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## **Auditory Priming in Spoken and Printed Word Recognition**

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Two lexical decision experiments are described in which the recognition of spoken and printed target words as a function of phonological similarity and semantic relatedness to a preceding spoken prime is investigated. While weak and unreliable auditory priming was observed in visual lexical decision, strong and reliable priming effects were found in auditory decision. It is argued that both phonological and semantic priming effects demonstrated in the auditory lexical decision task occur at a modality-specific level but not at an amodal level and that phonology does not play the same role during auditory word recognition as it does during visual word recognition.

### **Introduction**

Although both auditory and visual word recognition have been extensively studied by researchers in cognitive psychology and Psycholinguistics,

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relatively little attention has been paid to examining the extent to which common and/or modality specific processing occurs during reading and listening. This chapter represents a contribution to the study of the general question mentioned above by investigating whether the processes underlying priming differ during auditory and visual word recognition.

In this chapter, we attempt to address two specific questions. The first question concerns whether phonology or phonological activation plays the same role during auditory and visual word recognition. A popular view in the area postulates that the phonological code of a written word is activated before lexical access and serves as the critical mediator in activating the corresponding meaning (see, e.g., Perfetti, Bell, & Delaney, 1988; Van Orden, 1987). This hypothesis was tested in the experiments reported in this chapter by observing whether phonological priming generates similar effects in both visual and auditory lexical processing tasks. This issue is particularly interesting in a language such as Chinese where, unlike many European languages with alphabetic systems, the relationship between phonology and orthography is relatively opaque.

The second question addressed in this chapter concerns the nature and exact locus of semantic priming in lexical decision. This issue has also stimulated lively debate in the area (e.g., Shelton & Martin, 1992; see Neely, 1991, for a recent review). We attempt to address this issue by contrasting potential phonological and semantic priming effects in both visual and auditory lexical decision tasks.

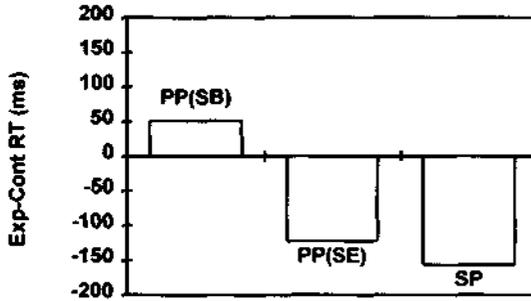
## Experiment 1 (Auditory Lexical Decision)<sup>1</sup>

The first experiment examined possible effects of phonological and semantic relatedness in auditory lexical decision with a forward priming paradigm using disyllabic stimuli in Cantonese as primes and targets. Sixty-four students at The Chinese University of Hong Kong participated in the experiment individually; all were native speakers of Cantonese with no reported hearing impairment. They were asked to listen to the stimuli and decide whether or not each target was a real Cantonese word.

Target words were preceded by (a) an unrelated word (baseline control), or (b) a semantically related word, or (c) a phonologically related word, which shared either the first or the second syllable (same beginning or same end, respectively) with the target word and differed in the other syllable, either in tone or in rime.

Figure 5.1 shows the phonological and semantic priming effect in the

**Figure 5.1 Mean Differences Between Experimental (Priming) and Control (No-priming) Group Response Latencies (in Milliseconds; Measured from Stimulus Offset) for the Three Prime Conditions Adjusted by the Between-group Difference for the Baseline Control Condition. PP(SB): Phonological Priming (Same Beginning); PP(SE): Phonological Priming (Same End); SP: Semantic Priming.**



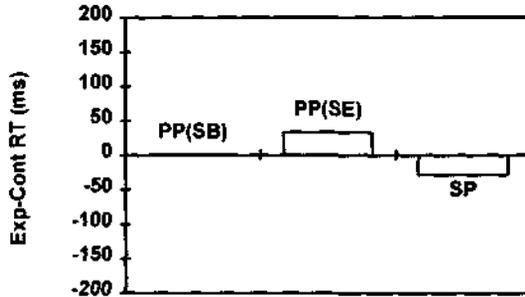
auditory lexical decision experiment. Both the phonological facilitation effects in the same end condition and the semantic facilitation effect were highly significant (both  $ps < 0.005$ ). The results also reveal a trend of phonological interference in the same beginning condition, but this effect was not statistically reliable. In sum, standard semantic priming effects and phonological similarity effects (i.e., overlap in the second syllable facilitated recognition, whereas overlap in the first syllable had a tendency to slow recognition) were observed (for detailed discussion, see Cutler & Chen, 1995). An interesting question arises at this point: Would these effects also occur in visual lexical decision?

## Experiment 2 (Visual Lexical Decision)

The materials and procedure were identical to those used in Experiment 1 with the exception that on each trial the target items were visually displayed for 1000 ms at the acoustic offset of the auditory prime on a video monitor situated in front of the subject. Sixty-four new subjects from the same population participated in the experiment.

Figure 5.2 summarizes the results in the visual lexical decision experiment. Overall, no reliable phonological priming effect nor semantic priming effect was found in this experiment. Although the semantic facilitation

**Figure 5.2 Mean Differences Between Experimental (Priming) and Control (No-priming) Group Response Latencies (in Milliseconds; Measured from Stimulus Offset) for the Three Prime Conditions Adjusted by the Between-group Difference for the Baseline Control Condition. PP(SB): Phonological Priming (Same Beginning); PP(SE): Phonological Priming (Same End); SP: Semantic Priming.**



was in the right direction, its magnitude was very small (29 ms) relative to that in the auditory experiment (157 ms). Although the current experiment differs from the preceding experiment in only one single aspect (i.e., the modality of target presentation), the priming effects demonstrated in the first experiment did not show up in this experiment. Thus the operations responsible for the priming effects in auditory lexical decision do not seem to be compatible with those in visual lexical decision.

### Conclusion

Clear phonological priming effects were found in auditory lexical decision, whereas no such effect was observed in visual lexical decision. These findings motivate us to conclude that (1) phonological similarity effects of this sort probably result from modality-specific operations; and (2) phonology does not play the same role during the processing of spoken items as it does during visual word recognition (see, e.g., Fleming, 1993, for a similar argument).

Furthermore, a strong semantic facilitation effect was demonstrated in the auditory task, but only a very weak trend was seen in the visual task. Thus, although there is evidence in the literature to show compatible effects of semantic facilitation using primes in such different forms as pictures and

visually presented words (e.g., Chen & Ng, 1989), our results clearly suggest that semantic priming in lexical decision does not go across modalities. These findings in Chinese parallel those from English (e.g., Holcomb & Anderson, 1993; Holcomb & Neville, 1990), and together they provide good support for the notion that semantic priming in the lexical decision task does not occur at an amodal semantic level but is more likely to be the result of processing at a modality-specific lexical level (e.g., Shelton & Martin, 1992).

## Note

1. Portions of this auditory lexical decision research were presented at the XIII International Congress of Phonetic Sciences in Stockholm, August 1995.

## References

- Chen, H.-C., & Ng, M.-L. (1989). Semantic facilitation and translation priming effects in Chinese-English bilinguals. *Memory and Cognition*, *17*, 454-462.
- Cutler, A., & Chen, H.-C. (1995). Phonological similarity effects in Cantonese word recognition. *Proceedings of XIII International Congress of Phonetic Science* (Vol. 1, pp. 106-109). Stockholm, Sweden.
- Fleming, K. K. (1993). Phonologically mediated priming in spoken and printed word recognition. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *19*, 272-284.
- Holcomb, P. J., & Anderson, J. E. (1993). Cross-modal semantic priming: A time-course analysis using event-related brain potentials. *Language and Cognitive Processes*, *8*, 379-411.
- Holcomb, P. J., & Neville, H. J. (1990). Semantic priming in visual and auditory lexical decision: A between modality comparison. *Language and Cognitive Processes*, *5*, 281-312.
- Neely, J. H. (1991). Semantic priming effects in visual word recognition. In D. Besner & G. W. Humphreys (Eds.), *Basic processes in reading* (pp. 264-336). Hillsdale, NJ: LEA.
- Perfetti, C. A., Bell, L. C., & Delaney, S. M. (1988). Automatic (prelexical) phonetic activation in silent word reading: Evidence from backward masking. *Journal of Memory and Language*, *27*, 59-70.
- Shelton, J. R., & Martin, R. C. (1992). How semantic is automatic semantic priming? *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *75*, 1191-1210.
- Van Orden, G. C. (1987). A row is a rose: Spelling, sound, and reading. *Memory and Cognition*, *15*, 181-198.