Yorkshire Assimilation: Exploring the Production and Perception of a Geographically Restricted Variable

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Abstract

This paper investigates a process referred to by Wells (1982) as "Yorkshire Assimilation," which is a process of assimilation in which voiced obstruents become fully devoiced when followed by a voiceless segment. The process is thought to occur only in Yorkshire, England. There is very little existing literature on Yorkshire Assimilation and, when it is discussed, it is described as a phonological rule, i.e., it is thought to be used categorically by those speakers who display the feature (Wells 1982:367; Petyt 1985:148). This paper presents the first empirical account of Yorkshire Assimilation. Using both historical and contemporary speech data from Huddersfield, West Yorkshire, we explore the extent to which Yorkshire Assimilation is indeed variable, how its use has changed over time, and how it is constrained by both linguistic and social factors in speech production. We also couple this production study with a small perception experiment designed to tap into the social meaning of Yorkshire Assimilation in Huddersfield.

Keywords

Yorkshire English, Yorkshire Assimilation, phonological variation, matched guise

1. Introduction

Voice assimilation can be observed across all documented varieties of English in connected speech (Giegerich 1992:289). Assimilation of voicing can occur where word-final voiced consonants are followed by their word-initial voiceless counterparts, for example /ð/ can be realized as [θ] in phrases such as *with thanks* (Cruttenden 2001:283). Canonical descriptions of voice assimilation suggest that only regressive assimilation (i.e., a segment is affected by a sound that follows it) is found across morpheme and word boundaries in English (Berg 1998:116). In the majority of cases, voiced sounds assimilate to a following voiceless sound; voiceless sounds rarely acquire voicing (Roach 2000:140-141).[1] In some cases, assimilation is embedded in the (morpho)phonology as an invariant "rule," e.g., progressive assimilation of voice is observed in genitive and plural markers in English, so that [s] is found only after voiceless consonants and [z] after voiced segments, for example [kats] and [dɒgz].

In Yorkshire, England, a specific type of assimilation known as "Yorkshire Assimilation" has been documented in the dialect literature (see, e.g., Wells 1982; Trudgill 1999). We explore both the production and perception of Yorkshire Assimilation (hereafter YA) in this paper. The same general principles of assimilation outlined above also apply to YA, i.e., YA can be observed in environments where a voiced obstruent is immediately followed by a word beginning with a voiceless segment.[2] Examples (1), (2), and (3) show the voiced plosives /b/, /d/, and /g/ undergoing YA (all extracts are from the Huddersfield Corpus; see 2.1 for discussion of the corpus).

(1) When I was born we used to have a bi*g t*ub and a-a boiler (Bertha, generation 1, born ~1890-1899).

(2) Haven't you to look around the golf clu*b s*ee if there's anybody on the course (Bertha, generation 1, born ~1890-1899).

(3) […] there were some goo*d t*imes (Leah, generation 1, born ~1890-1899).

In (1), /g/ in *big* assimilates in voicing to the following /t/ of *tub* and is subsequently realized as [k], giving [bɪktʊb]. In (2), /b/, the final segment in *club*, is realized as its voiceless counterpart [p] due to the following /s/ of *see*, giving [klʊpsi:]. In the case of /d/ (in 3), the process is slightly different. Rather than observing devoicing of /d/ in *good* to /t/, the outcome of YA is [ʔ]. Wells (1982:367) states that, for /d/, two processes can be observed: first, devoicing to /t/ occurs, which can then be subjected to word-final "t-glottalling." In the data we present here, there are no instances of devoicing to [t] or [tˀ], only observations of [ʔ]; thus, there is no evidence of the intermediate process taking place in Huddersfield.

In the more general connected speech process of voice assimilation, the voiced segment loses only part of its voicing (Cruttenden 2001:149-217). Wells (1982:366-367) claims that, during YA, the voiced obstruent is fully devoiced and cannot be distinguished from its voiceless counterpart, e.g., /b/ is realized as [p] rather than [b̥]. This phonetic difference was confirmed by Firth (1991), who conducted an acoustic analysis of /b/, /d/, and /g/ in environments where YA could occur and found that assimilated tokens do not carry any voicing whatsoever. There is also reason to believe that YA is constrained by both regional and social factors in ways that again set it apart from more general cases of voice assimilation in English. When considering the geographical regions where YA is heard, Wells (1982:367) admits that little is known; however, he does comment that "it is certainly general throughout West and South Yorkshire, where in the local accent it seems to be virtually categorical as a phonological rule of connected speech." Wells (1982:367) goes on to contend that, he would not be surprised to find the feature in use in North Yorkshire, Cleveland, and Humberside. Similarly, Hughes, Trudgill, and Watt (2005:95) assert that /b/, /d/, and /g/ are devoiced in

West Yorkshire "and other areas of Yorkshire," a vague statement which implies that the exact distribution of the feature is unknown. Finally, Trudgill (1999:70-71) claims that YA is found in the West Yorkshire locations of Halifax, Huddersfield, Bradford, and Leeds, in addition to York in North Yorkshire. Firth's (1991:24) statement that YA occurs "not 100% of the time (but the less slow and careful the speech is, the more frequently it seems to take place)" also points to potential social conditioning as it may pattern according to speech style, in the Labovian sense of the amount of attention paid to speech (Labov 1972:94-99).

Very little is known about the history, distribution, and sociolinguistic salience of YA, but given the apparent phonetic and social distributional differences between the general case of voice assimilation in English and YA, there is reason to treat this phenomenon as a sociolinguistic variable and to further investigate the linguistic and social constraints on its use. In this paper, we present the first empirical analysis of YA. We focus on the realization of word-final voiced plosives with a following voiceless environment. It is unclear from the scant existing literature on YA which obstruents undergo YA, however there is agreement in the literature that voiced plosives can (Wells 1982:367; Trudgill 1999:70; Hughes, Trudgill & Watt 2005:95), hence our decision to restrict the analysis to only voiced plosives in this instance. Our initial exploration of YA revealed that while it can occur in word-medial and word-final environments, word-medial sites of variation accounted for only around 3 percent of the possible sites of variation; to avoid model convergence issues in the statistical work we present here, we focus only on word-final sites of variability.

In section 2, we describe the methods used to explore both the production and perception of YA in Huddersfield. We describe a new corpus of historical and contemporary speech data from Huddersfield, West Yorkshire, which allows us to explore the variable production of YA in some detail, and we couple the production study with a matched guise perception experiment. Section 3 details the results of these studies and section 4 discusses these results

in light of some of the social changes which have affected Huddersfield in the past fifty years.

2. Methodology

2.1. Speech Production Data: The Huddersfield Corpus

The speech production data analyzed in this paper comes from a new spoken corpus from Huddersfield, West Yorkshire. This new corpus is composed of two sub-sections of speech data, collectively spanning over one hundred years of apparent time. One sub-section of the corpus contains personal accounts of historical events and social change in the Kirklees area of West Yorkshire, recorded by the Kirklees Council for the Kirklees Sound Archive.[3] Twenty-eight speakers were selected from the Kirklees Sound Archive. These speakers all fulfilled the criteria of having been born and raised in Huddersfield, and having held manual occupations (i.e., they are "working class" speakers and so are presumed to use the most non-standard variety in the region; cf., Trudgill 2000). The sample represents (roughly) equal numbers of males and females across three generations with birth dates ranging from 1890 to 1930. This was then supplemented by thirty-four recordings collected in 2008 by the first author with working class people living in Huddersfield. These recordings are in the form of standard sociolinguistic interviews with a focus on questions about the participant's past to make the genre as similar as possible across the whole corpus. This sub-section of the corpus contains recordings from equal numbers of males and females, across three further generations, with birth dates ranging from 1933 to 1992. Table 1 gives full details of the composition of the Huddersfield corpus.

[TABLE 1 HERE]

The historical data from the Kirklees Sound Archive were first digitized, and then interviews from both sub-corpora were fully transcribed in Transcriber (version 1.5.1).[4] This amounted to a corpus of over 310,000 words: 130,000 from the Kirklees Sound Archive and 180,000 from the sociolinguistic interviews (for more information about data collection and transcription of the Huddersfield Corpus, see Whisker 2012). In section 3.1, we discuss how we searched this corpus for instances of YA and explored the patterns in this data using statistical methods. For the moment, we will explain (in 2.2) how we collected the speech perception data for this paper.

2.2. Speech Perception Data: The Matched-Guise Experiment

It has been long established in studies of speech perception and accent variation that listeners hold various attitudes towards speakers with different regional and social accents (e.g., Giles 1971a, 1971b, 1992; Giles & Powesland 1975). The vast majority of studies which have attempted to quantify listener attitudes towards different linguistic varieties have used a version of the "Matched Guise Technique" (MGT; Lambert, Hodgson, Gardner & Fillenbaum 1960). In its original format, the MGT required a single bilingual or bidialectal speaker to be recorded producing the same linguistic content (usually a reading passage) in two "guises" (either in two languages or two dialects). Listeners were then played these recordings mixed in with other voices to act as fillers or foils, and they were told that they were listening to different speakers. They were asked to evaluate these speakers on a range of personality traits such as intelligence, friendliness, kindness, ambition, leadership, and sense of humor. Because the content and other paralinguistic cues such as voice quality and speech rate are kept constant (in so far as this is possible), any differences in the evaluation of the two experimental guises can be attributed to covert attitudes towards speakers of these linguistic varieties.

The success of the original MGT experiment meant that the methodology was quickly replicated and adapted, often to investigate underlying attitudes towards accent varieties within monolingual communities. Within the UK, for instance, the MGT was employed to elicit reactions towards regional accents in England (Giles 1971a; Giles, Harrison, Creber, Smith & Freeman 1983; Giles, Coupland, Henwood, Harriman & Coupland 1990; Dixon, Mahoney & Cocks 2002), Welsh accented English and RP (Giles 1971b; Brown & Bradshaw 1985), English and Scottish varieties in Scotland (Cheyne 1970; Abrams & Hogg 1987), and regional accents in Ireland (Edwards 1977).

As far as can be ascertained, only one study has ever attempted to explore language attitudes in Yorkshire, and this research was carried out in the 1980s. Petyt (1985) used both direct and indirect approaches in an attempt to elicit attitudinal responses from his participants. Initially, participants were asked to self-report their own use of particular linguistic features, and then they were asked to judge a number of recordings using an adapted version of the MGT (Lambert, Hodgson, Gardner & Fillenbaum 1960) in which Petyt (1985) attempted to explore how listeners reacted to different linguistic variables in the West Yorkshire dialect. Petyt (1985:298) designed a reading passage that consisted of individual sentences, each containing instances of one of ten linguistic variables of interest; however, YA was not one of them. Five of Petyt's acquaintances were recorded reading aloud the reading passage and these recordings were then played for listeners who provided evaluations. There were several methodological problems with this early study (e.g., Petyt [1985] states that he is interested in ten linguistic variables, but, upon close inspection of his reading passage, it becomes apparent that in most cases more than one of the target variables is included in the same extract), and so it is difficult to infer a great deal about the social meaning of variation observed in West Yorkshire from Petyt's (1985) results. In an effort to address this and elicit subjective reactions to the specific phenomenon of YA, we presented

participants with an adapted matched guise experiment using a much more tightly controlled set of experimental stimuli.

Listeners respond to numerous linguistic cues when evaluating speech. This is problematic when developing experimental stimulus which aim to elicit a response to a single element within speech. In order to be confident about which element a listener is responding to, all other possible cues in the speech need to be kept constant, if not identical. To do this, we followed the splicing method originally proposed by Campbell-Kibler (2006) in generating stimuli for our matched guise experiment.[5] A speaker from Huddersfield was recruited to read a short passage that we had constructed. The speaker first read it as naturally as possible without being given any specific instructions. They were then made aware of the variable of interest and asked to read the passage again using only the standard form (i.e., all final plosives were voiced).[6] Finally, they were asked to read it using only the non-standard form (i.e., all final plosives were voiceless before a following voiceless consonant).[7] To ensure that the recordings presented to listeners in the matched guise experiment were identical (aside from the manipulated variable), the initial base-line recording was digitally manipulated: every instance of the YA variable was first replaced with a copy of the corresponding standard variant from the standard reading. The new manipulated data was then saved as the standard version for that extract. The same procedure was followed to place YA variants into the baseline recording and this version was then saved as the non-standard recording of the extract. This resulted in two copies of each extract which are identical, with the exception of the variant that has been manipulated. As only the presence or absence of YA differs across the two conditions, we can be relatively confident that it is this element that listeners evaluated. So that listeners were not made aware of the two guises, and the specific feature being investigated here, we recorded speakers with other accents reading the same passage. These were used as fillers in the experiment.

Listeners are capable of perceiving a difference between read and spontaneous speech (Giles, Smith, Browne, Whiteman & Williams 1980; Blaauw 1994; Laan 1997), and so the decision to use a reading passage as stimulus is not an uncontroversial one, but we feel that the disadvantages of using spontaneous speech extracts in a matched guise experiment outweighed the benefits. We were especially concerned with being able to control the topic of the spoken stimuli, which can greatly affect evaluative judgements of a speaker (Heaton & Nygaard 2011), and we were also keen to make sure that no local dialect words occurred in the passage. This is particularly difficult to do when sampling speech data from an area with a distinctive regional dialect. The reading passage (see 4 below) was crafted so that it contained several potential sites of YA (in italics). As we will see when we discuss the results of our production study in section 3.1, the frequency of specific consonant clusters (i.e., combinations of the final segment of the first word and the first segment of the second word across a word boundary) is a relevant phonological constraint on YA in this speech community, and so we were sure to include a range of different sites of YA which represented different cluster frequencies in our spoken corpus. In other words, the passage was generated with an eye on how YA was used in our corpus of Huddersfield speech.

(4) I started a new *job two* weeks ago for a really *big firm*. On my first day I just *had to* watch them and not really do anything myself. It was a bit scary cause there was such a lot to take in. Now it's really *good cause* I know what I'm doing and feel a lot more confident, which I think is *good for* only two weeks of doing it.

The perception test was designed to be completed in the absence of the researcher to reduce any interviewer effects. Hay, Warren, and Drager (2010) have shown that in both

speech perception and speech production studies, even short-term exposure to the dialect of the experimenter can affect responses. The researcher running this experiment (the first author) is a native speaker of Yorkshire English, and so, if the researcher had conducted this experiment face-to-face, she may have inadvertently primed participants with YA immediately prior to the experiment. The experiment was therefore conducted online. Data were collected using the form creation facility provided by Google Docs. The experimental stimuli were held in MP3 format in a public folder in Dropbox storage. The files were then played directly from Dropbox when the survey was being completed.

The speakers who had taken part in the 2008 sociolinguistic interviews for the Huddersfield Corpus were re-contacted and asked if they would be willing to participate in an online voice survey. Although twenty informants expressed an interest, only seven individuals completed the survey: three aged 43–52 years old and four aged 20–22 years old.[8] To gain further young participants, the first author contacted a tutor at a further education college in Huddersfield who agreed to include the link to the survey on the virtual learning environment that their English Language A-level students (aged 16–18 years old) accessed on multiple occasions each week. Participants were asked to complete the survey if they considered themselves to be working class. This resulted in twenty-four additional responses from individuals who were born in Huddersfield, aged 16–18 years old, giving a total sample of thirty-one (see Table 2 for details).

[TABLE 2 HERE]

For each guise, participants were first asked to evaluate the age (college/university, early working life, mature working life, retired) and social class (working class, middle class) of the speaker. Then, following previous research in the MGT paradigm, subjective evaluations

of these guises were indirectly elicited using a questionnaire asking participants to rate the speaker according to eight adjectives, using a 6-point semantic differential scale. Figure 1 shows an example of the questionnaire. All questions follow the same structure: "How X do you think the speaker sounds?" (X = intelligent, friendly, reliable, responsible, confident, hard-working, interesting, old-fashioned, working class, trendy). These labels were chosen as they are used widely in attitudinal research to cover the core dimensions of status and solidarity, both of which listeners tend to relate to easily (Zahn & Hopper 1985; Giles & Billings 2004; Casesnoves & Sankoff 2004; Díaz-Campos & Killam 2012).

[FIGURE 1 HERE]

We will return to our analysis of the matched guise data in section 3.2. But first, we present our analysis of the speech production data in 3.1.

3. Analyzing Variation in Yorkshire Assimilation

3.1. Speech Production Data: Results from the Huddersfield Corpus

In order to explore the patterns of variation and change in YA in Huddersfield, all words ending in a voiced plosive and followed by a word-initial voiceless consonant were first extracted from the Huddersfield corpus. The voiced segment in the cluster was then coded as follows: a) standard realization (e.g., [b], [d], or [g]); b) YA realization (i.e., [p], [ʔ], or [k]); c) unreleased or fully deleted. The coding was done auditorily by the first author, and a random sample of the data was checked by the second author.[9] The distribution of YA shows that the feature has been in use in Huddersfield over the last century (see Table 3). Overall, it is clear that of the possible realizations, YA is the most frequent in the Huddersfield sample, accounting for around 60 percent of the data. Second to YA, 35 percent of tokens are

produced as the standard realization, and, in 6 percent of the tokens, the voiced obstruent is deleted.

[TABLE 3 HERE]

Handling deleted segments when investigating YA is problematic. It is important to note that in environments where YA of /d/ can occur, "coronal stop deletion" (or "-t,-d deletion") is also observed (see, e.g., Tagliamonte & Temple 2005). Where /d/ is found word-finally as an element within a consonant cluster (e.g., in *told* and *pound*), deletion of /d/ frequently occurs across speakers of all ages in a number of varieties of English (Labov 1989; Patrick 1992; Bayley 1994; Tagliamonte & Temple 2005). In this same environment, YA can also occur where a voiceless stop follows, as in phrases such as *told to* and *pound pack*. In instances of YA, /d/ not only assimilates in voicing, but also undergoes additional reduction to [ʔ]. It could be argued that, where deletion is observed in environments where YA can occur, it could potentially be a further reduction of [ʔ], similar to the lenition trajectory recognized in Liverpool English (Honeybone 2001:227). Consequently, where /d/ is deleted in the Huddersfield data, it could be accounted for by either YA or coronal stop deletion. To provide a true account of YA, all deleted realizations were omitted from the results rather than included as a debatable instance of YA. After discounting the excluded tokens, a total of 2462 tokens remained for further analysis.

[TABLE 4 HERE]

The results in Table 4 show that the four oldest Huddersfield generations (1-4, born 1890–1943) favor YA, with percentages ranging from 69 to 80 percent respectively. With a

rate of 44 percent, generation 5 (born 1953–1963) has a substantially lower rate of YA, while among the youngest speakers, generation 6 (born 1986–1992), only 10 percent of tokens have YA. These initial results suggest a sharp decline in YA over time. In order to fully understand the constraints operating on YA, and the extent to which they have changed or remained stable over time, we then fit binomial mixed-effects regression models to the data. The dependent variable was whether the voiced consonant in the cluster was assimilated in voicing (i.e., the standard realization and fully deleted forms were collapsed as alternatives to YA). The data were also coded for the following predictors:

- SPEAKER SEX (male, female)
- SPEAKER AGE GROUP (ordered categories over time; see Table 1)
- PHONOLOGICAL REPRESENTATION OF THE YA CONSONANT (i.e., /b/, /d/, /g/)
- PHONOLOGICAL REPRESENTATION OF THE FOLLOWING VOICELESS CONSONANT
- CONSONANT CLUSTER, i.e. YA consonant # following voiceless consonant(s), e.g., in *good times*, the consonant cluster is coded as [d#t]
- CLUSTER FREQUENCY (i.e., how frequent was [d#t]?)
- LEXICAL FREQUENCY (i.e., frequency of the token in which the YA consonant was present, e.g., the frequency of the word *good*)

For both frequency predictors (LEXICAL FREQUENCY and CLUSTER FREQUENCY), raw frequency was extracted from the Huddersfield corpus, and then this was converted to a logarithmic scale as is standard in work exploring the effects of linguistic frequency on variation because "there is evidence that humans process frequency information in a logarithmic manner—with differences amongst lower frequencies appearing more salient than equivalent differences amongst higher frequencies" (Hay & Baayen 2002:208). Binomial mixed-effect models were fit to the data by hand (see Baayen, Davidson & Bates

2008) using the lme4 package (version 1.1-10; Bates, Maechler, Bolker & Walker 2015) in R (version 3.1.2, R Core Team, 2012) with the bobyqa optimizer.

The PHONOLOGICAL REPRESENTATION OF THE YA CONSONANT (i.e., /b/, /d/, /g/) was included as a predictor in order to investigate whether one voiced plosive was more prone to devoicing than the others. The PHONOLOGICAL REPRESENTATION OF THE FOLLOWING VOICELESS CONSONANT explores whether some following environments encourage devoicing more than others. Clearly the third measure of phonological representation, the specific CONSONANT CLUSTER, is collinear with both of these previous measures. In order to avoid issues of collinearity, models were fit first with predictors coding for the PHONOLOGICAL REPRESENTATION OF THE YA CONSONANT and the PHONOLOGICAL REPRESENTATION OF THE FOLLOWING VOICELESS CONSONANT, and then models were fit with the CONSONANT CLUSTER as a predictor (i.e., without the PHONOLOGICAL REPRESENTATION OF THE YA CONSONANT or the PHONOLOGICAL REPRESENTATION OF THE FOLLOWING VOICELESS CONSONANT as a predictor). Finally, χ^2 likelihood tests compared which method of coding phonological environment provided the best model fit (i.e., whether the consonants should be coded as a cluster, or as two independent units). Further collinearities between predictors were checked for using the vif.mer function in R (Jaeger 2011).

Factors within the predictor SPEAKER AGE GROUP are naturally ordered categories (because speakers in category 1 are older than speakers in category 2, etc.). In an effort to ensure that the model recognized that these categories were ordered and not independent categories, this variable was treated as a continuous predictor in the model, which is to say that the model recognized the values 1-6 (age categories) along a scale. All continuous variables were fit as linear and non-linear predictors in separate models. Non-linear predictors used a restricted cubic spline function (rms package in R; Harrell 2016), which allows continuous data to vary from a straight line. The program default of three knots was

used in non-linear models; this simply means that the line was allowed to bend in three places. If continuous variables were found to significantly predict variation, $\chi 2$ likelihood tests were used to compare the linear and non-linear models and establish whether the non-linear component significantly improved the model. Model convergence issues were encountered when two-way and three-way interactions were tested, so the models presented here only contains main effects. Random intercepts for speaker and word were included, but, given the relatively small data set, convergence issues were again encountered when random slopes were included.

Typically, a linear regression model such as this assumes that the effects of a speaker's age (or SPEAKER AGE GROUP in this case), treated here as a continuous predictor, are the same across the dependent variable, and so it attempts to fit a straight line or linear correlation between the continuous predictor and the dependant variable. When we model the effects of SPEAKER AGE GROUP in this way, we find that there is indeed change over time: YA is a recessive feature that is disappearing over time with far fewer younger speakers (those in age group 5, born 1953–63, and 6, born 1986–92) using the voiceless variant. This can be seen Figure 2. However, when we allow the continuous variable of SPEAKER AGE GROUP to bend along a series of three knots, a very different shape emerges showing that the relationship between a speaker's age (group), and their use of YA is far from straightforward. This is plotted in Figure 3. The best fit model (see Table 5) is the one which allows age to function in a non-linear way. In other words, by not simply assuming a linear correlation between SPEAKER AGE GROUP and the YA variable, but, by allowing age to vary non-linearly with respect to YA, we are able to reach a better statistical model and so account for more of the variation in YA. Only the significant effects are presented in Table 5.

[FIGURE 2 HERE]

[FIGURE 3 HERE]

[TABLE 5 HERE]

The estimate column shows the effect of each independent variable on the log odds of YA and the significance of these effects is shown in the final two columns (* = $p \leq 0.05$; ** $p \leq 0.01$, *** $p \leq 0.001$). Only two predictors were found to significantly constrain variation in YA: SPEAKER AGE GROUP and the CLUSTER FREQUENCY (a measure of how frequently the final segment of the first word and the first segment of the second word across a word boundary occur in the corpus). SPEAKER AGE GROUP is the only significant non-linear predictor so two values are reported representing the first and second points of a three-knot restricted cubic spline. This effect is plotted in Figure 3 to aid interpretability.

We can see that YA is much more likely among the older speakers in the corpus; indeed, the phenomenon was apparently gaining ground in this variety between 1890 and 1930 (age groups 1-3). The rise in YA over this time is statistically significant (this result is reported with a *p*-value of 0.027363 in Table 5). Between 1933 and 1943 (age group 4) we can see a slight shift in frequency of YA, and from the mid 1950s (age group 5), the phenomenon begins to decline. The difference between the likelihood of YA in age group 4 (born 1933–1943) and age group 6 (born 1986–1992) is highly significant (this result is reported in Table 3 with a *p*-value of 2.92E-09).

Another significant predictor of YA in Table 5 is CLUSTER FREQUENCY, i.e., the frequency of the combination of the voiced plosive consonant and the following voiceless consonant in our corpus. Although this linguistic constraint is significant, it is much weaker than the social predictor SPEAKER AGE. This effect is visible in Figure 4.

[FIGURE 4 HERE]

We can see from Figure 4 that CLUSTER FREQUENCY has a fairly steady and (unlike SPEAKER AGE GROUP) predominantly linear effect on the likelihood of YA. All things being equal, the higher the frequency of the consonant cluster, the more likely it is that the voiced plosive will assimilate in voicing to the following voiceless segment. This means that YA is more likely to occur in a word ending in /d/ when the next word begins with /t/ (the most frequent combination of voiced plosive + voiceless consonant e.g., *seemed to*), than in a word ending in /g/ when the next word begins with /ʃ/ (the least frequent cluster of voiced plosive + voiceless consonant, e.g., *big sheet*). It is likely that this effect is being driven by a general tendency that has been noted across many studies for reduction and lenition to occur earlier (in the historical sense), and, to a greater extent, in high frequency phrases (Hooper 1976; Bybee & Scheibman 1999; Bybee 2000:2001). We explore these frequency effects in more detail in 4.1.

3.2. Speech Perception Data: Results of the Matched Guise Experiment

In the speech perception experiment, listeners were exposed to two guises and asked to evaluate them on a range of social attributes: listeners were asked to answer "How X do you think the speaker sounds?" where 'X' = intelligent, friendly, reliable, responsible, confident, hard-working, interesting, old-fashioned. Guise 1 was the standard guise where all final voiced plosives are realized as voiced, and guise 2 was the YA guise where all final voiced plosives were realized as voiceless. In order to explore the possible social salience and social meaning of YA in Huddersfield, mean responses to these two were compared statistically using the dependent *t*-test. The results of this analysis are presented in Table 6.

[TABLE 6 HERE]

Listeners evaluated the YA guise significantly differently from the standard guise on two social dimensions. The clearest difference between these guises is that a speaker using YA variants is perceived to be more old-fashioned than the same speaker using the standard variants ($p = 0.0007$). This result likely reflects the actual decrease in YA among Huddersfield speakers over the last century; as indicated in Table 4, the youngest generation (born 1986–1992) have only 10.4 percent YA (and only in fixed lexical items and high frequency phrases), compared with the oldest four generations (born 1890–1943) who average 80 percent. While age and old-fashioned are not exactly the same, it seems reasonable that a variant which is used almost exclusively by older speakers in a speech community would come to be imbued with the social meaning 'old fashioned.'

The second significant difference in evaluations is with respect to friendliness ($p = 0.0183$). As shown in Table 6, the guise with YA is judged as significantly more friendly than the same speaker using standard voiced plosives in word-final position. This is, perhaps, a surprising result as YA is clearly a feature that the younger Huddersfield generation do not use as often, yet they evaluate the YA variants more positively (at least with respect to friendliness) than the standard variants they themselves typically use.

4. Interpreting Results: Production and Perception of Yorkshire Assimilation in Huddersfield

4.1. Interpreting the Speech Production of YA in Huddersfield Over Time

In section 3.1, we found two main factors constraining the production of YA over time: SPEAKER AGE GROUP and CLUSTER FREQUENCY. In this section, we explore these patterns further.

The pattern of change that we saw emerging when we allowed age (or apparent time) to behave non-linearly is methodologically interesting because the vast amount of work in language variation and change continues to fit a linear model to apparent time data (although see recently, e.g., Hay & Foulkes 2016). It is also interesting from a sociolinguistic and historical perspective. This is because the noteable reduction in the use of YA occurs alongside a great economic change that affected Huddersfield.

For the first half of the twentieth century, Huddersfield was a flourishing town.[11] The town's prosperity came from the textile industry: it was famous for its fine quality textile goods. Industry resulted in villages emerging around the numerous mills, and inhabitants often worked and lived within their mill community. The success in textiles meant that engineering became the second most important industry in the town. Local engineering companies supplied much needed equipment to the textile mills that lined Huddersfield's valleys. In addition to textiles and engineering, the economy in Huddersfield was boosted by trade in chemical works and metal works, and, in the more rural areas surrounding the town, iron and coal mines (Haigh & Gillooley 2000).

However, the latter part of the twentieth century saw a rapid decline in the textile industry which naturally resulted in the beginning of massive changes in the economy. Partly to blame was the increase in competition from overseas, which quickly became a serious threat to cloth production in Huddersfield from the 1970s onward (Haigh & Gillooley 2000:16). In turn, this sudden decline led to a sharp rise in unemployment which was well above the national average (Haigh & Gillooley 2000:17). Generations 1-4 (born 1890–1943) were of working age during the period when there was sufficient work in the textile industry and associated industries for Huddersfield residents. However, the high demand for workers had all but disappeared within a decade. Consequently, by the late 1960s and early 1970s,

numerous mills and industrial firms which relied on the textile industry for business closed down.

These sudden changes in the Huddersfield economy had consequences for those speakers from generation 5 (born 1953–1963), who were due to start work between 1970–1980. Generation 5 was the first age group which did not have the option to work in the traditional industries that were available to the previous generations; consequently, many entered into the newly opened service industries which today account for the majority of the town's employment and income.[12] Because of the shift from manufacturing to service industries in Huddersfield, Generation 5 Huddersfield residents were much more likely to have daily contact with speakers from a wider geographical area than older generations were. Indeed, those Generation 5 individuals who did find work in the manufacturing sector found themselves working in more diverse roles withing smaller companies. These job roles involved conversing over the telephone with non-local clients and traveling outside of the Huddersfiled area to install the products produced on site, rather than solely remaining in the workshop. Prior to the decline in industry, individuals worked, socialized, and shopped within the communities where they lived and consequently belonged to tight social networks, which have been perceived to promote language maintenance rather than variation and change (Milroy & Milroy 1997; Milroy 2002). Several of the larger mills in Huddersfield even provided accommodation, shops, and pubs for workers; thus, employees had no need to venture further. However, when the mills closed, the social networks weakened as townspeople traveled further afield. These are social conditions which are known to promote dialect leveling (Milroy 1987). Consequently, it is possible that the decline of YA can be attributed to an increase in dialect contact (Trudgill 1986) involving service industry workers in West Yorkshire and beyond, circumstances which have had similar outcomes in other locations (see, e.g., Nichols 1976). Furthermore, Milroy (2002) argues that in contact

situations, features that are evaluated negatively can be avoided in favor of more widespread, non-local features. Interestingly, in Huddersfield it is predominantly the younger speakers who are evaluating YA as old fashioned. Investigations of language change amongst younger people have led to claims that there is a desire to sound like modern speakers, and this motivates speakers to avoid local features and use more widespread variants (Watt & Milroy 1999; Watt 2002). As YA is geographically restricted within Yorkshire, increased contact with the wider Yorkshire area would result in Huddersfield speakers coming into contact with individuals who do not use the feature, resulting in regional dialect leveling (Kerswill 2003).

The second important pattern observed in the statistical model presented in section 3.1 is that the probability of YA is highly predicted by the CLUSTER FREQUENCY of the word-final + word initial consonant cluster (i.e., the frequency of the co-occurrence of the final segment of the first word and the first segment of the second word across a word boundary). This was a surprising result to us, and, in an effort to understand the relationship between consonant clusters at the word boundary and word frequency, we turned to literature on word predictability. Transitional probability is a measure of the predictability of a word in context. Transitional probability, also known as word predictability, has been found to be a predictor of various reduction or lenition phenomena including word-final t/d deletion (Jurafsky, Bell, Gregory & Raymond 2001), syllable onset t/d deletion (Raymond, Dautricourt & Hume 2006), word shortening (Raymond, Jurafsky & Bell 2001), and nasal place assimilation (Turnbull, Seyfarth, Hume & Jaeger 2018. It was also found to be a successful predictor of French “liaison,” another word-boundary phenomenon (but one which is not reductive in nature as it refers to the process of inserting a consonant between two words) after many studies pointed to the possibility that liaison was likely to occur in environments where there was more “cohesion” between lexical items (Côté 2013). The transitional probability of each word in the data set was calculated using the following formula:

$$\text{Tp} = \frac{\textit{Frequency of YA word + following word (i.e. bigram frequency)}}{\textit{Frequency of YA word (word 1 of the bigram)}}$$

This provides a ratio which highlights the predictability of word 2 in a bigram, given word 1, in a particular sequence. For instance, the word *tend* is only ever followed by the word *to* in the Huddersfield Corpus (seventeen times) and so this bigram has a very high transitional probability; word 2 is highly predictable from word 1:

Tend to (*N* 17)

Tend (*N* 17) = 1 tp

The word *could* is much more "promiscuous" and can co-occur with lots of words; the contexts following the lexical item *could* are therefore much less predictable (and so have a lower transitional probability):

Could see (*N* = 18)

Could (*N* = 471) = 0.038216561 tp

Could smell (*N* = 2)

Could (N = 471) = 0.004246285 tp

Côté (2013:163) finds that liaison is "favored in contexts where there is minimal uncertainty over the nature of the coming element." We were interested to know whether "minimal uncertainty" or the predictability of a word in context could also help to predict the

likelihood of YA, and so we ran the statistical model again but included TRANSITIONAL PROBABILITY as a predictor (see Table 7).

[TABLE 7 HERE]

As expected, the non-linear effect of AGE GROUP is still a highly significant predictor of YA in this model, and the effect patterns in the same way as in Table 5. We can note the positive estimate of the first age result, which corresponds to a significant positive slope between age groups 1–3, and the highly significant negative estimate for the second age result, which corresponds to a steep negative slope between age groups 4–6, born 1933–1992. In this new model, which includes TRANSITIONAL PROBABILITY, CLUSTER FREQUENCY was no longer significant, which means that whatever the motivation for the significant correlation between cluster frequency and YA, this is now better captured by the measure of TRANSITIONAL PROBABILITY. As a main effect, TRANSITIONAL PROBABILITY does not reach significance but in interaction with the lexical frequency of the YA word, this effect is highly significant (p = 2.08E-09). The interaction between LEXICAL FREQUENCY and TRANSITIONAL PROBABILITY of the likelihood of YA can be seen more straightforwardly in Figure 5.

[FIGURE 5 HERE]

The y-axis shows the likelihood of YA,[13] the x-axis shows the transitional probability of word 2 given word 1, and the lexical frequency of word 1 in the bigram is shown using different slopes.[14] With the exception of words with very low lexical frequency (bottom slope or red slope if viewing online), there is a significant positive interaction between the frequency of word 1 in a bigram and the predictability of word 2. As LEXICAL FREQUENCY

and TRANSITIONAL PROBABILITY (or predictability) both increase (the values on each slope increase; this indicates increases in lexical frequency), so too does the likelihood of YA. This means that there is a much greater likelihood of finding YA in, e.g., *had to*, which is characterized by both high lexical frequency of word 1 and high transitional probability, than in, e.g., *intended to*, which has high transitional probability (because the word *intended* only occurs with the following word *to* in this corpus), but the lexical item *intended* is very low frequency. Neither LEXICAL FREQUENCY nor TRANSITIONAL PROBABILITY in isolation is enough to predict YA, but, together, the effect is very strong ($p = 2.08E-09$).

The interaction between LEXICAL FREQUENCY and TRANSITIONAL PROBABILITY that we see here is similar to that found by Watson, Clark, and van Eyndhoven (in prep) in an analysis of T-to-R, another word-final, boundary phenomenon which, like YA, is also regionally restricted largely to the North of England (see, e.g., Broadbent 2008). T-to-R is a variable phenomenon in which word-final /t/ may be realized as a rhotic in the context of a following vowel-initial word (Clark & Watson 2011). In a small sample of speech from Liverpool, Clark and Watson (2011) found an intriguing relationship between LEXICAL FREQUENCY, BIGRAM FREQUENCY, and LIKELIHOOD OF T-TO-R in Liverpool English. In an effort to better understand this relationship, Watson, Clark, and van Eyndhoven (in prep) explored this phenomenon in a larger corpus of speech. They split LEXICAL FREQUENCY into higher and lower frequency (all T-to-R words are fairly high frequency as the process tends to effect predominantly monosyllabic words like *get* and *what*) and interacted this frequency measure with a measure of transitional probability (using the same method of coding transitional probability as described above). As with YA, Watson, Clark, and van Eyndhoven (in prep) found that there is some evidence of a relationship between lexical frequency, the predictability of a word in context, and the realization of the final consonant such that words which are both high in frequency and are in a predictable environment are more likely to

undergo lenition. Interestingly, Watson, Clark, and van Eyndhoven (in prep) suggest that this result is not divorced from social motivations of variation and change, but may instead be capturing a social fact: as tokens with high transitional probability, by definition, regularly co-occur, so they can act as salient exemplars of a feature. That is, bigrams like *lot of* or *bit of* (in the case of T-to-R; Clark & Watson 2011) and possibly *had to* (in the case of YA) are more likely to act as linguistic stereotypes than something like *it all* (T-to-R) or *accustomed to* (YA), because of the greater entrenchment of bigrams with high transitional probability.

In summary of our results and findings from the production study, YA has undergone a great deal of change over time in Huddersfield. The current data suggest that until the 1930s, YA was used productively and was increasing in frequency in Huddersfield. In the present day variety, there is still some evidence of YA, but it appears to be becoming lexicalized. We attribute this shift in the frequency and use of YA to social and economic changes affecting the town in the 1960s and 1970s. During this time, Huddersfield underwent a rapid shift from traditional industry-based employment to service-based employment, disrupting social networks and creating more opportunities for contact with speakers from outside of Huddersfield. The changes in YA were also constrained by frequency (both lexical and phonological frequency) and predictability in interesting ways, which adds to existing work exploring phonological variability in word-final contexts.

4.2. Interpreting the Social Meaning of YA

There is a great wealth of work in sociolinguistics which attempts to establish a connection between ongoing sound change and speaker's attitudes towards innovative and relic linguistic features (e.g., Campbell-Kibler 2007; Llamas 2007; Haug-Hilton 2010; Haddican, Foulkes, Hughes & Richards 2013; Watson & Clark 2015; Kristiansen 2015). By exploring language

attitudes in this case, we hope to be able to offer additional explanations for the patterning of YA while exploring the social meaning of YA in this community.

In 3.2, we showed that there were two main social attributes which were evaluated significantly differently between the YA guise and the standard guise. First, listeners evaluated the guise with YA as sounding more old-fashioned than the guise with no YA. Importantly, it is primarily the youngest generation who completed the responses to the perception survey. In other words, the youngest generation, who make little use of YA in production, associate the variable with old-fashionedness (which is not necessarily the same, but certainly related to, old-age). From these results, it is important to note that we cannot simply presume that younger speakers are avoiding YA because they judge users as old-fashioned. Rather than being the cause of the decline of YA, judgements may simply reflect observations of variation within their community. We have shown in section 3.1 that this feature is in decline in this community and is used in production more by older speakers. In this section, we have shown that speakers/listeners in this community have some awareness that this feature indexes old-fashionedness, and this is likely because they associate its use with older speakers.

Second, listeners evaluated the guise with YA as significantly friendlier than the guise without YA. It has been shown before that listeners may indeed evaluate their own varieties more negatively than other varieties. For example, Edwards' (1977) research into varieties of Irish English in Dublin revealed an overall negative evaluation of the Dublin guise, and Miller (2009) reports negative evaluations of Swiss speakers' own variety in comparison to other French speakers. According to Trudgill (1986), a favorable attitude plays a key role in the adoption of a feature; however, the notion of what counts as "favorable" is difficult to define. Language attitudes are not simply positive or negative, favorable or disfavorable. Attitudes themselves are complex mental processes combining affective, cognitive, and

behavioral information (Erwin 2001:13; Huskinson & Haddock 2004:82). Affective information is comprised of an individual's feelings; cognitive information refers to the beliefs or thoughts an individual holds; finally, behavioral information involves any previous or intended associated behavior (Huskinson & Haddock 2004:82-83). For example, an individual may feel positively about the Yorkshire accent, and YA in particular (affective information); they may believe all people from Yorkshire are friendly (cognitive information); and they may choose to live there (behavioral information). Typically, positive feelings occur alongside positive beliefs and positive behaviors; but in this case, young listeners seem to be expressing two types of contradictory affective information simultaneously: YA sounds friendly, but also old-fashioned (with the implication that it is perhaps associated with older people, as have seen in the production data). The strength of association between YA and the social trait "old fashioned" is stronger for these listeners and so it is no surprise that, when it comes to behavior (i.e., using YA or not), this trumps the positive association with friendliness.

Overall, it appears that listeners are able to identify differences between YA variants and their standard equivalents as there are significant differences in evaluation for some characteristics; however, the feature is only associated with old-fashionedness and friendliness: speakers who use YA are viewed as old-fashioned (and, as we have seen in the production study reported in 3.1, also likely older in age) and friendly. We assume that this feature therefore indexes both a positive (friendly) and negative (old-fashioned) social meaning. Trudgill (1986) suggests that if attitudes are negative, features are more likely to be avoided. We have shown, however, that the binary distinction between positive and negative attitudes is an idealistic simplification. Speakers can and do express competing positive and negative attitudes towards linguistic variants and so the hypothesized relationship between negative attitudes and low use of a specific variant is much more complex in reality. With

respect to the other social characteristics in our perception study, it is difficult to know why the guise with YA and without YA were not evaluated significantly differently. It may be that the social meaning of YA is simply friendly and old-fashioned, that we have not accurately captured the social meaning of YA with our character traits, or that we need more data from a wider sub-set of the speech community to explore this further.

5. Conclusion

We have shown that while YA was once a productive (but variable) phonological process in this dialect, its frequency of occurrence has declined rapidly in recent years. We propose that the timing of the decline of YA is interesting because it correlates with massive social and economic changes taking place in Huddersfield. Furthermore, current mainstream approaches to statistical modeling in sociolinguistics which standardly treat age/apparent time as a linear variable would have reported this as a change in progress but would have missed the fact that YA began to decline in Huddersfield at the same time as industry began to decline. We have also shown that the variable patterns in interesting ways with respect to linguistic constraints and have usefully utilized a measure of transitional probability to help us better understand the relationship between the process of YA and lexical frequency.

Today in Huddersfield, YA is still variably in use among older speakers, but it is a marginal variant among younger speakers, and it is only found in high frequency constructions or local place names. Although it is rarely commented on in the local dialect literature or, indeed, by listeners themselves, suggesting that YA is not especially salient, younger speakers from Huddersfield seem to have some passive knowledge of this phenomenon and its social distribution across the community. In the perception experiment, we found that younger speakers evaluate guises containing YA as sounding significantly older and more friendly than guises with standard voiced plosive realisations.

Exploring both the subtle patterns of change over time and the social meaning of this variable has led to a much better understanding of how these two things are connected; how language attitudes or social meanings can result from patterns of language variation and change within the community. YA is used more by old people in this community—it is a relic form—and so it is no surprise that YA indexes the social trait old-fashioned, at least for young listeners in Huddersfield. We have also highlighted the complex nature of the role of language attitudes in sound change. Linguistic features can simultaneously index both positive and negative social meanings (e.g., younger listeners perceive YA as old-fashioned but also friendly), and so the claim (by Trudgill 1986) that linguistic features which are negatively evaluated are ultimately avoided is overly simplistic.

Finally, it has been argued elsewhere that sociolinguistic research needs to consider both the constraints that are typically observed operating on language use alongside the meanings that listeners attach to specific language use in order to fully understand variation and change in language (Ryan, Giles & Sebastian 1982). Our research has drawn upon the fields of variationist sociolinguistics and social psychology in an attempt to do just that. The combination of methods used here has informed our understanding of variation and change observed in an understudied phonological process known as Yorkshire Assimilation, and we encourage further studies in this vein.

Notes

1. A possible example of a voiceless segment acquiring voicing would be "T-to-R" whereby, in some varieties of British English such as Liverpool English, /t/ is produced as a rhotic after a short vowel, before a vowel-initial word (see, e.g., Wells 1982:370; Clark & Watson 2011).

2. This process can also occur word internally, e.g., in *Bradford*, but as this is relatively rare word-internally, we are focussing here on voicing assimilation across a word boundary.

3. For more information on the Kirklees Sound Archive see the Researcher's Guide to Screen Heritage, "KIRKLEES COMMUNITY HISTORY SERVICE." Available at: http://bufvc.ac.uk/archives/index.php/collection/269 (25 Jan 2018).

4. Transcriber was downloaded from: http://trans.sourceforge.net/

5. This method has since been replicated in numerous studies which have attempted to explore the social meaning of a single phonological variable, including Labov et al. (2011), Levon and Fox (2014), and Watson and Clark (2015).

6. Spectographic analysis confirmed that the variants used were fully voiced.

7. Spectographic analysis confirmed that the variants were fully devoiced.

8. Due to the small number of responses from this age group, we are unable to offer detailed comparisons of responses according to listener age; however, the overall responses provide valuable insight into the evaluation of YA at least within the youth of the Huddersfield speech community

9. These recordings were collected, for the most part, in the homes of our participants and so there is often low-level background noise affecting the quality of the recording. This has made it impossible to conduct an acoustic analysis of voicing for every speaker. However, we have inspected spectrograms for the few recordings which were less affected by low-level background noise, and it is clear that the phonological voiced obstruent is indeed fully devoiced, as was reported by Firth (1991). The length of the hold phase of the plosive also appears to be longer when the stop is undergoing YA. See Whisker (2012:176) for further details.

10. At the request of one reviewer, we provide here some further examples of contexts in which YA was found for the youngest age group: *tried to, told to, hundred pound, find people, forward to, Greenhead Park.*

11. Local people claim that there were more Rolls Royce motorcars per head than in any other location in England (Whitwam 2011).

12. Examples include local authority jobs, Calderdale and Huddersfield NHS, and jobs in further and higher education at Kirklees College and the University of Huddersfield. See Whisker (2012) for further details.

13. Previous plots showed the probability of YA. If we use probability on the Y axis here in the interaction, the graph becomes more "squashed," and it is harder to see the (statistically significant) trends, so, in this instance, to aid in visualizing the data, we have chosen to display likelihood (the default y-axis scale for plotting mixed effects regression models) rather than converting likelihood to probabilities.

14. The plotting function plotLMER.fnc "bins" the continuous variable "lexical frequency (log)" into quartiles as there is no straightforward way to plot an interaction between two continuous variables.

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TABLE 1

Composition of the Huddersfield Corpus by Speaker Sex and Age Group

	Generation (birth year)						
	1 (born 1890–99)	2 (born 1900–10)	3 (born 1920–30)	4 (born 1933–43)	5 (born 1953–63)	6 (born 1986–92)	
Male	2	5	6	6	6	5	30
Female	3	6	6	6	6	5	32
Total	5	11	12	12	12	10	62

TABLE 2

Demographic Composition of the Perception Experiment on YA

	Age		
Sex	16–18	20–22	43–52
Male	9	1	0
Female	15	3	3
Total	24	4	3

TABLE 3

Overall Distribution of YA Variants in the Huddersfield Corpus

Variant	%	N
YA	59.2	1524
Deleted segment	5.9	153
Standard realization	34.9	896
Total	100	2573

TABLE 4

Distribution of YA According to Speaker Age in the Huddersfield Corpus

Generation	% YA	Total number of instances of YA	Total number of word variable environments
1 (born 1890–1899)	68.9%	142	206
2 (born 1900–1910)	80.0%	434	542
3 (born 1920–1930)	77.7%	345	444
4 (born 1933–1943)	77.6%	305	393

5 (born 1953–1963)	43.8%	251	573
6 (born 1986–1992)	10.4%	47	451
Total		1524	2573

TABLE 5

Factors Constraining the Production of YA in the Huddersfield Corpus

	Estimate	Std. error	*z* value	*Pr*(>|*z*|)	
(Intercept)	-1.2376	0.7969	-1.553	0.120447	
Age groups, 1-3 (restricted cubic spline knot 1)	0.5696	0.2582	2.206	0.027363	*
Age groups, 4-6 (restricted cubic spline knot 2)	-2.2483	0.3788	-5.936	2.92E-09	***
Cluster frequency (log)	0.4958	0.1423	3.484	0.000493	***

TABLE 6

Results for the Evaluation of the Yorkshire Guise without YA and the Guise with YA

	Standard realization of final voiced plosives	YA realization of final voiced plosives
Old fashioned ($t(30) = 3.7796$, $p = 0.0007$, N = 31)		
Mean (M)	1.71	2.03
Standard Deviation (SD)	0.53	0.18
Standard Error (SE)	0.09	0.03
Friendly ($t(30) = 2.4968$, $p = 0.0183$, N = 31)		
Mean (M)	3.06	3.32
Standard Deviation (SD)	0.77	0.65
Standard Error (SE)	0.14	0.12
Trendy ($t(30) = 1.7472$, $p = 0.0857$, N = 31)		
Mean (M)	3.16	2.87
Standard Deviation (SD)	0.69	0.62
Standard Error (SE)	0.12	0.11
Reliable *($t(30) = 1.3056$, $p = 0.2016$, N = 31)*		
Mean (M)	3.23	3.06

Standard Deviation (SD)	0.80	0.63
Standard Error (SE)	0.14	0.11
Interesting *(t(30) = 1.1532, p = 0.2579, N = 31)*		
Mean (M)	2.87	3.03
Standard Deviation (SD)	0.72	0.87
Standard Error (SE)	0.13	0.16
Confident *(t(30) = 1.0946, p = 0.2824, N = 31)*		
Mean (M)	2.03	2.19
Standard Deviation (SD)	0.71	0.79
Standard Error (SE)	0.13	0.14
Intelligent *(t(30) = 1.0441, p = 0.3048, N = 31)*		
Mean (M)	3.19	3.03
Standard Deviation (SD)	0.79	0.71
Standard Error (SE)	0.14	0.13
Social class *(t(30) = 1.0000, p = 0.3253, N = 31)*		
Mean (M)	1.13	1.06
Standard Deviation (SD)	0.34	0.25
Standard Error (SE)	0.06	0.04
Responsible *(t(30) = 0.3868, p = 0.7016, N = 31)*		
Mean (M)	3.23	3.29
Standard Deviation (SD)	0.84	0.90
Standard Error (SE)	0.15	0.16
Hard working *(t(30) = 0.0000, p = 1.0000, N = 31)*		
Mean (M)	3.35	3.35
Standard Deviation (SD)	0.80	0.88
Standard Error (SE)	0.14	0.16

TABLE 7

Factors Constraining YA in the Huddersfield Corpus, Including TRANSITIONAL PROBABILITY

	Estimate	Std. error	*z* value	*Pr*(>|*z*|)	
(Intercept)	-0.05866	0.80988	-0.072	0.9423	
Age groups, 1-3 (restricted cubic spline knot 1)	0.63834	0.26473	2.411	0.0159	*
Age groups, 4-6 (restricted cubic spline knot 2)	-2.4064	0.39054	-6.162	7.20E-10	***

Lexical frequency (log) X Transitional probability	2.19498	0.36636	5.991	2.08E-09	***

Figure 1: Example of the Semantic Differential Scale Given to Participants in the Perception Experiment on YA

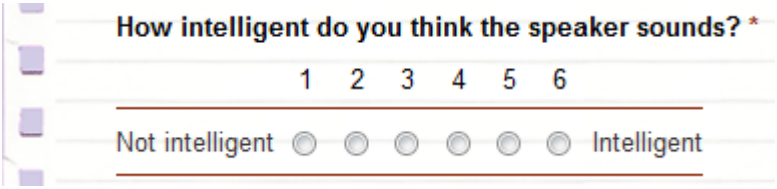
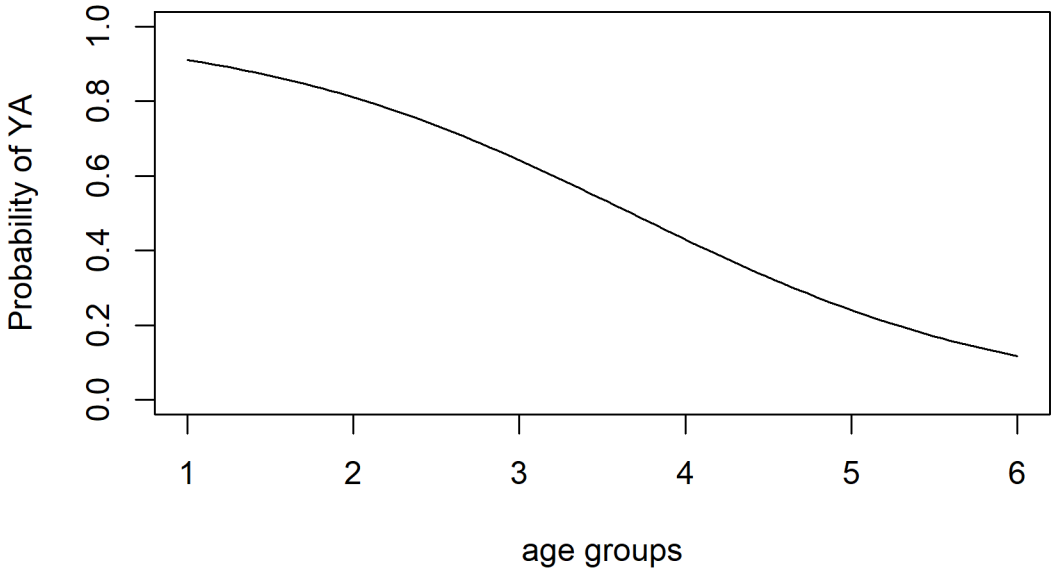
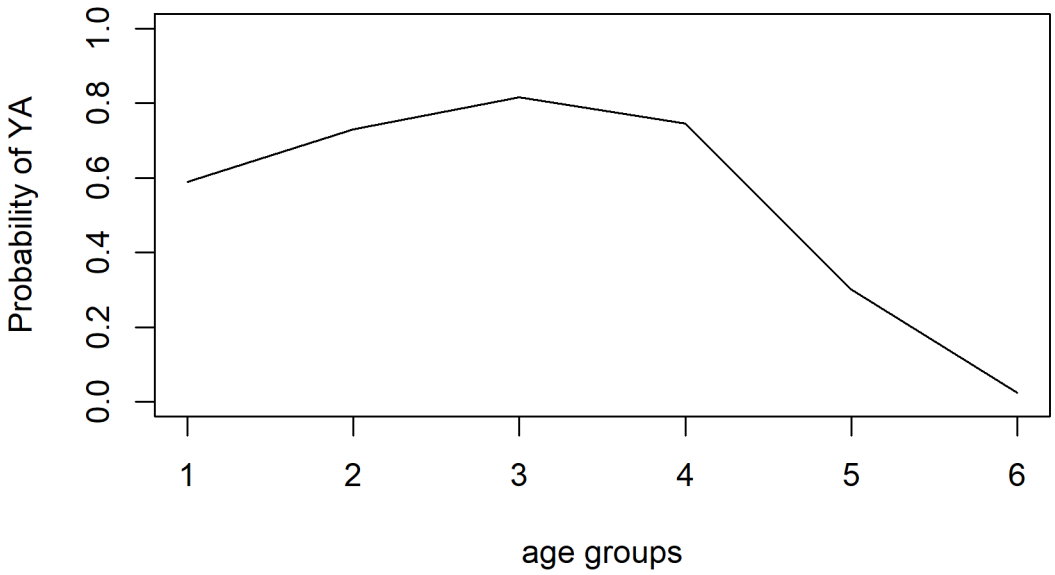


Figure 2: The Probability of YA in the Huddersfield Corpus by SPEAKER AGE GROUP when Age is Modeled as a Linear Predictor



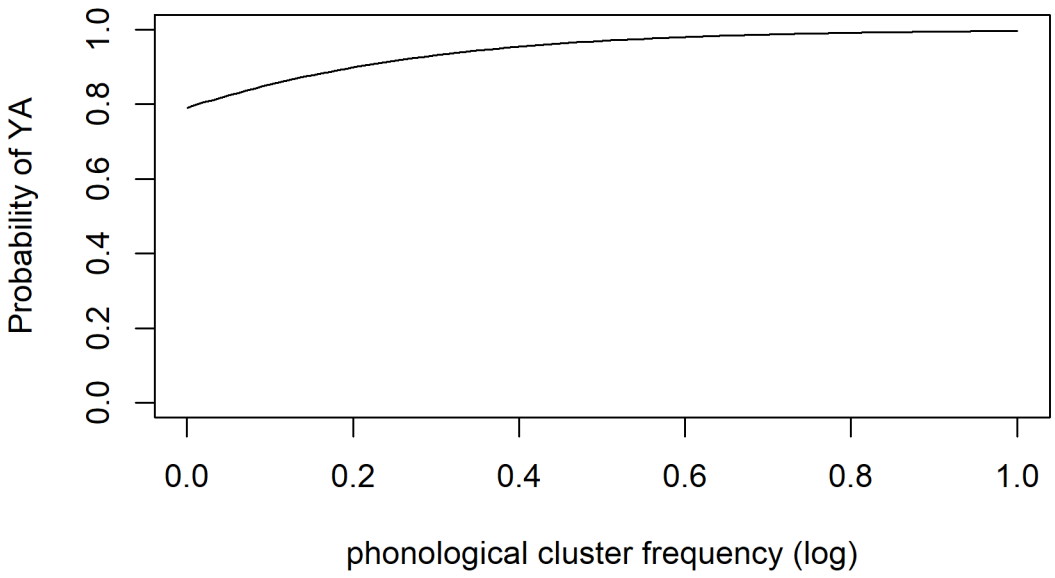
Note: Y axis: the probability of YA; X-axis: age groups of speakers in the corpus (oldest = 1; youngest = 6). Age is fit to a straight line in this graph.

Figure 3: The Probability of YA in the Huddersfield Corpus by SPEAKER AGE GROUP when Age is Modeled as a Non-Linear Predictor



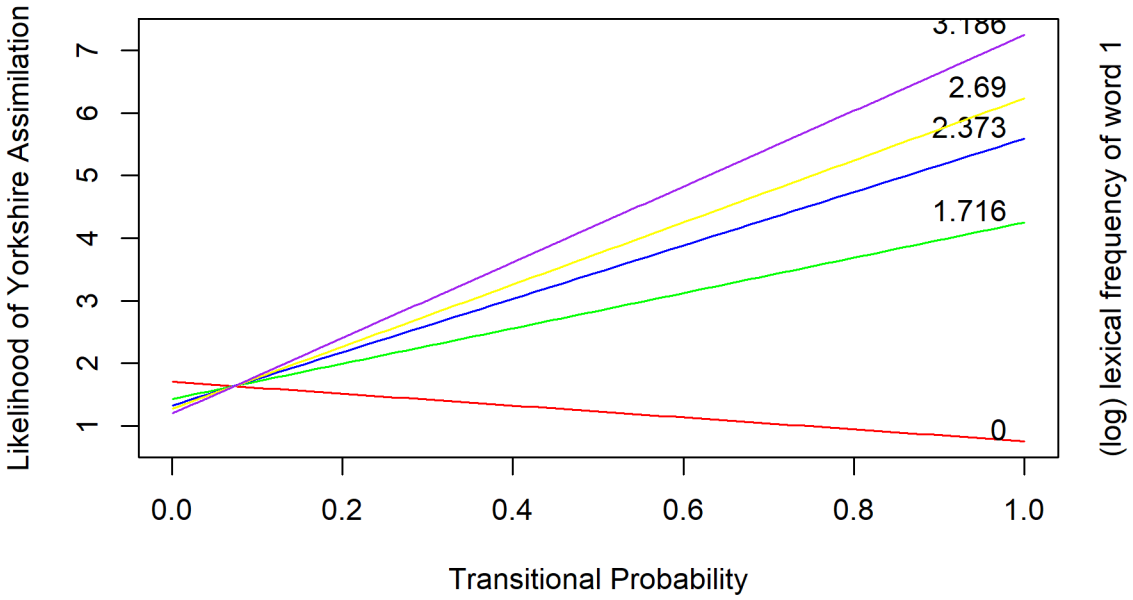
Note: Y axis: the probability of YA; X-axis: age groups of speakers in the corpus (oldest = 1; youngest = 6). Age is fit to a curved line or is allowed to vary along three points/knots.

Figure 4: The Probability of YA in the Huddersfield Corpus by CLUSTER FREQUENCY



Note: Y axis: the probability of YA; X-axis: frequency of consonant cluster (raw frequency has been converted to a logarithmic scale).

Figure 5: Likelihood of YA in the Huddersfield Corpus Predicted by LEXICAL FREQUENCY Interacting with TRANSITIONAL PROBABILITY



Note: Y axis: the Likelihood of YA; X-axis: Transitional Probability Word 2 Given Word 1; z axis: Lexical Frequency of YA Word (Transformed to a Logarithmic Scale).