

# Watching Spoken Language Perception: Using Eye-movements to Track Lexical Access

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## Introduction

Models of spoken word recognition can be divided into two classes: models such as the Cohort model (Marslen-Wilson, 1987) in which competition among lexical alternatives occurs in a strictly "left-to-right" fashion (e.g., "casket" competes with its cohort, "castle," but not with its rhyme, "basket") and activation models – e.g., TRACE (McClelland & Elman, 1986) – which specify that competition can occur throughout words (e.g., "casket" can compete with both "castle" and "basket"). While there is evidence that cohorts compete during on-line processing, evidence for competition between rhymes is less clear.

Tanenhaus et al. (1995) examined the effects of cohort competition in a task with real objects and instructions such as "Pick up the candy." Eye-movements to a target object were closely time-locked to the instruction, i.e., an eye-movement to the candy began shortly after the word ended, indicating that programming began before the end of the word. The presence of a "cohort" competitor (e.g. candle) increased the latency of eye-movements to the target object and induced frequent "false launches" to the competitor. In the present experiment we compare the effects of both cohort and rhyme competitors using a variation of this paradigm.

## Method and Results

An Applied Scientific Laboratories free-head eyetracker with an accuracy of approximately 1 degree was used. The stimuli were line drawings of objects presented on a computer screen. At the beginning of each trial, subjects were shown four objects (see Figure 1) and were asked to "pick-up" one of the objects with the mouse and move it to a specified location on a grid. We tracked both eye-movement patterns and latencies starting at the onset of the target word in the instructions.

The objects shown in Figure 1 illustrate a configuration taken from a critical trial. Here, the target (paddle) has both a cohort competitor (padlock) and a rhyme competitor (saddle), as well as a noncompetitive item (castle). Subjects moved targets in four competitor conditions: 1) cohort and rhyme; 2) cohort; 3) rhyme; and 4) no competitors.

A preliminary analysis of the error data shows that both cohorts and rhymes influence initial saccade patterns.

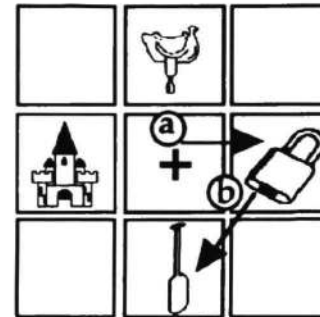


Figure 1: An example of eye-movements when the target is paddle. The first eye-movement (a) is to the cohort competitor, and the subsequent movement (b) is to the appropriate target.

Subjects were more likely to make a "false launch" in the cohort condition than they were in the no competitor condition. This pattern held true for the rhyme condition, although to a lesser degree. The condition with both cohort and rhyme competitors showed both types of effects, with cohort competitors again exhibiting more influence on initial saccades than rhyme competitors. These results support models of lexical access that are based on the spreading activation of lexical competition.

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## References

- Marslen-Wilson, W. D. (1987). Functional Parallelism in spoken word-recognition. *Cognition*, 25, 71-102.
- McClelland, J. L., & Elman, J. L. (1986). The TRACE model of speech perception. *Cognitive Psychology*, 18, 1-86.
- Tanenhaus, M. K., Spivey-Knowlton, M. J., Eberhard, K. M., & Sedivey, J. C. (1995). Integration of visual and linguistic information in spoken language-comprehension. *Science*, 268, 1632-1634.