

Turning the 'Dumb N400' into the 'Smart N400': What role-reversed sentences tell us about the time course of predictions

Wing-Yee Chow, Colin Phillips (University of Maryland, College Park), & Suiping Wang (South China Normal University)

wychow@umd.edu

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Despite much recent interest in how predictive processes may underlie successful online sentence processing [1-4], relatively little is known about the time course of such processes. Meanwhile, in another corner of the sentence processing literature, increasingly many findings suggest that the N400, long thought to reflect semantic processing, can be completely 'blind' to blatant semantic anomalies. For example, most studies of 'role-reversed' sentences such as "The fox.SUBJ the poacher.OBJ hunted" in verb-final constructions show that the verb elicits no N400 effect relative to the canonical word order control, despite the obvious anomaly [7-10]. This kind of 'dumb' N400 has been taken to reflect a semantic illusion [5-8], and it contrasts sharply with the extensive evidence for 'smart' N400 effects, where its sensitivity to semantic/pragmatic anomalies is not reducible to simple lexical associations [11-13]. We propose that the smart vs. dumb N400 contrast reflects how quickly the processor generates expectations about upcoming input, and show how it is possible to turn the dumb N400 into the smart N400. These findings undermine the semantic illusion account of the dumb N400. Instead, they fit with the view that N400 effects reflect top-down predictive mechanisms rather than bottom-up interpretive mechanisms. This account also allows us to give a unified account of diverse 'dumb N400' effects elicited in contexts such as negation and quantification [14-16].

We examined the effects of role-reversals on processing profiles using the unambiguous S-O-V BA-construction in Mandarin Chinese. In Experiment 1 (ERP, n=23), we examined the effects of role-reversals in predictive (a-b) vs. non-predictive (c-d) contexts and found that, even when the verb was highly predictable given its arguments (as determined by an offline cloze task), the N400 remained blind to role-reversals, though role-reversed sentences consistently elicited a P600 effect. In Experiment 2 (eye-tracking; n=24; identical materials), we found that role-reversals led to increased first fixation durations at the target verb, and also at the preceding word. These results show that the blindness of the N400 to role-reversals is unlikely to be due to weak contextual constraint (Exp1) or to slow recognition of the anomaly (Exp2). Experiment 3 (ERP, n=24) examined whether the N400's blindness to role-reversals reflects that the processor had insufficient time to generate expectations about the upcoming verb. We manipulated the linear distance between the arguments and the verb by placing an extra phrase either at the beginning of the sentence (local (e-f)) or between the verb and its arguments (non-local (g-h)). Notably, role-reversals elicited a significant N400 effect (i.e., a 'smart N400') only in the non-local conditions, although a significant P600 effect was observed in both conditions. This suggests that when the verb appeared just 600ms after the arguments, the processor had insufficient time to generate expectations for the verb, but that 1800ms was sufficient. Taken together, our results suggest that the 'dumb N400' reflects the processor's temporarily limited expectations for upcoming words, and the within-experiment contrast in Experiment 3 provides new evidence regarding the time course for expectation generation. A similar mechanism can account for other cases of N400 blindness that have been treated as separate phenomena [14-16].

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| a. Low predictability – Canonical: | Yesterday, customer BA salesperson <u>complain</u> ... |
| b. Low predictability – Role-reversed: | Yesterday, salesperson BA customer <u>complain</u> ... |
| c. High predictability – Canonical: | Last night, cop BA thief <u>arrest</u> ... |
| d. High predictability – Role-reversed: | Last night, thief BA cop <u>arrest</u> ... |
| e. Local – Canonical: | <i>Last spring</i> , philanthropist BA orphan <u>adopt</u> ... |
| f. Local – Role-reversed: | <i>Last spring</i> , orphan BA philanthropist <u>adopt</u> ... |
| g. Non-local – Canonical: | Philanthropist BA orphan <i>last spring</i> <u>adopt</u> ... |
| h. Non-local – Role-reversed: | Orphan BA philanthropist <i>last spring</i> <u>adopt</u> ... |

References

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