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Research Article

Canadian Raising in Chicagoland: The production and perception of a marginal contrast

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ABSTRACT

In some North American English varieties the diphthong /aɪ/ has developed a distinctively higher nucleus before voiceless consonants and also before a flapped /t/. The phenomenon is known as Canadian Raising, as it was first described for Canadian English. We report on variation in the production and perception of this distinction in a group of female and male speakers from the Chicago area. We focus on the context before flapped /t/ and /d/. The production results show that there is a significant difference in the quality of both the nucleus and the offglide between these two contexts, albeit of a smaller magnitude than the difference observed before word-final voiceless and voiced consonants. In addition, we find a small difference in duration between diphthongs in the two preflap contexts. In perception, our subjects were only moderately successful in recognizing words in minimal pairs containing the target diphthong preceding a flap (as in *writer* vs *rider*), although with much higher than chance accuracy. A Quadratic Discriminant Analysis model classified the stimuli with substantially greater accuracy than our subjects. We conclude that in this English variety there is a contrast between a higher diphthong [ʌɪ] and a lower diphthong [aɪ], but this contrast is only marginal. This study contributes to our understanding of marginal contrasts in production and perception. The understanding of these contrasts has both theoretical and practical relevance.

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1. Introduction

A common assumption in linguistic theory is that all words in a language can be uniquely analyzed in terms of a well-defined set of meaningless phonological units that constitutes the phonemic inventory of that language. This principle is embedded in Hockett's (1958, 1960) notion of duality of patterning and is still widely held (for discussion, see Ladd, 2014: 107–137).

Determining the set of contrasting phonological units of a language is crucial for linguistic analysis and for linguistic typology (e.g. when documenting the sound systems in the World Atlas of Language Structures project, Dryer & Haspelmath, 2013). It is also essential for many practical purposes, ranging from the development of writing systems for previously unwritten languages, to speech technology and to second language teaching and the study of second language acquisition (Ladd, 2006, 2014: 54; Scobbie & Stuart-Smith, 2008). A necessary assumption for these endeavors is that in any language phonemic analysis should be straightforward. That is, two phonologists, working within the same theoretical framework, are expected to agree on the phonemic inventory of any given language. Nevertheless, instances of marginal or quasi-phonemic contrasts, where such agreement is lacking as to whether two sounds are different phonemes or instead allophonic variants of a single phoneme have also been widely reported in recent years (Ladd, 2006, 2014: 117–118; Hall, 2005, see also Nadeu & Renwick, 2016; Renwick & Ladd, 2016). In fact, the claim has been made that many or even all languages may turn out to have such instances of uncertain phonemicization if investigated in sufficient detail (Scobbie & Stuart-Smith, 2008; Hualde, 2005; Hall, 2013; Ladd, 2014: 124). A better knowledge of such situations is thus of considerable interest for our understanding of phonological systems. Understanding the nature of marginal phonemic contrasts is also important for theories of speech perception, as it has been argued that "[s]uccessful speech recognition [...] entails discriminating the phonemic contrasts that distinguish a word

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from the other words that resemble it" (McQueen & Cutler, 2010: 489). The possibility of having situations that are intermediate between allophony and full phonemic contrasts is also relevant for models of first or second language acquisition that rely on the identification by the learner of the contrastive phonological units of the language.

A good example of a marginal phonological opposition of this type is the [aɪ] vs [ʌi] contrast in some varieties of North American English. This is the phenomenon with which we are concerned in this paper. This phenomenon is known as Canadian Raising, as it was first described for Canadian English (Joos, 1942; Chambers, 1973). It is also found in some northern US varieties (Chambers, 1989, 2006; Idsardi, 2006; Hall, 2005; Moreton & Thomas, 2007; Fruehwald, 2008) and has recently been reported for Philadelphia, in what appears to be an independent development (Fruehwald, 2016). As described in the literature, in all these varieties, the diphthong /aɪ/ has developed an allophone with a higher nucleus (and a more peripheral offglide) before voiceless consonants, as shown in (1).

(1) Basic (idealized) distribution of diphthongs in Canadian Raising varieties

[aɪ] before voiced consonants and word-finally: *ride, side, tribe, oblige, buy*
[ʌi] before voiceless consonants: *write, sight, pipe, life, like*

The Canadian Raising phenomenon has called the attention of phonologists for a long time—at least since Joos (1942)—especially because the complementary distribution shown in (1) is rendered opaque by the neutralization of /t/ and /d/ as a flap [ɾ] before an unstresssed vowel (Herd, Jongman, & Sereno, 2010). This creates minimal pairs, such as *writer* [ɹʌiɾɚ] vs *rider* [ɹaiɾɚ], which are differentiated by the quality of the nucleus. The contrast between [aɪ] and [ʌi] has thus been phonologized to some extent in these varieties. As such differences in diphthong quality are found in the context of flapping, where the contrast between /t/ and /d/ is neutralized, this is a case of transphonologization (Kirby, 2014, see also Hyman, 1976; Janda, 2003 on phonologization), where a formerly existing contrast between [t] and [d] in this context is now cued by the quality of the preceding diphthong.

In Canadian Raising varieties, [aɪ] and [ʌi] may be defined as "just barely constrasting sounds," in Goldsmith's (1995):11 classification, in which this label is used in situations where "x and y are phonetically similar and in complementary distribution over a wide range of the language, but there is a phonological context where the two sounds are distinct and may express a contrast." The context of potential contrast is before a flap [ɾ].

Regarding its historical origin, Canadian Raising is an instance of (incomplete) phonemic split, where a phonemic unit has developed distinct allophones, which eventually come to contrast in the same phonetic environment. It is thus the opposite process from a near-merger between historically different phonemes (Labov, 1994).

In at least some varieties, the diphthong /aʊ/ has had a parallel development, so that, for instance, *about* has a higher stressed nucleus than *loud,* and *pouter* may contrast with *powder* even under flapping (Chambers, 1973; Mendoza-Denton, Hendricks, & Kennedy, 2001). Interestingly, whereas the raising of the nucleus of /aʊ/ has become a stereotype of Canadian English speech for speakers of US English, there appears to be much less social awareness in the US regarding the raising of /aɪ/ (Chambers, 1989; Dailey-O'Cain, 1997; Niedzielski, 1999).

A similar, but not identical, situation, with a different distribution of variants, also obtains in Scottish English and some other British varieties (Gregg, 1973; Milroy, 1996; Scobbie, Turk, & Hewlett, 1999; Scobbie & Stuart-Smith, 2008; Ladd, 2006, 2014). In Scottish English, vowels and diphthongs are longer in open syllables than in closed syllables. In the case of the diphthong /aɪ/, this difference in duration is accompanied by a difference in vowel quality, with a higher diphthong in *side*, *tide* than in *sigh*, *tie*. In this variety, a contrast in the same phonological context arises because consonant-final words where the final consonant is an inflectional suffix, such as *sighed*, *tied,* have the lower diphthong usually found only in open syllables. There are thus minimal pairs like, e.g., *side* [sʌɪd] vs *sighed* [sɑɪd]. In these minimal pairs in Scottish English, the quality of the diphthong can be predicted from a difference in morphological structure, e.g. *side* /saɪd/ [sʌɪd] vs. *sighed* /saɪ+d/ [sɑɪd].

In Canadian Raising varieties, on the other hand, the conditioning factor for the raising of the diphthong is not a closed syllable but the (underlying) voicelessness of the following segment. It should be noted that whereas the difference in the diphthong of *write* [ɹʌit] vs *ride* [ɹaɪd] is predictable from the difference in the voicing of the following consonant, there is no difference either in phonetic context or in syllabic or morphological structure between contrasting items like *writer* [ɹʌiɾɚ] and *rider* [ɹaiɾɚ]. To account for differences in vowel quality in such pairs appeal would need to be made either to an underlying contrast between /t/ and /d/ in the phonemic representation of these words or to paradigm effects (i.e., the pronunciation of the diphthong in *writer* vs *rider* is influenced by that of *write* vs *ride*). For recent phonological analyses of the interaction between flapping and Canadian Raising, see Mielke, Armstrong, & Hume, 2003; Bermúdez-Otero, 2004; Idsardi, 2006; Pater, 2014.

In this paper, we focus on the [aɪ] vs [ʌi] contrast in the English spoken in the Chicago area of Illinois (Chicagoland), including both production and perception experiments. Kilbury (1983), who offers a description of his own Chicago idiolect, provides minimal and near-minimal pairs, based on introspection, even outside of the flapping context. However, preliminary observation shows that speakers from this area, in fact, differ in their intuitions regarding whether pairs of words like *writer* and *rider* are pronounced differently. This uncertainty and lack of agreement among speakers regarding the contrastive nature of these two diphthongs is what motivates our experimental work.

A similar situation involving some awareness of the existence of two distinct diphthongs together with inconsistency in intuitions has been reported for other northern US varieties. Vance (1987), who compares the intuitions of three speakers from Minnesota and Rochester, New York, reports many examples of unpredictable distribution, as well as considerable lack of agreement among his three speakers. See also Milroy (1996) for a speaker from Saginaw, Michigan.

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