

## Doing a production task encourages prediction: Evidence from interleaved object naming and sentence reading

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Prominent theories of predictive language processing assume that language production processes are used to anticipate upcoming linguistic input during comprehension (Dell & Chang, 2014; Pickering & Garrod, 2013). Here, we explored the converse case: Does a task set including production in addition to comprehension encourage prediction, compared to a task only including comprehension? To test this hypothesis, participants carried out a cross-modal naming task (Exp 1a), a self-paced reading task (Exp 1b) that did not include overt production, and a task (Exp 1c) in which naming and reading trials were evenly interleaved. We used the same predictable ( $N = 40$ ) and non-predictable ( $N = 40$ ) sentences in all three tasks. The sentences consisted of a fixed agent, a transitive verb and a predictable or non-predictable target word (The man breaks a glass vs. The man borrows a glass). The mean cloze probability in the predictable sentences was .39 (ranging from .06 to .8; zero in the non-predictable sentences).

A total of 162 volunteers took part in the experiment which was run in a between-participants design. In Exp 1a, fifty-four participants listened to recordings of the sentences which ended right before the spoken target word. Coinciding with the end of the playback, a picture of the target word was shown which the participants were asked to name as fast as possible. Analyses of their naming latencies revealed a statistically significant naming advantage of 108 ms on predictable over non-predictable trials. Moreover, we found that the objects' naming advantage was predicted by the target words' cloze probability in the sentences ( $r = .347$ ,  $p = .038$ ). In Exp 1b, 54 participants were asked to read the same sentences in a self-paced fashion. To allow for testing of potential spillover effects, we added a neutral prepositional phrase (breaks a glass *from the collection*/borrows a glass *from the neighbor*) to each sentence. The sentences were read word-by-word, advancing by pushing the space bar. On 30% of the trials, comprehension questions were used to keep up participants' focus on comprehending the sentences. Analyses of their spillover region reading times revealed a numerical advantage (8 ms;  $t_{\text{spillover}} = -1.1$ , n.s.) in the predictable as compared to the non-predictable condition. Importantly, the analysis of participants' responses to the comprehension questions, showed that they understood the sentences (mean accuracy = 93%). In Exp 1c, the task comprised 50% naming trials and 50% reading trials which appeared in random order. Fifty-four participants named and read the same objects and sentences as in the previous versions. The results showed a naming advantage on predictable over non-predictable items (99 ms) and a positive correlation between the items' cloze probability and their naming advantage ( $r = .322$ ,  $p = .055$ ). Crucially, the post-target reading time analysis showed that with naming trials and reading trials interleaved, there was also a statistically reliable prediction effect on reading trials. Participants were 19 ms faster at reading the spillover region on predictable relative to non-predictable items ( $t_{\text{spillover}} = -2.624$ ).

To summarize, although we used the same sentences in all sub-experiments, we observed effects of prediction only when the task set involved production. In the reading only experiment (Exp 1b), no evidence for anticipation was obtained although participants clearly understood the sentences and the same sentences yielded reading facilitation when interleaved with naming trials (Exp 1c). This suggests that predictive language processing can be modulated by the comprehenders' task set. When the task set involves language production, as is often the case in natural conversation, comprehenders appear to engage in prediction to a stronger degree than in pure comprehension tasks. In our discussion, we will discuss the notion that language production may engage prediction, because being able to predict words another person is about to say might optimize the comprehension process and enable smooth turn-taking.