

Extended Pre-Sleep Training Reinforces Memory Consolidation of Cantonese Tones in Older Adults

Kangdi LIU¹, Yan FENG², Quentin Zhen QIN¹

¹ The Hong Kong University of Science and Technology,

² Nanjing University of Science and Technology

kliubc@connect.ust.hk, yanny.feng@njust.edu.cn, hmzqin@ust.hk

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Research Objectives:

Population aging in China poses significant cognitive health challenges, particularly increasing dementia prevalence. Non-native language learning has emerged to boost cognitive reserve. Sleep-dependent *memory consolidation* supports language learning by transferring temporary memories into long-term storage. However, older adults' typically poor sleep quality may disrupt memory consolidation. A recent study demonstrated overnight accuracy gains in Mandarin-speaking young adults after six-block Cantonese tone-word training (*encoding* Tone 5-Tone 6). We employed the same design to explore memory consolidation in older adults (Experiment 1) and aimed to adapt an optimized learning protocol tailored for older adults (Experiment 2).

Methodology and Key Findings:

Experiment 1 assigned 60 Mandarin-speaking older adults (≥ 55 years) pseudo-randomly to either (See Figure 1): (1) evening group (six-block training and immediate test in the evening, followed by a 12-hour delay containing overnight sleep before retest) or (2) morning group (six-block training and test in the morning, with retest after 12-hour wake). No significant delayed accuracy improvement was observed in either group, indicating older adults struggled to consolidate newly acquired knowledge. Median-split analysis for training outcomes revealed that only high performers in the evening group exhibited young-adult-like consolidation patterns, implying that encoding strength potentially modulates their memory consolidation.

Building on these findings and prior evidence that extended training can enhance encoding strength, Experiment 2 increased training from *six* to *ten blocks* in a new cohort of 60 participants. The evening group demonstrated significant delayed accuracy gains, while the morning group showed no improvement. This supports that extended pre-sleep training can effectively reinforce memory consolidation in older adults through strengthening encoding.

Theoretically, these findings advance our understanding of tone learning and memory consolidation in aging. Pedagogically, it proposes an optimized protocol for older adults' language learning success: a pre-sleep training session of a reasonable length.

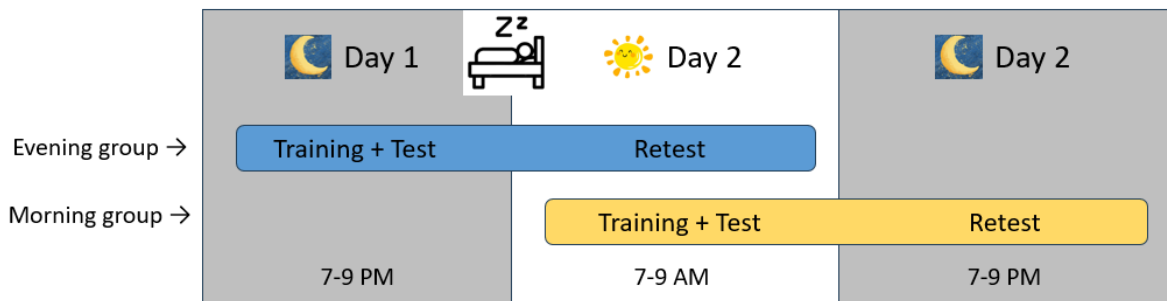


Figure 1 Procedures for Experiments 1 (*Six-Block Training*) and 2 (*Ten-Block Training*)