## Title

Updating Memory Representations during Reading: The Role of Cohort Competition



**Journal**

Proceedings of the Annual Meeting of the Cognitive Science Society, 20(0)

**Authors**

Tzeng, Yuhtsuen
Broek, Paul van den
Young, Michael E.

**Publication Date**

1998

Peer reviewed

# Updating Memory Representations during Reading: The Role of Cohort Competition

**Yuhtsuen Tzeng** (tzen0001@tc.umn.edu)
Department of Educational Psychology, University of Minnesota
178 Pillsbury Drive S. E., Minneapolis, MN 55455 USA

**Paul van den Broek** (pvdbroek@maroon.tc.umn.edu)
Department of Educational Psychology, University of Minnesota
178 Pillsbury Drive S. E., Minneapolis, MN 55455 USA

**Michael E. Young** (meyoung@blue.weeg.uiowa.edu)
Department of Psychology, University of Iowa
233 Spence Laboratories, Iowa City, IA 52242 USA

Forming a coherent representation from texts is key to comprehension. The processes of building and maintaining such representations are very complex and dynamic. In this presentation, we describe a computational model of reading comprehension—the competitive cohort model (CCM)—which captures how readers construct an interconnected network of memory representation during reading. The data from modeling are compared to existing human data.

In CCM, the reading process is conceptualized as a landscape of fluctuating activation. With each reading cycle, new elements are activated while old ones may decline. There are four major sources of activation, the current sentence, the activation vector at the end of the preceding cycle, readers' activated background knowledge, and the memory representation for prior text. These activations are updated after each statement is processed to reflect the current state of working memory. The resulting contents in working memory are represented in an activation matrix. When elements are co-activated in working memory, they create associations with each others as well as auto-associations to themselves. Once some initial connections are formed, whenever an element is activated, so are the elements that have become associated with it through spread of activation. The amounts of spread of activation are proportionally determined by the strengths of connection among elements and a free parameter. Additionally, this cohort activation is kept in check by a nonlinear asymptotic function to filter out noises. Furthermore, the elements compete with each other for the privilege of predicting other elements (hence the name of Competitive Cohort model). The expectancy of a particular element is determined by its contextual associations to all other activated elements. A target elements expectancy serves as a target activation value limiting its growth. As an elements actual activation approaches the expected activation in the context, the degree of change in connection strength correspondingly decreases. Elements in working memory are updated into episodic memory through a delta learning rule. The results of all the connections are captured in a connection matrix. The model has a retrieval component based on the same cohort activation mechanism as in the comprehension phase.

## Results

The results from modeling show that CCM captures the dynamically interactive nature of building representations during reading by allowing various sources of activation to contribute to memory representations. It also produces unique patterns of results that are consistent with findings in the literature, e.g., it shows a decay property without an explicit decay function. As a result, it can model delayed recall. The model also encodes the temporal dimension of the text input therefore captures asymmetric priming of text elements.

## Acknowledgments

This research was supported in part by the Center for Cognitive Sciences at University of Minnesota.

## References

van den Broek, P., Young, M., Tzeng, Y., & Linderholm, T. (in press). The landscape model of reading: Inferences and the on-line construction of a memory representation. In H. van Oostendorp & S. R. Goldman (Eds.), The construction of mental representations during reading. Mahwah, NJ: Erlbaum.

van den Broek, Risden, K., Fletcher, C. R., & Thurlow, R. (1995). A 'landscape' view of reading: Fluctuating patterns of activation and the construction of a stable memory representation. In B. K. Britton & A. C. Graesser (Eds.), Models of understanding text. Hillsdale, NJ: Erlbaum.