Cross-linguistic differences in long-lag priming

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Long-lag priming ([1], among others) is a useful technique for investigating the nature of lexical relationships and lexical activation patterns while avoiding potentially problematic influences of task-based strategies by the participants or of stimulus-based confounding issues such as associative or form relationships between stimuli. In long-lag priming experiments, participants see many stimuli and conduct some task (such as judging whether the stimulus is a real word or not) for every stimulus they see. Unbeknownst to participants, some stimuli are "primed" by a related stimulus (such as a repetition of the same stimulus, or a morphologically-related stimulus) that has occurred many trials earlier; other stimuli are not primed (the stimuli that occur before these are all unrelated to the target stimulus). Unlike in traditional paired priming paradigms, where primes and target stimuli are presented together and their relationship may be obvious to participants, in long-lag priming participants generally do not notice that some stimuli have been primed.

One important feature of long-lag priming is that the response time to target stimuli is facilitated by primes that are morphologically related to the target (e.g., *hunt… hunter*), compared to primes that are unrelated to them (e.g., *book… hunter*). This pattern is not due to the meaning relationship between prime and target, but to the morphological relationship (as associatively related prime-target pairs without morphological relationship do not show facilitation). Another important feature is priming may combine lexical effects and episodic effects [1]. Specifically, if the "related" prime for a target is the same word as the target (e.g., *hunter… hunter*), then there are two factors which facilitate response to the target: the fact that the lexical entry for HUNTER has been activated already (lexical priming), and the fact that the physical stimulus (the visual representation *hunter* or the auditory stimulus that was presented) is fresh in the participant's memory (episodic priming). Some evidence for this dissociation is that episodic priming, but not lexical priming, is absent if the prime is a different recording of the same word (e.g., $hunter_{\text{male-voice}}$ … $hunter_{\text{female-voice}}$). In such a situation, lexical priming is still present (as the lexical entry for HUNTER is activated each time) but episodic priming is not (as the stimuli are physically different). Target stimuli in this situation are responded to more quickly than targets with unrelated primes (suggesting that lexical priming is present) but more slowly than targets with completely identical primes (suggesting that episodic priming is gone).

These patterns have been observed in languages like French. In the present study, we tested these features of long-lag priming using Mandarin. Whereas morphological relationships in previous long-lag studies were generally based on concatenative morphology (e.g., *hunt* and *hunter* share a root but differ because of a suffix), the present study used tone to manipulate morphology. Mandarin syllables with Low tone undergo phonological alternations which, in certain contexts, cause them to be pronounced with Rising tone instead. Thus, segmentally identical syllables with Low and Rising tone (e.g., shi^{L} and shi^{R}) could be allomorphs of the same morpheme; in other words, they are morphologically related.

In Experiment 1 ("same voices"), 153 native Mandarin-speaking participants completed a long-lag priming task following the design of [1]. Participants heard 96 target monosyllables, each of which was preceded by either an unrelated prime (e.g., hua^{F}…shi^{L}), a morphologically related prime (e.g., shi^{R}…shi^{L}), or an identical prime, which was the exact same recording of the same monosyllable (e.g., shi^{L}…shi^{L}). There were 18-56 other syllables in between each prime and target. Mixed in with the critical prime-target pairs were 56 filler prime-target pairs, and 288 nonwords (phonotatically legal accidental gap syllables). Participants performed an auditory lexical decision for every stimulus they heard. Stimuli were arranged into three lists in a Latin square design. After

removing incorrect responses and outliers (trials more than 1.5IQR away from that participant's or item's median), priming effects were calculated by subtracting the response time for targets with unrelated primes from the response times for the other two targets. As shown in Figure 1, there was robust facilitation from identical primes (b=-65.78, t=-13.14 in a maximal mixed-effects model), but not from morphologically related primes (b=9.83, t=1.71), contrary to what has been observed in other languages (e.g., [1]).

Experiment 2 ("different voices", with 120 participants, out of a planned 153) followed the same design as the same-voices experiment, except that primes and targets were different recordings, spoken by different people (one woman and one man), and the stimuli organized into six Latin square lists instead of three. As shown in Figure 2, there was again robust identity priming (b=-61.36, t=-11.75) and not morphological priming (b=5.74, t=0.89), contrary to what was observed in other languages but replicating the pattern from the first experiment. Contrary to what has been observed previously [1], the same-word priming effect is about the same (61-65 ms) regardless of whether the words are spoken in the same voice or different voices.

The results challenge current understanding of the mechanisms underlying priming. The fact that morphological priming did not occur in Mandarin suggests that either there is something different about how lexical representations work in Mandarin compared to other languages that have been tested, or that some other moderating property of the stimuli interacts with morphological priming. One possibility is homophony: most of our monosyllabic stimuli correspond to multiple morphemes, so it is possible that morphological priming only occurs when one morpheme can be uniquely identified and activated; this is a question for future study. The fact that episodic priming played a smaller role (or none at all) compared to in previous studies suggests that current understanding of the role of episodic memory in priming experiments must be refined.

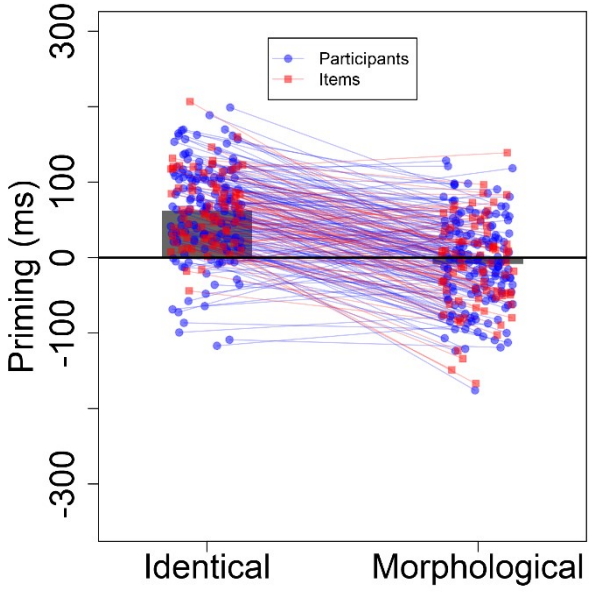

Fig.1 Experiment with same voices for prime and target

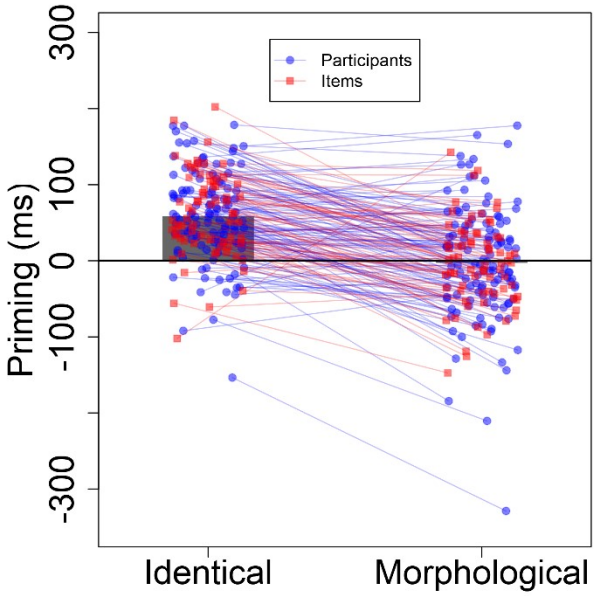

Fig.2 Experiment with different voices for prime and target

References

[1] Kouider, S., & Dupoux, E. (2009). Episodic accessibility and morphological processing: evidence from long-term auditory priming. *Acta Psychologica, 130*, 38-47.