

VOICING AND DEVOICING IN IRISH ENGLISH VOICED PLOSIVES

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ABSTRACT

This study investigates the extent of voicing in the voiced plosives /b, d/ across a range of phonetic contexts in Irish English. Spectrographic and waveform analysis showed that /b, d/ were almost always voiceless sentence-initially, substantially devoiced sentence-finally, and varied considerably sentence-medially. Further analysis of sentence-medial position found that if the plosive was part of a stressed syllable it was substantially less voiced than if it was part of an unstressed syllable. Focus also had an effect: less voicing was found in a nuclear syllable in narrow focus than in broad focus or a deaccented tail.

Comparison of these findings with an analogous study [6] of two other varieties of English (Wisconsin and North Carolina) did not verify the hypothesis that Irish English has a greater tendency to devoice medial /b/. Instead, there was a large inter-speaker difference, with two speakers showing devoicing of /b/ frequently and two speakers infrequently.

Keywords: voicing, voiced plosives, Irish English.

1. INTRODUCTION

It is well known that English ‘voiced’ plosives often partly or completely lack voicing. In particular, it has long been known that this is true of sentence-initial and sentence-final contexts. Sentence-medial position, however, has been described as voiced by traditional accounts [5, 8] and even some present-day accounts [9]. However, some recent acoustic studies have found a more complicated picture in that sentence-medial voiced plosives have been found with partial loss of voicing [6, 11].

Detailed examinations of voicing in sentence-medial position are fairly uncommon. As Docherty [3] points out, ‘the reports in the literature concentrate almost entirely on the timing of voicing in stop consonants in pre-stressed syllable, word-initial position’ (p. 15). Lisker and Abramson’s famous study [11], for example, does not divide its results for sentence-internal stops according to stress. Instead we only have generalizations such as this to rely on: ‘[variation in voicing in /b, d, g/] is chiefly a matter of whether or not the stop is

preceded by a voiced interval, for in such cases there is **usually** no break in the pulsing’ (p. 24, emphasis mine).

The first aim of this study, then, is to build a more detailed picture of sentence-medial position, investigating in particular whether a following stressed vowel reduces the voicing in the preceding plosive relative to an unstressed vowel. Similarly, we investigate the effect of focus: does the extent of voicing in a plosive vary depending on whether the syllable in question is in narrow focus, broad focus, or a deaccented tail? Theoretically, we might expect this to be the case given that the same word in each of these focus contexts will be uttered with different intensity and thus, different aerodynamic conditions for voicing.

The second aim of this study is to put Irish English in the context of other varieties of English: instrumental studies have found differences between speakers of English in how commonly devoicing occurs. For Glasgow English [14, 15], speakers born in the 1960s have been found to voice voiced plosives *less* than those born between the 1890s and 1920s. Along the Scottish/English border [4], younger speakers have again been found to have less voicing than older speakers. And on the Shetland Islands [13], those with English or mainland Scottish parents have been found to have less voicing on average than those with Shetland parents. For American English [6, 11], North Carolina and Wisconsin speakers have been found to differ substantially: North Carolina speakers voiced /b/ fully much more frequently, especially sentence-medially (North Carolina speakers had full voicing in 92% of these cases versus Wisconsin speakers’ 67%) [11].

The voicing of Irish English plosives has not been studied hitherto. The second aim of this paper, then, is to determine where on the voicing spectrum Irish English fits relative to these other varieties of English. My hypothesis prior to the study was that Irish English would show extensive devoicing, even sentence-medially.

2. METHODOLOGY

Speakers: Four male speakers were selected, aged between 23 and 30, all university-educated, and all from the Greater Dublin Area except one (who was

from Drogheda, which is just outside the Area). Their speech was broadly similar though Speakers A and B sounded more characteristically Dublin than Speakers C and D.

Material: A list of sentences was presented to the participants to be read aloud. Each sentence contained one voiced plosive, either /b/ or /d/. The plosives were placed in a variety of sentence positions, namely sentence-initial, sentence-medial, and sentence-final.

Of the three, sentence-medial position was examined in the most detail. To examine the effect of stress, pairs of plosives were compared in which the following vowel in one word was stressed but unstressed in the other, e.g. *ribbon* versus *rebéllion*, *riddle* versus *medállion*.

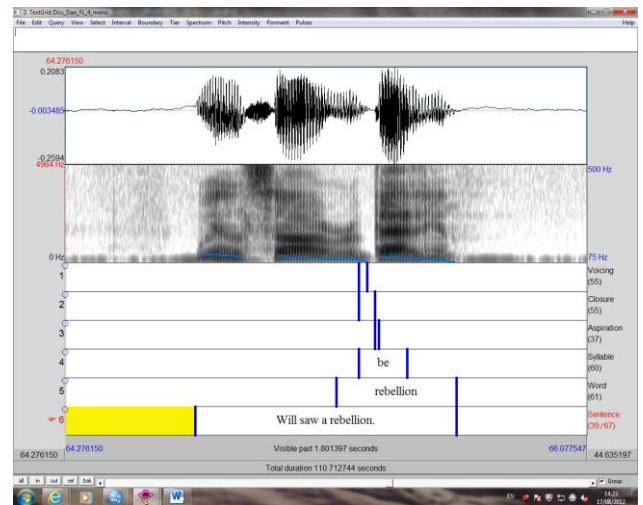
Focus was also investigated, to see if it would affect the extent of the plosive's voicing. To this end, triplets of sentences were formulated in which the test word was the same but the focus different, i.e. the voiced plosive was examined in broad focus, narrow focus, and a deaccented tail. For example, the sentence *Will saw a rebellion* was uttered in three ways: with broad focus, with narrow focus on *rebellion*, and with narrow focus on *Will*. In the last of these sentences, then, *rebellion* was in a deaccented tail.

In total there were 33 test sentences of which 26 were examined in the present study. The material was read 5 times; thus there were 520 tokens overall, of which 49 had to be excluded, either because the speaker failed to utter the sentences fluently or because they failed to utter it with the appropriate focus. This study only investigates /b, d/, as suitable lexical items containing /g/ were difficult to find: *ribbon* and *riddle* were both nouns and thus could be put in an identical sentence, but finding a noun with /g/ that was sufficiently similar in its segmental composition was not possible.

Recording: The material was read from a sheet in a semi-anechoic booth. The microphone was mounted obliquely on a table in front of the speaker. Recording was done using the Audacity software package [1] and was sampled at 44.1 kHz, with 32-bit quantization in mono channel.

Measurement: The recordings were annotated manually in Praat [12] using six annotation tiers. The tiers recorded to the nearest millisecond the duration of voicing, closure, aspiration, the syllable, word, and sentence, respectively. The percentage of closure voicing was obtained by dividing the voicing duration by the closure duration.

Figure 1: Screenshot of Praat, showing waveform, spectrogram, and annotation tiers.



All measurements were done by visual inspection. The point at which voicing ceased was set where the change in amplitude on the waveform from the peak to the trough was particularly small: less than 0.08 Pa. The precise value of this threshold is arbitrary but it was necessary to have the threshold to maximize consistency.

The information was inputted manually into SPSS, which was used to perform a Pearson bivariate correlation between closure duration and voicing duration, as well as between closure duration and the presence of a voicing break.

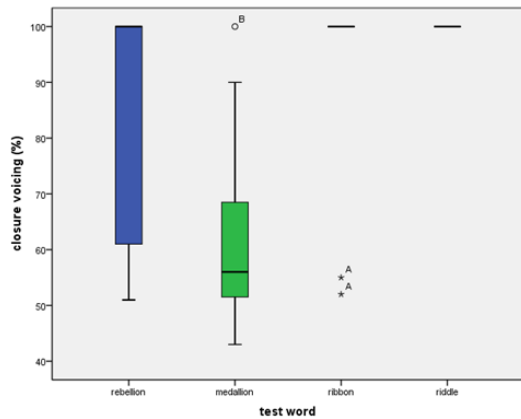
3. RESULTS

Sentence-initially, /b, d/ were almost invariably voiceless. There was just one token out of 67 where this was not the case (for Speaker D). In this environment Lisker and Abramson [10] found no voicing in 77% of cases, so the present rate of devoicing is higher than that for American English.

In sentence-final position, there were again no tokens with full voicing. Voicing did not cease instantly, taking on average 32 msec to cease in /b/ and 17 msec in /d/. This corresponded to average voicing for /b/ of 60% and /d/ of 50%. These are similar to what [3] found for British English: 55% for /b/ and 56% for /d/.

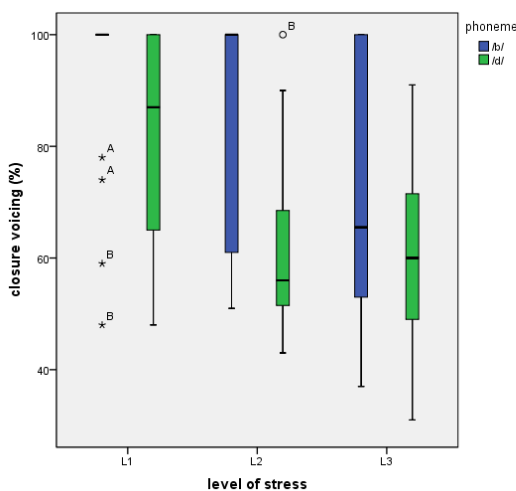
Let us turn now to sentence-medial position and begin with the question of whether the presence of stress following the plosive reduces its voicing. In Figure 1 below, we see that the extent of voicing is indeed lower when the syllable following the consonant is stressed. The difference is considerable: the median voicing in *medallion* is around 55% whereas in *riddle* it is 100%. The same pattern can be seen for *rebellion* versus *ribbon*.

Figure 2: Percentage closure voicing intervocalically before stressed (*ribbon*, *riddle*) versus unstressed (*rebellion*, *medallion*) segments, divided according to test word. The absence of a box length for *ribbon* and *riddle* indicates that their degree of closure voicing is invariably or nearly invariably 100%. The letter next to each outlier identifies the speaker (A/B/C/D) who produced it.



Let us turn now to the effect of focus, which is displayed on a three-point scale. At the lowest point on the scale (L1), the words *rebellion* and *medallion* are in a deaccented tail (i.e. they occur after the nucleus of a narrow-focus sentence); in L2, the same words carry broad-focus nuclear stress; at the highest end of the scale, L3, the words carry nuclear stress in a narrow focus sentence, i.e. the maximum level of stress.

Figure 3: Percentage closure voicing across three levels of focus in the words *rebellion* /b/ and *medallion* /d/, divided according to level of focus. (The L1 utterances for /b/ lack a box-length, which indicates that the degree of closure voicing is almost invariably 100%.)



As we can see, the effect of focus on voicing is less dramatic than that of the presence/absence of stress

in Figure 1. Nevertheless, the direction of the trend is the same: greater focus (i.e. greater stress) tends to result in reduced voicing in the preceding consonant. The same trend has also been noted by [6] for northern American speakers.

Finally, let us compare the present data with [6] who studied a northern and a southern variety of American English. This study is suitable for comparison as its test material is very similar to the present study (it too investigated three levels of focus).

Figure 4: Frequency (%) of a voicing break in /b/ for North Carolina speakers (blue bars) and Wisconsin speakers (green bars) across three levels of focus. (Adapted from [6]).

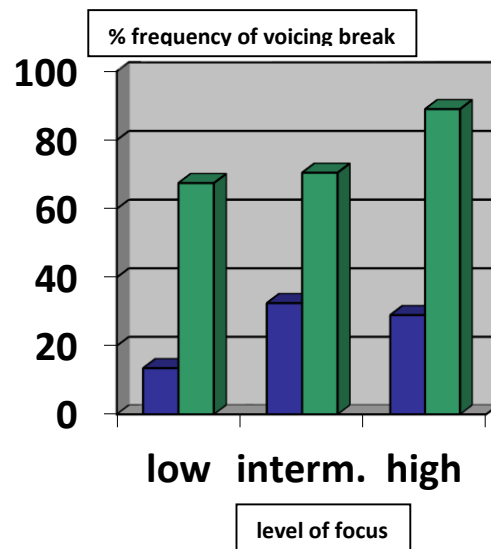
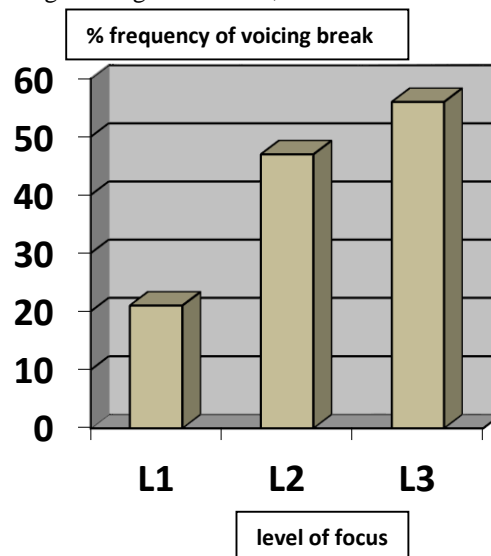


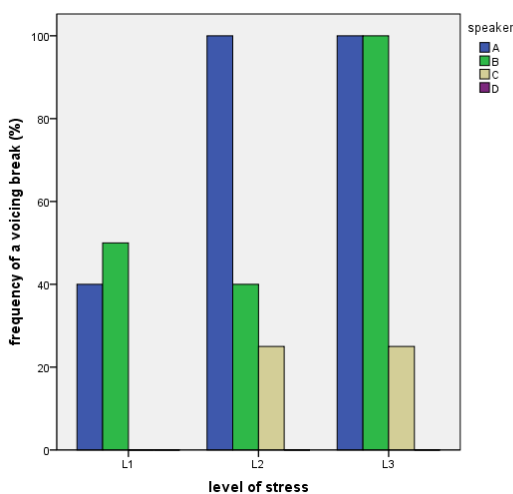
Figure 5: Frequency (%) of a voicing break in intervocalic /b/ for the present study's speakers, divided according to level of stress. L1 is the highest degree of focus, L3 lowest.



At first glance, the Irish pattern (Figure 5) appears to be intermediate between Wisconsin and North

Carolina (Figure 4): the frequency of a voicing break in Ireland is higher than Wisconsin but lower than North Carolina. However, when we break down the Irish data according to *individual speaker* (Figure 6), the data take on a different complexion: two speakers (A and B) are similar to the Wisconsin values whereas two (C and D) are closer to North Carolina's. The difference is striking: at one extreme, speaker A shows no voicing in two out of three contexts; at the other extreme speaker D shows full voicing in all three contexts.

Figure 6: Frequency (%) of voicing break in /b/ across three levels of focus for each of the Irish English speakers.



To summarize: compared to American English at least, Irish English appears to be unremarkable in the amount of voicing found in its lenis plosives. Instead, the interesting finding is that the amount of voicing varies dramatically between individual speakers of Irish English.

4. DISCUSSION

It would be interesting to understand why voicing varies in the manner seen in Figure 1. Why is it that the presence of stress reduces the voicing in the preceding plosive?

Although the present study is acoustic in nature, it seems reasonable to suggest the following explanation. Voicing in plosives is aerodynamically difficult: such consonants entail blocking the air flow through the vocal tract, which leads to a build-up in air pressure. If this intraoral pressure increases to within ca. 2cm H₂O of the subglottal pressure [2], voicing will cease since voicing can only be sustained if there is a sufficient transglottal pressure drop [7]. One aerodynamic consequence of stress is that it increases air flow due to increased initiator

power [2] (p. 84). This means that the transglottal pressure drop will be lost more rapidly in stressed syllables than unstressed syllables, since the higher initiator pressure of stressed syllables results in intraoral air pressure increasing more rapidly. Thus we expect voicing to cease more rapidly in stressed syllables than unstressed syllables, which is indeed what we observed in Figure 1.

The effect of focus (Figure 2) can probably be explained in a similar manner, since uttering words in a deaccented tail involves a decrease in intensity, i.e. a decrease in initiator power. Nevertheless, intensity was not investigated in the present study, so this explanation remains tentative.

Perhaps the most interesting finding of this study is that the amount of voicing in /b, d/ varies considerably depending on the individual. Given that the sample is small - four speakers - this finding has to be treated with caution. Further work would be needed to investigate whether this variation is merely the effect of small sample size or a genuine pattern in Irish English. It might be worth noting that the speech of C and D, who show the greater voicing, is less regional than that of A and B (who sound characteristically Dublin). Thus future research should study a larger number of speakers and investigate the effect of social class. The present study examined only young speakers; age may also be a relevant factor.

Even when all such factors are examined, we might still find that speakers of the same age, same social class, i.e. of the same *accent*, voice differently. This what Docherty [3] found among his five subjects, all of whom were male, aged 18-21, brought up in the south-east of England and all lacking a marked regional accent. Yet still there were individual differences: one subject produced prevoicing of utterance-initial voiced plosives in 75% of his tokens whereas three out of four of the remaining subjects did not do so at all (p. 167). Such findings defy simple explanation.

5. CONCLUSION

This study examined the amount of voicing in Irish English /b, d/ across a variety of phonetic contexts. In sentence-medial position, voicing was found to be lower if the plosive was part of a stressed syllable than an unstressed syllable. Focus also had an effect on voicing: less voicing in narrow focus and broad focus than in a deaccented tail.

Also, there was considerable individual variation in voicing, the possible sociolinguistic implications of which warrant further investigation.

6. REFERENCES

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