

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/rfjh6/>), twenty English non-words were recorded by a native speaker of Canadian English. Half were spelled with <i> (e.g. *blit*), 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> ~ /ɪ/ (e.g. *lick*); FR: <o> ~ /ɔ/ (e.g. *bogue* ‘husk’), EN: <o> ~ /ɑ/ (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%, $\beta = 0.73$, $SE = 0.36$, $p = .045$) and shorter response times (RTs) for correct responses in the AO (1417 ms) than in the A modality (1609 ms, $\beta = 0.13$, $SE = 0.054$, $p = .026$). 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: $\beta = 0.052$, $SE = 0.021$, $p = .022$; for F2 an interaction Vowel x Modality: $F(1,16.95) = 4.56$, $p = .048$). 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, $\beta = 0.87$, $SE = 0.27$, $p = .0011$; RTs: 1241 ms AO, 1359 ms A, $\beta = 0.094$, $SE = 0.028$, $p = .0009$), more French-like pronunciations for the AO modality, as shown by formant analyses (F1: $\beta = 0.21$, $SE = 0.071$, $p = .006$, F2 for <o>: $\beta = 0.63$, $SE = 0.19$, $p = 0.0043$ but not for <i>: $\beta = 0.04$, $SE = 0.056$, $p = .48$). Vowels were also more compact ($\beta = 0.40$, $SE = 0.11$, $p = .001$) ([KA14]) and had shorter Euclidean distances to the read French vowels ($\beta = 0.25$, $SE = 0.051$, $p < .0001$) in the AO condition. RTs for the picture mapping task were faster in the OA (1024 ms) than in the A condition (1059 ms, $\beta = 3.15e-05$, $SE = 1.12e-05$, $p = .0102$). 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.

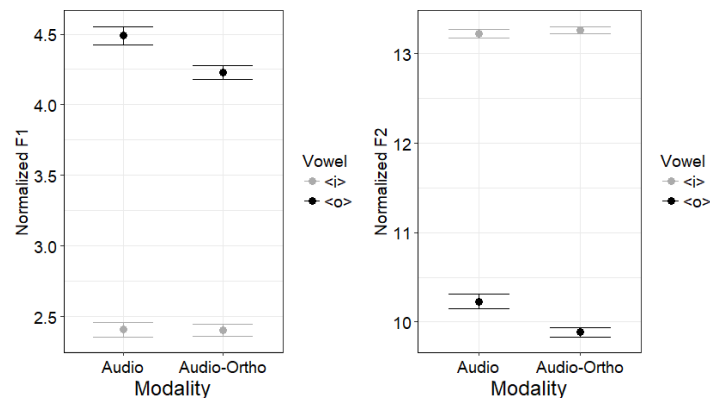


Figure 1. Normalized F1 and F2 by vowel and presentation condition, Experiment 1 ([BL84])

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