

Stability of individual patterns in learning a second language voicing contrast

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Background

- Variability in the acoustic realization of speech sounds is systematically constrained at the level of the individual speaker (Chodroff & Wilson, 2017; Clayards, 2017; Scobbie, 2006; Shultz et al., 2012)
 - Individual correlation between reliance on VOT vs. onset f0 in voicing contrasts (Shultz et al., 2012, on American English)
 - Same talker positive VOT of /p^h/ was highly correlated with that of /k^h/ (Chodroff and Wilson, 2017, on American English)

Background

- If stability is governed by individual speaking style, or speech 'habit', it should be maintained across languages and within language in L2 learners (Chodroff & Wilson, 2017)
 - **The present study examines the use of VOT and onset f0 in realization of voicing categories across English and French by American learners of French**

Research Questions

RQ #1

Does covariation between realizations of /b/ and /p/ exist on an individual level and is it maintained in both the first and second language?

RQ #2

Are members of the same phonological category produced by each talker with similar phonetic settings across languages?

RQ #3

Is the individual pattern of relative reliance on multiple correlates maintained across languages?

- Specifically, to what extent do individual talkers employ VOT vs. onset f0 to construct voicing contrasts in each language and across languages?

Methodology

Participants

- Experimental- 23 native speakers of American English learning French at Purdue (201 level or above)
- Control (Shultz, 2011)- 33 monolingual native speakers of Midwestern American English

Stimuli

- Four French voiced/voiceless bilabial stop pairs with vowels /i/, /ɛ/, and /a/ (i.e. bêche/pêche)
- Four English voiced/voiceless bilabial stop minimal pairs with vowels /i/ /ɪ/, /ɛ/, and /a/ (i.e. bet/pet)

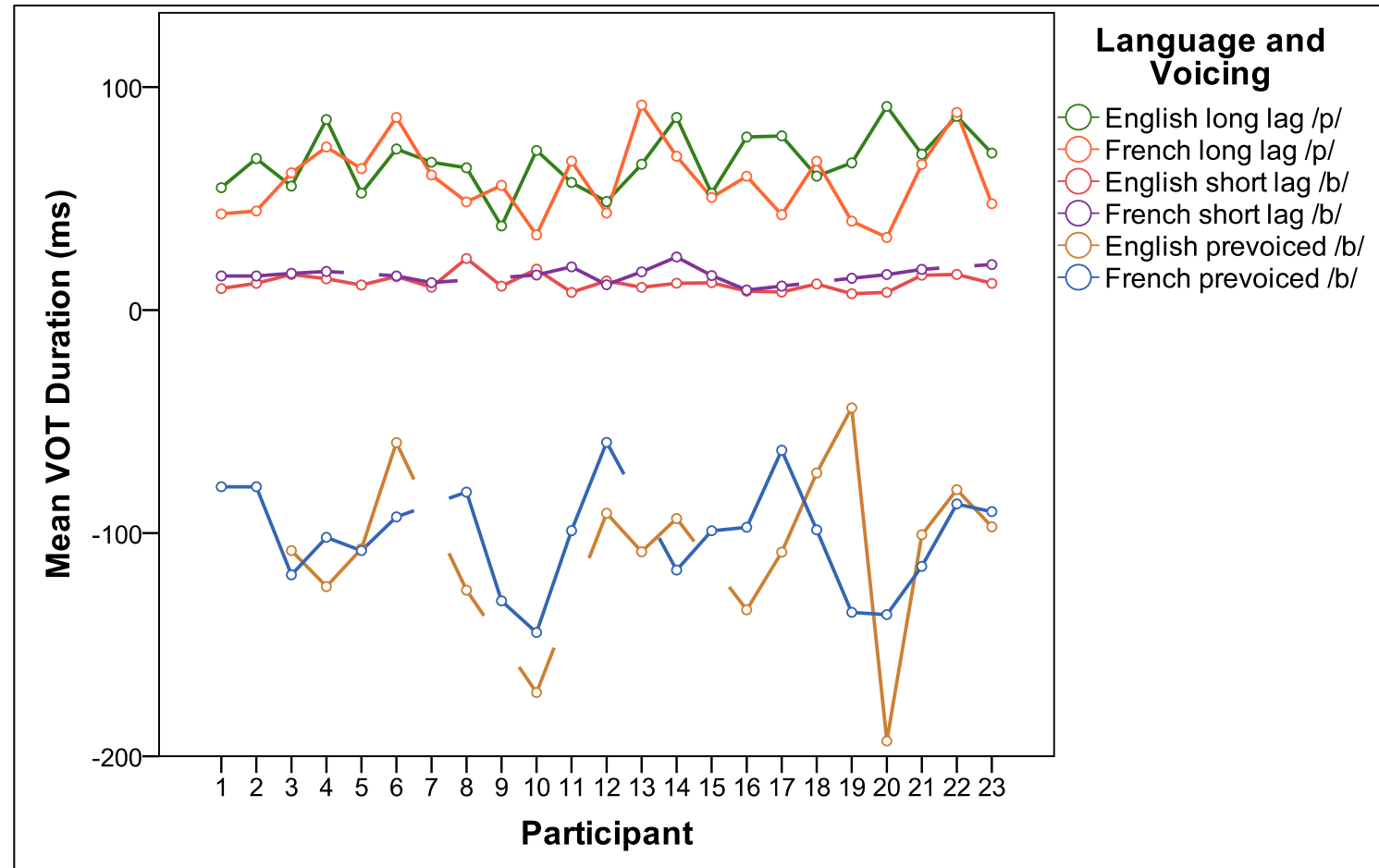
Tasks

- Words on screen in three randomized blocks

Measurements

- VOT (initial stops)
- Onset f0 (measured at the beginning of the vowel)

Results: Members of the contrast within language



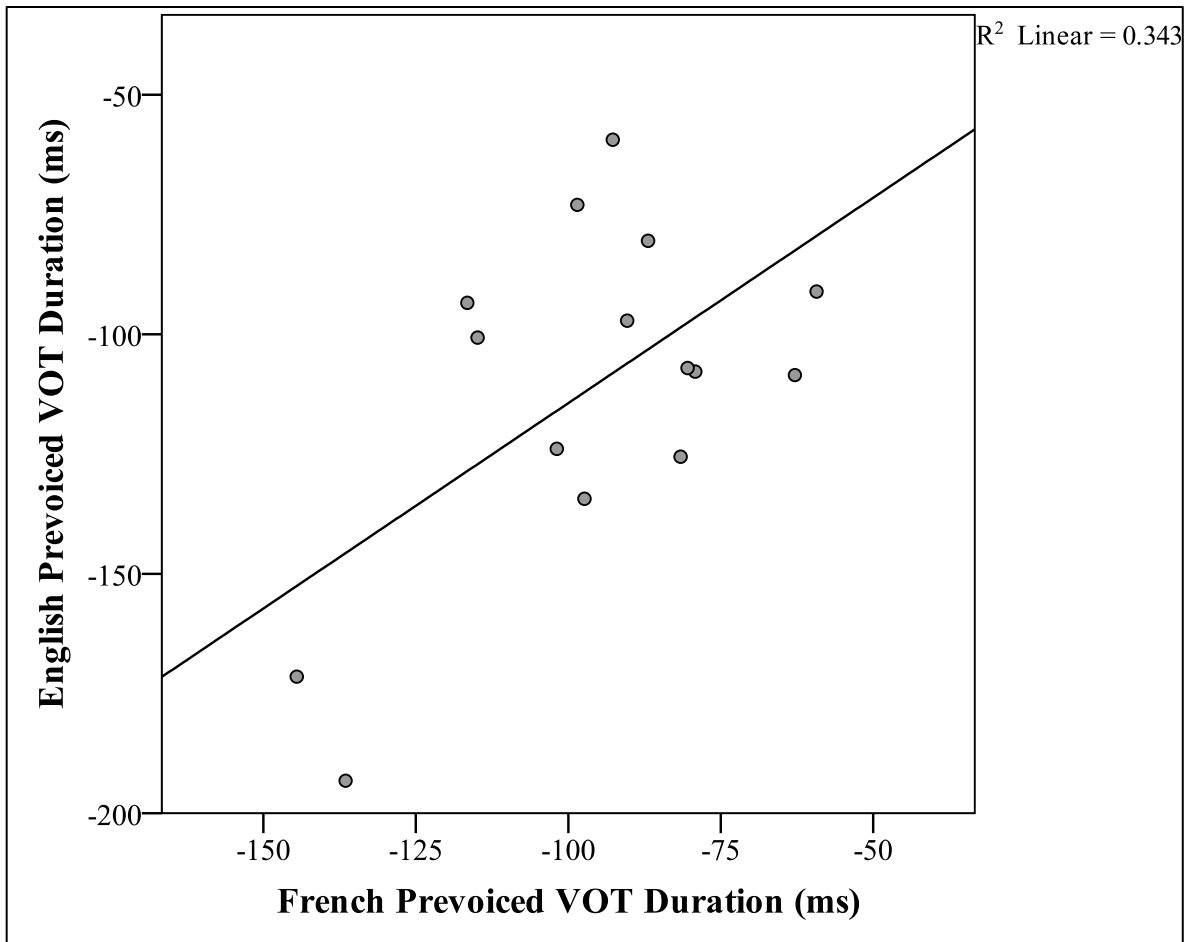
Results: Members of the contrast within language

RQ #1

Does covariation between realizations of /b/ and /p/ exist on an individual level and is it maintained in both the first and second language?

- Correlation analysis indicated that VOTs of /b/ were not significantly correlated with VOTs of /p/ in English or French
 - The realization of one member of the contrast was not related to the another member in English or French

Results: Same phonological category across languages

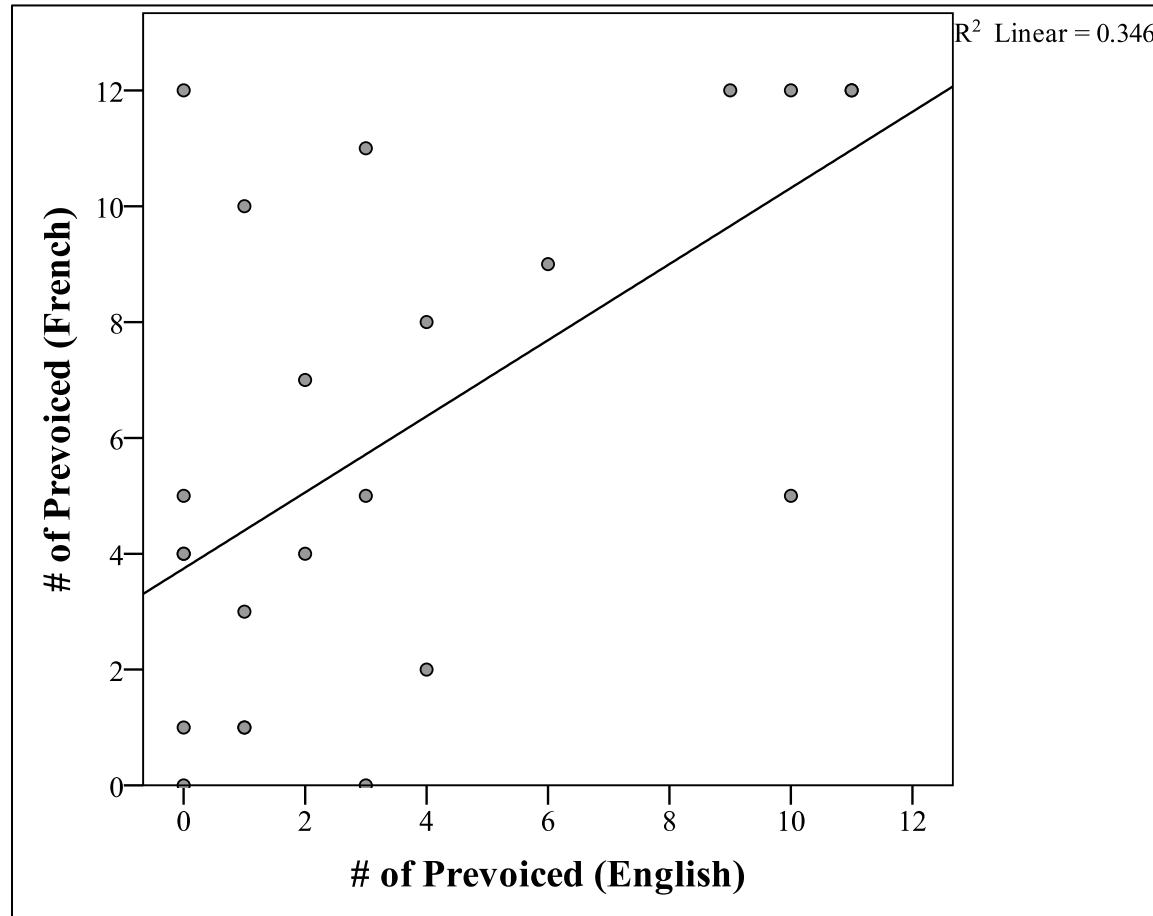


RQ #2

Are members of the same phonological category produced by each talker with similar phonetic settings across languages?

- Duration of prevoicing in English /b/ (for those who prevoiced) was significantly positively correlated with duration of prevoicing in French /b/ ($r[15] = .586, p = .022$)
 - Participants who produced longer prevoicing in English also produced longer prevoicing in French

Results: Same phonological category across languages



- Number of prevoiced English /b/s was significantly positively correlated with number of prevoiced /b/s in French ($r[23] = .588, p = .003$)
 - Participants who produced more prevoiced stops in English also produced more prevoiced stops in French

NOTE: A similar crosslinguistic link was not established for voiceless consonants

Results: Relative use of two acoustic correlates

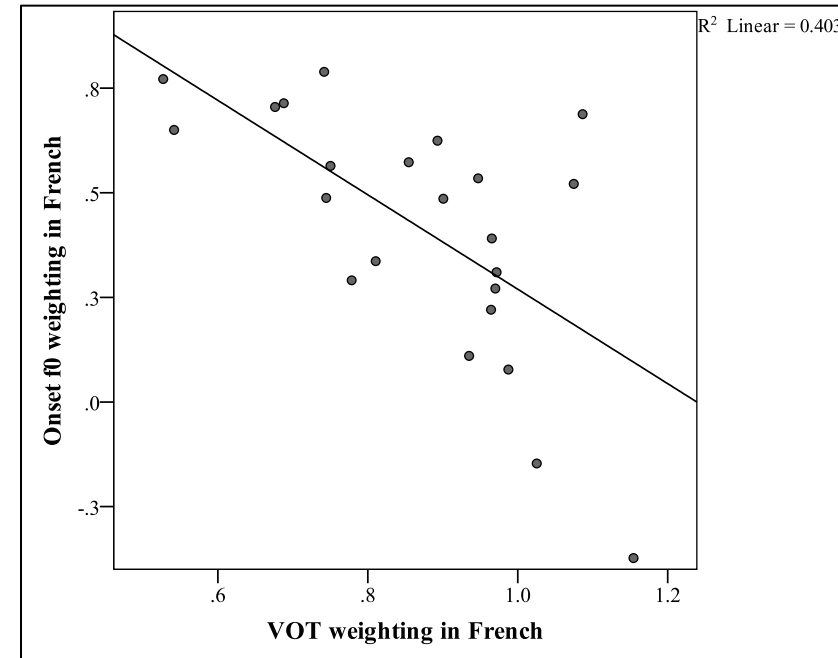
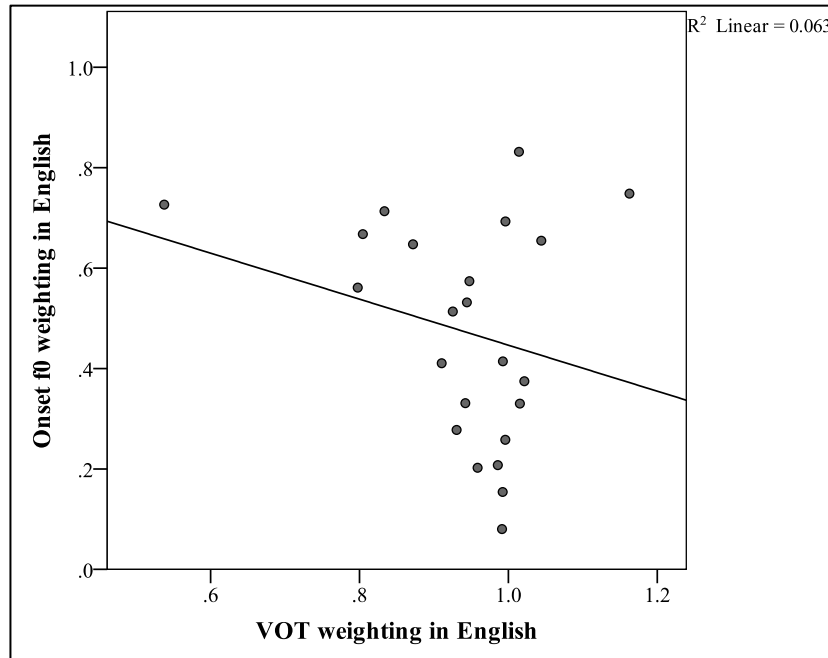
RQ #3

Is the individual pattern of relative reliance on multiple correlates maintained across languages?

- Specifically, to what extent do individual talkers employ VOT vs. onset f0 to construct voicing contrasts in each language and across languages?

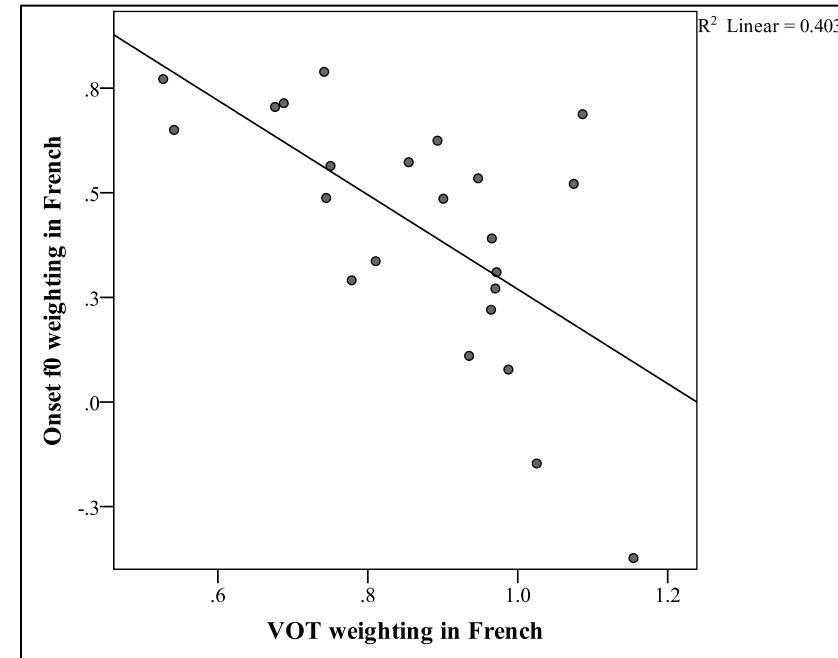
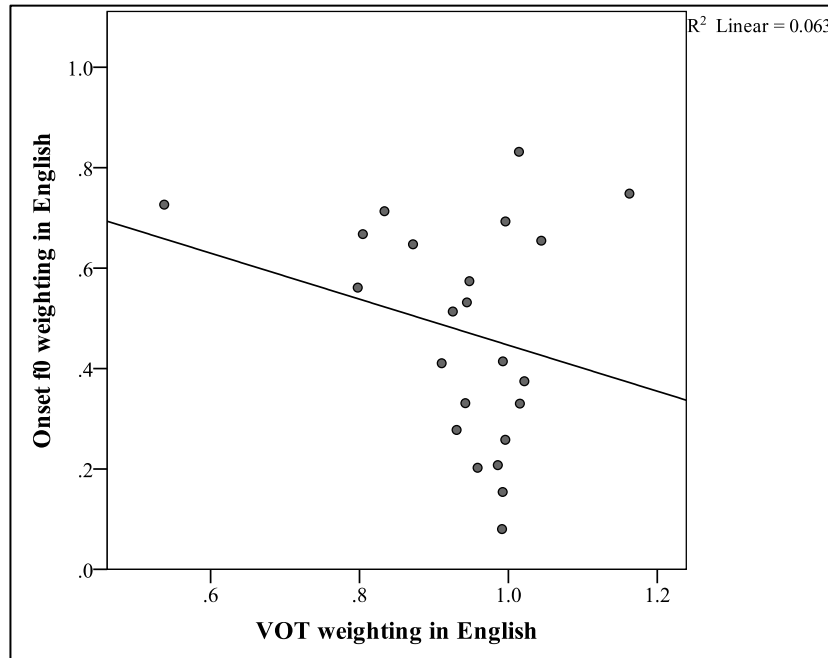
- We deployed a discriminant analysis to create a set of individual standardized coefficients for each correlate
 - These coefficients show us how much each speaker relied on each of the correlates of voicing (VOT or onset f0) when producing a voicing distinction
 - We then compared those individual coefficients across cues within language and across languages
- In both languages, VOT was the dominant correlate, but more consistently in English (L1) than French (L2)

Results: Relative use of two acoustic correlates



- Does the use of one correlate affect the use of another correlate?
 - No correlation between VOT weights and onset f0 weights in English ($r[23] = -.251$, $p = .248$): no trading relations between correlates
 - **Significant negative correlation** was present between VOT and onset f0 weights in French ($r[23] = -.635$, $p = .001$): **evidence of trading relations**

Results: Relative use of two acoustic correlates



- Is the use of one correlate in the L1 linked to the use of the same correlate in the L2?
 - Weighting of VOT across English and French were uncorrelated ($r[23] = -.030$, $p = .893$)
 - Weighting of onset f0 across English and French were uncorrelated: ($r[23] = 0.0003$, $p = .999$)

Summary of results

- The production of /b/ was not linked to the production of /p/ in either language
- Across languages, we saw a connection only for prevoiced stops
 - More frequent and longer prevoicing in English correlated with more frequent and longer prevoicing in French
- Discriminant weights of the two correlates were not linked across languages
 - e.g. heavier individual reliance on f0 in English did not correlate with heavier reliance on f0 in French
- The two correlates did not appear to be in a trading relationship in participants' L1, but traded off in their L2

Discussion

- Participants exhibited a correlation in their production of English and French prevoiced /b/
 - /b/ is a category that is phonologically equivalent and also phonetically similar (can be expressed phonetically with the same VOT category)
 - Perhaps L2 learners of French find prevoicing to be more salient as a category than voiceless?

Discussion

- In French, unlike in English, participants showed more variability in using VOT for voicing distinctions
 - In other words, VOT in French was less distinctive as a correlate of voicing
 - This was possibly due to the shortening of voiceless VOT, which was not sufficiently compensated by shifting voiced stops into the negative VOT region
 - The trading between correlates- an attempt to compensate for less distinctive VOT?

Discussion

- The presence of a compensatory relationship in L2 speech suggests the flexibility learners have in using acoustic correlates to produce a voicing distinction
 - It is possible that speakers apply these strategies when the primary cue becomes less distinct, mirroring a behavior that has already been established in speech perception (Whalen et al. 1990)

Thank you!

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