

Variability and orthography in learning new words

Pauline Welby¹, Elsa Spinelli², Jasmin Sadat¹, & Audrey Bürki³

¹ Aix Marseille Université, CNRS, LPL; ² Université Grenoble Alpes, CNRS, LPNC;

³ Universität Potsdam

pauline.welby@univ-amu.fr, elsa.spinelli@univ-grenoble-alpes.fr, buerki@uni-potsdam.de

Background

- **Orthography** is omnipresent in language learning and teaching. Studies report that words of a second language (L2) learnt with orthography are:
 - Better remembered and recalled faster in subsequent production tasks ([1]); mixed evidence in recognition tasks ([2, 3])
 - Produced with less native-like pronunciations ([1, 4] but see [5])
- In natural settings, new words often produced by **multiple speakers**. Studies report that new words or sounds learnt with multiple speakers:
 - Generate better [6] or worse [7] recognition/perception
 - Are produced with less dispersion, better generalization to new speakers [8]

Goals

- Investigate roles of variability and orthography on:
 - Recall of novel words in L2 perception and production
 - Pronunciation

Hypotheses

Presentation of the orthographic form along with the auditory form will:

1. Have a positive impact on learning: Improve recall in language production and recognition tasks
2. Have a negative impact on pronunciation: Lead to pronunciations that are closer to the acoustic space of the native language (L1)

Variability in speakers will:

3. Have a positive impact on learning: Improve recall in language production and recognition tasks
4. Have a positive impact on pronunciation: Cancel out the negative effect of orthography on pronunciations by providing learners with better L2 categories

Experiment

Participants & Materials

- 40 native speakers of Hexagonal French
- 20 monosyllabic CVC pseudowords with <i> or <o>, which have different grapheme-to-phoneme correspondences (GPCs) in English and in French.
 - English: <i> ~ /ɪ/ (*disk* [disk]), <o> ~ /ɑ/ (*bog* [bag]);
 - French: <i> ~ /i/ (*disque* [disk]), <o> ~ /ɔ/ in closed syllables (*bogue* [bɔg] 'husk').
- Pseudowords recorded by native speaker of Canadian English and paired with pictures of novel objects, plants, and animals

Procedure

Day 1: Learning phase

Each pseudoword presented 20 times with picture. Two factors:

A. Modality (within participants)

(1) Spoken and written form (Audio-Ortho)



(2) Spoken form only (Audio)



B. Variability (between participants): Single talker vs. multiple talkers

Day 2: **Test phase**: Picture naming and Picture mapping

Results: Remembering new words

Picture naming and picture mapping

- In both tasks, orthography improved speed and/or accuracy
- No evidence that variability modulated accuracy or response times

| Task/DV | Audio | Audio+Ortho | t | p |
|-------------------------|-------|-------------|-------|--------|
| Naming accuracy | 42% | 58% | 3.25 | 0.0011 |
| Naming RT (ms) | 1359 | 1241 | 3.35 | 0.0009 |
| Picture mapping RT (ms) | 1059 | 1024 | -2.81 | 0.0102 |
| | HV | LV | t | p |
| Naming accuracy | 62% | 62% | 0.037 | 0.97 |
| Naming RT (ms) | 1251 | 1337 | 1.21 | 0.23 |
| Picture mapping RT (ms) | 1058 | 1025 | -0.82 | 0.42 |

=> Written form improves recall & facilitates retrieval

Results: Pronouncing new words

Formants

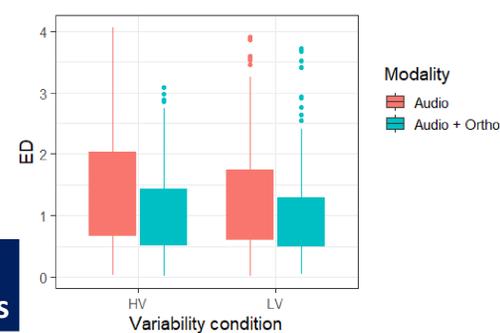
- F1 (normalized): lower in Audio+Ortho condition ($b = 0.21, p < 0.01$), effect of variability or interaction not significant ($ps > 0.06$)
- F2 (normalized):
 - <o> lower in Audio+Ortho condition ($b = 0.63, p < 0.01$), effect of variability or interaction not significant ($ps > 0.06$)
 - <i>: no significant effect of modality ($p > 0.4$), effect of variability ($b = 0.34, p < 0.05$), with lower values for multiple talkers, no interaction ($p > 0.7$)

=> More French like (/i/- or /ɔ/-like) productions when orthography is available

=> Written form leads to less native-like L2 pronunciations

Euclidean distance to French target

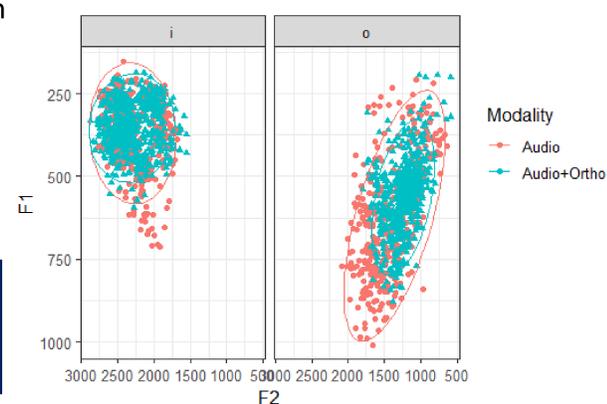
- Euclidean distance to French target of same participant smaller in Audio + Ortho condition ($b = 0.25, p < 0.0001$)
- No significant effect of variability or interaction ($ps > 0.3$)



=> Written form leads to more native-like L1 pronunciations

Compactness/dispersion

- Vowels more compact in Audio + Ortho condition ($b = 0.46, p < 0.001$)
- No significant effect of variability or interaction ($ps > 0.2$)



=> Written form leads to more compact pronunciations

Discussion & Conclusion

Availability of orthography during learning:

- **Impacts subsequent recall and retrieval**: advantage for novel words learnt with orthography in production and recognition tasks (in line with dual coding theory, e.g., Paivo, 1971)
- **Impacts subsequent pronunciations** for vowels whose GPCs differ between second and first language, with F1 and F2 values that are more compact and closer to L1 targets

High variability in spoken input (multiple talkers)

- No evidence that number of talkers impacts recall or pronunciation

References

- [1] Bürki, A., Welby, P., Clément, M., & Spinelli, E. (2019). Orthography and second language word learning: Moving beyond "friend or foe"? *JASA* 145.
- [2] Escudero, P., Hayes-Harb, R., & Mitterer, H. (2008). Novel second-language words and asymmetric lexical access. *Journal of Phonetics*, 36, 345–360.
- [3] Simon, E., Chambless, D., & K. Alves, U. (2010). Understanding the role of orthography in the acquisition of a non-native vowel contrast. *Language Sciences*, 32, 380–394.
- [4] Bassetti, B., & Atkinson, N. (2015). Effects of orthographic forms on pronunciation in experienced instructed second language learners. *Applied Psycholinguistics*, 36, 67–91.
- [5] Rafat, Y. (2015). The interaction of acoustic and orthographic input in the L2 production of assimilated/fricative rhotics. *Applied Psycholinguistics*, 36, 43–64.
- [6] Barcroft, J., & Sommers, M. S. (2005). Effects of acoustic variability on second language vocabulary learning. *Studies in Second Language Acquisition*, 27, 387–414.
- [7] Martin, C. S., Mullenix, 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.
- [8] Kartushina, N., & Martin, C. (2018). Talker and acoustic variability in learning to produce nonnative sounds: evidence from articulatory training. *Language Learning*, 69, 71–105.