Orthography and variability in second language word learning:
Evidence from perception and production

Pauline Welby[1], Mélanie Clément[2], Jasmin Sadat[3], Elsa Spinelli[4] & Audrey Bürki[5]
[1]Aix Marseille Université, CNRS, Laboratoire Parole et Langage, France
[2]Grenoble Alpes Université, France
[3]European Research Council, Belgium
[4]Grenoble Alpes Université, CNRS, Laboratoire de Psychologie et NeuroCognition, France
[5]Universität Potsdam, Germany

In a series of three experiments, we examined the roles of orthography and variability in the spoken input in second language (L2) word learning, using both perception and production tasks. Studies examining the effect of orthography on novel word learning have mostly focused on receptive vocabulary, with mixed results reported (e.g. [SI10], [ES14]). Earlier studies all report an influence of the first language (L1) orthography on L2 pronunciation accuracy (e.g. [BA17]). 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 multiple vs. a single talker 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/), 26 native speakers of French learned English pseudowords either with the orthographic form displayed under the corresponding picture (Audio-Ortho) or without (Audio). Twenty pseudowords were constructed and recorded by a native speaker of Canadian English. Half were spelled with <i> (e.g. *lisk*) and half with <o> (e.g. *mog*). Crucially, the French grapheme-to-phoneme correspondences (GTPCs) for these graphemes (<i> ~ /i/, e.g. *disque* [disk] 'disk' and <o> ~ /ɔ/ in closed syllables, e.g. *bogue* [bɔg] 'husk') differ from the vowel produced in the spoken stimuli and from the most common North American English GTPCs. In a picture naming task, pseudowords learned in the Audio-Ortho modality were produced faster and with fewer errors, providing a first piece of evidence that orthographic information facilitates the learning and on-line retrieval of productive vocabulary in a second language. Formant analyses, however, showed that productions from the Audio-Ortho modality were more French-like (i.e. less target-like), a result confirmed by a vowel categorization task performed by native speakers of English.

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: faster and more accurate responses in the Audio-Ortho modality, with more French-like pronunciations for the Audio-Ortho modality. Vowels were also more compact ([KA14]) and had shorter Euclidean distances to the read French vowels in the Audio-Ortho modality. For the picture mapping task, response accuracy was at ceiling, but RTs were faster in the Audio-Ortho than in the Audio modality. 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 (e.g. [BE07]) to integrate the potential role of L1 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. We further note that the null results found in the picture mapping task used in our experiments and in many previous studies may simply reflect the lack of sensitivity of these offline perception tasks.
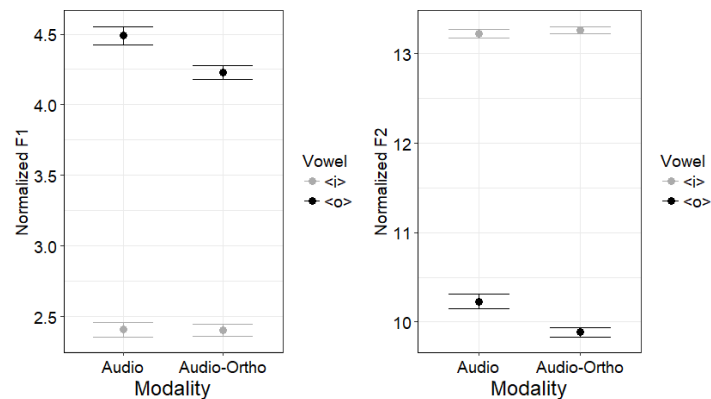

Figure 1. *Normalized F1 and F2 by vowel and presentation condition, Experiment 1 ([BL84, FL11])*

References

[BA05] Barcroft, Joe, & Sommers, Mitchell S. 2005. Effects of acoustic variability on second language vocabulary learning. *Studies in Second Language Acquisition* 27, 387–414.

[BA17] Bassetti, Bene. 2017. Orthography affects second language speech: Double letters and geminate production in English. *Journal of Experimental Psychology: Learning, Memory, and Cognition* 43, 1835–1842.

[BE07] Best, Catherine T., & Tyler, Michael D. 2007. Nonnative and second-language speech perception: Commonalities and complementarities. In, J. Munro & O.-S. Bohn (eds), *Second language speech learning: The role of language experience in speech perception and production*, pp. 13–34. Amsterdam: John Benjamins.

[BL84] Bladon, R. A. W., Henton, C. G., & Pickering, J. B. 1984. Towards an auditory theory of speaker normalization. *Language and Communication* 4, 59–69.

[EH07] Ehri, Linnea C., & Rosenthal, Julie. 2007. Spellings of words: a neglected facilitator of vocabulary learning. *Journal of Literacy Research* 39, 389–409.

[ES14] Escudero, Paola, Ellen Simon & Karen E. Mulak. 2014. 'Learning words in a new language: Orthography doesn't always help." *Bilingualism: Language and Cognition* 17: 384–395.

[FL11] Flynn, Nicholas, & Foulkes, Paul. 2011. Comparing vowel formant normalization methods, International Congress of Phonetic Sciences, Hong Kong.

[GA03] Gaskell M. Gareth, and Dumay, Nicolas. 2003. Lexical competition and the acquisition of novel words. *Cognition* 89, 105–132.

[KA14] Kartushina, Natalia & Frauenfelder, Ulrich H. 2014. On the effects of L2 perception and of individual differences in L1 production on L2 pronunciation. *Frontiers in Psychology* 5, 1246.

[KA18] Kartushina, Natalia, & Martin, Clara D. 2018. Talker and acoustic variability in learning to produce nonnative sounds: evidence from articulatory training. *Language Learning* 69, 71–105.

[MA89] Martin, C. S., Mullennix, J. W., Pisoni, D. B., & Summers, W. V. 1989. Effects of talker variability on recall of spoken word lists. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 15, 676–684.

[RA16] Rafat, Yasaman. 2016. Orthography-induced transfer in the production of English-speaking learners of Spanish. *The Language Learning Journal* 44, 197–213.

[SA05] Sadoski, Mark. 2005. A dual-coding view of vocabulary learning. *Reading and Writing Quarterly* 21, 221–238.

[SI10] Simon, Ellen, Della Chambless & Ubiratã Kickhöfel Alves. 2010. Understanding the role of orthography in the acquisition of a non-native vowel contrast. *Language Sciences* 32: 380–394.