

## **Sustained negativities for wh-movement may not extend to other types of syntactic predictions**

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Previous behavioral work suggests that humans pursue a top-down structure-building strategy in online sentence comprehension. Crucially, such top-down approaches require maintaining a memory representation of predictively generated structures until they are confirmed by the upcoming input. Prior ERP work has observed a sustained anterior negativity (SAN) for constructions involving filler-gap dependencies (e.g., wh-dependencies: Fiebach et al., 2002; Phillips et al., 2005; Ueno & Kluender, 2003; relative clauses: King & Kutas, 1995; argument scrambling: Hagiwara et al., 2007; Yano & Koizumi, 2018) relative to sentences with no such dependencies. While SANs have been widely interpreted as indexing the working memory cost of processing such constructions, less is known about what exactly is being held online. Here, we explore the possibility that what is being maintained online is a structural prediction (e.g., predicting an object position in wh-dependencies like (1a)). In particular, we investigate whether the SAN indexes the maintenance of non-local syntactic predictions *per se* by focusing on the case of sentence-initial subordinating adverbials (2a, 2c).

If the SAN is an index of actively maintaining non-local syntactic predictions, we expect sentence-initial subordinating adverbials (2a, 2c) – which trigger a prediction for an eventual subsequent matrix clause – to elicit a SAN relative to temporal adverbials that do not impose such a requirement (2b, 2d). Across three ERP experiments, we: (i) replicated a SAN for wh-dependencies (WHs), (ii) observed no such response in subordinating contrasts, and (iii) confirmed the above dissociation in a within-subjects design.

Materials were presented using RSVP, 500ms/word. In Exps 1 and 3 participants had to indicate whether a subsequent sentence was congruent with the preceding (target) sentence, while in Exp 2 participants answered standard two-choice comprehension questions. All contrasts had 30 items/condition except for the subordinate contrast in Exp 3, which was limited to 15 items/condition to ensure a reasonably short experiment length. Sustained effects were evaluated across 20 scalp electrodes (10 anterior/10 posterior) throughout the dependency, beginning 750ms after the onset of the word signaling the non-local dependency (the auxiliary signaling a wh-object question or the adverb signaling the clause structure). A SAN was interpreted as a significant interaction between condition and electrode site, such that anterior electrodes appear more negative for the condition eliciting non-local predictions (1a, 2a below).

Exp 1 (n=14) replicated previous work showing a SAN for WHs compared to yes/no controls (interaction:  $p=.013$ ) (Figure 1). In stark contrast, Exp 2 (n=25) revealed no SAN for subordinate adverbials relative to controls (interaction:  $p=.99$ ) (Figure 2). While visual inspection suggested a broader negativity in the 1300-2000ms region, the interaction was not significant ( $p=.84$ ). The dissociation between wh-dependencies and subordinates was then replicated within subjects in Exp 3 (n=17): we observed a SAN for the WHs (interaction:  $p=.0002$ ) (Figure 3) but not for the adverb contrast (interaction:  $p=.10$ ), which actually trended in the opposite direction in anterior electrodes (more positive for subordinates than controls) (Figure 4). Moreover, the WHs in Exp 3 still yielded a significant interaction when analysis was limited to 15 trials/condition ( $p=.022$ ).

These results suggest that the SAN observed for WHs does not necessarily extend to other constructions requiring the maintenance of syntactic predictions in memory. Notably, it is still possible that the SAN for WHs is involved in processes specific to representing a gap position, maintaining properties of the wh-filler, or actively constructing the conceptual properties of the filler as the intervening material is processed (e.g., ‘What is likely to be queried in relation to a *commentary*?’ in (1a)). The last is consistent with findings that the SAN associated with scrambling is eliminated when pragmatic support is available (Yano and Koizumi, 2018). Importantly, these results should *not* be taken as an argument against top-down parsing algorithms or syntactic prediction, but as an indication that ERP correlates of structural prediction in general have not been identified.

(1a) What did the commentary from the spokesman interrupt?

(1b) Did the commentary from the spokesman interrupt the game?

(2a) After Charlotte quit her boring job, she traveled to Rome like she always wanted to.

(2b) Today Charlotte quit her boring job and traveled to Rome like she always wanted to.

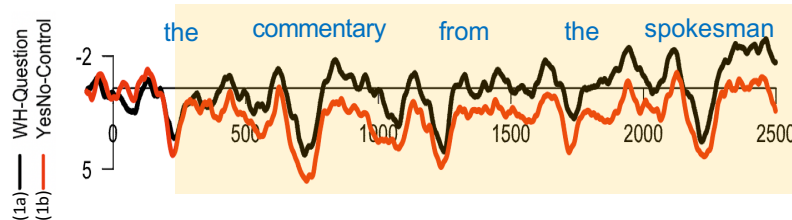
(2c) I think that after Charlotte quit her job, she traveled to Rome.

(2d) I think that today Charlotte quit her job.

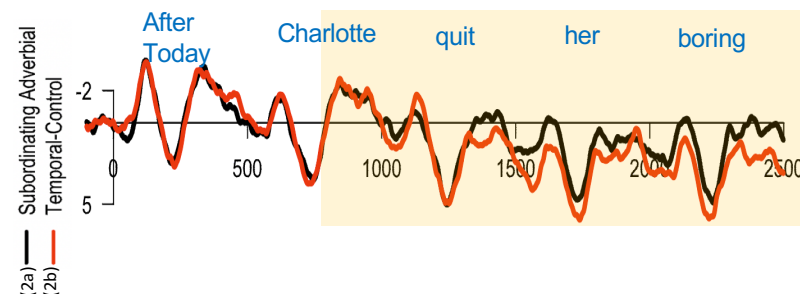
\_\_\_ = region of analysis

## FIGURES

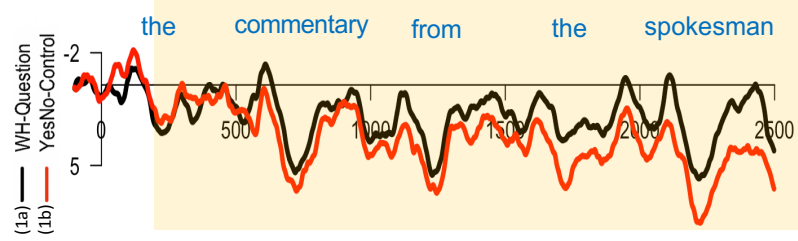
**Figure 1:** Exp1 WH > YN – Fz electrode plot and Scalp map (n=14)



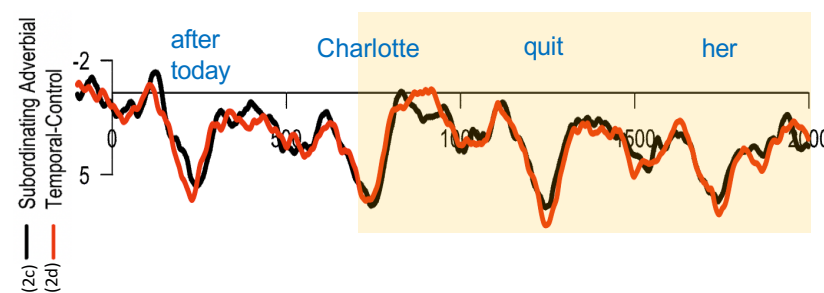
**Figure 2:** Exp2 SUB > TEMP – Fz electrode plot and Scalp map (n=25)



**Figure 3:** Exp3 WH > YN – Fz electrode plot and Scalp map (n=17)



**Figure 4:** Exp3 SUB > TEMP – Fz electrode plot and Scalp map (n=17)



## REFERENCES

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