Native and non-native patterns in conflict:
Lexicon vs. grammar in loanword adaptation in Brazilian Portuguese

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OVERVIEW: In Brazilian Portuguese (BP), English loanwords with /ʌ/ are normally produced with [ɐ] (see (1)). Although [ɐ] is articulatorily the closest vowel to /ʌ/ in the native inventory, it is the allophone for /a/ *only* before nasal consonants (compare (2a) and (2b)). It is thus surprising that this vowel appears in loanwords before both oral and nasal consonants ((1a) vs. (1b)). This violation of native BP phonotactics is presumably driven by speakers' desire to mirror the source language (English) as closely as possible.

(1) (a) *pub* → [ˈpɐbi], *bug* → [ˈbɐgi]
(b) *funk* → [ˈfɐ̃ŋki], *punk* → [ˈpɐ̃ŋki]

(2) (a) ˈkaza, *ˈkɐza 'house'
(b) ˈkɐ̃ma, *ˈkama 'bed'; ˈkɐ̃nto, *ˈkanto 'corner'

Although there is a growing number of loanwords in the BP lexicon with the profile in (1a), one question that arises is whether the ability to license [ɐ] in more contexts in loanwords than in native BP, as suggested by (1), is part of the BP grammar. In this paper, I experimentally explore the question of whether the lexicon and the grammar can differ with respect to their preferred adaptation patterns of the English vowel /ʌ/. Although there is a literature supporting lexicon-grammar asymmetries, it has largely been confined to examining whether speakers generalize unnatural patterns present in their native language (e.g., Becker et al. 2012, Garcia 2017, Jarosz 2017). In contrast, this paper explores this question in the realm of non-native patterns that are present in the lexicon due to borrowing.

Two experiments are conducted to answer this question. In brief, the results show that, while the pattern in (1) is observed in real loanwords, native speakers of BP generally avoid [ɐ] in nonce loanwords where the target vowel is not followed by a nasal coda, preferring [a] instead. This indicates that native speakers do not generalize non-native patterns that are present in the lexicon, mirroring what has been observed for the generalization of unnatural patterns in native grammars.

METHODOLOGY: Fifteen native speakers of BP with various levels of proficiency in English participated in two production tasks. One task included real loanwords while the other one included nonce loanwords. In the Real Loanword Task, participants read newspaper headlines containing English loanwords with /ʌ/ that are commonly used in BP (n = 26). The target vowel was either followed by a nasal coda (e.g., *funk*, *punk*) or an oral coda (e.g., *pub*, *bug*). Participants were instructed to read the headlines and to subsequently repeat them while staring at a blank screen (to minimize the effect of orthography). The task included filler sentences with no loanwords as well as sentences containing loanwords of different profiles.

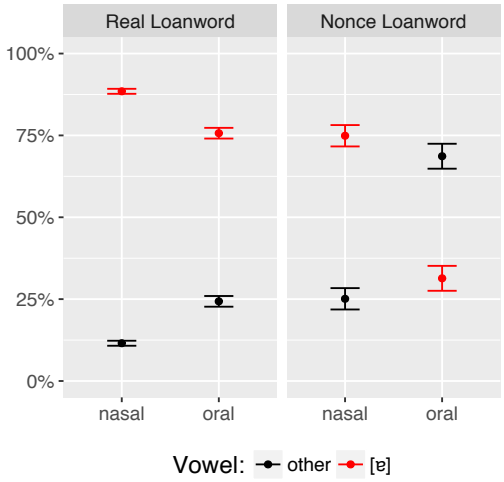
In the Nonce Loanword Task, participants were auditorily presented with items (n = 20) containing /ʌ/ either before a nasal coda (e.g., *tump*, *pund*) or an oral coda (e.g., *tuss*, *vup*). Participants were instructed to produce these words twice in carrier sentences in BP. The task included nonce loanword fillers of distinct phonological profiles. Participants' productions in both tasks were coded for vowel quality based on F1, F2 and F3 measurements and the judgements of a linguist who is a native speaker of BP.

RESULTS: Overall, participants used [ɐ] consistently more in the Real Loanword Task. Figure 1 shows that, when the loanword vowel was in a nasal context (*funk*, *tump*), it was produced as [ɐ] in the vast majority of cases. In oral contexts, on the other hand, the loanword vowel was produced as [ɐ] much more frequently when the item was a real word (*bug*) than when it was a nonce word (*vup*). In fact, participants' use of [ɐ] flips in oral contexts in the nonce loanword task: [ɐ] is used in a minority of cases.

In Figure 1, *other* indicates all non-[ɐ] productions found in the data. The Real Loanword Task and the Nonce Loanword Task differ in which *other* vowels were produced. In the Real Loanword Task, the majority of *other* segments are [u], which is unsurprising given BP orthography. In the

Nonce Loanword Task, the segments grouped under *other* are different depending on whether the vowel was in a nasal or oral context. While the non-[ɐ] productions with nasal vowels correspond for the most part to [u], productions with oral vowels exhibit much more variation: in addition to [ɐ] and [u], [ɔ] and [a] were observed. Productions with [u] in the Nonce Loanword Task can be explained based on participants' knowledge of sound-letter correspondence patterns in English. The use of [ɔ] can be accounted for based on the acoustic similarities between English [ʌ] and BP [ɔ]. The use of [a] can be explained based on speakers' avoidance of [ɐ] in non-native contexts (i.e., preceding non-nasal consonants, in which case [a] would be used; see (2)). A mismatch between the source language and participants' native language may be what prompts the use of different adaptation strategies in this particular context: while in English /ʌ/ is found before both nasal and oral consonants, its articulatorily closest segment in BP ([ɐ]) is licensed only in nasal contexts.

Fig. 1: % of [ɐ] by task and context



The results shown in Figure 1 were modelled with a hierarchical logistic regression with by-speaker random slopes for task and context (oral or nasal). The model indicates that the production of [ɐ] is disfavored in oral contexts and nonce loanwords ($\hat{\beta}$ = -1.61, $p < 0.0001$). Participants' proficiency in English has no effect on their productions.

FORMALIZATION: The variation in output forms observed in the nonce loanword data indicates that constraints that require faithfulness to the input are in conflict with constraints that ban non-native patterns. Such variation in output forms is formalized using a MaxEnt Grammar (Hayes & Wilson 2008), which allows for the probabilistic assessment of candidates. The formalization focuses on the productions of oral vowels in the Nonce Loanword Task that are not conditioned by orthography (i.e., with [a], [ɔ] or [ɐ]). These productions are accounted for by the constraints in (3) and illustrated in the tableau in (4):

(3) FAITH: Every segment in the input is featurally identical to every segment in the output
FAITH(round): Every segment in the input is identical in [round] to every segment in the output
LICENSE-[ɐ]: [ɐ] is followed by a nasal consonant

(4)

/vʌp/	FAITH [0.5]	LIC-[ɐ] [0.7]	FAITH(rnd) [0.6]	actual prop	probability
vɐp		1		35.8	0.35
vɔp	1		1	23.3	0.23
vap	1			40.9	0.42

Given that candidates with [a] and [ɐ] have relatively close proportions and violate only one constraint, the weight of LICENSE-[ɐ], which penalizes [vɐp], must be higher than the weight of FAITH, which penalizes [vap]. [vɐp] does not violate FAITH since it is assumed that BP speakers do not have distinct representations for native and non-native segments with near-identical articulation such as [ɐ] and /ʌ/ (see e.g., Peperkamp & Dupoux 2003; Hsu & Jesney 2017). Candidates with [ɔ] violate two faithfulness constraints and thus are the least likely to arise. In the lexicon, however, where productions with [ɐ] are the norm in oral contexts and [a] is not observed, the weight of FAITH must be overwhelmingly higher than the weight of LICENSE-[ɐ].

The results of these experiments support the proposal that there are asymmetries between the lexicon and the grammar. This thus extends the finding from previous research on unnatural grammatical patterns into a new empirical domain: loanword adaptation.