The Real-Time Processing of Pronouns in Weak and Weakest Crossovers

Antecedent retrieval for English pronouns has been shown to "filter out" morpho-semantically similar but syntactically inaccessible constituents [1,2,4,5,9]. For instance, prior research has demonstrated that a pronoun processing is unaffected by a gender-(mis)match with a dislocated constituent when grammatical constraints, such as the Weak Crossover (WCO) violation, prohibit binding (e.g., (1)) [4]. These findings have been widely regarded as primary evidence for a grammar-guided mechanism for antecedent retrieval, rather than a content-addressable one.

In this study, we further examine which properties of syntactic representations in WCO constructions enables the parser to exclude ungrammatical constituents during antecedent retrieval. The previous study [4] has proposed that the ungrammaticality of WCO constructions arises from a binder's (the wh-filler) inability to bind a pronoun in a non-argument position, as defined by the Bound Anaphor Condition (BAC) [7]. However, this explanation is challenged by constructions like (2), referred to as Weakest Crossover constructions, where a dislocated constituent still occupies a non-argument position but successfully binds the pronoun [8,10]. Alternatively, these two constructions may differ in the status of the gaps they involve: the gap in (1) is a null bound variable, while the gap in (2) is a null epithet (a definite description that corefer with referential noun phrases), and the Weak Crossover violation applies only to true variables [8].

We conducted a moving-window self-paced reading experiment (n = 80) to examine whether the parser differentiates these constructions based on the status of gaps rather than binders. Using the gender-(mis)match paradigm to identify antecedent retrieval [2,3,4,5,6,9], we designed 16 sets of stimuli in a 2x2x2 factorial design, manipulating NP1 Gender (Match vs. Mismatch), NP2 Gender (Match vs. Mismatch), and Structure Type (Weak vs. Weakest Crossover), as shown in (4). A sum-contrast coded linear mixed-effects model revealed no significant main effect of NP2 Gender in Weak Crossover constructions for the region *'(his) manager'* (β= -15.13, SE= 26.20, t= -0.57, $p > 0.05$), indicating that NP2 gender did not affect reading times. However, a significant main effect of NP2 Gender was observed in Weakest Crossover constructions (β= 76.04, SE= 24.23, t= 3.13, $p < 0.01$), with increased reading times when NP2 gender mismatched the pronoun, as illustrated in Figure 1.

Our findings reveal that the parser distinguished between Weak and Weakest Crossover constructions, selectively considering the relative head as an antecedent in Weakest Crossover constructions. This result supports, in line with the previous findings, the view that grammatical constraints function as a "gating" or "filtering" mechanism, allowing only grammatically accessible constituents to serve as antecedents [1,2,4,5,9], in contrast to models proposing that the parser processes all linguistic information simultaneously, including grammatically inaccessible constituents [3,6].

More importantly, our results indicate that the BAC alone cannot fully account for the ungrammaticality of WCO constructions. Instead, the findings suggest that the parser predictively constructs distinct types of gaps for Weak and Weakest Crossover constructions, yielding grammatical and ungrammatical representations, respectively. We propose that these two different syntactic representations, differentiated primarily by the status of the gaps, enable the parser to effectively exclude grammatically inaccessible constituents during retrieval.

[Supplementary material]

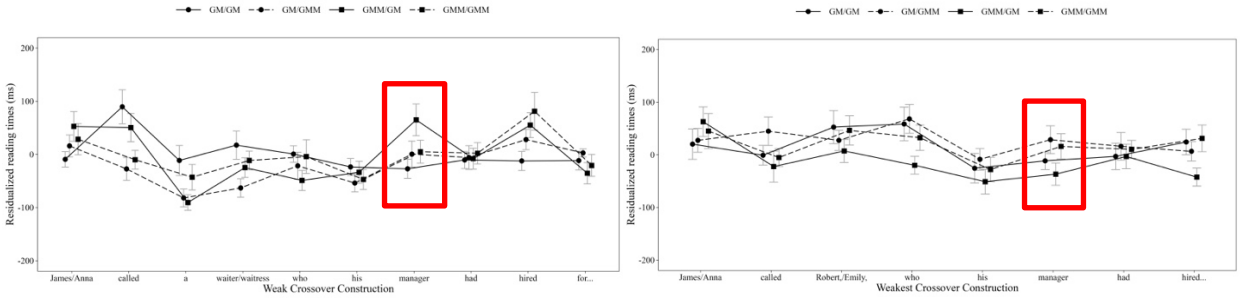
(1) ***A man**$_i$ who$_i$ his$_i$ wife loves (gap$_i$) left. [Weak Crossover Construction]
[GRAM-INACCESSIBLE]

(2) **John**$_i$, who$_i$ his$_i$ wife loves (gap$_i$), left. [Weakest Crossover Construction]
[GRAM-ACCESSIBLE]

(3) a. A waiter$_i$ who$_i$ his$_i$ manager [… **gap$_i$ (=bound variable)** …] → WCO violation
b. Robert$_i$, who$_i$ his$_i$ manager [… **gap$_i$ (=epithet)** …] → No WCO violation

(4) a. NP1(GM/GMM) & NP2(GM/GMM) & Weak Crossover construction (WCO violation)
$\{James|Anna\}_i$ called $\{a\ waiter|a\ waitress\}_i$ who *his*$_i$ manager had recently hired (gap)$_i$ for the night shift.
[GRAM-ACCESSIBLE] [GRAM-INACCESSIBLE]
b. NP1(GM/GMM) & NP2(GM/GMM) & Weakest Crossover construction (No WCO violation)
$\{James|Anna\}_i$ called $\{Robert|Emily\}_i$, who *his*$_i$ manager had recently hired (gap)$_i$ for the night shift.
[GRAM-ACCESSIBLE] [GRAM-ACCESSIBLE]

Figure 1. Reading times in Weak and Weakest Crossover Constructions



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