Effects of allophony and the representation of English loanwords in Brazilian Portuguese

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Overview

General Puzzle: Some strings in loanwords are not produced/repaired like native words

a. **English → Japanese**

- In Japanese, [t͡ʃi] (but not *[ti]) is attested in native words
- But some loans may be produced with [ti]: [ʃitibaŋkɯ] 'Citibank' (Broselow et al. 2012; Shaw 2007)

b. **English → Korean**

- In native Korean words, stop-nasal clusters result in nasal assimilation
  /kuk-min/ → [kuŋmin] 'nation'
- Loanwords with such (illicit) clusters exhibit epenthesis (Boersma and Hamann 2009; Daland et al. 2019)
  /pɪknɪk/ → [pʰikʰɨnik] 'picnic'

☞ Accounts based on faithfulness (to the source) and/or markedness

Overview

Our puzzle:

- Some strings in loanwords are not produced like native words
- But they are not faithful to the foreign input either—and no (native) repair applies

☞ The resulting string is an **expansion of what is possible in the native phonology**

Structures under focus: English /tu/ in Brazilian Portuguese (BP)

a. *two, too, to* → [t͡ʃu]
b. *student* → [ist͡ʃudent]
c. *today* → [t͡ʃudej]

☞ In native BP, [t͡ʃi] is allowed, but not *[t͡ʃu]

Loanword adaptation

Our puzzle in context: **Category proximity or phonetic approximation?**

Category proximity (LaCharité and Paradis, 2005, p. 227)

a. If a given L2 phonological category does not exist in L1, this L2 category will be replaced by the closest phonological category in L1, *even if the L1 inventory contains acoustically closer sounds*.

b. Category proximity is determined by the number of changes (e.g., features) that an L2 phoneme must undergo to become a permissible phoneme in L1.

Loanword adaptation

Category proximity or phonetic approximation?

English → Spanish

English /ɪ ʊ/ are phonetically closer to **Spanish** /e o/ than to /i u/ (Delattre 1981)

A. By phonetic approximation, we should get *building* as [*beldeŋ] and *cook* as [*kok]
B. But, in reality, we get [bildiŋ] and [kuk]

Option A changes the feature [high], selecting ≠ existing phonological categories

Option B keeps features (categories) intact by sacrificing phonetic approximation

Loanword adaptation

Category proximity or phonetic approximation

The example in Spanish suggests that **category proximity** $\succ$ **phonetic approximation**

☞ What happens when adapted forms involve **allophony?**

Loanword adaptation: The BP case

Category proximity or phonetic approximation

In **BP**, [t͡ʃ d͡ʒ] are allophones of /t d/ before [i]

- Examples: *tipo* [t͡ʃi.pu] 'type', *dia* [d͡ʒi.a] 'day'; **but** *tudo* [tu.du] 'all', *dúzia* [du.zi.a] 'dozen'

BP speakers' adaptation of English loanwords

- *tea* as [t͡ʃi] and *deep* as [d͡ʒip]: affrication of [t d] before [i]
- **But** English /tu/ sequences are also affricated by BP speakers: *two, too, to* = [t͡ʃu]
- This does not happen with /du/: *do* = [du] (cf. *[d͡ʒu]), *doom* = [dum] (cf. *[d͡ʒum])

☞ While affrication of /t/ before [i] is expected given allophony in BP, it's surprising before [u]

Loanword adaptation: The BP case

Category proximity or phonetic approximation

- Previous studies: have argued that this case of **spurious affrication (SA)** is **not caused by speakers perceiving aspiration as affrication:** (Nevins and Braun 2009)
  - Forms such as *student*, which has no aspiration, also result in SA in BP
  - **Proposal:** BP speakers represent the /tu/ strings as /tiu/ (English /u/ is fronted after coronals)
  - ☞ Representations contain the phonetic approximation perceived by speakers
  - Palatalization is a surface effect

- Issues with this proposal:
  - It does not explain why /du/ is not palatalized
  - It does not explain cases like [t͡ʃudej] 'today'

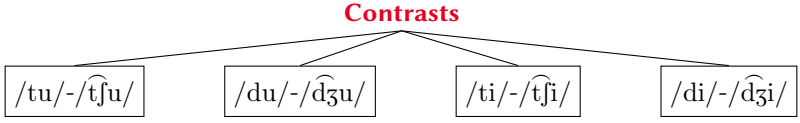
Additional issue: BP speakers' perception of aspiration vs. affrication hasn't been tested

☞ **This paper:** perception data strongly suggest that **aspiration is a key factor**

Methods

AXB task with CV stimuli (recorded by two native speakers of Canadian English)

- **Target items** ($n = 32$): [±voice] stops and affricates /t d t͡ʃ d͡ʒ/[1] + /i u/
- *Fillers* ($n = 76$): /ɑ/ and/or other consonants (e.g., /s z/)



Participants: BP speakers ($n = 26$) → learners of English living in Canada

Controls: native English speakers ($n = 13$) residing in the same region

[1] Voiceless stops were recorded with aspiration.

Methods

Stats

- Bayesian logistic regression
  - by-item random intercept
  - by-speaker random slope and intercept for vowel:consonant interaction
  - minimally informative priors

(Bürkner 2018)

Model specification

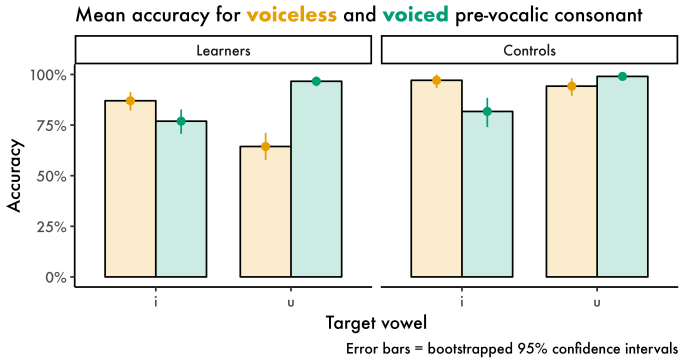
```
Y ~ C * V + (1 + C * V | ID) + (1 | item)
```

☞ Where `Y` is either **accuracy** (Bernoulli) or **reaction time** (lognormal)

Results and analysis

Accuracy

☞ /tu/-/$\widehat{\text{tʃ}}$u/: **most difficult** type for learners (< 75%)

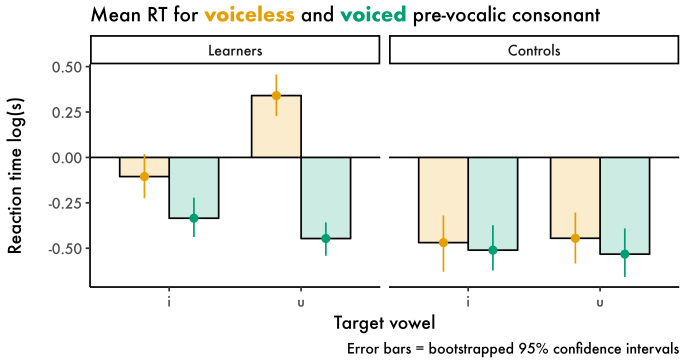


$\hat{\beta} = -4.34$, 95% CrI = $[-7.01, -1.82]$: effect of `consonant[t]-vowel[u]` interaction

Results and analysis

Reaction times

☞ /tu/-/t͡ʃu/: **slowest** type for learners (Med = 1.31s)



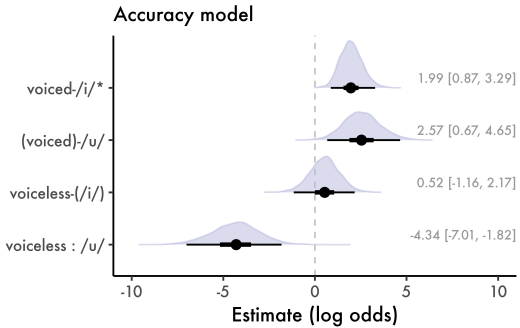
$\hat{\beta} = 0.55$, 95% CrI = $[0.05, 1.06]$: effect of `consonant[t]-vowel[u]` interaction

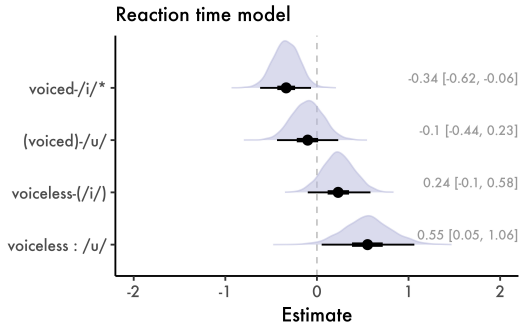
Results and analysis

Models (* = intercept)

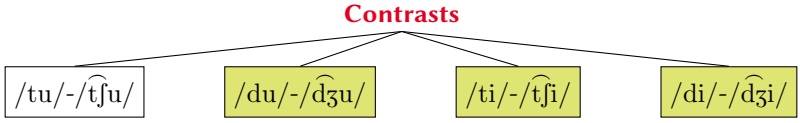
- Posterior distributions of effect sizes for both models + 50% and 95% credible intervals

☞ **voiceless : /u/** → lowest accuracy and slowest reaction times





Discussion



Results for $\frac{3}{4}$ contrasts were consistent with:

- BP allophonic patterns (higher accuracy; faster RTs)
- observations about the perception/production of allophonic variation (Peperkamp et al. 2003)

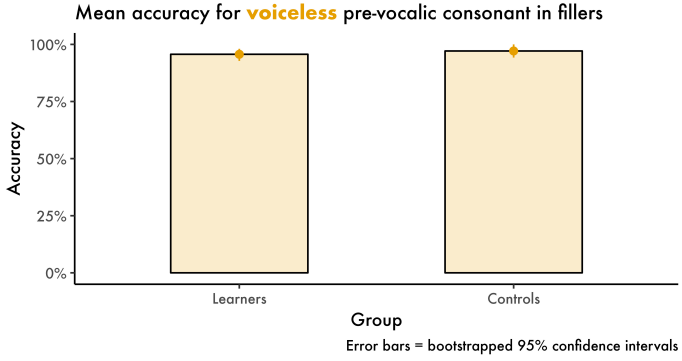
☞ **How about /tu/-/t͡ʃu/?**

Discussion

Idea: BP speakers approximate the cues present in the phonetic form [tʰu] as [t͡ʃu]

- This could stem from **aspiration noise** + **fronted quality** of English [u]

☞ **How do we know this isn't just about aspiration?** /tɑ/ vs. /t͡ʃɑ/ (fillers)



Discussion

☞ **How about words such as *student*?**

- Why do BP speakers produce SA in these contexts? (Nevins and Braun 2009)
- Not all unaspirated stops are the same (Lisker and Abramson 1964; Pierrehumbert et al. 2000; Ladefoged and Johnson 2011)

- **Plausible assumption:** BP speakers perceive [st] as [st + noise]
  - Unaspirated [t] in English has **longer VOT** than BP [t] (Cho et al. 2019)
- This explains why /tu/ and /stu/ are often perceived/produced as [t͡ʃ] and [st͡ʃ]

Discussion

☞ BP speakers' UR is **not** target /tu/

- Rather, it incorporates the aspiration and adapts it to the closest native category: /t͡ʃu/
- Aligned with models where representations are constrained by perception (Boersma and Hamann 2009)
- Variable surface forms consistent with probabilistic frameworks (Goldwater and Johnson 2003; Wilson 2006)

Discussion

☞ /t͡ʃu/ is a **marginal representation** in BP English

Marginal representations

- Deviate from the native patterns; expand what is allowed in the borrowing system
- Motivated by perception; not (necessarily) identical to what's observed in the source
- Low cost in loanword adaptation: no new phonological category involved

Discussion

Borrowing systems are able to accommodate **marginal representations**

- Another case in BP English: loanwords containing /ʌ/ (e.g., *pub*), often adapted to [ɐ] (Guzzo 2019)

☞ [ɐ] is only found in nasal contexts in BP (allophone of /a/):

a. *cama* [kɐ̃ma] 'bed'
b. *canto* [kɐ̃ntu] 'corner'

- The borrowing system allows an allophone to emerge in additional (i.e., non-nasal) contexts:

a. *pub* [pɐbi]
b. *Starbucks* [istarbɐkis]

- This results in an **expansion of the distribution of native allophonic patterns**

Discussion

Borrowing systems are able to accommodate **marginal representations**

How about the Japanese [ti] vs. [t͡ʃi] adaptations (e.g., *Citibank* → [ʃitibaŋkɯ])?

- [ti] in loans is a **marginal representation** in that it is not observed in native words
- But it differs from the BP English cases, which...

  ... are **not faithful** to the source

  ... involve **expansion of allophonic patterns**

Final remarks 1

Back to the beginning: **category proximity ≻ phonetic approximation** (LaCharité and Paradis 2005)

- Our results do not contradict this notion

☞ Instead, they show that phonetic approximation **can** be the main factor in loanword adaptation...

... when phonological categories aren't involved, and/or

... when the allophonic system may be expanded to accommodate perception

Final remarks 2

Back to Nevins and Braun (2009):

- [t͡ʃu] productions are mostly motivated by phonetic approximation (in perception)
- Yes, but...

1. aspiration plays a key role, and
2. speakers' representations include palatalization

☞ **Marginal representations**

Next steps

☞ **Next steps:** production data (in progress); follow up experiment(s); lexical issues
analyze fillers + phonetic correlates in stimuli

Acknowledgments

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