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Aspects of Prehead and Onset: The Onset Onglide Phenomenon

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Abstract

High pitch accents are often accompanied by a small upwardly gliding pitch slope towards the high tone target. In intonation phrase (IP) initial position, particularly when no unstressed syllables precede the accented one, it can be very hard to determine the status of this onglide: it may be connected to a low boundary tone, it may be a leading L tone associated with the onset H*, or it may be a matter of the phonetic implementation of H*. An experiment was devised that focuses on the relation between the prehead, the stretch of unstressed syllables introducing an IP, and the onset, the first accented syllable of an IP. The aim was to display the left-hand environment of the onset by systematically increasing the number of prehead syllables from none to three and observe whether the prehead pitch behavior revealed the nature of the onset onglide. Twenty speakers were asked to read aloud a passage containing twelve test sentences. Results suggest that the onglide movement is associated directly with the H* onset tone and does not spread into the preaccentual environment. Prehead pitch contours appear to be flat and do not interpolate towards the upcoming high pitch accent of the onset. Furthermore, a correlation was shown between the pitch height of the prehead and the one of the onset syllable.

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1. Introduction

Anstruther Scottish English (henceforth ASE), a variety of Scottish English spoken on the East coast of Fife, shows salient pitch onglides towards syllables bearing H* pitch accents. These onglides have been shown to be more prominent in ASE than in Southern British English (henceforth SBE) [1], as might be expected from the labeling of such onglides as L*..H in Glaswegian Scottish English [8]. Figure 1 shows onglide examples on the words ‘where’s’ and ‘air’ in ASE.

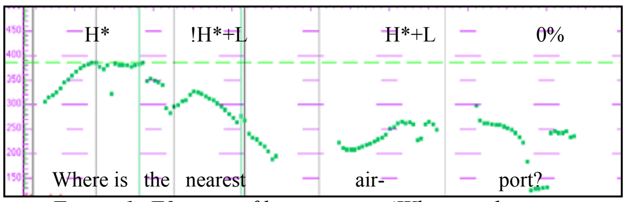

Figure 1: F0 trace of he utterance ‘Where is the nearest airport?’ in ASE, displaying onglides on ‘Where’ and ‘air’.

If high pitch targets are preceded by unstressed syllables, the left-hand segmental material displays the preceding pitch height and preceding pitch targets [8]. In onset position, this segmental material is provided by the unstressed syllables of the prehead.

However, little is know about the early IP constituents in English intonation. Descriptive auditory analyses such as [4, 12] recognize an unmarked prehead on a pitch level that is slightly below the level of the onset syllable, the latter being claimed by [4] to be produced on a speaker specific constant pitch height. From the unmarked case, [12] recognizes a high and a mid variant, while [4] describes a low and two high ones. As for the contour within the prehead, preheads remain unspecified, [4] mentioning briefly that the unmarked prehead is produced on a level pitch that may be gradually rising. Autosegmental metrical analyses (e.g. ToBI [2], IViE [6]) recognize a default prehead height in the middle of a speaker’s pitch range or lower and mark the variation of a high prehead by a boundary tone for cases where the prehead is high and cannot be attributed to an H accent in the onset.

Some recent studies scrutinize the interaction of prehead and onset. [3] reports that prehead pitch may be influenced by tonal sandhi, i.e. the assimilation of pitch by adjacent syllables. Other studies investigate in how far a speaker’s choices for pre-head and onset pitch height are interdependent. [7] regards prehead and onset pitch heights in Dutch to be independent choices by the speaker, the pitch height of the prehead being specified by an intitial boundary tone (as found by [9] and [13]). The author goes on to establish a stylistic rule he terms ‘Narration’, which describes the intonation of Dutch story telling and news bulletins. In ‘Narration’, an onset parameter applies according to which prehead and onset pitch height are fixed to a low prehead with an H*L onset accent and a high prehead with an L*H onset. The same ‘polar’ relationship between prehead and onset for Dutch was described by [5]. While the two components present separate intonational morphemes, the authors showed that they conspire semantically in the pragmatic meaning they convey (as first mentioned by [14]). The authors report that sequences of low preheads followed by high onsets and high preheads followed by low onsets were judged more favorably (friendlier, polite) by listeners than non-polar sequences of low preheads followed by low onsets and high preheads followed by high onsets. [11] run a systematic analysis on read speech data that relates different anacrusis (i.e. prehead) structures to the peak alignment of the onset tone. The authors observe that in utterances that are introduced by a prehead, the onset peak will be aligned with the onset syllable. In utterances with no prehead, however, the peak may only be reached beyond the onset syllable. As a possible explanation, the authors put forward the idea of perceptual salience: while a prehead provides segmental material for a rise to make the onset peak salient, the late peak appers to ensure equal salience of peaks without a preceding anacrusis by postponing the peak and using the first part of the onset as segmental material to implement a rise. Note however that the authors do not actually report a rising pitch pattern in the prehead.

The purpose of the present experiment is to contribute to our understanding of unmarked prehead pitch patterns and prehead and onset interactions and to observe the onset onglide within the framework of these two IP constituents.

2. Experiment

2.1. Experiment Design and Hypothesis

The design for the present experiment involves an H* accent on the onset syllable (henceforth S) preceded by a systematically increasing number of unstressed prehead syllables (henceforth s). Test utterances comprise the following prehead structures: S with no prehead, sS with one, ssS with two and sssS with three prehead syllables. This set-up allows us to observe the behavior of the prehead pitch contour, the onset pitch height and the behavior of the onset onglide within this framework. There are two conceivable ways in which the prehead pitch contour may take shape. As the stylized pitch contours in Fig. 2 illustrate, it can interpolate towards the upcoming H* target on the onset and be rising (pattern A), or it can stay on a flat and low prehead level and only rise later in direct vicinity of the onset syllable (pattern B). Pattern A would be predicted if the onset onglide is associated with a low boundary tone, from where the pitch rises towards the H* tone of the onset. Pattern B would be predicted if the onglide is associated with the onset syllable and not to be a low boundary tone. Furthermore, pattern B suggests some kind of boundary which prevents the onset from being anticipated in the prehead or the prehead syllables being used for a rise to the peak.

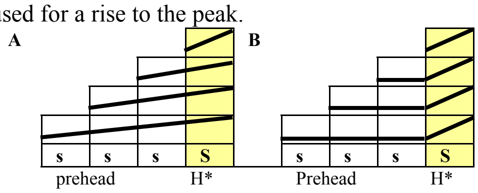

Figure 2: Stylized pitch pattern of conceivable prehead behaviour in test utterances.

2.2. Material

Participants were asked to read a passage from the Cinderella story as used by [10]. From this passage, twelve pragmatically and emotionally unmarked IPs were isolated according to their prehead structure, i.e. S, sS, ssS and sssS. Table 1 lists the test utterances.

structure	Text
S	Once upon a time there was…
S	Lilly and Rosa were very unfriendly.
S	Lilly and Rosa thought this was divine.
sS	but everyone called her Cinders.
sS	The ball would be held in…
sS	They dreamed of wedding bells.
ssS	For the third time, Cinders' mother…
ssS	But the slipper was always too small.
ssS	But the prince insisted that…
sssS	They wanted hairbrushes, hairpins…
sssS	And he began to search the kingdom.
sssS	But it was no use.

Table 1: Utterances and their prehead structures (onset syllables are underlined).

Since Dutch and English are closely related languages, [7]'s onset parameter of his 'Narration' modification for story telling was assumed to apply. Thus, a low prehead was expected with an H* onset. Effects as variation in onset height due to topic structure were automatically controlled for by the normalizing nature of read data, each speaker performing identical sentences with identical topic structures involved.
The experiment yielded three tokens per prehead structure for each speaker. In total, the data set consisted of 240 tokens.

2.3. Speakers

Twenty speakers in total participated in the experiment: 10 speakers of Anstruther Scottish English (ASE) and 10 speakers of Southern British English (SBE). Since the onset onglide phenomenon had been shown to be a dialect phenomenon in retreat, used more substantially by elderly speakers than by younger ones [1], each set of speakers of one variety involved two age groups of five speakers: students from a local secondary school aged 16-18 and elderly speakers from the local area aged 60-80. All speakers have lived in the respective towns for practically all their lives. The set of recordings from Cambridge students speakers was taken from the 'IViE Corpus' with kind permission of the Project 'English Intonation in the British Isles' [10]. Recordings were carried out in secluded rooms using a Sony DAT recorder and a dynamic microphone with a cardioid response. Speakers were not paid for their participation.

2.4. Measurements

Measurements were carried out using Xwaves (Entropic), taking the following measurement points for each utterance:

Aa F0 max in vowel of antepenultimate anacrusis syllable
Ap F0 max in vowel of penultimate anacrusis syllable
Au F0 max in vowel of ultimate anacrusis syllable
H0 First measurable F0 value in onset syllable
H1 F0 max in vowel of onset syllable
H2 F0 max in vowel of second head syllable
L Utterance-final F0 min

Cases that involved creaky voice, speech errors or stress variations were discarded. Unfortunately, most stress variations occurred in sssS prehead structures, the structures that are most revealing for the present purpose.

3. Results

3.1. Prehead Pitch Contour

Speakers of different varieties (ASE versus SBE) and different age groups (younger versus elderly speakers) show a considerable variation in pitch range [1]. Therefore, values were expressed logarithmically in semitones, as Hertz values would exaggerate pitch differences in the higher frequencies. Further, normalization was carried out to neutralize the effect of differences in the overall pitch range of each speaker and utterance. The overall pitch range of an IP was defined in terms of the distance between the onset H* pitch value in the IP and the utterance final L. All values were expressed as percentage of range between the final low of an IP and the onset H* value, L representing 0% and H representing 100%. This procedure allows a sound comparison of individual pitch values both within and between speakers.

The results reveal that the stretch of prehead syllables displays a fairly flat pitch contour on a low pitch level. Fig. 3 and 4 show the pitch contours that were found for all four groups of speakers in the specific prehead structures of ssS and sssS, averaging over instances and speakers. The pitch is kept low throughout the prehead and only rises rather abruptly towards the H* onset target in direct vicinity of the onset. This observation corresponds to the hypothesized pattern B in Fig. 2. The low pitch does not appear to be confined to the boundary; throughout the prehead, the pitch does not interpolate towards the upcoming high pitch target as it would if ‘tonal sandhi’ was involved and as was suggested by [11] when they assumed that the prehead could take part in the slope up to the onset syllable.

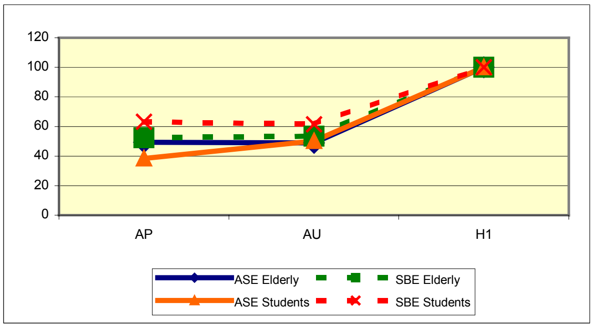

Figure 3: Pitch pattern of ssS prehead structures, values normalized for final L (0%) and H1 (100%).

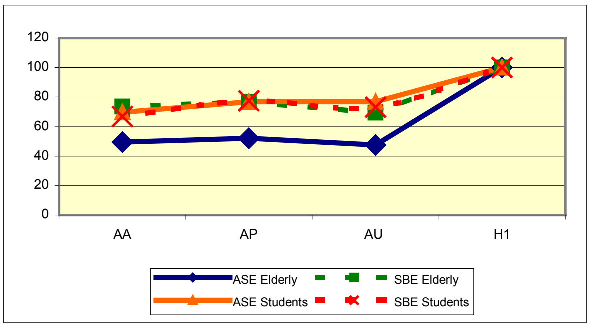

Figure 4: Pitch patterns of sssS prehead structure utterances, values normalized for final L (0%) and H1 (100%).

To account for the ‘flatness’ of the prehead in quantitative terms, a regression analysis was carried out on the sssS structure utterances of all 20 speakers, using the measurement points AA, AP and AU, i.e. the three prehead syllables, as the independent variable and the observations [st] as the dependent variable. The low mean value of the regression coefficient B (0.0251) shows that we were dealing with a quasi-horizontal regression line. The ‘goodness of fit’ to this line was evaluated by the mean value of absolute difference between observed and predicted values. The mean of these mean values for all speakers is 0.6509 st and therefore very low. The mean standard deviation was 0.3713. ASE speakers do not differ significantly from SBE speakers in their prehead flatness: while the mean value of absolute difference between observed and predicted values is 0.6557 st and the standard deviation is 0.3472 for ASE speakers, the respective values for SBE speakers are 0.6463 st and 0.3954. The quantitative analysis confirms the flat pitch contour and does not suggest any interpolation of pitch towards the high onset target within the prehead.

3.2. Correlation between prehead and onset pitch height

The second result to be reported here is a positive correlation that was found between prehead and onset pitch values. Fig. 5 displays the prehead values averaged over AA, AP and AU against the onset values for all speakers and all utterances. While indeed [7]’s onset parameter was shown to apply on a phonological level in a ‘polar’ manner, with the H* onset being preceded by a low prehead, the present data suggests that in relative, phonetic terms, lower preheads are followed by lower H* onsets and higher preheads by higher H* onsets. With an R^2 value of 0.6769, this finding suggests the two components to be related in pitch height. This observation supports the idea of the speaker’s choice of prehead and onset pitch being related, or fixed, in the ‘Narration’ modification.

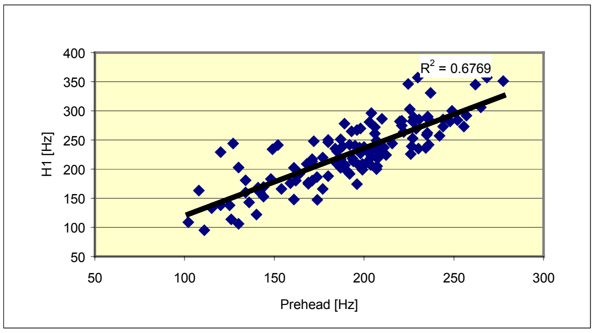

Figure 5: Onset pitch heights against prehead pitch height, averaged over syllables, showing the correlation.

3.3. Onset Onglide and Prehead

The first two sets of results have now set the frame in which the onglide takes place: it is produced between a prehead that is low and flat and an onset the pitch height of which is positively correlated with that of the prehead. The fact that the prehead does not appear to interpolate towards the high onset pitch target, i.e. that the onglide does not ‘spread’ into the prehead, was interpreted as the onglide not being attached to the left hand IP boundary as a boundary tone. Rather, the onglide seems to be associated with the onset syllable itself. The next step following this observation is a closer look at the onglide behavior itself in connection with the preceding prehead. The onglide was measured by taking the difference [st] from measurement point H0, the first F0 trace in the onset syllable, up to H1, the onset peak. The variation induced by syllable onsets that contained unvoiced consonants and therefore less segmental material for an onglide to be manifested was neutralised by the fact that the segmental material was identical for all speakers. As in Fig. 3 and 4, pitch was normalized for the final L as 0% and the onset peak as 100%. Thus, onglide spans can be compared within and between speakers as percentages of the individual IP’s pitch range.

In order to see in how far prehead and onglides are interrelated, onglide spans which are preceded by prehead syllables (sS, ssS and sssS) were compared to those with no preceding prehead (S). Results suggest that onglides are affected by the presence or absence of a prehead: utterances involving a prehead show much greater onglides than utterances in which the onset is not preceded by a prehead. Fig. 6 displays the results.

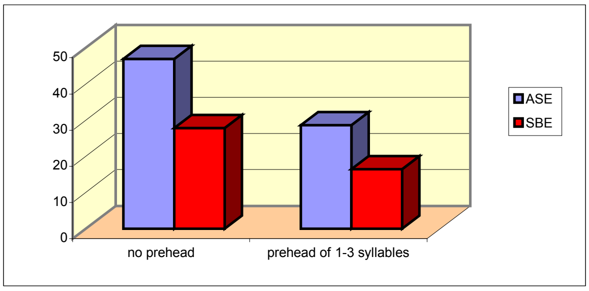

Figure 6: Onglide spans in [%] of IP pitch range in utterances with and without prehead

To substantiate this observation statistically, a paired sampled t-test was carried out on the null hypothesis that the presence of a prehead does not influence the amount of the onglide. Averaged onglide spans in onsets without prehead were compared to those in onsets with prehead, treating results of each speaker individually. On the basis of this t-test, we can reject the null hypothesis at a p-level <0.01 (t: 5.337, df: 19): onglide spans tend to be wider when there is no prehead preceding the onset syllable.

This observation may be seen in the same light in which [11] interpreted their observation that the absence of prehead syllables goes together with the onset peak not being reached on the onset syllable itself but only later. The authors explained this fact by the idea that it may be 'perceptually advantageous to have a slow rise to peak height, in order to render that peak more salient'. Similarly, the present data suggest that the onglide will contribute to this perceptual reinforcement of the peak by compensating missing preheads by onset onglides. Note however that we also showed above that preheads do not take part in the slope up to the onset syllable as was suggested by [11].

4. Discussion and Conclusion

The aim of the present experiment was to shed more light on the relation between prehead and onset in general and the onset onglide phenomenon in particular. The main hypothesis was that the onset onglide, which is hard to categorise particularly in onset positions that are not preceded by a prehead, is not to be regarded as a boundary tone but appears to belong to the onset syllable.

The experiment devised for this purpose consisted of test sentences that involved an increasing amount of segmental material in the prehead, ranging from zero to three syllables. These sentences were embedded in a story and read by 20 participants. The method proved to be practicable and normalized for a range of factors that would otherwise disturb the data, such as topic initiality and marked pragmatic and emotional meanings.

The results confirm that the prehead does not interpolate towards the onset H* pitch target but stays flat on a low pitch level. No evidence was observed for tonal sandhi between prehead and onset. As a next step, the low pitch level of the prehead could be shown to stand in positive correlation with the onset high peak, suggesting that the choice of the prehead pitch height by the speaker is somehow related to the choice of onset height. The third step was to look at the onset onglide within this framework of prehead and onset. Results suggest that even if prehead segmental material is available, the onset onglide does not 'spread' back into the prehead but remains attached to the onset syllable. This finding confirms our hypothesis that the onglide does not represent a low initial boundary tone. Furthermore, the onglide span was shown to be affected by the prehead: with no prehead present, the onglide appears to span over a wider pitch range than in presence of a prehead.

As for ASE, it remains to be determined whether the onglide phenomenon should be classified as a phonological L+H* accent, similar to the case of Glasgow L*..H [8], or whether the slope up to the onset peak is a matter of phonetic implementation. So far, no evidence was found to show a contrastive meaning of syllables with and without onglide in ASE.

To conclude, the present paper shows that prehead and onset form part of an integrated pitch range system in the IP. Prehead pitch contour, correlation between prehead and onset pitch height and onset onglide appear to conspire to a rather complex picture of what is going on in the early intonation in an IP.

5. Acknowledgements

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6. References

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