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A Conceptual Framework Integrating Grammatical and Lexical Proficiency in the Cue-Based Retrieval Model

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ABSTRACT

This conceptual paper explores the interplay between linguistic knowledge and memory mechanisms in language processing. While high-level proficiency remains a critical goal when learning a second language (L2), both native speakers and advanced L2 learners often struggle with real-time processing of complex structures. Existing research has yet to fully disentangle the relative contributions of grammatical and lexical knowledge to comprehension, nor adequately account for how these components influence the retrieval mechanism during sentence processing. Moving beyond traditional capacity-based models, we highlight the cue-based retrieval model, which attributes processing difficulty to similarity-based interference among memory representations. These effects are especially pronounced when competing constituents share syntactic or semantic features, leading to retrieval errors and comprehension difficulties. Although some recent studies suggest that advanced ESL learners may process sentences similarly to native speakers, differences in how they weigh cues during retrieval could still make them more prone to interference. Understanding the mechanism of cue weighting is crucial to capturing why such interference effects persist even among highly proficient learners. We propose an integrated model that incorporates linguistic proficiency in terms of grammatical and lexical knowledge as predictors that modulate cue weighting during retrieval, which reflects a speaker's susceptibility to interference. This paper advocates for treating proficiency as a multi-component construct and for incorporating L1-L2 comparisons as core elements of the existing cue-based models. We call for future research to investigate these interactions through experimental paradigms, offering a more nuanced understanding of both L1 and L2 sentence processing dynamics.

Keywords: syntactic and lexical proficiency; cue-based model; cue weighting; *memory retrieval interference; syntactic and semantic processing*

INTRODUCTION

Sentence comprehension remains a foundational component of language processing, reflecting an individual's ability to process complex linguistic structures and achieve functional proficiency. Despite advances in the field, achieving high-level proficiency—particularly in a non-native language—continues to pose challenges. While a substantial body of research has identified various factors contributing to successful (L2) acquisition, one recurring insight is the centrality of efficient real-time language processing (Hopp, 2022; Hopp et al., 2023). Within this domain, proficiency is frequently cited as a key predictor of comprehension performance (Luque & Morgan-Short, 2021). Yet, ambiguity persists around what 'proficiency' entails, particularly when examining the relative contributions of grammatical knowledge and lexical knowledge.

Beyond proficiency, an additional dimension that warrants a deeper theoretical exploration is the role of working memory, particularly in processing complex and ambiguous sentences, given evidence that language task performance is strongly influenced by general cognitive resources (Ahmad Rusli & Montgomery, 2020; Parina, 2011). Traditional models, such as the Working Memory framework by Baddeley and Hitch (1974), posit that language comprehension requires the simultaneous storage and manipulation of linguistic information. Most empirical studies have focused on capacity-based accounts (Ahmad Rusli & Montgomery, 2020; Daneman & Carpenter, 1980; Just & Carpenter, 1992), which view memory limitations as a function of how many items can be maintained and accessed (Cowan, 2014). However, competing models—particularly interference-based frameworks (Lewis & Vasishth, 2005)—argue that the content and quality of memory representations, rather than sheer capacity, may be more predictive of processing outcomes. Within this framework, cue weighting is a central component that guides the retrieval (Cunnings, 2017; Lewis & Vasishth, 2005) of linguistic information during sentence processing.

While much of this work has been conducted on native (L1) speakers and in Indo-European languages like English, there is increasing recognition that L2 learners—even when highly proficient—may process language differently than the L1 group. This difference is attributed to a greater reliance on stored linguistic cues during the processing of complex sentences. It is hypothesised that advanced L2 learners show greater sensitivity to semantic cues and reduced reliance on syntactic constraints during real-time parsing (Cunnings, 2017; Deniz, 2022; Patterson et al., 2014). However, empirical evidence supporting this claim remains limited.

Taken together, current accounts of sentence processing, particularly interference-based frameworks, emphasise the role of cue weighting in guiding retrieval during comprehension. However, these accounts do not fully explain what determines the relative weighting of linguistic cues during retrieval, or why certain cues are prioritised over others. While proficiency has often been associated with more efficient processing, its role in modulating susceptibility to interference remains unclear. Proficiency is rarely treated as a multi-component construct, comprising both grammatical and lexical knowledge; thus, how these components differentially influence cue weighting is not yet well understood. Importantly, while proficiency may modulate cue weighting, this factor does not fully capture differences in language experience. The inclusion of speakers' language profile (native vs non-native processing systems) into the framework will allow us to test whether cue weighting mechanisms are shaped solely by proficiency or are additionally modulated by language group.

Given these complexities, this paper suggests a conceptual refinement of the cue-based retrieval model by integrating proficiency (operationalised in terms of grammatical and lexical knowledge) and by modelling language group (L1 and advanced L2 speakers) as a between-subject factor. By integrating these components, this paper seeks to understand whether greater grammatical knowledge increases reliance on syntactic cues, and conversely, whether greater lexical knowledge enhances sensitivity to semantic information during sentence processing. We are interested in examining whether and to what extent linguistic proficiency contributes to susceptibility to interference and how this relationship operates within a cue-based retrieval framework. The ultimate aim of this integration is to provide a unified account of both native and non-native processing within a cue-based retrieval architecture.

This article comprises five main sections. The first three sections outline the three key components that address the refinement needed for the existing interference-based framework. In particular, the first section discusses proficiency as a multifaceted construct and the contribution of both grammatical and lexical knowledge in sentence processing models. The second section

highlights the role of interference-based accounts of working memory through cue-based retrieval models, including their limitations, which in turn motivate the proposed refinement of the framework. The third section examines the differences between L1 and L2 sentence processing, focusing on their relevance and status within the framework. The fourth section, which forms the core discussion of this paper, presents a refined version of the existing framework by critically discussing the integration of the three components, namely, the cue-based retrieval models, linguistic (i.e., grammatical and lexical) proficiency, and L1-L2 comparisons. This section also provides suggestions for future work. The final section concludes the article and outlines several important implications.

LANGUAGE PROFICIENCY AND SENTENCE COMPREHENSION: GRAMMAR VS. LEXICON

The role of language proficiency in sentence comprehension is well-established; yet, the precise contributions of its constituent elements—namely grammatical and lexical knowledge—remain debated. Several studies highlight the importance of grammatical knowledge, especially in understanding complex sentence structures. Although proficiency is often treated as a unified concept, increasing research suggests that these components may influence comprehension in distinct ways (Luque & Morgan-Short, 2021). Zheng et al. (2023) conducted a meta-analysis involving a broad range of studies with both native and L2 speakers, confirming that grammatical knowledge generally correlates strongly with reading comprehension. However, the strength of this relationship varies depending on how grammar is assessed. Specifically, implicit knowledge of syntax—such as sensitivity to syntactic errors—tends to show a stronger link with comprehension than explicit grammar tests, indicating that different types of grammatical knowledge may play varied roles in sentence processing.

Conversely, lexical knowledge, particularly vocabulary size and depth, also exerts a significant influence. Zhang (2012) examined 190 Chinese learners of English using structural equation modelling to evaluate the effects of grammar and lexicon on L2 reading comprehension. In this study, lexical knowledge was assessed through vocabulary breadth and depth measures, while grammar was evaluated via explicit and implicit grammatical tasks. Zhang's results revealed that lexical knowledge had a more substantial effect on comprehension than explicit grammatical knowledge, although implicit grammar remained an important factor (also refer to Lee & Wong, 2020). Studies on text readability also show that lexical features strongly influence the difficulty of reading materials, while sentence structure plays a less prominent role in determining comprehension (Barrot, 2013). Adding further nuance, Oh (2015) studied 75 Korean university students learning English as a second language to assess the relative influence of linguistic knowledge and processing speed on sentence comprehension. Her findings indicated that vocabulary knowledge, grammatical knowledge, and processing speed contributed roughly equally to comprehension performance in both listening and reading tasks. This outcome points toward a multifaceted view where linguistic components and cognitive processing abilities collectively affect sentence understanding (also refer to Parina, 2011).

In the sentence processing framework, we suggest grammatical and lexical knowledge as distinct but interacting components that contribute to sentence processing, especially during the retrieval process. The focus on grammatical and lexical knowledge is theoretically motivated by its central role in shaping the representational input to cue-based retrieval processes. Grammatical

knowledge involves the capacity to comprehend and apply grammatical rules, including those related to sentence structure, word order, and morphosyntactic agreement, while lexical knowledge, on the other hand, refers to a speaker's knowledge of word forms and meanings, including the ability to recognise and retrieve vocabulary during language processing. Rather than prioritising grammar or lexicon in isolation, it is more productive to explore how these linguistic resources work alongside cognitive mechanisms—such as working memory—to shape comprehension. As mentioned, these knowledge systems are assumed to influence sentence processing indirectly through cue-based retrieval mechanisms, namely, cue weighting. Specifically, grammatical knowledge is expected to facilitate reliance on syntactic cues, whereas lexical knowledge is expected to facilitate reliance on semantic cues during processing. Other dimensions of proficiency, such as processing speed or language exposure, are acknowledged as relevant but are treated as more distal factors that influence performance indirectly through their effects on representational knowledge rather than directly determining the cue weighting mechanism (which is considered the central idea in the proposed conceptual model).

COMPETING ACCOUNTS OF WORKING MEMORY: CAPACITY VS. INTERFERENCE

Building on the discussion of language proficiency and its components, it is crucial to consider the cognitive resources that support sentence comprehension. Among these, working memory plays a fundamental role in enabling the simultaneous storage and manipulation of linguistic information (Baddeley & Hitch, 1974) necessary for real-time language processing. Importantly, the consideration of working memory is central to the present framework, as it informs how sentence processing limitations are conceptualised in terms of either capacity constraints or interference-based mechanisms. Understanding the mechanisms of working memory, therefore, provides important insights into how both L1 and L2 groups manage the complex demands of sentence comprehension. This section reviews prominent theoretical frameworks of working memory, contrasting traditional capacity-based models with emerging interference-based accounts, and outlines the rationale for adopting an interference-based perspective as a core component of the present framework, while also acknowledging its limitations in the context of sentence processing.

Traditional models of working memory, such as those proposed by Daneman and Carpenter (1980) and Just and Carpenter (1992), emphasise the limited capacity of working memory as a key constraint in sentence comprehension and processing, particularly in the context of long-distance dependencies. Empirical research rooted in capacity-based accounts (e.g., Cowan, 2014) typically measures memory limitations by quantifying how many linguistic units can be actively maintained. Studies in this tradition generally find that individuals with greater memory capacity show better comprehension of syntactically complex sentences (Van Dyke et al., 2014), supporting the notion that capacity is a key predictor of successful sentence processing.

While capacity-based models explain processing difficulty in terms of limitations in how much information can be stored and manipulated in working memory, they, however, have faced criticism for overlooking the nuanced quality of memory representations and the interference caused by similarity among stored items. One major issue is that increases in memory load often go hand-in-hand with increased interference (Cunnings, 2022) from similar linguistic elements, making it difficult to determine whether difficulty stems from memory capacity limits or retrieval interference. Additionally, capacity-based accounts offer limited explanatory power in cases where

sentence complexity remains constant (e.g., the same number of words) but the content of those words compromises parsing accuracy (Ahmad Rusli & Montgomery, 2020). This gap has led to the rise of interference-based models of working memory, notably the cue-based retrieval framework proposed by Lewis and Vasishth (2005).

Unlike capacity accounts, interference models constitute a competing explanation. These models argue that the difficulty in sentence comprehension arises from the competition among similar items in memory during retrieval, rather than from limitations in the number of items that can be stored. This shift in focus from quantity to quality of memory content (Cunnings, 2022) reflects a more dynamic understanding of how comprehenders resolve dependencies. The cue-based retrieval model describes sentence comprehension as involving the activation of stored "chunks" of linguistic information, which are retrieved via cues derived from both syntactic and lexical features (Van Dyke & McElree, 2006; Tan et al., 2017; Cunnings & Sturt, 2018; Karageorgou et al., 2022). Retrieval occurs in parallel across all items in memory, and when multiple items share similar features, similarity-based interference can lead to retrieval or processing difficulties (Horne et al., 2022) and impact retrieval accuracy (Parker et al., 2017). For example, studies have documented illusions of grammaticality, where ungrammatical sentences are mistakenly perceived as acceptable due to interference effects (Wagers et al., 2009). This phenomenon challenges capacity-based models by highlighting retrieval errors caused by content overlap rather than storage limits due to dependency length. Extending this, Cunnings and Sturt (2018) introduced the notion of illusions of plausibility, showing that interference is not confined to syntactic similarity but also involves semantic factors. Their work demonstrates that semantic plausibility can further mislead comprehenders, especially when processing ungrammatical sentences that appear plausible due to interfering semantic cues (Karageorgou et al., 2022). This finding broadens the interference framework and suggests that both syntactic and semantic information must be considered in understanding retrieval dynamics.

Taken together, the adoption of the interference-based account of working memory, namely the cue-based retrieval model, into the current framework is mainly motivated by its close alignment with the sentence processing mechanism that entails activation and competition of multiple linguistic cues for retrieval during comprehension. Unlike capacity-based accounts, which attribute processing difficulty mainly to limited storage and attentional capacity, interference-based approaches provide a more mechanistic explanation by attributing processing difficulty to competition among overlapping representations during retrieval (Cunnings & Sturt, 2018; Wagers et al., 2009), which may lead to the misretrieval of the intended target word. Crucially, under a direct-access retrieval mechanism, retrieval time is relatively insensitive to the number of intervening items (Parker et al., 2017), suggesting that processing difficulty does not stem from capacity limitations.

While the interference-based approach offers a compelling explanation for retrieval difficulties in sentence comprehension, it is important to acknowledge some limitations and areas requiring further exploration. In cue-based retrieval models, cue weighting plays a central role in determining how different sources of information, such as syntactic and semantic cues, contribute to sentence interpretation. However, interference-based accounts have yet to specify how cue weighting is modulated by differences in linguistic knowledge, such as grammatical and lexical proficiency, or whether distinct components of proficiency exert differential effects on sentence interpretation. In addition, these accounts offer limited insight into how such differences in cue weighting between L1 and L2 speakers emerge, nor how they influence susceptibility to interference during sentence processing. In short, the current framework lacks a mechanism that

systematically links individual differences (in terms of proficiency and speaker profile) to cue weighting architecture within cue-based retrieval. Addressing these concerns is essential for developing comprehensive models that accurately reflect the complexity of both L1 and L2 sentence processing.

ESL LEARNERS AND SENTENCE PROCESSING: NATIVE-LIKE OR DIFFERENT?

This section provides critical evidence that cue-based retrieval mechanisms are influenced by language experience, thereby motivating the inclusion of L1-L2 comparisons into the present framework. Recent studies have extended the work investigating similarity-based interference effects during sentence comprehension to advanced L2 learners, examining whether the effects observed in L1 speakers generalise to advanced L2 learners' performance.

A seminal contribution in this area is Cunnings's (2017) memory retrieval model, which extended the interference-based account of working memory to L2 sentence processing. Cunnings argues that the difficulties L2 speakers encounter during the resolution of linguistic dependencies are better explained through cue-based retrieval interference rather than through fundamentally different parsing strategies. This perspective contrasts with the Shallow Structure Hypothesis (Clahsen & Felser, 2006), which claims that L2 speakers often rely less on hierarchical syntactic information and instead process language using more surface-level or semantic cues. In this view, L2 processing differences are best understood in terms of differential cue weighting driven by competing memory representations, rather than as evidence of incomplete or shallow syntactic parsing (Cunnings, 2017).

Drawing on cue-based parsing models (e.g., Lewis & Vasishth, 2005), Cunnings maintains that both L1 and advanced L2 speakers build structurally rich representations. However, the key difference lies in how they prioritise and weigh retrieval cues. L1 speakers tend to rely more on syntactic and structural cues, such as grammatical roles and binding constraints, to resolve dependencies. In contrast, L2 speakers may lean more heavily on non-structural information, such as linear proximity, morphological form, or semantic associations (for empirical evidence, see Deniz, 2022). In short, Cunnings proposes that L2 speakers experience more difficulties during the comprehension of complex sentences, not because they fail to construct syntactic structure, but because they differ in the types of information they use when retrieving linguistic material from memory. His account reframes L2 processing challenges as a function of general memory processes, suggesting that L2 speakers operate within the same parsing architecture as L1 speakers but face greater interference due to less efficient cue management.

While Cunnings (2017) emphasises the L1 and L2 differences during memory retrieval, subsequent research has revealed evidence that calls aspects of this account into question. Dong et al.'s (2023) study, which utilised event-related potential (ERP) experiments, investigated how native Mandarin speakers learning advanced English process long-distance dependencies during sentence comprehension. Their results indicated that the L2 group achieved comprehension accuracy comparable to native speakers. However, ERP data revealed notable differences in neural processing mechanisms. Native speakers exhibited a P600 component, a neural response commonly associated with syntactic violations and structural repair. In contrast, L2 speakers showed a prefrontal-central positivity, which likely reflects semantic processing strategies or compensatory processing. In summary, Dong et al.'s study emphasises that although L2 speakers

demonstrate comprehension performance similar to native speakers, their neural responses do not exhibit the same brain activity patterns observed in the L1 group.

In a related study, Fujita and Cunnings (2023) conducted a series of plausibility experiments involving native English and German L2 learners of English. Their study examined the processing of sentences containing semantic interference through relative clause structures. Using six experiments that employed self-paced reading, offline comprehension tasks, and speeded judgment tasks, Fujita and Cunnings found that both groups were affected by similarity-based interference when processing sentences containing plausible distractors, even when the sentence meaning was implausible. This is true in accordance with the cue-based retrieval model, which predicts comprehenders to mis-retrieve only when the sentence is ungrammatical (Martin, 2018). However, comparative analyses between the L1 and L2 groups revealed no significant differences in comprehension accuracy during the processing of semantically complex sentences.

Together, these studies highlight a crucial aspect of L1-L2 processing. Offline findings (e.g., Dong et al., 2023; Fujita & Cunnings, 2023) suggest that both native and non-native speakers often arrive at similar interpretative outcomes. In contrast, online neural evidence (e.g., Dong et al., 2023) informs us that these similar end-state interpretations may be supported by different underlying processing mechanisms. This dissociation suggests that differences in cue weighting strategies between L1 and L2 speakers may be theoretically meaningful, even when behavioural outcomes converge. Crucially, L2 speakers differ from L1 speakers not only in overall proficiency but also in the nature and stability of their linguistic representations, which may affect how retrieval cues are encoded, weighted, and accessed during processing (Cunnings, 2017). As a result, examining L2 performance is not merely an extension of L1 findings, but an important step in ensuring the generalisability of cue-based retrieval models to both L1 and L2 groups. Therefore, the present framework regards the inclusion of L1-L2 comparisons in the framework as not peripheral, but an essential pillar to better understand the underlying processing mechanisms in both native and non-native groups through online and offline measures. This, in turn, will help us decipher whether similar behavioural outcomes arise from different cue weighting and retrieval processes.

REFRAMING L2 SENTENCE COMPREHENSION: TOWARDS AN INTEGRATED MODEL

Building on the preceding discussion, a more comprehensive framework is required to account for how cue-based retrieval operates across L1 and L2 speakers. Existing accounts of sentence processing have successfully captured the role of cue-based retrieval mechanisms and, more recently, have begun to consider differences between L1 and L2 speakers (Deniz, 2022; Dong et al., 2023; Fujita & Cunnings, 2023). In parallel, research has highlighted the importance of linguistic proficiency (in terms of grammatical and lexical knowledge) in shaping comprehension outcomes. However, these aspects have largely been examined in isolation, making it difficult to establish which construct of linguistic proficiency (e.g., grammatical vs lexical knowledge) and language background is responsible for observed variation in cue weighting. In response to this gap, we propose an integrated framework of sentence comprehension in which interference-based processing serves as a central mechanism linking cue-based retrieval, variation in grammatical and lexical proficiency, and language background (L1 vs L2).

Figure 1 illustrates the inclusion of differential roles of grammar and lexical knowledge during sentence processing following the interference-based models, in comparison with capacity-based accounts of working memory. While traditional capacity-based accounts of working memory have helped illuminate storage limitations in sentence comprehension, they do not adequately explain why errors often occur in sentences of comparable length, particularly when multiple items in memory share similar features (Cunnings & Sturt, 2018; Ahmad Rusli & Montgomery, 2020). The capacity-based model emphasises storage limits and predicts difficulties in processing long or complex sentences, with individual differences linked to memory span. In contrast, the interference-based model focuses on the quality of stored information during retrieval. According to this competing account, comprehension difficulties arise from cue overload and similarity-driven misretrieval. Accordingly, we adopt the view that an interference-based account through the cue-based retrieval model (Lewis & Vasishth, 2005) provides a more accurate framework, especially in areas where competition between similar items in memory leads to retrieval difficulties. From this perspective, retrieval difficulties are understood to stem not primarily from deficient linguistic knowledge of speakers but from competing information available during retrieval, which is guided by the cue weighting.

In the present framework, cue weighting is positioned as a central mechanism of cue-based models governing how competing linguistic cues are prioritised during retrieval processes. Specifically, it refers to the process by which multiple linguistic cues (e.g., word order, agreement, animacy) are assigned varying levels of reliability during sentence interpretation. These weights guide memory retrieval processes, which help comprehenders decide who did what to whom in real time (Lewis & Vasishth, 2005). Importantly, these weights are not fixed properties of the cues themselves, but are dynamically modulated based on the comprehender's linguistic knowledge and experience. However, this relationship has yet to be discussed in depth in sentence processing literature.

We propose that linguistic proficiency plays a key role in modulating cue weighting during comprehension, thereby influencing susceptibility to interference during comprehension. Within this framework, linguistic knowledge functions as a higher-order constraint that shapes cue weighting by influencing the perceived reliability of each cue. Speakers with more robust grammatical knowledge are expected to assign greater weight to structurally informative cues, whereas less entrenched knowledge may lead to increased reliance on more superficial or context-driven cues (Cunnings, 2017; Deniz, 2022). Thus, we suggest that variation in linguistic knowledge systematically modulates cue weighting, which in turn affects the efficiency and accuracy of cue-based retrieval during sentence comprehension. Ergo, to capture this relationship, we suggest that proficiency has to be treated as a multi-component construct, i.e., grammatical and lexical knowledge. This concern is compounded by the fact that many past studies only operationalised proficiency in broad and general terms, often comparing low- and high-proficiency groups, thereby overlooking the possibility that different dimensions of proficiency may have important effects, especially on the cue weighting mechanism.

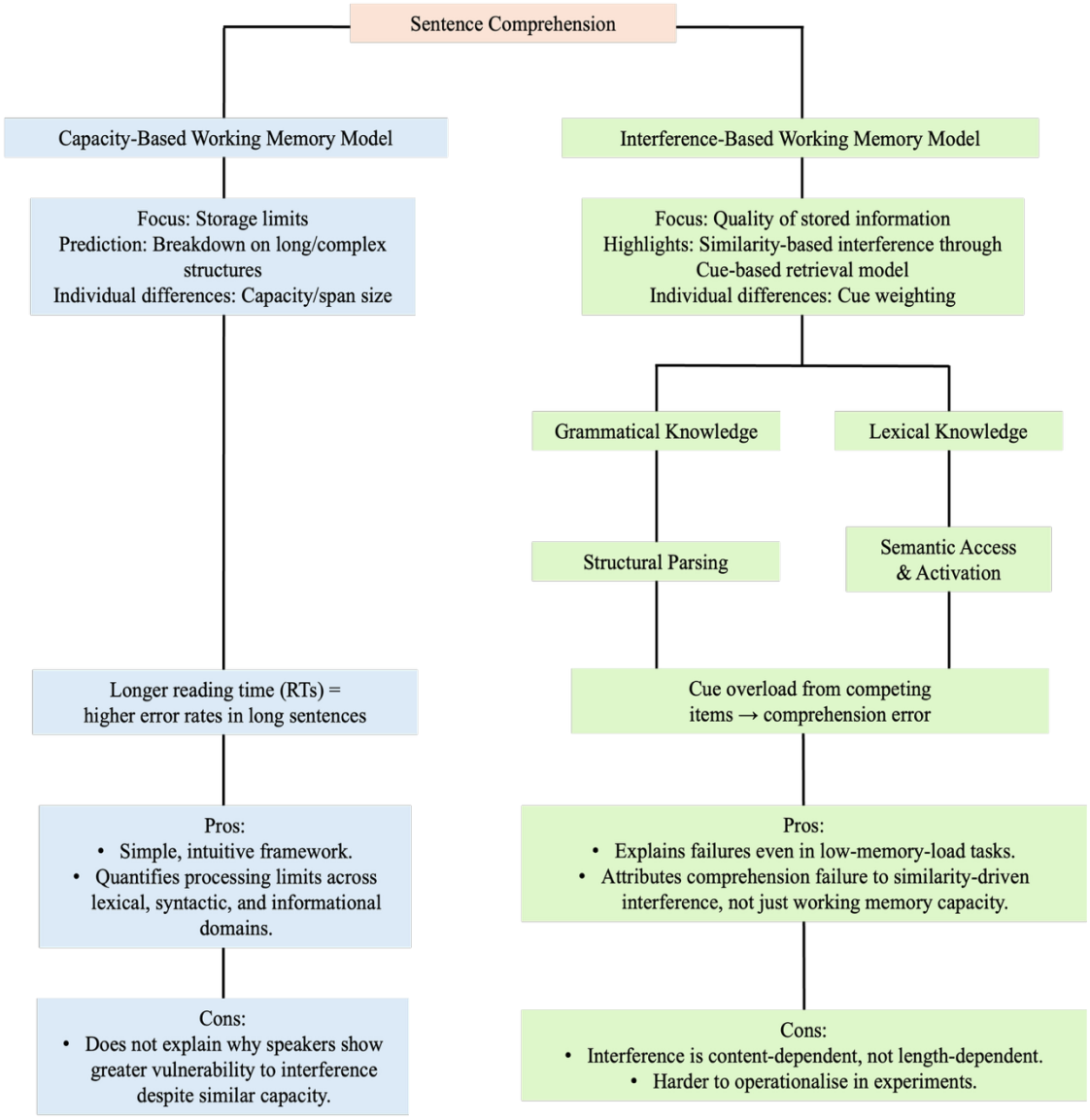

FIGURE 1. Comparison of Capacity-Based and Interference-Based Working Memory Models in Sentence Comprehension

Additionally, addressing whether high proficiency mirrors native-like processing requires more than integrating proficiency into cue-based models. Another important component that is easy to overlook is side-by-side comparison of L1 and L2 performance, with L1 speakers representing a reference point for native cue-weighting patterns, and L2 speakers examined in terms of whether their processing aligns with or differs from this pattern. In this regard, the present framework focuses on advanced L2 speakers rather than a broad proficiency range. We suggest that only at higher levels of proficiency can meaningful comparisons be made regarding convergence with, or divergence from, L1 processing. At lower proficiency levels, differences in language knowledge may hide the real processing patterns, making it hard to tell whether the observed differences are due to real structural differences or just limited language development.

Further explanation on how the present framework outlines the relationship between proficiency and cue weighting is illustrated in Figure 2. In the present framework, linguistic proficiency functions as a predictor whose effects on sentence processing are mediated by cue weighting during retrieval. We propose that L1 and L2 rely on the same underlying mechanisms, but differ in the strength of their linguistic knowledge, which affects how cues are weighted during processing. Factors such as similarity-based interference and task demands may further moderate this relationship.

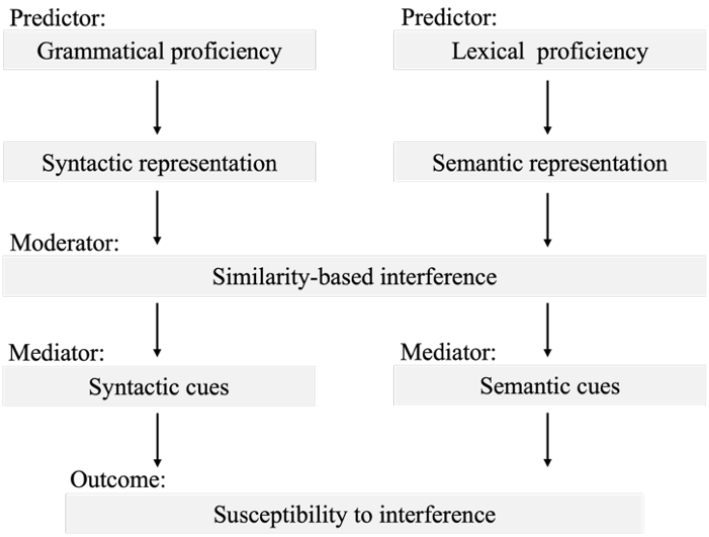

FIGURE 2. Proposed Refinement of the Cue-based Retrieval Model Consisting of the Predictor (Linguistic Proficiency), Mediator (Cue Weighting), and Moderator (Similarity-based Interference) for both L1 and L2 speakers

Based on Figure 2, grammatical proficiency enhances the strength and precision of the parser's structural representations, increasing the availability and activation of syntactic cues during retrieval. This may reduce susceptibility to syntactic interference. In parallel, lexical proficiency enriches the parser's semantic representations, increasing the availability and activation of semantic cues, which in turn may reduce susceptibility to semantic interference. However, it is important to note that this relationship may be non-linear. Increased proficiency may sometimes increase interference, as richer representational networks can lead to the activation of more competing alternatives during cue-based retrieval (Ahmad Rusli & Montgomery, 2020; Cunnings, 2017; Deniz, 2022).

During sentence processing, cues are activated in parallel. When elements within a sentence share overlapping retrieval cues, competition arises, resulting in interference. Under such conditions, syntactic and semantic cues compete for activation, and stronger linguistic cues that match the retrieval probe will be chosen by the parser. The key outcome of this competition is susceptibility to interference, and final interpretation reflects the weighted outcome of cue competition during retrieval. As the figure represents shared processing architecture for both L1 and L2 groups, analyses should focus on comparing performance between the two groups.

The proposed model is grounded in the use of sentence stimuli that systematically manipulate syntactic and semantic cues. Specifically, the stimuli include a mismatch between syntactic and semantic information, creating conflict conditions that elicit cue competition during

retrieval. Consider sentences in which cues such as word order and animacy are in conflict. For example, in a sentence like "The boy that the girl hit cried", structural cues indicate that 'the girl' is the agent of the action 'hit', despite 'the boy' appearing earlier in the sentence. Naturally, native speakers typically rely on these structural cues to assign thematic roles correctly. In contrast, L2 speakers—even highly proficient—may be more influenced by linear order or semantic expectations (Cunnings, 2017; Deniz, 2022), potentially misassigning 'the boy' as the agent of 'hit'. Our contribution to such understanding is that both L1 and L2 speakers are not fundamentally biased toward different cue types, but instead differ in the degree to which syntactic and semantic cues are weighted as a function of linguistic proficiency.

The present framework generates several testable predictions. First, it predicts that proficiency will modulate cue weighting, and interference effects can be attenuated when relevant syntactic or semantic cues are activated faster and retrieved from memory. In particular, grammatical proficiency is predicted to modulate syntactic cues while lexical proficiency is predicted to modulate semantic cues during retrieval. However, in the case of misretrieval, it is assumed that similarity-based interference is the strongest only when the sentences are ungrammatical (Fujita & Cunnings, 2023; Lewis & Vasishth, 2005) or due to an insufficient retrieval cue (Martin, 2018). Following that, the model predicts that advanced L2 speakers may show offline effects comparable to, e.g., comprehension accuracy to L1 speakers. However, the model suggests a difference in underlying processing, which can be observed in online measures, e.g., reaction times. These differences are assumed to reflect on L1 and L2 speakers' divergence in their cue weighting strategies, which leads to a differential susceptibility to interference on whether syntactic or semantic cues are more diagnostic in a given context.

DIRECTIONS FOR FUTURE RESEARCH

To empirically investigate the relative contributions of grammatical and lexical knowledge in shaping cue weighting during the retrieval process of different language groups, we propose an expanded experimental approach that addresses the gaps identified in previous research. Specifically, this approach should consider individual differences in language proficiency and working memory capacity among L1 and L2 groups to better understand how these factors interact with interference effects during sentence comprehension.

We suggest employing multi-method designs, such as combining behavioural tasks with real-time processing measures. In particular, rather than measuring proficiency as one general construct, future studies should measure proficiency separately in terms of grammatical and lexical knowledge. Grammatical proficiency can be measured using an Elicited Imitation Task (EIT) varying in length and complexity (Gaillard & Tremblay, 2016). EIT has been proven to reflect underlying grammatical proficiency (Lei & Yan, 2022) as the task is primarily constrained by learners' ability to reconstruct syntactically well-formed sentences under processing demands. Meanwhile, lexical proficiency can be measured using a Vocabulary Levels Test (VLT). This test assesses receptive vocabulary breadth across frequency bands and provides a detailed profile of lexical knowledge. It has also been shown to significantly predict performance on the Oxford Placement Test across proficiency groups (Enayat & Amirian, 2016). In addition to this, the Vocabulary Size Test (VST) may be used as an alternative measure to VLT for studies seeking a simpler overall index of vocabulary knowledge. Besides proficiency, future studies should also include a Reading Span Task in order to further investigate whether the observed effects are independent of working memory capacity. Finally, we suggest a Speeded Plausibility Judgment

Task as the main experiment, which combines Rapid Serial Visual Presentation (RSVP) with a plausibility judgment task (refer to Figure 3). Following this design, participants are required to read given stimuli word-by-word at a certain speed (e.g., 300ms per word) and are asked to judge the overall plausibility of the sentence, yielding binary (yes/no) responses. While less naturalistic than traditional eye-tracking, RSVP allows precise measurement of how participants allocate attention to different cues and manage interference during comprehension, shedding light on the underlying real-time processing.

Given our focus on similarity-based interference, we suggest that the stimuli used in the main experiment should be syntactically (e.g., word order or structural relations) and semantically (e.g., animacy or thematic role plausibility) manipulated. Online measures, such as reaction times, and offline measures, such as response accuracy, should be recorded. Lastly, we propose such design to be tested on both L1 and advanced L2 speakers, and the performance of both groups should be compared side by side to better understand the differences, if any, in the processing of native and non-native groups.

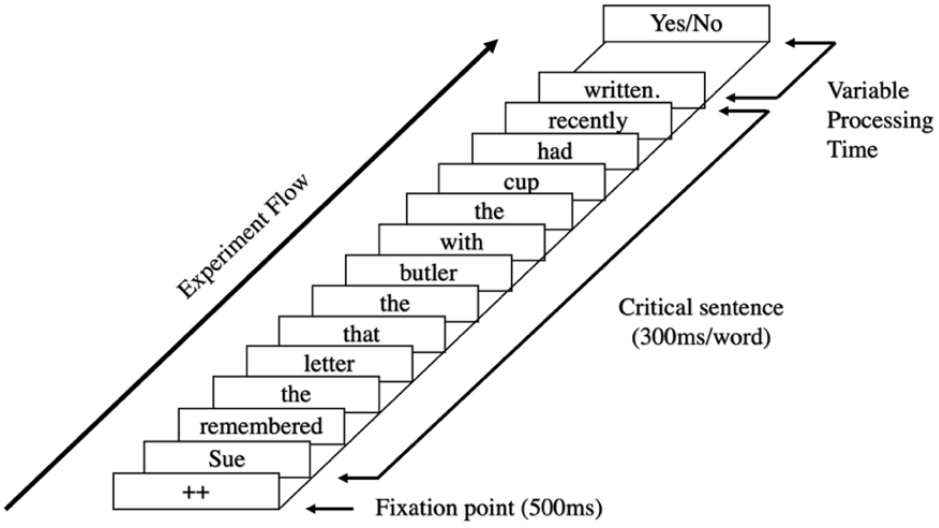

FIGURE 3. Illustration of proposed speeded plausibility judgment task, sentence adapted from Karageorgou et al. (2022)

CONCLUSION

We proposed a refined version of the framework that integrates a cue-based retrieval model with a componential view of linguistic proficiency, proposing that grammatical and lexical knowledge differentially shape cue weighting and susceptibility to interference during sentence processing across native and non-native speakers. This perspective contributes to existing models by shifting the focus away from language-group-based explanations towards proficiency-driven variation in cue weighting. In doing so, it aims to provide a more unified account of L1 and L2 sentence processing.

This model yields several conceptual implications. First, grammatical proficiency is expected to increase reliance on syntactic cues during retrieval, while lexical proficiency is expected to modulate the sensitivity to semantic information. Second, differences in cue weighting between L1 and advanced L2 speakers may persist even when their interpretation accuracy

converges. This suggests distinct underlying processing routes among the two groups. Third, susceptibility to interference is predicted to vary systematically as a function of proficiency profile rather than language group alone. Factors including grammatical and lexical knowledge, working memory capacity, and cue weighting should not be studied in isolation, but as interacting dimensions of real-time comprehension.

Taken together, this integrated framework provides a more nuanced approach, highlighting the importance of scrutinising cue weighting and interference at the level of underlying mechanisms rather than solely behavioural outcomes, providing a basis for future empirical testing using syntactic and semantic manipulations and advancing theoretical models of sentence processing.

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