Sociophonetic variability of post-vocalic /t/ in Aboriginal and mainstream Australian English

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Abstract
This paper analyses post-vocalic /t/ variability in controlled speech across two groups, both L1 Aboriginal English and mainstream Australian English speakers. Data were collected in Warrnambool, a small community in western Victoria (Australia). While both Aboriginal English and mainstream Australian English speakers used canonical aspirated [tʰ] a range of other variants were observed. The Aboriginal English group used a greater number of variants overall, and tended toward “glottal” variants (full glottal stops, pre-glottalised stops, and ejective-like stops) whereas the mainstream Australian group preferred so-called “breathy” variants (affricates, fricatives); we attribute this to sociophonetic variability, potentially linked with voice quality and glottal timing. Overall, the study highlights some previously undocumented variation both within L1 Aboriginal English, and between L1 Aboriginal English and mainstream Australian English.

Index Terms: plosives, variation, Aboriginal English, mainstream Australian English, sociophonetics

1. Introduction

1.1. Background – /t/ variability in mainstream Australian English

While earlier work on the sociophonetics of Australian English mostly investigated vowel variation, in recent years variation in consonant production has increasingly become a focus of research. For voiceless plosives, and /t/ in particular, phonetic context, speaking style, regional location, sex, accent variety and socioeconomic status have all been noted as playing a part in the patterns of variation exhibited [1,2,3,4].

1.2. L1 Aboriginal English

Aboriginal English is an under-studied variety spoken in Australia. The variety developed in Aboriginal communities, separate from the standard/mainstream [5], and the name Aboriginal English is often used as an umbrella term to apply to multiple varieties depending on the location and language experience(s) of the speakers [5,6]. In this study, we use the singular Aboriginal English because we are discussing one specific community of first language (L1) speakers (see 2.1). Compared with mainstream Australian English, the “standard” variety in Australia, Aboriginal English is characterised by a somewhat different sound system, as well as differences in every other aspect of language such as grammar, semantics, lexicon and pragmatics [6]. Aboriginal English ranges on a continuum from sounding very similar to standard Australian English (‘light’ Aboriginal English) to diverging markedly (‘heavy’), and speakers themselves can vary depending on the situation and audience [5,6]. Speakers can also be first (L1) or second language (L2) speakers.

1.2.1. Aboriginal English stop consonant production

There is not a great deal of phonetic research into characteristics of Aboriginal English, but there are some detailed summaries of its features. For example [5] provides an overview of Australian Aboriginal English phonology, and while much of what the author describes for stop consonants appears restricted to L2 varieties (i.e. lack of voicing distinctions in non-initial positions, retroflex variants and dental realizations of /t/ in some communities), the statement about the “phonemic boundaries [being] more porous” [5:134] certainly appears to apply, at least impressionistically, to the L1 Aboriginal English analysed in the current study. An overview of Aboriginal English stops is also given in [6] noting similarly that there is variability, but adding more phonetic detail to this picture. In [6] there is a discussion about the fact that Aboriginal English stops may indeed have a voicing contrast initially, but that the contrast may be deployed differently from mainstream Australian English – with the L2 Aboriginal English initial stops tending to be unaspirated. For L2 varieties, wide variability in general, and hypercorrection, are also said to be evident in stop production, and intra-speaker variability is also said to be large [6].

The only study we are aware of which specifically addresses phonetic stop consonant production in Aboriginal English is a recent paper [7] focusing on /p t k b d g/ variability between L1 Aboriginal English spoken in Northern Australia and mainstream Australian English spoken in Sydney. In particular, the authors analysed the stop voicing contrast, using Voice Onset Time (VOT), VTT (Voice Termination Time) and duration. They showed that the stop voicing contrast exists for these Aboriginal English speakers, and that there are no significant differences for VOT across the varieties. However, they also found VTT variability in the “voiceless” stop category for the L1 Aboriginal English speakers, whereby many voiceless tokens had some periods of “passive phonetic voicing” [7: 15-16]; this was not observed at all for the mainstream Australian English group. Confirming the prediction in [6], the authors conclude that while both groups use a voicing distinction, they use different strategies. In [7] the extent of variability across L1 and L2 Aboriginal English stops is quantified, and is shown to be statistically much greater than that seen in the mainstream variety.
1.3. Aims

Given that Aboriginal English has developed alongside the mainstream variety but separate from it [5], and that stop production is known to be a domain of extensive (socio)phonetic variability [8], comparing (post-vocalic) /t/ production across Aboriginal and mainstream Australian English from the same small community should highlight any local variability in production behaviour. The aim of the present study is therefore to determine the extent of sociophonetic variability in Aboriginal English and mainstream Australian English spoken in Warrnambool. We predict there will be differences in how speakers across the two groups produce post-vocalic /t/, and we also expect some gendered patterning within speakers from the same groups, given the variation observed in other studies. Aside from being a comparative study, this research will provide a first phonetic description of the extent of fine-grained phonetic variability that occurs in an L1 Aboriginal English variety.

2. Method and Analysis

2.1. Participants and experimental task

This study compares two groups of adult L1 English speakers from Warrnambool, a regional coastal city located in the south west of Victoria. It has a population of approximately 35,000 people, and is located 257 km from Melbourne, approximately three hours away by road.

The participants are 10 Aboriginal English speakers (5 M, 5 F) and 15 mainstream Australian English speakers (8 M, 7 F), recorded in 2015 and 2012 respectively by the first author. The participants were all adults, with wide variability in age. The Aboriginal English group were aged between 19 and 65 years, and the mainstream group was aged between 26 and 72 years. The participants took part in a number of activities (questionnaire, perception test, interview, reading a word list). The data used in the current study are post-vocalic /t/ extracted primarily from word-final contexts in /hVtV/ words and some intervocalic tokens from /hVtV/. The sample contains 864 tokens overall (466 for Aboriginal English speakers, 398 for the mainstream Australian English group). The majority of tokens were word final /t/, but 12% of the mainstream Australian English sample consisted intervocalic tokens along with 14% of the mainstream Australian English sample. We consider this a preliminary analysis in the sense that we also have spontaneous speech we wish to analyse, and the Aboriginal English sample is a subset from a larger group.

2.2. Analysis

2.2.1. Phonetic analysis

Speech data were manually-labelled by the first author using Praat [10] after autosegmentation of the phonemes using MAUS. The overall quality of each /t/ (and release where present) was visually categorised and identified from spectrograms and annotated on a “phonetic” tier. A tier “t-category” included classification decisions (canonical, fricative, glottal, etc. – see below for a full description). The release phase was labelled H in most cases, but also occasionally S which better suited any spirantised or affricate variants. As mentioned, some of this analysis has been presented in [9]. For the mainstream Australian English speaking community, the categories canonical, affricate, fricative, intermediate and tap accounted for all of the realisations of post-vocalic /t/ in the data set. Some additional categories were necessary when labelling the Aboriginal English data set, namely glottal, ejective, voiced, approximant. The following list gives the category names and explanations about the decisions made during the labelling process. This also gives a sense of the acoustic structure of /t/ in the data.

Canonical [ʰt]: period of full closure followed by burst. No voicing apparent [8,11].
Affricate [tʰ]: a closure followed by /s/-like release (not aspirated), no burst like characteristics [e.g. 3].
Fricative [t]: a fully fricanted variant, not the same as [s], better described as a “lowered t̆” [3].
Intermediate: this category is best described as [tʰ], it has the auditory percept of a fricated stop, but there are burst characteristics evident acoustically [3].
Tap [t̆]: a durationally very short, only observed intervocically [e.g.12].
Approximant [ɾ]: technically a tap which did not have full closure, also observed intervocically [e.g.12].
Glottal-unreleased (same as pre-glottalised) [ʔt]: these stops have glottal activity and unreleased supralaryngeal closure [4].
Glottal [ʔ]: these are full glottal stops; for these sounds there was no apparent supralaryngeal closure characteristics. These stops can be either plosive-like or creaky in appearance [11], we observed both in our data. [13] note that glottal stops are a possible allophone in mainstream Australian English (phrasefinally), but they must be rare, as they are not observed in our mainstream Australian English sample, nor mentioned in other recent studies focusing on Australian English /t/ [1,2,3,4,9].
Ejective [t̆]: Acoustically, ejectives tend to pattern in two ways: 1) with a period of closure followed by release of the supralaryngeal gesture, a period of “silence”, and a second release which coincides with glottal opening, or 2) cases without the silence, where glottal opening occurs immediately after oral release [13]. In our data there were often sharp “spikes” on the waveform, similar to examples in [14] where this is correlated with burst intensity. In English ejectives may also be considered “emphatic” stops [14].
Voiced [d]: these tokens were partially voiced, similar to what [7] describe for their Aboriginal English groups, with passive phonetic voicing in what is a phonologically voiceless category. To our knowledge these have not been observed in mainstream Australian English [e.g. no mention in 4,12].

2.2.2. Statistical analysis

Statistical analysis was carried out by the third author using SPSS Statistics 24 on the counts across the Aboriginal and mainstream Australian English samples, and within the Aboriginal sample (analysis within the mainstream sample was carried out in [9]).

3. Results

3.1. Group comparison: distribution of Aboriginal and mainstream Australian English post-vocalic /t/ variants

Figure 1 shows the per-group percentages of the phonetic variants observed in the data comparing the two varieties.
Despite some shared usage of features (i.e. both groups use significantly (at the .05 level, adjusted) for each variant. z-tests of proportions, and Bonferroni corrected p-values for between the two groups for each of the variants, we used of frequencies across varieties were significantly different, significant. Overall, the test showed that the two distributions We performed a chi-square test of association to assess only observed intervocally (but not the sole variant here). Aboriginal English group, we fit a multinomial regression, constraining factor), $\chi^2(9) = 105.663, p < 0.001$. This analysis shows that women are more likely to produce affricates with the men using other variants as described.

3.1.2. Mainstream Australian English: female / male

In previous work [9], we saw no statistically significant gendered patterns in the variants of post-vocalic /t/ used, unlike what we have described for the Aboriginal English group. Instead we saw an overall preference for what we call “breathy” tokens (i.e. Figure 1), especially affricates and fricatives. In [9], we looked in closer detail at the affricate category given its prevalence, and found sociophonetic conditioning within it, especially “hyper-lengthening” of the release phase which was used significantly more by young speakers and female speakers.

4. Discussion and Conclusion

This study compared variability in post-vocalic /t/ in Aboriginal and mainstream Australian English spoken in a small western Victorian community. Clear sociophonetic patterning of variation across the speaker groups was observed, as well as some variability within groups. L1 Aboriginal English speakers use a wider array of post-vocalic /t/ variants than the mainstream Australian English group. The Aboriginal English speakers also used more variants which we can describe as having an overall “glottal” quality (i.e. [ˀt̊] [ʔ]), while the mainstream Australian English speakers, as previously noted, preferred “breathy” variants – e.g. [t̊] [t]. While Aboriginal English speakers used canonical stops frequently, and affricates to some degree, impressionistically it appears that the quality of these is different across the groups. As already noted, the mainstream Australian English speakers hyper-lengthen affricate releases [9], and impressionistically the burst in canonical stops also seems longer overall; this needs independent verification in future work.

That the mainstream Australian English-speaking group use few “glottal” tokens differs from recent phonetic work on Australian English [4], and could be attributable to an urban/regional difference which would be interesting to explore further. The study also showed variability within the Aboriginal English sample between males and females (and within the mainstream group with respect to affricate characteristics, as discussed in 3.1.2). Despite varietal differences, where we can say that the Aboriginal English group use fewer “breathy” stops, male Aboriginal English speakers nevertheless used significantly more “glottal” tokens than the female speakers amongst the group; this was not observed in the mainstream Australian English group. The presence of both glottal stops and ejectives is an interesting addition to our knowledge of variability in Englishes in Australia. Where ejectives are concerned, their presence supports the assertion that such variants could occur in Englishes because of “different temporal alignment of the glottal and articulatory components of [pre-]glottalised plosives” [14: 201]; we think a similar interpretation may be true for the full glottal stops as well albeit with supralaryngeal stricture being lost. The findings relating to the presence of ejectives in the data support work predicting a connection between voice quality and consonant type [15,16,17]. While researchers find a connection, however,
they do not claim a one-to-one relationship. Work on Scottish English also shows a strong influence of social and stylistic factors with respect to the use of “glottal” variants (especially ejectives) [17,18]. Our study did not look specifically at age-related variability, but that will likely be another cause for difference within the sample; i.e. it was present for the mainstream sample in [9], and was observed in [4], as well as [18] for Scottish English ejective stops.

Given the /t/ categories used by the Aboriginal English speaking group have a) been previously documented in other Englishes, and b) are not in most cases at all similar to Indigenous Australian languages, results do not suggest a substrate transfer (nor had we predicted that they would).

Instead, we interpret the findings as evidence of different production strategies being used across the Aboriginal and mainstream Australian English groups, with clear sociophonetic distribution. While there is overlap in the types of stops used by the two groups, the proportions are vastly different - again, similar to findings for Aboriginal English in [7], and similar to [18] for Scottish English social groups.

One of our main findings is that the distribution of “glottal” vs. “breathy” tokens across the two speaker groups is sociophonetically stratified, and we suggest there is a potential link to voice quality differences. The idea that the realisation of consonants can be linked to voice quality is not unique, although it is certainly under-explored (especially in Englishes in Australia). [15:85] citing [16], explain that “segmental contrasts can provide a testbed for developing the study of voice quality”; and [16] proposes a glottal constriction continuum model, which is useful for interpreting our results.

We suggest that the mainstream Australian English speakers analysed in this study are on average using a more open glottis, contributing to what we term “breather” stop variants, and that the Aboriginal English group are likely using a more closed glottis, leading to a greater frequency of glottal or glottalized variants. This idea also supports the opinion that Aboriginal English has a different voice quality to the mainstream variety [6], and is an interesting finding with respect to the overall sociophonetic patterning of post-vocalic /t/ in two varieties of the same language. In this paper we have been deliberately broad in our use of the terms “glottal” and “breathy” and in future work we will acoustically analyse voice quality (H1-H2, H1-A1, spectral tilt) [i.e. 15,16,17], so that we may better understand the distributions observed, as well as confirm possible correlations between type of supralaryngeal articulation and glottal setting.

Although our study has used different analysis techniques, we can align our findings with previous work on Aboriginal English [5,6,7] which shows a maintenance of phonological contrasts used by the mainstream Australian English speaking community, but a difference in phonetic strategies used to implement the contrasts. We have also found that even in L1 Aboriginal English, the phonemic boundary for /t/ is more “porous” [5:134] than in the mainstream variety. The variability that is reported so far in this study and others [5,6,7] indicates that L1 and L2 Aboriginal English speakers rely less on the standard as a target, are exposed to greater variability in input, and in turn use greater variability in production. While this study focused largely on distributions of /t/ variants, the auditory impression of the stops used by Aboriginal and mainstream Australian English speakers is on balance markedly different. Ejectives are quite emphatic (to varying degrees), full glottal stops, and voiced stops sound relatively marked in an Australian English variety, and fricative variants add a marked breathy quality. As such, we can say that realisation of /t/ is a contributor to a difference in the overall auditory impression of L1 Aboriginal English and mainstream Australian English spoken in Warrnambool.

In summary, this study highlights previously undocumented variation across L1 Aboriginal English and mainstream Australian English. Results suggest clear sociophonetic patterning of /t/ across the two varieties, for females and males within the Aboriginal English group, and for mainstream Australian English females and males with respect to affricate length. We suspect that these patterns may be partly attributable to voice quality and glottal timing differences, which are also potentially sociophonetically determined. Future work will also more closely analyse prosodic position, as well as age-related patterning within the Aboriginal English group.

5. References

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