

Predicting Upcoming Meaning Involves Specific Contents and Domain-General Mechanisms

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In sentence comprehension, readers and listeners often anticipate upcoming information (e.g., Altmann & Kamide, 1999). We investigated two aspects of this process, namely 1) what is pre-activated when anticipating an upcoming word (the *contents* of predictions), and 2) which cognitive *mechanisms* are involved.

The contents of predictions at the level of meaning could be restricted to functional semantic attributes (e.g., edibility; Altmann & Kamide, 1999). However, when words are processed other types of information can also be activated, such as object shape representations. It is unknown whether this type of information is already activated when upcoming words are predicted. Forty-five adult participants listened to predictable words in sentence contexts (e.g., "In 1969 Neil Armstrong was the first man to set foot on the moon.") while looking at visual displays of four objects. Their eye movements were recorded. There were three conditions: target present (e.g., a moon and three distractor objects that were unrelated to the predictable word in terms of semantics, shape, and phonology), shape competitor (e.g., a tomato and three unrelated distractors), and distractors only (e.g., rice and three other unrelated objects). Across lists, the same pictures and sentences were used in the different conditions. We found that participants already showed a significant bias for the target object (moon) over unrelated distractors several seconds before the target was mentioned, demonstrating that they were predicting. Importantly, there was also a smaller but significant shape competitor (tomato) preference starting at about a second before critical word onset, consistent with predictions involving the referent's shape.

The mechanisms of predictions could be specific to language tasks, or language could use processing principles that are also used in other domains of cognition. We investigated whether performance in non-linguistic prediction is related to prediction in language processing, taking an individual differences approach. In addition to the language processing task, the participants performed a simple cueing task (after Posner, Nissen, & Ogden, 1978). They pressed one of two buttons (left/right) to indicate the location of an X symbol on the screen. On half of the trials, the X was preceded by a neutral cue (+). On the other half, an arrow cue pointing left (<) or right (>) indicated the upcoming X's location with 80% validity (i.e., the arrow cue was correct 80% of the time). The SOA between cue and target was 500 ms. Prediction was quantified as the mean response latency difference between the neutral and valid condition. This measure correlated positively with individual participants' anticipatory target and shape competitor preference ($r = .27$; $r = .45$), and was a significant predictor of anticipatory looks in linear mixed-effects regression models of the data. Participants who showed more facilitation from the arrow cues predicted to a higher degree in the linguistic task. This suggests that prediction in language processing may use mechanisms that are also used in other domains of cognition.

References

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