

Training confusable sounds in an L2 benefits word learning after sleep-related memory consolidation

Félix Desmeules-Trudel and Marc F. Joanisse

English listeners have difficulties perceiving French front-rounded [y] since they often confuse it with [u], a phenomenon known as perceptual assimilation (Best, 1995). This type of confusion impacts L2 word processing (Weber & Cutler, 2004), especially for word pairs that contain sounds that are absent for the listeners' L1 inventories (e.g., French [y]-[u] minimal pairs with English listeners). However, the influence of sound confusions on L2 word *learning* is largely undocumented. In the current study, native-English listeners were trained on pseudo-words that contained French [y] or [u], and two other vowels [ɑ] and [e]. The rate with which they could recognize the trained words containing these sounds was then assessed over two days, in addition to eye movements. These measures enabled us to evaluate the effect of phonetic confusion on L2 word learning and on real-time processing before and after sleep-related memory consolidation, an important factor for learning new linguistic information.

Participants were 24 native speakers of English who had no or little knowledge of French. They completed a training task immediately followed by a word recognition Visual World Paradigm eye tracking task. Individuals returned to the lab the following morning to complete the word recognition task a second time. Auditory stimuli were four sets of C₁V₁C₂V₂ nonwords pronounced by native speakers of French. For each set, C₁V₁C₂ were the same, and V₂ was one of [ɑ, 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. Half of the participants were always presented with [y]-[u] pairs (and [e]-[ɑ] pairs), promoting discrimination of [y]-[u] (phonetic-assimilation group – PA), while the other half were presented with [y]-[e] and [u]-[ɑ] pairs (no-phonetic-assimilation group – NPA). In the latter group, [y]-[u] discrimination was not promoted. 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 word recognition task, in which they saw four images on a display, heard one word, and had to find the matching image by pressing a button. Each participant completed 96 trials in the task (6 repetitions per word). Response accuracy and proportion of fixations to targets were measured throughout. This provided an index of lexical processing and learning on both day 1 and day 2. Improvement across sessions and training groups provided an index of word learning, and eye movement data provided a picture of real-time processing.

Results suggest no significant difference in the number of completed blocks during training (Fig. 1) between groups. For the word recognition task, performance on [ɑ] and [e] words was significantly better than performance on [y] words on both days, but [u] was not better than [y], showing the effect of [y]-[u] assimilation (Fig. 2). However, eye movements revealed memory-consolidation effects, i.e., all participants fixated more to the target on the second day of testing (Fig. 3). Furthermore, on day 2, the PA group fixated significantly more to the [y] targets than the NPA group (Fig. 3), suggesting that processing of [y] words in the PA group was facilitated after sleep and that [y]-[u] discrimination training was beneficial for word learning.

Overall, then, our study suggest that PA training and memory consolidation facilitates L2 word learning. Follow-up studies are examining electrophysiological signatures (event-related potentials; ongoing data collection) of word recognition depending on training, hoping to uncover cross-group effects that are not observed in behavioural or eye movement data on day 1 and that might be important to understand the mechanisms behind L2 word learning.

Best, C. T. (1995). A direct realistic view of cross-language speech perception. In W. Strange (Ed.), *Speech Perception and Linguistic Experience: Issues in Cross-Language Research* (pp. 171–204). Timonium, MD: York Press.

Weber, A., & Cutler, A. (2004). Lexical competition in non-native spoken-word recognition. *Journal of Memory and Language, 50*, 1-25.

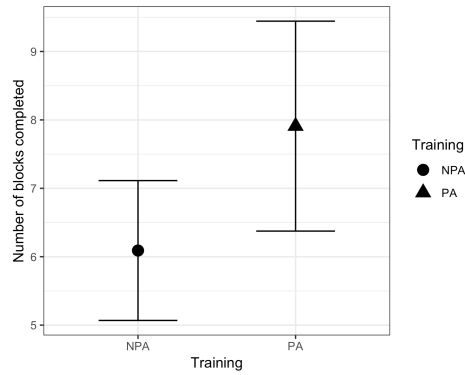


Figure 1. Number of completed blocks during training by group.

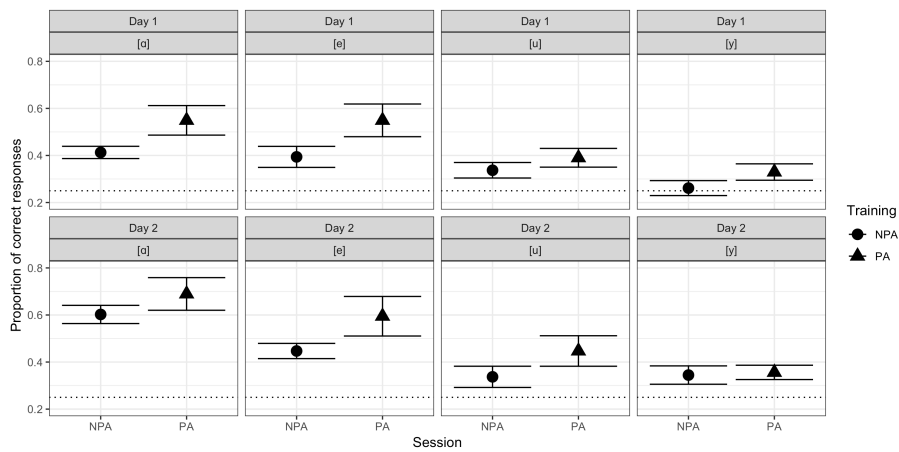


Figure 2. Accuracy results (word recognition) by vowel quality, day, and training group.

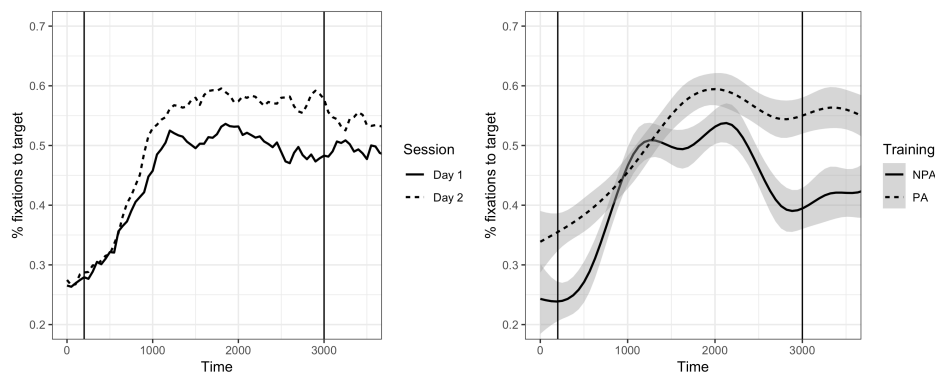


Figure 3. Proportions of fixations to the target by DAY (left) and TRAINING group for [y] words on DAY 2 (right; smoothed data)