UC Merced
Proceedings of the Annual Meeting of the Cognitive Science Society

Title
Memory Retrieval Processes during Real-Time Language Comprehension: Empirical Evidence and Computational Modelling

Permalink
https://escholarship.org/uc/item/395582f8

Journal
Proceedings of the Annual Meeting of the Cognitive Science Society, 46(0)

Author
Fujita, Hiroki

Publication Date
2024

Peer reviewed

eScholarship.org Powered by the California Digital Library
University of California

Memory Retrieval Processes during Real-Time Language Comprehension: Empirical Evidence and Computational Modelling

Hiroki Fujita (hiroki.fujita@uni-potsdam.de)
Department of Linguistics, University of Potsdam
Karl-Liebknecht-Str. 24–25, 14476 Potsdam, Germany

Abstract

This study investigates cue-based memory retrieval during sentence processing. Cue-based retrieval theories argue that the parser uses lexical and structural information as retrieval cues to retrieve items from memory. Evidence for cue-based memory retrieval comes from research showing that non-target representations matching retrieval cues interfere with target retrieval. However, the degree of susceptibility to this *similarity-based interference* has been debated, having led to the development of different computational models. This study focuses on two cue-based models and tests their predictions in two experiments. The results suggested similarity-based interference, but its patterns were not fully compatible with these models. To reconcile these findings within the framework of cue-based memory retrieval, this paper presents a model that assigns substantial weight to the structure-based cue and incorporates the notions of initial retrieval and revision. Results from simulations indicate that the model incorporating these assumptions provides a better fit to the observed data.

Keywords: Memory retrieval; revision; quantifier float; simulations; sentence parsing; sentence processing; computational modelling; ACT–R

Introduction

In real-time language comprehension, memory retrieval may be required during dependency formation. Approximately, two elements are in a dependency relation if and only if one of the elements requires the presence of the other in the sentence, or the form of one of the elements varies due to the presence of the other. For example, in sentence (1) below, NP1 and the floating quantifier "all" are in a dependency relation.

(1) [$_{\text{NP1}}$ The boys who [$_{\text{NP2}}$ the girls]] saw [$_{\text{QP}}$ all] walked back home.

In (1), the floating quantifier modifies NP1, as in *All the boys*…, but is separated from it, forming a long-distance dependency. In English, a floating quantifier is associated with a locally c-commanding NP. NP1 satisfies this structural constraint, while NP2 does not. In this paper, NP1, a structurally accessible element for the floating quantifier, is referred as *the target*, while NP2, which is a structurally inaccessible element, is referred to as a *distractor*.

To form a dependency relation between the floating quantifier and its associate during real-time incremental processing, the parser needs to retrieve the target at the quantifier from memory (Fujita & Cunnings, 2023). A well-known hypothesis about this memory retrieval process is cue-based memory retrieval (Lewis & Vasishth, 2005; Vasishth & Engelmann, 2021). Cue-based retrieval theories of sentence processing posit that the parser uses lexical and structural information as retrieval cues to retrieve an element from memory. For example, these theories predict that, in (1), the number feature and a feature encoding c-commanding relations (see Alcocer & Phillips, 2012; Kush, 2013) serve as retrieval cues. There are several computational models in the literature that implement this cue-based memory retrieval. The present study focuses on two cue-based computational models, which are described in detail in the following section. The study then reports two large-sample experiments aimed at testing these models. Lastly, the study presents a new computational model implemented within the framework of ACT–R to account for the results.

Cue-Based Computational Models

One of the cue-based models tested in this study is *the activation model* (Lewis & Vasishth, 2005). According to this model, elements that match a set of retrieval cues become retrieval candidates. The degree of match is computed as the level of activation, with a greater alignment in cues leading to a higher activation. The total activation (A) for an element i is given by:

(2) $A_i = B_i + \sum_j W_j S_{ij} + \varepsilon_i$

Here, B_i represents the base activation and is computed as $B_i = \ln(\sum_{k=1}^{n} t_k{}^{-d})$, where t_k refers to the time since jth retrieval of i. d is a constant and serves as a decay parameter. The second term $\sum_j W_j S_{ij}$ is the most important for the present study. This equation calculates the degree of agreement between cues and elements and the relative strength of their contribution. W_j represents cue weights, which are assumed to be equally distributed across the cues. S_{ij} represents associative strengths between j and i, and is computed as: $S_{ji} = m + ln(P(i|j))$, where m is the maximum association strength that item i could have. The

In L. K. Samuelson, S. L. Frank, M. Toneva, A. Mackey, & E. Hazeltine (Eds.), *Proceedings of the 46th Annual Conference of the Cognitive Science Society.* ©2024 The Author(s). This work is licensed under a Creative Commons Attribution 4.0 International License (CC BY).

equation implies that activation from a cue decreases as more items match the cue. The last term represents stochastic noise. In the activation model, retrieval times (RT) are calculated based on element activation, as follows: $RT = Fe^{-A_i}$, where F is a constant. The negative exponential function of A_i implies that lower activations lead to longer retrieval times.

As noted above, the activation level for the target varies depending on the number of other items matching retrieval cues. In quantifier float, this means that different retrieval times are predicted when a distractor matches a set of retrieval cues. For example, consider the following grammatical sentences.

(3a) The boys who the girls saw quite recently all walked back home from school.

(3b) The boys who the girl saw quite recently, all walked back home from school.

In these sentences, the target ("The boys…") matches the floating quantifier in number. In (3a), the distractor ("the girls") also matches the floating quantifier in number. Thus, the activation from the number cue is split between the target and the distractor, leading to a decrease in activation to the target. No such decrease is predicted in (3b) because the distractor in this sentence mismatches the floating quantifier in number. Consequently, the activation model predicts longer retrieval times at the floating quantifier in (3a) than (3b). This retrieval difficulty is referred to as *inhibitory interference* (Dillon et al., 2013).

The activation model predicts a different type of interference in ungrammatical sentences like below.

(3c) The boy who the girls saw quite recently all walked back home from school.

(3d) The boy who the girl saw quite recently all walked back home from school.

These sentences are ungrammatical because the target mismatches the floating quantifier's number. The activation model predicts shorter retrieval times at the floating quantifier in (3c) compared to (3d) over multiple trials due to the following scenario. In (3c), the distractor matches the number cue, leading to similar activation levels between the target and the distractor. Activation fluctuates from trial to trial due to stochastic noise (i.e., ε in equation (2)). Thus, the activation model predicts that when the floating quantifier appears, either the target or the distractor is retrieved randomly, with a probability of around 0.5. Because the element with the highest activation is retrieved, the retrieved element has a relatively high activation. In contrast, in (3d), where the distractor mismatches the number cue, the target is consistently retrieved, even when its activation is relatively low due to noise. As a result, over multiple trials, retrieval times are predicted to become shorter on average in (3c) than (3d). This effect is referred to as *facilitatory interference*.

As shown by the equation in (2), the activation model posits additive cue combination (i.e., $\sum_j W_j S_{ji}$). The other model this study tests assumes multiplicative cue combination. In language comprehension literature, this cue-combinatorics scheme is primarily motivated by the proposition that memory retrieval resists interference effects during sentence processing (Dillon et al., 2013; Parker, 2019). For example, the retrieval probability (RP) for i can be computed multiplicatively by:

(4) $$RP_i = \frac{\prod_j S_{ij}^{w_j}}{\sum_i \prod_j S_{ij}^{w_j}}$$

Here, cue strengths are multiplied, rather than summed. Thus, assuming that the feature match has a value of 0.99 and the feature mismatch 0.01, the equation in (4) implies that partially matching elements make minimal contributions relative to fully matching elements. For instance, the retrieval probability for the target becomes close to 1 in both (3a) and (3b). A similar probability obtains for (3d) because the distractor does not match any cues. However, in (3c), where the target and the distractor match the same number of cues, the denominator becomes twice the value of the numerator, resulting in a retrieval probability of 50% for the target. These probabilities provide a basis for evaluating similarity-based interference during sentence processing. The computation of retrieval times can take various forms, dependent on assumptions about the comprehension process after memory retrieval. A perspective, which computationally aligns with many proponents of multiplicative cue combination within the domain of language comprehension, is that the parser searches for another element whenever no grammatical dependency is formed (Yadav et al., 2023). This search will be referred to as *revision*. Since revision is an additional cognitive process, it takes some time to complete (Cunnings & Fujita, 2021; Frazier & Rayner, 1982; Fujita, 2021, 2023, 2024; Fujita & Cunnings, 2020, 2021a, 2021b; Sturt, 1997). In other words, if retrieval times follow a certain distribution with a mean and a standard deviation, e.g., $RT_i \sim Normal(\mu, \sigma)$, the times of retrieval involving revision can be expressed as: $RT_i \sim Normal(\mu + \alpha, \sigma)$.

In (3a/b), revision occurs at the probability of $1 - RP_{target}$. As noted, the retrieval probability for the target in (3a/b) is close to 1. Thus, retrieval times almost always follow the distribution of $Normal(\mu, \sigma)$, resulting in no discernible interference between (3a) and (3b). In (3c/d), revision always occurs because no elements fully match a set of retrieval cues. Therefore, although the retrieval probability for the target varies, depending on whether the distractor matches or mismatch in number, retrieval times are invariably generated by $Normal(\mu + \alpha, \sigma)$ in (3c) and (3d). Consequently, the multiplicative model predicts processing costs due to ungrammaticality (*ungrammaticality effects*) but no interference between (3a) and (3b) and between (3c) and (3d).

The present study

The present study first reports two experiments aimed at investigating interference effects in quantifier float. The motivations for this empirical investigation are as follows.

Firstly, there is substantial evidence of facilitatory interference in the literature (Cunnings & Fujita, 2023; Cunnings & Sturt, 2018; Fujita & Cunnings, 2022, 2023, 2024; Fujita & Yoshida, 2024; González Alonso et al., 2021; Jäger et al., 2017, 2020; Wagers et al., 2009). However, evidence of inhibitory interference is inconclusive (Dillon et al., 2013; Jäger et al., 2017; Nicenboim et al., 2018; Wagers et al., 2009). Some studies argue that the inconclusive evidence of inhibitory interference is due to the lack of statistical power in previous research. Nicenboim et al. (2018) claim that the effect size of inhibitory interference is only about 9ms. Assuming a standard deviation of 75ms (Parker, 2019), a simple power analysis suggested that a minimum of 550 participants is needed to have an 80% probability of detecting inhibitory interference. To address this concern, each experiment in this study involved 640 participants, with 24 sets of experimental sentences.

Secondly, this study aims to contribute to an ongoing debate regarding whether the position of a distractor influences similarity-based interference (Arnett & Wagers, 2017; Engelmann et al., 2019; Fujita & Yoshida, 2024; Parker & An, 2018). Parker and An (2018), for instance, suggest that memory retrieval during online language comprehension is insusceptible to similarity-based interference when the distractor is in a subject or object position. In contrast, Engelmann et al. (2019) claim that a distractor in a subject position is encoded prominently to some extent, leading to increased interference. Likewise, Arnett and Wagers (2017) argue for the significance of subject positions in interference, but only when memory retrieval exclusively targets subject positions. Given that the associate of a floating quantifier is not necessarily confined to a subject position (e.g., *Mary likes them all*), quantifier float provides an interesting test case of the influence of distractor position on memory retrieval. In Experiment 1, a distractor occupied a subject position in a relative clause, as in (3a–d), while in Experiment 2, it was in an object position (e.g., *The boy(s) who saw the girl(s) quite recently all walked back home from school*).

Experiment 1

Experiment 1 tested sentences like (3a–d).

Participants

In Experiment 1, 640 native English speakers were recruited via the Prolific platform (https://www.prolific.com/). All participants held university degrees, were British citizens, and had primarily lived in the UK before turning 18.

Items, Procedure and Analysis

For Experiment 1, 24 item sets, as illustrated in (3a–d), were prepared (24 sets × 4 conditions = 96 items). Participants saw six experimental items from each condition. These items were interspersed with 72 filler sentences. For the floating quantifier, the universal quantifier “all” was always used.

Participants’ reading times were measured through a lexicality maze task. In this task, sentences were presented word by word, accompanied by a pseudoword. Participants needed to choose correct words to read the sentences. When a pseudoword was chosen, the trial was immediately terminated, and the next trial began.

Log-transformed reading times at the floating quantifier and the subsequent (spillover) region were analysed using linear mixed effects models (Bates et al., 2015) in R (R Core Team, 2020). Random effects included random intercepts and all relevant slopes for both participants and items. The models included sum-coded (.5/–.5) fixed effects of Grammaticality (grammatical/ungrammatical) and Distractor (match/mismatch), along with their interaction.

Results

Figure 1 illustrates log-transformed reading times at the floating quantifier and the spillover region.

Floating quantifier region: There was a significant main effect of Grammaticality ($p < .001$), with longer reading times in the ungrammatical conditions (3c/d) than in the grammatical conditions (3a/b), suggesting ungrammaticality effects. There was also a significant Grammaticality by Distractor interaction ($p = .049$). A follow-up analysis examined the effect of Distractor within each level of Grammaticality. This analysis revealed a significant effect of Distractor in the ungrammatical conditions ($p = .003$), suggesting facilitatory interference (i.e., shorter reading times in (3c) than (3d)). The estimated effect size of facilitatory interference was 14ms, with a 95% confidence interval of [6, 23] ms. In contrast, the grammatical conditions did not show interference effects ($p = .684$), indicating the absence of inhibitory interference (i.e., similar reading times between (3a) and (3b)).

Spillover region: The results at the spillover region closely mirrored those at the critical region. There was a significant main effect of Grammaticality ($p < .001$), along with a significant Grammaticality by Distractor interaction ($p = .037$). These effects suggest ungrammaticality effects and facilitatory interference ($p < .001$), as well as the absence of inhibitory interference ($p = .325$). The estimate of facilitatory interference was 22ms, with a 95% confidence interval of [13, 31] ms.

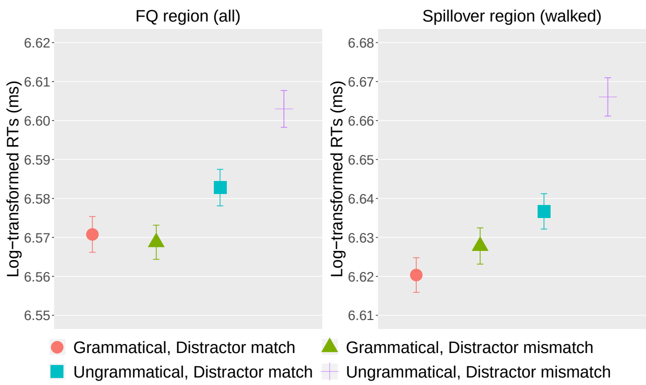

Figure 1. Reading times at the floating quantifier (FQ) and spillover regions in Experiment 1.

Experiment 2

Experiment 2 used sentences similar to (3a–d), but with the distractor in the object position of the relative clause, as follows:

(5a) The boys who saw the girls quite recently **all** walked…
(5b) The boys who saw the girl quite recently **all** walked…
(5c) The boy who saw the girls quite recently **all** walked…
(5d) The boy who saw the girl quite recently **all** walked…

The aims of Experiment 2 were to replicate the results of Experiment 1 as well as to explore the influence of distractor position on memory retrieval during real-time language comprehension.

Participants

For Experiment 2, 640 native English speakers, who had not participated in Experiment 1, were recruited from the same participant pool as Experiment 1 via the Prolific platform.

Items, Procedure and Analysis

As in Experiment 1, 24 item sets, as exemplified in (5a–d), were prepared. These items were interspersed with 72 filler items.

The procedure and data analysis were identical to those of Experiment 2.

Results

The results of Experiment 2 were similar to those of Experiment 1. Log-transformed reading times at the floating quantifier and the spillover region are illustrated in Figure 2.

Floating quantifier region: There was a significant main effect of Grammaticality ($p < .001$), with increased reading times in the ungrammatical conditions (5c/d) compared to the grammatical conditions (5a/b), suggesting ungrammaticality effects. There was also a significant interaction between Grammaticality and Distractor ($p = .027$). As in Experiment 1, a follow-up analysis was conducted to examine the effect of Distractor within each level of Grammaticality. For ungrammatical sentences, this analysis revealed shorter reading times in the Distractor-Match (5c) than Distractor-Mismatch conditions (5d) ($p = .020$), suggesting facilitatory interference. The estimate of facilitatory interference was 11ms, with a 95% confidence interval of [2, 20] ms. In contrast, the grammatical conditions (5a/b) did not show interference effects ($p = .695$), indicating no inhibitory interference.

Spillover region: There was a significant main effect of Grammaticality ($p < .001$), and there was a significant Grammaticality by Distractor interaction ($p = .009$). These effects indicated ungrammaticality effects and facilitatory interference ($p = .012$), with no significant effect of Distractor in the grammatical conditions, suggesting the absence of inhibitory interference ($p = .084$). The estimate of facilitatory interference was 18ms, with a 95% confidence interval of [5, 31] ms.

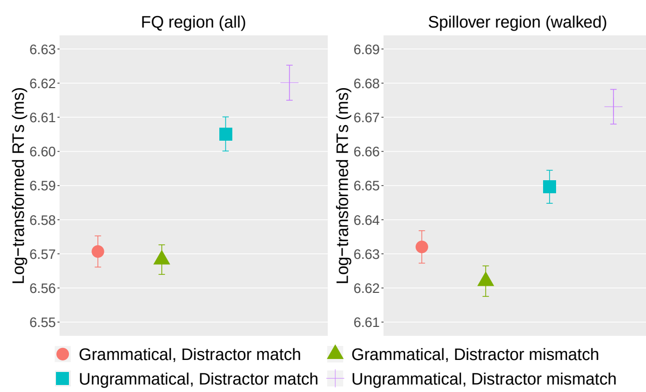

Figure 2. Reading times at the floating quantifier (FQ) and the spillover regions in Experiment 2.

Discussion

This study investigated the susceptibility of online memory retrieval to similarity-based interference, particularly the resistance to inhibitory interference, and the influence of distractor position on memory retrieval. Resolving these issues is essential for modelling memory retrieval processes during real-time language comprehension.

The results showed longer reading times at the floating quantifier in ungrammatical than in grammatical sentences. This finding suggests that, upon encountering a floating quantifier, the parser attempts to retrieve its associate NP in a structurally permissible position from memory. The results also showed that memory retrieval during sentence processing is susceptible to facilitatory interference. However, Experiments 1 and 2 did not show clear inhibitory interference. Also, there was no indication that distractor position influences memory retrieval; across Experiments 1 and 2, the size of facilitatory interference was similar.

Distractor Position and Memory Retrieval

Experiments 1 and 2 demonstrated facilitatory interference, suggesting that subject or object positions do not nullify interference effects during real-time language comprehension. This finding challenges the studies claiming that facilitatory interference does not arise from these positions (Parker & An, 2018). Parker and An claim that subjects and objects play a crucial role in sentence interpretations. Based on this claim, they argue that a distractor in a subject or object position is encoded distinctively, and the parser easily determines that it is not structurally permissible, leading to no interference effects. This claim is difficult to implement in the activation model because it conflicts with the model's assumption that items that are encoded distinctively receive high activation. Therefore, the findings of Experiments 1 and 2 are compatible with the activation model concerning the relation between encoding processes and activation levels.

This study also did not find that a distractor in a subject position elicits greater interference effects compared to when it is located in an object position; the estimates of facilitatory interference were similar between Experiments 1 and 2. This finding may be due to the distribution of quantifier float. As mentioned in the introduction, the associates of floating quantifiers are not restricted to subject positions; for example, they can appear in an object position. Therefore, it is conceivable that information specific to a subject position is not encoded as a retrieval cue for accessing the floating quantifier's associate in memory. This finding is most compatible with Arnett and Wagers (2017), who argue that subject positions cause increased interference effects only if memory retrieval exclusively targets subject positions.

Computational Modelling

The finding of facilitatory interference and no clear evidence of inhibitory interference pose a challenge to both the activation model, predicting both interference types (Lewis & Vasishth, 2005; Vasishth & Engelmann, 2021) and the multiplicative model, predicting no interference (Dillon et al., 2013; Parker, 2019). However, these findings align with many previous studies (Wagers et al., 2009). The substantial sample sizes of Experiments 1 and 2 strongly suggest the presence of facilitatory interference and the absence of inhibitory interference during real-time language comprehension. One way to model the observed reading time data within the framework of cue-based memory retrieval is to make two assumptions.

Firstly, substantial weight is assigned to the structure-based cue during initial memory retrieval. Here, initial memory retrieval is defined in opposition to revision. With this assumption (e.g., the weight of .999 assigned to the structure-based cue and .001 to the number cue), similar spreading activations are yielded between sentences like (3a) and (3b), as the number cue now makes a minimal contribution to activation levels relative to the structure-based cue. Thus, substantial weight of the structure-based cue allows us to account for the lack of inhibitory interference during real-time language comprehension.

Secondly, during revision, the parser reuses cue-based memory retrieval to form dependencies that do not adhere to structural constraints but remain consistent with lexical features. In other words, cue-based memory retrieval is invoked twice in ungrammatical sentences: once during initial memory retrieval and once during revision. Since the aim of this second cue-based retrieval is to form dependencies licensed by lexical features, the parser must rely on other cues, such as number in (3c/d), rather than the structure-based cue. This assumption allows us to naturally account for ungrammatical effects (because memory retrieval occurs twice) as well as facilitatory interference (because a feature-matching distractor leads to faster retrieval).

In order to simulate the specific processing time patterns generated by these assumptions, a computational model embodying them was implemented within the framework of ACT–R (Anderson, 2007), as in the activation model. Regarding model parameters, other than cue weighting, this proposed model mostly adopted the same values as the activation model (Vasishth & Engelmann, 2021). Simulations were run over 10,000 times, with each yielding a data point for each condition, as exemplified in (3a–d) (i.e., each condition had 10,000 data points). The simulation results are illustrated in Figure 3, along with the predictions of the activation model and the data observed at the critical region in this study. These results suggest that the proposed model provides a better fit to the data than the activation model.

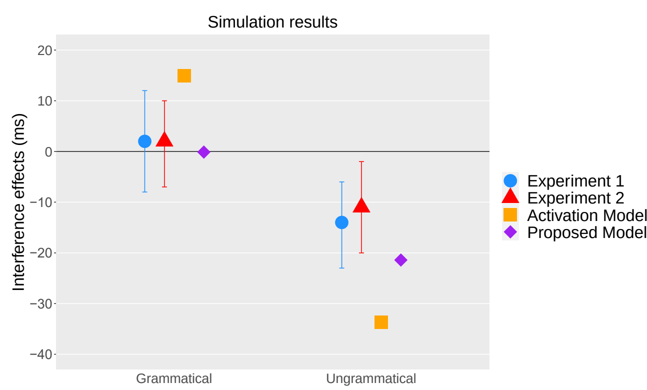

Figure 4. Simulation results. The data from Experiments 1 and 2 are obtained from the critical region. Positive values on the y-axis indicate inhibitory interference, whereas negative values denote facilitatory interference.

Conclusion

This study investigated two cue-based memory retrieval models by testing similarity-based interference during sentence processing with large samples. The result showed facilitatory interference in ungrammatical sentences but did not show inhibitory interference in grammatical sentences. These findings challenge the two cue-based memory models. To enable the cue-based memory retrieval theory to predict this interference pattern, this study posited a substantial weighting of the structure-based cue and incorporated the concepts of initial memory retrieval and revision. A computational model embodying these assumptions was presented and assessed through simulations. The results from these simulations indicated that this proposed model successfully predicts the observed data.

Acknowledgments

This study was supported by the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) – Project number 500540359. PI: Hiroki Fujita.

References

Alcocer, P., & Phillips, C. (2012). Using Relational Syntactic Constraints in Content-Addressable Memory Architectures for Sentence Parsing. *Retrieved from Http://Www.Colinphillips.Net/Wp-Content/Uploads/2014/08/Alcocer_phillips2012_v2.Pdf*.

Anderson, J. R. (2007). *How can the human mind occur in the physical universe?* (pp. ix, 290). Oxford University Press. https://doi.org/10.1093/acprof:oso/9780195324259.001.0001

Arnett, N., & Wagers, M. (2017). Subject encodings and retrieval interference. *Journal of Memory and Language*, *93*, 22–54. https://doi.org/10.1016/j.jml.2016.07.005

Bates, D., Mächler, M., Bolker, B., & Walker, S. (2015). Fitting Linear Mixed-Effects Models Using **lme4**. *Journal of Statistical Software*, *67*(1). https://doi.org/10.18637/jss.v067.i01

Cunnings, I., & Fujita, H. (2021). Quantifying individual differences in native and nonnative sentence processing. *Applied Psycholinguistics*, *42*(3), 579–599. https://doi.org/10.1017/S0142716420000648

Cunnings, I., & Fujita, H. (2023). Similarity-based interference and relative clauses in second language processing. *Second Language Research*, *39*(2), 539–563. https://doi.org/10.1177/02676583211063534

Cunnings, I., & Sturt, P. (2018). Retrieval interference and semantic interpretation. *Journal of Memory and Language*, *102*, 16–27. https://doi.org/10.1016/j.jml.2018.05.001

Dillon, B., Mishler, A., Sloggett, S., & Phillips, C. (2013). Contrasting intrusion profiles for agreement and anaphora: Experimental and modeling evidence. *Journal of Memory and Language*, *69*(2), 85–103. https://doi.org/10.1016/j.jml.2013.04.003

Engelmann, F., Jäger, L. A., & Vasishth, S. (2019). The Effect of Prominence and Cue Association on Retrieval Processes: A Computational Account. *Cognitive Science*, *43*(12). https://doi.org/10.1111/cogs.12800

Frazier, L., & Rayner, K. (1982). Making and correcting errors during sentence comprehension: Eye movements in the analysis of structurally ambiguous sentences. *Cognitive Psychology*, *14*(2), 178–210. https://doi.org/10.1016/0010-0285(82)90008-1

Fujita, H. (2021). On the parsing of garden-path sentences. *Language, Cognition and Neuroscience*, *36*(10), 1234–1245. https://doi.org/10.1080/23273798.2021.1922727

Fujita, H. (2023). Predictive structure building in language comprehension: A large sample study on incremental licensing and parallelism. *Cognitive Processing*, *24*(2), 301–311. https://doi.org/10.1007/s10339-023-01130-8

Fujita, H. (2024). Online revision process in clause-boundary garden-path sentences. *Memory & Cognition*, *52*, 73–90. https://doi.org/10.3758/s13421-023-01444-0

Fujita, H., & Cunnings, I. (2020). Reanalysis and lingering misinterpretation of linguistic dependencies in native and non-native sentence comprehension. *Journal of Memory and Language*, *115*, 104154. https://doi.org/10.1016/j.jml.2020.104154

Fujita, H., & Cunnings, I. (2021a). Lingering misinterpretation in native and nonnative sentence processing: Evidence from structural priming. *Applied Psycholinguistics*, *42*(2), 475–504. https://doi.org/10.1017/S0142716420000351

Fujita, H., & Cunnings, I. (2021b). Reanalysis processes in non-native sentence comprehension. *Bilingualism: Language and Cognition*, *24*(4), 628–641. https://doi.org/10.1017/S1366728921000195

Fujita, H., & Cunnings, I. (2022). Interference and filler-gap dependency formation in native and non-native language comprehension. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *48*(5), 702–716. https://doi.org/10.1037/xlm0001134

Fujita, H., & Cunnings, I. (2023). Interference in quantifier float and subject-verb agreement. *Language, Cognition and Neuroscience*, *38*(7), 1001–1019. https://doi.org/10.1080/23273798.2023.2189738

Fujita, H., & Cunnings, I. (2024). Subject-verb dependency formation and semantic interference in native and non-native language comprehension. *Applied Psycholinguistics*, *45*(1), 81–109. https://doi.org/10.1017/S0142716423000498

Fujita, H., & Yoshida, M. (2024). Online reflexive resolution and interference. *Language, Cognition and Neuroscience*, 1–14. https://doi.org/10.1080/23273798.2024.2329269

González Alonso, J., Cunnings, I., Fujita, H., Miller, D., & Rothman, J. (2021). Gender attraction in sentence comprehension. *Glossa: A Journal of General Linguistics*, *6*(1), 20. https://doi.org/10.5334/gjgl.1300

Jäger, L. A., Engelmann, F., & Vasishth, S. (2017). Similarity-based interference in sentence comprehension: Literature review and Bayesian meta-analysis. *Journal of*

Memory and Language, *94*, 316–339. https://doi.org/10.1016/j.jml.2017.01.004
Jäger, L. A., Mertzen, D., Van Dyke, J. A., & Vasishth, S. (2020). Interference patterns in subject-verb agreement and reflexives revisited: A large-sample study. *Journal of Memory and Language*, *111*, 104063. https://doi.org/10.1016/j.jml.2019.104063
Kush, D. (2013). *Respecting Relations: Memory Access and Antecedent Retrieval in Incremental Sentence Processing* [PhD Thesis, University of Maryland]. http://hdl.handle.net/1903/14589
Lewis, R. L., & Vasishth, S. (2005). An Activation-Based Model of Sentence Processing as Skilled Memory Retrieval. *Cognitive Science*, *29*(3), 375–419. https://doi.org/10.1207/s15516709cog0000_25
Nicenboim, B., Vasishth, S., Engelmann, F., & Suckow, K. (2018). Exploratory and Confirmatory Analyses in Sentence Processing: A Case Study of Number Interference in German. *Cognitive Science*, *42*(S4), 1075–1100. https://doi.org/10.1111/cogs.12589
Parker, D. (2019). Cue Combinatorics in Memory Retrieval for Anaphora. *Cognitive Science*, *43*(3), e12715. https://doi.org/10.1111/cogs.12715
Parker, D., & An, A. (2018). Not All Phrases Are Equally Attractive: Experimental Evidence for Selective Agreement Attraction Effects. *Frontiers in Psychology*, *9*, 1566. https://doi.org/10.3389/fpsyg.2018.01566
R Core Team. (2022). *R: A language and environment for statistical computing* [Computer software]. R Foundation for Statistical Computing. https://www.R-project.org/
Sturt, P. (1997). *Syntactic reanalysis in human language processing* [PhD Thesis]. University of Edinburgh.
Vasishth, S., & Engelmann, F. (2021). *Sentence Comprehension as a Cognitive Process: A Computational Approach*. Cambridge University Press. https://doi.org/10.1017/9781316459560
Wagers, M., Lau, E. F., & Phillips, C. (2009). Agreement attraction in comprehension: Representations and processes. *Journal of Memory and Language*, *61*(2), 206–237. https://doi.org/10.1016/j.jml.2009.04.002
Yadav, H., Smith, G., Reich, S., & Vasishth, S. (2023). Number feature distortion modulates cue-based retrieval in reading. *Journal of Memory and Language*, *129*, 104400. https://doi.org/10.1016/j.jml.2022.104400