Memory retrieval in presupposition processing: 3 eye-tracking experiments
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[Introduction] Retrieval in dependency resolution is generally thought to make use of a content-addressable, cue-based retrieval mechanism[1,2]. Most studies agree that all elements that share cues with a target can cause interference during resolution, even if they are not in a syntactic position to resolve the dependency[3,4]. Most studies focused on syntactic dependencies, such as subject-verb agreement and reflexives. However, little is known about dependencies that operate across a discourse. By studying presupposition resolution, which can depend on information given at any point in the preceding discourse, we can gain more insight into how memory works in the recall of information from the discourse. In particular, it is far from clear how presupposition resolution compares to syntactic dependency resolution, whether it can be modeled with cue-based retrieval, and what the role of semantic factors such as discourse accessibility is.

[Experimental setup] By means of 3 eye-tracking-while-reading experiments we studied the effect of (mis)matching information and accessibility in two-sentence discourses during presupposition resolution. A target and distractor in the first sentence could (mis)match the presupposition in the second sentence, leading to a 2x2 design (T-MATCH vs. T-MIS, D-MATCH vs. D-MIS). See (1) on the next page for an example. Crucially, the distractor was placed within the scope of a negation, making it inaccessible for presupposition resolution. Data were analyzed in the Bayesian paradigm using hierarchical models. Acceptability studies were performed separately for each experiment. Experiments were performed in Dutch.

[Results] Exp 1 (n=56, items=44) with gender-marked nouns that could (mis)match the gender of the noun in the presupposition, showed slowdown effects due to T-MIS and D-MIS in early measures (95% Confidence Intervals for critical region, right-bounded: T-MIS [-0.06;-0.01], D-MIS [-0.06;-0.02]; post-critical region and regression path duration similar). Crucially, we also found a positive interaction on the critical region (regression path duration: [0.00;0.06]) indicating longer reading times for the T-MIS D-MIS condition, consistent with the interference effect predicted by cue-based retrieval. In late measures we only found a slowdown effect due to T-MIS (total fixation duration: [-0.09;-0.03]; post-critical region similar). Exp 2 (n=58, items=40) with VPs that could (mis)match the VP in the presupposition showed similar results. Both experiments thus suggest that inaccessible information causes interference during presupposition resolution, but only in an early stage of processing. This does not only hold for feature-like information such as gender (Exp 1), but also for retrieval of lexical content (Exp 2). In Exp 3 (n=60, items=40) we switched target and distractor to study distance effects. Main effects were similar to Exp 1 & 2. However, no interaction was found, suggesting that when the distractor is further away from the presupposition, interference decreases. The acceptability studies of all 3 experiments showed that T-MATCH conditions consistently received higher ratings than T-MIS, while there was no difference between D-MATCH and D-MIS, suggesting that only accessible information influences final interpretation.

[Discussion] In early processing the results consistently show interference effects when a mismatch in information impedes presupposition resolution. This is comparable to previous work on other types of dependency resolution demonstrating interference by syntactically inaccessible elements, causing illusions of grammaticality[4,5]. The results support the use of a cue-based retrieval mechanism for modelling dependency resolution in a discourse. Discourse accessibility can be thought of as having a double role: initially, it acts as a retrieval cue, and later on it can completely block inaccessible information. This is supported by the acceptability studies, which showed that conditions with mismatching targets were consistently degraded in acceptability, while a mismatching distractor had no such effect. In sum, the results show that presupposition

resolution can be compared to other types of dependency resolution and that recall of information from the discourse can be modeled with a cue-based retrieval mechanism.
[Supplementary material]

(1) Example of a stimulus, Exp 1. Regions of interest are indicated with square brackets. Regions 6 and 7 are considered the critical and post-critical regions.

T-MATCH D-MATCH	[X is brandweer**man**,]$_1$ [maar]$_2$ [Y is geen brandweer**man**.]$_3$ *X is a fireman, but Y is not a fireman.*	[Zij hebben]$_4$ [een collega die ook]$_5$ [brandweer**man** is]$_6$ [en vaak nachtdiensten]$_7$ [moet draaien.]$_8$ *They have a colleague who is a fireman too, and has to work nightshifts often.*
T-MATCH D-MIS	[X is brandweer**man**,]$_1$ [maar]$_2$ [Y is geen brandweer**vrouw**.]$_3$ *X is a fireman, but Y is not a firewoman.*	
T-MIS D-MATCH	[X is brandweer**vrouw**,]$_1$ [maar]$_2$ [Y is geen brandweer**man**.]$_3$ *X is a firewoman, but Y is not a fireman.*	
T-MIS D-MIS	[X is brandweer**vrouw**,]$_1$ [maar]$_2$ [Y is geen brandweer**vrouw**.]$_3$ *X is a firewoman, but Y is not a firewoman.*	

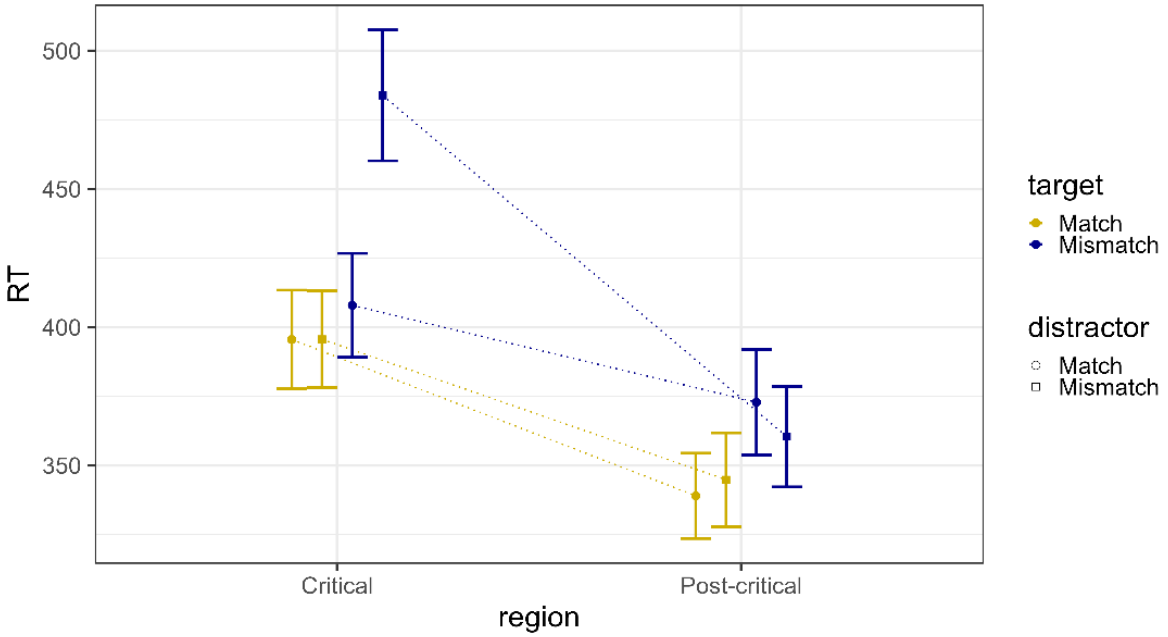

Figure 1: Right-bounded reading times, Exp 2. The critical region shows an interaction effect consistent with cue-based interference, and comparable to illusions of grammaticality in other dependency studies.

[References] [1] McElree (2000). Sentence comprehension is mediated by content-addressable memory structures. *JoPR*. **[2]** Van Dyke & Lewis (2003). Distinguishing effects of structure and decay on attachment and repair: A cue-based parsing account of recovery from misanalyzed ambiguities. *JML*. **[3]** Jäger, Engelmann, & Vasishth (2017). Similarity-based interference in sentence comprehension: Literature review and Bayesian meta-analysis. *JML*. **[4]** Wagers, Lau, & Phillips (2009). Agreement attraction in comprehension: Representations and processes. *JML*. **[5]** Pearlmutter, Garnsey, & Bock (1999). Agreement processes in sentence comprehension. *JML*.