

Predicting form during sentence processing: Investigating lexically-based processes

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Prediction is a topic of considerable interest in psycholinguistics, backed by a compelling body of empirical research. However, evidence that comprehenders pre-activate form during sentence processing (e.g., phonology/orthography), as predicted by a variety of approaches (e.g., Pickering & Gambi, 2018), is surprisingly mixed (e.g., De Long et al., 2005; Nieuwland et al., 2018). The current research explored the role of basic lexical processes in activating form (e.g., spreading activation within the lexicon; Collins & Loftus, 1975).

Recently, Ito et al. (2018) observed more looks to a clown (phonological competitor) than globe (unrelated distractor) when comprehenders heard “The tourists expected rain when the sun went behind the...”, suggesting pre-activation of “cloud”. An unexplored aspect of this research concerns lexical association: while “cloud” was a high cloze probability completion of the context, it was also highly related to a specific word in the context (e.g., “rain”). In this regard, these findings could be interpreted as reflecting spreading lexical activation between “rain” and “cloud” and “clown”, spanning both semantics and form. Experiment 1 aimed to partially replicate Ito et al.; Experiment 2 aimed to isolate the underlying lexical effects.

Experiment 1. Based on Ito et al., participants ($N = 24$) heard 16 high cloze probability sentences like “The tourists expected rain when the sun went behind the cloud” while viewing visual arrays with a cloud (target), clown (phonological competitor), bear and globe (unrelated distractors). In contrast to Ito et al., visual stimuli were presented beginning 500 ms before auditory stimuli and critical targets, competitors and distractors were all included in the same array. While targets were fixated most, growth curve analysis also revealed significantly more “predictive” looks to competitors ($M = 0.13$; $SD = 0.06$) than distractors ($M = 0.11$; $SD = 0.06$) during the time window spanning sentence onset to (mean) target word onset (Intercept: $Est. = -0.02$; $SE = 0.01$; $t = -2.32$, $p < .05$), consistent with Ito et al.

Experiment 2. For each sentence context in E1, the most highly target-related noun was identified based on LSA (e.g., cloud-rain; cosine $M = 0.38$, $SD = 0.22$). Participants ($N = 26$) heard the target (“cloud”) or target-related (“rain”) word (i.e., in isolation) while viewing visual arrays that were identical to Experiment 1. While targets were again fixated most with target-related words, growth curve analysis also revealed significantly more looks to competitors ($M = 0.08$; $SD = 0.04$) than distractors ($M = 0.06$; $SD = 0.03$) during the time window spanning word onset to (mean) trial offset (Intercept: $Est. = -0.02$; $SE = 0.01$; $t = -3.12$, $p < .01$).

Discussion. In both Ito et al.’s constraining sentence context (E1) and isolation (E2), comprehenders looked significantly more to a clown (phonological competitor of “cloud”) than globe (unrelated distractor) when hearing “rain”. E2 reveals the extent to which activation spreads within the lexicon, spanning both semantics and form during isolated lexical processing. Minimally, these results highlight a critical confound in studying pre-activation (i.e., cloze probability vs. lexical association), requiring careful control. Moreover, while the results of E1 and E2 could have different causes, they are also preliminarily consistent with a simple unified explanation: the pre-activation of form during sentence processing could depend on basic spreading activation within the lexicon, without requiring the involvement of predictive sentence processing mechanisms.