Attachment Preferences in Participle Constructions

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Introduction: Online ambiguity resolution processes are subject to various constraints. In English, studies have shown widespread biases for local/low attachment in sentences with attachment ambiguities [1-4], but a bias for high attachment is observed in some configurations [5]. Specifically, it has been suggested that high attachment is preferred when the low attachment structure is more complex [5]. This study investigates processing sentences with global ambiguity of the bare present participle clauses (PPCs) such as (1). The PPC, *wearing a hat*, can either attach low to the NP, *the girl*, or high to the VP, *met*. An A-Maze incremental reading experiment shows a bias for high attachment in online sentence processing. We argue that high attachment is preferred because it yields a simpler structure in the case of PPCs.

Processing PPCs: In an offline experiment, [6] suggested that the general preference for low attachment in English is also present in PPCs. This low attachment bias has not previously been tested in online processing. Considering structural complexity as a factor in attachment preferences, high attachment of PPC could be preferred in online processing. The structure of PPCs differs with high versus low attachment, as shown roughly in (2a) and (2b). (2a), high attachment, has an adjunct control structure, while (2b), low attachment, has a subject-gapped relative clause structure [7]. As in (2b), the NP-modifier structure involves movement of a silent relative pronoun and omission of the *be-verb*, making it more complex than the VP-modifier structure. If the parser obeys only the local attachment bias, there should be a bias for low attachment; but if a simpler structure is preferred, the parser would prefer high attachment.

Experiment: A Maze incremental reading experiment [2,8], where sentences are presented one word at a time and participants choose between two words as to which continues the sentence, was conducted with native English speakers (24 items: n=40). The semantic plausibility between the attachment site (*Attachment Site:* High vs. Low) and the PPC (*PPC:* Plausible vs. Implausible) were manipulated as independent factors in a 2x2 factorial design, in the following four conditions: High-Plausible/Low-Implausible (3a), High-Plausible/Low-Plausible (3b), High-Implausible/Low-Implausible (3c), and High-Implausible/Low-Plausible (3d). Thus, for example, in (3a), if the PPC is attached high, it yields the semantically plausible interpretation of *the coach holding the glove*, but if attached low, it has an implausible reading of *the padlock holding the glove*. This plausibility manipulation allows us to test the attachment preferences in PPCs: if a PPC attachment has an implausible interpretation, it should lead to reading time slowdown [9]. If the low attachment is preferred, when the parser reaches the embedded verb region, *holding* in (3), where the implausibility is recognized, the reading time should be slower in Low-Implausible conditions than Low-Plausible conditions. If, however, the high attachment is preferred, *holding* should be read significantly slower in High-Implausible conditions than in High-Plausible conditions. A linear-mixed effect model of log reading time revealed a significant main effect of *Attachment Site*, with low attachment conditions read significantly slower than high attachment (β=.09, SE=.03, t=3.05, p<.01) at the embedded verb region. Subset analysis revealed that the embedded verb in the High-Implausible/Low-Plausible condition is read significantly slower than the High-Plausible/Low-Implausible condition (β=.05, SE=.03, t=2.96, p<.05). The embedded verb in High-Implausible/Low-Implausible conditions was also read significantly slower than in High-Plausible/Low-Plausible conditions (β=.12, SE=0.04, t=2.93, p<.01).

Conclusions: The results of this experiment suggest that high attachment of PPC is preferred over low attachment. This supports that structural complexity influences ambiguity resolution and that high attachment is preferred when it yields a simpler structure. Additionally, the slower reading of High-Implausible/Low-Implausible than High-Plausible/Low-Plausible supports previous studies suggesting the ambiguity advantage [10, 11].

(1) The boy met the girl [PPC wearing a hat].
(2) a. The boy [VP met the girl [CP [IP PRO wearing a hat]]].
(2)b. The boy met [NP the girl [CP *Op* [IP t ~~was~~ wearing a hat]]]
(3)a. High-Plausible/Low-Implausible
     The coach locked the padlock holding a glove meanwhile the game went poorly.
(3)b.   High-Plausible/Low-Plausible
     The coach locked the vehicle holding a glove meanwhile the game went poorly.
(3)c. High-Implausible/Low-Implausible
     The keys locked the padlock holding a glove meanwhile the game went poorly.
(3)d. High-Implausible/Low-Plausible
     The keys locked the vehicle holding a glove meanwhile the game went poorly.
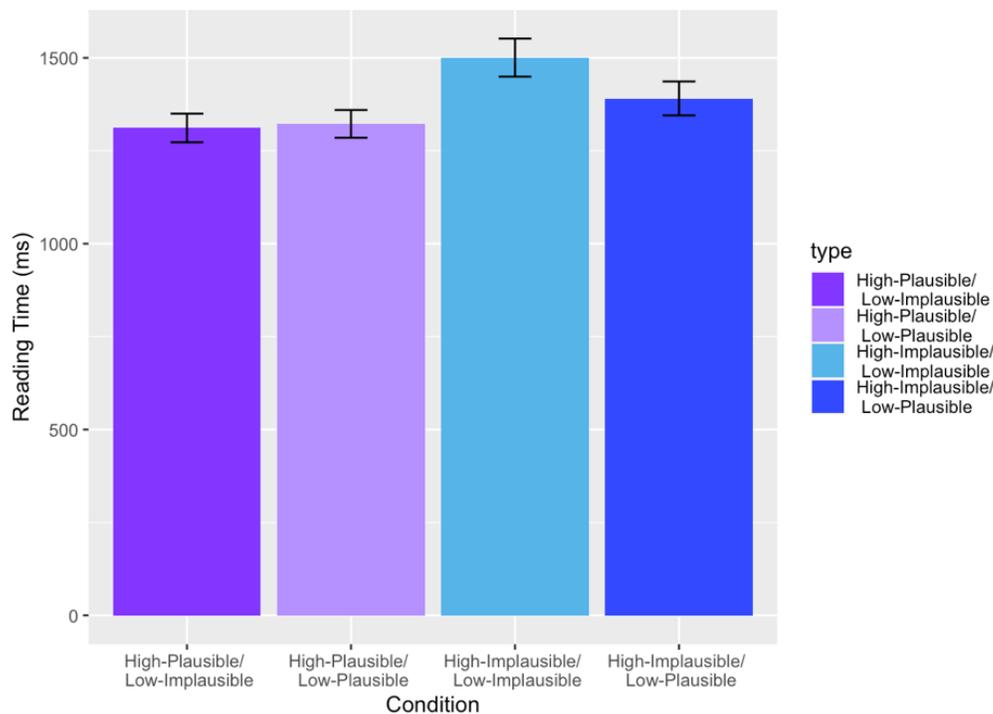
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