

How Eye Movements Reflect Concept Activation in Working Memory during Sentence Reading using LSA

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Abstract

It is well-known that eye movements provide an indication of language processing because they are affected by lexical variables such as word predictability. Rayner and Well (1996) found that the predictability of target words (as determined by a cloze task, Taylor, 1953) has a strong influence on eye movements during reading. There have been several computational alternatives to approximate predictability and their effects on eye movements, such as transitional probability (TP, McDonald and Shillcock, 2003), Latent Semantic Analysis (LSA, Wang, Chen, Ko, Pomplun, & Rayner, 2010), surprisal (Boston, Hale, Kliegl, Patil, and Vasishth, 2008), and co-occurrence probability (CCP, Ong and Kliegl, 2008). However, it is still unclear how readers perform cloze task for a target word from the prior sentence context. One possible explanation is that when readers read words in prior context as inputs, they activate those concepts in working memory according to the semantic connections among concepts in episodic memory. The predictability of the target word is then determined by how much the concept of the target word is activated by the related concepts in prior context. This study proposes a computational model to represent the activations of concepts in working memory and investigate how eye movement measures reflect concept activation. The computation of concept activation is based on a connectionist model (LandScape model, see van den Broek, 2010) and the simulation of semantic connections among concepts is according to LSA.

Keywords: eye movements; reading; word predictability; latent semantic analysis; LandScape model.