Roles of orthography and variability in second language word learning and production

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We examined the influence of orthography and variability in the spoken input on novel word form learning and pronunciation accuracy in a second language (L2). Earlier studies all report an influence of first language (L1) orthography on L2 pronunciation accuracy (e.g. [BA17] and references). To our knowledge, however, no prior study has examined whether orthography influences acquisition in the L2 production lexicon ([EH07] on L1, also [SA05]). Moreover, in natural settings, new words are produced by multiple talkers. Previous studies comparing words learned with one vs. multiple talkers report contrasting results (better [BA05] or worse [MA89] recognition/perception, produced with less dispersion [KA18]).

In Exp. 1 (datasets and scripts: https://osf.io/rtfh6/), twenty English non-words were recorded by a native speaker of Canadian English. Half were spelled with <i> (e.g. bliλ), half with <o> (e.g. mog), for which English and French have different grapheme-phoneme correspondences (GTPCs): FR: <i> ~ /i/ (e.g. lit ‘bed’), EN: <i> ~ /i/ (e.g. lick); FR: <o> ~ /ɔ/ (e.g. bogue ‘husk’), EN: <o> ~ /a/ (e.g. box). Twenty-six native speakers of Hexagonal French learned the 20 non-words and their meanings, presented as pictures on a screen (learning phase). They learned half the non-words with both spoken and orthographic input (AO modality) and half with only spoken input (A modality). The following day ([GA03]), they performed a picture-naming task (test phase). As predicted, the presence of the orthographic form facilitated the encoding of the representations of novel L2 words, with more correct responses in the AO (50%) than in the A modality (39%, \( \beta = 0.73, SE = 0.36, p = 0.045 \)) and shorter response times (RTs) for correct responses in the AO (1417 ms) than in the A modality (1609 ms, \( \beta = 0.13, SE = 0.054, p = 0.026 \)). In line with L1 GTPCs, for <i>, formant analyses showed that vowels were more /i/-like (French-like) in the AO than in the A modality, that is, with lower F1 and higher F2, thus higher and fronter. For <o>, vowels were more /ɔ/-like (French-like) in the AO modality, that is, higher, backer and possibly rounded, with both lower F1 and lower F2. (F1 for both vowels: \( \beta = 0.052, SE = 0.021, p = 0.022 \); for F2 an interaction Vowel x Modality: F(1,16.95) = 4.56, p = 0.048). See Fig. 1. In Exp. 2 (preregistered: https://osf.io/cdh7n), 40 native speakers of French learned the same non-words as in Exp. 1. Half learned them produced by a single voice (Low variability), half by six voices (High variability). The test session included the picture naming task, a picture mapping task, and the reading of a list of French words. The results replicated those of Exp. 1 (correct responses: 68% AO, 56% A, \( \beta = 0.87, SE = 0.27, p = 0.011 \); RTs: 1241 ms AO, 1359 ms A, \( \beta = 0.094, SE = 0.028, p = 0.0099 \)), more French-like pronunciations for the AO modality, as shown by formant analyses (F1: \( \beta = 0.21, SE = 0.071, p = 0.006 \), F2 for <i>: \( \beta = 0.63, SE = 0.19, p = 0.0043 \) but not for <i>: \( \beta = 0.04, SE = 0.056, p = 0.48 \)). Vowels were also more compact (\( \beta = 0.40, SE = 0.11, p = 0.001 \)) ([KA14]) and had shorter Euclidean distances to the read French vowels (\( \beta = 0.25, SE = 0.051, p < 0.0001 \)) in the AO condition. RTs for the picture mapping task were faster in the OA (1024 ms) than in the A condition (1059 ms, \( \beta = 3.15 \times 10^{-5}, SE = 1.12 \times 10^{-5}, p = 0.0102 \)). However, we found no effect of Variability in any task. In Exp. 3, we test the hypotheses that later presentation of orthography during learning (Day 2 vs. Day 1) allows better
word learning and attenuates the influence of L1 orthography on phonological representations. Sixty speakers participated, and analyses are underway.

The current results and other recent results ([RA16]) highlight the importance of expanding models of the influence of the L1 phonological system on that of L2 to integrate (e.g. [BE07]) the potential role of orthography. We note that the orthography-induced phonological transfer observed here for L2 is in line with the hypothesis that orthography can modify the nature of the phonological representations in the L1.

![Figure 1. Normalized F1 and F2 by vowel and presentation condition, Experiment 1 ([BL84])](image)

**References**


