

A Psycholinguistic Perspective on Sentence Understanding for Second Language Learners

Yuqi Zhao *

Social Science and Public Policy, King's College London, London, SE1 8WA, United Kingdom

* Corresponding Author Email: yuqi.1.zhao@kcl.ac.uk

Abstract. This study delves into the intricacies of second-language sentence comprehension, investigating the impact of psycholinguistic variables. An online sentence comprehension task engaged 100 proficient English speakers with intermediate Spanish proficiency, integrating eye-tracking technology. Assessing sentence complexity, word order, lexical ambiguity, and working memory, the findings highlight higher accuracy in simple declarative sentences, while non-canonical word orders led to significantly prolonged response times. Lexical ambiguity correlated with increased error rates, yet superior working memory capacities were associated with enhanced processing efficiency. The research underscores the necessity for nuanced language instruction, emphasizing metacognitive strategies to address challenges posed by sentence complexity and ambiguity. Despite limitations in sample size and controlled settings, this study lays a foundational framework for future cognitive investigations into second-language sentence comprehension.

Keywords: Second Language Acquisition; Psycholinguistic Variables; Cognitive Processes; Language Instruction.

1. Introduction

Second language acquisition (SLA) is an intricate and dynamic process shaped by various cognitive and linguistic factors influencing learners' proficiency in comprehending and analyzing sentences in the target language. Comprehending the nuanced difficulties encountered by second language learners, particularly in sentence processing, is fundamental for enhancing language teaching and learning strategies. Grounded in the psycholinguistic model, a theoretical framework elucidating language processing mechanism, this research aims to assess the extent to which psycholinguistic models unveil the intricacies of sentence parsing and comprehension for second language learners. The investigation seeks to contribute to the refinement of language instruction by leveraging psycholinguistic theories, fostering the development of tailored teaching methodologies and interventions to address specific challenges in sentence processing faced by learners.

This paper begins by examining pertinent literature concerning psycholinguistic models and challenges encountered in the processing of sentences in a second language. Subsequently, it delves into the practical applications of these models within the realm of SLA. Subsequently, the insights drawn from these models, their implications for language instruction, the methodology employed in the study, empirical findings and comprehensive discussions. Finally, conclusions outlining key findings, limitations and further research directions will be presented.

2. Key Definitions and Literature Review

2.1. Psycholinguistic Models

SLA research has extensively explored the application of psycholinguistic models in understanding the challenges faced by second language learners in comprehending and producing sentences.

Ullman's Declarative/Procedural model posits that lexical information is stored in the declarative memory system, while grammar and syntax are managed by the procedural memory system [1]. This model offers valuable insights into the cognitive processes employed by language learners [1].

VanPatten and Williams emphasized the significance of input processing and skill acquisition, highlighting the importance of implicit learning mechanisms in SLA [2].

Hopp's investigation into syntactic features and reanalysis in near-native processing contributes to our understanding of near-native competencies in syntax and the resolution of syntactic ambiguity [3]. McDonald furthered the discourse by investigating the performance of grammaticality judgment in late second language learners, providing support for a processing-based explanation of the difficulties encountered by this group [4]. Additionally, Kaan delved into the realm of predictive sentence processing, scrutinizing the distinctions in strategies employed by native and non-native speakers in both L2 and L1 contexts [5].

Clahsen and Felser conducted a comprehensive review of cognitive processes in language learners, highlighting the significance of individual differences in morphosyntactic processing [6]. DeKeyser's work delves into the realm of second language learning, offering insights from both applied linguistics and cognitive psychology to explore effective learning strategies [7].

O'Grady presents an emergentist perspective on syntax, positing that language acquisition entails building knowledge from a sophisticated, usage-based system [8]. This approach contends that learners construct linguistic understanding through exposure to diverse language contexts, emphasizing the dynamic and multifaceted nature of the learning process [8]. Ellis delved into language acquisition, examining usage-based and form-focused approaches [9]. He underscored the significance of construction learning, emphasizing its implications for effective language instruction [9].

These studies collectively showcase the intricate characteristics of psycholinguistic models in the context of SLA, presenting varied insights into how cognitive and linguistic mechanisms influence the processing and acquisition of language structures among learners of a second language.

2.2. Challenges in Second Language Sentence Processing

Alternatively, SLA also involves multifaceted challenges in the comprehension and parsing of sentences for learners. The focus of this section is on various psycholinguistic and linguistic theories, which reveal these challenges and draw on groundbreaking works in the fields of SLA and psycholinguistics. As mentioned above, Ullman's examination of psycholinguistic models lays the theoretical groundwork, specifically addressing the declarative/procedural model and its implications for the acquisition of grammar and syntax in second language learners [1]. It assesses the role of psycholinguistic models in illuminating the complexities of sentence processing in the second language [1]. Based on this theory, some challenges have been proposed in more detailed aspects.

2.2.1. Cognitive Processes and Sentence Complexity

Hopp meticulously explores the intricate interplay of cognitive factors in sentence processing and comprehension. Specifically, her research investigates the challenges encountered by near-native learners, focusing on sentence complexity, syntactic features, and reanalysis processes [3]. The study reveals that learners often grapple with increased processing demands when confronted with intricate sentence structures. The findings indicate that cognitive mechanisms play a pivotal role in both facilitating and impeding near-native processing [3]. However, limitations include the need for further exploration into individual differences and external factors influencing cognitive processing in the context of SLA [3].

2.2.2. Word Order Variations and Lexical Ambiguity

Building upon insights from Ellis and Hawkins, this part uncovers the complexities introduced by non-standard word order variations in second-language sentence comprehension [9, 10]. It explores the challenges learners face, such as prolonged response times and decreased accuracy when confronted with sentences deviating from standard structures [9, 10]. The research reveals that learners often grapple with reordering cognitive processes to accommodate non-canonical patterns, impacting their overall sentence interpretation [9, 10]. Additionally, the hurdles posed by lexical ambiguity are highlighted, as elucidated by Ellis, pinpointing a notable increase in errors and slower

processing times when learners encounter ambiguous lexical items within sentences [11]. Despite these invaluable findings, the limitations include a scarcity of studies addressing specific learner profiles and the need for further investigations into pedagogical interventions.

2.2.3. Working Memory and Sentence Processing Efficiency

The study of working memory's impact on sentence processing, inspired by McDonald, and Roeper and Roberge, focuses on how varying working memory capacities affect learners' efficiency in comprehending and parsing sentences [4, 12]. The challenges encountered in this line of inquiry include identifying a reliable measure for working memory capacity, controlling for extraneous variables, and addressing potential individual differences among learners [4, 12]. Preliminary results suggest a significant correlation between higher working memory capacities and enhanced efficiency in sentence processing [4, 12]. Nevertheless, the study encounters limitations in its applicability, attributed to a relatively modest sample size. Further investigations into distinct cognitive processes associated with diverse sentence structures are imperative for a more nuanced comprehension of the intricate relationship between working memory and sentence processing. These promising findings underscore the intricacy of this association, emphasizing the necessity for additional research to attain a comprehensive understanding.

In summary, exploring the challenges in processing second-language sentences unveils the complexities inherent in learners' comprehension and parsing. The discussed studies shed light on cognitive processes, sentence complexity, word order variations, and working memory implications. However, limitations persist, underscoring the need for a nuanced approach in research design. The forthcoming section delineates a methodological framework that addresses these challenges by employing rigorous measures, expanding participant diversity, and refining procedures. In pursuing this investigation, this paper seeks to enhance our grasp of the intricacies involved in processing sentences in a second language, all the while acknowledging and working to overcome the recognized limitations.

3. Cognitive Processes in Second Language Sentence Parsing and Comprehension

Firstly, the intricate process of sentence parsing in second language learners is addressed [3]. It highlights that learners often face challenges when processing sentences due to syntactic and morphological differences between their native and second languages [3]. Research indicates that unfamiliarity with complex sentence structures and word order variations can impede efficient parsing and comprehension [3].

In exploring how first-language structures shape the processing of sentences in a second language, it is revealed that learners tend to interpret sentences based on their native language when the syntax and structures differ from the target language, leading to comprehension difficulties [13].

Regarding comprehension difficulties and strategies, cognitive strategies such as context utilization, predictive processing, and reliance on word order are actively employed by learners to overcome comprehension barriers [5]. Strategies such as context utilization, predictive processing, and reliance on the order of words in a sentence assist in overcoming comprehension barriers, suggesting that learners actively apply cognitive strategies to understand and parse sentences [5]. On top of that, Bovolenta and Marsden's pre-activation research indicates that in contrast to native speakers, individuals acquiring a second language may exhibit a diminished capacity for generating expectations, particularly concerning verb-related information within a discourse context [14]. Due to limitations in cognitive processing, second language L2 speakers may encounter challenges in effectively incorporating cues for predictive comprehension. However, the differences in prediction between L1 and L2 may be quantitative rather than qualitative, and the predictive ability of L2 speakers varies depending on their proficiency level, showing that proficiency plays an important role in the pre-activation of L1 and L2 speakers [14]. Advanced L2 speakers demonstrate comparable

predictive proficiency to their L1 counterparts, underscoring the imperative role of accurate knowledge representation and swift knowledge deployment in anticipating language materials [14].

Furthermore, studies exploring how sentence complexity influences learners' sentence processing reveal that increased cognitive demands are associated with more intricate sentence structures, including those with embedded clauses or non-canonical word orders [6]. Negotiating such sentences necessitates heightened cognitive effort, potentially leading to delayed comprehension and parsing.

An in-depth grasp of the cognitive mechanisms influencing second language sentence parsing and comprehension holds paramount significance for educators. Acknowledging the impact of first language nuances, comprehension challenges, and sentence complexity offers profound insights into the intricate hurdles learners confront and the strategies they employ to surmount these obstacles [3, 5, 6, 13, and 14]. This comprehension of cognitive processes not only enriches our understanding but also serves as a foundational resource for crafting impactful teaching methodologies and targeted interventions, ultimately aimed at elevating the proficiency in parsing and comprehending second-language sentences.

4. Research Design and Findings

This study utilizes a mixed-methods approach to examine the influence of psycholinguistic variables on the comprehension of second-language sentences. The participant pool consists of 100 proficient English speakers with an intermediate grasp of Spanish (47 males, 53 females). Their average age is 35.4 years, ranging from 18 to 55. The participants, hailing from diverse economic and educational backgrounds, all currently reside in Barcelona for a minimum of six months, ensuring a varied yet carefully controlled sample.

Participants will undergo an online sentence comprehension task utilizing a computer-based program specifically crafted to evaluate factors associated with sentence complexity, word order, lexical ambiguity, and working memory. The task entails reading sentences in L2 Spanish and responding to comprehension questions. This design facilitates the investigation of instantaneous processing and comprehension strategies, providing a nuanced exploration of participants' cognitive engagement.

The experimental task is designed to systematically investigate different psycholinguistic dimensions. We examine sentence complexity by presenting participants with both straightforward declarative sentences and more intricate structures containing embedded clauses. Additionally, we manipulate word order variations to gauge their influence on processing times. Lexical ambiguity is introduced by incorporating ambiguous words within sentences, providing insights into the challenges posed by linguistic ambiguity. Working memory is evaluated by measuring participants' response times and accuracy in processing sentences with varying structural complexity.

The study employs a multifaceted data collection approach. Accuracy rates and response times for sentence comprehension questions are recorded to quantify participants' performance across different linguistic challenges. Eye-tracking technology is deployed to capture participants' reading patterns, measuring reading times and gaze duration on specific elements within sentences. This comprehensive dataset enables a nuanced understanding of how participants navigate and comprehend sentences under diverse linguistic conditions.

Ensuring ethical standards are upheld in this study, all participants will provide informed consent, demonstrating their comprehensive understanding of the research's aims and procedures. Strict confidentiality measures will be in place to safeguard the privacy of participant data. Steps are taken to minimize potential stress or discomfort during the experiment, fostering a controlled and ethical research environment.

According to Table 1, preliminary findings underscore the influence of psycholinguistic variables on second-language sentence comprehension. Participants exhibited higher accuracy rates (82%) in simple declarative sentences compared to complex sentences with embedded clauses (accuracy: 63%), indicating a proficiency gap in processing syntactically complex structures. Non-canonical word

orders led to significantly longer response times (mean: 5.2 seconds) compared to those with standard word order (mean: 3.8 seconds), providing clarity on the processing challenges posed by deviations from standard sentence structures. The presence of ambiguous words within sentences resulted in higher error rates (24%) compared to unambiguous sentences (7%), highlighting the difficulties associated with lexical ambiguity. Moreover, participants with higher working memory capacities demonstrated superior processing efficiency, showcasing the pivotal role of working memory in navigating sentences with increased structural complexity.

Table 1. Accuracy Rate and Response Time on Different Language Feature.

Language Feature	Accuracy Rate (%)	Response Time (seconds)
Sentence Complexity		
Simple Declarative Sentences	82	3.9
Complex Sentences	63	4.8
Word Order		
Standard Word Order	88	3.8
Non-Canonical Word Order	71	5.2
Lexical Ambiguity		
Unambiguous Sentences	93	3.5
Ambiguous Sentences	76	4.3
Working Memory (WM)		
High WM Capacity	86	3.5
Low WM Capacity	78	4.1

5. Discussion

5.1. Bridging Theory and Practice

The findings of this study offer valuable insights into bridging theoretical perspectives on psycholinguistic variables and their practical implications for second-language sentence comprehension. Shimanskaya's research on the role of linguistic exposure in SLA aligns with studies on sentence complexity, underscoring how syntactic variations significantly influence learners' processing efficiency [15]. The present study extends this understanding by empirically demonstrating that syntactic complexities, such as embedded clauses, pose significant challenges for learners, contributing to the theoretical discourse on sentence processing.

Tomasello's usage-based theory of language acquisition resonates with the findings on working memory, emphasizing the interplay between cognitive processes and sentence comprehension [16]. The observed correlation between higher working memory capacities and enhanced efficiency in processing structurally complex sentences supports Tomasello's notion of language acquisition as a dynamic, usage-driven process [16].

Additionally, the study's alignment with Godfroid, Winke, and Conklin's exploration of second language processing with eye tracking further strengthens the theoretical foundation [17]. The incorporation of eye-tracking technology in the research design provides a methodologically robust means to investigate the real-time cognitive processes involved in sentence comprehension, aligning with the broader discussions in the field.

This bridge between theory and practice contributes to a nuanced understanding of how psycholinguistic variables operate in the context of second-language sentence comprehension. Additionally, the integration of theoretical frameworks enhances the applicability of the findings to practical language instruction, providing educators with valuable insights for informed pedagogical decisions.

5.2. Pedagogical Implications

The pedagogical implications of the study's findings underscore the importance of tailoring language instruction to address the specific challenges identified in second-language sentence

comprehension. Based on Ellis's work on SLA how the study's insights can inform pedagogical strategies will be discussed in this section [11].

The challenges posed by sentence complexity highlight the need for structured instructional interventions that gradually expose learners to increasingly complex sentence structures. The generative introduction to second language syntax offers a theoretical basis for designing instructional sequences that scaffold learners' exposure to varied syntactic forms, aligning with the study's focus on sentence complexity [18].

Furthermore, the impact of word order variations on processing times emphasizes the significance of explicit instruction on different sentence structures. Pedagogical approaches drawing from Taguchi's handbook on SLA and pragmatics can guide educators in integrating varied word order patterns into instructional materials, promoting a more comprehensive understanding among learners [19].

The observed challenges related to lexical ambiguity underscore the need for explicit instruction on strategies to navigate and disambiguate meaning. Drawing on insights from Garces, who discusses the bilingual mind and its impact on language and thought, educators can integrate metacognitive strategies into their instruction, empowering learners to actively engage with and resolve lexical ambiguities [20].

Essentially, this study underscores the pedagogical significance of an informed and precisely tailored language instruction approach. Aligning instructional strategies with theoretical frameworks and empirical insights enables educators at the postgraduate level to cultivate a supportive learning environment. Such an approach is instrumental in addressing the specific challenges revealed in comprehending second-language sentences, fostering a more effective and targeted educational experience.

5.3. Implications for Language Instruction

This study holds multifaceted implications for language instruction, offering practical insights for educators aiming to improve second language sentence comprehension. The findings resonate with the investigation of syntactic awareness in reading comprehension, providing additional depth to the understanding of the interplay between cognitive processes and language comprehension [21].

Firstly, the observed proficiency gap in processing complex sentence structures calls for a tiered approach to instruction. Building on Ellis's study of SLA, educators can adopt a task-based approach that systematically introduces and practices syntactically complex structures, fostering gradual mastery among learners [11].

The impact of word order variations on processing times necessitates explicit instruction on sentence structures. Hawkins's generative introduction could also provide a theoretical foundation for integrating diverse word order patterns into instructional materials [18]. Educators can design activities that specifically target non-canonical word orders, providing learners with ample practice to enhance their proficiency in processing varied sentence structures.

The challenges posed by lexical ambiguity underscore the importance of metacognitive strategies in language instruction. Learners can benefit from explicit training in cognitive strategies to navigate ambiguous lexical items [20]. Integrating such strategies into language instruction empowers learners to actively engage with and resolve lexical ambiguities in real-time comprehension.

Moreover, the positive correlation between working memory capacities and processing efficiency highlights the need for instructional strategies that enhance learners' working memory skills. Drawing from the insights of Godfroid, Winke, and Conklin, educators can incorporate activities that specifically target working memory, promoting its development alongside language proficiency [17].

In conclusion, the implications for language instruction emphasize the importance of a targeted and evidence-based approach. By integrating theoretical frameworks and empirical findings into instructional practices, educators can create a pedagogically sound environment that fosters effective second-language sentence comprehension.

6. Conclusion

In summary, this study illuminates critical facets of second-language sentence comprehension through a comprehensive exploration of psycholinguistic variables. Findings underscore distinct challenges, with participants exhibiting proficiency gaps in syntactically complex structures and prolonged processing times for non-canonical word orders. The presence of lexical ambiguity introduced errors, emphasizing its impact on comprehension. Notably, participants with higher working memory capacities demonstrated superior efficiency in processing structurally complex sentences.

Nevertheless, this study has its constraints. The relatively small sample size, although offering valuable insights, may restrict the ability to generalize findings. Additionally, the controlled experimental environment may not fully encompass the complexities inherent in real-world language usage. Future research should expand participant diversity, considering proficiency levels and diverse linguistic backgrounds. Longitudinal studies could provide insights into the evolving nature of second language sentence comprehension over time. Exploring the intersection of psycholinguistic variables with socio-cultural factors may further enrich our understanding. Despite these limitations, this study lays a foundation for nuanced approaches to second language instruction, catering to the diverse challenges that learners encounter in comprehending and parsing sentences.

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