

Ambiguity Processing in Participle Constructions

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Introduction: During online attachment ambiguity resolution in English, there is a general preference for low attachment (LA) structures over high attachment (HA)[1-3]. Additionally, with ambiguous reflexive pronouns, preferences have been found for a local antecedent [4,5]. This study investigates how bare present participle clauses (PPCs [6]) are processed. As (1a) shows, PPC exhibits attachment ambiguity. At the same time, as (1b) shows, PPCs can include a reflexive, and give rise to an 'antecedent ambiguity.' In this context we can potentially see how resolution of attachment ambiguity and antecedent ambiguity interact during online sentence processing. An A-Maze online reading experiment [7,8] was conducted to investigate the processing of PPCs that are globally ambiguous as in (1) (Experiment 1). Another maze experiment tested PPCs containing a reflexive pronoun like in (2) (Experiment 2). These experiments, interestingly, show different attachment preferences: a HA preference when PPCs do not have a reflexive, but a LA preference when PPCs have a reflexive.

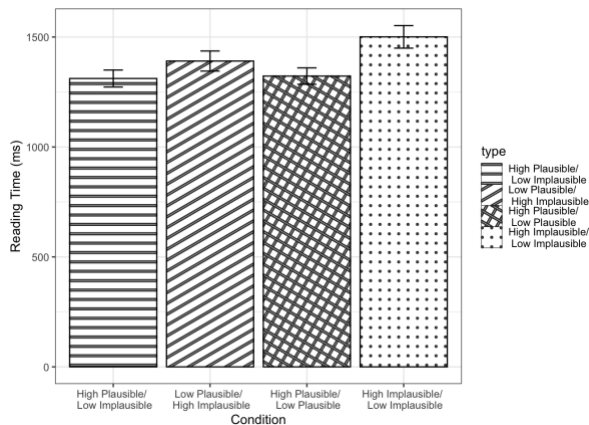
Experiment 1: (24 items: n=40): Semantic plausibility between Attachment Site (Attachment Site: High vs. Low) and PPC (PPC: Plausible vs Implausible) were manipulated as independent factors in a 2x2 factorial design, which yielded the following four conditions: High-Plausible/Low-Implausible (3a), Low-Plausible/High-Implausible (3b), High-Plausible/Low-Plausible (3c), and High-Implausible/Low-Implausible (3d). Thus, for example, in (3a), a HA interpretation of the PPC results in a semantically plausible interpretation but a LA interpretation yields implausibility. This manipulation tests PPC's attachment preferences, as an implausible interpretation should result in a reading time slowdown [9]. A linear-mixed effect model of log reading time showed a significant main effect of Attachment Site, where HA conditions were read significantly faster than LA at the embedded verb region ($\beta=.09$, $SE=.03$, $t=3.05$, $p<.01$). Subset analyses showed the embedded verb was read significantly slower in the Low-Plausible/High-Implausible condition than in the High-Plausible/Low-Implausible condition ($\beta=.05$, $SE=.03$, $t=2.96$, $p<.05$). Furthermore, the High-Plausible/Low-Plausible conditions were read significantly faster than the High-Implausible/Low-Implausible conditions ($\beta=.12$, $SE=0.04$, $t=2.93$, $p<.01$). Despite English's general LA preference, the resolution of ambiguity in certain structures can drive a HA preference [10]. This HA preference in PPCs is expected if the parser prefers a simpler syntactic structure. When the PPC is a modifier for a Noun Phrase (NP), it has the structure of reduced relative clauses (RC) but when it is a modifier for a Verb Phrase (VP), its structure has a subject controlled PRO [6]. The reduced RC structure of PPC, the LA structure, involves movement of a relative pronoun and omission of the relative pronoun and complementizer, which is arguably more complex than the PRO structure. Thus, if the parser prefers a simpler structure, the parser should pick the HA structure, in this case the PRO structure.

Experiment 2: (24 items: n=80): The gender match between a reflexive pronoun and the subject and object were manipulated as independent factors in a 2x2 factorial design: High Attachment Gender Match (4a), Low Attachment Gender Match (4b), High and Low Attachment Gender Match (4c), and No Gender Match (4d). Thus, depending on attachment site, the parser can find a potential antecedent for the reflexive with matched or mismatched gender information. At the reflexive, a linear-mixed effect model revealed Low Match conditions were read significantly faster than High Match conditions ($\beta=.13$, $SE=0.03$, $t=5.02$, $p<.0001$). This result is expected if the parser strongly prefers to link the reflexive to the closest antecedent [8]. In this experiment, the closest potential antecedent is the object NP, leading to the LA preference.

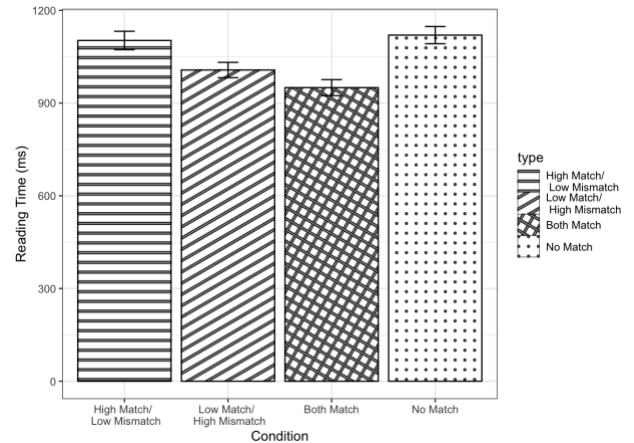
Conclusions: Experiment 1 suggested the preference for building the simpler structure that led to the HA of PPC. However, the results from Experiment 2 suggest that this preference can be overridden by the strength of the locality preference for antecedents of reflexive pronouns, thus revealing that the parser puts a higher priority on reflexive resolution.

- (1)a. The boy met the girl wearing a hat. (The boy wearing a hat vs The girl wearing a hat)
 (1)b. The lady answered the girl brewing herself a cup of coffee. (The lady brewing herself coffee vs The girl brewing herself coffee)
 (2) The boy met the girl knitting him/herself a hat.
 (3)a. High-Plausible/Low-Implausible
 The coach locked the padlock holding a glove meanwhile the game went poorly.
 (3)b. Low-Plausible/High-Implausible
 The keys locked the vehicle holding a glove meanwhile the game went poorly.
 (3)c. High-Plausible/Low-Plausible
 The coach locked the vehicle holding a glove meanwhile the game went poorly.
 (3)d. High-Implausible/Low-Implausible
 The keys locked the padlock holding a glove meanwhile the game went poorly.
 (4)a. High Match/Low Mismatch
 The quarterback answered the nurse brewing himself a cup of coffee.
 (4)b. Low Match/High Mismatch
 The quarterback answered the nurse brewing herself a cup of coffee.
 (4)c. Both Match
 The sniper answered the quarterback brewing himself a cup of coffee.
 (4)d. No Match
 The sniper answered the quarterback brewing herself a cup of coffee.

Experiment 1: Reading Time at Embedded Verb



Experiment 2: Reading Time at Reflexive Pronoun



References: [1] Traxler, Pickering, & Clifton. (1998). "Adjunct attachment is not a form of lexical ambiguity resolution." [2] Pickering, M. & Traxler, M. (1998). "Plausibility and recovery from garden paths: an eye-tracking study." [3] Phillips & Gibson. (1997). "On the strength of the local attachment preference." [4] Chomsky, N. (1981). "Lectures on government and binding." [5] Sturt, Patrick. (2003). "The time-course of the application of binding constraints in reference resolution." [6] Williams, E. (1992). "Adjunct control." [7] Witzel, N., Witzel, J., Forster, K. (2012) "Comparisons of online reading paradigms: eye tracking, moving-window, and maze." [8] Boyce, V., Futrell, R., Levy, R. (2019). "Made made easy: better and easier measurement of incremental processing difficulty." [9] Pickering, M. & Traxler, M. (1998). "Plausibility and recovery from garden paths: an eye-tracking study." [10] Grillo, N., Costa, J., Fernandes, B., & Santi, A. (2015). "Highs and lows in English attachment."