

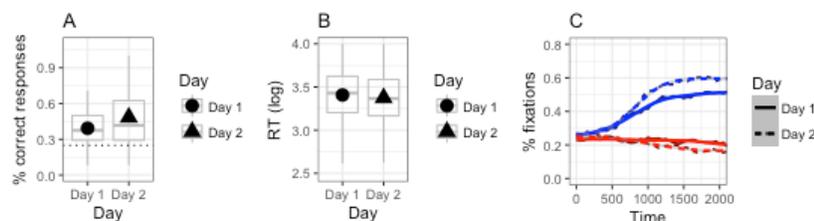
## Memory traces of newly-learned words that contain non-native sounds are more robust after sleep consolidation

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Sleep plays a central role in consolidating new memories such as newly learned words (Dumay & Gaskell, 2012). In the present study, we examined how sleep contributes to learning words incorporating *non-native* sounds, as we would expect in second-language (L2) learning. This more closely captures the nature of L2 learning that many artificial studies seek to simulate. Native English listeners were trained on words that contained French front-rounded [y], a vowel that is absent from their vowel inventories. We then assessed the rate with which they could learn words containing non-native sounds, and the subsequent effect of sleep consolidation on this ability.

Participants were 16 native speakers of English (ongoing data collection) who had no or little knowledge of French and who completed a training task immediately followed by a word recognition Visual World Paradigm (VWP) eye tracking task. Individuals returned to the lab the following morning to complete the VWP task a second time. Auditory stimuli were four sets of four-phoneme  $C_1V_1C_2V_2$  nonwords pronounced by native speakers of French. For each set,  $C_1V_1C_2$  were the same, and  $V_2$  was one of [a, e, u, y], yielding 16 words that were associated with cartoon images of alien-like creatures. During the training task, listeners saw two pictures on a display (one on each side), heard one word, and had to decide if the matching picture was on the left or right. Learning was promoted via automatic feedback. Blocks of 16 training trials (one per word) were repeated until listeners scored 14/16 correct within a block. Following training, participants proceeded to the eye tracking task, in which they saw four images on a display, heard one word, and had to find the matching image by pressing a button on a button box. Each participant completed 96 trials in the VWP task (6 repetitions of each newly-learned word). Response accuracy, reaction times, and proportion of eye movements to target and competitors were measured throughout. This provided measures of lexical activation and processing speed on both day 1 and day 2. Improvement across sessions provided an index of memory consolidation of new words. Sleep quantity and quality were assessed both by self-report and using an electronic activity monitor worn between the two test sessions.

Preliminary results suggest listeners were generally more accurate (panel A) and slightly faster to respond (panel B) on day 2. Eye movements revealed participants tended to fixate more



to the target on day 2 (dashed vs. full blue lines in C), starting 750 ms after word onset, again suggesting more robust lexical memory representations of target words after sleep consolidation. Patterns were

similar across vowel qualities. Participants also fixated less to the competitor on day 2 (dashed vs. full red line in C), approximately 1000 ms after word onset. This suggests that not only were representations more robust, but also that competitor inhibition was more efficient after sleep.

Our findings suggest memory consolidation impacts word learning when the items have a non-native phoneme, in addition to improved competitor inhibition after sleep in an L2. Follow-up studies will examine the extent to which quality and quantity of sleep impacts consolidation and whether diminished effects occur when no sleep occurs between testing sessions.

## Reference

Dumay, N. & Gaskell, M. G. (2012). Overnight lexical consolidation revealed by speech segmentation. *Cognition*, *123*(1), 119-132.