THE ROLE OF GENDER-CORRELATED SOCIOLINGUISTIC VARIABLES IN IDENTIFYING SPEAKER-INDEXICAL INFORMATION

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Abstract

The present paper investigates perceptions of speaker social-indexical information, including gender, age and social-class, from smaller phonetic segments such as gender-correlated phonetic variants. Since fundamental frequency (F0) is not the only cue to speaker gender identification, the perceptions are examined using gender-ambiguous sounding speech. The results of the study show that while speaker social-indexical information is identifiable at the segmental level, some of the phonetic variants seem to encode social-indexical information to a more consistent degree than others.

1. Introduction

Previous socioperceptual studies focus on identifying speaker-indexical information such as ethnicity (Purnell et al., 1999; Wolfram, 2000), geographic origin (Bezooijen & Gooskens, 1999; Clopper et al., 2005) or personality traits (Ball & Giles, 1988; Bezooijen, 1988; Lambert et al., 1960). Researchers have also investigated female and male voice identification (Biemans, 2000; Munson & Babel, 2007). Even though it has been established that listeners are quite accurate at identifying adult female and male voices, it is still unclear how listeners identify gender in the speech signal (Munson & Babel, 2007). Literature provides evidence that fundamental frequency impacts femininity and masculinity judgments (Foulkes et al., 2010; Munson & Babel, 2007). However, fundamental frequency is not always a decisive factor. First of all, there is an overlap of female and male pitch ranges, such that a lower-pitched female voice might be erroneously taken for a higher-pitched male voice and vice versa (Biemans, 2000; Foulkes et al., 2010). Furthermore, Johnson et al. (1999) showed in their study that a voice judged as most stereotypically female had lower mean fundamental frequency than the non-stereotypical female voice. Also Klatt & Klatt (1990) demonstrated that voices judged as typically female were not always characterised by high pitch.

Finally, it has been reported that listeners are able to distinguish male and female speakers in the absence of acoustic information normally found in speaker fundamental frequency (Assmann & Nearey, 2007; Coleman, 1971; Hubbard & Assmann, 2013; Lass et al., 1975). These findings imply that parameters of the vocal tract are not the only factors deciding whether a speaker sounds feminine or masculine, which further implies that gender-specific acoustic information does not rely heavily on fundamental frequency.

Because fundamental frequency is not the only cue to speakers’ gender identification, it is hypothesised that when speaker-social information embedded in fundamental frequency is not accessible to the listener, this type of information can be identified from other cues such as gender-correlated phonetic variants.
Therefore, this paper examines whether speaker social-indexical information can be identified at the segmental level.\(^1\)

This study builds on earlier research on perception of speaker-indexical information in child speech (Foulkes et al., 2010). Following the findings of Foulkes et al. (2010), it is hypothesised that listeners familiar with the dialect and particular variant realisations should be sensitive to speaker-indexical information carried by these variants. However, listeners with no previous exposure to the dialect are not expected to be able to access this information. The present study also goes further in investigating perceptions of speaker-indexical information than Foulkes et al. (2010). In addition to speaker gender, it investigates perceptions of speaker age and social class. The three types of speaker indexical-information will be discussed in detail in the Results section.

A set of gender-correlated phonetic variants identified in Tyneside English were selected for the purpose of this study. Variants are sociolinguistically marked in terms of speaker gender, age and social class. It was decided to use Tyneside English phonetic variants in the study for the following reasons. Firstly, in Tyneside English vowels and stops can be realised using a number of variants, as will be sown in the following section. Because Newcastle is considered to be the hub of the North East region, its dialect has been extensively researched and described (Beal et al., 2012; Docherty & Foulkes, 1999; Foulkes et al., 2005; Milroy, Milroy & Hartley, 1994; Milroy, Milroy, Hartley & Walshaw, 1994; Watt, 2000, 2002; Watt & Allen, 2003; Watt & Milroy, 1999). Furthermore, Tyneside English is stereotypically perceived as the variety spoken in all of the North East (Beal et al., 2012; Pearce, 2009).

Perceptions of Tyneside-localised variants were compared and contrasted with perceptions of other localised variants used in the wider North-East region, or non-marked supra-local variants. And so, localised vowel variants were contrasted with supra-local variants, while consonantal variants, with one exception, were contrasted with non-marked variants.

2. **Tyneside English**

Great Britain is characterised by an abundance of local dialects. The North East of England, with Tyneside English being one of many spoken in the region, is no different. However, outsiders tend to have a distorted view of the North East. They seem to neglect a number of distinct dialects, such as Sunderland or Middlesbrough dialects, present in the region and consider Tyneside English to be spoken anywhere up north (Beal et al., 2012; Pearce, 2009). However, each of the dialects in the region is characterised by distinctive phonetic features.

Variation in the use of some vowels and consonants is one of the main phonetic cues revealing social and regional characteristics of the speakers within the North East (Beal et al., 2012: 26). However, there is also considerable variation within Tyneside English in terms of the use of phonetic variants. In fact, Tyneside English is characterised by an array of localised phonetic variants, which are marked sociolinguistically, as they are not only gender-but also age- and class-specific (Watt & Allen, 2003: 269). It is these features that distinguish Tyneside speakers from speakers south of the River Wear or Teesside (Beal et al., 2012). It is also these features that distinguish speakers within Tyneside English.

\(^1\) While further research will investigate and compare perceptions of speaker-social information provided by Tyneside listeners and listeners from the whole of the North East region, the present paper focuses on listeners from Tyneside, who are familiar with the dialect.
Therefore, a set of Tyneside English gender marked phonetic variants have been selected for the purpose of this study. The vowel variables comprise realisations of the FACE, GOAT and NURSE vowels. The remaining variables constitute realisations of voiceless plosives /p, t, k/ in word-final and medial positions.

The section below provides an account of variation and possible realisations of the variables investigated in the study.

Two perceptually prominent vowels in Tyneside English are the FACE and GOAT vowels (Beal et al., 2012; Watt, 2000). Not only can they be realised using a number of variants but also different variants are used by older and younger speakers (Watt, 2000).

Watt (2000, 2002) lists three types of realisations of the FACE and GOAT vowels and groups them into monophthongs, centring diphthongs and closing diphthongs. The most commonly occurring and unmarked variants of FACE and GOAT in Tyneside English are the monophthongal realisations, [eː] and [oː]. These realisations are also found in other varieties of North East English, and as such, are supra-local (Beal at al., 2012: 31).

Monophthongal [eː] and [oː] are found across male and female speakers of different ages and social backgrounds in Tyneside English. The only exceptions are older working-class male speakers who, instead, use the centring diphthong [iæ] as a realisation of the FACE vowel. The GOAT vowel is realised as monophthongal [oː], the centring diphthong [uə] or the fronted monophthongal [ɛ]2 in this group of speakers (Beal at al., 2012; Watt, 2000, 2002; Watt & Milroy, 1999).

While the diphthongal FACE and GOAT variants [iə] and [uə] are found in all of the North East, they are, in fact, associated with Tyneside English and considered to be traditional and old-fashioned, and are most often used by older working-class males (Beal at al., 2012; Watt, 2000, 2002). [iæ] can also be found in the speech of younger working-class males, although much less frequently than in older working-class males (Watt & Milroy, 1999). [uə] is less frequently used by other groups of male speakers than older working-class. For example, older middle-class or younger working-class speakers use it less frequently, and younger middle-class speakers use it very rarely (Watt & Milroy, 1999).

The closing diphthongs are [eɪ], which is a realisation of the FACE vowel, and [oʊ], which is a realisation of the GOAT vowel. Overall, [eɪ] is not a common variant in Tyneside English, yet it is becoming more popular among younger middle-class speakers. It is used most often by young female middle-class speakers, followed by young middle-class male speakers (Watt, 2000). Both diphthongs are also Standard English forms.

The closing diphthong [oʊ] is also widely used in other parts of the country. In Tyneside English, this realisation is used by young middle-class speakers (Watt, 2000; Beal et al., 2012). The fronted monophthongal [ɛ], on the other hand, is largely found in male speakers and is used most frequently by younger middle-class males but also older and younger working class males. However, the variant is becoming less common in general and female speakers refrain from using it (Watt, 2000; Watt & Milroy, 1999).

Finally, Watt & Allen (2003: 269) and Viereck (1968: 69,70) provide more examples of the realisation of the GOAT vowel which make the vowel contrast in Tyneside English even more varied. For example, [iə] can be found in words like [stɪən] stone, [hɪəm] home and [bʊən] bone, and [æ] in words like snow [snæ]. These pronunciations occur in older working-class male speakers and are considered to be old-fashioned even by Viereck (1968).

2 Although the fronted monophthongal [ɛ] is also used in other varieties of English, for example in Yorkshire English (Haddican et al., 2013), for the purpose of this study it was treated as a localised variant.
Another vowel associated with significant variability in the region is the NURSE vowel, which can be realised as the localised retracted [ɔː], fronted [øː] and centralised [ɜː] (Beal et al., 2012; Watt, 1998; Watt & Milroy, 1999).

While the first variant is now rare and used mostly by older working-class male speakers, the two other variants are more commonly used in Tyneside English than [ɔː]. The centralised [ɜː] is most common and also supra-local. Watt (1998) and Watt & Milroy (1999) point out that the fronted variant [øː] is marked for age and gender, as it is found in female speakers, and especially younger middle- and working-class females who use it more frequently than [ɜː].

In general, localised vowel variants seem to be used by older and usually male speakers. Younger speakers, especially females, tend to prefer supra-local variants, widely found across the region and the country (Beal et al., 2012).

Overall, a decrease in the use of localised, traditional forms can be observed in Tyneside English (Watt, 2000). In their place, new, non-regional forms are adopted. The process leads to a reduction of the number of vowel variants in use and implies dialect levelling, which results in formation of a more uniform repertoire of phonetic variation, one that is closer to other varieties of British English (Watt, 2000, 2002). At the same time, the supra-local forms new to the region seem to be less socially and geographically marked.

The situation is quite the opposite in the case of consonant productions. Some localised consonantal realisations seem to be becoming more widely used by speakers of Tyneside English (Beal et al., 2012: 45).

One of the characteristic features of the North East dialects is a wide variety of realisations of voiceless stops. For example, /t/ in Tyneside English can be realised as T-to-R variant, a glottalised stop, a pure glottal stop, a fully released /t/ or pre-aspirated /t/ (Beal et al., 2012; Watt & Milroy, 1999). Also /p/ and /k/ are glottalised, pre-aspirated or realised as glottal stops in Tyneside English (Beal et al., 2012; Watt & Milroy, 1999).

As has been already mentioned, word-final /t/ can be realised as [ɻ]. This feature is commonly referred to as T-to-R and it is found in some restricted contexts, in pre-vowel position in a limited number of common verbs and non-lexical words, for example put on or shut up (Beal et al., 2012; Milroy, Milroy, Hartley &Walshaw, 1994; Watt & Milroy, 1999: 30).

Given the fact, that T-to-R is found most frequently in older working class female speakers and, to a lesser extent, in younger working class females, the process is marked sociolinguistically (Watt & Milroy, 1999).

Another marked feature of Tyneside English is glottalisation or glottal reinforcement of voiceless plosives (Beal et al., 2012; Docherty et al., 1997; Docherty & Foulkes, 1999; Milroy, Milroy & Hartley, 1994; Milroy, Milroy, Hartley &Walshaw, 1994; Watt & Allen, 2003; Watt & Milroy, 1999). Overall, glottalisation is a feature preferred by male speakers and it is found in intervocalic position when a stop gap is followed or preceded by a laryngealised voice, in words like for example: city, copy, happy, bottle, wanted, lucky or local (Watt & Allen, 2003: 268). These variants are associated with a double articulation and as such they are usually transcribed as [ɻp], [ɻt] and [ɻk] (Beal et al., 2012). At the same time, glottalised variants, and particularly glottalised /p/ and /k/ are claimed to be recessive (Docherty et al., 1997: 306).
As far as glottalisation of /p, t, k/ in intervocalic position is concerned, of the three stops, /p/ is most often realised as a glottalised stop. Table 1 presents rates of use of glottalised /p/ by male and female speakers in Tyneside English.

**Table 1:** Rate of use of glottalised /p/ by male and female speakers in Tyneside English (Beal et al., 2012; Docherty et al., 1997; Milroy, Milroy & Hartley, 1994).

<table>
<thead>
<tr>
<th>Gender</th>
<th>Rate of Use of Glottalised /p/</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men</td>
<td>Almost categorical</td>
</tr>
<tr>
<td>Women</td>
<td>58%</td>
</tr>
</tbody>
</table>

Glottalised /t/ is also a significantly frequent realisation of /t/ in intervocalic contexts. This feature is characteristic of older working class male speakers. Table 2 presents rates of use of glottalised /t/ by male and female speakers in Tyneside English.

**Table 2:** Rate of use of glottalised /t/ by male and female speakers in Tyneside English (Beal et al., 2012: 39, Watt & Milroy, 1999).

<table>
<thead>
<tr>
<th>Gender</th>
<th>Rate of Use of Glottalised /t/</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men</td>
<td>82%</td>
</tr>
<tr>
<td>Women</td>
<td>42%</td>
</tr>
</tbody>
</table>

Table 3 presents rates of use of glottalised /k/ by male and female speakers in Tyneside English.

**Table 3:** Rates of use of glottalised /k/ by male and female speakers in Tyneside English (Beal et al., 2012: 38).

<table>
<thead>
<tr>
<th>Gender</th>
<th>Rate of Use of Glottalised /k/</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men</td>
<td>82%</td>
</tr>
<tr>
<td>Women</td>
<td>37%</td>
</tr>
</tbody>
</table>

Voiceless plosives in Tyneside English can be also realised as pure glottal stops [\]/. In Tyneside, /t/ is realised as [\] more often than /p/ or /k/ (Beal et al., 2012; Docherty & Foulkes, 1999; Milroy, Milroy & Hartley, 1994; Milroy, Milroy, Hartley & Walshaw, 1994). While realisations of /t/ as glottal stops are quite commonly used in southern parts of the North East region, in Tyneside English this type of realisation is found word medially before syllabic L (Beal et al., 2012). Apart from this context, intervocalic word-medial glottal stops are not very common in Tyneside English, where only young speakers use it 11 per cent of the time (Beal et al., 2012: 46). According to Watt & Milroy (1999), Milroy, Milroy, Hartley & Walshaw (1994) and Milroy, Milroy & Hartley (1994), this realisation is most commonly occurring in the speech of young middle class females, who are also responsible for spreading the variant.
Glottalised /p/, on the other hand, is not very common in Tyneside English and amounts to only 1 per cent of use for male and female speakers. It is more widely used for example, in Sunderland and especially Middlesbrough, where it has been a growingly popular variant among young female speakers (Beal et al., 2012).

As far as realisations of /k/ as [k] are concerned, they have not been found in Tyneside English (Beal et al., 2012: 39).

Finally, realisations of word final pre-pausal voiceless stops as pre-aspirated variants, with /t/ being most frequently pre-aspirated of the three variables, have been reported in the North East (Jones & Llamas, 2003; Beal et al., 2012). These variants have been also found in Tyneside English, where they are most frequent in young female speech (Docherty & Foulkes, 1999; Foulkes et al., 2005; Watt & Allen, 2003).

3. Method

For the purpose of this study, speaker pitch was shifted to obtain the effect of a gender-ambiguous-sounding voice.

This study uses single-word stimuli. The advantage of using single words over connected speech is that listeners can focus with greater ease on the specific type of information present in the acoustic signal (Munson, 2007). At the same time, this approach allows the researcher to control for more parameters and therefore draw more reliable conclusions from the data when analysing which phonetic cues listeners rely on.

In constructing each stimulus, it was important to ensure that listeners responded only to the variant under investigation as opposed to any other segment of a word. This was achieved by realising the variant of interest as localised, with all other segments being standard pronunciation.

3.1 Stimuli

A total of four voices were used in this study. Two phoneticians recorded target stimuli using Tyneside English variants and two other speakers recorded fillers used in the study. Speakers were in their forties and mid-twenties.

Stimuli selected for this study account for specific phonological contexts. Vowels occur in three phonological contexts: word-finally in open syllables, preceding a nasal, and preceding a fricative in one instance. For example, the words in the GOAT group included: grow, stone, dough, go, home and toe. Consonantal stimuli were also one-syllable words, where the variables under investigation occurred in intervocalic word-medial and final position. All consonants were adjacent to vowels, and so for example in the T-to-R group get off, put on and shut up were used, whereas in the glottalised /t/ group, bottle, wanted and city were found.

Preliminary tests with Adobe Audition 3.0 (Adobe, 2007) revealed that regarding the range of possible pitch manipulation and the final outcome in terms of voice naturalness, male voices gave better results than female voices. In other words, when working with male voices, it was possible to apply a wider range of pitch manipulations before the voice started to sound
unnatural. The results were less optimistic for female voices which would lose their naturalness before they started to sound gender-ambiguous. Therefore, only male voices were used in this study.

The tokens were recorded in a recording studio to .wav sound files at a sampling rate of 44.1 kHz and 16 bit mono resolution. All tokens were manipulated in Adobe Audition 3.0 (Adobe, 2007) using the Pitch Shifter function to raise pitch and obtain the effect of gender-ambiguous-sounding voice. In addition to preserving the tempo of the samples, high precision and default appropriate settings were selected. Pitch Shifter allows changes in fundamental frequency by semitones and cents, where 1 semitone is equal to 100 cents. Each token was manipulated individually between 1.0 and 4.0 semitones. Average F0 of target stimuli was 135 Hz.

The algorithm implemented by the Pitch Shifter allows the speech tempo to be preserved and the formant values to be adjusted to changes in pitch (Adobe, 2007). Because this study investigates perception of gendered phonetic variables in the absence of gender-specific fundamental frequency, the aim was to manipulate only one of the phonetic cues, that is, fundamental frequency. Preserving tempo and adjusting formant values to changes in pitch sustained other acoustic features of the recordings. Furthermore, this approach allowed to control for pitch and draw more specific conclusions about the acoustic cues responsible for perceptions of speaker-indexical information.

Figure 1: The [øː] variant in stir. Before manipulation of F0.
The role of gender-correlated sociolinguistic variables

Figure 2: The [øː] variant in *stir*. Shifted by 3.5 semitones.

All tokens were normalised for volume in Adobe Audition CS5.5 (Adobe, 2012) using the Match Volume function. A single token was pre-selected and the remaining tokens were matched in volume to the pre-selected token using the file total root mean square power (RMS) function and limiting settings to ensure the output files were not clipped or overly loud.

In one instance, token duration required elongation using the Stretch and Pitch function in CS5.5. Previous shifting of F0 resulted in a speeded and unnatural output of the token. While duration was stretched by 50 per cent using iZotope Radius algorithm, pitch and speech characteristics were preserved.

At the end of the process, the naturalness and gender-ambiguity of the stimuli and fillers were judged by a male and a female sociophonetician familiar with the dialects of North East England.

3.2 Procedure

The experiment was conducted in laboratory conditions and administered in SurveyGizmo (SurveyGizmo, 2014). At the beginning of the experiment there was a short training session during which participants familiarised themselves with the types of scales used in the experiment. Participants heard four words, each with a different scale, and attempted to evaluate the speakers. Data from the training session were excluded from analysis. After the training participants were given time to ask questions. A total of 531 single-word stimuli and fillers were presented via headphones at a comfortable hearing level, one at a time. Each stimulus was played once only. The entire session took about 90 minutes and there were three breaks during which participants were asked to complete sudoku.

During the experiment, a visual representation of a stimulus was displayed on screen. Sound was played after an image and scale were loaded. The onset delay for audio was about a second.
The role of pictures was to help listeners not familiar with Tyneside English understand the recordings. The images also served as an additional element in the study, which alleviated a possible feeling of boredom. In order to avoid visual priming, except for two instances referring to filler words, pictures excluded images of men or women. Care was also taken to ensure that pictures used in the study were not associated with males or females. Images included photographs, drawings, cartoons and computer icons. They presented objects, concepts or activities illustrating words played to the listeners. Nevertheless, it could be argued that for some listeners some of the pictures could be associated with men or women. For example, with the word bat, a picture of a bat or a picture of a baseball bat was shown. With blur, a picture of blurred birds in motion or a picture of a blurred view through a windshield was shown. It could be argued that participants may have stereotypically associated driving fast with men. The same might be true for a baseball bat. A bowl filled with dough however, might be stereotypically associated by some with women. However, associations of this type may depend on an individual and their experience; as a result they may vary from person to person.

As far as the words are concerned, these were not tested for gender bias.

Listeners were instructed to listen to each stimulus and evaluate it using a Visual Analogue Scale (VAS) slider with a 0 to 100 point scale, incrementing by 1 point and logging participant choices on the x axis. Listeners were also asked to go with their first impressions and to not over think their choices.

![Visual Analogue Slider (VAS) scale for evaluating perceived speaker-femaleness.](image-url)
The role of gender-correlated sociolinguistic variables

Figure 4: Visual Analogue Slider (VAS) scale for evaluating perceived speaker-maleness.

Figure 5: Visual Analogue Slider (VAS) scale for evaluating perceived speaker-age.
The scales of choice were Visual Analogue Scales (VAS), which are continuous, fine-grained scales. One of their major advantages over other types of scales is that they give the subjects more flexibility when providing subjective ratings. This, in turn, makes the analysis more precise (Llamas & Watt, 2014).

However, to be effective, VAS needs to be clearly defined and polar rather than bipolar (Torrance, Feeny & Furlong, 2001). Thus, the left and right anchor points of the scale are required to not introduce two contrastive concepts, for example Definitely male – Definitely female. Instead, the concepts should form end-points of a continuum, for example Definitely female – Definitely not female or Definitely male -- Definitely not male. This was the reason for developing two separate scales to evaluate speaker-gender in the present study. Applying bipolar scales would make it impossible to conduct analysis and interpret data.

Wording in each of the scales was colour-coded for the benefit of the participant. Distinctive colours aimed to associate a particular colour with a particular scale. Colour-coding was consistent, and so the femaleness scale used red wording, the maleness scale -- navy blue, the age scale -- orange and the social-class scale -- green.

Stimuli were presented in a fixed order and the slider was reset to a midpoint position on the scale after each evaluation. Additionally, the slider did not allow for stimuli to be left unrated and so, in order to proceed, participants had to move it.

Each stimulus was evaluated four times along four dimensions: perceived speaker gender – maleness and femaleness and perceived speaker age and social class. These alternatives were
presented in a mixed order, in such a way, that every stimulus was rated along only one dimension per block and on all four of them in total.

Data were saved on an external server owned by the software provider.

3.3 Participants

Listeners who participated in the study were from Tyneside, and so they fulfilled the criterion of being familiar with the dialect under investigation. They were volunteers recruited from the undergraduate and graduate student bodies at the University of York and Newcastle University. The majority of participants recruited at the University of York were in their fresher year, thus had lived away from Tyneside for about 6 months. Four of the York students were more advanced in their coursework and had lived in York longer, between 1 to 4 years. However, all of the students maintained to have family and friends in Tyneside and to visit home often. As far as participants from Newcastle University are concerned, they claimed to have lived in Tyneside all their lives.

Listeners were also close in age. With the exception of three persons, whose age ranges were 25-34, the rest of the participants were ages 18-24. Even though participants were asked to provide age ranges rather than specify their age, from additional questions in the survey it was clear that the oldest participant was 28 years of age.

Twenty-four female and seven male listeners participated in the study. Although the aim was to obtain a balanced sample of male and female participants, this proved difficult in practice.

In terms of social background, 13 participants considered themselves to be of working-class background and 11 described themselves as middle-class. The rest declared to be of lower-middle class or did not have a clear idea.

Only five participants claimed to speak a foreign language, out of whom two spoke two non-native languages. Participants also came from a wide variety of fields, the most popular being: speech and language therapy, history, philosophy and psychology.

None of the listeners reported a hearing impairment and only two suffered from a mild cold.

Each participant was paid £12 upon completing the study.

3.4 Data analysis

As has been already mentioned, 31 listeners participated in the study. Each participant evaluated between two to three words in each of the vowel and consonantal groups when evaluating localised variants and, in some cases, as many as six non-localised words per group. This resulted from the study design. Furthermore, this meant that data were clustered and they could be correlated rather than independent (Galbraith, Daniel & Vissel, 2010; Zyzanski, Flocke & Dickinson, 2004). In order to analyse data, first, average values for each of the participants were determined. It was decided to use averages rather than medians because of the small number of measurements per participant. Applying this type of measure ensured that data were independent which, in turn, allowed statistical analysis. Because in a number of cases data distributions were skewed, a non-parametric Wilcoxon test was applied. This type of test compares differences between two medians. Additionally, the exact probability option of the test was selected.
4. Results

This section presents and discusses experimental results of the perceptual study. First, the FACE, GOAT and NURSE vowel variants are discussed in terms of perception of speaker gender, age and social class. Next, results for T-to-R, glottalised voiceless stops and pre-aspirated /t/ are presented.

The data analysis presented below is based on all 31 Tyneside listeners who participated in the study.

4.1 Analysis of listener perception of vowels

The following section focuses on evaluation of speaker-indexical-social information of localised and supra-local vowel variants occurring in Tyneside English. Table 4 presents patterns of use of the FACE vowel variants in Tyneside English.

<table>
<thead>
<tr>
<th>Variants of the FACE vowel</th>
<th>Speakers</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Iː] – a localised variant</td>
<td>most often used by older working-class (WC)</td>
</tr>
<tr>
<td></td>
<td>male speakers</td>
</tr>
<tr>
<td>[ɛː] – a supra-local variant</td>
<td>used across all groups of speakers</td>
</tr>
</tbody>
</table>

Table 4: Usage patterns of the FACE vowel variants in Tyneside English (Beal et al., 2012; Watt, 2000; Watt & Milroy, 1999).

A closer look at the results presented below provides some interesting observations. Figure 7 and Figure 8 show evaluations of perceived speaker femaleness and maleness, respectively. The localised variant is used most often by older working-class males. As can be seen, both variants were evaluated as overall male sounding. Also a Wilcoxon signed-rank test did not show a statistically significant difference between evaluations of the two variants in terms of gender (maleness and femaleness). It can be noticed that Figures 7 and 8 are mirror images of one another. This would imply listeners were consistent with their evaluations.

Furthermore, from the results presented in the plots it can be concluded that evaluations provided by listeners seem to reflect results of the production studies (Beal et al., 2012; Watt, 2000; Watt & Milroy, 1999).
Figure 7: FACE localised [ɪɹ] (1) and supra-local [ɛː] (2) variants -- evaluation of speaker gender.

Figure 8: FACE localised [ɪɹ] (1) and supra-local [ɛː] (2) variants -- evaluation of speaker gender.
In terms of the perceived age of speakers (Fig. 9), the results show that the localised and supra-local variants were judged equally in the middle range of the scale which might imply that most participants found the voices to be mature but young-sounding. Furthermore, the spread of evaluations, particularly in the case of the localised variant \([\text{I} \leftrightarrow \text{I}]\) would suggest that listeners varied considerably in their perceptions.

A Wilcoxon signed-rank test showed a statistically significant difference \((p < 0.001)\) between evaluations of the localised variant \([\text{I} \leftrightarrow \text{I}]\) and pan-northern variant \([\text{C}:]\) in terms of speaker social-class (Fig. 10). As can be noticed, the localised \([\text{I} \leftrightarrow \text{I}]\) was found to sound more working-class which corroborates findings of the production studies. By contrast, the pan-northern variant \([\text{C}:]\) was found to be less working-class sounding when compared with the localised variant. Furthermore, when taking a closer look at the box-plot it can be noticed that the \([\text{C}:]\) variant is characterised by a considerably wide spread of evaluations including working-class judgements as well as non-working class judgements. What is interesting, especially in comparison with the FACE results obtained for gender and age, is that participants seemed to be quite sensitive to the social-class information of the speakers.
The role of gender-correlated sociolinguistic variables

Figure 10: FACE localised [ʌː] (1) and supra-local [ɛː] (2) variants -- evaluation of speaker class.

Table 5 presents patterns of use of the GOAT vowel variants in Tyneside English.

<table>
<thead>
<tr>
<th>Variants of the GOAT vowel</th>
<th>Speakers</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ʌː] – a fronted monophthongal localised variant</td>
<td>most often by younger middle-class (MC) males but also older and younger WC males</td>
</tr>
<tr>
<td>[iːə] – an archaic localised variant</td>
<td>found in the speech of older WC males</td>
</tr>
<tr>
<td>[ʊə] – a centring diphthongal localised variant</td>
<td>most often used by older WC males</td>
</tr>
<tr>
<td>[oː] – a supra-local monophthongal variant</td>
<td>used across all groups of speakers</td>
</tr>
</tbody>
</table>

Figure 11 presents evaluations of speaker gender of the three localised GOAT variants. It seems that listeners found the fronted monophthongal and archaic variants to be very similar sounding in terms of the perceived speaker femaleness – that is, as not female sounding. The centring diphthong received the widest spread of evaluations in the second quartile, which might suggest that listeners did not have any strong associations of the variant sounding typically male (Figure 11). Finally, the supra-local variant was found to be overall not female sounding. However, less so than the fronted monophthongal and archaic variants.

In terms of evaluation of perceived femaleness of the GOAT variants, a Wilcoxon signed-rank test showed a statistically significant difference (p < 0.01) between evaluations of the localised [ɔː] and [ʊə] and between the archaic variant [iːə] and localised [ʊə] in terms of the perceived femaleness of voices. However, no difference in perception has been found for the localised [ɔː] and the archaic [iːə].

Listeners found the localised and archaic male variants [ɔː] and [iːə] to be overall male sounding, which is consistent with the results presented for evaluations of perceived femaleness. However, as can be seen in Figure 11, the spread of evaluations shows that some listeners found the variants to be altogether female sounding. As far as evaluations of the [ʊə] variant are concerned, a spread of evaluations noticed especially in the second and third quartile (Figure 11) suggests that listeners had quite varied perceptions of this variant and some of the listeners did not have a strong association of the variant as male sounding.
In terms of statistically significant differences in perception of maleness of the four GOAT variants, a Wilcoxon signed-rank test did not show differences between any of the localised variants. However, such differences were reported for the localised [ɵː], archaic [iːə] and the supra-local variant [oː], where p < 0.05 in both cases.

The results for the perceived speaker-age seem to be reflecting the findings of the production studies only to a certain extent. While the supra-local variant [oː] and the localised [ɵː] male variant were found to be in general mature-sounding, which correlates with the age ranges of speakers using these variants, the evaluations of the localised male variant [ʊə] and the archaic male variant [iːə] were not as clear-cut. Even though the evaluations of [ʊə] show a significant dispersion of ratings in the first and second quartile, the median itself is located towards the end of the scale, which means that the variant was perceived as older sounding. This, in turn, corroborates with findings of the production studies. This finding is particularly interesting when compared with the results of gender evaluation of this variant. Of the four GOAT variants, [ʊə] was judged as somewhat female sounding by the highest number of respondents. This links with the fact that the same variant was perceived as old sounding. This is the first instance of a possible correlation between perceived speaker-age and gender identified in this study. It will be investigated in the following sections whether more examples of such correlations can be reported.

As far as evaluations of the archaic [iːə] are concerned, a spread of evaluations can be noticed especially in the second and third quartile (Figure 12). This might suggest that listeners did not necessarily have any strong associations of this variant with older working-class males simply because of the young age of the listeners and the fact that the variant was already
recessive in the mid- to late-1990s. This spread and the fact that the median evaluation is at mid-point on the scale, might actually reflect listeners’ uncertainty as to how to evaluate it.

Statistical differences were recorded for the following localised variants: [ɵː] and [ʊə] (p < 0.01) and [iːə] and [ʊə] (p < 0.05) as well as for the localised [ʊə] and supra-local [oː] (p < 0.01).

![Diagram](image)

**Figure 13**: GOAT localised [oː] (1), [iːə] (2) and [ʊə] (3) and supra-local [oː] (4) variants – evaluation of speaker social class.

A Wilcoxon signed-rank test showed a statistically significant difference (p < 0.01) between evaluations of almost all variants under investigation in terms of perceived speaker social class. The only non-significant comparison was found between the localised archaic [iːə] and localised [ʊə]. A closer look at Figure 13 reveals that the archaic [iːə] and local [ʊə] variants were, in fact, evaluated as working-class sounding. While the localised [ɵː] was found to be much less working-class sounding than the other two localised variants it was also perceived to be more working-class sounding in comparison with the supra-local variant [oː]. Once again, it seems that the listeners were quite sensitive to social-class information, even in the case of the archaic variant.

The results so far show that listeners are sensitive to the speaker social-indexical information embedded in the phonetic variants under investigation to a varied degree.

Table 6 presents patterns of use of the NURSE vowel variants in Tyneside English.
The role of gender-correlated sociolinguistic variables

<table>
<thead>
<tr>
<th>Variants of the NURSE vowel</th>
<th>Speakers</th>
</tr>
</thead>
<tbody>
<tr>
<td>[øː] – a fronted localised variant</td>
<td>most often used by young MC and WC females but also older WC females</td>
</tr>
<tr>
<td>[ɔː] – a retracted localised variant</td>
<td>most often used by older WC males</td>
</tr>
<tr>
<td>[ɜː] – a supra-local centralised variant</td>
<td>used across all speaker groups</td>
</tr>
</tbody>
</table>


The final vowel investigated in the study is the NURSE vowel (Figure 14). When looking at Figure 14 it can be noticed that the female variant [øː] was evaluated as more female sounding than the male variant [ɔː]. At the same time a Wilcoxon signed-rank test showed a statistically significant difference (p < 0.05) between evaluations of these two localised variants in terms of their perceived femaleness. A difference between the male and non-marked variant was also reported, where p < 0.01 when evaluating the femaleness and maleness of the speaker.
As far as evaluations of speaker age are concerned (Figure 15), only the medians for the male [ɔː] and female [øː] illustrate a difference in perception. While the female variant [øː] was evaluated as slightly less old sounding, the male variant [ɔː] was found to be slightly older sounding in comparison. The supra-local variant, on the other hand, was evaluated similarly to the female variant. As could be expected from the spread of evaluations, no statistically significant differences were reported.

The results in Figure 16 show that, as for the previous variables, listeners were again quite sensitive to social-class information carried by the three variants. The results corroborate with findings of the production studies. Furthermore, perceptions of these variants in terms of social class were statistically significant (p < 0.001).
4.2 Analysis of listener perceptions of plosives

The following section focuses on evaluation of speaker gender, age and social class of localised and supra-local variants of voiceless plosives occurring in Tyneside English.

Table 7 presents patterns of use of the GOAT vowel variants in Tyneside English.

<table>
<thead>
<tr>
<th>Variants of word-final pre-vocalic /t/</th>
<th>Speakers</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ɹ] – T-to-R</td>
<td>most often used by older WC female speakers</td>
</tr>
<tr>
<td>[ʔt] – glottalised /t/</td>
<td>most often found in older MC and WC male speech</td>
</tr>
</tbody>
</table>

Listener perceptions of speaker femaleness and maleness were mirror images of one another. This would imply that listeners have a clear and consistent perception of the two variants in terms of their perceived gender. It is also worth drawing attention to the fact that the results of the perceptual test correlate with the results of production studies (Docherty & Foulkes, 1999; Watt & Milroy, 1999; Milroy, Milroy, Hartley & Walshaw, 1994; Milroy, Milroy & Hartley, 1994). While glottalised /t/ was strongly perceived as a male variant (see Figure 17), T-to-R received a wider spread of evaluations. This might imply that listeners were in fact sensitive to the gender information carried by the variant under investigation.

A Wilcoxon signed-rank test showed a statistically significant difference for age and social class for the two variants (p < 0.001). Thus, the results indicate a clear difference in perception of the two variants. In other words, social-indexical information encoded in these variants seems to be quite salient to Tyneside listeners.

Figure 17: T-to-R [t] (1) and glottalised /t/ [ɹ] (2) variants -- evaluation of speaker gender.
Although a statistically significant difference between perceived speaker age of T-to-R and glottalised /t/ has been found, it seems that evaluations of speaker age do not reflect findings of the production studies (Figure 18), which report both variants to be used mostly by older speakers (Watt & Milroy, 1999; Beal et al., 2012; Docherty et al., 1997; Milroy, Milroy & Hartley, 1994). Nevertheless, a relation between perceived speaker age and gender can be noticed in the case of glottalised /t/. This relation results most probably from the design of the present study. Upon raising F0, male voices may seem to sound younger than before manipulation. A similar age-gender correlation has been already reported for one of the GOAT variants, which was found to be somewhat female-sounding and, at the same time, older-sounding (see Figures 11 & 12).

In terms of evaluation of speaker social class, a clear difference in perception of the two variants can be noticed (Figure 19). The female variant was found to be definitely working-class sounding. The male variant, by contrast, was perceived as less definitely working-class sounding. These results corroborate findings of the production studies. Furthermore, there was a wider spread of evaluations of the male variant, which suggests that listeners varied more in their judgments.
Figure 19: T-to-R [ɹ] (1) and glottalised /t/ [ʔ] (2) variants – evaluation of speaker class.

Table 8 presents patterns of use of /t/ in intervocalic context in Tyneside English.

<table>
<thead>
<tr>
<th>Variants of intervocalic /t/</th>
<th>Speakers</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ʔ] – glottalised /t/ - a localised variant</td>
<td>most often found in older MC and WC male speech</td>
</tr>
<tr>
<td>[ʔ] – glottalled /t/ - a localised variant</td>
<td>most often used by younger MC female speakers</td>
</tr>
<tr>
<td>released /t/ – a non-local variant</td>
<td>used across all speaker groups</td>
</tr>
</tbody>
</table>

Table 8: Realisations of intervocalic /t/ in Tyneside English (Beal et al., 2012; Docherty & Foulkes, 1999; Milroy, Milroy & Hartley, 1994; Milroy, Milroy, Hartley & Walshaw, 1994).
Figure 20: Glottalised /t/ [ʔt] (1), glottal stop [ʔ] (2) and released /t/ (3) variants -- evaluation of speaker gender.

Figure 20 presents evaluations of the perceived speaker gender of three realisations of /t/ found in the Tyneside dialect. As can be observed, the average and spread of ratings for [ʔt] stimuli differs in this and the previous group. This might be because [ʔt] stimuli in different phonological contexts were used in opposition to [ʔ] and [ʔ]. It can be noticed that listeners did not differ in their perceptions of speaker-gender of the three variants (Figure 20). Glottalised, glottal and released /t/ were quite consistently evaluated as male sounding. Furthermore, when taking a closer look at the plots, it can be seen that even though listeners found these variants to be definitely male sounding, /t/ was found to be the most male sounding and the most definitely not female sounding in evaluations of perceived maleness and femaleness respectively. This is interesting since the variant is supra-local and as such is used by males and females alike.

No statistically significant results were recorded.
In terms of perception of speaker age (Figure 21), a difference can be noticed between evaluations of glottalised and glottal /t/. This difference was also statistically significant (p = 0.001). As far as the released /t/ variant is concerned, it was found to be the oldest sounding of the three variants under investigation. A Wilcoxon signed-rank test showed a statistically significant difference between evaluations of [ʔ] and released /t/ (p = 0.005). This would mean that listeners were sensitive to information about speaker age embedded in the phonetic variants to a certain degree. We can definitely say that perceptual differences were found for the variants under investigation. These differences reflect the pattern of results of production studies, which have established that glottalised /t/ is most often used by older speakers, while glottal /t/ is used by younger speakers. Interestingly enough however, from the results presented in the plots, it can be seen that overall, all the variants were found to be young sounding. This might result from the fact that all three variants were evaluated by listeners to be male sounding.
The role of gender-correlated sociolinguistic variables

Even though a Wilcoxon signed-rank test showed statistically significant differences between evaluations of the two localised variants (p < 0.01) and each of the localised variants and the supra-local variant (p < 0.001) in terms of speaker social-class (Figure 22), the results presented in the plot do not reflect results of the production studies, especially when comparing evaluations of the two local variants with the evaluations of the non-local variant. While glottalised /t/ is used by both working- and middle-class speakers, the listeners evaluated it to be less definitely working-class sounding than [ʔ] which is used by middle-class speakers. The main-stream variant, released /t/, was found to be perhaps middle-class sounding with the median evaluation around the mid-point of the scale. This, as well as the fact that the variant received the widest spread of evaluations might suggest that listeners associated it with speakers of all social strata.

Table 9 presents patterns of use of /p/ in intervocalic context in Tyneside English.
Variants of word-medial /p/ | Speakers
---|---
[ʔp] – glottalised /p/ - a localised variant | most often used by male speakers
released /p/ – a non-localised variant | used across all speaker groups


Figure 23: Glottalised /p/ [ʔp] (1) and non-marked released /p/ [p] (2) variants -- evaluation of speaker gender.

As in the case of glottalised and released /t/, glottalised and released /p/ were both evaluated as overall male sounding (Figure 23). Listeners seemed to be quite certain when judging perceived femaleness of the speakers (Figure 23), which is reflected by narrow spread of evaluations. No statistically significant differences were reported for evaluations of perceived speaker gender.
The evaluations of speaker perceived age (Figure 24) of the localised variant do not corroborate the results of the production studies. The fact that glottalised /p/ was found to be young sounding might mean that, again, voice characteristics influenced listeners’ judgements of the perceived speaker age. It has been noticed already that variants perceived as male sounding were also found to be young sounding (see for example Figures 20 & 21). This correlation however, cannot be noticed for the standard released /p/ variant, which was found to be male- and older than teenage-sounding. Since a wider spread of evaluations close to the mid-point on the scale characterises this variant, it could be argued that it was found to be used most often by middle-aged speakers. This, on the other hand, reflects findings of the production studies.

A Wilcoxon signed-rank test showed a statistically significant difference between evaluations of the two variants in terms of perceived speaker age (p < 0.001).

The results for evaluation of speaker social-class draw attention to a difference in perception of the two variants (p < 0.001). While the localised variant was found to be rather working-class sounding, the standard variant was perceived as much less working-class sounding, perhaps even middle-class sounding. The results show that social-class is quite a salient feature to listeners.
Table 10 presents patterns of use of /k/ in intervocalic context in Tyneside English.

<table>
<thead>
<tr>
<th>Variants of word-medial /k/</th>
<th>Speakers</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ʔk] – glottalised /k/, a localised variant</td>
<td>most often used by male speakers</td>
</tr>
<tr>
<td>released /k/ – a non-localised variant</td>
<td>used across all speaker groups</td>
</tr>
</tbody>
</table>

Table 10: Realisations of intervocalic /k/ in Tyneside English (Docherty et al., 1997: 306; Milroy, Milroy & Hartley, 1994; Milroy, Milroy, Hartley & Walshaw, 1994).
Listeners perceived the glottalised and released /k/ as different in terms of gender of the speakers. The difference can be noticed especially when examining perceptions of femaleness (Figure 26), where $p < 0.001$. While [ʔk] was found to sound definitely male, released /k/ was found to sound overall male, however, listeners perceived it as a less definitely male feature.

However, with regards to perceived speaker maleness, the perceptual difference between the two variants was less significant ($p < 0.01$).
Ania Kubisz

Figure 27. Glottalised /k/ [ʔ] (1) and non-marked released /k/ [k] (2) variants -- evaluation of speaker age.

In terms of speaker-age, glottalised and released /k/ were found to be perceived as different sounding (p < 0.01) (Figure 27). Glottalised /k/ was evaluated as younger sounding than released /k/. Both variants are characterised by wide spreads of evaluations, especially in the first and fourth quartiles. The medians, however, show that the variants were found to be overall mature-sounding. Thus, the results corroborate with findings of production studies only to some extent.

Also, differences between evaluations of speaker social-class were statistically different (p < 0.001). While glottalised /k/ was found to be working-class sounding, released /k/, by comparison, was evaluated as much less working-class sounding (Figure 28). Once again, it seems that listeners were quite sensitive to social-class information embedded in the phonetic variants.
Figure 28: Glottalised /k/ [ʔ] (1) and non-marked released /k/ [k] (2) variants – evaluation of speaker class.

Table 11 presents patterns of use of word-final post-vocalic /t/ in Tyneside English.

<table>
<thead>
<tr>
<th>Variants of word-final post-vocalic /t/</th>
<th>Speakers</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ʰt] – pre-aspiration /t/, a localised variant</td>
<td>characteristic of younger female speakers</td>
</tr>
<tr>
<td>released /t/ – a non-localised variant</td>
<td>used across all speaker groups</td>
</tr>
</tbody>
</table>

Table 11: Realisations of word-final post-vocalic /t/ in Tyneside English (Beal et al., 2012; Docherty & Foulkes, 1999; Foulkes et al., 2005).
Two variants of pre-aspirated /t/ were contrasted with released /t/, which is a realisation found in Tyneside and other parts of the country. A closer examination of pre-aspirated and released realisations of /t/ reveals that there were no differences between perceptions of the two variants of pre-aspirated /t/ in terms of femaleness (Figure 29). However, listeners did perceive localised and supra-local variants as different (p < 0.01 & p < 0.01). The supra-local variant was evaluated as the least definitely not female sounding.

Interestingly, however, listeners did not seem to be sensitive to speaker-gender information encoded in the pre-aspirated variants which were reported by production studies to be typically female. This might imply that the linguistic change has progressed and that word-final pre-aspirated /t/ is used by men and women alike.

Evaluations of perceived maleness of the stimuli under investigation revealed that the three variants were found to be overall male sounding. However, it should be pointed out that the pre-aspirated variant of longer duration had the highest spread of evaluations, including evaluations of definite femaleness, in the fourth quartile.
The role of gender-correlated sociolinguistic variables

As far as age ratings are concerned, the non-marked fully released /t/ was evaluated as mature adult-sounding (Figure 30). The localised variant of shorter duration of pre-aspiration is characterised by a spread of evaluations in the second quartile. Overall, it was found to sound similar to the non-local variant.

Nevertheless, the localised variant of longer duration of pre-aspiration is characterised by even larger spread of evaluations, especially in the third quartile. This would imply that for some listeners this variant sounded older than the other two. This could be correlated with the fact that this variant was found to be the most female sounding of the three variants under investigation. These findings can be tied to earlier findings of age-gender correlation resulting from the design of the study. However, if any age-gender correlation exists in this case, it does not seem to be very strong.

Figure 30: Variants of pre-aspirated /t/ [ʰʃ] (1) of longer duration and more breathy pre-aspiration, shorter duration and less breathy pre-aspiration [ʰʃ] (2) and non-marked released /t/ [ʃ] (3) -- evaluation of speaker age.

Pre-aspirated and released /t/- mean evaluation of speaker age

Sounds retired

Sounds late teen
As can be noticed, variants of pre-aspirated and fully released /t/ were evaluated as rather middle-class sounding (Figure 31). None of the variants were perceived as definitely working-class sounding.

A Wilcoxon signed-rank test did not show a statistically significant difference between evaluations of the three variants in terms of social-class.

5. Discussion and Conclusions

The results presented in the previous sections indicate that listeners familiar with the dialect under investigation were sensitive to speaker-indexical information on the segmental level. This information was identified from gender-ambiguous sounding speech. Furthermore, certain localised variants seemed to encode social-indexical information to a more consistent degree than others. While some of the presented results constitute very clear-cut cases, for example T-to-R, others reflect findings of the production studies only to some extent, for example the FACE vowel or pre-aspirated /t/. One of the possible explanations is that some
other cues came into play and overshadowed indexical information encoded in phonetic variants themselves.

As far as evaluations of gender of the speaker are concerned, it should be reminded that even though the voices sounded gender-ambiguous, it is often the case that localised variants are attributed to male speakers. This could explain why listeners not always evaluated variants most frequently used by female speakers as female. Nevertheless, even if this was the case, often statistically significant differences between variants were reported. This would indicate that, in fact, listeners were sensitive to gender differences between the variants at least to some extent.

Evaluating age of the speaker seemed to pose a similar problem to the listeners. Overall, variants were evaluated as middle aged sounding. The only exceptions were the majority of the glottalised variants which were found to be young sounding. Another finding was the age-gender correlation which could be noticed, for example, for a variant of the GOAT vowel and T-to-R contrasted with glottalised /t/. Variants perceived as more female sounding were also evaluated as older sounding, whereas variants found to be definitely male sounding were also rated as younger sounding.

It seems that after removing the cue of gender specific fundamental frequency social class of the speaker became the most salient social-indexical feature. From the evaluations of speaker social-class presented in the Results section, is it clear that listeners seemed to be quite sensitive to this type of indexical information and correctly identified patterns conditioned by social class of the speaker. It may be worth mentioning at this point that a number of participants reported feeling uncomfortable having to evaluate social class of the speaker.

It should be pointed out that perhaps different results would be obtained from listeners older than the current group. Especially perception of speaker age could differ. Even though the scales used in the study had clearly defined end points, it is common knowledge that the general perception of age and what or who is thought to be young or old varies between age groups.

From the results presented above it is clear that listeners were able to extract speaker-indexical information from phonetic segments alone. Even though the success rate varied between variants and depended on the social-indexical feature being evaluated, the present study provides evidence that speaker social-indexical information is identifiable at the segmental level.

References


