

ALL RISE? THE PERCEPTION OF FALLS, PLATEAUX AND SIMPLE RISES IN BELFAST ENGLISH

Anna Bothe Jespersen

Department of English, Aarhus University
anna.jespersen@cc.au.dk

ABSTRACT

This paper investigates the perception of rising and falling F0 in statements and questions in Belfast English. This variety is known for its statement rises, realised as rise-plateaux, but recently, younger speakers have begun producing another statement rise, namely uptalk. This study presented 20 listeners of two age groups with stimuli stepwise manipulated to form high and low falls, as well as rises with different elbow and peak heights, and corresponding either to simple rises or rise-plateaux. Listeners were asked to identify stimuli as statements or questions. Results show that listeners primarily used rise shape and peak height to differentiate between statements and questions: simple rises with high peaks were more likely to be rated as questions. However, younger listeners exhibited signs that this distinction is blurring, with more simple rises interpreted as statements and less clear-cut distinctions between low, medium and high peaks.

Keywords: Intonation, Belfast English, Perception

1. INTRODUCTION

Belfast English, like other varieties of Northern Irish English, is well-known for its statement rises [7, 19, 22]. These generally take the form of rise-plateaux or rise-plateau-slumps, and previous research on Belfast English intonation has reported that the vast majority of statements carry such rising contours (above 70% in [14] and [21]; 83.3% in the IViE project [12, 13]), while falling contours, which are commonly associated with statements in standard British English varieties, were almost never found with statements in Belfast English (4.2%, [12]). Furthermore, in the IViE corpus, *no* simple rises were found with statements. On the other hand, questions were realised with an average of 7.4% simple rises, 90.7% plateaux and 1.9% falls.

In the IViE corpus, recorded in 1996, there was thus a clear distinction in production between statements (produced with plateaux or falls, but not simple rises) and questions (produced with plateaux and simple rises, but rarely falls). However, recent work [15] has found that, similarly other varieties of British English [1, 18], young speakers of Belfast

English have started using uptalk, another statement rise. Following the methodology of [27], this paper investigates the effect of the introduction of uptalk rises on Belfast listeners' question/statement judgements of different contours.

Uptalk is a widespread phenomenon in English (and beyond: [31], pp. 163-169) which is commonly associated with Australian and American Englishes, with young speakers and with women (though see [13, 17]). It differs from the Belfast rise-plateau both formally and functionally. In terms of function, the main difference lies in markedness: plateaux are an unmarked "default" with statements in Belfast (and other Urban Northern British varieties, [6], whereas uptalk, at least in British varieties, is marked ([31], p. 91, [18]). In terms of form, uptalk (Figure 1) tends to be simple rises, e.g. L* L-H%, L* H-H% and H* H-H%, in most varieties ([1, 8, 10, 13, 26, 28], though see [16, 9, 11]).

Figure 1: A Belfast English uptalk rise.

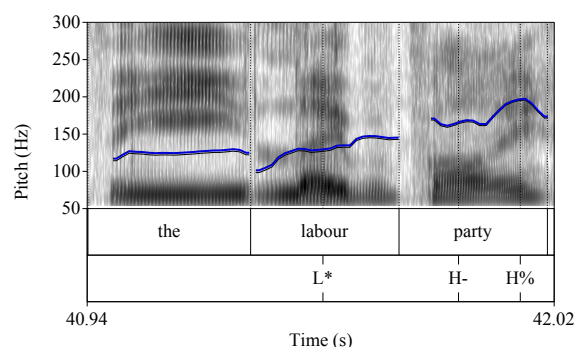
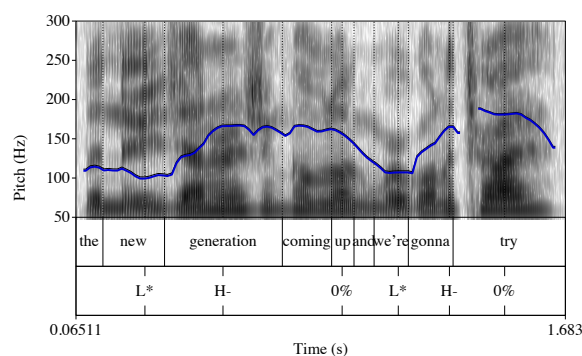


Figure 2: Two rise-plateaux, same speaker as Figure 1.



On the other hand, a rise-plateau(-slump) features an abrupt rise after a low pitch accent, ending in an F0

plateau that can span several syllables or words, and may end in a final optional F0 “slump” (Figure 2).

While there have been plenty of sociolinguistic studies of Belfast English [22, 23], these have generally not considered intonation. Two exceptions, [19, 20], reported a higher frequency of falling contours with higher levels of formality, explained as accommodation to SSBE. [15] found that a speaker’s political stance may also influence contour choice.

Given the fact that uptalk seem to be relatively newly introduced to Northern Ireland (see also [31], pp. 90-92), it is relevant to also consider the age of the listeners. As we know that innovations are often spread by adolescents [29], this paper considers both near-adolescent and adult listeners. This allows for a consideration of not just whether listeners perceive simple rises as pertaining to questions, and falls to statements, but also whether this is changing with the younger generation as uptalk is slowly creeping into Belfast English.

This paper has the following research questions:

1. Do Belfast listeners judge simple rises as belonging to questions, and falls to statements?
2. What roles do the height of rise elbows and peaks play in judgements?
3. Do these patterns change with young listeners?

2. METHODS

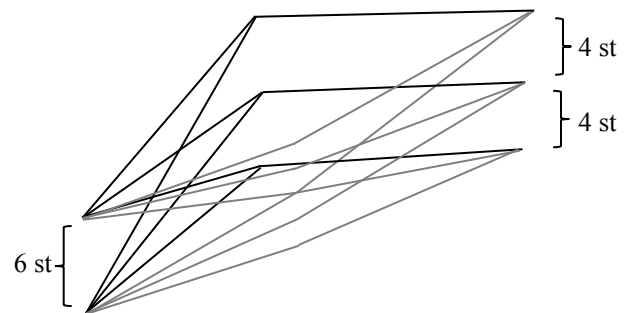
20 listeners (12 f, 8 m) participated in the experiment. All reported normal hearing. The participants were further divided into young ($n=9$, range=17-21, mean=18.7) and adult ($n=11$, range=25-48, mean=34.1) listeners. All had lived in Belfast for at least a year, and most ($n=15$) grew up in the city.

The stimuli consisted of 5 short phrases, a determiner or preposition plus a two-syllable noun of the CVCV type. The phrases were read by a young male speaker of Belfast English who was not part of the experiment, and was not known to the listeners. The phrases chosen were part of the IViE materials, designed to elicit series of sonorants, thus avoiding microprosodic perturbations of the F0. The stimuli were resynthesised in PSOLA in Praat [2]. The stimuli were manipulated at the *low elbow*, or starting point, and *peak*, or ending point, of each contour, as well as at an equidistant point in between the two. The middle point was hand-corrected to a later point in the contour to increase naturalness in 12 items.

At rise elbows, F0 was changed in one 6 st increment to correspond to low and high elbows. At rise peaks, stimuli were changed in two 4 st

increments to correspond to low, medium and high rises. The pitch ranges and semitone increments were chosen based on the speaker’s natural pitch range and rise characteristics. Rise shape was manipulated to create either slightly concave smooth rise for simple rises, and an abrupt, convex rise for plateau rises. The anchor point for manipulating rise shape followed the speaker’s natural productions, and was kept constant across items. The procedure is illustrated in Figure 3.

Figure 3: schematic representation of the manipulation of rise stimuli in terms of elbow height, peak height and shape. Dark lines represent plateau rises, light lines represent simple rises.



In addition to the rise stimuli, two different falls were included as distractors, and to allow for an investigation of differences between rising and falling contours. Pitch ranges for falls were again matched to the speaker’s natural falls, and the difference between high falls and low falls was manipulated though elbow height (corresponding to a 6 st difference); peak height and shape were kept constant. The stimuli were checked for naturalness by a speaker of Belfast English. The reanalysis resulted in 60 items, and the experiment produced 1200 tokens for analysis.

Listeners were presented with one item at a time through the Praat experiment interface, and were asked to decide whether each item was a statement or a question. A second set of responses was also required of the listeners, but not covered in this paper. Listeners were instructed to decide on their responses as fast as possible. Stimuli were presented in 5 randomised blocks of 12, with each combination of elbow, peak and shape present only once in each block. Each phrase occurred a maximum of three times per block.

Statistical analysis was conducted through Bayesian multilevel regression in the Stan framework [5] accessed with *brms* [3, 5] in *R* [25]. Model comparisons were executed though leave-one-out cross-validation using *loo()* [30], and the models were plotted using *marginal_effects()*. To improve convergence and prevent overfitting, mildly informative conservative priors were specified.

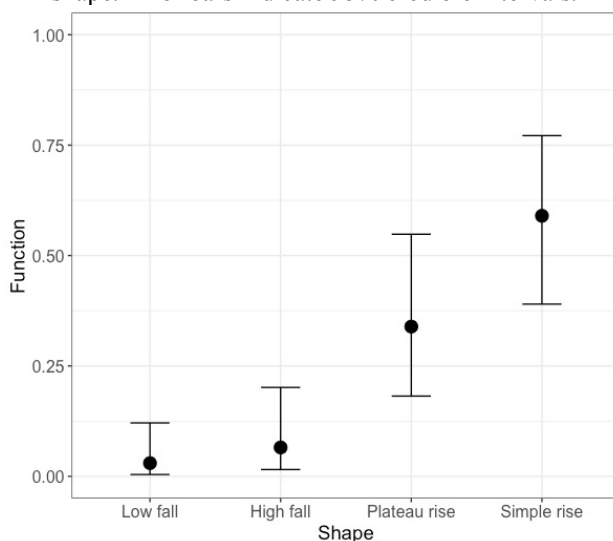
3. RESULTS

3.1. Elbow height, peak height, shape

Three Bayesian multilevel models were fitted to investigate the effects of contour shape, elbow height and peak height on listeners' judgement of stimuli as questions or statements. In all models, age was added as a fixed effect, and speaker and stimulus as random intercepts. Speaker age will be discussed in the next section. Gender was too highly correlated with age to be included in the final models, and more data is therefore needed to consider gender effects. In the following, contrasts between posterior distributions will be reported in the text, and fitted values from the regression models will be illustrated through figures.

The first model, summarised in Figure 4, investigated the effect of F0 shape on whether an item was judged to be a statement or a question. Based on the IViE data, the prediction is that simple rises would be more likely to be judged as questions. Comparing the posterior distribution of the contrast between simple rises and other F0 shapes, simple rises are judged as 37.2% (95% CI = [15.6, 59.8]) more likely to be questions than plateau rises, and 43.2% (95% CI = [20.1, 56.0]) more likely than falls of any height. As shown in Figure 4, high falls were marginally more likely to be judged as questions than low falls, but this distinction was not supported by posterior distributions.

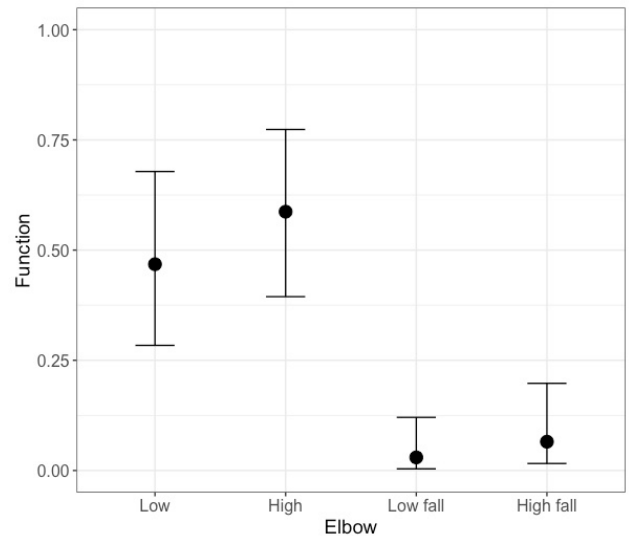
Figure 4: Marginal effects of F0 shape on question/statement judgement, where 0 on the y-axis indicates a statement response and 1 a question response. Points indicate the posterior mean estimates for each shape. Error bars indicate 95% credible intervals.



Another model was fitted to investigate the influence of elbow height on statement/question judgement. Plateaux are often realised with lower elbows than simple rises, so the prediction is that rise stimuli with

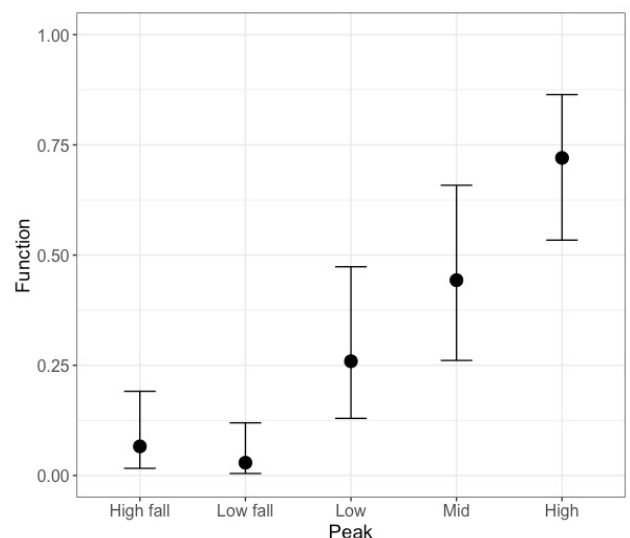
higher elbows would be more likely to be judged as questions. As seen in Figure 5, this hypothesis is marginally supported by the regression model. Comparing posteriors between rises with low and high elbows revealed a small effect: rise stimuli with high elbows were 11.2% (95% CI = [3.9, 18.8]) more likely to be judged as questions.

Figure 5: Marginal effects of elbow height on question/statement judgement, where 0 indicates a statement response and 1 a question response.



The third model investigated the contribution of peak height. For this investigation, hypothesis testing is hampered by a lack of precise phonetic description of simple rises in Belfast English. However, the annotation L* H-H% in the IViE corpus suggests a high-rising component which can be surmised to be higher than the plateau component of the plateau rise.

Figure 6: Marginal effects of peak height on question/statement judgement, where 0 indicates a statement response and 1 a question response.



The prediction would thus be that higher peaks lead to more question judgements. Figure 6 illustrates the fitted effects of the model. This graph documents a clear likelihood progression for the question judgement with increased peak height.

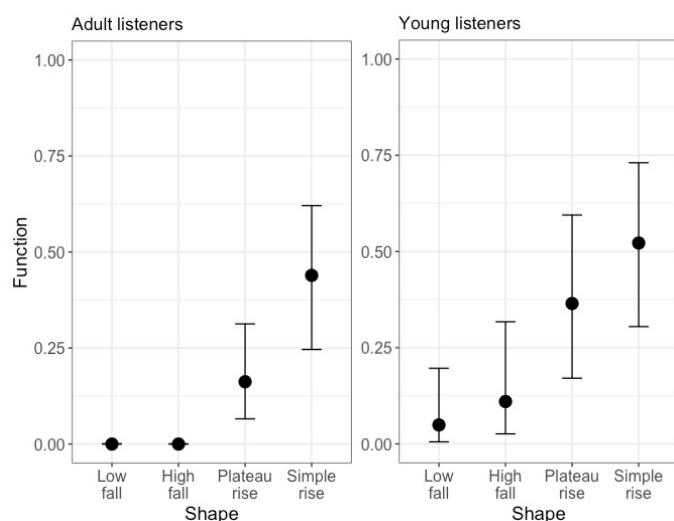
Confirming this picture, a comparison of posterior distributions shows that rise stimuli high peaks are 55.3% (95% CI = [39.3, 69.4]) more likely to be judged as questions than mid-peak stimuli, while these are 29.8% (95% CI = [16.8, 44.5]) more likely to be judged as questions than stimuli with low peaks. These, however, are still 14.1% (95% CI = [0.5, 26.2]) more likely to be judged as questions than falls of any shape.

3.2. Adult versus young listeners

Addressing the final research question, this section reports on the influence of listener age on the perception of rise and fall stimuli as either statements or questions. For brevity's sake, only F0 shape will be considered. The model considered is thus identical to the initial one presented in the previous section.

The hypothesis to be tested in this section is that, due to the introduction of uptalk, younger listeners will have a less pronounced, or even overturned, association between simple rises and questions than older listeners. Addressing this hypothesis, Figure 7 illustrates the fitted effects of listener age on judgements of different F0 shapes. As can be seen in Figure 7, in this study, adult (left) and young listeners (right) do not have identical judgements of different F0 shapes.

Figure 7: Marginal effects of F0 shape by listener age on question/statement judgement, where 0 indicates a statement response and 1 a question response.



Firstly, with adults, simple rises are 26% (95% CI = [15.1, 37.1]) more likely be judged as questions,

while the corresponding number for young listeners is 15.2% (95% CI = [2.8, 27.9]). Furthermore, young listeners are slightly more likely to judge falls as questions, but this corresponds to an overall greater bias towards the question response (a possible artefact of low token numbers), and the effect is not supported by the statistical model.

4. DISCUSSION AND CONCLUSION

This paper has addressed the lack of perception studies on Belfast English intonation, investigating whether listeners' perception match the production literature, which acoustic cues are used by speakers to make question/statement judgments of rises, and whether younger listeners exhibit a changing perceptual system after the rise of uptalk in Belfast.

Findings indicate that both rise shape, peak height and elbow height (in this order of importance) contribute to question/statement judgements. The use of elbow and peak height as cues to rise status provides us with valuable evidence of the perceived phonetic characteristics of rises in this variety of English – characteristics which have not been documented in production studies. Furthermore, the tentative finding that younger listeners have a less well-defined distinction between plateau and simple rises suggests that their perceptual systems are reacting to the change in production caused by the introduction of uptalk rises [15], as laid out in Labov 2001; see [29], p. 5. It is exactly this age group who can be surmised to produce the first reactions to a new change in production by an alteration of their perception. New generations will then progressively acquire, increment and stabilise the change.

These results are important pieces of evidence for the impact of production changes on perception (for change in production, see [17, 18]), and of the ways in which intonational change conforms to models of change in similar ways to segmental sound change.

5. ACKNOWLEDGEMENTS

This research is funded by a postdoctoral fellowship grant from the Carlsberg Foundation.

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