

The effect of implied speed on eye movements in a (blank) visual world

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Pragmatics/semantics; Comprehension; Eye-tracking; English

Research has demonstrated that eye movements around a static scene can be guided by pragmatic and semantic cues (among other things) within a concurrent discourse [1,2]. Moreover, similar effects have been found even when that scene is absent, with recent studies showing that under these conditions, listeners can actually update their representation of a scene based on incoming language input [3]. The fact that participants in these tasks direct their gaze to the appropriate on-screen locations supports the experiential nature of language comprehension and demonstrates that the *affordances* denoted by an object/verb influence our understanding of their use in discourse.

We report results from two 'blank screen' paradigm studies, where participants viewed a visual scene containing either a 'fast' or 'slow' object (e.g. hare vs. tortoise), then once the scene had been removed, listened to short auditory descriptions of upcoming events (e.g. 'The [object] will [verb] across the garden'). Using a blank screen paradigm allowed participants to update their *mental* representation of the object, without constraints from the static visual scene. Experiment 1 (N=24) used neutral movement verbs (e.g. 'move') to examine baseline effects of object speed on eye movements, while Experiment 2 (N=40) also manipulated verb speed (e.g. 'bolt' vs. 'saunter'). Thus, we examined how pragmatic and semantic cues interact to influence the expected distance that an object will travel by measuring the distance of fixations around a blank screen, relative to the target object.

Eye-tracking analyses focused on the first five fixations from the verb onset. Results from Experiment 1 revealed that when one's pragmatic knowledge about an object implied a 'fast' movement (e.g. a hare), participants fixated on-screen locations that were further away from the target object, compared to objects that implied a 'slow' movement (a tortoise). This effect was apparent in the 3rd and 4th fixations following the neutral movement verb (all $t_s > 2.22$, $p_s < .05$). Moreover, in Experiment 2, analyses of fixation distances revealed a significant object*verb interaction in the 1st, 3rd, 4th and 5th fixations following the verb onset (all $F_s > 3.96$, $p_s < .05$). Simple main effects showed that these effects reflected fixations that were significantly further away from the target object in the fast object-fast verb condition, compared to either the fast object-slow verb (all $t_s > 2.02$, $p_s < .05$) or slow object-fast verb conditions (all $t_s > 2.2$, $p_s < .05$). In contrast, fixation distances in the slow object-slow verb condition did not differ from the slow object-fast verb or fast object-slow verb conditions (all $t_s < 1.18$). The exact time-course of these effects will be plotted relative to evolving language input.

These results show that a combined interpretation of pragmatic and semantic cues from incoming language can influence the incremental control of eye movements around a (blank) scene. Specifically, they suggest that the fixation distance from a target object can be modulated by pragmatic knowledge about the object's likely speed of travel, as well as semantic inferences from the movement verb itself. Moreover, these results show that this dynamic updating process rapidly integrates these cues and can reduce the *representational momentum* [4] when the two cues point to an implausible outcome (e.g. a sprinting tortoise), and maximize it under plausible conditions (e.g. a sprinting hare).

References

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