

**Using eye movements to track the spread of
semantic activation during spoken word recognition**

*Eiling Yee & Julie Sedivy
eiling_yee@brown.edu*

Department of Cognitive and Linguistic Sciences, Brown University

Evidence from cross-modal semantic priming studies suggests that presenting just the beginning of a prime word can be enough to activate a semantically related target word (e.g., Marslen-Wilson, 1987; Zwitserlood, 1989; Moss et al., 1997). For example, when subjects are primed auditorily with just the "silv" of "silver", lexical decisions on "bronze" (presented visually at the offset of "silv") are speeded. The advantage of using cross-modal semantic priming is that it makes it possible to measure the activation of a word semantically related to the prime before the offset of the prime. However, it is laborious to obtain time course information, as only one temporal point can be tested on any given trial. It is also somewhat unnatural because it requires the prime to be cut off before its offset (this may encourage subjects to place artificially heavy weight on phonological information available at the beginnings of words - see Allopenna et al., 1998). Furthermore, it requires subjects to make a metalinguistic judgement about the target, making it difficult to use the technique with very young or impaired populations.

Recent studies measuring eye movements in response to spoken instructions have generated data consistent with measures from reaction time studies. In particular, Allopenna et al., (1998) and Tanenhaus et al., (2000) have argued that there is a direct relationship between eye movements and patterns of lexical activation. If this is true, eye movements should reflect the activation of words semantically related to a given spoken word. We have found preliminary evidence that they do.

Twenty four subjects were shown an array of four pictures and instructed to point to one of them (the "target"). The target item (e.g., "bike") was either presented with a semantically related item (e.g., "car") and two unrelated items, or it was presented with three unrelated items. Subjects were more likely to fixate on an item semantically related to the target than a control item (the same item, but in a trial in which it was unrelated to the target). Examining the time course of subjects' fixations revealed that this pattern emerged about 570 ms after the onset of the target word. Moreover, subjects continued to be more likely to fixate on the related than the control item until about 800 ms after the onset of the target word. If one allows 200 ms to program and launch an eye movement, then it appears that semantically related items become active enough to draw fixations about 370 ms after the onset of the target word (average target word duration = 517 ms).

These results, from an independent paradigm, are consistent with the cross-modal semantic priming data referenced above. Furthermore, taken together with previous studies that used eye movements to examine spoken word recognition (e.g., Allopenna et al., 1998), they suggest that eye movement measures are particularly promising for experimental work that depends on documenting full time-course information of subtle lexical effects.

References:

- Allopenna, P.D., Magnuson, J., & Tanenhaus, M.K. (1998). Tracking the time course of spoken word recognition using eye movements: Evidence of continuous mapping models. *Journal of Memory and Language*, 38, 419-439.
- Marslen-Wilson, W.D. (1987) Functional Parallelism in spoken word-recognition. *Cognition*, 25, 71-102.
- Moss, H.E., McCormick, S.F., & Tyler, L.K. (1997). The time course of activation of semantic information during spoken word recognition. *Language and Cognitive Processes*, 12(5/6) 695-731.
- Tanenhaus, M.K., Dahan, D., Magnuson, J.S., & Hogan, E.M. (2000). Tracking the time course of subcategorical mismatches in lexical access in contiguous speech. Paper presented at the 13th Annual CUNY Conference on Sentence Processing.
- Zwitserlood, P. (1989). The locus of the effects of sentential-semantic context in spoken-word processing. *Cognition*, 32, 25-64.