

## Lexical prediction and the processing of argument structure in English psych verbs

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Many theories of sentence processing propose that comprehenders interpret the first NP in a sentence as the agentive subject [1–2]. However, the mapping between argument structure and meaning is complex [3–5]. For instance, *psych verbs*, which denote mental states, often do not have agentive subjects. Instead, psych verbs may relate the *experiencer* thematic role to the subject grammatical function, whereas others relate it to PPs. This is reflected in real-time processing. For instance, [6] found that Spanish speakers experience processing difficulty when reading psych verbs, which they attribute to a difference in mapping between argument structure and thematic interpretation. However, if the sentence contained a fronted PP, then psych verbs were easier to process. [6] attribute this effect to a difference in canonical word order, because fronted PPs are canonical for Spanish psych verbs. Thus, Spanish speakers predicted that the upcoming predicate would be a psych predicate, facilitating processing.

A similar pattern holds in English. A PP may occur at the beginning of the sentence if it expresses an experiencer, e.g., [<sub>PP</sub> *To me*], *this dish tastes great*. However, verbs that take recipient PP arguments do not permit the PP to front easily: ?\* [<sub>PP</sub> *To me*], *John gave a present*. Additionally, psych verbs like *taste*, *matter*, and *appear* do not clearly assign an agent thematic role to their subject. In this study, we show that a fronted PP reduces the processing difficulty associated with a psych verb, like [6]. Unlike Spanish, we do not think it's appropriate to attribute this to a canonical word order effect, since fronted PPs are likely non-canonical in English. Thus, we attribute this to lexical prediction [7–9]. Upon detecting a PP, comprehenders may interpret it as a perspective holder or experiencer, which preactivates a psych verb. Additionally, we show that processing a non-fronted PP is more difficult if the main verb is a psych verb compared to a non-psych verb. We attribute this to the non-canonical grammatical function-thematic role alignment that psych verbs impose on their arguments, such that interpreting an experiencer PP is harder than a recipient PP.

**Experiment.** Thirty participants read 24 sets of items (86 fillers) in a self-paced reading paradigm [10]. We manipulated  $\pm$ Psych Verb and  $\pm$ PP Fronting. In the +Psych Verb conditions, the main predicates were headed by psych verbs that did not assign an agent thematic role to their subject, and assigned an experiencer thematic role to a PP argument. In the –Psych Verb conditions, we used verbs with typical alignment. In the +PP Fronting conditions, there was a PP containing an argument that was either interpreted as a dative recipient (–Psych Verb) or as an experiencer (+Psych Verb):

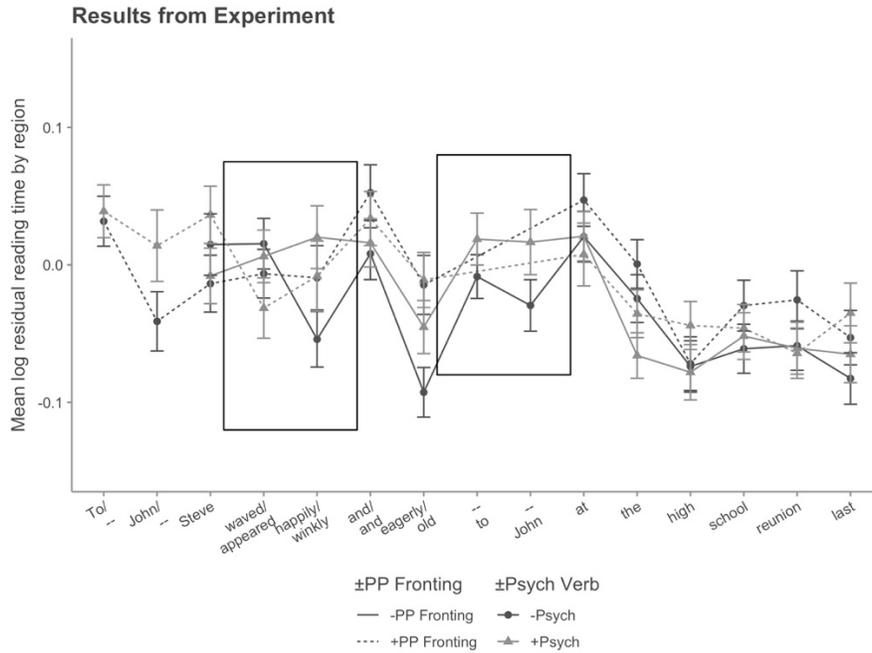
(1) **+PP Fronting, {–Psych Verb/+Psych Verb}**

[<sub>PP</sub> *To John*], Steve {waved happily and eagerly/appeared wrinkly and old} at the reunion

(2) **–PP Fronting, {–Psych Verb/+Psych Verb}**

Steve {waved happily and eagerly/appeared wrinkly and old} [<sub>PP</sub> *to John*] at the reunion

We constructed mixed linear effects models with the log residual reading times as dependent variable, and the structure suggested by [10] for the main clause predicate region (*waved happily and eagerly vs. appeared wrinkly and old*) and for the second PP region (*to John*). In this latter model, we did not include  $\pm$ PP Fronting as a factor, since there was no data in the –PP Fronting conditions in this region. In the main clause predicate, we did not find a main effect of either  $\pm$ Psych Verb or  $\pm$ PP Fronting ( $ps > 0.05$ ). However, we did find an interaction effect between these factors ( $\beta = 0.024 \pm 0.009$ ,  $t = 2.6$ ,  $p < 0.01$ ). We take this finding to demonstrate that comprehenders forecast a psych verb if they had encountered a fronted experiencer PP, as Spanish speakers did in [6]. Finally, in the later PP region, we found a marginal effect of  $\pm$ Psych Verb ( $\beta = 0.017 \pm 0.0089$ ,  $t = 1.9$ ,  $p = 0.06$ ). We take this to mean that comprehenders more easily integrate a recipient PP than an (unfronted) experiencer PP, which we attribute to the non-canonical alignment between grammatical function and thematic role that psych verbs impose.



**Figure 1.** Mean log residual reading times by word number and condition. Boxed reading times correspond to the regions in which analysis was conducted.

[1] T.G. Bever. (1970). *Cognition and the Development of Language*. [2] D.G. Tight (2015). *Studies in Hispanic and Lusophone Linguistics* 5. [3] M. Baker. (1988). *Incorporation*. [4] A. Belletti & L. Rizzi. (1988). *NLLT* 6. [5] I. Landau. (2009). *The Locative Syntax of Experiencers*. [6] C.A. Gattei et al. (2015). *Quarterly Journal of Experimental Psychology* 68. [7] W.-Y. Chow et al. (2015). *LCN* 31. [8] G.T.M. Altmann & Y. Kamide. (1999). *Cognition* 73. [9] K.D. Federmeier & M. Kutas. (1999). *JML* 41. [10] <https://hlplab.wordpress.com/2008/01/23/modeling-self-paced-reading-data-effects-of-word-length-word-position-spill-over-etc/>