Ashley Farris-Trimble (Simon Fraser University) and Anne-Michelle Tessier (UBC)
GLOW48

Does phonological opacity help listeners? A study of derived contrast

Background: 'Canadian' Raising (CR [1,2]) is a process that raises the diphthongs /aɪ/ and /aʊ/ before tautosyllabic voiceless consonants. This process is robust in many parts of North America [3,4], in spite of its famously opaque interaction with flapping: Raising applies in *writing* [ɹʌɪɾɪŋ], resulting in apparent overapplication before a derived voiced flap and creating a minimal pair with *riding,* [ɹaɪɾɪŋ]. One explanation for the persistence of opaque patterns like CR is that they help the listener access underlying representations, maintaining a *derived* contrast (e.g. [5,6,7]). In this case, diphthong height in *writing*/*riding* is the derived, reliable cue to the following stop's underlying voicing, while the surface flap itself is not.

Phonological theories differ as to whether such derived contrasts are epiphenomenal, or actively protected and pursued by the grammar itself. This study aims to investigate the primacy of derived contrast in speakers' knowledge of CR by asking 1) whether listeners can reliably focus on diphthong height in e.g. *writing* and *riding* to recover their bases [ɹʌɪt] vs [ɹaɪd], and 2) whether they can extend this recovery when evaluating novel derived words.

Methods: 28 adult L1 speakers of Canadian English completed two tasks. ***Judgment task.*** Participants heard 52 pairs of monomorphemic bases and *-ing* affixed forms (16 real /aɪ/ words, 20 nonce /aɪ/ words, 16 control words with other vowels; Table 1) and responded whether the two words' bases were same or different. Half were same pairs, transparent (*riding/ride*) or opaque (*writing/write*). The other half were different pairs in which the derived word was paired with a base with the opposite raising (*riding/write* or *writing/ride*). Trials were counterbalanced for order (bare vs. affixed form first). ***Production tasks.*** The same participants also produced plain and affixed real words in two tasks: first reading a wordlist, and second hearing an affixed form like *writing* and producing its base.

Production results: To summarize: our participants showed clear evidence of /aɪ/ raising before /t/ (Figure 1), so we take our judgment data to come from productive raisers.

Judgment Results: We coded each word pair for shared diphthong height and shared stop voicing (Table 1). Figure 2 plots responses (same/different) across all participants, grouped according to shared features and real vs. nonce words. If participants relied on the reliable cue when judging sameness, we would expect responses to depend on shared vowel alone. While the plot confirms this pattern for real-word pairs, nonce pairs are more complicated. Along with a main effect of real vs. nonce words, the two other main effects in Table 2's model reveal that participants were influenced both by whether a base/derived pair shared a diphthong, as expected, but also by the unreliable cue of whether they shared stop voicing. This is especially true for nonce words, revealed by two- and three-way interactions in the model. In particular, participants seemed to disregard vowel height differences when words share surface stop voicing (e.g., incorrectly judging nonce ***dwit****ing/****dwide*** as sharing a base).

Experimental Interpretation: In the opaque interaction of diphthong raising and flapping, CR listeners are indeed able to use the derived contrast of vowel height to recover the underlying form of the flap in real words; for nonce derived words, however, listeners are swayed by aspect(s) of the phonetic similarity between [d] and flap, even when the vowels mismatch. This suggests that the derived contrast created by opacity *is* a potential method for recovering underlying forms in the mental lexicon, but that this tactic does not easily extend to this recovery task for nonce words bases.

Theoretical Implications: Taken together with other CR literature (e.g.[8]), we argue that these results support phonological theories which capture opacity while adopting a 'middle ground' as to the role of derived contrast. We suggest that they challenge both the view that derived contrasts are actively protected by the grammar (e.g. [6,7]) given the weak influence of vowel height in nonce words, but they also challenge the view that *any* evidence of derived contrast will lead to phonemic restructuring (e.g. [9]), since nonce bases were still recoverable via vowel height in some contexts (i.e. when not misled by shared stop voicing.)

	same V[height] 1	**diff V[height] 0**
same C[voice] 1	r[aɪɾ]ing/r[aɪd]e bl[aɪɾ]ing/bl[aɪd]e	wr[ʌɪɾ]ing/r[aɪd]e dw[ʌɪɾ]ing/d[aɪd]e
diff C[voice] 0	wr[ʌɪɾ]ing/wr[ʌɪt]e d[ʌɪɾ]ing/d[ʌɪt]e	r[aɪɾ]ing/wr[ʌɪt]e v[aɪɾ]ing/v[ʌɪt]e

Table 1. Sample stimuli pairs/coding, real and nonce

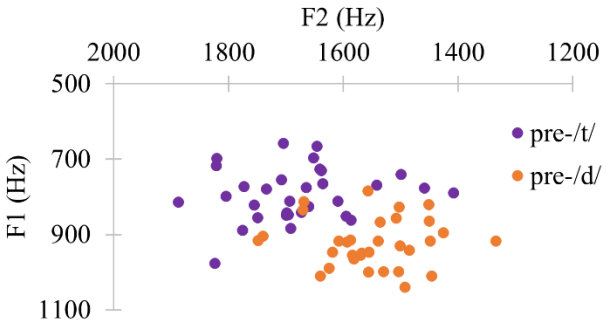

Figure 1. F1/F2 for raised (pre-/t/) and unraised (pre-/d/) V productions

Figure 2. Judgment task responses

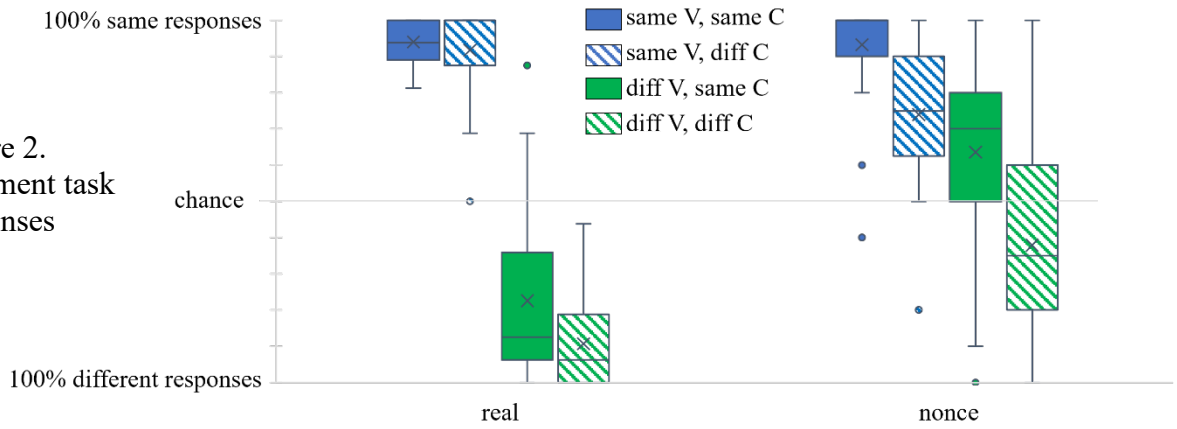

Table 2. Mixed effects logistic regression model & results

response ~ shared_C * shared_V * real/nonce + (1|subject) + (1|item)

	Estimate	Std. Error	z value	p
shared_C	1.184	0.221	5.365	<.001
shared_V	1.720	0.229	7.525	<.001
real/nonce	1.794	0.233	7.687	<.001
shared_C * shared_V	0.477	0.375	1.273	.203
shared_C * real/nonce	0.218	0.310	0.702	.483
shared_V * real/nonce	3.233	0.342	9.449	<.001
shared_C * shared_V * real/nonce	1.093	0.534	2.047	.041

References [1]Joos, M. 1942. A Phonological Dilemma in Canadian English. *Language*, 18(2), 141. | [2]Chambers, J. K. 1973. Canadian raising. *Canadian Journal of Linguistics* 18(2), 113–135. | [3]Davis, S., & Berkson, K. (2021). 1. American Raising. *The Publication of the American Dialect Society*, *106*(1), 1–12 | [4]Idsardi, W.J. 2006. Canadian Raising, Opacity, and Rephonemicization. *Canadian Journal of Linguistics* 51(2-3):119-126 | [5]Kaye, J. 1975. A functional explanation of rule ordering in phonology. In *Papers from the Parasession on Functionalism* (pp. 244–252). Chicago Linguistics Society. | [6]Flemming, E. 2004. Contrast and perceptual distinctiveness. In B. Hayes et al (eds) *Phonetically-based Phonology* CUP: 232-276. | [7]Łubowicz, A. 2003. *Contrast preservation and phonological mapping* [Doctoral thesis] UMass Amherst.| [8]Nazarov, A. 2019. Formalizing the connection between opaque and exceptionful grammars. *Toronto Working Papers in Linguistics* 41(1) | [9]Mielke, J., M. Armstrong and E. Hume. 2008. Looking through opacity. *Theoretical Linguistics* 29(1-2).