

Dynamic representations of speed in sentence processing

Submission type: Either

It has been increasingly established that meaning in language is rooted in our perceptuomotor experience [1], and that language comprehension can lead to experiential “simulations” [2]. With the linguistic description of motion events, comprehenders need to update the positions of entities, along with making inferences regarding the path and manner of motion. One such inference is the speed at which an entity moves. We used an eye tracking visual-world paradigm to assess simulations [3], investigating how speed information signalled by verb semantics would influence visual attention to a scene. In addition, we looked at how speed-associated inferences influenced movement time in a mouse tracking task.

A norming study was conducted to help select 16 “fast” and 16 “slow” verbs that were rated to differ in speed and be appropriate as verbs describing agentive movement. Along with 18 filler sentences, these verbs were used to describe events in visual-world scenes which featured an agent, a path, and a goal object, with an example scene and accompanying sentences illustrated in Figure 1.



Figure 1. Example scene for the sentences “*The truck will dart/lumber along the track to the temple*”.

Eye movements were recorded as participants heard spoken versions of the sentences whilst looking at the matching scenes. Following the eye tracking study, participants were again exposed to the pictures and sentences but after the sentence ended they used the mouse to move the agent, with instructions to focus on the end state of the movement event by moving the agent to where the sentence describes it will move to.

Our main prediction was that participants would spend more time looking along the path for the slow sentences compared with the fast sentences. We restricted our analysis to the mean total duration of fixations between the onset of the verb and object noun. With twenty-two native English speakers we found a significant interaction between verb speed and the scene regions; while there was no significant differences for the agent or background, as we predicted, participants spent more time looking along the path region for slow verb sentences compared with fast verbs. In addition, we found significantly greater looking times at the goal region for fast verb sentences consistent with a faster event leading to earlier arrival at the goal. The analysis of the mouse tracking study revealed significantly greater total movement time for the

slow verb sentences compared with the fast verb sentence, indicating that the verb semantics influenced motor processing.

These results indicate that dynamic information associated with the inferred speed of a linguistically described motion event influence visual attention and motor execution in a way consistent with simulation-based accounts of language comprehension. These results further our understanding of the on-line processing involved in the understanding of motion events.

References

- [1] Barsalou (2008). Annual Review of Psychology.
- [2] Zwaan (2004). In B. Ross (Ed.), The Psychology of Learning and Motivation.
- [3] Coventry, Lynott, Cangelosi, Monrouxe, Joyce, & Richardson (2010). Brain & Language.