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Intonational variation in urban dialects of English spoken in the British Isles

1. Introduction

The production of prosody is subject to a multitude of factors. Prosodic patterns are affected by dialect, speaking style, discourse structure, syntax, the words spoken, the segmental phonetic structure of the utterance, speaker habit, gender, age and social background. In addition, these factors interact. Nevertheless, variation has not been a major concern of prosodists. Especially in studies on the phonology of intonation, references to variation are rare. Often, variation is treated as noise in the data and held to conceal what is really important about the prosodic structure of a language. Many investigations are restricted to a single standard variety and cross-speaker variation is ignored or masked by statistical processing. Nevertheless, the results are frequently taken to be representative of the language as a whole. Recent research challenges this approach. Experimental investigations have shown that the effects of variation on prosody need to be taken seriously. One area of research that has provided evidence for dialectal variation in prosody is the study of rhythm. Rhythmic classifications of languages as stress- or syllable-timed have a long tradition (e.g. Pike 1945). Recent studies of the acoustic correlates of rhythm, however, have shown that varieties of one language can differ as much in their rhythmic structures as two different languages. Dialectal differences in rhythmic structure have been reported for Italian and Arabic. Italian has been classified as syllable-timed, like French, but southern varieties tend towards stress-timing (Grice, D'Imperio, Savino and Avesani to appear). Similarly, some dialects of Arabic can be classified as stress-timed and others as syllable-timed (Ghazali, Hamdi and Barkat 2002). Cross-varietal differences in rhythmic structure have also been found for English. British English is usually described as stress-timed but the acoustic correlates of rhythm in British English and Singapore English differ significantly (Low, Grabe and Nolan 2001, Grabe and Low 2002). Taken together, these studies show that prosodic variation within languages can be considerable. The finding has implications for work on prosodic typology, an area of research which is becoming increasingly popular (e.g. Hirst & Di Christo 1998, Fitzpatrick-Cole 1999, Auer et al. 2000, Grabe 2002, Jun in press). The data suggest that cross-linguistic differences in prosodic structure are more accurately described as differences between dialects of different language, not as cross-linguistic differences *per se*.

An equally pressing reason for more work on variation is given in a recent volume on urban dialects in the British Isles (Foulkes and Docherty 1999): „The failure to address the fundamental fact of variability in speech may hinder progress in phonology. Phonological knowledge must enable listeners to cope with variability in the speech of others, and (arguably) plays a part in producing variable phonetic output on the part of the speaker. Understanding the nature and role of variability would therefore appear to be a highly productive route towards constructing an adequate model of phonological knowledge".

In this paper, I present evidence for intonational variation in dialects of English spoken in the British Isles. I will discuss (1) variation conditioned by dialect and (2) variation across speakers of a single dialect.

2. Background

Work on various aspects of prosodic variation has been carried out, but not in a standard sociolinguistic framework and most investigations have not systematically examined cross-dialectal and cross-speaker variation. The effect on prosody of speaking style was investigated by Bruce (1995), Hirst, Astésano and Di Christo (1998), Swerts, Strangert and Heldner (1996), Hirschberg (2000) and Terken (2001). The effect of speech rate on prosody was studied by Caspers (1994) and Monaghan (2001). The alignment of f0 peaks and troughs in different utterance positions has also received attention (Steele 1986, Silverman and Pierrehumbert 1990, van Santen and Hirschberg 1994, Arvaniti, Ladd and Mennen 2000, Wichmann, House and Rietveld 2000). The effect on f0 of segmental structure was investigated by Lehiste and Peterson (1961). The effect on f0 of segmental and prosodic structure in combination ('truncation') was studied by Erikson and Alstermark (1972), Bannert and Bredvad (1975), Grønnum (1989), Grabe (1998) and Grabe, Post, Nolan and Farrar (2000). Only three of these studies, however, considered dialect (Bannert and Bredvad 1975, Grønnum 1989 and Grabe et al. 2000). None investigated cross-speaker variation in any detail.

Cross-linguistic research on intonation has a long tradition, but most studies are monodialectal. The prosodic structure of selected dialects of English was investigated in a number of studies (e.g. Jarman and Cruttenden 1976, Pellowe and Jones 1978, Wells 1982, Tench 1990, Sebba 1993, Cruttenden 1995, Fitzpatrick-Cole 1999, Cruttenden 2001, Gussenhoven 2000, Warren and Britain 2000). Only a few studies have compared several dialects, multiple speakers, or more than one speaking style. Exceptions are investigations by Bruce, Elert, Engstrand, Eriksson and Wretling (1999), Auer, Gilles, Peters and Selting (2000), Grabe et al. (2000), Warren and Britain (2000), Ghazali, Hamdi and Barkat (2002), Grabe and Post (2002) and Ulbrich (2002). The transcription of intonation across dialects of one language has been considered by Grabe, Post and Nolan (2001) and Grice, D'Imperio, Savino and Avesani (to appear). Two studies have investigated cross-speaker variation in the production of intonation in a single dialect (Peppé, Maxim and Wells 2000, Grabe and Post 2002). Cross-gender variation has also received some attention (Vermillion 2001, Hasegawa and Hata 1994, Haan and van Heuven 1999, Daly and Warren 2000, Warren and Daly 2000).

3. Dialect variation in the intonation of English spoken in the British Isles

In the British Isles, dialectal differences in intonation are well-attested. The intonation of Belfast English was described by Jarman and Cruttenden (1976), Rahilly (1991), Wells and Peppé (1996) and Lowry (1997). English spoken in Tyneside was studied by Pellowe and Jones (1978) and by Local, Kelly and Wells (1986). Liverpool English was investigated by Knowles (1978). Wells (1982), Tench (1990) and Walters (1999) described the intonation of Welsh English. London Jamaican was investigated by Sebba (1993) and by Sutcliffe and Figueroa (1992). The intonation of Glasgow English was described by Mayo, Aylett and Ladd (1996) and by Vizcaino-Ortega (2002). The intonation of English spoken in Manchester, finally, was investigated by Cruttenden (2001). The studies on Belfast, in particular, show that the level of variation between intonation systems in the British Isles is considerable. For instance, Southern British English speakers produce declaratives with falling intonation and questions without morphosyntactic markers with final rises. Belfast speakers do not appear to make this distinction; both sentence types are produced with rising intonation (Rahilly 1991, Cruttenden 1995).

Comparisons between varieties of English have been restricted to one dialect and the so-called standard spoken in the South of England. This is the variety of English that is described in textbooks on English intonation. Cross-dialect studies were non-existent, at least until very recently.

Between 1997 and 2002, a first step was taken towards the collection of directly comparable and experimentally controlled speech data from several dialects of English spoken in the British Isles. The IViE project[1] (IViE = Intonational Variation in English) was set up with the following aims:

1. the creation of a large corpus of recordings from several urban[2] dialects of English spoken in the British Isles in a range of speaking styles, from several groups of speakers controlled for dialect, age, peer group and gender,
2. the provision of linguistic transcriptions that assist users in the quantification of intonational variation, specifically, the effect of dialect, style, speaker,
3. the provision of a number of linguistic analyses on the data, using acoustic evidence and prosodic transcriptions.

Section 4 of this paper provides a summary of the IViE project (dialects, speakers, experimental materials, recordings and prosodic annotations). Section 5 summarises two types of findings from the project: phonetic variation and phonological variation. The findings show how data on cross-dialect and cross-speaker variation in different utterance types in English can advance intonational typology. The paper ends with a discussion of the findings and their implications.

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[1] Economic and Social Research Council award to F. Nolan (University of Cambridge) and E. Grabe (Universities of Cambridge and Oxford). Research Associates: K. Farrar and B. Post. Funding period: 1997-2002.

[2] For the term „urban dialect“, cf. Trudgill 1998.

4. The IViE project

Recordings for the IViE corpus were made between 1997 and 2000, in nine urban locations in the British Isles. Twelve speakers were recorded in each location. All took part in the same set of tasks, eliciting five speaking styles. Further information on dialects is given in section 4.1. Speakers, speaking styles and recordings are described in section 4.2.

In total, the IViE corpus contains 36 hours of speech data from 108 speakers. The data were released in 2001 and disseminated via sets of five CD-ROM disks in .wav format. The CDs contained data from nine dialects and five speaking styles. At the same time, the complete set of speech data was made available via the Internet[3]. Generally accessible information about the project such as background information on intonation in the British Isles, a map showing where the recordings were made, speech examples etc. was given on the project home page[4].

A further aim of the project was to provide machine-readable linguistic analyses of intonation patterns in the corpus. The provision of these required the development of a notation system that allowed for comparisons of the intonation of several dialects of one language. At the time, all available notation systems were mono-lingual and mono-dialectal ('ToBI-style' systems). The new system, the IViE system, was based on the ToBI concept and allowed for directly comparable analyses of several dialects of one language in one transcription system. Additionally, the system provided labellers with the opportunity to record a wider range of prosodic observations than is possible in other systems. Further information on IViE is given in section 4.3 below.

IViE was used to create a prosodically transcribed version of the IViE corpus using a subsection of the data. The transcribed corpus contains one hour of speech transcribed on five levels. Data from the seven dialects of English in the original project application were included (London, Cambridge, Leeds, Bradford, Newcastle, Belfast, Dublin), in five speaking styles. From each dialect, we chose one male and one female speaker. The final version of the transcribed corpus has been available on the Internet since June 2002[5].

The third aim of the project involved an examination and comparison of intonational variation in the data. Two major insights were developed; these will be described and discussed in section 5.

We recorded nine urban dialects of English spoken by peer groups of adolescents in London, Cambridge, Cardiff, Liverpool, Leeds, Bradford, Newcastle, Belfast, Dublin. The locations in which the recordings were made are shown in Figure 1.

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[3] IViE labelling guide *www.phon.ox.ac.uk/~esther/ivyweb/guide.html* .
[4] IViE home page *www.phon.ox.ac.uk/~esther/ivyweb/index.html.*
[5] The annotated IViE corpus *www.phon.ox.ac.uk/~esther/ivyweb/search_trans.html.*

Figure 1. Map showing the nine urban centres in the British Isles in which recordings were made.

Figure 1 also shows that we recorded three dialects spoken by ethnic minorities: Punjabi English spoken in Bradford, Welsh English spoken in Cardiff and West Indian English spoken in London. Punjabi English was chosen because Punjabi has become the language with the second largest number of speakers in the UK. In the British Isles, the language is spoken by approximately 1.3 million speakers (1991 UK Census). Our Punjabi English speakers were bilingual and spoke Punjabi at home. In Bradford, about 10% of adults are estimated to speak Punjabi (Bradford City Council Electoral Register October 1997). A 1998 Statistical Press Notice published by the UK government Department for Education and Skills showed that in Bradford, 27% of pupils in schools use a language other than English at home. Approximately a third of those speak Punjabi.

West Indians constitute the second most influential group of immigrants in the British Isles (the most influential group consists of Indian and Pakistani immigrants), and in 1991, 0.9% of the British population were of Caribbean origin. Accordingly, our second group of ethnic minority speakers were of Caribbean descent. These speakers were monolingual. The recordings were made in London. In 1998, the British Council estimated that 5.4% of the London population were of Caribbean origin.

The Welsh English speakers were bilingual. The 1991 UK Census showed that Welsh was then spoken by 18.7% of the population of Wales. 2001 Census data for Welsh is not

yet available but and increase in the number of Welsh speakers is expected. Nearly one-third of all primary school children in Wales are now receiving their education in Welsh-medium or bilingual schools. Our subjects spoke Welsh at home and recordings were made in a school in Cardiff in which all teaching was conducted in Welsh.

4.1 Speakers, recordings and speaking styles

All recordings were made on location, in the secondary schools attended by our speakers[6]. Recordings were made in a quiet room. The speakers were 16 years old at the time of recording. All speakers were chosen by the teachers who taught their English classes. Prior to the recordings, the teachers had been asked to choose students who had been born and had grown locally. In each of the nine cities, twelve speakers were chosen, six male and six female. All took part in the same battery of tasks, designed to elicit directly comparable data in five speaking styles:

1. Each speaker read twenty-two context-free fully voiced sentences with various grammatical structures: declaratives, wh-questions, yes/no questions, questions without morphosyntactic question markers, coordination structures.

2. Each speaker read a passage of text, the fairy tale Cinderella. The text was chosen because it was likely to be familiar to all speakers and the options for different interpretations of the text would be limited.

3. The next task involved story telling from memory. The speakers were asked to retell the fairy tale, assisted by a set of pictures.

Two interactive tasks followed.

4. The speakers took part in a map task designed for the purposes of our project. A map task is an interactive game involving two speakers (Anderson and colleagues 1991). In our recordings, the two speakers were separated by a screen or some other obstacle available on site. One speaker was given a map of a small town with a route drawn around a number of landmarks, in our case, buildings. The name of each building on the map was given orthographically underneath the building. The other speaker was given a map showing the buildings, but not the route. In addition, the names of several landmarks on the second speaker's map were changed. The first speaker's task was to explain the route to the second so that the second could draw a copy of the route on his or her map. Since the participants could not see each others' maps, disagreements and discussions ensued. To facilitate the analysis of fundamental frequency, the names of

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[6] Kimberley Farrar made recordings in Cambridge, Leeds, Newcastle and Dublin. Brechtje Post recorded the data from Bradford, London and Cardiff. Catherine Sangster recorded the data from Liverpool. The Belfast recordings were made by Orla Lowry. Farrar, Post and Sangster speak Southern Standard British English. Post is a native speaker of Dutch. Lowry is from Belfast.

all landmarks on the maps were fully voiced. In addition, we controlled for number of syllables, to allow for investigations of fundamental frequency alignment in interactive speech (e.g. monosyllabic: *Farm*, disyllabic: *Jeweller*, trisyllabic: *Alleyway*). Names on the maps were also controlled for stress (initial: ˈ*Jeweller*, medial: *Muˈseum*, final: *Ann's* ˈ*Arms*[7]). Contrastive stress in initial and final position was elicited via two compounds. These were *Ann's Arms* and *Jolly Miller* on Map 1. On Map 2, *Ann's Arms* became *John's Arms* and *Jolly Miller* became *Jolly Sailor*. The maps are given in the appendix.

5. The fifth task involved a three to five minute conversation about a given topic, produced by the same pair of speakers who had carried out the map task. All conversations were face-to-face and with one exception, they involved single-sex pairs. All speakers knew each other and some pairs were close friends, but not all. The topic of conversation suggested to the speakers was „smoking".

Prior to the recordings, the experimenters explained all tasks to the subjects. During the recordings, the experimenter remained in the recording room.

At the end of the recording session, the speakers filled in a questionnaire. The questionnaire was designed to elicit information on their place of birth, their parents' place of birth, the area of the city in which they lived, the kind of house they lived in and the occupation of the parents, if any. These questions were combined with filler questions about e.g. the speaker's taste in music or the subjects they studied at school.

4.2 The Transcription of Intonational Variation

Many machine-readable intonation transcription systems are modelled on the ToBI system (Silverman and colleagues 1991, Beckman and Ayers-Elam 1997) and the IViE system is no exception. The original ToBI system, however, was intended for the transcription of standard varieties of English. IViE allows for directly comparable transcriptions of intonational variation, specifically dialectal variation. Prosodic transcriptions are made on three separate tiers, one for the transcription of variation in the location of stressed syllables, one for the transcription of phonetic variation and one tier for the transcription of phonological variation. The phonological system proposed is autosegmental-metrical in nature and based on work by Gussenhoven 1984 and Grabe 1998a. The symbols on the IViE tone tier are similar to those given in the ToDI system (Gussenhoven, Rietveld and Terken 1999).

A complete IViE transcription consists of five levels of transcription (two orthographic, three prosodic). They are arranged as shown in Table 1.

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[7] Analogous with e.g. „The King's Arms", a popular name for a Pub in the British Isles.

Comment Tier	Alternative transcriptions and notes
Phonological Tier	Formal linguistic representations of speakers' intonational choices
Phonetic Tier	Syllable-by-syllable transcriptions of pitch patterns surrounding prominent syllables and IP-boundaries
Prominence Tier	Location of prominent syllables (stressed and accented) and rhythmic boundaries
Orthographic Tier	Transcriptions of the words spoken and their location in the acoustic signal

Table 1. Transcription tiers in the IViE system for prosodic labelling.

The following sections provide a brief description of the three prosodic tiers, beginning with the phonological tier. Additional information about the transcription system is given in Grabe, Post and Nolan (2001) and in the on-line labelling guide on the Internet.

4.2.1 The phonological tier

The nature of intonational phonology is still debated and there are no widely accepted tests for phonological category membership of pitch patterns. Eventually, each contrast postulated by a prosodic labeller requires further investigation via a number of experimental techniques. Labels provide observations and hypotheses for experimental investigations. On the phonological tier of the IViE system, labellers provide a two-tone autosegmental-metrical description of observed intonation patterns. They label accented syllables and IP-boundaries. Since intonation patterns are subject to considerable levels of variation, even in relatively well controlled data from a single dialect, we took a comparative approach, following the one proposed in Grabe (1998a). An utterance from a particular speaker was not labelled in isolation, but in comparison with a directly comparable utterance produced by another speaker from the same dialect. Accordingly, we began with analyses of the read speech data, particularly, the fairy tale. The fairy tales were directly comparable across speakers. Each speaker produced the same text in the same context, and since the speakers read a familiar tale, they were likely to read the utterances with similar intent. Fairy tales produced by six speakers from a particular dialect were compared, intonation phrase by intonation phrase, and labelled. Then, labelling was continued on the next dialect.

To ensure transparency and comparability of transcriptions, all dialects were transcribed with labels taken from a single pool of labels (but not all labels or label combinations were used for every variety). All accents in the label pool were left-headed, i.e. they began with a symbol transcribing a pitch level that is associated with a stressed syllable.

Table 2 shows the IViE tone labels.

Accent labels:

Label	One commonly observed implementation
H*L	High target on prominent syllable followed by low target
H*	High target, common in initial position in so-called flat hats
!H*L	Downstepped high target, low target
L*HL	IP internal or IP final rise-fall: Low target on prominent syllable, high target on next syllable followed by low target
L*H	Low target on prominent syllable followed by high target
L*	Low target
H*LH	IP internal or IP final fall-rise: high target on strong syllable, low, high

Table 2. Autosegmental-metrical labels for accents given in the IViE system.

Table 3 shows intonation phrase boundary symbols. An intonation phrase boundary can be associated with a high tone, a low tone or no tone (%).

Phrase-initial	Phrase-final	Transcribes:
%H	H%	high target
%	%	no pitch movement at boundary
%L	L%	low target

Table 3. Intonation phrase boundary specifications in the IViE system.

The % boundary symbol is used when a pitch level is sustained up to the IP boundary, e.g. in the transcription of Northern Irish rise-plateau patterns (Grabe 1998a). Ladd (1996:145 pp.) discussed the transcription of rise-plateaux patterns with reference to Glasgow English: in the original ToBI system, rise-plateau tunes are transcribed with the label combination L*H-L%. In the absence of a rise-plateau-fall tune, this is not particularly problematic. Glasgow English, however, has a rise-plateau *and* a rise-plateau-fall tune. If one wishes to make a ToBI transcription of Glasgow English which is comparable with a ToBI transcription of e.g. Southern British English, then L*H-L% cannot be used to transcribe the rise-plateau-fall tune; otherwise, L*H-L% would describe a rise-plateau in one Southern British English and a rise-plateau-fall in Glasgow English. The same issue arises in the transcription of Belfast English; a dialect included in the IViE corpus. Belfast has a rise-plateau-rise, a rise-plateau and a rise-plateau-fall. Therefore, in the IViE system, the rise-plateau is transcribed with a % boundary (i.e. no boundary tone), the rise-plateau-fall with L% and the rise-plateau-rise with H%. These transcriptions are given in Table 4 and illustrated with stylised f0 traces. The left panel shows tunes and transcriptions in Belfast English. The right panel shows tunes in Southern British English.

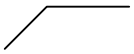
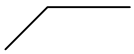
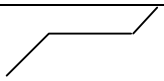
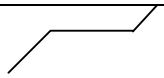
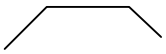
Belfast English	Southern British English
	
L*H %	L*H %
	
L*H H%	L*H H%
	Not attested
L*H L%	

Table 4. Comparable boundary transcriptions in two dialects of English.

4.2.2 The phonetic tier

The intonation of two dialects may differ in phonological structure. Secondly, there may be differences in the phonetic implementation of intonation. Leeds and Newcastle English, for instance, have a falling accent transcribed as H*L. Under time pressure, a cross-dialectal difference in the phonetic implementation of this accent can be observed (Grabe et al. 2000). If the accent is produced in intonation-phrase-final position, on a short word with little scope for voicing (e.g. *hat*), then Leeds English speakers truncate: the pitch movement remains incomplete. Newcastle English speakers compress: the pattern is produced faster. This observation (and others) can be noted on the phonetic tier of the IViE system and is illustrated in Figure 2; with stylised f0 patterns, phonological, phonetic and orthographic transcriptions.

Figure 2 (a) shows that in Newcastle and in Leeds, on the word *limousine*, H*L is implemented as a fall in f0. Figure 2 (b) shows that in an identical context, the implementation of the word *lip* differs across dialects. In Newcastle, H*L is implemented as a sharp, compressed fall. In Leeds, H*L is truncated. In the phonetic transcription, in Figure 2 (a), the fall in pitch and f0 is transcribed as H-l. 'H' transcribes the high pitch on the initial, stressed syllable of the word *limousine*. 'l' transcribes the low at the end of the accent foot (an accent foot consists of an accented syllable and all following syllables, if any, up to the next accented syllable). The diacritic '-' stands for the interpolation between H and l[8]. In Figure 2 (b), on *lip*, the phonetic transcriptions for the two dialects differ. In Newcastle, the word is transcribed as a high-low glide HL. Two capital letters represent a fall in f0 on a single syllable. There is no fall in Leeds English and accordingly, the pitch pattern is transcribed as H, i.e. high pitch on the accented syllable.

[8] The interpolation symbol makes phonetic transcriptions more economical. H-l can transcribe a fall in pitch on two syllables or a fall which spans more than two syllables.

(a)

Phonology:	H*L	H*L
IViE phonetic transcription	H-l	H-l
Word spoken:	*Limousine*	*Limousine*

(b)

Phonology	H*L	H*L
IViE phonetic transcription	HL	H
Words spoken	*lip*	*lip*

Figure 2. A difference between Newcastle English and Leeds English in the phonetic implementation of pitch patterns.

More information on truncation and compression is given in Grønnum (1989) and Grabe (1998a). More information on the phonetic tier is available in Grabe, Nolan and Farrar (1998) and Grabe, Post and Nolan (2001).

4.2.3 The Prominence Tier

Dialects may also differ in the location of stressed syllables. For instance, the word *suddenly* is stressed on the first syllable in British English, but in Singapore English, it is often the last syllable of the word that is heard as most prominent, especially by listeners from a British English background[9] (Low and Grabe 1999). A similar effect was observed in IViE data from Newcastle *What is the matter?* /ˈmaˈʔə/). Observations such as these can be noted on the prominence tier: here, labellers transcribe the location of stressed and/or accented syllables (i.e. not all syllables that are noted as prominent on this tier will be labelled as accented on the phonological tier). In addition, labellers transcribe the location of rhythmic boundaries in the speech and the location of hesitations or repairs. A prominence tier can also be helpful when labellers disagree. Often, the disagreement begins with different views on whether a syllable is accented or merely stressed.

[9] Singapore English speakers do not appear to be able to make prominence judgements with a great degree of confidence.

4.3 Summary

The IViE system was developed for the transcription of prosodic variation in dialects of English spoken in the British Isles. The system allows for the transcription of three types of variation: (1) cross-dialectal differences in the phonological structure, (2) differences in the phonetic implementation of the phonological structure and (3) differences in the location of stressed and accented syllables.

The phonetic tier and the prominence tier were developed to increase the level of transparency and replicability of the phonological transcription. In essence, they permit a two-step breakdown of the process which leads to phonological transcriptions. In English, this process begins with the identification of prominent (stressed) syllables. These provide anchors for accented syllables. In the IViE system, we have made the identification of prominent syllable overt, rather than implicit (i.e. everyone who labels English in a ToBI-style system makes decisions about the location of anchor points for accents but the original ToBI does not allow for a distinction between stressed and accented syllables). The second step involves involves the identification of the shape of pitch movements surrounding prominent syllables. This step requires careful listening and the examination of the f0 trace. The labeller's observations are recorded on the phonetic tier. Finally, the labeller arrives at a generalisation, i.e. a phonological classification. A labeller may conclude, for instance, Even if two intonation patterns are somewhat different in their phonetic implementation, that the intonation patterns of two utterances differ somewhat in their phonetic implementations but nevertheless, the patterns make comparable contributions to the meaning of an utterances. In that case, the implementational differences will be described on the phonetic tier. The hypothesised phonological identity will be recorded on the phonological tier.

5. Findings

The IViE corpus provided quantitative evidence of cross-dialect and cross-speaker variation in English intonation (Grabe et al. 2000, 2001, Grabe and Post 2002, Grabe 2002). In the following sections, two findings are summarised. Evidence for phonetic variation is given in section 5.1. Section 5.2 provides evidence for phonological variation.

5.1 Cross-dialect differences in phonetic realisation

In 1998, in a cross-linguistic investigation of English and German, Grabe (1998b) showed that the truncation/compression parameter distinguishes Southern British English (compressing) from Northern Standard German (truncating). This finding appeared to support a suggestion put forward by Ladd (1996). Ladd suggested that truncation and

compression could be language-specific parameters in intonation typology. Earlier work on Swedish, however, suggested that differences in the application of truncation and compression could be dialect specific rather than language-specific (Bannert and Bredvad 1975). The data from Swedish motivated an investigation of truncation and compression in the IViE project. We tested the application of the suggested language-specific parameter in four dialects of English. Since English was said to be a compressing language, we expected to find compression in all four dialects. Using Grabe's (1998b) method, we collected data from Cambridge, Leeds, Newcastle and Belfast. The stimuli consisted of the surnames *Mr. Sheafer*, *Mr. Sheaf* and *Mr. Shift*, embedded in identical carrier phrases. The pragmatic intent of the test utterances was cued by identical precursors. Since the surnames exhibited successively less scope for voicing, the speaker was expected either to increase the rate of f0 change from the longest to the shortest word (compression) or to complete less of the pattern (truncation). Details of experimental procedure and measurements are given in Grabe et al. (2000). A summary of our findings is given in Figure 3. The figure shows that the findings did not confirm out expectation. The data showed that not all dialects of English compress. We found evidence of compression in Cambridge and Newcastle English but evidence of truncation in the data from Belfast and Leeds.

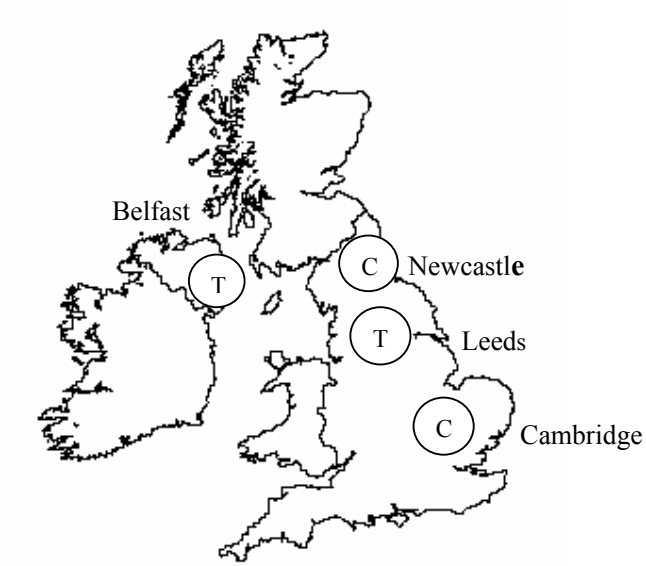


Figure 3: Compression and truncation in four varieties of English. C= Compression, T=Truncation.

5.2 Cross-dialect differences in the phonological structure

This section summarises our findings on cross-dialect and cross-speaker variation in the phonological structure of English intonation. The data given in Table 5 are based on the sentence data in the prosodically annotated section of the IViE corpus. They illustrate

nuclear accent production in seven urban dialects, spoken in Belfast, Bradford, Cambridge, Dublin, Leeds, London and Newcastle[10]. The results are from six speakers from each dialect (three male, three female). The stimuli were presented to the speakers in the form of a randomised list. Each speaker read eight declaratives (e.g. *We arrived in a limo*), three wh-questions (e.g. *where's the manual?*) three yes/no questions (e.g. *May I lean on the railings?*), and three declarative questions (questions without morphosyntactic questions markers, e.g. *You remembered the lillies?*). Table 5 below shows the proportions of each nuclear accent type produced in each dialect, per utterance type.

	Nuclear Accent	**DEC**	**WH-Q**	**Y/N-Q**	**DEC-Q**
London	H*L %	95.8	55.6	27.8	5.6
	H*L H%	4.2	33.3	16.7	16.7
	H* H%	0	0	16.7	33.3
	H* %	0	0	0	0
	L*H %	0	0	0	0
	L*H H%	0	0	0	38.9
	L*H L%	0	0	0	0
	L* H%	0	11.1	38.9	5.6
Cambridge	H*L %	93.8	61.1	44.4	11.1
	H*L H%	6.3	16.7	27.8	0
	H* H%	0	0	0	0
	H* %	0	0	0	0
	L*H %	0	0	0	0
	L*H H%	0	22.3	27.8	88.9
Bradford	H*L %	100.0	83.3	16.7	22.2
	H*L H%	0	5.6	0	5.6
	H* H%	0	0	0.0	0
	H* %	0	0	11.2	5.6
	L*H %	0	0	66.7	66.7
	L*H H%	0	0	5.6	0
Leeds	H*L %	100.0	72.2	44.4	0
	H*L H%	0	11.1	0	0
	H* H%	0	0	0	5.6
	H* %	0	0	0	0
	L*H %	0	5.6	55.6	72.2
	L*H H%	0	11.1	0	22.2
Newcastle	H*L %	83.3	61.1	44.4	11.1
	H*L H%	0	0	16.7	0
	H* H%	0	5.6	0	0
	H* %	0	0	0	5.6
	L*H %	16.7	33.3	38.9	83.3

[10] Cardiff and Liverpool English were not included in the original IViE project proposal.

Belfast	H*L %	4.2	5.6	0	0
	H*L H%	0	0	0	0
	H* H%	0	0	0	0
	H* %	0	0	0	0
	L*H %	83.3	94.4	94.4	83.3
	L*H H%	0	0	5.6	16.7
	L*H L%	12.5	0	0	0
Dublin	H*L %	94	77.8	68.4	27.8
	H*L H%	0	5.6	15.8	0
	H* H%	0	0	0	0
	H* %	0	0	0	0
	L*H %	6	16.7	15.8	50.0
	L*H H%	0	0	0	5.6
	L*H L%	0	0	0	22.2

Table 5. Intonational variation in statements, wh-questions, yes/no questions and declarative questions in seven dialects of British English.

The first column of Table 5 shows the dialect. The second shows transcriptions of the nuclear accents observed in the data. The third shows nuclear accent distribution in declaratives. The remaining columns show nuclear accent distribution in wh-questions, yes/no questions and declarative questions.

Falling nuclear accents (H*L %) were predominant in declaratives, in six of the seven dialects. The only exceptions is Belfast. Here, declaratives were predominantly rising (L*H %). This finding was predicted by earlier work (e.g. Rahilly 1991 and Cruttenden 1995). Newcastle and Dublin fall into an intermediate position. Here, rising declaratives are possible, but not particularly common (15% and 6% respectively).

Nuclear accent productions in questions were subject to more variation; in questions, speakers appeared to produce a larger number of nuclear accent types. In declaratives, two nuclear options per dialect were common. In questions, we observed three or four patterns per dialect. Some if these patterns differed across dialects, but we also found evidence of overlap between dialects, in questions and in declaratives. Cross-dialectal differences and overlap between dialects in the production of nuclear accent types is shown in Figure 4, with data from Belfast, Dublin and Cambridge. The utterance type chosen for the illustration is the declarative. Overlap patterns for questions are more complex.

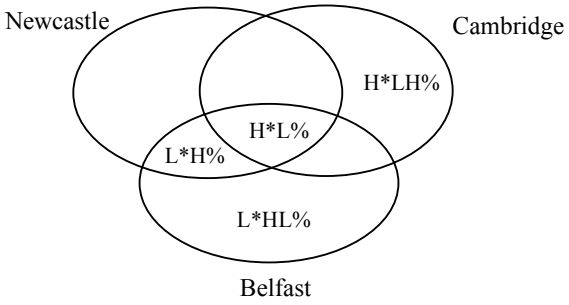


Figure 4. Illustration of cross-dialectal differences and cross-dialectal overlap in the production of nuclear accent patterns in declaratives.

Figure 4 shows that Newcastle speakers produced two types of nuclear accents in declaratives. One of them, H*L%, was also available to Cambridge and to Belfast speakers (but note that H*L% was rare in our Belfast data). The other Newcastle pattern, L*H%, was also produced by Belfast speaker, but not by Cambridge speakers. Cambridge speakers also had two options. They produced a falling-rising nuclear accent H*LH%, and this pattern was not shared with either Newcastle or Belfast. The other Cambridge option, H*L% was shared by both. Belfast speakers, finally, produced L*HL%. In the IViE data summarised here (i.e. read sentences), this pattern was not produced by Newcastle or Cambridge speakers.

In sum, Table 5 shows that the production of nuclear accents varies along three dimensions: (1) dialect, (2) utterance type and (3) speaker. Variation conditioned by the factor Dialect is illustrated by a comparison of the results from Cambridge and Belfast. Our Belfast speakers produced rise-plateau (L*H %) patterns, but our Cambridge speakers did not. Variation added by the factor Utterance Type is illustrated by a comparison of nuclear accents produced in the Leeds data. 100% of speakers produced H*L % in declaratives. In wh-questions, they produced 73% H*L, in yes/no questions 44% H*L and in declarative questions, the pattern was not produced at all. Variation introduced by the factor Speaker is illustrated by the data from Newcastle yes/no questions. 44% of speakers produced H*L %, 16% produced a H*L H% (a falling-rising nuclear accent) and 39% produced L*H % (a rise-plateau). A single nuclear accent type produced by all speakers of a particular dialect on a particular utterance type was encountered only twice; in Leeds and in Bradford declaratives.

6. Discussion

The IViE corpus provided quantitative evidence of intonational variation in the British Isles. The data showed that dialect affects the phonetic realisation of intonation. The data also showed that dialect, utterance type and speaker have a considerable effect on phonological choice.

The level of variation observed in the IViE corpus raises a question about linguistic descriptions of intonation. In many formal, language (but not dialect)-specific accounts, variation does not play a role. In the absence of quantitative data on the distribution of particular patterns in particular contexts, the basis of such accounts is not always clear. Some may be based on patterns that speakers are assumed to produce most frequently. Such accounts will then reflect many of the intonational characteristics of a particular language, but they will not account for less frequent patterns. These, however, may be systematic; a pattern is not necessarily unimportant because it is rare. Corpus linguists are familiar with the uneven distribution of features that characterise speech and language. Van Santen (1994) has called this property *lopsided sparsity*: some features occur very frequently but the vast majority are rare. The type count of rare features, however, is so large that the likelihood of encountering one in a small sample is near certainty (i.e. there will always be that one intonation pattern that does not fit the description). In the light of this observation, the structural variation in nuclear accent distribution shown in Table 5 is evidence of lopsided sparsity.

How then can we include the facts of variation in accounts of intonation while simultaneously capturing generalisations? In Grabe (2002), I argued that an investigation of variation can meet both needs. Variation can provide information about universal aspects of intonation as well as data on dialect-specific aspects of intonation. In turn, that information can lead to new and better generalisations.

6.1 Intonational variation, universals and dialect-specificity

Haan (2002) made a link between structural variation in intonation and potentially universal linguistic function. The linguistic function in question was interrogativity. Haan showed that speakers' intonational choices can be constrained by the number of syntactic or lexical question-markers in an utterance. In Dutch, Haan compared the acoustic features of declaratives with those of wh-, yes/no and declarative questions. She predicted a trade-off between the number of syntactic and/or lexical markers of interrogativity in the utterance and final rising pitch. A rise to high pitch would be maximally present in declarative questions. These do not contain any syntactic or lexical question markers. Questions with word order changes contain a one question marker and will exhibit fewer instances of high pitch. Questions with inversions and a wh-question word contain two question markers. Here, the instances of high pitch would be reduced further. Haan's prediction is illustrated in Figure 5. Haan's data supported her predictions.

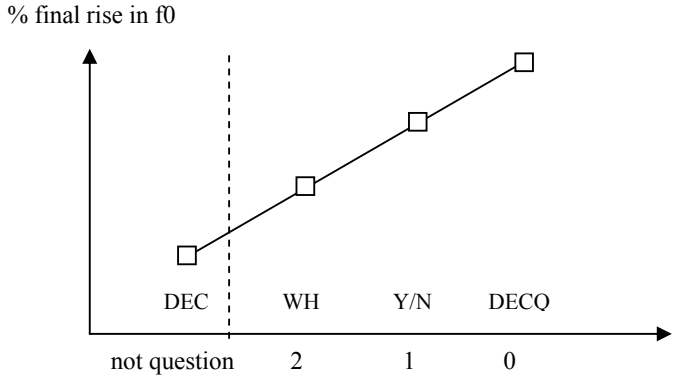


Figure 5. Haan's prediction for the distribution of final rising f0 patterns in nuclear position in declaratives, wh-questions, yes/no questions and declarative questions in Dutch (DEC = declarative, WH = Wh-question, Y/N = yes/no question, DECQ = declarative question).

Haan's approach can be expanded to shed light on the variation in nuclear accent production in dialects of English shown in Table 5 above. The IViE data in Table 5 are directly comparable with the data collected by Haan. In Grabe (2002), the two data sets were compared. Haan's investigation was restricted to the presence or absence of rising f0 in intonation phrase-final position; phonological transcriptions were not made. The IViE data, however, were also transcribed at the phonological level and the transcriptions allow for a compararison of cross-dialects similarities *and* cross-dialectal differences. To allow for a direct comparison of the potential cross-linguistic generalisation observed in Dutch and the data from English, the English transcriptions in Table 5 were recoded. The key to the recoding is given in Table 6.

Transcription	Impressionistic description	Recoding
H*L %	fall	Not rising
L*H L%	rise-plateau-fall	Not rising
H*L H%	fall-rise	Rising
H* H%	high accent followed by a rise	Rising
(L) H* %	high accent preceded by low target	Rising
L*H %	rise-plateau	Rising
L* H%	late rise	Rising
L*H H%	double-rise	Rising

Table 6. Transcriptions and recoding of patterns as "rising" or "not rising".

The results of the recoding are shown in Table 7.

	Nuclear Accent	DEC	WH-Q	Y/N-Q	DEC-Q
London	Not rising	95.8	55.6	27.8	5.6
	Rising	4.2	44.4	72.2	94.4
Cambridge	Not rising	93.8	61.1	44.4	11.1
	Rising	6.2	38.9	55.6	88.9
Bradford	Not rising	100.0	83.3	16.7	22.2
	Rising	0	16.7	83.3	77.8
Leeds	Not rising	100.0	72.2	44.4	0
	Rising	0	27.8	55.6	100
Newcastle	Not rising	83.3	61.1	44.4	11.1
	Rising	16.7	38.9	55.6	88.9
Belfast	Not rising	16.7	5.6	0	0
	Rising	83.3	94.4	100	100
Dublin	Not rising	94	77.8	68.4	50
	Rising	6	22.2	31.6	50

Table 7. Proportion of rising and non-rising nuclear accent in four utterance types and seven dialects of English. An illustration of the data is given in Figure 6.

Figure 6 shows how the incidence of final rising patterns in the four utterance types increases as predicted. A two-way analysis of variance showed that the increase in the incidence of final rises was significantly affected by utterance type ($p<0.001$, for details of the statistical analysis, cf. Grabe 2002).

There are two exceptions in Figure 6. One represents the data from Belfast. Here, the incidence of final rises in yes/no questions and declarative questions is 100%. This is not surprising; Belfast declaratives usually end in L*H %. Table 5, however, shows that the incidence of L*H H% patterns in Belfast increased from 6% in yes/no questions to 17% in declarative questions. The Belfast speakers produced higher rises in declarative questions than in yes/no questions.

The other exception involves the data from Bradford. Here, the incidence of final rises increased from declaratives to yes/no questions, but not from yes/no questions to declarative questions. More data are required to investigate this anomaly.

Figure 6 and Table 7 show that the data from English supported Haan's predictions for Dutch. With the two exception discussed, speakers from seven English dialects were more likely to produce IP-final rising pitch when the text of the utterance contained fewer syntactic or lexical markers of interrogativity. In addition, the data from English showed that

(a) the phonological structure of the final rise was variable,

(b) the variation in the shape of the nuclear accent was affected by dialect, and

(c) the dialect-dependent variation appeared to be subject to a constraint which operates in Dutch and in dialects of English: final rises were produced more frequently when the text contained fewer lexical or syntactic question markers.

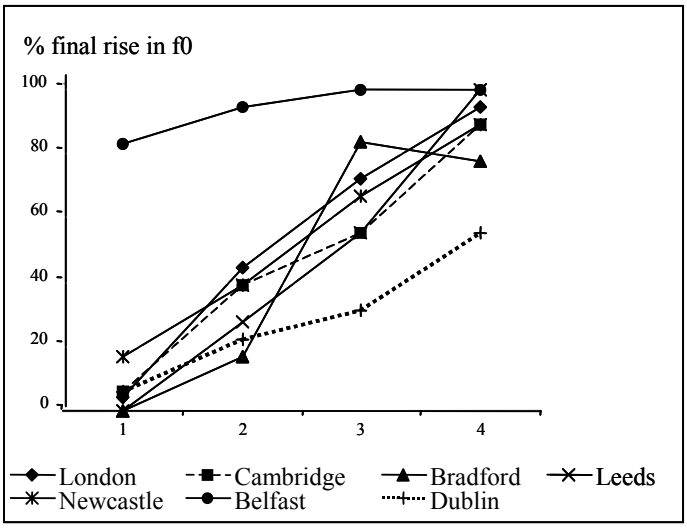


Figure 6. Distribution of final rising f0 patterns in nuclear position in declaratives, wh-questions, yes/no questions and declarative questions in seven varieties of English.

The trade-off between high pitch (i.e. high but not necessarily rising pitch, cf. Haan 2002 and Gussenhoven 2002) and the presence of question-markers in the text may be universal. A similar trade-off has been reported for German, another Germanic language (Brinckmann and Benzmüller 1999) but also for Polish, a non-Germanic language (Grabe and Karpinski 2003).

The origin of the trade-off was discussed by Haan (2002). Haan argued that her data show that phonological options are constrained by the universal Frequency Code (Ohala 1983). Ohala offers a biological view of the relationship between high pitch and questions. High pitch is said to signal subordination, dependence, and lack of threat. In asking questions, the speaker depends on the listener's cooperation and the use of high pitch is frequent. Haan argued that the Frequency Code induces speakers to choose phonological units that involve final high/rising f0 if other cues to interrogativity are absent. An evolutionary view of the link between high pitch and questions has been offered by Chafe (1994) and Wennerstrom (2001). These authors suggest that the link stems from prelinguistic responses to important observations in the environment. Questions are usually produced as demands for interaction and they are intended to attract the listener's attention. Therefore, the speaker may want to make them especially prominent (i.e. involving the production of high pitch) in the stream of speech.

But why would languages and dialects offer their speakers the opportunity to produce high pitch as part of a number of different nuclear accent types? Taking biological and/or

evolutionary accounts of the use of high pitch in speech a step further, I suggest that speakers may have access to different nuclear accent options to express interrogativity in different degrees. In a dialect which has a low rise (L*H) and a high rise (L*H H%), for instance, the high may signal interrogativity more clearly than the low rise. Speakers choices of particular nuclear accents would then depend on the extent to which they intend to express interrogativity. Evidence for this suggestion comes from the Belfast data in Table 5. In Belfast English, L*H H% is not observed when the need for intonational interrogativity is weaker, e.g. in wh-questions. In yes/no questions, the pattern appears. The incidence of the pattern increases further between yes/no and declarative questions, from 6% to 17% The rise-plateau-fall pattern L*H L%, on the other hand, is observed only in declaratives.

My proposal does not claim that the different LH options for questions add nothing beyond degree of interrogativity to communicative impact. Whether they do or not is an empirical question.

In sum, I have shown that a pattern previously found in Dutch intonational data also occurs in English. Such cross-language similarities are a major concern of language typologists. In addition, the English data revealed dialect-specific differences in structural options. Such differences are another concern of language typologists. In both cases, attention to variation reveals essential information. Finally, findings such as these challenge current approaches in intonation analysis. They show that we need to develop new models of intonation that can accommodate intonational variation.

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