td>
<td>Traditional Instruction</td>
<td>Mean (SD)</td>
<td>Processing Instruction</td>
<td>Mean (SD)</td>
</tr>
<tr>
<td>Vocabulary Test (0-72)</td>
<td></td>
<td>Traditional Instruction</td>
<td>Mean (SD)</td>
<td>Processing Instruction</td>
<td>Mean (SD)</td>
</tr>
</tbody>
</table>

In order to measure the comparability of the groups prior to treatment, a series of independent t-tests were conducted to identify any differences on these measures. This analysis revealed that the TI group had studied German for an average of 1.25 years longer than the PI group, and this difference was significant ($t(42) = 2.67, p = .012$). There were no significant differences on any of the other measures included in the analysis (years of 3rd language instruction: $t(42) = 1.71, p = .094$; self-ratings of listening comprehension: $t(42) = 1.07, p = .290$; all other measures $t < 1$).

Thus, the groups were comparable in their language background and cognitive measures, except for their length of study. This suggests that the TI group may have had an advantage during the tasks in this experiment. However, although the TI group had studied German for a
longer period of time, this did not translate into significant differences in their proficiency or vocabulary scores, nor was it evident in any of the self-rating measures. It is therefore likely that any of the differences observed between the groups after training are a result of the treatment itself, and do not stem from the difference in length of study.

3.2.4 Training

3.2.4.1 Traditional Instruction

The traditional instruction (TI) training (Appendix D) was adapted from grammar units found in two popular college-level textbooks for beginning German (Lovik, Guy, & Chavez, 2010; Moeller, Adolf, Hoercherl-Alden, & Berger, 2009) and one website popular among German instructors (Thuleen, 1999). Thus, the training was “traditional” in that it was representative of grammar training used in text-book based curricula in many college-level German courses. The training consisted of three main components: explicit information (EI), computer training with feedback, and production tasks. As is common for German textbooks, the EI focused on an explanation of what direct objects are, and it introduced the nominative- and accusative-marked definite and indefinite articles for each gender in German. Critically, there was no information about inverted word order and no warning about processing strategies. That is, the participants were never explicitly told to avoid a subject-first interpretation strategy. The EI was presented via E-Prime (Schneider et al., 2002) across several slides; participants could read each individual slide as long as they wanted, but could not review slides once they had moved on.

After the EI, participants in the TI group completed two referential activities. In the first activity, participants read target sentences displayed on the screen and identified the direct object (or else indicated that there was not a direct object in the sentence). They received simple one-
word feedback after answering each question. The second activity was a multiple choice fill-in-the-blank exercise, in which participants supplied nominative and accusative definite articles. This exercise was adapted for the computer so that the participants could receive feedback after their answer. Neither of these activities contained OVS sentences, as is typical for college-level grammar activities in German.

After completing these two referential activities, participants completed two pencil and paper affective activities that required production of the accusative case. In the first activity, the participants saw a series of items with price tags and wrote four sentences to explain which items they would buy for their dorm rooms without exceeding a budget of 200 €. In the second affective activity, participants checked boxes to indicate what items they and a friend own and wrote five sentences comparing their possessions.

3.2.4.2 Processing Instruction

Similar to the TI training, The Processing Instruction (PI) training (Appendix E) contained three major components: explicit information (EI), referential Structured Input (SI) activities, and affective Structured Input activities. The EI was derived from VanPatten et al. (2013), who reported that EI provided some initial benefits over training that included only SI activities. This EI training was designed to emphasize the definite articles’ function as a cue to grammatical roles. As the feminine, neuter, and plural definite articles are the same in the nominative and accusative cases, training focused on the masculine nominative and accusative articles der and den. In order to highlight why articles are important for determining grammatical roles, information about inverted word order and object-first sentences was also included in the explicit information. Finally, the participants were told that articles are critical for avoiding misinterpretations and received a warning that the first noun is not always the subject of the
sentence in German. As with the TI training, the explicit information seen by the PI group was presented via E-Prime (Schneider et al., 2002) across several slides, such that participants could take as much time as they wanted, but could not review slides they had already read.

Participants in the PI group first completed the referential activity, which was adapted from the one used by VanPatten et al. (2013) and was presented via E-Prime (Schneider et al., 2002). In this task, the participants first heard a sentence and then used the keyboard to choose the picture they thought best represented the meaning of the target sentence; they then received simple one-word feedback on their answer. The training consisted of 30 sentences spoken by a male native speaker with neutral prosody. As seen in Figure 3, each sentence was a simple transitive construction consisting of an NP-V-NP sequence in which case markings unambiguously identified the sentence as SVO (as in A) or OVS order (as in B). Accompanying the audio presentation of the sentences were two pictures: one representing an SVO interpretation of the sentence, and the other representing the OVS interpretation. The presentation of the pictures was randomized with regard to which interpretation appeared on the left and right sides of the screen.
There were 23 OVS sentences and seven SVO sentences placed in a repeating sequence of three OVS items, followed by one SVO item to ensure even distribution of the SVO distractor items. Importantly, the target sentences in this activity contained only animate nouns and both an SVO and an OVS interpretation were equally plausible. Further, as noted above, the sentences were spoken with neutral prosody (i.e., there were no intonational cues to meaning); thus, the case markings were the only cue that participants could use to comprehend the sentences.

Given technical limitations of the computer labs reserved for the study, audio files associated with the referential activity in the PI training could not be played at the individual computer stations; thus the audio files were played aloud through the classroom speakers, and

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13 This method was also employed by Culman et al. (2009) and Henry et al. (2009), both of whom administered a debriefing questionnaire, in which no participant indicated that they noticed the regularity of the SVO and OVS sentences.
participants followed along, marking their answers at their stations. Consequently, participants were not able to proceed through this task at their own pace as in VanPatten et al. (2013). However, care was taken to ensure that each participant had time to complete each question and receive individual feedback before moving on.

After the referential activity, participants completed two affective activities adapted from Farley (2004). In the first of these activities, participants read a series of sentences and decided if they applied to their relationship with a good male friend. They then decided if the same sentences applied to their relationship with a male relative and compared their answers. In the second activity, participants read a list of things that a supportive wife might do for her husband and ranked them according to how important they are for a good marriage. They then compared their answers to a set of rankings provided to them in the instructions. Though there are no wrong answers in either of these two tasks, the task itself requires participants to process OVS word order and case markers in order to understand the meaning of the sentences; thus, these activities act as an input flood and reinforce the importance of case markings for comprehension.

It is important to emphasize that the TI and PI trainings were identical with respect to the use of both referential and affective activities and the quality and quantity of corrective feedback. Thus, the differences between the TI and PI trainings lie solely in the principles of Processing Instruction (Lee & VanPatten, 2003): the PI training concentrated on one form (the masculine accusative), it used both aural and written input, and attention to meaning was required for successful completion of the tasks. Most importantly, the activities were designed to compel the

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14 The reader is reminded that in both of these activities, the focus on male persons was necessary as the feminine article in German (*die*) is ambiguous with respect to the nominative and accusative cases, whereas the masculine article changes from *der* in the nominative to *den* in the accusative.
participants to process case-marking information more readily instead of relying on a first-noun strategy. The TI training, on the other hand, followed traditional textbook methods, which present multiple forms at once, focus on accurate production, and typically include reliable non-target cues, such as word order (i.e., consistent presentation of SVO sentences), animacy, plausibility, and context that mediates the interpretation of simple transitive sentences.

### 3.2.5 Assessment Materials and Procedure

#### 3.2.5.1 Offline Pre-test/Post-test

**3.2.5.1.1 Materials**

There were two versions of the offline test that functioned as pre- and posttests. Each version of the test consisted of two parts, a sentence interpretation task, and a picture description task. For the sentence interpretation task (Appendix F), participants read a total of 20 sentences also found in the self-paced reading task (see section 3.2.5.2) and answered an accompanying Yes/No question by circling their answer. Of the 20 items, eight specifically tested the interpretation of grammatical roles and 12 were filler items. The eight items testing grammatical role assignment were divided evenly among four sentence types that varied with regards to word order (SVO and OVS) and position of the disambiguating noun (first or second). Participants therefore saw two of each of the following sentence types:

1. **(16a) SVO-Disambiguating Noun First**
   
   Der Räuber verletzt die Polizistin an dem Tatort.  
   TheNOM thief injures theACC policewoman at the crime scene.  
   “The thief injures the policewoman at the crime scene.”  
   Does the thief injure the police officer?  
   Yes  
   No

2. **(16b) OVS-Disambiguating Noun First**
   
   Den Piloten weckt die Stewardess am Morgen.  
   TheACC pilot wakes theNOM female flight attendant in the morning.
“The female flight attendant wakes the pilot up in the morning.”
Is the stewardess waking up the pilot? Yes No

(16c) SVO-Disambiguating Noun Second
Die Professorin stört den Studenten in der Bibliothek.
The NOM female professor disturbs the ACC student in the library.
“The female professor is disturbing the student.”
Is the student disturbing the professor? Yes No

(16d) OVS-Disambiguating Noun Second
Die Frau küsst der Kellner in dem kleinen Restaurant.
The ACC woman kisses the NOM waiter in the small restaurant.
“The waiter kisses the woman in the small restaurant.”
Does the woman kiss the waiter first? Yes No

As seen above, the Yes/No question that accompanied these sentences specifically addressed who did what to whom and Yes/No answers were divided evenly among the items such that each of the four sentence-types described above received one ‘Yes’ and one ‘No’ response. The comprehension questions were presented in English so that participants could not answer the question by simply matching the case markings from the sentence and the comprehension question. For example, had the questions been presented in German, the sentence Die Frau küsst der Kellner in dem kleinen Restaurant (‘The waiter kisses the woman in the restaurant’) would have had the comprehension question Küsst die Frau den Kellner im Restaurant?. In this case, participants could have simply noticed a mismatch between the articles preceding Kellner and answered the question correctly with a ‘No’ response.

The picture description task (Appendix G) was adapted from White's (2008) discourse-level production task. In this task, the participants saw four picture sets and wrote a short story to describe what was happening in each picture set. As depicted in Figure 2, each of these picture sets contained three pictures, a question prompt, and a list of verbs to help the participants complete the task.
What is the boy doing with the double bass (der Bass)?

Figure 4. Example of picture description task from offline pre/posttest

Of the four picture sets, two contained pictures depicting a person interacting with a masculine person or object. Thus, these pictures specifically elicited use of the target items—the masculine case markers *der* and *den*—while the other two served as distractors. Participants were instructed to write at least one sentence per picture to answer a prompt so that the masculine target word would be used at least three times; however, participants were not limited to three sentences, nor were they required to use the verbs presented to them.

3.2.5.1.2 Procedure

As mentioned above, there were two versions of the offline test that functioned as the pre- and posttests. These two tests were counterbalanced such that half of the participants in each group received version A as the pretest and version B as the posttest; the other half of the participants received version B as the pretest and version A as the posttest.

The pretest was administered along with the screening and proficiency tests during the first session, and the participants completed it at their own pace during a regularly scheduled class meeting. The posttest was completed after training during the second session and was also included as part of the experimental packet that participants completed at their own pace.
3.2.5.2 Self-Paced Reading Task

The self-paced reading (SPR) task in this experiment was presented using E-Prime 2.0 (Schneider et al., 2002) in order to assess the participants’ real-time processing behavior of SVO and OVS sentences. The task used a non-cumulative moving window design (Just, Carpenter, & Woolley, 1982), in which participants read sentences phrase by phrase. While participants read these sentences, the presentation software collects reading times (in milliseconds) for each phrase. The key assumption in this type of task is that reading time is influenced not only by word length, but also by the difficulty in processing components of the sentence. By comparing reading times on similar sentences, researchers can gain insight into which sentences—and which parts of sentences—are processed with more effort. In the context of this experiment, OVS sentences are far less frequent and require more complex structure building than SVO sentences; consequently, one would expect more effortful processing (and longer reading times) on the disambiguating segments of OVS sentences. If participants show increased reading times on OVS sentences relative to SVO sentences, this would provide evidence that L2 German learners are sensitive to case-marking information and use it to assign grammatical roles.

3.2.5.2.1 Materials

During the SPR task, participants saw a total of 76 items, each of which was followed by a comprehension question. Of these, there were 4 practice items, 24 experimental items, and 48 fillers belonging to one of several types. A complete list of the SPR sentences and the accompanying comprehension questions can be found in Appendix H.

3.2.5.2.1.1. Experimental Sentences

The experimental sentences in this task investigated learners’ processing of object-first sentences. Accordingly, 24 sentence quadruplets were created, manipulating two main variables:
word order (SVO or OVS) and placement of the disambiguating (i.e., masculine) noun. Each quadruplet consisted of an NP-V-NP sequence in which one of the nouns was masculine and the other was either feminine or neuter. In order to capture any so-called ‘spillover effects’ and to avoid sentence wrap-up effects on the second NP, the NP-V-NP sequence was followed by one or two prepositional phrases that ended the sentence. These sentences were then divided into five to seven regions for the presentation of the SPR task. For the purpose of analyses, both NPs (regions 1 and 3) were identified as critical regions, and the regions that followed (regions 2 and 4) were identified as spillover regions. The final segment in each sentence was also identified as a region of interest to account for end-of-sentence processing effects. In example (17) (and the examples that follow), the slashes represent the division of the items into regions, bold-faced type indicates the critical regions, and italicized type represents the spillover regions.

(17a) SVO-Disambiguating Noun First

Der Kellner / küsst / die Frau / im / Restaurant / neben / dem Kino.
ThenOM waiter kisses theACC woman in.the restaurant next to.the cinema.
"The waiter kisses the woman in the restaurant next to the cinema."

(17b) OVS-Disambiguating Noun First

Den Kellner / küsst / die Frau / im / Restaurant / neben / dem Kino.
TheACC waiter kisses theNOM woman in.the restaurant next to.the cinema.
"The waiter kisses the woman in the restaurant next to the cinema."

(17c) SVO-Disambiguating Noun Second

TheNOM woman kisses theACC waiter in.the restaurant next to.the cinema.
"The woman kisses the waiter in the Restaurant next to the cinema."

(17d) OVS-Disambiguating Noun Second

TheACC woman kisses theNOM waiter in.the restaurant next to.the cinema.
"The woman kisses the waiter in the Restaurant next to the cinema."
These stimuli were divided into four experimental lists so that participants only saw one version of each sentence. Thus, participants saw six sentences from each of the conditions described above.

In order to control for reading time differences that might result from the number of letters in the regions of interest, all of the phrases in the pre-critical, critical, and spill-over regions of the experimental stimuli were controlled for length across the four lists. In addition, the stimuli were controlled so that they were equally plausible regardless of which NP was seen first. Plausibility was determined via a norming survey administered to 20 native and highly proficient L2 German speakers who did not participate in the main experiment. The speakers rated one sentence from each of the 24 experimental items and 16 distractors using a 7-point Likert scale (1 = not plausible; 7 = very plausible). Each of the sentences was presented in one of the SVO conditions with the masculine noun coming either first or second as in (17a) and (17c), and sentences were divided among participants so that no one saw any given sentence in more than one condition. The final stimulus set for the SPR task included only sentences that were given a rating of 4 or higher in both conditions. On average, the participants gave sentences with masculine agents a rating of 5.79, while sentences with feminine or neuter agents were given a rating of 5.98. The average difference in plausibility rating between any two equivalent sentences was 1.06, and the maximum difference was 2.56. A paired t-test confirmed that the difference in ratings between conditions was not significant ($t < 1$). A complete table of the mean ratings and differences for the final stimulus set is found in Appendix I.

Each sentence in the SPR task was followed by a comprehension question to ensure that participants read the sentence for meaning. Half of the comprehension questions specifically
tested the assignment of grammatical roles, while the other half inquired about information found in the prepositional phrase, as seen in sentences (18a) and (18b), respectively.

(18a) Target Sentence: Der Kellner küsst die Frau im Restaurant neben dem Kino.  
“The waiter kisses the woman in the restaurant next to the cinema.  
Question: Are the people eating out?

(18b) Target Sentence: Der Räuber verletzt die Polizistin an dem Tatort.  
“The thief injures the police woman at the crime scene.”  
Question: Does the thief injure the police officer?

Additionally, half of these questions had a correct response of 'Yes,' and half had a correct response of 'No'.

3.2.5.2.1.2. Filler Group A

The first set of filler items (8 items) included sentences that were similar in design to the experimental items but featured a double-masculine construction (DMC). These sentences contained two masculine nouns and manipulated the grammaticality of the case markings. In the grammatical condition, each sentence was marked unambiguously for SVO word order; in the ungrammatical condition, both masculine nouns were marked as nominative. This double-nominative created an ungrammaticality, which also creates ambiguity since word order can no longer be discerned based on case markings. The items were divided into regions in the same manner as the experimental items:

(19a) **Der Taxifahrer** / **sieht** / **den Fan** / **neben** / **der Straße**.
    TheNOM taxi driver sees theACC fan next to the street.

(19b) **Der Taxifahrer** / **sieht** / **der Fan** / **neben** / **der Straße**.
    TheNOM taxi driver sees theNOM fan next to the street.

These items were split across lists such that participants saw four grammatical sentences and four ungrammatical sentences; no participant saw any of the sentences in more than one
condition. As with the experimental items, these items were also controlled for length in the pre-critical, critical, and spillover regions. The comprehension question for these items were again split evenly between correct ‘Yes’ and ‘No’ responses, and half of the questions asked specifically about grammatical roles, while half focused on other parts of the sentence.¹⁵

3.2.5.2.1.3. Filler Group B

The second set of experimental items included 24 sentences that contained a past-tense time adverbial (e.g., *gestern*, 'yesterday') and a verb inflected for tense (past or present). Thus, in these filler items, grammaticality was manipulated such that half of the conditions for each sentence had a conflict of tenses and half did not. In addition, the order of the verb and time adverbial was manipulated, as seen in (20), which resulted in four versions of each sentence:

(20a) Grammatical-Verb First

*Der Autor/ hörte/ gestern/ dem Album/ im/ Büro/ zu.*
The author listened yesterday the album in the office to.

(20b) Ungrammatical-Verb First

*Der Autor/ hört/ gestern/ dem Album/ im/ Büro/ zu.*
The author listens yesterday the album in the office to.

(20c) Grammatical-Verb Second

*Gestern/ hörte/ der Autor/ dem Album/ im/ Büro/ zu.*
Yesterday listened the author the album in the office to.

(20d) Ungrammatical-Verb Second

*Gestern/ hört/ der Autor/ dem Album/ im/ Büro/ zu.*
Yesterday listens the author the album in the office to.

"Yesterday the author listened/*s to the album in his office"

As with the previous sentence types, the items were split across conditions so that participants saw six sentences from each of the conditions above, and no participant saw more than one

¹⁵ As the ungrammatical sentences contained a double-nominative—and were therefore ambiguous—questions asking about thematic roles technically had no incorrect answer. Thus comprehension questions for these items were treated as correct in the analyses, regardless of the actual response.
version of each sentence. The comprehension questions for these items focused on the content of each sentence, and did not refer specifically to tense as illustrated below:

(21) Sentence: „Gestern hörte der Autor dem Album im Büro zu.
   “Yesterday the author listened to the album in the office.”
   Question: Did the author watch a TV show?

3.2.5.2.1.4. Filler Group C

The final set of fillers contained 18 sentences of three different types as shown in the examples below:

(22) Simple Intransitive Sentences
    Die Ingenieurin geht heute nach Berlin.
    “The female engineer is going to Berlin today.”

(23) Transitive sentences with inanimate agents
    Die Putzfrau kauft ein Geschenk für den Geburtstag ihrer Tante.
    “The cleaning lady buys a present for her aunt’s birthday.”

(24) Sentences with multiple clauses
    Der Feuerwehrmann fragt\textsuperscript{16} wie viele Menschen im Haus waren.
    “The fireman asks how many people were in the house.”

There were no systematic design constraints for any of these sentences or their comprehension questions. There was only one version of each sentence, and every participant saw each sentence once.

3.2.5.2.2 Procedure

Participants completed the SPR task at their individual computer stations. As illustrated in Figure 5, each SPR trial began with a fixation cross in the center of the screen; participants then pressed the spacebar on the computer keyboard to begin reading the sentence. The first word appeared on the left side of the screen, followed by a series of dashes representing the other

\textsuperscript{16} In keeping with traditional methods for SPR tasks, all commas were removed from the stimuli where necessary.
words. The participants then used the spacebar to reveal the rest of the sentence phrase by phrase. As each phrase was revealed, the previous word disappeared. To end the trial, participants answered the Yes/No comprehension question to ensure that they had read and understood the sentence.

Figure 5. Procedure for Self-Paced Reading Trials

The participants first completed the practice sentences and then moved on to the main experiment. The experimental and filler sentences were presented in a pseudo-randomized order so that sentences of the same type did not appear in more than two consecutive trials.

3.3 Data Scoring and Results

3.3.1 Offline Pretest and Posttest

3.3.1.1 Data Scoring

The offline interpretation measure consisted of 20 items, 8 of which tested the interpretation of grammatical roles. For each of these eight target items, a correct answer was
given a score of 1, while incorrect answers were given a score of 0. To test the effect of training type on the interpretation of subject-first and object-first sentences separately, two sub-scores were created for SVO and OVS items. Thus, the possible range of scores on the SVO and OVS items was 0-4 points each.

For the production task, separate scores were calculated for the participants’ accuracy with masculine nominative markers and masculine accusative markers. Both the articles *der* and *den* and their corresponding pronouns *er* and *ihn* were considered for this score, which was computed by dividing the number of accurate uses by the number of obligatory occasions in each response. For the purpose of this measure, an obligatory occasion was defined as a point in the utterance in which a masculine article or pronoun was necessary to complete a phrase grammatically; any instance in which the omission of the article or pronoun would not have resulted in an ungrammaticality was not considered. A nominative or accusative marker was considered to be correct if it accurately described the picture with respect to thematic roles. For example, one of the pictures in the picture description task depicted a girl seeing her father. Due to the case-ambiguous nature of feminine and neuter articles, the sentence *Das Mädchen sieht der Vater*—the father sees the girl—is not ungrammatical, but was treated as incorrect because the roles of the father and the girl were reversed.17 The scores reported for the accuracy of *der* and *den* are presented as a percentage of accurate uses.

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17 It should be noted that one of the pictures depicted a girl and her father hugging. Because of the ambiguity inherent in the picture, it was impossible to determine whether the article *der* appearing as the second NP in the sentence was an incorrect use of the accusative case or a correct use of the nominative and OVS word order. In other words, both the sentence *Das Mädchen umarmt den Vater*—the girl hugs her father—and the sentence *Das Mädchen umarmt der Vater*—the father hugs the girl—accurately describe the picture; thus, both were counted as correct.
3.3.1.2 Results

3.3.1.2.1 Interpretation Task

The means and standard deviations for the interpretation task are found in Table 3, and the results are graphically represented in Figure 6. A 2x2x2 repeated measures ANOVA was conducted with Time (pretest and posttest) and Word Order (SVO or OVS) as within-participant factors and Training (TI or PI) as a between-participants factor. The analysis revealed a main effect for both Time ($F(1, 42) = 12.89, p = .001$) and Word Order ($F(1, 42) = 92.75, p < .001$), and significant interactions of Time X Training ($F(1, 42) = 4.88, p = .033$), Word Order X Training ($F(1, 42) = 4.67, p = .037$), Word Order X Time ($F(1, 42) = 10.55, p = .002$), and Time X Word Order X Training ($F(1, 42) = 7.20, p = .01$).

In order to explore the 3-way interaction between Time, Word Order and Training, a series of paired $t$-tests were conducted between the pretest and posttest scores for each group. These analyses showed that, while the TI group did not improve after training on either the SVO ($t < 1$) or OVS ($t(27) = 1.13, p = .27$) items, the PI group improved on OVS items ($t(15) = 4.56, p < .001$) and performed to the same level on SVO items ($t < 1$).

In sum, these results show that the PI group made significant improvements in their ability to understand OVS sentences, while the TI group did not. Furthermore, the PI group’s performance on SVO items did not decrease post-training; that is, the gains made by the PI group were not the result of overgeneralization and adoption of an object-first bias.
Table 3

Means for Interpretation Task (standard deviations in parentheses)

<table>
<thead>
<tr>
<th></th>
<th>Traditional Instruction</th>
<th>Processing Instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pretest</td>
<td>Posttest</td>
</tr>
<tr>
<td>SVO</td>
<td>3.29 (.85)</td>
<td>3.39 (0.74)</td>
</tr>
<tr>
<td>OVS</td>
<td>1.14 (1.04)</td>
<td>1.39 (1.07)</td>
</tr>
</tbody>
</table>

![Figure 6. Sentence Interpretation Accuracy](image)

3.3.1.2.2 Production Task

The means and standard deviations for the picture description task are found in Table 4, and are displayed graphically in Figure 7. A 2x2x2 repeated measures ANOVA was conducted with the within groups factors Time (pretest and posttest) and Case (nominative or accusative) and the between groups factor Training (TI or PI). This analysis revealed no main effect for Training ($F < 1$), but did reveal main effects for Case ($F(1, 37) = 29.01$, $p < .001$) and Time ($F(1, 37) = 14.02$, $p = .001$), as well as a significant interaction for Case X Time ($F(1, 37) = ...
16.38), \( p < .001 \) and no Training X Case, Training X Time, or Training X Case X Time interactions (all \( F < 1 \)). There were no Training X Case, Training X Time, or Training X Case X Time interactions (all \( F < 1 \)). Follow-up paired t-tests between the groups’ pretest and posttest scores revealed that both groups exhibited significant improvement in their accuracy with accusative case markers (TI: \( t(25) = 3.48, p = .002 \); PI: \( t(14) = 3.66, p = .003 \)), though there were not any more or less accurate with nominative case makers on the posttest as compared to the pretest (TI: \( t < 1 \); PI: \( t < 1 \)).

Taken together, the results from the production task show that both groups were significantly more accurate producing accusative case markers on the posttest; thus, both groups benefited from training. Moreover, both groups improved to the same degree, and both groups retained high performance with nominative case markers from the pretest to the posttest.

Table 4

<table>
<thead>
<tr>
<th>Means for the Picture Description Task (standard deviations in parentheses)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Accuracy on Nominative</td>
</tr>
<tr>
<td>Accuracy on Accusative</td>
</tr>
</tbody>
</table>
3.3.2 Self-Paced Reading Task

3.3.2.1 Data Scoring

Reading Times (RTs) for each region of the experimental sentences were recorded by E-Prime, as were responses to the comprehension question that followed each sentence. As a result, the SPR yielded both an offline measure of comprehension, and an online measure of processing speed.

The comprehension questions were scored as either correct or incorrect, and all of the scores reported in this section reflect the percentage of correct responses. There were two primary measures of interest: total comprehension, and comprehension on items that targeted grammatical role assignment. The total comprehension score is the percentage of correct responses for all items in the SPR task, including the filler items. In order to test the...
comprehension of items targeting grammatical role assignment, separate sub-scores for SVO and OVS items were computed for comparison.

For the RT analysis, only sentences which were correctly understood were included in the data analysis, as is typical in this type of research. This resulted in a loss of 32% of the data. After excluding these items, all RTs below 200 ms and above 4,000 ms were trimmed from the data. In addition, any RT outside a range of +/- 3 standard deviations from a participant’s mean RT for the experimental sentences was defined as an outlier and discarded. These trimming procedures resulted in a loss of 3.1% of the data. After trimming the data, the new mean RTs were then calculated for each participant in each condition by region (as defined in section 3.2.5.2) for the purposes of comparison.

3.3.2.2 Results

3.3.2.2.1 Comprehension

The means and standard deviations for accuracy on the comprehension questions are reported in Table 5 below. As can be seen in Table 5, the TI and PI groups scored similarly on overall comprehension accuracy. An independent samples t-test confirmed that the difference between the groups was not significant ($t < 1$).

In order to investigate whether the groups differed in their ability to assign grammatical roles, the sub-scores for SVO and OVS sentences were compared in a 2x2 repeated measures ANOVA treating Word Order (SVO vs. OVS) as a within-participant factor and Training (PI vs. TI) as a between-participant factor. This analysis revealed a main effect for Word Order indicating that SVO sentences were comprehended more accurately than OVS sentences ($F(1, 42) = 25.65, p < .001$). There was no main effect for Training ($F(1, 42) = 1.00, p = .323$), and
there was no Word Order X Training interaction ($F < 1$). Thus, although the PI group had a higher accuracy score on OVS items, this difference was not statistically significant.

Table 5

Means for SPR task Comprehension Data (standard deviations in parentheses)

<table>
<thead>
<tr>
<th>Measure</th>
<th>Traditional Instruction</th>
<th>Processing Instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Accuracy</td>
<td>71.15 (7.81)</td>
<td>68.89 (6.78)</td>
</tr>
<tr>
<td>Items testing grammatical role assignment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subject-First (SVO)</td>
<td>68.45 (15.93)</td>
<td>68.75 (18.13)</td>
</tr>
<tr>
<td>Object-First (OVS)</td>
<td>41.66 (21.52)</td>
<td>50.00 (24.34)</td>
</tr>
</tbody>
</table>

Overall, these data show that while overall comprehension was relatively accurate, both groups had difficulty interpreting OVS sentences—and to some extent, even SVO sentences—in the context of the SPR task.

3.3.2.2.2 Reading Times

3.3.2.2.2.1. Experimental Sentences

The means and standard deviations for the RTs at each region are presented for each group by condition in Table 6. For the experimental sentences, regions one and three were the disambiguating segments and were defined as critical regions, while segments two, four and the final segment were considered spillover regions. For each of these segments, 2x2x2 ANOVAs were conducted with Word Order (SVO vs. OVS) and Placement of the masculine noun (henceforth Placement; first vs. second) as within-participant variables and Training (PI vs. TI) as a between-participant variable. In all of the analyses, both participants ($F_1$) and items ($F_2$) were considered as random factors. The results of these analyses are displayed in Table 7.
Table 6
Mean reading times by group and condition for SPR task (standard deviations in parentheses)

<table>
<thead>
<tr>
<th>Segment</th>
<th>NP1</th>
<th>V</th>
<th>NP2</th>
<th>Prep</th>
<th>Final</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Traditional Instruction</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SVO, Masculine 1st</td>
<td>943 (321)</td>
<td>730 (285)</td>
<td>875 (311)</td>
<td>469 (81)</td>
<td>745 (247)</td>
</tr>
<tr>
<td>OVS, Masculine 1st</td>
<td>928 (372)</td>
<td>790 (320)</td>
<td>833 (283)</td>
<td>539 (129)</td>
<td>767 (269)</td>
</tr>
<tr>
<td>SVO, Masculine 2nd</td>
<td>1079 (532)</td>
<td>752 (316)</td>
<td>819 (277)</td>
<td>500 (91)</td>
<td>822 (257)</td>
</tr>
<tr>
<td>OVS, Masculine 2nd</td>
<td>1051 (486)</td>
<td>676 (233)</td>
<td>815 (393)</td>
<td>492 (115)</td>
<td>822 (321)</td>
</tr>
<tr>
<td>DMC, Grammatical</td>
<td>1025 (378)</td>
<td>823 (422)</td>
<td>830 (307)</td>
<td>514 (159)</td>
<td>698 (404)</td>
</tr>
<tr>
<td>DMC, Ungrammatical</td>
<td>1041 (384)</td>
<td>702 (216)</td>
<td>772 (221)</td>
<td>491 (130)</td>
<td>768 (270)</td>
</tr>
<tr>
<td><strong>Processing Instruction</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SVO, Masculine 1st</td>
<td>1244 (477)</td>
<td>866 (313)</td>
<td>1218 (572)</td>
<td>574 (194)</td>
<td>998 (418)</td>
</tr>
<tr>
<td>OVS, Masculine 1st</td>
<td>1436 (665)</td>
<td>855 (388)</td>
<td>1170 (471)</td>
<td>566 (187)</td>
<td>977 (533)</td>
</tr>
<tr>
<td>SVO, Masculine 2nd</td>
<td>1341 (542)</td>
<td>1,021 (483)</td>
<td>1185 (532)</td>
<td>572 (150)</td>
<td>933 (483)</td>
</tr>
<tr>
<td>OVS, Masculine 2nd</td>
<td>1408 (606)</td>
<td>981 (365)</td>
<td>1206 (531)</td>
<td>507 (94)</td>
<td>1112 (786)</td>
</tr>
<tr>
<td>DMC, Grammatical</td>
<td>1342 (593)</td>
<td>721 (206)</td>
<td>1141 (604)</td>
<td>704 (284)</td>
<td>882 (473)</td>
</tr>
<tr>
<td>DMC, Ungrammatical</td>
<td>1131 (549)</td>
<td>792 (293)</td>
<td>924 (398)</td>
<td>646 (277)</td>
<td>835 (334)</td>
</tr>
</tbody>
</table>
### Table 7

**ANOVA results for SPR experimental items**

<table>
<thead>
<tr>
<th>Region</th>
<th>Source of Variance</th>
<th>df</th>
<th>F1</th>
<th>df</th>
<th>F2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Segment 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(First NP)</td>
<td>Word Order</td>
<td>1,42</td>
<td>1.74</td>
<td>1,46</td>
<td>0.19</td>
</tr>
<tr>
<td></td>
<td>Placement</td>
<td>1,42</td>
<td>1.79</td>
<td>1,46</td>
<td>2.01</td>
</tr>
<tr>
<td></td>
<td>Training</td>
<td>1,42</td>
<td>7.94**</td>
<td>1,46</td>
<td>41.07***</td>
</tr>
<tr>
<td></td>
<td>Word Order X Placement</td>
<td>1,42</td>
<td>0.53</td>
<td>1,46</td>
<td>0.42</td>
</tr>
<tr>
<td></td>
<td>Word Order X Training</td>
<td>1,42</td>
<td>3.38†</td>
<td>1,46</td>
<td>0.61</td>
</tr>
<tr>
<td></td>
<td>Placement X Training</td>
<td>1,42</td>
<td>0.61</td>
<td>1,46</td>
<td>0.67</td>
</tr>
<tr>
<td></td>
<td>Word Order X Placement X Training</td>
<td>1,42</td>
<td>0.36</td>
<td>1,46</td>
<td>0.02</td>
</tr>
<tr>
<td><strong>Segment 2</strong></td>
<td>Word Order</td>
<td>1,42</td>
<td>0.24</td>
<td>1,46</td>
<td>1.94</td>
</tr>
<tr>
<td>(Verb)</td>
<td>Placement</td>
<td>1,42</td>
<td>2.02</td>
<td>1,46</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td></td>
<td>Training</td>
<td>1,42</td>
<td>5.03*</td>
<td>1,46</td>
<td>23.73***</td>
</tr>
<tr>
<td></td>
<td>Word Order X Placement</td>
<td>1,42</td>
<td>1.62</td>
<td>1,46</td>
<td>0.22</td>
</tr>
<tr>
<td></td>
<td>Word Order X Training</td>
<td>1,42</td>
<td>0.07</td>
<td>1,46</td>
<td>1.32</td>
</tr>
<tr>
<td></td>
<td>Placement X Training</td>
<td>1,42</td>
<td>7.81**</td>
<td>1,46</td>
<td>0.90</td>
</tr>
<tr>
<td></td>
<td>Word Order X Placement X Training</td>
<td>1,42</td>
<td>0.68</td>
<td>1,46</td>
<td>0.01</td>
</tr>
<tr>
<td><strong>Segment 3</strong></td>
<td>Word Order</td>
<td>1,42</td>
<td>0.25</td>
<td>1,46</td>
<td>0.92</td>
</tr>
<tr>
<td>(Second NP)</td>
<td>Placement</td>
<td>1,42</td>
<td>0.33</td>
<td>1,46</td>
<td>0.65</td>
</tr>
<tr>
<td></td>
<td>Training</td>
<td>1,42</td>
<td>10.42**</td>
<td>1,46</td>
<td>62.62***</td>
</tr>
<tr>
<td></td>
<td>Word Order X Placement</td>
<td>1,42</td>
<td>0.45</td>
<td>1,46</td>
<td>0.14</td>
</tr>
<tr>
<td></td>
<td>Word Order X Training</td>
<td>1,42</td>
<td>0.01</td>
<td>1,46</td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td>Placement X Training</td>
<td>1,42</td>
<td>0.38</td>
<td>1,46</td>
<td>0.39</td>
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<tr>
<td></td>
<td>Word Order X Placement X Training</td>
<td>1,42</td>
<td>0.04</td>
<td>1,46</td>
<td>0.06</td>
</tr>
<tr>
<td><strong>Segment 4</strong></td>
<td>Word Order</td>
<td>1,42</td>
<td>0.03</td>
<td>1,46</td>
<td>0.92</td>
</tr>
<tr>
<td>(Preposition)</td>
<td>Placement</td>
<td>1,42</td>
<td>2.19</td>
<td>1,46</td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td>Training</td>
<td>1,42</td>
<td>2.99†</td>
<td>1,46</td>
<td>9.44**</td>
</tr>
<tr>
<td></td>
<td>Word Order X Placement</td>
<td>1,42</td>
<td>5.13*</td>
<td>1,46</td>
<td>0.04</td>
</tr>
<tr>
<td></td>
<td>Word Order X Training</td>
<td>1,42</td>
<td>4.86*</td>
<td>1,46</td>
<td>5.00*</td>
</tr>
<tr>
<td></td>
<td>Placement X Training</td>
<td>1,42</td>
<td>0.77</td>
<td>1,46</td>
<td>0.07</td>
</tr>
<tr>
<td></td>
<td>Word Order X Placement X Training</td>
<td>1,42</td>
<td>0.13</td>
<td>1,46</td>
<td>0.49</td>
</tr>
<tr>
<td>**Final</td>
<td>Word Order</td>
<td>1,42</td>
<td>1.24</td>
<td>1,46</td>
<td>0.04</td>
</tr>
<tr>
<td>Segment</td>
<td>Placement</td>
<td>1,42</td>
<td>1.32</td>
<td>1,46</td>
<td>2.22</td>
</tr>
<tr>
<td></td>
<td>Training</td>
<td>1,42</td>
<td>4.71*</td>
<td>1,46</td>
<td>18.46***</td>
</tr>
<tr>
<td></td>
<td>Word Order X Placement</td>
<td>1,42</td>
<td>0.71</td>
<td>1,46</td>
<td>2.26</td>
</tr>
<tr>
<td></td>
<td>Word Order X Training</td>
<td>1,42</td>
<td>0.71</td>
<td>1,46</td>
<td>0.11</td>
</tr>
<tr>
<td></td>
<td>Placement X Training</td>
<td>1,42</td>
<td>0.13</td>
<td>1,46</td>
<td>0.09</td>
</tr>
<tr>
<td></td>
<td>Word Order X Placement X Training</td>
<td>1,42</td>
<td>1.11</td>
<td>1,46</td>
<td>1.32</td>
</tr>
</tbody>
</table>

*Note:* †p < .1. *p < .05. **p < .01. ***p < .001.
At the first segment (the first NP) there was a main effect for Training, showing that the PI group was slower to read the first segment than the TI group ($M = 1357$ ms vs. $M = 1000$ ms). In addition, there was an interaction between Word Order and Training that trended towards significance in the participant analysis, but not in the item analysis.

The ANOVA for the second segment (the verb) revealed a main effect for Training, again showing that the PI group had longer reading times overall ($M = 930$ ms vs. $M = 797$ ms). The analysis also revealed a Placement X Training interaction in the participant analysis, but not in the item analysis. This interaction arose in the participant analysis because the PI group read the verb more slowly after encountering a feminine or neuter noun than a masculine noun on the first NP ($M = 1001$ ms vs. $M = 860$ ms) while the TI group did not ($M = 760$ ms vs. $M = 714$ ms).

For the third segment (the second NP) the ANOVA yielded a main effect for Training because the PI group read the segments more slowly than the TI group ($M = 1195$ ms vs. $M = 836$ ms). However, there were no main effects for Word Order, Placement, or Training and there were no interactions between these factors.

At the fourth segment (the preposition), there was a main effect for Training that was not significant in the participant analysis but was significant in the item analysis, because the PI group was slower overall than the TI group ($M = 557$ ms vs. $M = 499$ ms). Additionally, there was a significant Word Order X Training interaction. To follow up on this interaction, two independent 2x2 repeated measures ANOVAs were conducted for each group; this analysis yielded no main effects for Word Order in the TI group ($F1(1, 27) = 2.85, p = .103$; $F2(1, 23) = 1.43, p = .244$); however in the PI group, there was a main effect for Word Order that was not significant in the participant analysis, but trended towards significance in the item
analysis \( F(1, 15) = 2.19, p = .16 \); \( F(1, 23) = 3.57, p = .072 \). This main effect arose because RTs on SVO items were longer than RTs on OVS items \((M = 576 \text{ ms vs. } M = 539 \text{ ms})\).

At the sentence final region, the ANOVA revealed a main effect for Training that arose because the PI group exhibited slower reading times than the TI group \((M = 1005 \text{ ms vs. } M = 789 \text{ ms})\). There were no significant effects for Word Order or Placement, and there were no significant interactions between these factors.

In sum, while the PI group took consistently longer to read target words than the TI group, the RT analyses for each segment showed no reliable effects for word order across all analyses. Consequently, these data provide no statistical evidence to suggest that participants in either group processed SVO and OVS sentences differently, as one would predict if they used case markers to assign grammatical roles incrementally like German native speakers. Moreover, the lack of word order effects in the final region suggests that the participants did not process the items differently after having read the entire sentence.

3.3.2.2.2. Filler Group A

The sentences from Filler Group A contained double-masculine constructions (DMCs) that were either grammatical—containing a masculine nominative article on the first NP and a masculine accusative article on the second NP—or ungrammatical—containing a two nominative articles. Thus, the critical region was the second NP because it contained the second (ungrammatical) nominative article. Region 4 and the final region were also considered regions of interest in order to capture spillover effects. Separate 2x2 repeated measures ANOVAs were conducted for these items with Grammaticality (grammatical vs. ungrammatical) as a within-participant factor and Training (PI vs. TI) as a between-participant factor. Both participants \( F(1) \)
and items ($F_2$) were considered as random factors in these analyses. The means and standard deviations for each group are displayed in Table 6 and the results of the ANOVAs are found in Table 8.

### Table 8
*ANOVA results for SPR filler items*

<table>
<thead>
<tr>
<th>Region</th>
<th>Source of Variance</th>
<th>By Participants</th>
<th>By Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Segment 3 (Second NP)</td>
<td>Grammaticality</td>
<td>1, 41 4.70*</td>
<td>1, 13 1.95</td>
</tr>
<tr>
<td></td>
<td>Training</td>
<td>1, 41 5.59*</td>
<td>1, 13 11.49**</td>
</tr>
<tr>
<td></td>
<td>Grammaticality X Training</td>
<td>1, 41 1.37</td>
<td>1, 13 3.19†</td>
</tr>
<tr>
<td>Segment 4 (Preposition)</td>
<td>Grammaticality</td>
<td>1, 41 1.03</td>
<td>1, 14 2.45</td>
</tr>
<tr>
<td></td>
<td>Training</td>
<td>1, 41 11.67**</td>
<td>1, 14 8.97*</td>
</tr>
<tr>
<td></td>
<td>Grammaticality X Training</td>
<td>1, 41 0.19</td>
<td>1, 14 0.05</td>
</tr>
<tr>
<td>Final Segment</td>
<td>Grammaticality</td>
<td>1, 41 &lt; .01</td>
<td>1, 14 1.10</td>
</tr>
<tr>
<td></td>
<td>Training</td>
<td>1, 41 2.58</td>
<td>1, 14 1.83</td>
</tr>
<tr>
<td></td>
<td>Grammaticality X Training</td>
<td>1, 41 0.38</td>
<td>1, 14 1.11</td>
</tr>
</tbody>
</table>

*Note:* †p < .1. *p < .05. **p < .01. ***p < .001.

At the critical region (the second NP) there was a main effect for Training, stemming from longer RTs for the PI group than for the TI group ($M = 996$ ms vs. $M = 746$ ms) in both the participant and item analyses. The ANOVA also yielded a main effect for Grammaticality in the participant analysis but not the item analysis, as both groups had longer RTs on the grammatical sentences than on the ungrammatical sentences.

At segment 4 (the preposition), both the participant and item analyses revealed a main effect for Training because the PI group had longer RTs overall than the TI group ($M = 931$ ms vs. $M = 771$ ms). However, there was no effect for Grammaticality and no Grammaticality X Training interaction.
The analyses on the final segment of the sentence showed no main effects and no interactions between Grammaticality and Training.

Taken together, the results from these items—like the experimental items—show that the PI group was generally slower to read the critical regions than the TI group. But the fact that the participants did not exhibit longer RTs on ungrammatical sentences again provides evidence that neither group used case markings to assign grammatical roles in real time or after reading the whole sentence.

3.4 Summary of Major Findings and Discussion

The data from the offline tasks showed that while the PI group improved in their interpretation and production of case markers from the pretest to the posttest, the TI group only improved in the production task. To answer the first research question laid out at the beginning of this chapter, then, PI was indeed effective in helping L2 learners acquire the form-meaning connections required to assign grammatical roles on the basis of case-marking information on German articles; moreover, they were able to put these form-meaning connections to use during written production. Thus, PI provided a distinct advantage over TI, which only benefited the learners during production, and not comprehension. Though the target form in this experiment has never been studied in this type of experimental paradigm,\(^\text{18}\) this conclusion is not unique within the PI literature; at least four other studies have found this exact pattern in their comparisons between PI and TI groups on comprehension and production tasks (Benati & Lee, 2008; Benati, 2001; Cadierno, 1995; VanPatten & Cadierno, 1993). The offline tasks therefore fit squarely into previous research that finds benefits for PI over TI.

\(^{18}\) While three studies—Henry et al. (2009), Culman et al. (1993), and VanPatten et al. (2013)—tested the acquisition of German accusative articles and inverted word order, none of these studies included true posttests comparing results against a traditional instruction control, nor did they include any type of production task.
On the other hand, the results from the reading time data provide little evidence that the participants in either group used case markers—either incrementally or at the end of the sentence—to disambiguate SVO and OVS word orders and assign grammatical roles. To be sure, the results from the comprehension questions show that even the PI group had difficulty interpreting both SVO and OVS sentences, as they were less accurate overall than they were during the offline posttest. Thus, the results provide a mixed picture of PI and its effects: when interpreting sentences offline, PI provides distinct advantages—presumably because processing behavior has been affected through training—yet an investigation of online processing shows that they do not process case markers in a qualitatively different way from the TI group.

3.4.1 A Mixed Picture

At this point, it is helpful to consider the usual interpretation for the effect of PI on the comprehension and production of L2 grammatical forms and apply this explanation to the current experiment. PI is informed by research on input processing, which identifies processing strategies that both promote and hinder the processing of targeted forms. By structuring input such that the use of non-optimal processing strategies results in a parsing failure, the learner is made aware (e.g., through feedback) that the optimal strategy is the only one that will result in successful comprehension of the sentence. As VanPatten and Fernández (2004) put it: “Their internal mechanisms, then, are literally forced to adopt a new strategy or abandon the old one. The result is that the accommodation and restructuring mechanisms receive better (in this case, correct) data for internalization” (p. 277). In the context of the current experiment the addition of OVS sentences (coupled with the lack of predictability from verb-noun pairings or context) compels the learners to process articles for case and assign grammatical roles based on this information and—crucially—not on word order. This forced processing is in turn responsible for
creating better intake from the input, and learners are able to establish form-meaning connections between the articles and grammatical roles. Importantly, learners can access these form-meaning connections during both comprehension and production.

Despite the fact that the offline data clearly support this view, performance on the SPR task calls this interpretation into question, as there is no direct evidence that PI leads learners to attend to articles as markers of grammatical roles in an online reading task. To put it succinctly, if the performance increases associated with PI are driven by changes in processing strategies that force learners to process case marking information instead of relying on word order, why is this not evident in the online data? In other words, what accounts for the dissociation between the offline data and the online data?

In the following sections, I consider several possible explanations for the discrepancy between the online and offline effects of PI reported in this experiment. First and foremost, I will highlight a number of methodological concerns that could have contributed to the null effects seen in the SPR task. Secondly, I will consider the nature of online sentence processing, the direction of cognitive resources, and a potential role for additive cues.

3.4.1.1 Methodological Considerations

There are two primary methodological limitations to this study that could have influenced the findings, particularly in the SPR task. The first is the small sample of participants in the PI group. While this is not a concern for the TI group (which had 28 participants), high attrition rates in two of the classes resulted in only 16 eligible participants in the PI group. The results from the offline task were robust enough that it was not difficult to capture the effects of training statistically; however, it could be that the online effects are more difficult to capture. The smaller group size could have contributed to larger variability, and thus to null effects. Although a coarse
analysis of individual differences suggests that this is not the case, one could argue that this study’s findings are, at least in part, due to a small sample size.

Of larger concern is the fact that the participants scored very low on the vocabulary task administered to evaluate the participants’ familiarity with the vocabulary used in the SPR task. Though words were taken from the introductory German texts used in their previous first and second semester German courses, both groups only scored around 63% on the vocabulary measure. This was likely due to a number of factors. First, many of the participants in the study completed their first and second semester German courses in high school and thus may not have used textbooks that taught the same words. Secondly, the number of stimuli used in the SPR task—along with restrictions on repetition, animacy, and plausibility of the items—necessitated that some lower-frequency items be included.

Given that many of the vocabulary items were unfamiliar to the participants, it is likely that either the participants did not have the appropriate lexical representations (and associated gender knowledge), or they needed to devote more resources to lexical processing during the SPR task than expected. Moreover, it is impossible to know whether the difficulty presented by the unfamiliar vocabulary is consistent across conditions. Because these difficulties in lexical processing could have inflated RTs and hidden any potential word order effects, it is difficult to attribute differences in reading times—or the lack thereof—solely to morphosyntactic processing.

19 For example, on region one of the experimental sentences, the PI group showed an average RT difference of 192 ms between the SVO and OVS sentences. The statistical analyses revealed that this difference was not significant. Indeed, only half of the participants in the PI group had longer reading times in the OVS condition for this region, and five participants had longer reading times in the SVO condition. Thus, a look at individual differences is also indeterminate with respect to the reliability of word order effects seen on this region.
3.4.1.2 Processing Resources and Task Demands

Aside from the methodological concerns described above, the discrepancy between the offline and online tasks can be explained partly by the demands of the SPR task and the availability of processing resources to meet those demands. To be sure, the offline sentence interpretation task and the SPR task are very similar tasks. First, the items used in the offline task were taken directly from the SPR task, and many of these had comprehension questions that were the same in both tasks. Secondly, the sentences in both tasks were mixed with filler sentences at a similar ratio. Even so, the offline sentence interpretation task and the SPR task are not directly analogous because of the task demands.

While the sentences presented on a printed page are available to participants all at once, the sentences in the SPR task are presented one segment at a time, and participants cannot revisit any of the words that they have previously read. Thus, unlike the offline interpretation task, the SPR task presents the reader with the extra burden of processing information quickly in real-time. Moreover, the reader is required to hold more of this information in working memory while the sentence is processed. It is therefore likely that during the SPR task, some morphosyntactic information is left unanalyzed due to time and memory constraints, even if learners have acquired the required form-meaning connections. Thus, while the SPR task stresses the system, the offline task represents the “best-case-scenario” where learners are able to take full advantage of newly developed form-function mappings.

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20While a few of the sentences were slightly different between the tasks, the differences were minor and should have had no effect on the comprehensibility of the sentence with respect to grammatical roles. For example the sentence from the SPR task, *Der Kellner küsst die Frau im Restaurant neben dem Kino* appeared simply as *Die Frau küsst der Kellner in dem kleinen Restaurant* in the offline task. The only changes were that the final prepositional phrase (*neben dem Kino*) was deleted, and the contraction *im* was decomposed to read *in* dem.
3.4.1.3 A Potential Role for Additive Cues

To summarize the discussion up to this point, it seems that the use of morphosyntactic cues to assign grammatical roles relies on at least four factors: (1) the availability and strength of form-meaning connections; (2) the availability of appropriate processing mechanisms; (3) task demands that influence the overall cognitive load; and (4) task demands that affect the direction of cognitive resources. Yet there may be a fifth factor to add to the list, namely, the competition—or convergence\(^{21}\)—of multiple cue types. According to the Competition Model (Bates & MacWhinney, 1987), if multiple cues are in conflict, they compete for selection, and sentence comprehension is strained; on the other hand, if they converge and point towards the same function, the cues should support each other and facilitate comprehension. PI, as implemented in this study and others, focuses entirely on the former, teaching learners how to deal with competing cues (i.e., case marking and word order). But there may be a role for additive cues as well; if cues support each other, they could ease the cognitive load on the comprehension system and allow a full syntactic parse to proceed more efficiently.

There has been much research on competition between cues and what information learners use during sentence comprehension (e.g., Jackson, 2007; LoCoco, 1987; Sagarra et al., 2006; VanPatten & Fernández, 2004; VanPatten & Keating, 2007) but there has been comparatively less research on additive cues. One area of growing interest, however, is the relationship between syntax and prosody. Research on prosody in L1 and L2 language acquisition has shown that prosody functions as an essential grammatical cue in the acquisition of structure-building operations, such as phrase recognition (Henderson & Nelms, 1980; Pilon,

\(^{21}\) The following discussion uses the terms converging, additive, and supportive interchangeably to describe any situation in which cues always work together to support the same interpretation.
1981; Wakefield et al., 1974), long-distance dependencies (Langus et al., 2012), and constituent order (Langus et al., 2012; Nespor et al., 2008). Several L2 sentence processing studies have also suggested that even less-proficient late L2 learners can use prosodic information to disambiguate temporary syntactic ambiguities in the L2 (Dekydtspotter et al., 2008; Harley, Howard, & Hart, 1995; Hwang, 2007; Ying, 1996). Thus, prosodic information may not only support the acquisition of syntax, but also play a role in syntactic processing.

As detailed in section 2.3.2, there is evidence that pitch accents work together with case markings to facilitate comprehension. For example, Weber et al. (2006) showed that prosodic cues facilitate the processing of temporarily ambiguous OVS sentences in L1 German. Furthermore, research on L1 acquisition in German suggests that case-marking morphology alone is insufficient to override word order biases in children (Dittmar et al., 2008), but that when prosodic cues are presented alongside morphological cues, they are better able to establish agent-patient relationships (Grünloh et al., 2011). In the context of PI, then, it is possible that prosody could be used as an additive cue in Structured Input activities. Recall that prosodic cues were removed from the PI training under the assumption that the cues were competitive; but, if—as the L1 research suggests—the cues are additive, then their inclusion in Structured Input could be beneficial. First, it could make the case markings more salient and promote the acquisition of form-function mappings, perhaps through bootstrapping. Secondly, if the learners are able to use prosodic cues alongside case markings in natural language processing, perhaps this could lower the cognitive load enough that the processor can use the morphosyntactic information efficiently in real time.

The fundamental question that emerges from this line of inquiry is whether or not the prosodic cues in question are competitive or additive in nature. That is, does the presence of
prosodic cues hinder the acquisition of morphosyntax when the two cue types converge, and what impact does this have on real-time processing? This is one of the primary motivating questions for Experiment 2.
CHAPTER 4: Experiment 2

4.1 Introduction and Research Questions

The aim of Experiment 1 was to establish whether the explicit manipulation of surface cues via Processing Instruction (PI) had an effect on (1) the strength and availability of form-meaning connections during offline language use; and (2) the ability to use morphosyntactic information during real-time L2 processing. The results of Experiment 1 presented a mixed picture, in that Processing Instruction did seem to affect offline language use, but not online processing behavior. The goal of Experiment 2 is explore this pattern of results, and, in doing so, it will address the methodological and theoretical issues outlined in section 3.4.1.

There were two main methodological concerns addressed in Experiment 2. The first was the size of the Processing Instruction group, which, after exclusions and attrition included only 16 participants in Experiment 1. Experiment 2 was conducted in a laboratory setting instead of the classroom, in part to ensure that each group contained a larger and more equal sample size. The second primary methodological concern addressed in Experiment 2 was the learners’ lack of vocabulary knowledge with regard to the items in the self-paced reading task (SPR task). In order to control for this factor, each participant in Experiment 2 was trained on the relevant vocabulary items both before and after grammar instruction. In addition to these changes, Experiment 2 also included a SPR task both before and after training so that any changes in the groups’ processing behavior as a result of the training could be observed more directly.

The main theoretical question posed by the results of Experiment 1 concerned whether the addition of prosodic cues may play a facilitative role in the acquisition and processing of case markers. Because pitch accents are typically placed on the object in simple transitive sentences (Grünloh et al., 2011), these constitute a relatively reliable indicator of constituent order (SVO or
OVS) that can be used even when morphological information is not contrastively available on the first NP (Weber, Grice, et al., 2006). Importantly, unlike word order, which is more variable, these pitch accents typically converge with case markings; in other words, when contrastive morphological information is available, both prosodic and morphological cues point to the same interpretation of the sentence. Thus, if L2 learners can exploit prosodic cues in the input to understand SVO and OVS sentences, they may be able to bootstrap that information onto morphosyntax and acquire it more quickly. Likewise, because prosody and morphosyntax converge, it is also possible that the activation of prosodic structures online could lower the processing load and allow for more efficient morphosyntactic processing. While there is some support for these hypotheses from the L1 literature (Grünloh et al., 2011), they have not yet been investigated with L2 learners using a training mechanism like Processing Instruction, which specifically manipulates the input’s surface cues in order to increase morphosyntactic processing. Thus, it is not well understood how the use of prosodic cues may affect the acquisition of grammatical forms or influence L2 morphosyntactic processing strategies.

In order to address these research questions, Experiment 2 contains a third group in addition to the Traditional Instruction (TI) and Processing Instruction (PI) groups used in Experiment 1. This third group received a modified form of the PI training that included consistent presentation of pitch accents alongside case markers during the referential activity. The addition of this group provides insight into whether prosodic cues facilitate the creation of form-meaning connections between articles and grammatical roles, and whether they are useful during online processing. Experiment 2 thus has four main research questions:

**RQ1:** Does Processing Instruction lead to more accurate comprehension and production of accusative case markers in German than Traditional Instruction?
**RQ2:** Does Processing Instruction lead learners to process morphosyntactic forms more readily than Traditional Instruction?

**RQ3:** Does the inclusion of prosody in the PI training lead to different outcomes in the comprehension and production of accusative case markers than either Traditional Instruction or standard Processing Instruction?

**RQ4:** Does Processing Instruction with prosodic cues lead learners to process morphosyntactic forms more readily than Traditional Instruction or standard Processing Instruction?

The remainder of this chapter is organized as follows: section 4.2 provides an overview of the experimental approach and describes the participants, training mechanisms, and assessment measures used in this experiment. In section 4.3, I describe the data scoring methods and present the results of the experiment. The final section of this chapter provides a synopsis and brief discussion of the results for each group.

**4.2 Overview of Experimental Approach**

The following sections detail the design and methodology used in Experiment 2. As this experiment was similar in design to Experiment 1, this overview will focus primarily on the changes made to previous tasks, as well as new tasks that were not included in Experiment 1. For tasks that were implemented in the previous experiment, the reader will be referred to section 3.2 for a detailed description of the materials.

**4.2.1 Experimental Design and General Method**

Experiment 2 was conducted in three sessions. Session 1 took place during regularly scheduled meetings for nine third and fourth-semester German classrooms, while sessions 2 and 3 were conducted in a laboratory setting. As illustrated in Figure 8, during session 1, the
participants gave their informed consent and then completed the language background questionnaire, pretest, and proficiency task. Participants were given an experiment packet including step-by-step instructions and materials for each task. They were allowed to ask questions about the instructions and completed the tasks at their own pace.

The second session was conducted in a laboratory on campus, where the participants were seated at a computer in a quiet room. They completed the vocabulary learning task, followed by the working memory task and the pretest SPR task. Participants were given instructions for each task, and had the chance to ask questions about the instructions. They then completed the tasks at their own pace.

The third session was held in the same laboratories as the second session, and participants were seated at the same computer workstations. During this session, the participants completed five tasks: (1) the (reduced) vocabulary learning task; (2) the training module; (3) the SPR posttest; (4) the offline posttest; and (5) the vocabulary test. The experimenter guided the participants through the session and gave the participants instructions for each task. As in previous sessions, participants were able to ask questions about the instructions and completed each task at their own pace. After completing the final task, participants were paid (when applicable) and debriefed, ending their participation in the study.
4.2.2 Participants

Participants for this second experiment were drawn from third and fourth semester German learners enrolled in German courses at Penn State University. The participants completed the language background questionnaire, proficiency test, and pretest in order to determine their eligibility for the study. Eligibility was determined using the same guidelines outlined in section 3.2.1; as a result, 40 of the 159 participants were eliminated from the study because they had an L1 other than English (10), proficiency in an L2 other than English (5), or established knowledge of case markings and OVS sentence structure as determined by the pretest (25). Of the 119 participants eligible for the study, 80 chose to continue past the first session and completed all of the tasks; one additional participant was eliminated because of a technical error that resulted in corrupted data. Thus, 79 participants are included in the analyses presented.

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22 Of the 159 participants, 130 (81.8%) were third semester learners and 29 (18.2%) were fourth semester learners. Of the 25 participants eliminated because they had established knowledge of case markings and OVS sentence structure, 16 (64%) were third semester learners and 9 (36%) were fourth semester learners.
in this chapter. The participants were given either extra credit or payment for completing the study.

In contrast to Experiment 1, Experiment 2 was conducted primarily in a laboratory setting. Thus, it was possible to divide the participants evenly between the three experimental groups, Traditional Instruction (TI), Processing Instruction (PI), and Processing Instruction with Prosody (PI+P). As the participants were drawn from classrooms with different instructors, care was taken to ensure that the participants from each instructor were evenly divided among the three groups. In total, the TI group had 26 participants, the PI group had 25 participants and the PI+P group had 28 participants. Information about the participants' language background, working memory, proficiency, and vocabulary scores are given in Table 9 (Section 4.2.3.2).

4.2.3 Screening and Proficiency Measures

4.2.3.1 Materials and Data Scoring

In Experiment 2, there were four screening or proficiency measures: the language background questionnaire, the working memory task, the proficiency test, and a German vocabulary test. Since vocabulary knowledge was identified as a potential reason for null effects observed in the SPR task in Experiment 1, a vocabulary learning task was included to ensure familiarity with the vocabulary. The vocabulary test will be described alongside the learning task in section 4.2.4.

The language background questionnaire collected basic demographic information and information about the participants’ language history (Appendix A). The proficiency test was the Wisconsin Placement Exam for learners of German, (Appendix B), and the working memory task was derived from Waters and Caplan (1996). All of these tasks were implemented exactly as in Experiment 1, and the scoring methods remained unchanged (see section 3.2.3),
4.2.3.2 Results

The means and standard deviations for the screening and proficiency measures are displayed by group in Table 9.

Table 9
Means for screening and proficiency measures, Exp. 2 (standard deviations in parentheses)

<table>
<thead>
<tr>
<th>Variable (Range of Possible Scores)</th>
<th>TI Mean (SD)</th>
<th>PI Mean (SD)</th>
<th>PI+P Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (19.38, 2.53)</td>
<td>19.36 (2.48)</td>
<td>19.75 (2.08)</td>
<td></td>
</tr>
<tr>
<td>Time Spent Abroad in Months (0.08, 0.27)</td>
<td>0.10 (0.29)</td>
<td>1.95 (7.18)</td>
<td></td>
</tr>
<tr>
<td>Years of German Instruction (4.02, 2.01)</td>
<td>4.17 (3.36)</td>
<td>3.63 (1.78)</td>
<td></td>
</tr>
<tr>
<td>Years of instruction in a 3rd Language (1.29, 2.28)</td>
<td>1.91 (2.21)</td>
<td>1.85 (3.19)</td>
<td></td>
</tr>
<tr>
<td>Self-rating: Reading Proficiency (1-10) (5.54, 1.42)</td>
<td>6.02 (1.36)</td>
<td>5.96 (1.55)</td>
<td></td>
</tr>
<tr>
<td>Self-rating: Spelling Proficiency (1-10) (5.77, 1.80)</td>
<td>6.54 (1.51)</td>
<td>5.79 (1.47)</td>
<td></td>
</tr>
<tr>
<td>Self-rating: Writing Proficiency (1-10) (5.12, 1.45)</td>
<td>5.06 (1.28)</td>
<td>5.36 (1.31)</td>
<td></td>
</tr>
<tr>
<td>Self-rating: Speaking Proficiency (1-10) (4.77, 1.45)</td>
<td>5.20 (1.71)</td>
<td>5.64 (1.34)</td>
<td></td>
</tr>
<tr>
<td>Self-rating: Listening Comprehension (1-10) (5.31, 2.00)</td>
<td>5.30 (1.31)</td>
<td>6.11 (1.69)</td>
<td></td>
</tr>
<tr>
<td>Working Memory- Set Size (0, 2-6) (3.35, 0.72)</td>
<td>3.68 (0.83)</td>
<td>3.63 (1.19)</td>
<td></td>
</tr>
<tr>
<td>Working Memory- Words Remembered (0-89) (60.69, 10.40)</td>
<td>65.36 (11.31)</td>
<td>63.82 (13.94)</td>
<td></td>
</tr>
<tr>
<td>Proficiency Task Accuracy (0-30) (13.65, 4.45)</td>
<td>13.24 (5.76)</td>
<td>13.00 (5.62)</td>
<td></td>
</tr>
</tbody>
</table>

A series of one-way ANOVAs were conducted to identify potential inter-group differences in participants’ language background and/or cognitive abilities. These analyses revealed that there were no differences between the groups on any of the factors included as a screening or proficiency measure (time spent abroad: $F(2, 76) = 1.70, p = .189$; self-ratings of spelling: $F(2, 76) = 1.94, p = .150$; self-ratings of speaking: $F(2, 76) = 2.26, p = .111$; self-ratings of listening comprehension: $F(2, 76) = 2.04, p = .137$; working memory words remembered: $(F(2, 76) = 1.00, p = .372)$; all other measures $F < 1$). These results show that the groups were evenly divided with regards to their language background and working memory capacity.
4.2.4 Vocabulary Learning and Assessment

4.2.4.1 Materials and Procedure

In order to address the possibility that the vocabulary in the SPR task was unfamiliar to the participants and ultimately responsible for the null effects observed in Experiment 1, all participants were trained on the vocabulary used for the experimental items in the SPR task prior to completing the SPR task in sessions 2 and 3. The training consisted of 72 words from the SPR task. These were the same items that were tested and analyzed in Experiment 1. These words were divided into three equal blocks consisting of a training phase and a test phase, both of which were completed using the computer program E-Prime (Schneider et al., 2002). In each block, participants were trained and tested on 24 words: in blocks 1 and 2 all of the words were nouns; in block 3, all of the words were verbs (see Appendix C for a complete list of the words used in the training).

During the training phase, participants were presented with the target words in a random order within their respective block using both written and aural modalities. The recordings used for audio presentation of the words were made by a female native German speaker and were recorded at a sampling rate of 44.1 kHz per second. As seen in Figure 9, each word-learning trial began when the participants saw an English translation of the target word with a fixation cross below it. After 1000 ms, the German word (and for nouns, its gender) appeared on the screen in place of the fixation cross, and the word was played through the computer. Participants then repeated the word aloud. After 4000 ms, the trial terminated and participants were presented with the next word. In Session 2, each word was seen three times before participants moved to the test phase; in Session 3 each word was seen twice.
During the test phase, participants first saw the target words in German and provided the English translation orally. The experimenter coded each response as correct or incorrect and moved on to the next word. After all 24 words from the block had been seen, the participants repeated those items that they translated incorrectly during the first pass. If the participant still could not recall the correct translation, the trial was again scored as incorrect, and they were provided the answer before moving to the next word. This process was repeated until the participant had correctly provided the correct translation for all of the words in each block.

The participants’ ultimate knowledge of vocabulary items used in the SPR task was evaluated via an offline translation test like the test used in Experiment 1 (Appendix C). However, in order to reduce the amount of time it took participants to complete the offline test, it was reduced to include only those items that were included in the vocabulary training. Thus, the offline vocabulary test included only the experimental items from the SPR task and consisted of a total of 48 nouns and 24 verbs. During this test, participants simply provided a translation of
each of the 72 words; for the 48 nouns, they also checked a box to indicate the correct gender of the word. This vocabulary test was completed at the end of session 3.

4.2.4.2 Data Scoring

All of the items on the offline vocabulary test were considered for analysis, and participants were assigned two separate scores. The first score was for lexical accuracy, defined as the number of vocabulary words for which a correct translation equivalent was provided. The second score was for gender accuracy, defined as the number of nouns for which the correct gender was supplied. As there were 48 nouns and 24 verbs included in the test, the possible range of scores for the lexical accuracy score was 0-72, while it was 0-48 for the gender accuracy score.

4.2.4.3 Results

The means and standard deviations for the two measures in the offline vocabulary test conducted at the end of session 3 are presented by group in Table 10. As seen in the table, each of the three groups attained a high degree of accuracy for both measures. In order to test comparability between the three groups, a one-way ANOVA was conducted on each of the scores, and no significant differences were found for either lexical accuracy ($F(2, 76) = 1.56, p = .216$) or gender accuracy ($F < 1$).

<table>
<thead>
<tr>
<th>Training Group</th>
<th>TI</th>
<th>PI</th>
<th>PI+P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vocabulary Test- Lexical Accuracy (0-72)</td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
</tr>
<tr>
<td>Vocabulary Test- Gender Accuracy (0-48)</td>
<td>71.65 (0.56)</td>
<td>71.08 (1.87)</td>
<td>71.14 (1.11)</td>
</tr>
<tr>
<td>Vocabulary Test- Gender Accuracy (0-48)</td>
<td>46.04 (2.46)</td>
<td>45.40 (3.04)</td>
<td>45.21 (3.00)</td>
</tr>
</tbody>
</table>
Based on the high degree of accuracy and comparability for all three groups, the vocabulary training implemented in this experiment was effective in familiarizing the participants with the vocabulary used in the SPR task.

4.2.5 Grammar Training

There were three types of training used in Experiment 2: Traditional Instruction (TI), Processing Instruction (PI) and Processing Instruction with Prosody (PI+P). In this section, I first describe the training used for the TI group and then turn to the two Processing Instruction groups.

4.2.5.1 Traditional Instruction

As in Experiment 1, the training for the TI group consisted of three major components: text-book like explicit instruction (EI), two referential activities focusing on sentence analysis and word-level production of the target form, and two affective activities focusing on sentence-level production. None of these three components was changed for Experiment 2 (see section 3.2.4.1 for a full discussion of the TI training).

4.2.5.2 Processing Instruction

4.2.5.2.1 General Design

The training for the PI and PI+P groups was very similar to the PI training found in Experiment 1 and included EI, a referential activity in which participants heard sentences and matched them to pictures, and two affective activities which provided additional practice in processing OVS sentences.

As in Experiment 1, the EI included information about German case markings, inverted word order, and the first noun principle. However, several additional components were added to
the EI in order to elaborate on the discourse functions associated with inverted word order and—in the PI+P group—to draw attention to the presence of prosodic cues. First, participants read a statement that inverted word order is used in conversational situations when a speaker wants to emphasize the object of the sentence. Secondly, participants listened to examples of an SVO and an OVS sentence with the prosodic contours found in their respective trainings. Finally, the PI+P group read two sentences stating that it is natural to place an accent on the first noun of the sentence when it is the direct object.

In the referential activity, both the PI and PI+P groups listened to SVO and OVS sentences, matched them to a picture, and received simple feedback on the accuracy of their response. There were two substantive changes made to this activity from Experiment 1. First, the activity was expanded to include 50 sentence/picture interpretations in order to match the training sequence from VanPatten et al. (2013). Secondly, new audio recordings were created for the task in order to control for the presence and absence of overt prosodic cues. The audio recordings and the process used to create them is described in detail in section 4.2.5.2.2.

As in Experiment 1, the final component of the PI and PI+P trainings consisted of two affective activities, which functioned as an input flood for OVS sentences. The affective activities used in Experiment 2 were unchanged from the prior experiment (see section 3.2.4.2).

4.2.5.2.2 Audio Stimuli for PI and PI+P trainings

As mentioned above, the primary difference between the PI and PI+P trainings were the audio recordings used in the referential activity: the sentences used in the PI training featured neutral prosody, while the sentences in the PI+P training featured contrastive prosody. The recordings for this activity were made by a female German native speaker living in the United States who was unfamiliar with prosodic analysis and naïve to the goals of the present study. The
recordings were made on a computer using the program Audacity at a sampling rate of 44.1 kHz per second. For the neutral prosody condition, the speaker was instructed to speak as naturally as possible, but not to emphasize any of the words in the sentences, such that SVO and OVS sentences were identical with respect to their intonation. For the contrastive prosody condition, the speaker was instructed to speak as naturally as possible and imagine that she was responding to a direct question. Multiple recordings of each sentence were made during the recording session, and those fitting the desired contour were selected for use in the trainings.

In order to evaluate the sentences used in the PI and PI+P trainings and make sure that they included the expected pitch accents, each sentence was evaluated by an independent rater using the GToBI (German Tones and Break Indices) system (Grice & Baumann, 2002). In the GToBI system, pitch accents are marked as either high (H*) or low (L*) in relation to the speaker’s starting pitch. These tones can also be accompanied by leading tones that precede the pitch accent and can be either low or high, resulting in complex tones (i.e., H+L* or L+H*). Additional annotations are used to mark nuclear accents and boundary tones, such as offglides that typically occur at the end of sentences (L-%).

The analyses showed that in the contrastive prosody condition (used for the PI+P training), all of the NP1s in the OVS sentences were characterized by a high pitch accent with a low leading tone (L+H*), which represents a strong rise occurring in the accented syllable. In contrast, none of the SVO sentences included the L+H* pattern on NP1; rather, the SVO sentences contained an unaccented NP1, and a nuclear accent on NP2. It should be noted that due to individual variations in the sentence—and due to offglides that typically accompany sentence-final constituents—the specific patterns seen on NP2 are somewhat variable; however, the independent GToBI rater confirmed that, in spite of this variability, the nuclear accent was on
NP2 in each of the SVO sentences. In the neutral prosody condition (used in the PI training), none of the sentences contained the L+H* pattern on either NP, and there were no systematic variations between the SVO and OVS sentences. An example of the pitch contours used in the PI+P and PI trainings is illustrated in Figure 10 and Figure 11, respectively.

A. SVO items

![Image of SVO items]

B. OVS items

![Image of OVS items]

*Figure 10. Sample waveform and spectrogram for training sentences (contrastive prosody)*
In addition to the GToBI analysis described above, the recordings were analyzed phonetically using the computer program PRAAT (Boersma & Weenink, 2014). The key variables used for phonetic evaluation were peak F0 and pitch excursion for the accented syllable in both NP1 and NP2. Peak F0 was defined as the highest pitch reached during the accented syllable. Pitch excursion was determined following the procedures laid out by M. G. O’Brien et al. (2014). On syllables where there was a distinct rise or fall in the fundamental frequency (F0), the beginning and the end of the rise or fall (i.e., the F0 minimum and maximum values) were marked and used for analysis; on syllables that contained no rise or fall, the accented vowel and
end of the stressed syllable were used for analysis. Pitch excursion was defined as the difference between the minimum and the maximum F0 values on each accented syllable.

Means and standard deviations for peak F0 and pitch excursion on NP1 and NP2 are presented in Table 11. The phonetic analysis of NP1 shows that OVS sentences in the contrastive prosody condition had higher F0 and pitch excursion values, confirming the presence of a sharp rise. The SVO sentences were comparatively lower in pitch ($t(48) = 11.58, p < .001$) and had lower pitch excursion values ($t(48) = 5.56, p < .001$). On the other hand, this contrast was not present in the neutral prosody condition, as SVO and OVS sentences were nearly identical with respect to F0 ($t(48) = 1.45, p = .155$) and pitch excursion values ($t < 1$). Similarly, the analyses on NP2 show that SVO sentences in the contrastive prosody condition had higher peak F0 values ($t(48) = 3.441, p < .001$) as well as larger pitch excursion values ($t(48) = 4.40, p < .001$) when compared with the OVS sentences in the contrastive prosody condition, indicating the presence of the nuclear accent. These differences were not observed in the neutral condition (F0: $t < 1$; pitch excursion: $t < 1$).

As seen above, the phonetic analyses of peak F0 and pitch excursion demonstrate that the SVO and OVS sentences had substantially different prosodic contours in the contrastive condition, while they were very similar in the neutral condition. As a result, the phonetic analyses reinforce the conclusion drawn from the GToBI analysis.
Table 11
*Acoustic Properties of Training Stimuli (standard deviations in parentheses)*

<table>
<thead>
<tr>
<th></th>
<th>NP1</th>
<th>OVS</th>
<th>NP2</th>
<th>OVS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Peak F0</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contrastive Prosody</td>
<td>247.30 (28.74)</td>
<td>329.52 (18.63)</td>
<td>197.28 (29.18)</td>
<td>178.30 (10.33)</td>
</tr>
<tr>
<td>Neutral Prosody</td>
<td>236.85 (17.16)</td>
<td>230.02 (13.30)</td>
<td>197.71 (27.48)</td>
<td>200.11 (17.34)</td>
</tr>
<tr>
<td><strong>Pitch Excursion</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contrastive Prosody</td>
<td>61.05 (29.28)</td>
<td>119.30 (32.34)</td>
<td>-42.08 (32.24)</td>
<td>-16.32 (9.83)</td>
</tr>
<tr>
<td>Neutral Prosody</td>
<td>31.72 (26.41)</td>
<td>31.24 (18.60)</td>
<td>-22.63 (10.46)</td>
<td>-26.80 (20.36)</td>
</tr>
</tbody>
</table>

*Note:* Values for pitch excursion are presented such that positive values represent a rise in pitch; negative values represent a fall in pitch.

4.2.6 Materials and Procedure

4.2.6.1 Offline Pretest/Posttest

4.2.6.1.1 Materials

As in Experiment 1, the offline effects of training were assessed via a pretest/posttest test design consisting of a sentence interpretation task and a picture description task. The picture description task consisted of four picture sets that the participants used to tell a short story. There were no changes made to any of the items in the picture description task from Experiment 1 (see section 3.2.5.1.1 for a full description of this task).

In the sentence interpretation task, participants read sentences in German and answered a simple yes/no question about the sentence. This task was identical in design to the task used in Experiment 1. However, the original version of the task contained several sentences with vocabulary found to be unfamiliar to the participants; these sentences were therefore substituted for items in which the vocabulary was more familiar to the participants (see Appendix F). This was done to minimize the possibility that any gains observed between the pretest and posttest
were a result of the vocabulary learning task, and not the TI, PI, and PI+P treatments. All other elements of the pretest/posttest design were identical to those in Experiment 1.

4.2.6.1.2 Procedure

There were two versions of the offline test that functioned as pretests and posttests. These two versions were counterbalanced so that half of the participants received version A as the pretest, while the other half received version B; at posttest, the participants received the version that they had not yet seen. The pretest was completed along with the screening and proficiency materials during a regularly scheduled class meeting. The posttest was administered in a laboratory setting during the third session. The participants completed both the pretest and the posttest at their own pace and were permitted to ask questions about the instructions.

4.2.6.2 Training Comparisons of PI and PI+P Groups

Several recent studies on the role of EI in PI (Culman et al., 2009; C. Fernández, 2008; Henry et al., 2009; VanPatten et al., 2013) have found it particularly useful to investigate not only the final outcome of training, but also how learners perform within the training itself. More specifically, these studies have looked at accuracy during the training itself and a measure known as trials to criterion, or the number items it takes learners to begin processing the target form correctly.

This comparison was made using data collected during the referential component of PI training, in which participants listened to sentences and chose the picture that best represented their understanding of the sentence (as described in section 4.2.5.2). As both the PI and PI+P trainings utilized the same referential activity, an analysis of participant responses allows a direct comparison of the trainings and may indicate whether one training type leads participants to use the desired processing strategy earlier.
4.2.6.3 Self-Paced Reading Task

4.2.6.3.1 Materials

In order to test whether the training affected the participants’ real time processing strategies, they completed a SPR task both before and after training. The self-paced reading (SPR) task in this experiment was identical to the one used in Experiment 1. It consisted of 24 experimental quadruplets that manipulated word order (SVO or OVS) and the placement of the masculine noun (pre-verbal, post-verbal). In addition to the experimental items, the SPR task included 48 fillers of various types. Each sentence in the SPR task was followed by a comprehension question in order to encourage the participants to read the target sentences for meaning (see section 3.2.5.2.1 for a complete description of the task and for a complete list of the sentences and comprehension questions).

4.2.6.3.2 Procedure

The procedure for the SPR task was implemented as described for Experiment 1 (see section 3.2.5.2.2). In order to obtain a view of their processing behavior prior to training—and to rule out the possibility that participants were sensitive to the word order manipulations on the pretest—the SPR task was conducted both before and after training. Prior to training, participants were randomly assigned one of the four SPR lists; after training, participants received a different list so that they did not see any of the experimental sentences in the same conditions as they did pre-training.
4.3 Data Scoring and Results

4.3.1 Offline Pretest/Posttest

4.3.1.1 Data Scoring

The sentence interpretation and picture description tasks were scored separately in the same manner as Experiment 1. Following the procedure outlined in section 3.3.1.1, the sentence interpretation task consisted of two sub-scores—one for SVO and one for OVS sentences. Similarly, the picture description task consisted of two independent sub-scores for accuracy with nominative and accusative case markers.

4.3.1.2 Results

4.3.1.2.1 Interpretation Task

The means and standard deviations for the interpretation task are presented by group in Table 12 and are visually represented in Figure 12. In order to investigate the differences between means, a 2x2x3 repeated measures ANOVA was run with the within-participant factors Time (pretest vs. posttest) and Word Order (SVO vs. OVS) and a between-participant factor of Training (TI vs. PI vs. PI+P). The analysis showed main effects for Time ($F(1, 76) = 97.00, p < .001$) and Word Order ($F(1, 76) = 439.81, p < .001$), which were qualified by significant interactions for Time X Training ($F(2,76) = 15.34, p < .001$), Word Order X Training ($F(2, 76) = 17.41, p < .001$), and Word Order X Time X Training ($F(2, 76) = 22.25, p < .001$).

In order to investigate the interactions further, a series of one-way ANOVAs were conducted for the SVO and OVS sentences at pretest and posttest. At pretest, there were no differences between the groups in their interpretation of SVO sentences ($F < 1$) or OVS sentences ($F < 1$), indicating that the groups were similar prior to training. At posttest, the
analyses showed that there were no differences between the groups for the interpretation of SVO sentences \((F<1)\), but there was a significant difference between groups for the interpretation of OVS sentences \((F(2, 76) = 34.17, p < .001)\). A Tukey HSD Post-Hoc test of the group means on the posttest OVS items further revealed that this effect was driven by a significant difference between the TI group and the PI \((p < .001)\) and PI+P groups \((p < .001)\). There was no difference between the PI and PI+P groups \((p = .394)\).

Taken together, these results indicate that only the PI and PI+P trainings led to improved interpretation with the OVS items on the sentence interpretation task. Furthermore, both groups maintained high comprehension scores on the SVO items. Thus, the results show that, for the sentence interpretation task, the PI and PI+P trainings were equally effective, and both were more effective than the TI training.

Table 12
*Means for Interpretation Task, Exp. 2 (standard deviations in parentheses)*

<table>
<thead>
<tr>
<th></th>
<th>TI</th>
<th>PI</th>
<th>PI+P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pretest</td>
<td>Posttest</td>
<td>Pretest</td>
</tr>
<tr>
<td>SVO</td>
<td>3.5 (0.71)</td>
<td>3.81 (0.49)</td>
<td>3.68 (0.48)</td>
</tr>
<tr>
<td>OVS</td>
<td>0.73 (0.72)</td>
<td>0.81 (1.44)</td>
<td>0.64 (0.63)</td>
</tr>
</tbody>
</table>
4.3.1.2.2 Production Task

The group means and standard deviations for the production task are shown in Table 13 and Figure 13. To evaluate the results statistically, a 2x2x3 repeated measures ANOVA was conducted with the within-participant factors of Time (pretest vs. posttest) and Case (nominative vs. accusative) and a between-participant factor of Training (PI vs. TI vs. PI+P). There were main effects for Time ($F(1, 76 ) = 60.78, p < .001$) and Case ($F(1, 76 ) = 73.46, p < .001$), and a significant interaction for Time X Case ($F(2, 76 ) = 34.49, p < .001$). There was, however, no main effect for Training ($F < 1$) and no significant interactions that included the between-participant factor Training (Time X Training: $F(2, 76 ) = 2.11, p = .128$; Case X Training: $F < 1$; Case X Time X Training: $F(2, 76 ) = 2.23, p = .114$).

In order to further explore the Time X Case interaction, a series of paired t-tests were conducted for each group exploring the degree to which accuracy improved for nominative and accusative case markings. This analysis revealed that the TI group improved slightly with
nominative case markers ($t(25) = 2.12, p = .045$), while the PI and PI+P groups were equally accurate on SVO items in the pretest and posttest (PI: $t(24) = 1.52, p = .143$; PI+P: $t(27) = 1.22, p = .232$). Each group was significantly more accurate with accusative case markers after training (TI: $t(25) = 2.35, p = .027$; PI: $t(24) = 5.20, p < .001$; PI+P: $t(27) = 5.23, p < .001$).

In sum, these analyses show that there were no differences between the groups at pretest or at posttest, and each group improved with respect to their ability to produce accusative case-markers correctly. The three training methods therefore led to statistically similar results.

Table 13
Means for Picture Description Task, Exp. 2 (standard deviations in parentheses)

<table>
<thead>
<tr>
<th></th>
<th>TI</th>
<th>PI</th>
<th>PI+P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy on Nominative</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pretest</td>
<td>0.95 (.12)</td>
<td>0.95 (0.12)</td>
<td>0.96 (0.19)</td>
</tr>
<tr>
<td>Posttest</td>
<td>1.0 (0.00)</td>
<td>0.99 (0.05)</td>
<td>1.0 (0.00)</td>
</tr>
<tr>
<td>Accuracy on Accusative</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pretest</td>
<td>0.56 (0.40)</td>
<td>0.46 (0.40)</td>
<td>0.43 (0.46)</td>
</tr>
<tr>
<td>Posttest</td>
<td>0.75 (0.38)</td>
<td>0.85 (0.32)</td>
<td>0.85 (0.31)</td>
</tr>
</tbody>
</table>

Figure 13. Percentage of tokens produced accurately in picture description task, Exp. 2
4.3.2 Training Comparisons of PI and PI+P groups

4.3.2.1 Data Scoring

Following Fernández (2008), three measures were used to compare the efficacy of the PI and PI+P trainings: (1) the proportion of participants who reached criterion, (2) trials to criterion, and (3) accuracy after criterion. For the current study, criterion was defined as successfully processing three OVS and one SVO sentence in a row (see Henry et al., 2009 who used similar procedures). The proportion of participants who reached criterion was calculated as a simple ratio of the number of participants who reached criterion and the total number of participants in the group.

Trials to criterion was determined by identifying the first instance where criterion was met, and counting the number of items the participant had seen prior to meeting criterion. For example, if a participant interpreted the first four items correctly, he would receive a score of zero because he did not see any items prior to the onset of correct responses. Following Henry et al. (2009), it was assumed that any participant who did not meet criterion would have done so immediately had the activity extended past 50 items; thus, they were assigned a score of 50.

The third measure, accuracy after criterion, was the percentage of items interpreted accurately after the participant began processing the target form correctly. For example, if a participant reached criterion after 20 trials, then this measure reflects the percentage of accurate responses for items 21 through 50. Participants who did not meet criterion did not receive an accuracy score, and were thus treated as missing data for the purpose of data analysis.

4.3.2.2 Results

All 26 participants in the PI group reached criterion by the end of the referential training, while 27 of the 28 participants (96.42%) in the PI+P group did. Due to the fact that fewer than
five participants failed to reach criterion in both groups, the data do not meet the requirements for a statistical test of proportions.

The mean trials to criterion for the PI group was 2.46 ($SD = 3.85$), while it was 7.89 ($SD = 11.51$) for the PI+P group, meaning that the PI group began processing the target form correctly earlier in the training than the PI+P group. An independent samples t-test confirmed that this difference was statistically significant ($t(52) = 2.29, p = .026$).

After meeting criterion, the PI group answered 74.7% of the items correctly ($SD = 13.7$), and the PI+P group answered 72.1% of the items correctly ($SD = 14.5$). An independent samples t-test showed that this difference was not significant ($t < 1$).

Taken together, these results suggest that the PI and PI+P trainings lead to similar outcomes, but that learners may began processing and interpreting sentences correctly earlier if prosodic cues were not present in the training.

4.3.3 SPR task

4.3.3.1 Data Scoring

Data from the SPR task included both comprehension and reading time data. As in Experiment 1, the comprehension scores reflect the percentage of correct responses, and the analyses included comparisons on comprehension accuracy on all items as well as on only the items that targeted grammatical role assignment. Similar to Experiment 1, the latter comparison used two sub-scores for SVO and OVS items.

As is typical for this type of research, any participant who had an overall comprehension rate less than 60% for the entire task or less than 33% for any of the experimental conditions were excluded from analysis; this was done to ensure that each participant contributed at least two samples from each sentence condition. Five of the 79 participants (6.3%) were excluded
from data analysis for this reason (four from the PI group and one from the PI+P group). For the remaining participants, the analysis of reading time data included only those sentences where participants responded correctly to the comprehension question.\(^{23}\) This resulted in a loss of 27.2\% of the data on the pretest and 24\% of the data on the posttest. After these exclusions, data trimming procedures followed those described under Experiment 1 (section 3.3.2.1): all RTs below 200 ms and above 4,000 ms were discarded, as were RTs outside a range of +/- 3 standard deviations from a participant’s mean RT for the experimental sentences. These trimming procedures resulted in a loss of 3.2\% of the data in the pretest and 3.7\% of the data in the posttest. After applying these trimming procedures, the mean RTs were calculated for each participant in each condition by region for the purposes of comparison.

4.3.3.2 Results

4.3.3.2.1 Comprehension Questions

The means and standard deviations for comprehension accuracy are given in Table 14. The raw scores show that all three groups averaged between 72 and 76 percent accuracy overall on both the pretest and the posttest, and each group improved slightly from pretest to posttest. A 2x2 repeated measures ANOVA with Time (pretest vs. posttest) as a within-participant factor and Training (TI vs. PI vs. PI+P) as a between-participant factor showed that there was no main effect for Training ($F < 1$). There was a main effect for Time ($F(1, 71) = 11.23, p = .001$), but no Time X Training interaction ($F < 1$). Thus, all three groups comprehended the sentences equally well on the pretest and posttest, and they were all more accurate on the posttest.

\(^{23}\) Because a subset of the experimental sentences tested comprehension of the form under investigation, a separate analysis was also conducted including both correct and incorrect items. The pattern of results for this analysis was very similar to that of the main analysis. Therefore, the exclusion of incorrectly understood items had minimal impact on the results presented here.
Table 14
*Means for SPR task Comprehension Data, Exp. 2 (standard deviations in parentheses)*

<table>
<thead>
<tr>
<th>Time</th>
<th>Pretest</th>
<th>Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traditional Instruction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall Accuracy</td>
<td>72.48 (5.32)</td>
<td>73.74 (6.52)</td>
</tr>
<tr>
<td>Items testing role assignment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subject First (SVO)</td>
<td>76.92 (20.59)</td>
<td>78.85 (15.32)</td>
</tr>
<tr>
<td>Object First (OVS)</td>
<td>25.0 (23.21)</td>
<td>28.85 (18.59)</td>
</tr>
<tr>
<td>Processing Instruction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall Accuracy</td>
<td>72.99 (4.73)</td>
<td>76.0 (5.11)</td>
</tr>
<tr>
<td>Items testing role assignment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subject First (SVO)</td>
<td>77.78 (20.64)</td>
<td>80.16 (14.55)</td>
</tr>
<tr>
<td>Object First (OVS)</td>
<td>26.19 (20.12)</td>
<td>43.65 (23.85)</td>
</tr>
<tr>
<td>Processing Instruction with Prosody</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall Accuracy</td>
<td>73.86 (4.76)</td>
<td>75.78 (5.17)</td>
</tr>
<tr>
<td>Items testing role assignment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subject First (SVO)</td>
<td>79.63 (16.23)</td>
<td>75.93 (18.68)</td>
</tr>
<tr>
<td>Object First (OVS)</td>
<td>27.16 (22.72)</td>
<td>37.04 (23.72)</td>
</tr>
</tbody>
</table>

The groups’ ability to assign grammatical roles in the SPR task was assessed by a subset of the comprehension questions, as described in section 3.2.5.2.1. The response data from these questions showed that, for the SVO items, all groups had similarly high accuracy rates on both the pretest and posttest; for the OVS items, none of the groups achieved high accuracy rates, although the PI and PI+P groups showed marginal improvement.

To investigate these results statistically, a 2x2x3 repeated measures ANOVA was conducted with the within-participant factors Time (pretest vs. posttest) and Word Order (SVO vs. OVS), as well as a between-participant factor of Training (TI vs. PI vs. PI+P). There was no main effect for Training ($F(1, 71) = 2.158, p = .123$). However, the analysis revealed a main effect for Word Order ($F(1,71) = 259.39, p < .001$), showing higher comprehension of SVO
sentences than OVS sentences. There was also a main effect for Time ($F(1, 72) = 8.62, p = .004$) because accuracy on the posttest was higher overall. These effects were qualified by a marginally significant Word Order X Time interaction ($F(2,72) = 3.57, p = .063$), showing that the main effect for Time was driven by an increase in comprehension for the OVS sentences (from 26.1 to 36.5) in the absence of significant change for the SVO sentences (78.1 to 78.3).

Arguably, the most relevant information stemming from the comprehension questions is accuracy on OVS sentences, since this measure reflects the tendency to use a strict first-noun strategy. Recall that the use of such a strategy results in extremely high comprehension scores for SVO sentences, and extremely low scores for OVS sentences. In fact, this is exactly the pattern observed in the pretest data for the SPR task and the online tasks—in both of these, SVO scores are above 70% for all groups, and OVS scores are below 30%. Participants that deviate from this pattern, scoring 50% or above on OVS sentences are likely not using a strong first noun strategy, even if they do not reach high degrees of accuracy. While the statistical results presented above shed light on this issue, differences between the groups might be hidden by looking at group averages. Therefore, an additional analysis was conducted to examine the proportion of participants in each group that scored at or above chance (50%) on the OVS sentences (i.e., the proportion of participants that did not appear to use a strict first-noun strategy).

<table>
<thead>
<tr>
<th>Time</th>
<th>Pretest</th>
<th>Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Traditional Instruction</strong></td>
<td>6/25 (24%)</td>
<td>8/25 (32%)</td>
</tr>
<tr>
<td><strong>Processing Instruction</strong></td>
<td>6/25 (24%)</td>
<td>15/25 (60%)</td>
</tr>
<tr>
<td><strong>Processing Instruction with Prosody</strong></td>
<td>6/26 (23%)</td>
<td>13/26 (50%)</td>
</tr>
</tbody>
</table>
As can be seen in Table 15, each of the groups had six participants who scored at or above chance on the pretest. On the posttest, however, at least half of the participants in the PI and PI+P groups scored at or above chance, while the TI group only had eight participants who did so. Thus, despite lower accuracy rates on the OVS sentences, it does appear that Processing Instruction—with or without prosody—encouraged the participants to abandon the subject-first strategy at a higher rate than did traditional instruction.

In sum, the results from the comprehension questions show that the three groups were similar with regard to their overall comprehension rates on the pretest and posttest, and that all three groups comprehended sentences more accurately on the posttest. On the comprehension of the experimental items that tested grammatical role assignment, each group was relatively accurate on the SVO items, but had difficulty with the OVS items both before and after training. However, the proportion of participants who scored at or above chance on the SPR comprehension measures increased substantially from pretest to posttest within the PI and PI+P—but not the TI—groups. This exploration of individual differences suggests that the PI and PI+P trainings did in fact affect the participants’ tendency to adopt a strict subject-first strategy when processing these sentences, while TI did not.

4.3.3.2.2 Reading Times

4.3.3.2.2.1 Pretest

4.3.3.2.2.1.1 Experimental Items

Segments one and three contained the article that disambiguated between SVO and OVS word order and were therefore defined as critical regions; segments two, four and the final segment were considered regions of interest as they may contain so-called spillover effects. For
each segment, 2x2x3 ANOVAs were conducted with Word Order (SVO vs. OVS) and Placement of the masculine noun (henceforth, Placement; first vs. second) as within-participant factors, and Training (TI vs. PI vs. PI+P) as a between-participant factor. In the ANOVAs and accompanying post-hoc Tukey HSD tests, both participants ($F_1; p_1$) and items ($F_2; p_2$) were treated as random factors. The mean reading times and standard deviations for each segment are displayed by group and condition in Table 16, and the results of the ANOVAs are presented in Table 17.
Table 16
Mean reading times by group and condition for SPR task, Pretest Exp. 2 (standard deviations in parentheses)

<table>
<thead>
<tr>
<th>Segment</th>
<th>NP1</th>
<th>V</th>
<th>NP2</th>
<th>Prep</th>
<th>Final</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Traditional Instruction</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SVO, Masculine 1&lt;sup&gt;st&lt;/sup&gt;</td>
<td>909 (295)</td>
<td>807 (358)</td>
<td>909 (357)</td>
<td>540 (153)</td>
<td>935 (383)</td>
</tr>
<tr>
<td>OVS, Masculine 1&lt;sup&gt;st&lt;/sup&gt;</td>
<td>1014 (390)</td>
<td>982 (487)</td>
<td>915 (388)</td>
<td>579 (167)</td>
<td>962 (336)</td>
</tr>
<tr>
<td>SVO, Masculine 2&lt;sup&gt;nd&lt;/sup&gt;</td>
<td>1054 (420)</td>
<td>917 (321)</td>
<td>800 (247)</td>
<td>536 (104)</td>
<td>885 (324)</td>
</tr>
<tr>
<td>OVS, Masculine 2&lt;sup&gt;nd&lt;/sup&gt;</td>
<td>1000 (320)</td>
<td>936 (449)</td>
<td>739 (205)</td>
<td>464 (105)</td>
<td>1002 (427)</td>
</tr>
<tr>
<td>DMC, Grammatical</td>
<td>1129 (466)</td>
<td>837 (294)</td>
<td>921 (378)</td>
<td>557 (125)</td>
<td>800 (277)</td>
</tr>
<tr>
<td>DMC, Ungrammatical</td>
<td>1205 (539)</td>
<td>819 (323)</td>
<td>827 (343)</td>
<td>571 (177)</td>
<td>985 (399)</td>
</tr>
<tr>
<td><strong>Processing Instruction</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SVO, Masculine 1&lt;sup&gt;st&lt;/sup&gt;</td>
<td>1042 (499)</td>
<td>894 (436)</td>
<td>945 (362)</td>
<td>552 (193)</td>
<td>881 (367)</td>
</tr>
<tr>
<td>OVS, Masculine 1&lt;sup&gt;st&lt;/sup&gt;</td>
<td>1120 (598)</td>
<td>908 (493)</td>
<td>1016 (444)</td>
<td>514 (201)</td>
<td>830 (376)</td>
</tr>
<tr>
<td>SVO, Masculine 2&lt;sup&gt;nd&lt;/sup&gt;</td>
<td>1104 (481)</td>
<td>964 (536)</td>
<td>914 (398)</td>
<td>527 (161)</td>
<td>833 (338)</td>
</tr>
<tr>
<td>OVS, Masculine 2&lt;sup&gt;nd&lt;/sup&gt;</td>
<td>1173 (603)</td>
<td>927 (563)</td>
<td>877 (475)</td>
<td>513 (162)</td>
<td>858 (409)</td>
</tr>
<tr>
<td>DMC, Grammatical</td>
<td>1103 (532)</td>
<td>890 (427)</td>
<td>869 (425)</td>
<td>538 (166)</td>
<td>751 (255)</td>
</tr>
<tr>
<td>DMC, Ungrammatical</td>
<td>1182 (546)</td>
<td>825 (275)</td>
<td>828 (376)</td>
<td>524 (141)</td>
<td>793 (345)</td>
</tr>
<tr>
<td><strong>Processing Instruction with Prosody</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SVO, Masculine 1&lt;sup&gt;st&lt;/sup&gt;</td>
<td>1009 (287)</td>
<td>929 (317)</td>
<td>926 (258)</td>
<td>549 (150)</td>
<td>865 (322)</td>
</tr>
<tr>
<td>OVS, Masculine 1&lt;sup&gt;st&lt;/sup&gt;</td>
<td>1048 (314)</td>
<td>965 (325)</td>
<td>974 (318)</td>
<td>518 (117)</td>
<td>979 (387)</td>
</tr>
<tr>
<td>SVO, Masculine 2&lt;sup&gt;nd&lt;/sup&gt;</td>
<td>1191 (391)</td>
<td>927 (377)</td>
<td>983 (345)</td>
<td>512 (103)</td>
<td>923 (267)</td>
</tr>
<tr>
<td>OVS, Masculine 2&lt;sup&gt;nd&lt;/sup&gt;</td>
<td>1086 (415)</td>
<td>952 (468)</td>
<td>873 (295)</td>
<td>551 (131)</td>
<td>930 (394)</td>
</tr>
<tr>
<td>DMC, Grammatical</td>
<td>1287 (394)</td>
<td>798 (268)</td>
<td>1015 (292)</td>
<td>594 (176)</td>
<td>800 (259)</td>
</tr>
<tr>
<td>DMC, Ungrammatical</td>
<td>1279 (412)</td>
<td>879 (312)</td>
<td>872 (288)</td>
<td>551 (130)</td>
<td>873 (283)</td>
</tr>
</tbody>
</table>
Table 17
ANOVA for SPR experimental items, Pretest, Exp. 2

<table>
<thead>
<tr>
<th>Region</th>
<th>Source of Variance</th>
<th>By Participants</th>
<th>By Items</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>df</td>
<td>F1</td>
</tr>
<tr>
<td>Segment 1 (First NP)</td>
<td>Word Order</td>
<td>1, 71</td>
<td>1.16</td>
</tr>
<tr>
<td></td>
<td>Placement</td>
<td>1, 71</td>
<td>7.49**</td>
</tr>
<tr>
<td></td>
<td>Training</td>
<td>2, 71</td>
<td>1.17</td>
</tr>
<tr>
<td></td>
<td>Word Order X Placement</td>
<td>1, 71</td>
<td>2.89†</td>
</tr>
<tr>
<td></td>
<td>Word Order X Training</td>
<td>2, 71</td>
<td>1.07</td>
</tr>
<tr>
<td></td>
<td>Placement X Training</td>
<td>2, 71</td>
<td>0.36</td>
</tr>
<tr>
<td></td>
<td>Word Order X Placement X Training</td>
<td>2, 71</td>
<td>0.27</td>
</tr>
<tr>
<td>Segment 2 (Verb)</td>
<td>Word Order</td>
<td>1, 71</td>
<td>2.8†</td>
</tr>
<tr>
<td></td>
<td>Placement</td>
<td>1, 71</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>Training</td>
<td>2, 71</td>
<td>0.11</td>
</tr>
<tr>
<td></td>
<td>Word Order X Placement</td>
<td>1, 71</td>
<td>1.63</td>
</tr>
<tr>
<td></td>
<td>Word Order X Training</td>
<td>2, 71</td>
<td>0.79</td>
</tr>
<tr>
<td></td>
<td>Placement X Training</td>
<td>2, 71</td>
<td>0.54</td>
</tr>
<tr>
<td></td>
<td>Word Order X Placement X Training</td>
<td>2, 71</td>
<td>0.65</td>
</tr>
<tr>
<td>Segment 3 (Second NP)</td>
<td>Word Order</td>
<td>1, 71</td>
<td>0.31</td>
</tr>
<tr>
<td></td>
<td>Placement</td>
<td>1, 71</td>
<td>4.00*</td>
</tr>
<tr>
<td></td>
<td>Training</td>
<td>2, 71</td>
<td>1.26</td>
</tr>
<tr>
<td></td>
<td>Word Order X Placement</td>
<td>1, 71</td>
<td>5.08*</td>
</tr>
<tr>
<td></td>
<td>Word Order X Training</td>
<td>2, 71</td>
<td>0.30</td>
</tr>
<tr>
<td></td>
<td>Placement X Training</td>
<td>2, 71</td>
<td>1.68</td>
</tr>
<tr>
<td></td>
<td>Word Order X Placement X Training</td>
<td>2, 71</td>
<td>0.30</td>
</tr>
<tr>
<td>Segment 4 (Preposition)</td>
<td>Word Order</td>
<td>1, 71</td>
<td>0.28</td>
</tr>
<tr>
<td></td>
<td>Placement</td>
<td>1, 71</td>
<td>2.88†</td>
</tr>
<tr>
<td></td>
<td>Training</td>
<td>2, 71</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td>Word Order X Placement</td>
<td>1, 71</td>
<td>0.33</td>
</tr>
<tr>
<td></td>
<td>Word Order X Training</td>
<td>2, 71</td>
<td>0.68</td>
</tr>
<tr>
<td></td>
<td>Placement X Training</td>
<td>2, 71</td>
<td>1.71</td>
</tr>
<tr>
<td></td>
<td>Word Order X Placement X Training</td>
<td>2, 71</td>
<td>3.41*</td>
</tr>
<tr>
<td>Final Segment</td>
<td>Word Order</td>
<td>1, 71</td>
<td>2.62</td>
</tr>
<tr>
<td></td>
<td>Placement</td>
<td>1, 71</td>
<td>0.26</td>
</tr>
<tr>
<td></td>
<td>Training</td>
<td>2, 71</td>
<td>0.22</td>
</tr>
<tr>
<td></td>
<td>Word Order X Placement</td>
<td>1, 71</td>
<td>0.06</td>
</tr>
<tr>
<td></td>
<td>Word Order X Training</td>
<td>2, 71</td>
<td>0.55</td>
</tr>
<tr>
<td></td>
<td>Placement X Training</td>
<td>2, 71</td>
<td>0.22</td>
</tr>
<tr>
<td></td>
<td>Word Order X Placement X Training</td>
<td>2, 71</td>
<td>1.20</td>
</tr>
</tbody>
</table>

Note: †p < .1. *p < .05. **p < .01. ***p < .001.
On the first segment (the first NP), the analyses revealed a main effect for Training that was not significant in the participant analysis, but was significant in the item analysis. A Tukey post-hoc test showed that there were no differences between the TI and PI group in the participant analysis, but in the item analysis, the TI group had faster RTs than the PI group ($M = 994$ ms vs. $M = 1152$ ms) ($p_1 = .294; p_2 = .014$). There were no differences between the TI and PI+P groups ($M = 994$ ms vs. $M = 1087$ ms) ($p_1 = .615; p_2 = .230$) or the PI and PI+P groups ($M = 1152$ ms vs. $M = 1087$ ms) ($p_1 = .804; p_2 = .366$). The ANOVAs also revealed a main effect for Placement, stemming from longer reading times on feminine NPs than on masculine NPs ($M = 1120$ ms vs. $M = 1034$ ms). This effect was significant only in the participant analysis. The main effect for Placement appears to have been driven by the PI+P group, who displayed the greatest difference in RTs on feminine and masculine NPs ($M = 1147$ ms vs. $M = 1026$ ms); however, there was no Placement X Training interaction.

On the second segment (the verb), there were no main effects for Word Order, Placement, or Training, nor were there any significant interactions between these factors.

On the third segment (the second NP), there was a main effect for Training that only reached significance in the item analysis. Tukey post-hoc tests revealed that there was no difference between the TI and PI groups in the participant analysis ($M = 840$ ms vs. $M = 965$ ms); but the tests showed that the TI group read sentences more quickly than the PI group in the item analysis ($p_1 = .308; p_2 = .041$). There were no differences between the TI and PI+P groups ($M = 840$ ms vs. $M = 936$ ms) ($p_1 = .453; p_2 = .220$) or the PI and PI+P groups ($M = 965$ ms vs. $M = 936$ ms) ($p_1 = .935; p_2 = .633$).

In addition to the main effect for Training, the participant analyses on the third segment also revealed a main effect for Placement that was qualified by a significant Placement X Word
Order interaction. These effects resulted from faster reading times on the masculine NP in OVS sentences (i.e., reading times were fastest when the article in this region was the nominative masculine, *der* as compared with the masculine accusative *den* and the feminine/neuter NPs). Although this effect is strongest in the TI and especially the PI+P group, neither the main effect for Placement, nor the Placement X Word Order interaction was significant in the item analysis.

On the fourth segment (the preposition), the 2x2x3 ANOVA revealed no main effects for Training, but did reveal a three-way interaction between Word Order, Placement, and Training that was significant only in the participant analysis. In order to explore this interaction and investigate each group individually, separate 2x2 repeated measures ANOVAs were conducted with Word Order and Placement as within-participant factors for each training group. In this analysis, the TI group displayed a main effect for Placement (*F*1(1, 25) = 6.98, *p* = .014, *F*2(1, 18) = 1.99, *p* = .176) that was qualified by a significant Placement X Word Order interaction in the participant analysis (*F*1(1, 25) = 4.90, *p* = .036, *F*2(1, 18) = 1.95, *p* = .179). Together, these effects show that the TI group was faster overall when a masculine NP had been read in the preceding region; the interaction indicated that this effect was driven by particularly fast reading times on the OVS sentences (i.e., after the participants had read a noun with masculine nominative article, *der*). The 2x2 ANOVAs did not reveal any significant effects for the PI or PI+P groups (all *p* > .14).

On the final segment of the sentence, there were no effects of Word Order, Placement, or Training in either the participant or item analyses, and there were no significant interactions between these factors.
4.3.3.2.2.1.2. Filler Group A

The filler items discussed here contained double-masculine constructions, which were either grammatical or ungrammatical, meaning that they contained two noun phrases marked for the nominative case. The critical region was the third segment as it contained the second nominative NP in the ungrammatical sentences. To account for potential spillover effects, the fourth segment and the final sentence region were also included in these analyses. On each of these sentence regions, 2x3 repeated measures ANOVAs were conducted with Grammaticality (grammatical vs ungrammatical) as a within-participant factor, and Training (TI vs. PI vs. PI+P) as a between-participant factor. Both participants ($F_1$) and items ($F_2$) were considered as random factors for the analyses. The mean RTs and standard deviations for each segment are displayed in Table 16, and the ANOVA results are found in Table 18.

Table 18
ANOVA results for SPR task filler items, Pretest, Exp. 2

<table>
<thead>
<tr>
<th>Region</th>
<th>Source of Variance</th>
<th>By Participants</th>
<th>By Items</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>$df$ $F_1$</td>
<td>$df$ $F_2$</td>
</tr>
<tr>
<td>Segment 3</td>
<td>Grammaticality</td>
<td>1, 71 4.19*</td>
<td>1, 20 1.92</td>
</tr>
<tr>
<td>(Second NP)</td>
<td>Training</td>
<td>2, 71 0.72</td>
<td>2, 20 1.03</td>
</tr>
<tr>
<td></td>
<td>Grammaticality X Training</td>
<td>2, 71 1.50</td>
<td>2, 20 0.91</td>
</tr>
<tr>
<td>Segment 4</td>
<td>Grammaticality</td>
<td>1, 71 0.94</td>
<td>1, 20 1.42</td>
</tr>
<tr>
<td>(Preposition)</td>
<td>Training</td>
<td>2, 71 0.50</td>
<td>2, 20 0.25</td>
</tr>
<tr>
<td></td>
<td>Grammaticality X Training</td>
<td>2, 71 0.77</td>
<td>2, 20 0.15</td>
</tr>
<tr>
<td>Final Segment</td>
<td>Grammaticality</td>
<td>1, 71 11.99**</td>
<td>1, 20 0.38</td>
</tr>
<tr>
<td></td>
<td>Training</td>
<td>2, 71 0.94</td>
<td>2, 20 0.51</td>
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<tr>
<td></td>
<td>Grammaticality X Training</td>
<td>2, 71 1.28</td>
<td>2, 20 0.37</td>
</tr>
</tbody>
</table>

Note: †p < .1. *p < .05. **p < .01. ***p < .001.

On the critical region, (the second NP), the 2x3 ANOVA showed no main effect for Training, but did show a main effect for Grammaticality that was significant only in the
participant analysis. This indicated that the participants in each group took longer to read the grammatical sentences than the ungrammatical sentences. Although there was no Grammaticality X Training interaction, the difference in RTs between grammatical and ungrammatical sentences was largest in the PI+P group.

The analyses on the fourth segment (the preposition) revealed no effect for Grammaticality or Training and no interactions between these factors.

On the final segment of the sentence, there was no main effect for Training. There was a main effect for Grammaticality that was significant in the participant analysis, but not the item analysis. This effect arose because ungrammatical sentences were read more slowly than grammatical sentences ($M = 891$ ms vs. $M = 778$ ms). As seen in Table 16, the mean RTs indicate that this effect was present in each of the three groups and was the strongest in the TI group. There was no Grammaticality X Training interaction.

4.3.3.2.2.1.3. Summary

Results from the pretest show that the participants did not process SVO and OVS sentences in a substantially different way. On segments one and two, there were no effects that might indicate incremental processing of case markers for unambiguous sentences (those with the masculine noun first). On segments three and four, the analysis did reveal one relevant effect for the TI and PI+P groups. Specifically, both groups displayed evidence that they were slower to read segments containing or following NPs marked with the accusative masculine article *den*.\(^{24}\) This suggests that, although the participants processed *der* and *den* differently, they were not able to use them to recognize object first word order, as if they had, they would have shown

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\(^{24}\) For the PI+P group, this effect showed up on the segment containing NP, while it was on the following segment for the TI group.
higher RTs on *der* (not *den*) when it was found in this region. On the final segment, there were no effects for word order, and thus, there was no evidence that the difference between SVO and OVS sentences was processed after having read the entire sentence.

On the sentences with a double-masculine construction, the analyses revealed that participants had longer RTs on grammatical sentences at the third sentence segment, but that they had longer RTs on ungrammatical sentences at the final sentence segment. The analyses revealed no statistically significant differences between the groups.

4.3.3.2.2.2. Posttest

4.3.3.2.2.1. Experimental Items

The mean reading times and standard deviations for each segment are displayed by group and condition in Table 19. As in the pretest, the first four sentence segments and the final segment were considered for the analyses either as critical regions (segments 1 and 3) or spillover regions (segments 2, 4, and the final segment). The RTs for each segment were analyzed via a 2x2x3 repeated measures ANOVA with Word Order (SVO vs. OVS) and Placement of the masculine noun (henceforth, Placement; first vs. second) as within-participant factors and Training (PI vs. TI vs. PI+P) as a between-participant factor. For the ANOVAs and accompanying Tukey post-hoc tests, both participants (*F*; *p*1) and items (*F*2; *p*2) were treated as random factors in the analyses. The results of these analyses are found in Table 20.
Table 19
Mean reading times by group and condition for SPR task, Posttest, Exp. 2 (standard deviations in parentheses)

<table>
<thead>
<tr>
<th>Segment</th>
<th>NP1</th>
<th>V</th>
<th>NP2</th>
<th>Prep</th>
<th>Final</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Traditional Instruction</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SVO, Masculine 1st</td>
<td>831 (308)</td>
<td>800 (372)</td>
<td>881 (356)</td>
<td>519 (121)</td>
<td>786 (241)</td>
</tr>
<tr>
<td>OVS, Masculine 1st</td>
<td>779 (285)</td>
<td>784 (378)</td>
<td>828 (259)</td>
<td>500 (101)</td>
<td>862 (444)</td>
</tr>
<tr>
<td>SVO, Masculine 2nd</td>
<td>835 (265)</td>
<td>802 (413)</td>
<td>713 (218)</td>
<td>498 (103)</td>
<td>831 (307)</td>
</tr>
<tr>
<td>OVS, Masculine 2nd</td>
<td>810 (348)</td>
<td>774 (323)</td>
<td>698 (299)</td>
<td>478 (77)</td>
<td>877 (354)</td>
</tr>
<tr>
<td>DMC, Grammatical</td>
<td>995 (429)</td>
<td>722 (250)</td>
<td>742 (270)</td>
<td>508 (106)</td>
<td>729 (304)</td>
</tr>
<tr>
<td>DMC, Ungrammatical</td>
<td>948 (333)</td>
<td>723 (240)</td>
<td>691 (197)</td>
<td>509 (85)</td>
<td>762 (315)</td>
</tr>
<tr>
<td><strong>Processing Instruction</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SVO, Masculine 1st</td>
<td>1126 (682)</td>
<td>825 (402)</td>
<td>1055 (509)</td>
<td>517 (156)</td>
<td>861 (387)</td>
</tr>
<tr>
<td>OVS, Masculine 1st</td>
<td>1253 (658)</td>
<td>872 (399)</td>
<td>1234 (662)</td>
<td>500 (110)</td>
<td>872 (343)</td>
</tr>
<tr>
<td>SVO, Masculine 2nd</td>
<td>1117 (584)</td>
<td>813 (403)</td>
<td>1028 (484)</td>
<td>548 (199)</td>
<td>790 (297)</td>
</tr>
<tr>
<td>OVS, Masculine 2nd</td>
<td>1103 (534)</td>
<td>778 (421)</td>
<td>968 (670)</td>
<td>511 (189)</td>
<td>901 (446)</td>
</tr>
<tr>
<td>DMC, Grammatical</td>
<td>1257 (680)</td>
<td>691 (302)</td>
<td>1053 (686)</td>
<td>547 (204)</td>
<td>741 (385)</td>
</tr>
<tr>
<td>DMC, Ungrammatical</td>
<td>1262 (628)</td>
<td>801 (338)</td>
<td>959 (598)</td>
<td>558 (216)</td>
<td>852 (343)</td>
</tr>
<tr>
<td><strong>Processing Instruction with Prosody</strong></td>
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<td></td>
</tr>
<tr>
<td>SVO, Masculine 1st</td>
<td>959 (289)</td>
<td>840 (277)</td>
<td>958 (403)</td>
<td>528 (129)</td>
<td>790 (304)</td>
</tr>
<tr>
<td>OVS, Masculine 1st</td>
<td>1081 (437)</td>
<td>781 (209)</td>
<td>1016 (597)</td>
<td>532 (127)</td>
<td>892 (362)</td>
</tr>
<tr>
<td>SVO, Masculine 2nd</td>
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<td>819 (289)</td>
<td>998 (465)</td>
<td>503 (127)</td>
<td>860 (332)</td>
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<tr>
<td>OVS, Masculine 2nd</td>
<td>1065 (443)</td>
<td>856 (410)</td>
<td>907 (432)</td>
<td>682 (569)</td>
<td>947 (453)</td>
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<td>DMC, Grammatical</td>
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<td>822 (351)</td>
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<td>794 (304)</td>
</tr>
<tr>
<td>DMC, Ungrammatical</td>
<td>1159 (319)</td>
<td>768 (247)</td>
<td>1021 (569)</td>
<td>538 (173)</td>
<td>795 (248)</td>
</tr>
</tbody>
</table>
Table 20

ANOVA results for SPR experimental items, Posttest, Exp. 2

<table>
<thead>
<tr>
<th>Region</th>
<th>Source of Variance</th>
<th>By Participants</th>
<th>By Items</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>df</td>
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</tr>
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<td>Segment 1</td>
<td>Word Order</td>
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<td>Placement</td>
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<td>Training</td>
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<td>Word Order X Placement</td>
<td>1, 71</td>
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<td>Word Order X Training</td>
<td>2, 71</td>
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<td>Placement X Training</td>
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<td>Word Order X Placement X Training</td>
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<td>Segment 2</td>
<td>Word Order</td>
<td>1, 71</td>
<td>0.17</td>
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<td>(Verb)</td>
<td>Placement</td>
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<td>Word Order X Placement</td>
<td>1, 71</td>
<td>0</td>
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<td>Word Order X Training</td>
<td>2, 71</td>
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<tr>
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<td>Placement X Training</td>
<td>2, 71</td>
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<td></td>
<td>Word Order X Placement X Training</td>
<td>2, 71</td>
<td>0.89</td>
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<tr>
<td>Segment 3</td>
<td>Word Order</td>
<td>1, 71</td>
<td>0.01</td>
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<td>Placement</td>
<td>1, 71</td>
<td>11.12**</td>
</tr>
<tr>
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<td>Training</td>
<td>2, 71</td>
<td>3.55*</td>
</tr>
<tr>
<td></td>
<td>Word Order X Placement</td>
<td>1, 71</td>
<td>3.03†</td>
</tr>
<tr>
<td></td>
<td>Word Order X Training</td>
<td>2, 71</td>
<td>0.6</td>
</tr>
<tr>
<td></td>
<td>Placement X Training</td>
<td>2, 71</td>
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</tr>
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<td>Word Order X Placement X Training</td>
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<td>1.45</td>
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<tr>
<td>Segment 4</td>
<td>Word Order</td>
<td>1, 71</td>
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</tr>
<tr>
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<td>Placement</td>
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<td>Placement X Training</td>
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</tr>
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<td>1.84</td>
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<td>Word Order</td>
<td>1, 71</td>
<td>6.49*</td>
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</tr>
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<td>Training</td>
<td>2, 71</td>
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<td>Word Order X Training</td>
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<td>Placement X Training</td>
<td>2, 71</td>
<td>0.93</td>
</tr>
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<td></td>
<td>Word Order X Placement X Training</td>
<td>2, 71</td>
<td>0.67</td>
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</tbody>
</table>

Note: †p < .1. *p < .05. **p < .01. ***p < .001.
On the first segment (the first NP) there was a main effect for Training. Tukey post-hoc tests showed that the mean RTs for the TI group were faster than the PI group ($M = 814$ ms vs. $M = 1150$ ms) ($p_1 = .01; p_2 < .001$). In the participant analysis, the post-hoc tests showed that the TI group was not faster than the PI+P group ($M = 814$ ms vs. $M = 1024$ ms); but in the item analysis, the test showed that the TI group was faster than the PI+P group ($p_1 = .115; p_2 < .001$). In the participant analysis, the test also showed that the RTs for the PI and PI+P groups were not significantly different ($M = 1150$ ms vs. $M = 1024$ ms); but in the item analysis, the PI group was marginally slower than the PI+P group ($p_1 = .492; p_2 = .069$). There were no effects for Word Order or Placement and no interactions that involved these factors.

On the second segment (the verb) there were no effects of Training, Word Order, or Placement, and no interactions between these factors.

On the third segment (the second NP) there was a main effect for Training. As in segment one, a Tukey post-hoc test showed that the TI group had significantly faster RTs than the PI group in both the participant and the item analyses ($M = 780$ ms vs. $M = 1071$ ms) ($p_1 = .031; p_2 < .001$). The test also showed that the difference between the TI and PI+P groups were not different in the participant analysis, but that the TI group was faster than the PI+P group in the item analysis ($M = 780$ ms vs $M = 969$ ms) ($p_1 = .179; p_2 = .002$). Both the participant and item analyses showed that the PI and PI+P groups had statistically similar RTs ($M = 1071$ ms vs. $M = 969$ ms) ($p_1 = .633; p_2 = .166$).

In addition to the main effect for Training on the third segment, there was also a main effect for Placement, which was qualified by a significant Placement X Word Order interaction that trended towards significance in both the participant and item analyses. This interaction
stemmed from longer reading times on feminine or neuter NPs in this segment (i.e., when the masculine noun was in the first segment).

On the fourth segment (the preposition) there was no main effect for Training, and the groups had similar overall RTs. There was, however, an interaction between Word Order and Training that reached significance in the participant analysis, but not in the item analysis. Follow-up repeated measures ANOVAs by group revealed that this interaction was driven by the PI+P group, who exhibited a main effect for Word Order that trended towards significance only in the participant analysis ($F_1(1, 26) = 3.38, p = .077; F_2(1, 21) = 1.20, p = .286$). This effect for Word Order was a result of longer RTs on OVS than on SVO sentences ($M = 607$ ms vs. $M = 515$ ms). For the TI and PI groups, there were no effects that reached significance (all $p > .18$).

On the final sentence segment, there was no main effect for Training or Placement but there was a main effect for Word Order that was significant in the participant analysis and trended towards significance in the item analysis. This main effect for Word Order was not qualified by an interaction with Placement or Training, but the effect seems to have been driven by the PI+P group, who displayed the largest RT differences between SVO and OVS word order (TI: $M = 808$ vs. $M = 869$; PI: $M = 825$ ms vs. $M = 886$ ms; PI+P: $M = 825$ ms vs. $M = 919$ ms).

4.3.3.2.2.2.2. Filler Group A

As in the pretest, the critical region was segment three—the segment containing the second nominative NP in the ungrammatical sentences—and the fourth and final segments were considered for analyses as spillover regions. Each of these segments were analyzed with 2x3 repeated measures ANOVAs, treating Grammaticality (grammatical vs. ungrammatical) as a within-participant factor and Training (TI vs. PI vs. PI+P) as a between-participant factor. As
with the previous ANOVAs and post-hoc Tukey tests, both participants ($F_1; p_1$) and items ($F_2; p_2$) were analyzed as random factors. The means and standard deviations for each group can be found in Table 19, and the results of the ANOVAs can be found in Table 21.

Table 21

<table>
<thead>
<tr>
<th>Region</th>
<th>Source of Variance</th>
<th>By Participants</th>
<th></th>
<th>By Items</th>
<th></th>
</tr>
</thead>
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<td>$df$</td>
<td>$F_2$</td>
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<td>0.41</td>
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<td>Training</td>
<td>2, 71</td>
<td>3.21*</td>
<td>2, 19</td>
<td>2.38</td>
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<td></td>
<td>Grammaticality X Training</td>
<td>2, 71</td>
<td>2.30</td>
<td>2, 19</td>
<td>1.43</td>
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<td>Segment 4 (Preposition)</td>
<td>Grammaticality</td>
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<td>0.20</td>
<td>1, 19</td>
<td>0.11</td>
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<td>1.13</td>
<td>2, 19</td>
<td>1.03</td>
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<td>0.77</td>
<td>2, 19</td>
<td>0.23</td>
</tr>
</tbody>
</table>

Note: †$p < .1$. *$p < .05$. **$p < .01$. ***$p < .001$.

On the critical region (the second NP), a repeated-measures ANOVA revealed a main effect for Training in the participant analysis, but not in the item analysis. A Tukey post-hoc test of means showed that the TI group had marginally faster RTs than the PI group in the participant analysis, but not in the item analysis ($M = 716$ ms vs. $M = 1006$ ms) ($p_1 = .063; p_2 = .157$). Both the participant and item analyses revealed no differences between the TI and PI+P group ($M = 716$ ms vs. $M = 957$ ms) ($p_1 = .111; p_2 = .196$), or the PI and PI+P groups ($M = 1006$ ms vs. $M = 957$ ms) ($p_1 = .918; p_2 = .991$). There was no main effect for Grammaticality, and there was no significant interaction between Grammaticality and Training. However, it is worth noting that the PI+P group is the only group that took longer to read ungrammatical sentences than grammatical sentences ($M = 1021$ ms vs. $M = 893$).
On the fourth segment (the preposition) and on the final segment the analyses revealed no main effects for Training or Grammaticality and no interactions between them.

4.3.3.2.2.3. Summary

In sum, the results from the posttest provide evidence that training had a limited effect on processing behavior. First, on segments containing NP1 and NP2 in both the experimental and filler items, the PI and PI+P groups had slower RTs than the TI group; while the effect was less consistent for the PI+P group, this could indicate that the PI and PI+P groups were more attentive to all NPs, regardless of gender or word order. Secondly, during the final segment, the PI+P group had marginally longer RTs on OVS sentences compared to SVO sentences, potentially showing that the participants waited until the end of the sentence to disambiguate word order. With regard to the filler items, however, none of the groups exhibited a significant difference in RTs between grammatical and ungrammatical sentences at the critical region, the spillover region, or the sentence-final segment.

4.4 Summary of Major Findings and Discussion

In this section I will summarize and discuss the major findings in order to highlight the effects of each training type. The theoretical and pedagogical implications of these findings will be discussed in depth in Chapter 5.

4.4.1 The Development of Form Meaning Connections

The offline tasks and comprehension scores from the SPR task corroborate the findings from Experiment 1 and therefore suggest that TI had little or no effect on the development of form-meaning connections. Although the TI group did produce the accusative case marker *den* more accurately after training, they did not improve with respect to their comprehension of OVS
sentences. These results are similar to those of other PI studies that find that TI had little effect on comprehension (e.g., Benati, 2001, 2005; Cadierno, 1995; VanPatten & Cadierno, 1993; VanPatten & Fernández, 2004). As explained by VanPatten and Cadierno (1993), the results of the comprehension task suggest that, because TI does not focus on the connection between the accusative case and its meaning, it does not lead to changes within the developing system.

Indeed, the improvement in the production task can be explained by the development of explicit knowledge about the target forms, not the development of stronger form-meaning connections. This is especially true given that the production-focused practice did not require the learners to connect articles to their grammatical roles at all; rather they simply needed to produce den postverbally. To be sure, the training did not provide the learners with any evidence that word order is not a reliable cue to grammatical role assignment in German, and thus their default first-noun strategy persisted throughout the training and testing periods.

On the other hand, both the PI and PI+P groups not only improved their comprehension of OVS sentences, but produced the accusative article den more accurately after training. This contrasts with the TI group, who only improved in the production task. As the comprehension task was similar to the PI training, it is perhaps unsurprising that the participants improved on the sentence interpretation task; yet their performance on the production task provides clear evidence that the results are not simply a practice effect. If it were, one would not expect performance increases in novel tasks, particularly when the task type focuses on different skill sets (i.e., production rather than comprehension). Rather, the increase in production performance suggests that the learners were drawing upon more robust connections in their developing system. It is worth emphasizing that these connections are developed as learners begin to process word order and morphosyntax as separate (non-converging) cues and recalibrate the reliability of each of
these cues independently of one another. In other words, because sentences are presented with mixed word order, PI leads learners to realize that *der* and *den* have a consistent relationship with grammatical roles, 25 whereas word order does not. This creates a learning environment in which the connections between articles and grammatical roles are more likely to develop.

4.4.2 The comprehension of sentences online

Though the PI and PI+P groups had clearly developed the appropriate form-meaning connections and were able to use case markers in the offline tasks, they also had difficulty comprehending OVS sentences on the SPR task posttest. In fact, neither group reached 50% accuracy, and neither group appeared to improve significantly from pretest to posttest. However, a look at individuals does show that both the PI and PI+P groups had a significant increase in the number of participants who were at or above chance on these sentences. The number of participants reaching this mark after training was comparable in both the PI (15/26) and PI+P group (13/26); thus it seems that a similar number of individuals in both groups showed some improvement, though the group averages mask this. Even so, the scores on the OVS items in the SPR task represent a significant drop-off in accuracy when compared to the offline tasks: both groups achieved at least 74% accuracy on the offline interpretation tasks, whereas they both averaged below 44% on the SPR task. 26 This suggests that participants were unable to use the appropriate form-meaning connections effectively in the SPR task.

What can account for the difficulty comprehending these sentences online? Surely there are effects unique to this particular task that can account for some of the drop-off in accuracy.

25Gender also plays a role here. In the context of the present experiment, *der* and *den* have a consistent form-function mapping; however, in the dative case feminine and plural nouns take the articles *der* and *den*, respectively.

26The discrepancy between offline and online scores is also present in the individual results: 23 of 26 participants in the PI group achieved a score of at least 50% on the offline posttest interpretation task, while 24 of 26 participants in the PI+P group did.
For example, the use of English in the comprehension questions could have easily resulted in retention errors because switching languages, decoding the question, and matching it with the representation of the German sentence is a taxing process (Meuter & Allport, 1999). Although language switching likely played a role, it seems more likely that low accuracy rates on the comprehension questions are primarily the result of breakdowns within the comprehension system that arise from the complexity and difficulty of online processing and being forced to read sentences in a phrase-by-phrase format in the SPR task.

4.4.3 Extraction and Integration of Morphosyntactic Information

Given that speakers can draw on the appropriate grammatical representations during sentence processing, breakdowns within the comprehension system are likely to occur at two stages: extraction and integration. That is, even if form-meaning connections are in place, sentence comprehension can fail when speakers do not identify and process relevant cues, or when they are unable to rapidly integrate this information into their representation of the input. The reading times on the SPR task lend evidence that, while TI does not influence either the extraction or integration of information, PI may aid the extraction of information while integration remains difficult.

On the pretest for the SPR task, the TI group showed some signs that they were sensitive to the morphosyntactic (case) information since RTs on accusative-marked determiner *den* were higher than RTs on the nominative-marked *der*. These results are similar to those of Jackson, Dussias, and Hristova (2012), who reported higher RTs on *den* than on *der* in an eye-tracking study. As they explain, this pattern of results suggests that the participants detected and processed case information, and it is likely that the learners have taken the initial steps to connect case-marking information to argument structure. In the present study, the participants in the TI
group were also slower to read the final segment of ungrammatical sentences featuring two nominative masculine articles, further supporting the notion that these learners were sensitive to the role of case information in identifying argument structure. Even though they did not use case information in a native-like way, these results indicate that the TI group was able to process case information, and therefore may have been developmentally ready to acquire the specific cue networks for nominative and accusative case markings, which would allow them to disambiguate word order online. Yet, the analysis of the posttest SPR task did not produce evidence of differential processing for SVO and OVS sentences. It did, however, reveal two other changes in processing behavior in the TI group.

Contrary to the pretest, the TI group did not take longer to read NPs marked with *den* on the posttest. It is impossible to rule out retest effects as the cause for the disappearance of these effects. However, it may be that RTs were elevated for *den* in the pretest because it is the less frequent determiner, and it would therefore be more difficult to process (Jackson et al., 2012). If so, the TI training may have provided sufficient recent practice that reduced the processing cost for *den*, eliminating the difference in RTs between *der* and *den*. Traditional Instruction may therefore benefit real-time processing by aiding the recognition of and access to morphosyntactic features. With regard to the lack of sensitivity to ungrammatical double nominatives exhibited by the TI group in the posttest, it is more difficult to rule out retest effects, but the assessment materials could have also influenced the results. In particular, the experimental materials provided an abundance of positive evidence that a nominative article could appear in the second noun phrase. Consequently, the experimental materials could have increased the expectation for *der* post-verbally, thus reducing the likelihood that the second nominative would be treated as ungrammatical.
Although TI may have aided learners in the access to morphosyntactic features, it does not seem to affect the cue network that could be used during online and offline processing. In other words, it does not seem that TI had a substantial impact on the creation of form-meaning connections. This is not surprising given that the TI group did not improve on the offline or online comprehension measures and thus showed no evidence of developing the requisite form-meaning connections during training. As discussed previously, these underlying representations are the linchpin for the comprehension system—without them, the identification of cues is less likely, and the interpretation of the cues is impossible.

In contrast, there is some evidence that PI had a larger impact on online processing behavior than did TI. On the pretest, the PI group showed no signs that they processed SVO or OVS sentences differently, and they were not sensitive to ungrammaticalities in the filler items. The PI+P group, on the other hand, was similar to the TI group in that they seemed to process *der* and *den* differently, and they were sensitive to the double-nominative constructions. Thus, they may have also been developmentally ready to begin using morphosyntax to disambiguate word order. Regardless of this developmental difference, both the PI and PI+P groups were slower to read NP1 and NP2 than the TI group on the posttest. What’s more, these group effects were not present on the verb, prepositional phrase or final region. This could suggest that—overall—Processing Instruction compelled the participants to direct their attention to morphosyntactic information provided by the definite article, resulting in longer RTs overall on NP1 and NP2 in the posttest relative to the TI group.

One could argue these RT differences are the result of differences in RTs more generally across the groups, or that such differences stem from the participants’ overall familiarity with the SPR task by the posttest. However, three pieces of evidence suggest that the difference between
the groups is due to attention to the NPs, and not overall reading speed. First, there were only
minor group differences in RTs on the pretest; in fact, the only differences appeared in the items
analyses between the TI and PI groups, and even then, only in the experimental items (and not
the fillers). In contrast, the group differences on the posttest were more robust and appeared
between the TI group and both Processing Instruction groups. For the PI group (but not the PI+P
group) this effect also appeared even in the items with double-masculine constructions.
Secondly, these group differences are concentrated on the NPs and do not appear on any other
regions. Increased reading times were therefore limited to exactly the areas targeted by the PI
training, and participants were not simply slower to read these sentences overall. Finally, a post-
hoc analysis of reading speed on all non-experimental filler items (Filler Groups B and C) revealed no group differences. For this analysis, a 2x4x3 ANOVA was conducted with the
within-participant variables Time (pretest or posttest) and Segment (segment 1, 2, 3, or 4) and
the between-participant variable of Training. The ANOVA revealed no significant effects for
Training ($F(2, 71) < 1$), and no interactions for Region X Training ($F(6, 213) = 1.75, p = .111$),
Time X Training ($F(2, 71) < 1$), or Region X Time X Training ($F(6, 213) < 1$).

Given the discussion above, it seems that both the PI and PI+P trainings impacted the
way that the participants extracted data from the input. That is, after training requiring the PI and
PI+P participants to process articles for meaning, they directed more attention to the critical noun
phrases. This is precisely what one would expect if the participants identified the articles as
relevant cues and attempted to process these cues as they did during the training.

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27 These are not to be confused with Filler Group A, which contained double-masculine constructions and were not included in this analysis.
Despite the fact that the participants in the PI and PI+P groups appeared to direct more attention to morphosyntactic information, they were unable to use this information rapidly enough to guide structure building. While the responses on the comprehension questions from the SPR task suggest that a large subset of participants in the PI and PI+P groups may have relied less on the first noun strategy than they did on the pretest, a first noun strategy was still actively employed by both PI groups. More importantly, neither group appeared to process SVO or OVS sentences differently on the critical regions, as one would expect if they had integrated case-marking information online and used this information to recover from the initial misparse in a target-like way. Thus, it seems that Processing Instruction did not have a significant impact on the ability of intermediate L2 German learners to integrate case-marking information immediately and interpret this information to determine grammatical roles in real-time. However, the RT data did show that the PI+P group was in fact slower to read OVS sentences in the fourth segment and the final segment. Though the data in the final segment could be influenced by so-called wrap up effects, this suggests that the PI+P group was able to use the morphosyntactic cues for word order disambiguation, though they waited until they had read both noun phrases.

4.4.4 The role of Prosody in PI

Given that differences between the PI and PI+P group emerged during training and in the SPR task, it is necessary to ask if the addition of prosody promoted or hindered the acquisition of case markings. With respect to the final outcome of training and the development of form meaning connections, the answer seems to be ‘no’. Both groups improved with the target form to a similar degree on both of the offline tasks, and thus it seems that PI+P and PI are on roughly equal footing. During the training itself, it again seems that PI and PI+P are more or less equal:
though the training data does show that the PI group was slightly quicker to process sentences correctly—the PI group averaged 2.46 trials to criterion, while the PI+P group averaged 7.89 items—both groups were quite accurate after criterion, scoring 74.7% and 72.1% respectively. The apparent delay in optimal processing behavior is likely because the learners in the PI+P group had to grapple with prosody as an additional cue and there was an extra adjustment period while they processed the two cues and—possibly—linked them together. Even so, the delay was not large enough to be of major pedagogical concern, and more importantly, it did not affect the eventual outcome of the training, as there was no difference between the PI and PI+P groups in terms of their overall accuracy and accuracy after meeting criterion.

With respect to online processing behavior, both the PI and PI+P trainings seem to have impacted the amount of processing resources directed towards articles. By the same token, the lack of differential processing for SVO and OVS sentences at the critical regions suggests that neither training type successfully pushed learners to integrate case markings immediately and use them to disambiguate word order. However, the RT data also provided evidence that the PI+P group read OVS sentences more slowly than SVO sentences in the fourth segment and final segment of the sentences. Although this was after both noun phrases had been read—and therefore does not mirror the processing pattern of L1 German speakers—this result shows that the addition of prosodic cues may have had a facilitative effect on integration processes as hypothesized at the outset of the chapter. Thus, prosody appears to provide some advantages during the integration process, presumably because the morphosyntactic and prosodic cues converge, thus making it easier to override word order biases.

Unfortunately, it is difficult to attribute this advantage solely to the prosodic cues presented in the training because the PI and PI+P groups may have been at different
developmental stages. As evidenced by differential reading times on NPs marked with *der* and *den* on the pretest, the PI+P group seemed to treat nominative and accusative articles differently, whereas the PI group did not. To be sure, the results cannot be a result of readiness alone—recall that the TI group also appeared to be “ready” at pretest—but it is impossible to tease these developmental factors apart from the inclusion of prosodic cues. That is, it may be that if learners are “ready” and receive PI—regardless of whether it contains prosodic cues or not—then they are more likely to integrate cue information successfully in real time.

It is important to stress that prosody had no negative impact on the effectiveness of PI, and seems to have even provided some advantages over the standard PI training. The exclusion of prosodic cues has been a criticism of PI, particularly as applied to the target form in this dissertation. This is largely because the removal of pitch accents on OVS sentences strips them of their pragmatic and discourse functions and makes them infelicitous and unnatural. Traditionally, studies on PI and German accusative case markers have opted to present sentences with neutral prosody so that prosodic cues do not detract from the acquisition of the target form (see Culman et al., 2009). But the results of this study show that, at a minimum, the addition of prosodic cues does not hinder the acquisition of morphosyntax. Therefore, the naturalness of language need not be compromised for fear that the PI training will be undercut by contrastive prosody.

### 4.4.5 Conclusion

In sum, it does not seem that Traditional Instruction significantly impacted the participants’ ability to use case-marking information to assign grammatical roles. Indeed, it seems that TI was ineffective in creating the grammatical representations necessary to use morphosyntactic cues offline or online; it may have even reinforced the tendency to use less-
reliable cues such as word order, potentially delaying the acquisition of the target form. While
the increased ability to recognize and process surface morphosyntactic features can be seen as a
positive result for TI, it is also true that this does not lead to increased comprehension;
consequently it is questionable that this provides any significant advantage to learners. Thus,
while TI does impact learner behavior to a degree, its effects appear to be extremely limited.

Processing Instruction, regardless of whether prosodic cues were present during training,
was effective in developing the form-meaning connections needed to use case markings in
offline sentence comprehension as well as production. As a result, PI also affected the amount of
processing resources devoted to processing articles. Moreover, PI seems to have compelled a
subset of learners (around 55% of the PI and PI+P groups combined) to avoid the first noun
strategy while interpreting the sentences in the SPR task. Despite this, PI had a lesser impact on
the ability to integrate case markings online and use them to override word order biases—
consequently the participants were less accurate overall, and they showed no evidence of
processing SVO and OVS sentences differently in their reading times on critical regions.

On the whole, there were few differences between the PI and PI+P groups, suggesting
that the inclusion of prosody did not have a substantial impact on the effectiveness of training.
This is not to say that the prosodic training was completely inconsequential: there is some
evidence that the PI+P group was slower to begin processing sentences correctly during training,
but that they were more successful while integrating information online, even though they did
not appear to integrate this information incrementally. The theoretical and pedagogical
implications of these results will be discussed at length in the following chapter.
Chapter 5: Conclusions

5.1 Introduction

At the outset of this dissertation, three major goals were identified in order to investigate how the quality of input (i.e., the presence or absence of cues in the input) affects how L2 learners make form-meaning connections, and to what extent psycholinguistic processes can be influenced by instruction. As stated in section 2.5.1, these goals were:

1. To further explore the interaction between lexical-semantic and morphosyntactic cues and the effects of cue competition on the acquisition of grammar
2. To investigate the interaction between prosodic and morphosyntactic cues and explore the possibility that these cues can be used additively during acquisition
3. To explore the effects of instruction on processing behaviors using online assessment measures

In the sections that follow, I will discuss the major findings from Experiments 1 and 2 in relation to these goals. I begin with a short summary of the primary results that serve as a reference point for the conclusions discussed in the remainder of the chapter. In section 5.3, I discuss the interaction between lexical-semantic and morphosyntactic cues; in section 5.4, I discuss the interaction between prosodic and morphosyntactic cues and additivity; in section 5.5, I discuss the online and offline effects of Processing Instruction. In section 5.6 I discuss questions that the present research cannot address directly, and which should be investigated by further research. Finally, I conclude by offering a summary of the dissertation’s main goals and contributions to the literature.
5.2 Summary of Results

The primary results from each of the assessment measures are presented below:

**Offline Sentence Interpretation:**

1. In both Experiments 1 and 2 the PI groups had higher comprehension rates on OVS sentences on the posttest, showing improvement after training. The TI groups did not.
2. In both Experiments 1 and 2 the PI groups scored higher than the TI groups on the interpretation of OVS sentences on the posttest.
3. In Experiment 2 the PI+P group scored higher on the comprehension of OVS sentences after training.
4. In Experiment 2 the PI+P group outscored the TI group on OVS sentences at the posttest and had equally high scores when compared to the PI group.

**Offline Sentence Production:**

1. In both Experiments 1 and 2, both the PI and TI groups had higher accuracy rates on the posttest than on the pretest with regard to the production of *den*.
2. In both Experiments 1 and 2 the PI groups and the TI groups scored equally high on the production of the accusative case marker *den* on the posttest.
3. In Experiment 2 the PI+P group had higher accuracy rates on the posttest than on the pretest with regard to the production of *den*.
4. In Experiment 2 the PI+P group was equally accurate in their production of *den* when compared to the TI and PI groups.
Results from Training Data for PI and PI+P Groups (Experiment 2 Only):

1. The PI group began processing OVS and SVO sentences correctly five items earlier during the training than the PI+P group.

2. There were no differences between the PI and PI+P groups in terms of overall accuracy or accuracy after meeting criterion during the training.

Self-Paced Reading Comprehension

1. In Experiments 1 and 2, none of the three groups achieved higher than 50% accuracy on the OVS items in the SPR tasks.

2. In Experiment 2, the proportion of participants in the PI and PI+P groups who scored 50% or above on the OVS items more than doubled from pretest to posttest. In the TI group, the proportion rose, but just slightly.

Self-Paced Reading Task Reading Times

1. In Experiment 1, neither the PI, nor the TI group showed evidence of longer reading times for OVS sentences or ungrammatical double-nominatives.

2. On the SPR pretest in Experiment 2, no group showed evidence of longer reading times for OVS sentences or ungrammatical double nominatives. The PI+P and TI groups displayed longer reading times for noun phrases containing der relative to those containing den.

3. On the SPR posttest in Experiment 2, the TI and PI groups did not show evidence of longer reading times for OVS sentences or ungrammatical double nominatives.
4. On the SPR posttest in Experiment 2, the PI+P group did display longer reading times on OVS sentences in the fourth sentence segment (the preposition) and appeared to drive a main effect for Word Order on the sentence’s final segment; however, they did not have longer reading times on ungrammatical double nominatives.

5. On the SPR posttest in Experiment 2, the PI and PI+P groups displayed longer reading times on noun phrases than the TI group. However, there were no significant differences in reading times on other segments in the experimental sentences or filler items.

5.3 The Competition between Morphosyntactic and Lexical-semantic Cues

With regard to the competition between morphosyntactic and lexical-semantic cues, the findings of both Experiments 1 and 2 support previous research on input processing that has found that the absence of lexical-semantic cues promotes the processing and acquisition of L2 morphosyntax (e.g., Benati, 2005; VanPatten & Cadierno, 1993; VanPatten & Oikkenon, 1996). Support for this conclusion comes from a comparison of the performance of the PI and TI groups on the offline tasks in both experiments. In the sentence interpretation task, participants in the PI training group—in which lexical-semantic information and reliable word order cues were removed from the input—were significantly more accurate than participants in the TI training group—which did not manipulate the quality of the input. On the production task, the PI and TI trainings were found to be equally effective in both experiments, even though the PI group did not complete any production activities. As discussed in section 4.4.1, the transfer of knowledge to untrained tasks suggests that training led to the creation or strengthening of form-meaning connections. Thus, the findings support the conclusion that PI enabled learners to develop robust
form-meaning connections, whereas TI did not. Thus, present study provides positive evidence for processing theories such as the Input Processing model (VanPatten, 2004a), which claim that lexical-semantic cues and reliable word order cues impede acquisition by blocking the development of form-meaning connections (see also N. C. Ellis et al., 2012). The present study serves as a validation of the Lexical Preference and First Noun Principles, which posit that learners tend to rely on lexical-semantic and word order cues instead of using morphosyntactic cues to derive meaning during early stages of acquisition.

The findings from the offline sentence comprehension and production tasks also find support for several tenets of the Competition Model (Bates & MacWhinney, 1987), which proposes that cue reliability and cue availability affect which grammatical structures are acquired first during language learning. In particular, because the PI training increased the contrastive availability and highlighted the reliability of case markings, the training’s overall effectiveness validates the hypothesis that these constructs are important factors in acquisition. The Competition Model also provides for “perceivability” of the stimulus and memory limitations through a construct known as “cue cost,” which describes limits on the ability to process cues (see Bates & MacWhinney, 1989). Thus, when cues are readily available, highly reliable in the input, and have low cue-cost (i.e., are easy to perceive and require fewer memory resources), forms should be easy to acquire. In the current study, Processing Instruction accounted for both of these factors: in contrast to the traditional instruction methods, the SI activities ensured a simplified task in which memory limitations were mitigated (e.g., sentences were kept consistently short), and care was taken to ensure that the case markers were easy to perceive. Thus, the effectiveness of the PI trainings used in this study also supports the Competition Model’s constructs of cue cost.
These findings highlight an area where Input Processing and Processing Instruction research can provide support for the Competition Model. In particular, while the Competition Model “relates all sentence processing to cue detection and interpretation” (MacWhinney, 2001, p. 69), it does not specify how learners first detect and interpret cues in initial stages of acquisition. In other words, it does not address (nor does it seek to address) how forms are first made available to the systems that track statistical properties of the input such as cue validity (VanPatten, 1996). Given that the PI groups outperformed the TI groups on the offline sentence comprehension measures it seems that the interaction between learners and cues is absolutely essential. Only after learners interact with input that requires the detection and processing of specific cues do constructs such as cue validity or cue reliability become active factors in the acquisitional process.

Finally, reading times in the posttest SPR task show that the PI and PI+P groups in Experiment 2 spent more time processing noun phrases than the TI group. Consequently, it seems that learners are more likely to attend to morphosyntactic forms when they have frequent or recent interactions with input that requires these cues to be processed for meaning. This could suggest that learners begin to switch out of shallow processing strategies by interacting with natural language that mirrors the qualities of structured input. As will be discussed in section 5.5.2, however, even frequent processing of these forms does not necessarily allow learners to adopt native-like processing strategies quickly. Rather, there appear to be internal limits on the adaptability of the processing system (e.g., working memory capacity). It is more likely that the switch out of shallow processing strategies is a very gradual process that begins with attention towards the targeted forms. The change in processing strategies observed among the participants in this study may therefore reflect the initial step out of shallow processing, where
morphosyntactic processing is still extremely difficult, but learners are able to recognize and process cues to some degree. Only after repeated practice with specific morphosyntactic forms—and when processing other elements of the sentence becomes easier—would learners be ready to automatize processing routines, allowing for efficient incremental processing. Future research may be able to determine how processing strategies develop further and at what point in the acquisition process incremental processing strategies prevail.28

5.4 The Use of Prosody and Additivity

One of the primary questions raised in section 2.3.2 concerned whether prosodic cues would be treated as competitive when processed in the input, thereby hindering acquisition of case markers. As it relates to the specific cues used in this experiment, this question can be answered with some certainty given two key findings: (1) both the PI and PI+P groups scored higher on the offline tasks after training with regard to their comprehension of OVS sentences and production of the accusative marker den; and (2) there were no differences between the PI and PI+P groups at posttest on any of the offline measures. Given that the presence of prosodic cues did not result in lower scores on the offline comprehension or production measures, it seems that they did not present a barrier to acquisition as lexical-semantic cues did.

Interestingly, it appeared that the addition of prosodic cues presented learners with an initial challenge because the PI+P groups began processing SVO and OVS sentences correctly later in the training than the PI group. While it may be that the cues competed for processing resources in the training, this challenge was apparently overcome quickly and did not affect

28 The automatization of processing routines is described here without reference towards a particular theoretical framework, but the reader will note that the claim made here is similar to claims made by the Declarative/Procedural Model (Ullman, 2005), which posits differences in the way high and low proficiency learners deploy different memory systems. In particular, this account fits well with claims made by Paradis (2009), who emphasizes the importance of procedural memory for automatized processing routines.
accuracy on the remainder of the SI activity. Furthermore, the PI+P group’s performance on the offline posttests suggests that the participants did not use prosody alone to figure out who did what to whom—if they had, they would not have shown any improvement on the offline measures, which were written and, thus, contained no overt prosodic cues. Together, these two results support the interpretation that the prosodic and morphosyntactic cues in this study were not ultimately competitive.

Although the discussion above points to the lack of competition between morphosyntactic and prosodic cues, the issue of whether the participants were able to use prosody additively is more complicated. The results from the offline tasks and training measures are unfortunately uninformative in this matter. Since the PI+P group performed similarly to the PI group on the offline tasks, it is possible that participants ignored the prosodic cues in the treatment altogether. Similarly, it is possible that the delay in application of the correct processing strategy simply reflects the time it took the participants to settle on a morphosyntax-only approach.

This interpretation is problematic for two reasons. First, given that prosodic cues in the input were highly salient, it is unclear why the participants would have chosen to ignore this cue in favor of less-salient morphosyntactic cues. This is especially true given that the prosodic and morphological cues indicated the exact same structures with equal reliability. More importantly, the PI+P group displayed evidence for elevated RTs on OVS sentences in the SPR posttest while the PI group did not. Recall that research on the Competition Model and coalitions as prototypes suggests that processing is strained when cues are in conflict, but that processing is facilitated when multiple cues are used together in a coalition (Dittmar et al., 2008; Grünloh et al., 2011; Ibotson & Tomasello, 2009). The reading time data therefore suggests that the prosodic cues
were activated covertly during the SPR task (this is discussed in greater detail later in this section) and—crucially—that they were used additively to interpret the input more efficiently. It is therefore likely that the delay in application of the correct processing strategies during the training reflected the time that it took participants to cope with attending to multiple cues and build a coalition between them.

One may question why, if prosodic cues were used additively, they did not provide more robust advantages in the form of higher scores on the offline tasks or more native-like processing patterns in the SPR task (i.e., elevated reading times on OVS sentences on the critical NPs). With regard to the offline tasks, it could be that both the PI and PI+P groups in this study were influenced by the presence of explicit instruction in both trainings. If learners rely heavily on explicit instruction during training, this would minimize the impact that prosody has. For instance, one potential advantage for prosody is that it could make the articles and noun phrases more salient during training; but if the EI draws learners’ attention to the articles and noun phrases too, even in the PI group that received no contrastive prosodic cues during training, then the benefit of having prosodic cues would be attenuated.

For the SPR task, on the other hand, the lack of native-like processing patterns in the PI+P group is likely a reflection of the difficulty of the task presented to the learners. While the additive use of prosodic cues seems to have reduced the overall cognitive load and allowed more efficient processing, the immediate integration of case information also requires a large number of cognitive resources, coupled with both automatized processing routines and an ability to recover quickly from misparses once they are recognized. The development of these automatized routines and recovery processes almost certainly require the development of a tightly interconnected language system that evolves along with proficiency over a long span and after
many hours of natural language processing. As a result, while the use of cue-coalitions may free up some cognitive resources by making processing more efficient, native-like processing routines are unlikely to develop unless the language system is ready to support them.

One important finding in the current study is that, although the PI+P group received aural input that contained a coalition of morphosyntactic and prosodic cues, they were still able to comprehend sentences accurately in the offline task, where prosodic cues were not present. This indicates that participants were able to transfer the training to the written modality and actively use case markers to assign grammatical roles even without explicit prosodic cues. Importantly, the fact that prosody seems to have had a facilitative effect on processing in the SPR task also implies that the PI+P group was able to use the morphosyntactic cues to activate and apply the appropriate prosodic structures covertly (see Féry, 2005; Fodor, 2002). This covert activation would have allowed learners to use the coalition between prosodic and morphosyntactic structures additively during silent reading.

This finding provides evidence for proposals in the sentence processing literature that stress the role of activating prosodic structures during L2 sentence processing. Dekydtspotter et al. (2006), for example, argue that the use of non-target prosodic structures could be one reason that L2 learners have difficulty processing syntactic structures as described by the Shallow Structures Hypothesis (Clahsen & Felser, 2006a, 2006b). Given that the PI+P group was the only one to display any significant signs of differential processing for SVO and OVS sentences, the results from Experiment 2 suggest that the ability to connect syntactic structures to the appropriate prosodic representations does indeed play an important role in the integration of (morpho)syntactic information online. Thus, even though the learners in this study did not process sentences in a native-like manner, these findings support the proposal made by
Dekyndspotter et al. Notably, these findings also demonstrate that the ability to impose the correct prosodic pattern is not only important for structural ambiguity and attachment preferences, but also for morphosyntactic features, like case markers, that are involved in structure building processes during real-time L2 processing.

5.5 Implications for Processing Instruction

5.5.1 The Offline Effects of Processing Instruction

With regard to the overall effectiveness of PI, the experiments in this dissertation show that Processing Instruction is an effective tool for developing form-meaning connections that can be used for both comprehension and production of German accusative case markers. This conclusion is made on the basis of two main results. First, each of the groups receiving PI showed significant improvement on the offline comprehension and production measures. Secondly, the groups receiving PI outperformed groups that received TI on the posttest comprehension measures and equaled their performance on posttest production measures. As discussed in section 4.4.1, these results mirror those of other studies that have found benefits for PI over TI (e.g., Benati, 2001, 2005; Cadierno, 1995; VanPatten & Cadierno, 1993; VanPatten & Fernández, 2004). This is an important finding given that most PI research on German accusative case markings has focused on the usefulness of EI during training (Culman et al., 2009; Henry et al., 2009; VanPatten & Borst, 2012a), and thus did not include a production measure or compare PI to traditional instruction. Thus, the present study extends the positive effects of PI to a form that has only recently been given attention in the PI literature, and which has not typically been tested using production measures (but see Agiasophiti, 2011; Hanan & Marsden, 2014).

The present study also utilized offline assessment tasks that are less common in the PI research. Traditionally, PI studies (e.g., Benati, 2001; VanPatten & Cadierno, 1993) use
comprehension measures that are very similar—if not identical—to the comprehension tasks included in the instructional materials. To measure production, PI studies have typically used cloze tests, and thus required only word-level production. The present study, on the other hand, utilized a sentence-level production task. By the same token, the offline comprehension measure was not a simple replication of the training; rather it included new stimuli presented in the written modality. These studies therefore show that the offline effects of PI extend to multiple tasks types that are only now becoming more common in the PI literatures (see Agiasophiti, 2011; Hanan & Marsden, 2014; White, 2008).

5.5.2 Processing Instruction’s Central Claim and the Changes to Processing Strategies

One of the primary motivations for the present study was to evaluate the central claim behind Processing Instruction theory that Processing Instruction changes processing behaviors, thus creating the circumstances under which learners can develop form-meaning connections. This claim is the backbone of the theory behind PI and has been used to explain the positive effects of PI in dozens of studies since VanPatten and Cadierno’s (1993) seminal study.

The findings from Experiment 2 in this dissertation do, in fact, support a narrow interpretation of this claim given three major findings: (1) reading times on the SPR task indicated that the PI and PI+P groups spent more time reading noun phrases overall than the TI group; (2) accuracy data on the SPR task’s comprehension items showed that approximately half of the participants who received PI or PI+P were able to avoid the first-noun strategy consistently; and (3) reading times on the SPR tasks showed that the PI+P group treated SVO and OVS items differently on the final two regions of the experimental sentences. Taken together, these three results imply that PI compelled learners to direct attentional resources to the relevant morphosyntactic cues, thus lowering the tendency to rely solely on the first noun.
strategy, and—when prosodic cues were present in the training input—allowing learners to integrate case-marking information more efficiently. However, this interpretation is tempered by the fact that the same tasks indicate that the participants in the PI and PI+P groups were much less accurate on the comprehension questions in the SPR task than in the offline comprehension task. Furthermore, the absence of RT differences between SVO and OVS sentences in the disambiguating regions suggests that the participants did not integrate case-marking information immediately as native speakers would. In other words, there may have been some changes in processing behavior, but processing remained extremely inefficient and inaccurate. Thus, while the present study finds evidence to support PI’s central claim, the findings also show that there are limits to the changes that occur due to Processing Instruction, particularly as it relates to PI’s ability to create native-like processing behaviors.

It is, however, important to recognize that the changes that were observed are significant because they are entirely consistent with the goals of the PI training. In particular, the training was designed to teach learners to attend to articles instead of simply relying on a first-noun strategy. While participants did ultimately use a first-noun strategy to understand many of the sentences in the SPR task, the fact that attentional resources were directed towards the noun phrases suggests that this may have been a fall-back strategy utilized because the task and memory demands were higher in the SPR task than in the offline task. Indeed, the PI and PI+P groups demonstrated during training that they could use case markings effectively in controlled tasks where the goal of processing, and the information needed to complete the task, is kept constant, even when they were not able to reanalyze input as in the written tasks. Thus, it does not seem that PI was completely ineffective at developing morphosyntactic processing strategies. Rather, it seems that the availability of these strategies is simply limited due to internal and
external factors that have larger effects on the processing system in uncontrolled online tasks, such as working memory (e.g., Dracos, 2013; Keating, 2009; see Juffs & Harrington, 2011), speed of lexical access (e.g., Miller, 2011, 2014), or task-type (e.g., Leeser, Brandl, & Weissglass, 2011).

In sum, the present study finds support for PI’s central claim, but also finds that this claim must be qualified. In short, these experiments demonstrate that PI influences the tendency to process certain cues, and these newly developed strategies may be put to use past the initial training. However, PI trainings such as the ones used in this study may not substantially influence other components of L2 processing as described in the IP model. For example, it may have less impact on the availability of cognitive resources outside of training, which would limit its effect on the development of native-like processing ability. These limits are likely influenced by the fact the PI trainings are generally short in nature, providing only limited input and practice processing the target form. For some forms this may be less problematic because learners would be required to process them for meaning rather often. For others (e.g., the accusative case in German), the frequency of practice with quality input (e.g., object-first sentences in German) could be much more limited. Thus, in order to have a more substantial impact, PI would likely need to be longer and repeated several times.

5.5.3 Prosody and PI

Another primary motivation of the present research was to determine if the use of prosodic cues in PI training would present a barrier to acquisition, much like lexical semantic cues had been shown to do in prior research. Several results are informative with regards to this question: (1) the PI+P and PI groups performed similarly on both the offline comprehension and production tasks; (2) the PI+P group began processing sentences later in the training than the PI
group, but this delay was short-lived; (3) the PI and PI+P groups both had difficulty comprehending OVS sentences in the SPR task, but each group improved similarly with regards to the number of participants who achieved a score of at least 50% on this measure; (4) both the PI and PI+P trainings directed attention towards the noun phrases in the SPR task; and (5) the PI+P group was the only group to show evidence of differential processing for SVO and OVS sentences, though the emergence of these effects late in the sentence suggests that case markers were not integrated into the structure of the target sentence immediately.

Taken together, these results show that the presence of the prosodic cues used in this training did not act as a significant barrier to acquisition, and PI was as effective in creating form-meaning connections and directing attention towards the noun phrases when the prosodic cues were present as it was without them. Furthermore, given that the PI+P group showed longer reading times on OVS sentences in the posttest SPR task, the prosodic cues may have facilitated the integration of case markers such that participants could put this information to use more efficiently. As discussed in section 4.4.4, it is difficult to say whether the boost in online processing observed for the PI+P is perhaps due to developmental readiness. Even so, while neither the PI, nor the PI+P training enabled efficient and effortless processing of the target form, prosody may have had a positive impact on the availability of resources or the speed of processing, albeit somewhat marginal.

It is still unclear whether the use of prosodic cues in this study could be used in other instantiations of PI. First, similar forms in other languages do not have corresponding prosodic cues that could be used during training. For example, Spanish OVS sentences that make use of clitic objects are spoken with the same prosodic contours as SVO sentences. Similarly, the application of prosodic cues would be limited for verbal morphology across languages, as bound
morphemes (e.g., tense morphemes) rarely, if ever, trigger contrastive prosodic structures.\textsuperscript{29} Secondly, as the present study is the first to specifically investigate the role of prosody in PI, more research is needed to explore whether the effects observed here are limited to this particular combination of structures. Although the previous literature on the use of prosody for syntactic processing suggests that this is not the case (Grünloh et al., 2011; Henry et al., 2014; see section 2.3.2 for further discussion), it may well be that there is more competition between morphosyntactic and prosodic cues for other languages and target structures.

5.5.4 The Implementation of Processing Instruction

The results of the present study support several suggestions for the implementation of PI in the L2 classroom. First, the fact that 84\% of the third-semester participants displayed a lack of knowledge for accusative articles on the pretest indicates that the form under investigation is not easy to acquire and that traditional instruction methods do not typically result in lasting knowledge of this form. This is confirmed by the results of the offline comprehension measures that showed no improvement in the TI group. Given that the PI groups made rather significant improvements on the offline tasks, PI represents a useful tool that can be used to ease the acquisition of this form. Furthermore, because the present study was carried out with third-semester learners of German, who had been exposed to the target form many times before, the results suggest that PI would be useful as an activity for learners in the second year. Although neither this study, nor other studies on German accusative case markers, has directly tested learners who have no prior experience with the form, PI is likely a useful intervention for less-

\textsuperscript{29} It would, however, be interesting to investigate whether artificial application of prosodic cues could act as an effective form of input enhancement for free morphemes, even when this would be unnatural.
experienced learners as well, provided that the vocabulary used during the training is selected appropriately.

Secondly, the presentation of the PI materials demonstrates two potential avenues for implementing PI in a classroom. First, the materials in Experiment 1 were presented via the presentation program Power Point, which is a fixture on today’s university campuses and in secondary schools. Thus, the use of this specific PI training is easily adaptable to the classroom environment.  

Indeed, many of the previous studies on PI have been conducted in the classroom environment (e.g., VanPatten & Cadierno, 1993). Secondly, the effectiveness of the computer-delivered PI in Experiment 2 shows that PI could be implemented for self-study, perhaps as a web-based homework assignment, or a language lab activity. This would allow learners to proceed at their own pace and repeat training multiple times.

As discussed in section 2.5.1.3, standard applications of PI in German have removed prosodic cues from the input, which results in unnatural prosodic contours. What is clear from this study is that prosodic cues do not interfere with processing of German accusative case markers; furthermore, prosodic cues may even facilitate the integration of morphosyntactic information. Thus, PI activities for German accusative case markers should make use of the natural prosodic contours when language is presented aurally. Nevertheless, as discussed in section 5.5.3, it is yet unclear to what extent this conclusion can be generalized to other target forms.

Finally, as discussed in section 5.5.2, the results from the present study suggest that the time spent during training did not change processing strategies, such that forms were processed

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30 While feedback was presented at each participant’s computer station, given the simplicity of the feedback (a simple message stating “CORRECT” or “INCORRECT”), it would likely be equally effective to give students the correct answer and let them self-correct.
accurately and efficiently outside of the training (i.e. when processing unstructured language for meaning). Other research on PI has shown that, while PI is effective over the long-term, its effects are not completely durable, and participants lose some of the gains displayed immediately after training (VanPatten & Fernández, 2004). Thus, PI is likely to be more effective if the time-on-task is increased, and if it is implemented repeatedly over the course of a semester, so that learners are reminded of the optimal processing strategies, and so that they are given a chance to process the target forms consistently. In fact, repeated use of PI could give teachers a chance to move to more complicated tasks that go beyond sentence-level discourse. This is one of the core design principles for PI (Wong, 2004, see section 2.4.1), and would give key practice using cues in more complex, and less predictable contexts.

In addition, there are opportunities to use structured input during language activities that are non-grammar focused. For example, object-first sentences could be incorporated into reading and listening activities. As with the repeated use of structured input, this would provide learners additional input of the target structure and give them additional opportunities to practice processing input helpful for reinforcing both form-meaning connections and optimal processing strategies. With this approach, however, care must be taken to ensure that learners are pushed to comprehend these sentences correctly so that incorrect interpretations of the input, and thus incorrect deployment of processing strategies, do not persist. Thus, it could be useful to call attention to these sentences through comprehension checks.

5.6 Open Questions and Directions for Future Research

The experiments presented in this dissertation contribute to our understanding of cue interaction and Processing Instruction, providing details that have not yet been shown in previous
research. Yet, the experiments leave several important questions open to future research, particularly with regards to the offline and online effects of PI and the use of prosodic cues.

The first of these questions centers on whether the observed effects are durable at longer intervals. Because this experiment did not include a delayed posttest and because the SPR task in this experiment was administered almost directly after training, it is impossible to know how long participants retained the grammatical information acquired during training. Similarly, it is impossible to know how long the observed processing changes—specifically the attention to noun phrases, as measured by reading times in the SPR task—continued after training. Furthermore, the present study did not include a systematic investigation of more complex sentence structures or sentences in which lexical-semantic cues were present. Thus, the present experiment cannot comment on the effects of training for the processing of more complex language. If the strategy to direct processing resources towards noun phrases was indeed durable, applied to more complex structures, and applied when other cues could be used instead, then this would suggest that PI enables learners to continue learning from new language input encountered outside of the intervention. That would further solidify form-meaning connections and facilitate a switch away from shallow processing behaviors. If not, then the effects of PI would be much more limited. This is an issue that should be addressed in future research through the addition of delayed posttests and the use of more complex stimuli that would test whether processing strategies generalize to other types of sentences.

By the same token, it would be informative to test whether changes to morphosyntactic processing strategies transfer to other forms as a result of training. Recently, the PI literature has reported evidence of transfer-of-training effects suggesting that this may be the case. For example, Benati and Lee (2008) reported that PI training influenced the comprehension and
production of not only primary forms (those that are targeted in the training), but also secondary forms (forms that present the same processing problem as the targeted form), and cumulative forms (forms that do not share a processing problem). In light of the findings in this dissertation, online research methods would provide a fruitful avenue for investigating and interpreting secondary and cumulative transfer-of-training effects.

Another important question that the present research cannot address is whether the short training utilized in this experiment is the source of discrepancies between the offline and online effects. That is, the length of training could have contributed to the fact that learners were quite accurate on the offline comprehension measures but were inaccurate on the SPR task’s comprehension measures and did not show evidence for immediate incremental processing. In many of the early studies on PI (e.g. Cadierno, 1995; VanPatten & Cadierno, 1993; VanPatten & Oikkenon, 1996), learners were provided with much more exposure and practice with the target form. For example, in VanPatten and Cadierno's (1993) original study, participants completed the training over two consecutive class periods. The training in this study, however, was completed within 20-25 minutes for most participants. Thus, it is possible that with a longer training—or perhaps repeated training sessions—participants would have been able to use the accusative articles more efficiently during the online training. In particular, future research could address this by testing the effects of PI implementations with longer and repeated trainings, as suggested in section 5.5.4.

It is also unclear what effect the inclusion of explicit information (EI) may have had on the results of these experiments. As discussed in section 2.4.2, recent research on the role of EI in PI has shown that it leads learners to process German accusative case markers more accurately sooner during training as compared to PI treatment without the addition of explicit information.
(e.g., Culman et al., 2009; Henry et al., 2009). These findings contrast with similar experiments showing that EI is not helpful for similar forms in other languages (e.g., VanPatten et al., 2013). In these studies, the researchers argued that the “portability” of the EI (i.e., the ability to keep the EI in memory and access it during the training) is a significant factor influencing whether the use of EI during training affects the ability of learners to internalize the optimal processing strategies correctly. Because the EI for German is highly portable, it could be that learners adopt a task-specific strategy based on the EI. Such a strategy would be useful during training, but may not be useful during more complex tasks. This could account for the discrepancy between performance on the offline and online tasks. Consequently, it would be informative to explore whether structured input activities alone would be sufficient to lead to more robust changes in processing behavior since learners would not be able to rely on EI. As discussed in section 5.4, the use of EI may also be implicated in the similarities between the PI and PI+P groups on the offline measures. Given that the previous research has shown that German learners are very slow to process object-first sentences correctly when EI is absent from the training (Culman et al., 2009; Henry et al., 2009; VanPatten & Borst, 2012a), investigating the impact of prosody on PI trainings without EI may reveal greater differences that those found in the present study.

The findings of the present study also leave open the possibility that developmental readiness—and not the use of prosodic cues—was the primary source of differential processing for SVO and OVS sentences in the PI+P group. Recall that in the SPR pretest, the PI+P group read noun phrases marked with den longer than those marked with der, implying that they treated the articles differently on the pretest; the PI group showed no such effect. Thus, it could be that the PI+P group was simply more ready to begin using case markers online, leading to the differential processing for SVO and OVS sentences observed in the posttest. The present study
cannot comment directly on this issue, and future research with more comparable PI and PI+P groups would provide a useful comparison for determining the role that developmental readiness may have played.

Finally, with regards to the additive use of prosody and the lack of competition between prosodic and morphosyntactic cues, the results in the present study provide only a small window into a larger issue. It would be informative to establish whether the lack of competition between morphosyntactic and prosodic cues in this study is due to the particular combination of cues, or if the entire class of morphosyntactic and prosodic cues pattern similarly. Thus, future research needs to investigate different types of prosodic cues paired with other target structures. Similarly, in light of the results that prosody did not interfere with the acquisition of the case markers, Processing Instruction theory and research (including the Input Processing model) should reevaluate whether the cue competition observed for lexical-semantic cues generalizes to prosodic cues. The guidelines for PI stipulate that all non-target cues be removed from the input. But the present study shows that there are some circumstances, as in the present study, where this may not be the most effective form of training and would also present students with unnatural input. Thus, research on input processing and PI needs to further explore the interactions of specific cues in order to identify areas where training can be improved by the use of supportive cue coalitions. It is clear from this study that these investigations could inform the theory and guidelines that underlie PI.

**5.7 Final Summary and Conclusions**

The goal of this dissertation was to explore the psychological principles that underlie learners’ interactions with multiple cues in an input stream, examine how these processes impact the acquisition of morphosyntactic forms, and investigate what impact, if any, instruction could
have on processing. To this end, the experiments in this research tested the offline and online effects of Processing Instruction on the acquisition and subsequent processing of German accusative case markers. As a whole, the current research shows that learners have difficulty acquiring morphosyntactic cues when lexical-semantic cues express the same semantic notions and compete for attentional resources. On the other hand, when morphosyntactic and prosodic cues express the same semantic notions, the cues appear to support each other and facilitate processing. Moreover, this dissertation finds evidence to support the claim that Processing Instruction affects change in a learner’s developing system by changing processing strategies and allowing a learner to deliver better intake to the developing system. Specifically, it seems that Processing Instruction compels learners to devote attentional resources to the targeted grammatical forms during online sentence comprehension. Although there are limits to the scope of processing changes and learners may not be able to adopt native-like processing strategies immediately after training, this research suggests that Processing Instruction is a useful tool for language acquisition because it promotes interaction with input that is optimized for the creation of form-meaning connections.

A further goal of this dissertation was to connect various elements of psycholinguistic and classroom-based research and highlight areas where these fields can inform each other. In particular, this dissertation shows that it is important to develop instructional techniques based on psycholinguistic principles, and that, in doing so, improved pedagogical methods can be used effectively in the classroom. By the same token, this dissertation also shows that it is important to evaluate trainings developed with psycholinguistic models, because this type of research can provide critical detail and lead to improvements in the models themselves. Thus, instructional trainings are a useful tool for evaluating theoretical notions in psycholinguistics. Consequently, a
combination of classroom and psycholinguistic approaches has much to offer both fields and can facilitate an informative dialogue between the disciplines.
REFERENCES


Appendix A  Language History Questionnaire

This questionnaire is designed to give us a better understanding of your experience with other languages. We ask that you be as accurate and as thorough as possible when answering the following questions.

Part I

1. Gender: ___________________

2. Age: _____ years

3. Do you have any known visual and/or hearing problems (either corrected or uncorrected)?
   □ No
   □ Yes [Please explain: _____________________________________________________________]

4. Native Country/Countries (Please check all that apply.)
   □ United States
   □ Other [Please specify: ___________________]

5. Native Language(s) (Please check all that apply.)
   □ English
   □ Other [Please specify: ___________________]

6. Language(s) spoken at home. (Please check all that apply.)
   □ English
   □ Spanish
   □ German
   □ Chinese
   □ Other [Please specify: ___________________]

Part II

The next section of the questionnaire deals with your second language learning experience.

7. Have you studied any second language(s)?
   □ No → If NO, please go to Part IV (on the final page of this questionnaire).
   □ Yes → If yes, which language(s)? ________________________________________________

8. If you studied any second language(s) (including German) before college, please check all of the following that apply and indicate the starting age and length of study for any second language(s) learned before college.
9. Have you studied any second language(s) (including German) in college?
   - No → If NO, please go to Question # 13.
   - Yes → If yes, which language(s)? ________________________________
     For how long?
     - Less than one semester
     - 1-2 semesters
     - 3-4 semesters
     - 5-6 semesters
     - 7-8 semesters
     - 8+ semesters

10. Are you currently taking any language courses besides Germ 003?
    - No
    - Yes → If yes, which course(s)? ________________________________

11. Have you studied and/or lived abroad? If you were not born in the United States, please include your stay(s) in the United States in the table below.
    - Yes
    - No

If YES, where and when did you study, for how long, and what language(s) did you speak?

<table>
<thead>
<tr>
<th>Country</th>
<th>Approx. dates</th>
<th>Length of Stay</th>
<th>Language</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


12. What do you consider to be your primary second language? (You may check more than one if you feel that you have multiple “primary” second languages.)

- English
- Spanish
- German
- Chinese
- Other [Please specify: ____________________________]

Part III
The next section asks you to rate your skills in German.  ________________________

Appendix A Your reading proficiency in German. (1 = not literate and 10 = very literate)

1 2 3 4 5 6 7 8 9 10

Appendix B Your spelling proficiency in German. (1 = not good and 10 = very good)

1 2 3 4 5 6 7 8 9 10

Appendix C Your writing proficiency German. (1 = not literate and 10 = very literate)

1 2 3 4 5 6 7 8 9 10

Appendix D Your speaking ability in German. (1 = not fluent and 10 = very fluent)

1 2 3 4 5 6 7 8 9 10

Appendix E Your speech comprehension ability in German. (1 = unable to understand conversation and 10 = perfectly able to understand)

1 2 3 4 5 6 7 8 9 10

Optional questions (collected for informational purposes only, this is NOT a variable relevant to the research questions)
28. What is your race?

- White
- Black/African-American
- American Indian or Alaska Native
- Asian
- Native Hawaiian or Other Pacific Islander
- More than one race
- Other

29. Are you of Hispanic, Latino, or Spanish origin?

- yes  
- no
Appendix B Proficiency Test

1. „Gestern war ich krank.“
   „__ du auch Fieber?“
   a. Hättest
   b. Hattest
   c. Habest
   d. Hast

2. Er ist __, denn er hat seine Kamera vergessen.
   a. zurückfahren
   b. zurückzufahren
   c. zurückgefahren
   d. zurückfahrend

3. „Arbeitet er morgen?“
   „Ja, er __.“
   a. müßte
   b. muß
   c. mußt
   d. mußte

4. Ich habe mit __ Freund getanzt.
   a. mein
   b. meinem
   c. meinen
   d. meiner

5. Du gibst bald eine Party! __ willst du denn einladen?
   a. Wer
   b. Wem
   c. Wen
   d. Wo

6. „Was trinkst du, Cola oder Tee?“
   „Ich trinke __ Cola als Tee.“
   a. gern
   b. am liebsten
   c. lieb
   d. lieber

7. „Hast du einen Plattenspieler?“
   „Nein, ich habe __.“
   a. nicht
   b. keinen
   c. kein
   d. nicht einen

8. Für __ ist das zu früh.
   a. ihm
   b. ihr
   c. Ihnen
   d. ihn

9. „Was habt ihr denn gestern gemacht?“
   a. „Wir gehen ins Kino.“
   b. „Wir möchten ins Kino gehen.“
   c. „Wir sind ins Kino gegangen.“
   d. „Wir waren ins Kino gegangen.“

10. Heute ist Montag, ____.
    a. am ersten Juni.
    b. ersten Juni.
    c. den ersten Juni.
    d. der erste Juni.

11. „Was für ein Mann war denn das?“
    „Es war __ dicker.“
    a. ein
    b. einen

12. „Was hast du am Montag gemacht?“
    „Am Montag ____ zum Arzt gegangen.“
    a. ich bin
13. „Weiβt du, was er gesagt hat?“ „Nein, daran kann ich ___.“
   a. nicht mehr erinnern  
   b. dich nicht erinnern  
   c. mich nicht erinnern  
   d. mir nicht erinnern
   a. könne  
   b. konnte  
   c. kann  
   d. könnte
15. Hans ist schon wieder zu Hause. Er ___ gestern Abend aus dem Urlaub zurück.
   a. kommt  
   b. komme  
   c. kam  
   d. kamt
16. Jens war so dumm. Er ___ die Antwort nicht.
   a. weißt  
   b. wißt  
   c. wußte  
   d. weiß
17. Die Dame kam ins Geschäft, sah den blauen Pullover und ___ ihn sofort.
   a. kaufen  
   b. kaufte  
   c. kauft  
   d. kauftet
18. Er braucht Hilfe mit seinen Hausaufgaben. Kannst du ___?
   a. ihm mit ihnen helfen  
   b. ihnen damit helfen  
   c. ihn mit ihnen helfen  
   d. ihm damit helfen
19. „Wer ist denn das?“ „Das ist die Frau ___.“
   a. meines Arztes  
   b. meinen Arzt  
   c. meinem Arzt  
   d. mein Arzt
20. „Wie lange seid ihr schon hier?“ „Wir warten schon seit fünf Uhr ___ euch.“
   a. für  
   b. bis  
   c. auf  
   d. vor
21. „Was wollt ihr zu Weihnachten bekommen?“ „Wir ___ viele schöne Geschenke bekommen!“
   a. mögen  
   b. mochten  
   c. wollten  
   d. möchten
22. „Diese Brücke ist neu, nicht wahr?“ „Nein, sie ___.“
   a. wurde 1937 gebaut  
   b. wird 1937 gebaut  
   c. waren 1937 gebaut  
   d. sind 1937 gebaut
23. „Was machen wir heute Abend?“
„Gehen wir zu Meyers. ___ denen wird Geburtstag gefeiert.“
   a. An
   b. Bei
   c. Zu
   d. Auf

24. „Warum ist Fritz nicht hier?“
„Er ist noch in Bonn und ___.“
   a. er erst später kommt
   b. er erst später ankommt
   c. erst später kommt an
   d. kommt erst später an

25. „Wie kommt ihr nach Berlin?“
   „Wir fahren ___.“
   a. mit dem Zug dahin
   b. da bei dem Zug
   c. da mit dem Zug
   d. bei dem Zug dahin


27. Der Komponist, ___ heute spielt, kommt aus Berlin.
   a. Den
   b. Der
   c. Dem
   d. des

   a. habe
   b. gehabt hätte
   c. hätte
   d. hatte

29. „Warum bist du gestern nicht zur Party gekommen?“
   „Gestern ___.“
   a. ich habe nicht kommen können
   b. ich kann nicht kommen
   c. könnte ich nicht kommen
   d. konnte ich nicht kommen

30. Ein Student studiert, ____.
   a. eine Stelle zu bekommen
   b. zu bekommen eine Stelle
   c. eine Stelle bekommen
   d. um eine Stelle zu bekommen
Appendix C  Vocabulary Items

Please write a translation for the following words. For the nouns, please check the M, F, N, or PL box to indicate whether the word should be masculine, feminine, neuter, or plural. If you do not know a word or its gen, please take your best guess.

1. Kellner □M □F □N □PL
2. Junge □M □F □N □PL
3. Jogger □M □F □N □PL
4. Lehrer □M □F □N □PL
5. Dichter □M □F □N □PL
6. Kaufmann □M □F □N □PL
7. Köchin □M □F □N □PL
8. Lamm □M □F □N □PL
9. Familie □M □F □N □PL
10. Assistentin □M □F □N □PL
11. Ministerin □M □F □N □PL
12. Polizistin □M □F □N □PL
13. Tochter □M □F □N □PL
14. Agentin □M □F □N □PL
15. Ehefrau □M □F □N □PL
16. Kusine □M □F □N □PL
17. Sängerin □M □F □N □PL
18. Stewardess □M □F □N □PL
19. Vater □M □F □N □P
20. Soldat □M □F □N □PL
21. Ehemann □M □F □N □PL
22. Vetter □M □F □N □PL
23. Gitarrist □M □F □N □PL
24. Pilot □M □F □N □PL
25. Frau □M □F □N □PL
26. Mutter □M □F □N □PL
27. Trainerin □M □F □N □PL
28. Klasse □M □F □N □PL
29. Autorin □M □F □N □PL
30. Sekretärin □M □F □N □PL
31. Professorin □M □F □N □PL
32. Königin □M □F □N □PL
33. Athletin □M □F □N □PL
34. Oma □M □F □N □PL
35. tötet □M □F □N □PL
36. pflanzt □M □F □N □PL
37. arbeitet □M □F □N □PL
38. spielt □M □F □N □PL
39. wartet □M □F □N □PL
40. kauft □M □F □N □PL
41. zeigt □M □F □N □PL
42. traut □M □F □N □PL
43. macht □M □F □N □PL
44. reist □M □F □N □PL
45. diskutiert □M □F □N □PL
46. lernt □M □F □N □PL
47. baut □M □F □N □PL
48. Fan □M □F □N □PL
49. Musiker □M □F □N □PL
50. Jeep □M □F □N □PL
51. Nachbar □M □F □N □PL
52. küsst □M □F □N □PL
53. ärgert □M □F □N □PL
54. stört □M □F □N □PL
55. umarmt □M □F □N □PL
56. verliert □M □F □N □PL
57. rettet □M □F □N □PL
58. vermisst □M □F □N □PL
59. trägt □M □F □N □PL
60. bittet □M □F □N □PL
61. kritisiert □M □F □N □PL
62. besucht □M □F □N □PL
63. grüßt □M □F □N □PL
64. verfolgt □M □F □N □PL
65. überrascht □M □F □N □PL
66. fotografiert □M □F □N □PL
67. bewundert □M □F □N □PL

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35. Schwester ______ □M □F □N □PL
36. Nichte __________ □M □F □N □PL
37. Student __________ □M □F □N □PL
38. Prinz ____________ □M □F □N □PL
39. Coach ____________ □M □F □N □PL
40. Opa ______________ □M □F □N □PL
41. Teenager __________ □M □F □N □PL
42. Onkel ____________ □M □F □N □PL
43. Lamm _____________ □M □F □N □PL
44. Tierarzt ___________ □M □F □N □PL
45. Wolf ______________ □M □F □N □PL
46. Sohn _____________ □M □F □N □PL
47. Manager __________ □M □F □N □PL
48. Diplomat __________ □M □F □N □PL
49. Räuber ____________ □M □F □N □PL
50. Mann _____________ □M □F □N □PL
51. hört ________________
52. guckt _______________
53. wandert ______________
54. plant ________________
55. sucht ________________
56. lehrt ________________
57. beantwortet __________
58. kocht ________________
59. tanzt ________________
60. backt ________________
61. Geschäft ___________ □M □F □N □PL
62. gestern _____________
63. gestern Abend __________
64. Eltern _____________ □M □F □N □PL
65. Freundin ___________ □M □F □N □PL
66. Ballerinen __________ □M □F □N □PL
67. Bäcker _____________ □M □F □N □PL
68. Spione _____________ □M □F □N □PL
69. kennt ________________
70. ruft ________________
71. trifft ________________
72. sieht ________________
73. weckt ________________
74. schiebt ______________
75. verletzt ______________
76. Gärtner ___________ □M □F □N □PL
77. Arzt _______________ □M □F □N □PL
78. Präsident __________ □M □F □N □PL
79. Rebell ______________ □M □F □N □PL
80. öffnet ________________
81. Autor _______________ □M □F □N □PL
82. Kollegen ___________ □M □F □N □PL
83. Ritter _____________ □M □F □N □PL
84. Arbeiter ___________ □M □F □N □PL
85. Model _____________ □M □F □N □PL
86. Lehrer _____________ □M □F □N □PL
87. letzte Woche __________
88. letztes Jahr __________
89. letzten Sommer __________
90. Metzger ___________ □M □F □N □PL
91. Mechaniker __________ □M □F □N □PL
92. Tourist ____________ □M □F □N □PL
93. Freunde ____________ □M □F □N □PL
94. Künstler ___________ □M □F □N □PL
95. Pfarrer _____________ □M □F □N □PL
96. letzten Monat __________
97. letzten Winter __________
98. Studenten __________ □M □F □N □PL
99. General _____________ □M □F □N □PL
100. Kandidaten __________ □M □F □N □PL
101. Schüler ___________ □M □F □N □PL
102. Ingenieure ___________ □M □F □N □PL
Below are the vocabulary words pulled from experimental items in the self-paced reading task. In Experiment One, these words were included in the vocabulary test along with 64 filler items. In Experiment Two, no filler items were included in the vocabulary test. These words were also included in the vocabulary training task in Experiment Two. As explained in section 4.2.4, the words appeared in three separate training blocks as they appear below.

**Block One**

<table>
<thead>
<tr>
<th>German Word</th>
<th>English Translation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Der Kellner</td>
<td>The waiter</td>
</tr>
<tr>
<td>Der Junge</td>
<td>The boy</td>
</tr>
<tr>
<td>Der Jogger</td>
<td>The jogger</td>
</tr>
<tr>
<td>Der Lehrer</td>
<td>The teacher</td>
</tr>
<tr>
<td>Der Dichter</td>
<td>The poet</td>
</tr>
<tr>
<td>Der Kaufmann</td>
<td>The businessman</td>
</tr>
<tr>
<td>Die Köchin</td>
<td>The female cook</td>
</tr>
<tr>
<td>Das Lamm</td>
<td>The lamb</td>
</tr>
<tr>
<td>Die Familie</td>
<td>The family</td>
</tr>
<tr>
<td>Die Assistentin</td>
<td>The female assistant</td>
</tr>
<tr>
<td>Die Ministerin</td>
<td>the female minister</td>
</tr>
<tr>
<td>Die Polizistin</td>
<td>The female police officer</td>
</tr>
<tr>
<td>Die Tochter</td>
<td>The daughter</td>
</tr>
<tr>
<td>Die Agentin</td>
<td>The female Agent</td>
</tr>
<tr>
<td>Die Ehefrau</td>
<td>The wife</td>
</tr>
<tr>
<td>Die Kusine</td>
<td>The female cousin</td>
</tr>
<tr>
<td>Die Sängerin</td>
<td>The female singer</td>
</tr>
<tr>
<td>Die Stewardess</td>
<td>The female flight attendant</td>
</tr>
<tr>
<td>Der Vater</td>
<td>The father</td>
</tr>
<tr>
<td>Der Soldat</td>
<td>The soldier</td>
</tr>
<tr>
<td>Der Ehemann</td>
<td>The husband</td>
</tr>
<tr>
<td>Der Vetter</td>
<td>The male cousin</td>
</tr>
<tr>
<td>Der Gitarrist</td>
<td>The guitarist</td>
</tr>
<tr>
<td>Der Pilot</td>
<td>The pilot</td>
</tr>
</tbody>
</table>

**Block Two**

<table>
<thead>
<tr>
<th>German Word</th>
<th>English Translation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Die Frau</td>
<td>The woman</td>
</tr>
<tr>
<td>Die Mutter</td>
<td>The mother</td>
</tr>
<tr>
<td>Die Trainerin</td>
<td>The female trainer</td>
</tr>
<tr>
<td>Die Klasse</td>
<td>The class</td>
</tr>
<tr>
<td>Die Autorin</td>
<td>The female author</td>
</tr>
<tr>
<td>Die Sekretärin</td>
<td>The female secretary</td>
</tr>
<tr>
<td>Die Professorin</td>
<td>The female professor</td>
</tr>
<tr>
<td>Die Königin</td>
<td>The queen</td>
</tr>
<tr>
<td>Die Athletin</td>
<td>The female athlete</td>
</tr>
</tbody>
</table>
Die Oma  The grandmother
Die Schwester  The sister
Die Nichte  the niece
Der Student  The student
Der Prinz  The prince
Der Coach  The coach
Der Opa  The grandfather
Der Teenager  The teenager
Der Onkel  The Uncle
Der Tierarzt  The veterinarian
Der Wolf  The wolf
Der Sohn  The son
Der Manager  The manager
Der Diplomat  The diplomat
Der Räuber  The robber

**Block Three**
küsst  kisses
ärger  annoys
stört  disturbs
umarmt  hugs
verliert  loses
rettet  saves
vermisst  misses
riecht  smells
trägt  carries
bittet um  asks for
kritisiert  criticizes
besucht  visits
grüßt  greets
verfolgt  follows
überrascht  surprises
fotografiert  photographs
bewundert  admires
kennt  knows
ruft  calls
trifft  meets
sieht  sees
weckt  wakes
schiebt  pushes
verletzt  injures
Appendix D  Traditional Instruction Training

Explicit Instruction

The subject of a sentence performs the action described by the verb and is in the nominative case (der Nominativ). It answers the questions wer? (who?) and was? (what?). The accusative case (der Akkusativ) is used to designate the direct object (das direkte Objekt). The direct object is the target or product of the action expressed by the verb and answers the questions wen? (whom?) and was? (what?).

Was hat Anna?  
Anna hat einen Traum.  
*What is Anna having?  
Anna is having a dream.*

Was sucht Anna?  
Anna sucht den Hörsaal.  
*What is Anna looking for?  
Anna is looking for the lecture hall.*

Wen fragt Anna?  
Anna fragt eine Studentin.  
*Whom does Anna ask?  
Anna asks a (female) student.*

Was schreibt Anna?  
Anna schreibt eine E-Mail.  
*What is Anna writing?  
Anna is writing an e-mail.*

You can identify the accusative case by looking at the ending on the article. The ending denotes both the gender (masculine, feminine, neuter) and the number (singular or plural) of the noun, as well as its function (direct object as opposed to subject, etc.). The following chart shows all the forms of the definite and indefinite articles, plus kein in the nominative and accusative case.

<table>
<thead>
<tr>
<th>Case</th>
<th>Singular</th>
<th>Feminine</th>
<th>Plural</th>
<th>All Genders</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Masculine</td>
<td>Neuter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nominative</td>
<td>der Mann</td>
<td>das Kind</td>
<td>die Frau</td>
<td>die Kinder</td>
</tr>
<tr>
<td></td>
<td>ein Mann</td>
<td>ein Kind</td>
<td>eine Frau</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>kein Mann</td>
<td>kein Kind</td>
<td>keine Frau</td>
<td>keine Kinder</td>
</tr>
<tr>
<td>Accusative</td>
<td>den Mann</td>
<td>das Kind</td>
<td>die Frau</td>
<td>die Kinder</td>
</tr>
<tr>
<td></td>
<td>einen Mann</td>
<td>ein Kind</td>
<td>eine Frau</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>keinen Mann</td>
<td>kein Kind</td>
<td>keine Frau</td>
<td>keine Kinder</td>
</tr>
</tbody>
</table>

Note that only the singular masculine forms are different in the nominative (der, ein, kein) and in the accusative (den, einen, keinen). Singular feminine and neuter forms as well as plural forms are identical in the nominative and in the accusative. Please also note that kein and the possessive pronouns (mein, dein, sein, ihr, unser, euer) have the same endings as ein.
Computer Activity 1

David wants to know something about Ryan’s German course. Several parts of the following sentences are underlined. Identify which underlined portion is the direct object in the sentence, and use the keyboard to select the number that corresponds to it. If there is no direct object, choose number 6.

Beispiel

1. *Kaufst du eine Pizza im Supermarkt?*
   
<table>
<thead>
<tr>
<th>Kaufst</th>
<th>du</th>
<th>eine Pizza</th>
<th>im Supermarkt?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

   No object = 6

2. *Kennst du die Studenten gut?*
   
<table>
<thead>
<tr>
<th>Kennst</th>
<th>du</th>
<th>die Studenten</th>
<th>gut?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

   No object = 6

3. *Ist dein Professor eine Frau oder ein Mann?*
   
<table>
<thead>
<tr>
<th>Ist</th>
<th>dein Professor</th>
<th>eine Frau oder ein Mann?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

   No object = 6

4. *Ist das dein Deutschbuch?*
   
<table>
<thead>
<tr>
<th>Ist das</th>
<th>dein Deutschbuch?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

   No object = 6

5. *Brauchst du ein Buch aus Deutschland?*
   
<table>
<thead>
<tr>
<th>Brauchst</th>
<th>du</th>
<th>ein Buch aus Deutschland?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

   No object = 6

6. *Wann schreibst du dieses Semester eine Prüfung?*
   
<table>
<thead>
<tr>
<th>Wann schreibst du dieses Semester eine Prüfung?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
</tr>
</tbody>
</table>

   No object = 6

7. *Ist das dein Heft auf dem Tisch?*
   
<table>
<thead>
<tr>
<th>Ist das dein Heft auf dem Tisch?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
</tr>
</tbody>
</table>

   No object = 6

8. *Musst du im Internet Aktivitäten machen?*
   
<table>
<thead>
<tr>
<th>Musst du im Internet Aktivitäten machen?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
</tr>
</tbody>
</table>

   No object = 6

9. *Wo ist denn dein Klassenzimmer?*
   
<table>
<thead>
<tr>
<th>Wo ist denn dein Klassenzimmer?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
</tr>
</tbody>
</table>

   No object = 6

    
    | Musst du heute Nacht einen Bericht vorbereiten? |
    |-----------------------------------------------|
    | 1       | 2 | 3 | 4 | 5 |

    No object = 6
Computer Activity 2

Now that you’ve had some practice recognizing forms, what about choosing them yourself? Use the answer choices and their corresponding keys to fill in the correct word for the blank with an * in it. For example, for the following sentence, you would choose the correct word for the blank before the word 'Vater'.

*_ Vater findet ___ Tür nicht.

Remember, first figure out what word is the subject and what is the object; then decide what the right form is.

<table>
<thead>
<tr>
<th>No.</th>
<th>Sentence</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>* Vater (m) findet _____ Tür (f) nicht.</td>
<td>A. der B. die C. das D. den</td>
</tr>
<tr>
<td>2.</td>
<td>* Vater (m) findet ___ Tür (f) nicht.</td>
<td>A. der B. die C. das D. den</td>
</tr>
<tr>
<td>3.</td>
<td>* Professorin (f) schreibt einen Brief.</td>
<td>A. der B. die C. das D. den</td>
</tr>
<tr>
<td>4.</td>
<td>Hat der Bruder ___ Buch (n)?</td>
<td>A. der B. die C. das D. den</td>
</tr>
<tr>
<td>5.</td>
<td>Er hat ein Buch und ___ Stift (m).</td>
<td>A. ein B. eine C. einen</td>
</tr>
<tr>
<td>6.</td>
<td>Die Frau kauft ___ Fernseher (m), ___ Lampe (f) und ___ Telefon (n).</td>
<td>A. ein B. eine C. einen</td>
</tr>
<tr>
<td>7.</td>
<td>Die Frau kauft ___ Fernseher (m), ___ Lampe (f) und ___ Telefon (n).</td>
<td>A. ein B. eine C. einen</td>
</tr>
<tr>
<td>8.</td>
<td>Die Frau kauft ___ Fernseher (m), ___ Lampe (f) und ___ Telefon (n).</td>
<td>A. ein B. eine C. einen</td>
</tr>
<tr>
<td>9.</td>
<td>Das ist ___ Mann (m)!</td>
<td>A. der B. die C. das D. den</td>
</tr>
<tr>
<td>10.</td>
<td>Ich mache ___ Buch (n), ___ Tür (f) und ___ Fenster (n) auf.</td>
<td>A. der B. die C. das D. den</td>
</tr>
<tr>
<td>11.</td>
<td>Ich mache ___ Buch (n), ___ Tür (f) und ___ Fenster (n) auf.</td>
<td>A. der B. die C. das D. den</td>
</tr>
<tr>
<td>12.</td>
<td>Ich mache ___ Buch (n), ___ Tür (f) und ___ Fenster (n) auf.</td>
<td>A. der B. die C. das D. den</td>
</tr>
<tr>
<td>13.</td>
<td>___ Zimmer (n) ist sehr groß.</td>
<td>A. der B. die C. das D. den</td>
</tr>
<tr>
<td>14.</td>
<td>___ Bücher (pl) sind klein.</td>
<td>A. der B. die C. das D. den</td>
</tr>
<tr>
<td>15.</td>
<td>Wo sind ___ Kinder (pl)?</td>
<td>A. der B. die C. das D. den</td>
</tr>
<tr>
<td>16.</td>
<td>Wo ist ___ Schreibtisch (m)?</td>
<td>A. der B. die C. das D. den</td>
</tr>
<tr>
<td>17.</td>
<td>Ich sehe ___ Schreibtisch (m).</td>
<td>A. der B. die C. das D. den</td>
</tr>
<tr>
<td>18.</td>
<td>Wir hören ___ Studenten (pl).</td>
<td>A. der B. die C. das D. den</td>
</tr>
<tr>
<td>19.</td>
<td>___ Mutter (f) lernt Englisch.</td>
<td>A. mein B. meine C. meinen</td>
</tr>
<tr>
<td>20.</td>
<td>Herr und Frau Schmidt verstehen ___ Sohn (m) und ihre Tochter nicht.</td>
<td>A. ihr B. ihre C. ihren</td>
</tr>
</tbody>
</table>
Written Activity 1

You are buying things for your room. You have 200 Euro to spend and need at least 4 items. Look at the pictures with their prices below and tell your roommate what 4 items you are going to buy.

Beispiel

Ich kaufe einen Tisch.

Bett (n) Tisch (m) Lampe Stuhl (m) Fernseher (m) Uhr (f) Bücher (pl)

(f)
**Written Activity 2**

Think about you and your best friend. Look at the list of things/family members/pets below and decide what you and your friend have at home. Write an X in the blank provided if you have the named thing/family member/pet. Then write 5 sentences in German comparing what you and your best friend have.

**Beispiel**

<table>
<thead>
<tr>
<th>Personen/Tiere/Objekte</th>
<th>Du</th>
<th>Dein Freund</th>
</tr>
</thead>
<tbody>
<tr>
<td>einen Hund</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

*Ich habe einen Hund, aber mein Freund hat keinen Hund.*

<table>
<thead>
<tr>
<th>Personen/Tiere/Objekte</th>
<th>Du</th>
<th>Dein Freund</th>
</tr>
</thead>
<tbody>
<tr>
<td>einen Hund</td>
<td></td>
<td></td>
</tr>
<tr>
<td>eine Katze</td>
<td></td>
<td></td>
</tr>
<tr>
<td>einen Bruder</td>
<td></td>
<td></td>
</tr>
<tr>
<td>eine Schwester</td>
<td></td>
<td></td>
</tr>
<tr>
<td>zwei (drei, vier) Geschwister</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ein Kind</td>
<td></td>
<td></td>
</tr>
<tr>
<td>einen DVD-Spieler</td>
<td></td>
<td></td>
</tr>
<tr>
<td>einen großen Fernseher</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ein Deutschbuch</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix E  Processing Instruction Training

Explicit Instruction (Underlined text only appears in Experiment Two; Italicized text was only seen by the Processing Instruction + Prosody group)

In German, the nominative and accusative cases designate “who does what to whom.” That is, case tells us which noun in the sentence is the “verb-er” and which is the “verb-ed.”

Take the following sentence for example: “The woman calls the man.”

In this case, the woman is the caller (verb-er) and the man is called (verb-ed). The woman is the subject of the verb and the man is the direct object.

In German, one way to tell what is the subject and what is the direct object is by looking at the definite article (the small word meaning “the”) before the noun.

This is especially true for masculine nouns. When a masculine noun is the subject, the definite article is der. When it is the direct object, the article is den.

Example: Der Mann geht nach Hause “The man goes home“
BUT Die Frau sieht den Mann. “The woman sees the man”

Feminine and Neuter nouns’ articles do not change between nominative and accusative. That is, they stay die (fem) or das (neut) in both nominative and accusative.

Inverted Word Order in German

Word order in German is more flexible than English. Whereas English is always subject-verb-object, German can be both subject-verb-object and sometimes object-verb-subject. Compare the two examples. Both mean “The woman sees the man.”

Die Frau sieht den Mann.
Den Mann sieht die Frau.

Inverted word order like the sentences above is often used in certain conversational situations. Most often, inverted word order is used when a speaker wants to emphasize the object of the sentence.

Click on the two sentences above to hear what these sentences sound like.
As you may have just heard, it is also natural in German to place an accent on the first noun in the sentence, when it is the direct object. In other words, the first noun will often be louder and higher in pitch than the other words in the sentence.

Thus, case markings on articles become important so that you don’t misinterpret who does what to whom. Learners of German often rely on word order to determine who did what to whom, thinking the first noun is always the subject. But it may not be!

If you see or hear den in front of a noun, that noun is not the “verb-er” and thus not the subject of the sentence.

Structured Input Sentences for Referential Activity (Experiments 1 and 2)

1. Den Hund hört die Katze  OVS
2. Den Studenten sieht die Lehrerin.  OVS
3. Den Jungen umarmt das Mädchen.  OVS
4. Der Affe schüttelt den Jungen.  SVO
5. Die Katze beißt der Hund  OVS
6. Den Mann zieht der Esel.  OVS
7. Das Kind findet der Vater.  OVS
8. Der Mann tötet den Löwen.  SVO
9. Den Sohn ruft der Vater.  OVS
10. Den Jungen liebt das Mädchen.  OVS
11. Den Mann hört der Löwe nicht.  OVS
12. Die Lehrerin sieht den Studenten.  SVO
13. Den jungen Mann ruft das Mädchen.  OVS
14. Den Präsidenten sieht der Vizepräsident.  OVS
15. Den Sohn küssst die Mutter.  OVS
16. Der Vater hasst die Mutter.  SVO
17. Den Arzt ersticht der Patient.  OVS
18. Den Hund stoppt der Affe.  OVS
19. Den Vater liebt der Sohn.  OVS
20. Der Vogel sucht die Katze.  SVO
21. Den Löwen jagt der Tiger.  OVS
22. Die Oma hört der Opa.  OVS
23. Das Mädchen umarmt der Junge.  OVS
24. Der Junge schüttelt den Affen.  SVO
25. Den Löwen tötet der Mann  OVS
26. Den Ehemann versteht die Ehefrau nicht.  OVS
27. Den Sohn liebt der Vater.  OVS
28. Die Oma hört den Opa.  SVO
29. Die Katze hört der Hund.  OVS
30. Den Affen beißt der Hund.  OVS

Additional Structured Input Sentences for Referential Activity (Experiments 2)

31. Den Esel zieht der Mann.  OVS
32. Der Präsident sieht den Vizepräsidenten.  SVO
33. Die Mutter hasst der Vater.  OVS
34. Den Jungen schüttelt der Affe.  OVS
35. Den Hund hört die Katze.  OVS
36. Der Löwe jagt den Tiger.  SVO
37. Die Lehrerin führt der Student.  OVS
38. Den Mann schiebt der Esel.  OVS
39. Den Affen stoppt der Hund.  OVS
40. Der Vater liebt den Sohn.  SVO
41. Die Ehefrau versteht der Ehemann nicht.  OVS
42. Den Mann zieht der Esel.  OVS
43. Den Löwen hört der Mann nicht.  OVS
44. Der Patient ersticht den Arzt.  SVO
45. Das Auto schiebt der Lieferwagen.  OVS
46. Den Löwen jagt der Tiger.  OVS
47. Den Studenten führt die Lehrerin.  OVS
48. Der Mann schiebt den Esel.  SVO
49. Den Hund beißt der Affe.  OVS
50. Das Mädchen hört der Junge.  OVS
### Affective Activity 1:

**Step 1:** Think about your best male friend. Then indicate whether or not each statement about your best friend applies to you.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Ja, das stimmt für mich</th>
<th>Nein, das stimmt für mich nicht</th>
</tr>
</thead>
<tbody>
<tr>
<td>Den Freund rufe ich oft an.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Den Freund verstehe ich gut.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Den Freund sehe ich oft.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Den Freund umarme ich, wenn wir uns sehen.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Den Freund frage ich um Rat (\textit{advice}).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Den Freund respektiere ich viel.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Step 2:** Now think about a close male family member (der Verwandte). Indicate whether the same statements apply for him.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Ja, das stimmt für mich</th>
<th>Nein, das stimmt für mich nicht</th>
</tr>
</thead>
<tbody>
<tr>
<td>Den Verwandten rufe ich oft an.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Den Verwandten verstehe ich gut.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Den Verwandten sehe ich oft.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Den Verwandten umarme ich, wenn wir uns sehen.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Den Verwandten frage ich um Rat (\textit{advice}).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Den Verwandten liebe ich viel.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Step 3. Look at your answers from steps 1 and 2. Did you answer any question in Step 2 differently from the same question in Step 1? How many did you answer differently?

Step 4. How would you describe your relationship with these two people: (a) very similar, (b) somewhat different, or (c) very different? Write 2 sentences in English to explain what you decided and explain why.

Affective Activity 2:

Andre Agassi and Steffi Graf are professional tennis players, marriage partners, and parents. Steffi is a particularly good wife and she supports her husband (den Mann) in many ways.

Step 1: Look at the list of her actions as a wife, and decide which of her caring actions are absolute essentials for a good marriage. Rank them from most important (1) to least important (7) Feel free to give more than one item the same ranking if you truly believe that they are equally important.

<table>
<thead>
<tr>
<th>Ranking</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>_______</td>
<td>Den Mann liebt sie sehr.</td>
</tr>
<tr>
<td>_______</td>
<td>Den Mann kritisiert sie nicht.</td>
</tr>
<tr>
<td>_______</td>
<td>Den Mann versteht sie gut.</td>
</tr>
<tr>
<td>_______</td>
<td>Den Mann umarmt sie viel.</td>
</tr>
<tr>
<td>_______</td>
<td>Den Mann unterstützt sie in schlechten Zeiten.</td>
</tr>
<tr>
<td>_______</td>
<td>Den Mann respektiert sie.</td>
</tr>
<tr>
<td>_______</td>
<td>Den Mann ärgert sie nicht oft.</td>
</tr>
</tbody>
</table>

Step 2: Your instructor has also ranked the nice things a wife might do for her husband in order of importance. Look at his/her rankings below:

1. Den Mann liebt sie sehr.
2. Den Mann respektiert sie.
3. Den Mann versteht sie gut.
4. Den Mann unterstützt sie in schlechten Zeiten.
5. Den Mann umarmt sie viel.
6. Den Mann ärgert sie nicht oft.
7. Den Mann kritisiert sie nicht.

Did you tend to agree about the most essential qualities in a good spouse? Were your answers: (a) very similar, (b) somewhat different, or (c) very different? Write 2 sentences in English to explain what you decided and explain why.
Appendix F  Sentence Interpretation Task

Target Items for Experiment 1

Version A

1. Das Lamm riecht den Wolf neben dem Fluss.
   Does the wolf smell the lamb?

2. Den Dichter bewundert die Autorin aus der Romantik.
   Does the author admire the poet?

3. Der Ehemann bittet die Ehefrau um Verzeihung.
   Is the woman asking for forgiveness?

   Does the teacher greet the students?

5. Die Assistentin fotografiert den Manager für die Webseite.
   Is the assistant photographing the manager?

   Is the coach criticizing the athlete?

7. Der Prinz vermisst die Königin während des Kriegs.
   Does the prince miss the queen?

8. Die Köchin umarmt der Tierarzt vor der Tür.
   Does the woman hug the man first?

Version B

1. Die Frau küsst der Kellner in dem kleinen Restaurant.
   Does the woman kiss the waiter first?

2. Der Teenager ruft die Schwester nach der Schule an.
   Does the sister call the teenager?

3. Der Räuber verletzt die Polizistin an dem Tatort.
   Does the thief injure the police officer?

4. Den Piloten weckt die Stewardess am Morgen.
   Is the stewardess waking up the pilot?
5. Den Vater ärgert die Tochter in dem Wohnzimmer.
   Is the father annoying the daughter?

   Is the niece shoving the uncle?

7. Die Oma überrascht der Opa während der Party.
   Is the grandpa throwing the grandma a party?

8. Die Professorin stört den Studenten in der Bibliothek.
   Is the student disturbing the professor?

Target Items for Experiment 2

Version A

1. Das Lamm riecht den Wolf neben dem Fluss.
   Does the wolf smell the lamb?

2. Den Dichter bewundert die Autorin aus der Romantik.
   Does the author admire the poet?

3. Der Jogger trägt die Trainerin wegen der Verletzung
   Is the trainer carrying the jogger?

   Does the teacher greet the students?

5. Die Assistentin fotografiert den Manager für die Webseite.
   Is the assistant photographing the manager?

   Is the coach criticizing the athlete?

7. Der Prinz vermisst die Königin während des Kriegs.
   Does the prince miss the queen?

8. Die Sängerin kennt der Gitarrist von dem Album.
   Does the singer know the guitarist?
Version B

1. Die Frau küsst den Kellner in dem kleinen Restaurant.
   Does the woman kiss the waiter first?

2. Der Teenager ruft die Schwester nach der Schule an.
   Does the sister call the teenager?

3. Der Sohn besucht die Familie während des Semesters.
   Does the son visit his family?

4. Den Piloten weckt die Stewardess am Morgen.
   Is the stewardess waking up the pilot?

5. Den Vater ärgert die Tochter in dem Wohnzimmer.
   Is the father annoying the daughter?

6. Die Sekretärin sieht den Kaufmann neben dem Tisch stehen.
   Does the secretary see the business man?

7. Die Oma überrascht den Opa während der Party.
   Is the grandpa surprising the grandma?

8. Die Professorin stört den Studenten in der Bibliothek.
   Is the student disturbing the professor?
Appendix G  Picture Description Task

Target Items for Experiments 1 and 2

VERSION A

What is the boy doing with his friend (der Freund)?

Verbs

telefonieren
sehen
tragen

What is the woman doing with the key (der Schlüssel)?

Verbs

sehen
abholen
stellen
VERSION B

What is the boy doing with the double bass (der Bass)?

Verbs
- sehen
- kaufen
- spielen

What is the girl doing with her father (der Vater)?

Verbs
- anrufen
- sehen
- umarmen
## Appendix H  Self-Paced Reading Stimuli

### Experimental Items

<table>
<thead>
<tr>
<th>Item</th>
<th>Sentence</th>
<th>Comprehension Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>Der Kellner / küsst / die Frau / im / Restaurant / neben / dem Kino.</td>
<td>Are the people eating out?</td>
</tr>
<tr>
<td>1b</td>
<td>Die Frau / küsst / den Kellner / im / Restaurant / neben / dem Kino.</td>
<td>Are the people eating out?</td>
</tr>
<tr>
<td>1c</td>
<td>Den Kellner / küsst / die Frau / im / Restaurant / neben / dem Kino.</td>
<td>Are the people eating out?</td>
</tr>
<tr>
<td>1d</td>
<td>Die Frau / küsst / der Kellner / im / Restaurant / neben / dem Kino.</td>
<td>Are the people eating out?</td>
</tr>
<tr>
<td>2a</td>
<td>Der Vater / ärgert / die Tochter / im / Wohnzimmer.</td>
<td>Are the father and his daughter in the same place?</td>
</tr>
<tr>
<td>2b</td>
<td>Die Tochter / ärgert / den Vater / im / Wohnzimmer.</td>
<td>Are the father and his daughter in the same place?</td>
</tr>
<tr>
<td>2c</td>
<td>Den Vater / ärgert / die Tochter / im / Wohnzimmer.</td>
<td>Are the father and his daughter in the same place?</td>
</tr>
<tr>
<td>2d</td>
<td>Die Tochter / ärgert / der Vater / im / Wohnzimmer.</td>
<td>Are the father and his daughter in the same place?</td>
</tr>
<tr>
<td>3a</td>
<td>Der Student / stört / die Professorin / in / der Bibliothek.</td>
<td>Is the professor in his office?</td>
</tr>
<tr>
<td>3b</td>
<td>Die Professorin / stört / den Studenten / in / der Bibliothek.</td>
<td>Is the professor in his office?</td>
</tr>
<tr>
<td>3c</td>
<td>Den Studenten / stört / die Professorin / in / der Bibliothek.</td>
<td>Is the professor in his office?</td>
</tr>
<tr>
<td>3d</td>
<td>Die Professorin / stört / der Student / in / der Bibliothek.</td>
<td>Is the professor in his office?</td>
</tr>
<tr>
<td>4a</td>
<td>Der Tierarzt / umarmt / die Köchin / vor / der Tür.</td>
<td>Are the people behind the house?</td>
</tr>
<tr>
<td>4b</td>
<td>Die Köchin / umarmt / den Tierarzt / vor / der Tür.</td>
<td>Are the people behind the house?</td>
</tr>
<tr>
<td>4c</td>
<td>Den Tierarzt / umarmt / die Köchin / vor / der Tür.</td>
<td>Are the people behind the house?</td>
</tr>
<tr>
<td>4d</td>
<td>Die Köchin / umarmt / der Tierarzt / vor / der Tür.</td>
<td>Are the people behind the house?</td>
</tr>
<tr>
<td>5a</td>
<td>Der Junge / verliert / die Mutter / im / Supermarkt.</td>
<td>Are the mother and child at the mall?</td>
</tr>
<tr>
<td>5b</td>
<td>Die Mutter / verliert / den Jungen / im / Supermarkt.</td>
<td>Are the mother and child at the mall?</td>
</tr>
<tr>
<td>5c</td>
<td>Den Jungen / verliert / die Mutter / im / Supermarkt.</td>
<td>Are the mother and child at the mall?</td>
</tr>
<tr>
<td>5d</td>
<td>Die Mutter / verliert / der Junge / im / Supermarkt.</td>
<td>Are the mother and child at the mall?</td>
</tr>
<tr>
<td>6a</td>
<td>Der Soldat / rettet / die Agentin / vor / der Bombe.</td>
<td>Was the person saved from gunfire?</td>
</tr>
<tr>
<td>6b</td>
<td>Die Agentin / rettet / den Soldaten / vor / der Bombe.</td>
<td>Was the person saved from gunfire?</td>
</tr>
</tbody>
</table>
6c Den Soldaten / rettet / die Agentin / vor / der Bombe.  Was the person saved from gunfire?
6d Die Agentin / rettet / der Soldat / vor / der Bombe.  Was the person saved from gunfire?

7a Der Prinz / vermisst / die Königin / während / des Krieges / in / Afrika.  Is the prince away at war?
7b Die Königin / vermisst / den Prinzen / während / des Krieges / in / Afrika.  Is the prince away at war?
7c Den Prinzen / vermisst / die Königin / während / des Krieges / in / Afrika.  Is the prince away at war?
7d Die Königin / vermisst / der Prinz / während / des Krieges / in / Afrika.  Is the prince away at war?

8a Der Wolf / riecht / das Lamm / neben / dem Fluss.  Are the animals close to water?
8b Das Lamm / riecht / den Wolf / neben / dem Fluss.  Are the animals close to water?
8c Den Wolf / riecht / das Lamm / neben / dem Fluss.  Are the animals close to water?
8d Die Lamm / riecht / der Wolf / neben / dem Fluss.  Are the animals close to water?

9a Der Jogger / trägt / die Trainerin / wegen / der Verletzung.  Did one of the people get hurt?
9b Die Trainerin / trägt / den Jogger / wegen / der Verletzung.  Did one of the people get hurt?
9c Den Jogger / trägt / die Trainerin / wegen / der Verletzung.  Did one of the people get hurt?
9d Die Trainerin / trägt / der Jogger / wegen / der Verletzung.  Did one of the people get hurt?

10a Der Ehemann / bittet / die Ehefrau / um / Verzeihung.  Did someone ask for forgiveness?
10b Die Ehefrau / bittet / den Ehemann / um / Verzeihung.  Did someone ask for forgiveness?
10c Den Ehemann / bittet / die Ehefrau / um / Verzeihung.  Did someone ask for forgiveness?
10d Die Ehefrau / bittet / der Ehemann / um / Verzeihung.  Did someone ask for forgiveness?

11a Der Coach / kritisiert / die Athletin / nach / dem Spiel.  Are the coach and athlete at practice?
11b Die Athletin / kritisiert / den Coach / nach / dem Spiel.  Are the coach and athlete at practice?
11c Den Coach / kritisiert / die Athletin / nach / dem Spiel.  Are the coach and athlete at practice?
11d Die Athletin / kritisiert / der Coach / nach / dem Spiel.  Are the coach and athlete at practice?

12a Der Sohn / besucht / die Familie / während / des Semesters.  Is the visit happening during the summer break?
12b Die Familie / besucht / den Sohn / während / des Semesters.  Is the visit happening during the summer break?
12c Den Sohn / besucht / die Familie / während / des Semesters.  Is the visit happening during the summer break?
12d Die Familie / besucht / der Sohn / während / des Semesters.  
Is the visit happening during the summer break?

13a Der Lehrer / grüßt / die Klasse / am / Morgen.  
Does the class greet the teacher?

13b Die Klasse / grüßt / den Lehrer / am / Morgen.  
Does the teacher greet the class?

13c Den Lehrer / grüßt / die Klasse / am / Morgen.  
Does the teacher greet the class?

13d Die Klasse / grüßt / der Lehrer / am / Morgen.  
Does the class greet the teacher?

14a Der Vetter / verfolgt / die Kusine / ins / Haus.  
Is the girl chasing her cousin?

14b Die Kusine / verfolgt / den Vetter / ins / Haus.  
Is the boy chasing his cousin?

14c Den Vetter / verfolgt / die Kusine / ins / Haus.  
Is the boy chasing his cousin?

14d Die Kusine / verfolgt / der Vetter / ins / Haus.  
Is the girl chasing her cousin?

15a Der Opa / überrascht / die Oma / während / der Party.  
Does the grandpa surprise grandma?

15b Die Oma / überrascht / den Opa / während / der Party.  
Does the grandma surprise grandpa?

15c Den Opa / überrascht / die Oma / während / der Party.  
Does the grandma surprise grandpa?

15d Die Oma / überrascht / der Opa / während / der Party.  
Does the grandma surprise grandpa?

16a Der Manager / fotografiert / die Assistentin / für / die Webseite / der Firma.  
Is the manager photographing the assistant?

16b Die Assistentin / fotografiert / den Manager / für / die Webseite / der Firma.  
Is the assistant photographing the manager?

16c Den Manager / fotografiert / die Assistentin / für / die Webseite / der Firma.  
Is the assistant photographing the manager?

16d Die Assistentin / fotografiert / der Manager / für / die Webseite / der Firma.  
Is the manager photographing the assistant?

17a Der Dichter / bewundert / die Autorin / aus / der Romantik.  
Does the poet admire the author?

17b Die Autorin / bewundert / den Dichter / aus / der Romantik.  
Does the author admire the poet?

17c Den Dichter / bewundert / die Autorin / aus / der Romantik.  
Does the author admire the poet?

17d Die Autorin / bewundert / der Dichter / aus / der Romantik.  
Does the poet admire the author?

18a Der Gitarrist / kennt / die Sängerin / von / dem Album.  
Does the guitarist know the singer?

18b Die Sängerin / kennt / den Gitarristen / von / dem Album.  
Does the singer know the guitarist?

18c Den Gitarristen / kennt / die Sängerin / von / dem Album.  
Does the singer know the guitarist?

18d Die Sängerin / kennt / der Gitarrist / von / dem Album.  
Does the guitarist know the singer?
19a Der Teenager / ruft / die Schwester / nach / der Schule / an. Is the sister making a phone call?
19b Die Schwester / ruft / den Teenager / nach / der Schule / an. Is the teenager making a phone call?
19c Den Teenager / ruft / die Schwester / nach / der Schule / an. Is the sister making a phone call?
19d Die Schwester / ruft / der Teenager / nach / der Schule / an. Is the sister making a phone call?

20a Der Diplomat / trifft / die Ministerin / aus / Kanada. Is the minister meeting the diplomat?
20b Die Ministerin / trifft / den Diplomaten / aus / Kanada. Is the diplomat meeting the minister?
20c Den Diplomaten / trifft / die Ministerin / aus / Kanada. Is the minister meeting the diplomat?
20d Die Ministerin / trifft / der Diplomaten / aus / Kanada. Is the minister meeting the diplomat?

21a Der Kaufmann / sieht / die Sekretärin / neben / dem Tisch / stehen. Does the secretary see the business man?
21b Die Sekretärin / sieht / den Kaufmann / neben / dem Tisch / stehen. Does the business man see the secretary?
21c Den Kaufmann / sieht / die Sekretärin / neben / dem Tisch / stehen. Does the business man see the secretary?
21d Die Sekretärin / sieht / der Kaufmann / neben / dem Tisch / stehen. Does the secretary see the business man?

22a Der Pilot / weckt / die Stewardess / am / Morgen. Does the stewardess wake up the pilot?
22b Die Stewardess / weckt / den Piloten / am / Morgen. Does the pilot wake up the stewardess?
22c Den Piloten / weckt / die Stewardess / am / Morgen. Does the stewardess wake up the pilot?
22d Die Stewardess / weckt / der Pilot / am / Morgen. Does the pilot wake up the stewardess?

23a Der Onkel / schiebt / die Nichte / aus / dem Zimmer. Does the uncle shove the niece?
23b Die Nichte / schiebt / den Onkel / aus / dem Zimmer. Does the niece shove the uncle?
23c Den Onkel / schiebt / die Nichte / aus / dem Zimmer. Does the niece shove the uncle?
23d Die Nichte / schiebt / der Onkel / aus / dem Zimmer. Does the uncle shove the niece?

24a Der Räuber / verletzt / die Polizistin / an / dem Tatort. Does the thief injure the police officer?
24b Die Polizistin / verletzt / den Räuber / an / dem Tatort. Does the police officer injure the thief?
24c Den Räuber / verletzt / die Polizistin / an / dem Tatort. Does the police officer injure the thief?
24d Die Polizistin / verletzt / der Räuber / an / dem Tatort. Does the thief injure the police officer?
<table>
<thead>
<tr>
<th>Item</th>
<th>Sentence</th>
<th>Comprehension Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>101a</td>
<td>Der Taxifahrer / sieht / den Fan / neben / der Straße.</td>
<td>Is the fan standing close to the street?</td>
</tr>
<tr>
<td>101b</td>
<td>Der Taxifahrer / sieht / den Fan / neben / der Straße.</td>
<td>Is the fan standing close to the street?</td>
</tr>
<tr>
<td>102a</td>
<td>Der Experte / hört / den Arzt / im / Gerichtssaal / sprechen.</td>
<td>Are the people in a courtroom?</td>
</tr>
<tr>
<td>102b</td>
<td>Der Experte / hört / der Arzt / im / Gerichtssaal / sprechen.</td>
<td>Are the people in a courtroom?</td>
</tr>
<tr>
<td>103a</td>
<td>Der Schauspieler / erkennt / den Musiker / von / den Fotos.</td>
<td>Does the actor recognize the musician?</td>
</tr>
<tr>
<td>103b</td>
<td>Der Schauspieler / erkennt / der Musiker / von / den Fotos.</td>
<td>Does the actor recognize the musician?</td>
</tr>
<tr>
<td>104a</td>
<td>Der Babysitter / findet / den Jungen / während / des Spiels.</td>
<td>Were the people playing hide-and-seek?</td>
</tr>
<tr>
<td>104b</td>
<td>Der Babysitter / findet / der Junge / während / des Spiels.</td>
<td>Were the people playing hide-and-seek?</td>
</tr>
<tr>
<td>105a</td>
<td>Der Lastwagen / zieht / den Jeep / aus / dem Dreck.</td>
<td>Is the jeep stuck in the mud?</td>
</tr>
<tr>
<td>105b</td>
<td>Der Lastwagen / zieht / der Jeep / aus / dem Dreck.</td>
<td>Is the jeep stuck in the mud?</td>
</tr>
<tr>
<td>106a</td>
<td>Der Kandidat / respektiert / den Präsidenten / wegen / seiner / Politik.</td>
<td>Does the candidate respect the president?</td>
</tr>
<tr>
<td>106b</td>
<td>Der Kandidat / respektiert / der Präsident / wegen / seiner / Politik.</td>
<td>Does the candidate respect the president?</td>
</tr>
<tr>
<td>107a</td>
<td>Der Schüler / erschreckt / den Nachbarn / mit / seinem / furchtbaren / Heavymetal.</td>
<td>Does the student listen to classical music?</td>
</tr>
<tr>
<td>107b</td>
<td>Der Schüler / erschreckt / der Nachbar / mit / seinem / furchtbaren / Heavymetal.</td>
<td>Does the student listen to classical music?</td>
</tr>
<tr>
<td>108a</td>
<td>Der Politiker / kritisiert / den Rebellen / in / einem / Interview / mit / CNN.</td>
<td>Did the politician praise the rebel?</td>
</tr>
<tr>
<td>108b</td>
<td>Der Politiker / kritisiert / der Rebell / in / einem / Interview / mit / CNN.</td>
<td>Did the politician praise the rebel?</td>
</tr>
</tbody>
</table>
**Filler Group B**

<table>
<thead>
<tr>
<th>Item</th>
<th>Sentence</th>
<th>Comprehension Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>25a</td>
<td>Gestern / hörte / der Autor / dem Album / im / Büro / zu.</td>
<td>Did the author watch a TV show?</td>
</tr>
<tr>
<td>25b</td>
<td>Der Autor / hörte / gestern / dem Album / im / Büro / zu.</td>
<td>Did the author watch a TV show?</td>
</tr>
<tr>
<td>25c</td>
<td>Gestern / hört / der Autor / dem Album / im / Büro / zu.</td>
<td>Did the author watch a TV show?</td>
</tr>
<tr>
<td>25d</td>
<td>Der Autor / hört / gestern / dem Album / im / Büro / zu.</td>
<td>Did the author watch a TV show?</td>
</tr>
<tr>
<td>26a</td>
<td>Letzte Woche / machten / die Studenten / die Aufgaben / in / der Bibliothek.</td>
<td>Were the students in their dorm rooms?</td>
</tr>
<tr>
<td>26b</td>
<td>Die Studenten / machten / letzte Woche / die Aufgaben / in / der Bibliothek.</td>
<td>Were the students in their dorm rooms?</td>
</tr>
<tr>
<td>26c</td>
<td>Letzte Woche / machen / die Studenten / die Aufgaben / in / der Bibliothek.</td>
<td>Were the students in their dorm rooms?</td>
</tr>
<tr>
<td>26d</td>
<td>Die Studenten / machen / letzte Woche / die Aufgaben / in / der Bibliothek.</td>
<td>Were the students in their dorm rooms?</td>
</tr>
<tr>
<td>27a</td>
<td>Gestern Abend / arbeiteten / die Metzger / im / alten / Supermarkt.</td>
<td>Did the butchers work in their own shop?</td>
</tr>
<tr>
<td>27b</td>
<td>Der Metzger / arbeiteten / gestern Abend / im / alten / Supermarkt.</td>
<td>Did the butchers work in their own shop?</td>
</tr>
<tr>
<td>27c</td>
<td>Gestern Abend / arbeiten / die Metzger / im / alten / Supermarkt.</td>
<td>Did the butchers work in their own shop?</td>
</tr>
<tr>
<td>27d</td>
<td>Die Metzger / arbeiten / gestern Abend / im / alten / Supermarkt.</td>
<td>Did the butchers work in their own shop?</td>
</tr>
<tr>
<td>28a</td>
<td>Letzte Woche / beantworteten / die Eltern / die Emails / von / ihren / Kindern.</td>
<td>Were the E-Mails from the parents' colleagues?</td>
</tr>
<tr>
<td>28b</td>
<td>Die Eltern / beantworteten / letzte Woche / die Emails / von / ihren / Kindern.</td>
<td>Were the E-Mails from the parents' colleagues?</td>
</tr>
<tr>
<td>28c</td>
<td>Letzte Woche / beantworten / die Eltern / die Emails / von / ihren / Kindern.</td>
<td>Were the E-Mails from the parents' colleagues?</td>
</tr>
<tr>
<td>28d</td>
<td>Die Eltern / beantworten / letzte Woche / die Emails / von / ihren / Kindern.</td>
<td>Were the E-Mails from the parents' colleagues?</td>
</tr>
<tr>
<td>29a</td>
<td>Letzte Woche / kochte / die Freundin / das Essen / für / ihren / Freund.</td>
<td>Did the girlfriend buy her boyfriend dinner?</td>
</tr>
<tr>
<td>29b</td>
<td>Die Freundin / kochte / letzte Woche / das Essen / für / ihren / Freund.</td>
<td>Did the girlfriend buy her boyfriend dinner?</td>
</tr>
<tr>
<td>29c</td>
<td>Letzte Woche / kocht / die Freundin / das Essen / für / ihren / Freund.</td>
<td>Did the girlfriend buy her boyfriend dinner?</td>
</tr>
<tr>
<td>29d</td>
<td>Die Freundin / kocht / letzte Woche / das Essen / für / ihren / Freund.</td>
<td>Did the girlfriend buy her boyfriend dinner?</td>
</tr>
<tr>
<td>30a</td>
<td>Gestern Abend / spielten / die Mechaniker / ein Kartenspiel / in / der Garage.</td>
<td>Did the mechanics play videogames?</td>
</tr>
</tbody>
</table>
30b Die Mechaniker spielten gestern Abend ein Kartenspiel in der Garage. Did the mechanics play videogames?
30c Gestern Abend spielen die Mechaniker ein Kartenspiel in der Garage. Did the mechanics play videogames?
30d Die Mechaniker spielen gestern Abend ein Kartenspiel in der Garage. Did the mechanics play videogames?

31a Letztes Jahr reiste der General für ein Treffen in die Türkei. Did the General make a call to Turkey?
31b Der General reiste letztes Jahr für ein Treffen in die Türkei. Did the General make a call to Turkey?
31c Letztes Jahr reist der General für ein Treffen in die Türkei. Did the General make a call to Turkey?
31d Der General reist letztes Jahr für ein Treffen in die Türkei. Did the General make a call to Turkey?

32a Gestern guckten die Kollegen die Fernsehshow in der Wohnung. Did the colleagues watch a movie together?
32b Die Kollegen guckten gestern die Fernsehshow in der Wohnung. Did the colleagues watch a movie together?
32c Gestern gucken die Kollegen die Fernsehshow in der Wohnung. Did the colleagues watch a movie together?
32d Die Kollegen gucken gestern die Fernsehshow in der Wohnung. Did the colleagues watch a movie together?

33a Gestern Abend wanderte der Ritter im dunklen Wald. Was the knight in a large castle?
33b Der Ritter wanderte gestern Abend im dunklen Wald. Was the knight in a large castle?
33c Gestern Abend wandert der Ritter im dunklen Wald. Was the knight in a large castle?
33d Der Ritter wandert gestern Abend im dunklen Wald. Was the knight in a large castle?

34a Letzten Monat diskutierten die Kandidaten die Wirtschaft in einer Debatte. Did the candidates discuss the wars?
34b Die Kandidaten diskutierten letzten Monat die Wirtschaft in einer Debatte. Did the candidates discuss the wars?
34c Letzten Monat diskutieren die Kandidaten die Wirtschaft in einer Debatte. Did the candidates discuss the wars?
34d Die Kandidaten diskutieren letzten Monat die Wirtschaft in einer Debatte. Did the candidates discuss the wars?

35a Gestern wartete der Tourist zehn Minuten auf einen Bus. Did the tourist wait over an hour?
35b Der Tourist wartete gestern zehn Minuten auf einen Bus. Did the tourist wait over an hour?
35c Gestern wartet der Tourist zehn Minuten auf einen Bus. Did the tourist wait over an hour?
35d Der Tourist wartet gestern zehn Minuten auf einen Bus. Did the tourist wait over an hour?

36a Letzte Woche tanzten die Ballerinen im großen Ballsaal. Were the people in a big club?
36b Die Ballerinen tanzten letzte Woche im großen Ballsaal. Were the people in a big club?
36c Letzte Woche / tanzen / die Ballerinen / im / großen / Ballsaal. / Were the people in a big club?
36d Die Ballerinen / tanzen / letzte Woche / im / großen / Ballsaal. / Were the people in a big club?

37a Letztes Jahr / backte / der Bäcker / einen / Kuchen / für / die Hochzeit. Was the cake for a wedding?
37b Der Bäcker / backte / letztes Jahr / einen / Kuchen / für / die Hochzeit. Was the cake for a wedding?
37c Letztes Jahr / backt / der Bäcker / einen / Kuchen / für / die Hochzeit. Was the cake for a wedding?
37d Der Bäcker / backt / letztes Jahr / einen / Kuchen / für / die Hochzeit. Was the cake for a wedding?

38a Gestern / kauften / die Freunde / einen / blauen / Stuhl / für / die Wohnung. Did the friends buy furniture?
38b Die Freunde / kauften / gestern / einen / blauen / Stuhl / für / die Wohnung. Did the friends buy furniture?
38c Gestern / kaufen / die Freunde / einen / blauen / Stuhl / für / die Wohnung. Did the friends buy furniture?
38d Die Freunde / kaufen / gestern / einen / blauen / Stuhl / für / die Wohnung. Did the friends buy furniture?

39a Letzte Woche / lernte / der Schüler / für / die Prüfung / in / Biologie. Was there a test in the student's class?
39b Der Schüler / lernte / letzte Woche / für / die Prüfung / in / Biologie. Was there a test in the student's class?
39c Letzte Woche / lern / der Schüler / für / die Prüfung / in / Biologie. Was there a test in the student's class?
39d Der Schüler / lernt / letzte Woche / für / die Prüfung / in / Biologie. Was there a test in the student's class?

40a Gestern Abend / planten / die Arbeiter / eine / Party / für / ihren / Boss. Was there a party at the office?
40b Die Arbeiter / planten / gestern Abend / eine / Party / für / ihren / Boss. Was there a party at the office?
40c Gestern Abend / planen / die Arbeiter / eine / Party / für / ihren / Boss. Was there a party at the office?
40d Die Arbeiter / planen / gestern Abend / eine / Party / für / ihren / Boss. Was there a party at the office?

41a Letzten Sommer / suchte / das Model / einen / schönen / Rock / im / Geschäft. Was the model looking new clothes?
41b Das Model / suchte / letzten Sommer / einen / schönen / Rock / im / Geschäft. Was the model looking new clothes?
41c Letzten Sommer / sucht / das Model / einen / schönen / Rock / im / Geschäft. Was the model looking new clothes?
41d Das Model / sucht / letzten Sommer / einen / schönen / Rock / im / Geschäft. Was the model looking new clothes?

42a Letzten Winter / bauten / die Ingenieure / einen / Roboter / für / die Fabrik. Did the engineers build a robot?
42b Die Ingenieure / bauten / letzten Winter / einen / Roboter / für / die Fabrik. Did the engineers build a robot?
42c Letzten Winter / bauen / die Ingenieure / einen / Roboter / für / die Fabrik. Did the engineers build a robot?
42d Die Ingenieure / bauen / letzten Winter / einen / Roboter / für / die Fabrik. Did the engineers build a robot?

43a Letzten Winter / zeigte / der Künstler / seine / neuesten / Gemälde / in / der Galerie. Did the artist hold an exhibition?
43b Der Künstler / zeigte / letzten Winter / seine / neuesten / Gemälde / in / der Galerie. Did the artist hold an exhibition?
43c Letzten Winter / zeigt / der Künstler / seine / neuesten / Gemälde / in / der Galerie. Did the artist hold an exhibition?
43d Der Künstler / zeigt / letzten Winter / seine / neuesten / Gemälde / in / der Galerie. Did the artist hold an exhibition?

44a Letzten Sommer / töteten / die Spione / den Diktator / im / Palast. Was the dictator assassinated?
44b Die Spione / töteten / letzten Sommer / den Diktator / im / Palast. Was the dictator assassinated?
44c Letzten Sommer / töten / die Spione / den Diktator / im / Palast. Was the dictator assassinated?
44d Die Spione / töten / letzten Sommer / den Diktator / im / Palast. Was the dictator assassinated?

45a Letzten Sommer / pflanzte / der Gärtner / zwei / kleine / Pflanzen / im / Hinterhof. Did the gardeners plant two trees?
45b Der Gärtner / pflanzte / letzten Sommer / zwei / kleine / Pflanzen / im / Hinterhof. Did the gardeners plant two trees?
45c Letzten Sommer / pflanzt / der Gärtner / zwei / kleine / Pflanzen / im / Hinterhof. Did the gardeners plant two trees?
45d Der Gärtner / pflanzt / letzten Sommer / zwei / kleine / Pflanzen / im / Hinterhof. Did the gardeners plant two trees?

46a Letzten Winter / traute / der Pfarrer / das Ehepaar / in / der Kirche. Was the couple married in a church?
46b Der Pfarrer / traute / letzten Winter / das Ehepaar / in / der Kirche. Was the couple married in a church?
46c Letzten Winter / traut / der Pfarrer / das Ehepaar / in / der Kirche. Was the couple married in a church?
46d Der Pfarrer / traut / letzten Winter / das Ehepaar / in / der Kirche. Was the couple married in a church?

47a Letzten Winter / öffnete / das Geschäft / am / späten / Nachmittag. Did the store open in the afternoon?
47b Das Geschäft / öffnete / letzten Winter / am / späten / Nachmittag. Did the store open in the afternoon?
47c Letzten Winter / öffnet / das Geschäft / am / späten / Nachmittag. Did the store open in the afternoon?
47d Das Geschäft / öffnet / letzten Winter / am / späten / Nachmittag. Did the store open in the afternoon?

48a Letzten Sommer / lehrten / die Lehrer / einen / Kurs / über / Chemie. Was the course about science?
48b Die Lehrer / lehrten / letzten Sommer / einen / Kurs / über / Chemie. Was the course about science?
48c Letzten Sommer / lehren / die Lehrer / einen / Kurs / über / Chemie. Was the course about science?
### Filler Group C

<table>
<thead>
<tr>
<th>Item</th>
<th>Sentence</th>
<th>Comprehension Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>109</td>
<td>Die Ingenieurin / geht / heute / nach / Berlin.</td>
<td>Are the engineer and her friends taking a trip?</td>
</tr>
<tr>
<td>110</td>
<td>Die Krankenschwester / lacht / viel / über / den Film.</td>
<td>Is the film serious?</td>
</tr>
<tr>
<td>111</td>
<td>Das Theaterstück / dauert / ungefähr / vier / Stunden.</td>
<td>Is the play long?</td>
</tr>
<tr>
<td>112</td>
<td>Die Leute / wohnen / im / Süden / von / der Wüste.</td>
<td>Do the people live north of the desert?</td>
</tr>
<tr>
<td>113</td>
<td>Der Ring / kostet / im / Moment / nur / dreihundert / Euro.</td>
<td>Is the ring usually more expensive?</td>
</tr>
<tr>
<td>114</td>
<td>Die Lampe / steht / in / der Ecke / des Wohnzimmers.</td>
<td>Is the lamp in the bedroom?</td>
</tr>
<tr>
<td>115</td>
<td>Die Putzfrau / kauft / ein / Geschenk / für / den Geburtstag / ihrer / Tante.</td>
<td>Does the aunt have a birthday?</td>
</tr>
<tr>
<td>116</td>
<td>Der Geschäftsmann / bestellt / den Döner / mit / Schafkäse / zum / Mittagessen.</td>
<td>Is the teenage ordering a hamburger?</td>
</tr>
<tr>
<td>117</td>
<td>Die Handwerkerin / schneidet / sich / die Hand / an / einem / Messer.</td>
<td>Is the handworker injured?</td>
</tr>
<tr>
<td>118</td>
<td>Der Kritiker / genießt / das Konzert / vom / berühmten / Pianisten.</td>
<td>Does the critic dislike the music?</td>
</tr>
<tr>
<td>119</td>
<td>Die Designerin / hängt / ein Bild / an / die Wand.</td>
<td>Is the designer decorating a room?</td>
</tr>
<tr>
<td>120</td>
<td>Der Elektriker / mietet / die Wohnung / in / der Stalinallee.</td>
<td>Does the electrician own the apartment?</td>
</tr>
<tr>
<td>121</td>
<td>Der Bauer / sagt / dass / sein / Land / nicht / reich / ist.</td>
<td>Is the farmer's land bad?</td>
</tr>
<tr>
<td>122</td>
<td>Der Clown / weiß / dass / Kinder / Angst / vor / ihm / haben.</td>
<td>Do all of the children love the clown?</td>
</tr>
<tr>
<td>123</td>
<td>Der Feuerwehrmann / fragt / wie viele / Menschen / im / Haus / waren.</td>
<td>Is the fireman concerned about the people?</td>
</tr>
<tr>
<td>124</td>
<td>Der Arzt / merkt / dass / der Patient / sehr / stark / blutet.</td>
<td>Does the patient have a stomach ache?</td>
</tr>
<tr>
<td>125</td>
<td>Die Kundin / erwartet / dass / der Kassierer / ihr / helfen / wird.</td>
<td>Does the customer expect help?</td>
</tr>
<tr>
<td>126</td>
<td>Die Architektin / beschreibt / wie / das Gebäude / aussehen / soll.</td>
<td>Did the architect describe plans for a park?</td>
</tr>
</tbody>
</table>
# Appendix I Plausibility Norms for Self-Paced Reading Sentences

<table>
<thead>
<tr>
<th>Item</th>
<th>Sentences</th>
<th>Mean Rating</th>
<th>Mean Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Der Kellner küsst die Frau im Restaurant neben dem Kino. Die Frau küsst den Kellner im Restaurant neben dem Kino.</td>
<td>5.33</td>
<td>1.34</td>
</tr>
<tr>
<td>2</td>
<td>Der Vater ärgert die Tochter im Wohnzimmer. Die Tochter ärgert den Vater im Wohnzimmer.</td>
<td>6.00</td>
<td>0.89</td>
</tr>
<tr>
<td>3</td>
<td>Der Student stört die Professorin in der Bibliothek. Die Professorin stört den Studenten in der Bibliothek.</td>
<td>6.33</td>
<td>0.77</td>
</tr>
<tr>
<td>4</td>
<td>Der Tierarzt umarmt die Köchin vor der Tür. Die Köchin umarmt den Tierarzt vor der Tür.</td>
<td>5.44</td>
<td>0.45</td>
</tr>
<tr>
<td>5</td>
<td>Der Junge verliert die Mutter im Supermarkt. Die Mutter verliert den Jungen im Supermarkt.</td>
<td>4.22</td>
<td>2.56</td>
</tr>
<tr>
<td>6</td>
<td>Der Soldat rettet die Agentin vor der Bombe. Die Agentin rettet den Soldaten vor der Bombe.</td>
<td>6.11</td>
<td>1.00</td>
</tr>
<tr>
<td>7</td>
<td>Der Prinz vermisst die Königin während des Krieges in Afrika. Die Königin vermisst den Prinzen während des Krieges in Afrika.</td>
<td>5.67</td>
<td>0.44</td>
</tr>
<tr>
<td>8</td>
<td>Der Wolf riecht das Lamm neben dem Fluss. Das Lamm riecht den Wolf neben dem Fluss.</td>
<td>6.11</td>
<td>0.89</td>
</tr>
<tr>
<td>9</td>
<td>Der Jogger trägt die Trainerin wegen der Verletzung. Die Trainerin trägt den Jogger wegen der Verletzung.</td>
<td>4.13</td>
<td>1.98</td>
</tr>
<tr>
<td>10</td>
<td>Der Ehemann bittet die Ehefrau um Verzeihung. Die Ehefrau bittet den Ehemann um Verzeihung</td>
<td>6.33</td>
<td>0.33</td>
</tr>
<tr>
<td>11</td>
<td>Der Coach kritisiert die Athletin nach dem Spiel. Die Athletin kritisiert den Coach nach dem Spiel.</td>
<td>6.78</td>
<td>1.67</td>
</tr>
<tr>
<td>12</td>
<td>Der Sohn besucht die Familie während des Semesters. Die Familie besucht den Sohn während des Semesters.</td>
<td>6.44</td>
<td>0.56</td>
</tr>
<tr>
<td>13</td>
<td>Der Lehrer grüßt die Klasse am Morgen. Die Klasse grüßt den Lehrer am Morgen.</td>
<td>7.00</td>
<td>0.67</td>
</tr>
<tr>
<td>14</td>
<td>Der Vetter verfolgt die Kusine ins Haus. Die Kusine verfolgt den Vetter ins Haus.</td>
<td>6.00</td>
<td>0.33</td>
</tr>
</tbody>
</table>

240
<table>
<thead>
<tr>
<th></th>
<th>Vorgang</th>
<th>Position 1</th>
<th>Position 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>Der Opa überrascht die Oma während der Party.</td>
<td>6.56</td>
<td>0.34</td>
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<tr>
<td></td>
<td>Die Oma überrascht den Opa während der Party.</td>
<td>6.22</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Der Manager fotografiert die Assistentin für die Webseite der Firma.</td>
<td>5.13</td>
<td>1.65</td>
</tr>
<tr>
<td></td>
<td>Die Assistentin fotografiert den Manager für die Webseite der Firma.</td>
<td>6.78</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Der Dichter bewundert die Autorin aus der Romantik.</td>
<td>4.67</td>
<td>1.89</td>
</tr>
<tr>
<td></td>
<td>Die Autorin bewundert den Dichter aus der Romantik.</td>
<td>6.56</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Der Gitarrist kennt die Sängerin von dem Album.</td>
<td>6.22</td>
<td>0.44</td>
</tr>
<tr>
<td></td>
<td>Die Sängerin kennt den Gitarristen von dem Album.</td>
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<td></td>
</tr>
<tr>
<td>19</td>
<td>Der Teenager ruft die Schwester nach der Schule an.</td>
<td>6.56</td>
<td>2.34</td>
</tr>
<tr>
<td></td>
<td>Die Schwester ruft den Teenager nach der Schule an.</td>
<td>4.22</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Der Diplomat trifft die Ministerin aus Kanada.</td>
<td>7.00</td>
<td>0.11</td>
</tr>
<tr>
<td></td>
<td>Die Ministerin trifft den Diplomaten aus Kanada.</td>
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<td></td>
</tr>
<tr>
<td>21</td>
<td>Der Kaufmann sieht die Sekretärin neben dem Tisch stehen.</td>
<td>6.33</td>
<td>1.55</td>
</tr>
<tr>
<td></td>
<td>Die Sekretärin sieht den Kaufmann neben dem Tisch stehen.</td>
<td>4.78</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Der Pilot weckt die Stewardess am Morgen.</td>
<td>4.00</td>
<td>1.56</td>
</tr>
<tr>
<td></td>
<td>Die Stewardess weckt den Piloten am Morgen.</td>
<td>5.56</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Der Onkel schiebt die Nichte aus dem Zimmer.</td>
<td>5.33</td>
<td>0.34</td>
</tr>
<tr>
<td></td>
<td>Die Nichte schiebt den Onkel aus dem Zimmer.</td>
<td>5.67</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Der Räuber verletzt die Polizistin an dem Tatort.</td>
<td>5.33</td>
<td>1.23</td>
</tr>
<tr>
<td></td>
<td>Die Polizistin verletzt den Räuber an dem Tatort.</td>
<td>6.56</td>
<td></td>
</tr>
</tbody>
</table>
Vita
Nick Henry

Education
2010-Present  Ph.D. in German Applied Linguistics and Language Sciences, The Pennsylvania State University
2008-2009  Master of Arts in German, Texas Tech University
2006-2008  Master of Arts in Applied Linguistics, Texas Tech University
2003-2006  Bachelor of Arts in German, English Minor Texas Tech University

Research and Teaching Interests
Second language acquisition and the effects of instruction; input processing and sentence processing; psycholinguistics and bilingualism; East-German studies; German culture

Selected Grants and Awards
2013-2015  Doctoral Dissertation Improvement Award, NSF, BCS-1252109,
2013-2014  NSF PIRE Graduate Student Fellowship. Awarded through the Penn State University Center for Language Science in conjunction with the NSF Office of International and Integrative Activities grant OISE-0968369.

Selected Publications

Selected Presentations

Selected Academic Employment and Other Relevant Experience
2010-Present  Graduate Instructor, Linguistics and German programs, Penn State University
2011-2013  Research Assistant to Dr. Mike Putnam, The Pennsylvania State University
2009-2010  Research Assistant to Dr. Bill VanPatten, Texas Tech University
2006-2010  Instructor/ Graduate Instructor, German program, Texas Tech University