

# Acquisition of regional pitch patterns in L2

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## Abstract

Most speakers in today's societies are bilingual or multilingual and linguistic research has shown that the grammatical systems of two or more languages interact in speech production and perception [11,13]. The confrontation of two or more competing phonological systems and their phonetic realization leads to what we generally understand as a "foreign accent". The interference appears on the segmental and the prosodic level. Research in second language acquisition has previously focused on segmental features while research on prosody and its important role in language learning is rather scarce. This present paper examines the intonation of Belfast English produced by native speakers and two groups of German second language learners of English. Acoustic prosodic characteristics responsible for the perception of a foreign accent are identified as deviations in the nuclear pitch patterns. Using production data the study aims to examine the occurrence of regional marked intonation patterns in different speaking styles. The study provides (1) evidence that specific regional intonation patterns are acquired in a naturalistic setting, (2) that these patterns are transferred into different speaking styles in second language production whereas regionally marked intonation patterns vary according to the formality of the speaking style in native language production.

## 1. Introduction

The majority of second language (henceforth L2) studies have previously focused on the segmental rather than the prosodic level of speech production and perception [e.g. 11,2]; unsurprisingly, since only over the past decades spoken language research experienced an increased interest in prosody. However, the significant influence on the foreign accent (henceforth FA) of the prosodic level has been acknowledged in previous studies [22,27,42]. More recently the importance of the prosodic level in L2 acquisition has been acknowledged in a number of publications showing – amongst other aspects – that:

- errors in the realization of prosodic features in L2 contribute more to a foreign accent (henceforth FA) than those on the segmental level [24,30]
- improvement towards a native-like prosody affects the fluency in L2 [41]
- training instructions regarding the prosodic level of speech are more likely to prove effective in the achievement of native-like spontaneous speech than segmental training [7]
- prosodic difference and similarities between the native and the target language affect the L2 acquisition [17]
- age of exposure to L2 determine rate and success of the acquisition of native-like L2 speech [36,38,12]

Nonetheless, there is striking evidence that in language learning differences in the acquisition of prosodic features occur and their source has not been identified yet [29].

## 1.1. Belfast Intonation

Due to the multidimensional functions of prosody its variability has become a major concern in prosodic typology [15]. Cross-linguistic and cross-varietal, inter- and intra-speaker variation have previously been addressed [e.g.16,18,40]. A number of studies have been concerned with stylistic or sociolinguistic variation [31,4,37,34,19,20,9]. Studies on stylistic variation provide evidence that speaking style and formality have an effect on the production of prosodic features.

Belfast English (henceforth Bf English) intonation has previously been described rather impressionistically to have rising nuclear pitch pattern. Only recently a number of studies produced experimental evidence showing that the unmarked pattern for Bf English in declaratives is a rising pattern whereas most accents in the British Isles have falling nuclear pitch patterns. However, the frequencies of rising patterns specified vary greatly, which can be due to several reasons such as incomparable stimuli and material, differences in prosodic annotations etc.. In [21] was reported that 70% of the nuclei in declaratives were produced with a rising pitch pattern by their subjects. In a more recent study rising patterns were produced in only 53% [32]. A comprehensive analyses of intonational variation of nuclear accent types in several accents of British English revealed differences in the functional load of specific patterns in declaratives (DEC), Wh-questions (WH Q, Yes/No-questions (Y/N Q) and inversion questions (DECQ) [15] (see table 1).

Table 1: *Bf-rising patterns in [15]*

BELFAST	DEC	WH Q	Y/N Q	DECQ
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

## 1.2. Speaking style as a factor of intonational variation

Most comprehensive investigations of variation have been concerned with the geographical dimension and thereby focused on the distribution of segmental characteristics across dialects and accents. Current work in sociolinguistics, however, focuses on the gradient nature of inter- and intra-speaker variation. This variation can be influenced by a number of factors, e.g. physical, contextual, social, and individual. Each of those factors interacts with the others and entails further subordinated factors. E.g. social factors entail gender, age, class, and ethnicity etc. Amongst these we find interactions hand-in-hand with even more fine-grained distinctive situative and contextual aspects influencing speech production and perception [25].

The present study deals with the acquisition of regional pitch patterns and their occurrence in different speaking styles.

Speaking style (or register) depends on speaker/listener relationship, discourse, physical circumstances of the context, and temporary external influences. According to those factors native speakers are (consciously or unconsciously) able to alter their speech production. These alternations range from gradual shifts to more categorical changes known as code switching, they can be task-dependent or they can be the effect of audience design [3]. E.g. the phonetic realization of <brother> by a Bf English speaker will considerably differ in informal conversation speech [ɔ̃-ɪ] compared to its realization in reading where speakers will produce a less regionally marked [ɹ].

Our knowledge about prosodic aspects of speech has advanced enormously over the last decades but still faces considerable barriers in the understanding of the form-function-relationship of prosodic features and their phonetic correlates. Therefore, it is not surprising that in the equally relatively young discipline of variationist sociolinguistics – including variation triggered through bilingualism – prosodic aspects of speech are only recently considered. However, there is no doubt that prosody contributes to a functioning interaction between speaker and listener and inappropriate use of prosodic features crucially affects comprehensibility and intelligibility [26]. ‘Wrong’ or inappropriate use can lead to frustration or misunderstandings; they can affect the perception of attitudinal misconceptions or the perception of FA [23].

The awareness that spoken language differs in varying speaking styles, i.e. read vs. spontaneous speech is not new [33] and has experienced a great deal of interest in speech technology [1,6]. Especially in automated speech training applications for second language learners varying pronunciation qualities are considered and integrated [10,35].

In the literature it is often reported that in self-conscious speech or more formal speech individuals tend to produce a less regionally marked variety of their accent adapting what is perceived as standard language or norm. In the case of Bf English compared to Southern British English that would imply a reduction of regionally marked rising pitch patterns and an increase of falling nuclear pitch patterns [15]. Evidence for the phenomenon was provided in [28] as shown in Table 2. The results also show a well known gender-specific effect, a difference which has extensively been addressed in the literature [5,25]. Informal observation has led to the research question of the present paper that these alternations cannot be found in L2 production of Bf English.

Table 2: *H\*L in different speaking style in Bf in [28]*

	Careful	Semi-spontaneous	Spontaneous
Females	45.41%	22.3%	0.26%
Males	14.15%	5.9%	2.5%

## 2. Methods and Material

The speech material consists of recordings of five female L2 speakers of Bf English (L2) from Germany, five female L2 speakers of English just recently arrived in Belfast on an exchange program (control subjects CT\_1) and five age-, gender- and class matched native speakers of Bf English (Bf). The L2 speakers have lived and worked in Belfast for two to eight years and therefore experienced long-term exposure to the regional accent. The recordings were taken in the Phonetics Lab of the University of Ulster at 16 kHz mono format. The speakers were presented with three tasks designed to elicit different speaking styles. Each speaker read aloud a short text eliciting

careful speech (R). They had to explain the preparation of a recipe using given keywords, eliciting semi-spontaneous speech (SE). Each speaker participated in a short interview where spontaneous speech was elicited (S). The speech material was labeled using an adaptation of the IViE system [15]. The acoustic analysis was carried out using PRAAT. The statistical analysis was carried out using SPSS.

### 2.1. Initial Perception test

Northern Irish English cannot be understood as a single dialect and although not much scientific evidence has led to a comprehensive description, native speakers of Northern Irish English are confident and skilled in identifying a speaker’s origin within Northern Ireland. To ensure that all recorded native speakers are clearly identified as Bf English speakers and the L2 group can be distinguished from CT\_1 a pre-perception test was carried out. The recordings were presented to 27 Northern Irish speakers of English from county Londonderry (Coleraine), county Tyrone (Omagh) and County Antrim (Ballymena and Belfast). Recordings from five native speakers of English from Leeds, London (2 speakers), Glasgow and Bristol (CT\_2) were inserted as distracter items to allow for differentiation of British English accents. CT\_2 speakers were native speakers of their accent. They were born and had lived in the city all their life and solely provide the basis for comparison for the perception test. The data have not been further considered during the prosodic analysis. The participants were presented with two sentences per speaking style and asked to indicate the following:

- i) native speaker of English vs. non-native speaker
- ii) a. if native, from which city (no choice given)  
b. if non-native, where was English acquired (choice between Belfast or Germany)

### 2.2. Prosodic Annotation

The prosodic annotation was carried out using the IViE system which has been developed to allow for comparative research in intonation considering rhythmic, phonetic and phonological characteristics. The following pitch contours have been described for high and low targets and were adapted for the present analysis:

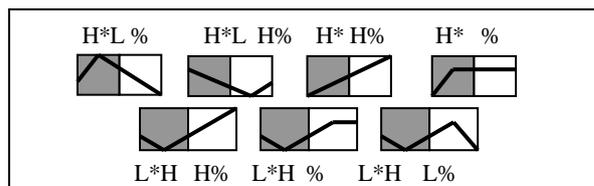


Figure 1: *Nuclear pitch patterns as described in IViE*

## 3. Results

Pre-perception test

- i) All non-native speakers were correctly identified (error rate 0%).
- ii) a) All native speakers were identified correctly and Bf English speakers were allocated to their city of origin (error rate 0%)  
b) The place of acquisition was correctly allocated for L2 and CT speakers (error rate 0%)

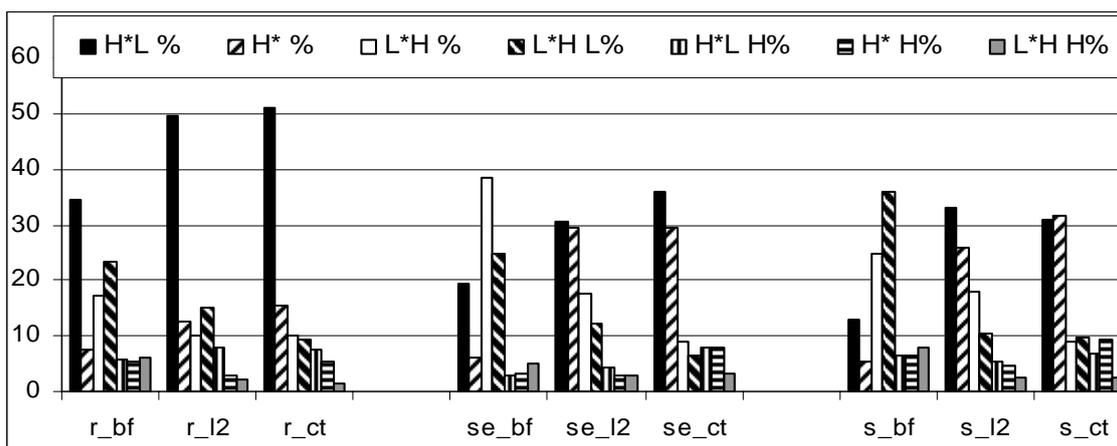


Figure 2: Percentage of nuclear pitch patterns in read, semi-spontaneous and spontaneous speech produced by Bf, L2 and CT

In order to see whether there is a difference between native and non-native speakers of Bf English in the realisation of regionally marked nuclear pitch contours in varying speaking styles the total number of nuclear accents produced by each speaker in each of the tasks was counted and calculated as a percentage of the speaker's total number of nuclear accents. The results are presented graphically in figure 2. The statistical analysis was carried out in SPSS with speaking style and speaker's origin as independent and the nuclear pitch patterns as dependent variables.

No significant effects were found regarding speaker's origin and speaking style or their interaction in the realisation of H\*H %, H\*L H% and L\*H H%. Those patterns have been realized in less than 7% by the individual speakers in all speaking styles and were most frequently found by [15] in the realisation of questions types which were not present in the analyzed data. Significant difference was found in the realisation of H\*L % and H\* %, L\*H % and L\*H L%.

CT and L2 produced significantly more H\*L % compared to the group of native speakers of English across all three speaking styles. All speakers realized significantly more falling pitch accents in read speech ( $F_{(2,36)}=25.9, p<0.05$ ) compared to SE and S. In Bf English the number of H\*L % was lower in S compared to SE however, statistically no significant interaction was found for origin and speaking style. L2 and CT did not differ significantly in the realization of H\*L %.

In the realization of high plateaus (H\* %) a significant interaction between origin and speaking style was found ( $F_{(4,36)}=10.3, p<0.05$ ). Whilst L2 and CT produced more H\* % patterns in SE and S compared to R, Bf speakers produced a comparably low number of this patterns across all speaking styles. Additionally, the results showed that L2 and CT produced significantly more H\* % patterns across the three speaking styles ( $F_{(2,36)}=75, p<0.05$ ).

A significant interaction effect for origin and speaking style was found in the realization of L\*H % ( $F_{(4,36)}=7.65, p<0.05$ ). Whilst Bf and L2 speakers produced more rising patterns in SE and S compared to R, the number of L\*H % was equally low in all three speaking styles produced by CT. The pattern was produced most frequently by Bf English speakers. In the CT data the pattern occurred least frequently.

Again, the interaction between origin and speaking style showed significant effects in the realisation of L\*H L% ( $F_{(4,36)}=7.33, p<0.05$ ). The number of L\*H L% patterns was found to be

significantly higher in Bf English across the speaking styles. Only in Bf English the number of L\*H L% realizations increased with increase of spontaneity in the speaking styles.

Generally it was found that Bf English native speakers produced significantly more L\*H % and L\*H L% patterns compared to the L2 and CT. However, in the L2 data the number of rising nuclear pitch patterns was significantly higher than in the CT data. Additionally it was found that low boundary tones, regardless the preceding target tone, occurred more often in read speech than in semi-spontaneous or spontaneous speech.

#### 4. Summary and Discussion

The results of the initial perception test showed that all speakers were identified correctly as native or non-native speaker regardless the speaking style. Additionally, the allocation of Belfast as the place of acquisition for the second language learners has been shown to be similarly straightforward for the L2 group. However, the present study has not identified whether this is due to segmental or prosodic features and what their relative organization could be in the allocation of place of acquisition.

The results of the prosodic analysis showed that native speakers of Bf English tend to vary regional markers depending on the speaking style. It has frequently been reported that segmental variables can vary according to the formality of the context in which communication takes place [25]. Most recently it has also been shown that Bf English speakers tend to produce less regionally marked intonation contours in more careful speech [28]. The present study supports these findings.

The study also provides evidence that regionally marked pitch patterns are acquired by L2 learners after long-term exposure. This was supported by the findings of significant differences in the number of rising pitch patterns between L2 and CT [40].

The main issue addressed in the present paper, however, was whether or not L2 speakers of English vary regionally marked intonation contours according to the speaking style they produce after long term exposure to a regional accent. Although, marked patterns are acquired, it seems that the stylistic variation cannot be employed or applied by L2 speakers since no significant difference in the number of rising pitch patterns in the L2 across the three speaking styles were found. This suggests that the speakers are not aware of stylistic variation or unable to realize the alternation of regionally marked prosodic features according to the formality of the speaking style.

This could be due to a number of reasons. The question, however, about their appropriateness to explain the present results remains unanswered and needs further exploration. Generally, speakers of a regionally marked variety tend to alter aspects of their pronunciation on the segmental and/or suprasegmental level, their grammar or vocabulary towards a (perceived) standard by active or passive control. The lack of experience with those norms might affect the unchanged utilization of regional pitch accent patterns across different speaking styles. These features might be intended to aid integration processes of individuals within the given society and therefore individuals will actively train those features to facilitate linguistic integration into communities and to achieve a high level of nativeness. Another possibility is that such fine-grained stylistic features might generally be acquired very late or not at all in second language acquisition.

## 5. References

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