A SOCIOPHONETIC INVESTIGATION OF THE 'SCOTTISH' CONSONANTS (/x/ AND /ʍ/) IN THE SPEECH OF GLASWEGIAN CHILDREN

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ABSTRACT

Glaswegian, like other forms of Scottish English, is generally regarded as having two extra consonant sounds, /x/ in e.g. *loch* vs *lock*, and /ʍ/ in e.g. *whine* vs *wine*. It has been recently observed that /x/ and /ʍ/ tend to be replaced by /k/ and /w/, particularly by younger speakers. This paper considers the evidence for the loss of /x/ and /ʍ/ in the speech of 16 Glaswegian children, using auditory and acoustic analysis. In particular, we investigate the extent to which the Scottish consonants are simply being replaced by variants of /k/ and /ʍ/. Auditory analysis, confirmed by acoustic analysis, of the sounds in read wordlists and conversations suggests that Glaswegian children may indeed be losing the Scottish consonants. However our analysis also shows that the process of change seems more complex than previous accounts suggest, which may have implications for understanding the mechanism of sound change in general.

1. INTRODUCTION

Scottish English phonology differs systemically from that of most varieties of 'English' English in that it has retained two consonantal phonemes which are not present in 'English' English speech, /x/ and /ʍ/. Recent discussion of Glaswegian (e.g. [1]), which is also assumed to show these sounds, suggests a tendency to replace these sounds with /k/ and /w/, particularly by younger speakers. This paper presents a sociophonetic investigation of these hitherto anecdotal observations, from the auditory and acoustic analysis of speech of 16 Glaswegian schoolchildren. The results suggest that a process of loss may indeed be underway, although differently according to social class. However they also suggest that the process of loss (or change) is more complex than a simple replacement of one variant with another. We tentatively suggest that these results may have implications for the modelling of variation and change in general.

2. SOCIOPHONETICS

Quantitative sociolinguistics has always been interested in the relationship of phonetic/phonological variation and social factors (e.g. [2]). The phonetic analysis of sounds in read and spontaneous speech has formed the basis of much important research into synchronic sociolinguistic variation, and into the observation of ongoing variation and change. Increasingly, the term 'sociophonetics' is being used to refer to phonetic analysis carried out within quantitative sociolinguistics.

While much sociophonetic research rests on auditory analyses, techniques from acoustic analysis have also been used for some time, e.g. [3]. However, most of this work is on vowel sounds. Foulkes and Docherty [4] point out that the acoustic analysis of consonants within sociophonetics has been largely neglected. One reason for this would seem to be that the usual method of auditory transcription of variants, usually by a trained phonetician, is regarded as reliable. Different variant pronunciations of consonants are thought to be easy to identify and clearly audible.

However the results of acoustic analysis of /t/ in Newcastle and Derby speech (e.g. [4]), has yielded interesting results: what seems auditorily invariant can be acoustically variable; and fine acoustic variation correlates strongly with social factors.

3. THE 'SCOTTISH' CONSONANTS

The two consonants referred to here as the 'Scottish' consonants, are identified as the voiceless velar fricative, /x/, and the voiceless labial-velar fricative, represented here as /ʍ/ (e.g. [5]). /x/ is found in e.g. *loch* vs *lock* [x]; /ʍ/ in e.g. *whine* vs *wine*. Both sounds existed in earlier forms of English English, but were lost from most varieties by the end of the Early Modern period.

As in other forms of Scottish English, these two consonants are generally found in Glaswegian. However, Macafee [6,1] notes a tendency for both sounds to be replaced by /k/ and /w/ respectively. This is particularly the case for /ʍ/ in younger speakers.

4. RESEARCH QUESTIONS

The loss of the 'Scottish' consonants in the speech of young Glaswegians to date is based largely on anecdotal observation. Here we use the analysis of speech data from 16 Glaswegian children to consider two main research questions:

1. Are younger Glaswegian speakers losing the 'Scottish' consonants, that is replacing /x/ and /ʍ/ with /k/ and /w/?
2. Does acoustic analysis allow more insight into the process of change or loss? In particular, is the process one of simple replacement, or is it more complex?

5. METHODOLOGY

5.1. Data collection

The data discussed here form part of a larger socially-stratified dataset collected in the spring and summer of 1997 for the Glasgow Speech Project [7, 8]. The speech of 16 children (8 girls, 8 boys; aged 13-14) was digitally recorded onto DAT using wide frequency response clip-on microphones, from same-sex casual conversations of up to 40 minutes and read wordlists. In order to investigate the role of social class in the realization of /x/ and /ʍ/, the children were drawn from two schools each in a different area of the Glaswegian conurbation, one in a middle class suburb just outside the city limits, and one in a working class inner city area.

Note that within the variationist paradigm it is not possible to establish evidence for change with data from only one age group. Thus our discussion of loss or change of the 'Scottish' consonants here is inferred from the assumption that Glaswegian adults still maintain /x/ and /ʍ/. (A full apparent time study is currently in progress.)

5.2. Data analysis

The speech was first analysed auditorily. Instances of /x/ and /ʍ/ were identified in orthographic transcripts of the conversations, and phonetic variants identified and transcribed. This methodology is typical of traditional sociophonetic analysis, although note that we transcribed all instances of each sound in each conversation. The wordlists were digitized into the *xwaves* speech processing environment running on a Linux platform. Auditory transcriptions were made of the sounds in the relevant words from the digitized waveforms. The acoustic analysis was primarily qualitative, and concentrated on tokens from the wordlists.

6. AUDITORY ANALYSIS

6.1. /x/

6.1.1. /x/ in wordlists. The high quality digitized recordings enabled narrow auditory transcription. /x/ was realized phonetically in a number of ways, which we grouped into three categories: (1) voiceless fricatives, mainly velar, but also more retracted articulations, which we represent together with [x]; (2) voiceless velar plosives, represented with [k]; and (3) a third, 'inbetween' group of sounds which are auditorily similar to a fricative and a stop together, and which we found difficult to transcribe, but represent together as [kx]. /x/ was equally likely to be realized with [x] variants as with [k] or [kx] variants across both social classes (Figure 1).
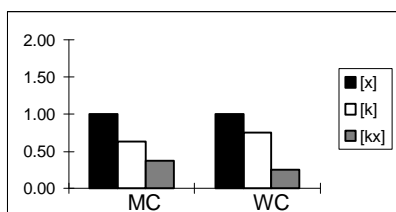

Figure 1. Realization of /x/ according to social class (average proportion of words –*loch, Docherty*- with variant as shown).

6.1.2. /x/ in conversations. /x/ is a very low frequency phoneme in Glaswegian, and was thus very rare in spontaneous speech. Only 18 instances occurred overall. Nevertheless, these few tokens suggest a difference in pronunciation according to class. The middle class children had 5 tokens of /x/, 3 of which were [x] (all in names: *Murdoch, McGeoch, McEchny*). The working class children had 13 tokens, of which 12 were [k] (in the names *Ruchill, McCulloch*, and in the interjection *och*).

6.2. /ʍ/

6.2.1. /ʍ/ in wordlists. As for /x/, the narrow transcription of /ʍ/ resulted in the identification of three main groups of variants: (1) variants which sounded typical of voiceless labial-velar fricatives, here represented as [ʍ]; (2) voiced labial-velar approximants,

represented with [w]; (3) and again, a third group of variants, which sounded neither like [ʍ] nor like [w], and which are represented loosely as a breathy [w̤]. /ʍ/ showed clear social differences in realization, with the middle class children using [ʍ] far more than the working class children, who tended to use [w] or [♦] (Figure 2).
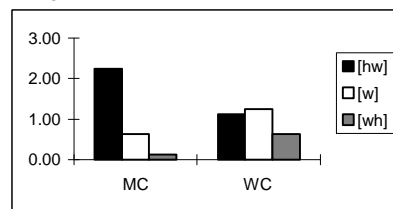

Figure 2. Realization of /ʍ/ according to social class (average proportion of words – *where, whether, whine* – as variant shown).

6.2.2. /ʍ/ in conversations. The social stratification in the wordlists was similarly apparent in the realization of /ʍ/ in spontaneous speech. Middle class children use the standard variant [ʍ] more often than working class children, who in turn tend to use [w] more (Figure 3; both differences were statistically significant in the Mann-Whitney U-Test to $p < 0.05$.)
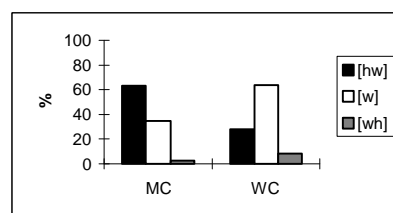

Figure 3. Realization of /ʍ/ according to social class (average percentage of tokens from conversation).

6.3. Auditory analysis: summary

The results from the auditory analysis suggest that /x/ and /ʍ/ may be changing in the speech of these children, with working class children appearing to lead the way. The process does not, however, appear to be a simple replacement of e.g. [x] with [k], given the identification in both cases of 'inbetween' variants, which are difficult to classify and transcribe auditorily.

7. ACOUSTIC ANALYSIS

7.1. /x/

The acoustic analysis of both /x/ and /ʍ/ was motivated by the auditory analysis: we wished to confirm the variants identified during the auditory analysis, and in particular, to investigate the acoustic nature of the 'inbetween' variants which had been found for each sound.

7.1.1. [x] variants. Many of the fricative variants were acoustically typical of voiceless velar fricatives (e.g. [9]), showing a continuous period of friction with a relatively low frequency peak of energy (Figure 4). There was also evidence for more retracted fricatives, as had been noted during the auditory transcription.

7.1.2. [k] variants. Most plosive variants were acoustically similar to voiceless velar plosives found for /k/ in e.g. *lock* (Figure 5), with silent portion, burst, and a degree of affrication on release.
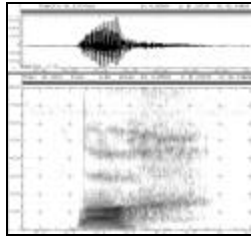

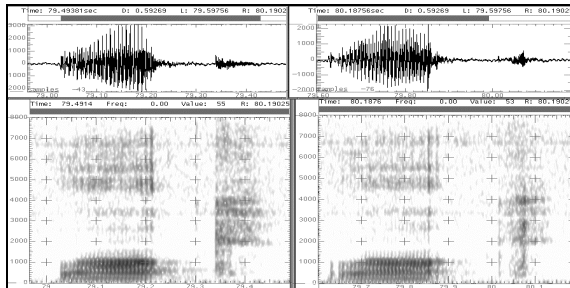Figure 4. Typical instance of [x] in *loch*.

Figure 5. *loch* (left) and *lock* (right) from the same speaker, both showing [k].

7.1.3. [kx] variants. We were surprised to find that variants which we had grouped together under [kx], that is, as sounds which were difficult to classify auditorily as either fricative or stop, also acoustically showed features of both. Figure 6 shows an instance of [kx] in *loch*, where the offset of the vowel is followed by a period of friction, there is a virtually silent portion, and then another period of friction. The auditory effect is of a heavily fricated stop, although there is no burst. The stop percept may be provoked by the 'silent' portion, which presumably reflects an extreme narrowing of the articulators and subsequent blockage of airflow.
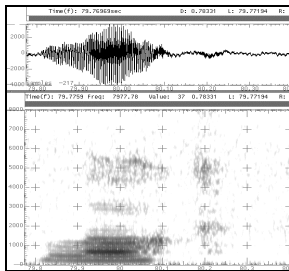

Figure 6. [kx] variant for *loch*.

7.2. /ʍ/

7.2.1. [ʍ] variants. The acoustic analysis of variants transcribed [ʍ] was made slightly more complex by the paucity of previous descriptions, though see [10] for [ʍ] in American English. In general, we expected from [10] (and also [5, 11]), that these variants would be acoustically characterized by showing a period of voiceless friction (Figure 7a).

We were therefore surprised to find variants which sounded voiceless but which showed no voiceless friction phase (Figure 7b). There is no acoustic characteristic obvious from visual inspection of spectrograms or spectra which could account for the perception of voicelessness, although we noted that several spectrograms showed an abrupt start to the first and second formants, a feature also found immediately after the voiceless period of usual [ʍ].

This acoustic variation correlates with social class. Of the 17 variants transcribed [ʍ] for the middle class children, 11 showed a period of voiceless friction (average duration 70.6ms). For the working class children only 3 of the 8 variants heard as voiceless actually showed friction, and the duration of this phase was much shorter (average 48ms).
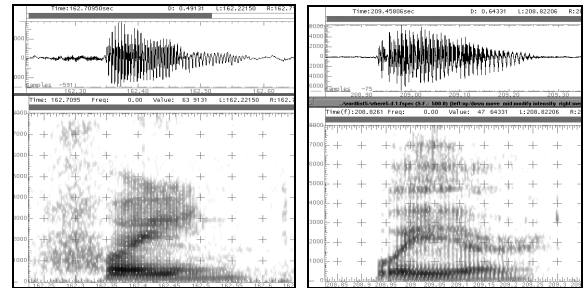

Figure 7a. [ʍ] with friction (*whine*); b. and without (*where*).

7.2.2. [w] variants. Variants transcribed as [w] were generally similar to [w] as in *wine* (Figure 8), showing a low first formant (F1) with a low, weaker, second formant (F2); e.g. [12]. We observed a trend for the duration of low F1/F2 before the start of higher formants to be longer in middle class children (average duration 77ms) than in working class children (average duration 51ms).
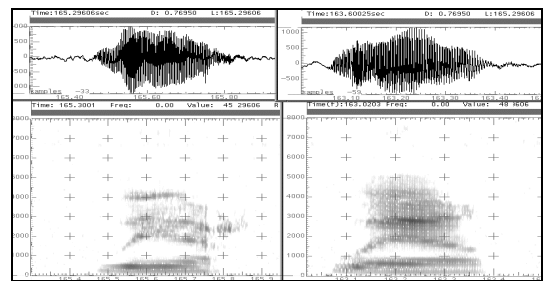

Figure 8. *where* and *wear* with [w] from the same speaker.

7.2.3. [w̥] variants. The third group of variants appeared to be acoustically variable. At present we find it difficult to identify an obvious acoustic characteristic which could account for the auditory effect of being neither like [w] nor like [ʍ] (Figure 9).

We hypothesized that a possible acoustic characteristic could lie in the duration of the transitions of the first and second formants before the higher formants begin. Typically [w] is characterized by a period where F1 and F2 are low frequency before they begin to move towards the formants of the following vowel. [ʍ] variants (with/without friction), on the other hand,

tend to show an abrupt start to F1/F2 quickly followed by the higher formants. We wondered whether the inbetween auditory nature of [w̞] variants was due to an intermediate duration of the low F1/F2 period.

[w̞] variants did show a relatively shorter duration of F1/F2 in comparison to [w] for both social classes. However, this duration was not particularly shorter than those [ʍ] variants which did not show voiceless friction.
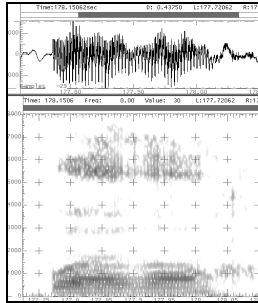

Figure 9. [w̞] variant for *whether*.

It seems likely that variants transcribed as [w̞] and those heard as [ʍ], which show no friction, probably do lie on an acoustic continuum, but not one which we have yet identified. It is possible that the distribution of spectral energy may be important; this is presently under investigation.

7.3. Acoustic analysis: summary

The acoustic analysis largely confirmed our auditory findings. In general non-standard variants of /x/ and /ʍ/, [k w], were acoustically typical of variants of /k/ and /w/, which overall showed little variation. The standard variants of /x/, [x], were as expected. Those of /ʍ/ were less so, in particular, the acoustic variants with no period of voiceless friction. Interestingly, our auditory transcription of 'inbetween' variants did seem to be justified acoustically. [kx] variants, which we heard as possessing both fricative and stop features, showed acoustically characteristics of [x] and [k] together. [w̞] variants, which sounded like neither [ʍ] nor [w] variants, were also somewhat different from either acoustically. The acoustic analysis also revealed the existence of socially-correlating variation which we were unable to perceive auditorily, at least for /ʍ/.

8. CONCLUSIONS

This study has investigated the evidence for the loss of the 'Scottish' consonants in the speech in 16 Glaswegian children from two social classes. The high quality recordings enabled both acoustic and auditory analysis. We conclude as follows.

The auditory analysis would seem to suggest a process of change, possibly loss, of both of the 'Scottish' consonants, in the speech of these children. This is not necessarily one of simple replacement by /k/ and /w/, as previous reports have suggested.

Working class children in general tend to use the non-standard ([k w]) variants or 'inbetween' variants ([kx, w̞]) more than middle class children. Thus they may be leading the process of change.

Acoustic analysis confirms the auditory identification of 'inbetween' variants, and thus that the process of change/loss is phonetically complex.

Acoustic analysis also reveals the presence of systematic, socially-correlated acoustic variation, which is difficult to detect auditorily.

We feel our results may have implications for understanding better the mechanism of sound change. We note that previous variationist accounts of consonant change tend to operate with what might be called 'static' or 'simple' variants, i.e. variants which can be easily categorized as one sound or another. Our auditory analysis, supported by the acoustic analysis, suggests that alongside standard and non-standard 'simple' variants, there may also exist 'dynamic' or 'complex' variants, i.e. variants which are difficult to categorize, and the perception of which may change on repeated hearings.

It is difficult to know how these 'complex' variants should be explained in a model of consonant change. One scenario is that e.g. /x/ [x] > /k/ [k], and that [kx] results as a subsequent byproduct of the process. An alternative possibility is that /x/ [x] > [kx] > /k/ [k], and that [kx] represents some type of intermediary stage in the process. These tentative suggestions remain to be substantiated, or revised, by future research.

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