

# THE PHONETICS OF FINAL PITCH ACCENTS IN AMERICAN ENGLISH POLAR QUESTIONS

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## ABSTRACT

In an ongoing corpus study we have found that polar questions in American English tend to be low rising, characterized by a low final pitch accent followed by a rise to the end of the utterance. A study of a minority pattern of questions with a high final pitch accent followed by a rise reveals that such pitch accents often fall on a type of word that is typically unaccented, thus raising the question of whether these words are accented at all. For this paper, we subjected a small number of crucial tokens from our database to a close analysis in order to uncover the phonetic and pragmatic factors contributing to the patterns of prominence that we detected. The results suggest that many of our final high pitch accents are post-nuclear accents in the sense of Ladd (2008).

**Keywords:** Polar question, pitch accent, post-nuclear accent, American English, corpus study.

## 1. INTRODUCTION

Traditionally, the nuclear accent is taken to be the last pitch accent in the intonation phrase and is considered to be the most important accent in terms of meaning in that it marks the ‘focus’ of the utterance (for a recent summary of information structure distinctions, see [6]).

Recently, however, the possibility of distinguishing focal, nuclear accents from final non-focal pitch-accented elements of the utterance has been articulated. Specifically, it has been proposed that there exist post-nuclear accents, which are edge tones, i.e. ‘phrase accents’ in ToBI, that are associated with post-nuclear lexically stressed syllables. Thus, Grice, et al. [8] propose that in the Eastern European Question Tune, the high phrase accent of the rise-fall (H-L%) question contour can be associated with a lexically stressed syllable, thereby creating a post-nuclear accent. (For discussion see [10], section 4.1.3).

Further examples of post-nuclear accents have been identified in Western Germanic fall-rise (L-

H%) questions [8, 11] and in Romance languages [12, 13]. In this paper, we provide evidence for the occurrence of post-nuclear pitch accents in some American English rising (H-H%) polar questions.

## 2. BACKGROUND AND METHOD

In previous work, we extracted 410 polar questions with the form of interrogative sentences from the speech files of the Callhome [4] and Fisher corpora [5]. Using Praat [3], we annotated their intonation according to the ToBI guidelines [2] and classified them according to their apparent nuclear contour as shown in Table 1. At that time, we defined the nuclear contour as the tune beginning with the final pitch accent of the utterance and continuing with the phrase accent and boundary tone.

Nuclear contour	ToBI category	Number
Low rise	L*H-H%	325
	L*L-H%	2
High rise	H*H-H%	39
	!H*H-H%	5
High fall	H*L-L%	9
	!H*L-L%	1
	L+H*L-L%	7
Low fall	L*L-L%	6
Fall rise	H*L-H%	1
	L+H*L-H%	1
Level	H*H-L%	9
	!H*H-L%	3
	L*+HH-L%	2
<b>Total</b>		<b>410</b>

Table 1: Distribution of Nuclear Contours: Initial Classification

We then consulted the transcripts [5, 9] and attempted to determine meaning differences between questions with different final contours. For example, we determined that falling polar questions tend to function as non-genuine questions in the sense of Banuazizi and Cresswell [1]—e.g. questions that were used to make requests for action rather than requests for information.

We also classified words that follow the final pitch accent, finding that they tend to be pronouns or other words that are given in the discourse, function words such as some adverbs, or words following normal early stress such as the head noun of a compound, as illustrated in (1)-(5).

(1) So **have** you been **able** to get **close** to them?  
 H\*                    !H\*                    L\*H-H%

(2) Can **you** **believe** that?  
 H\*    L\*H-H%

(3) And **did** they **mention** their **other** children?  
 H\*            H\*        L-            L\*H-H%

(4) Did you **get** my **letter** yet?  
 L+H\*    L\*H-H%

(5) Did I **send** it to **you** on **computer** paper?  
 H\*            !H\*            L\*H-!H%

Crucially, when we examined high-rises, we found that unlike the pitch accents of the low-rise tunes, the high pitch accents tend to occur on words of the same type as final unaccented words, as illustrated in (6)-(10).

(6) Do you **know** **them**?  
 L\*        H\*H-H%

(7) Could there **be** a **reason** for **that**?  
 L\*    L\*+H        H\*H-H%

(8) Is that **really** such an **awful** **job**?  
 L\*+H                    L\*+H    H\*H-H%

(9) Did **she** **enjoy** **coming** **visiting** **here**?  
 H\*    L\*HH%    H\*    L\*+H    !H\*H-H%

(10) Do y- would you like an **area** **code**?  
 L\*+H    H\*H-H

This finding raises the question of whether such final words are actually pitch accented at all. In order to answer this question, we subjected a subset of our tokens to a deeper phonetic analysis for the current study, in order to determine whether the tones that we classified as high pitch accents really are pitch accents.

We are also interested in a second question: If such items are indeed pitch accented, can these

accents be explained pragmatically as focal accents, which would justify classifying them as nuclear accents; or should they instead be classified as non-focal, post-nuclear accents arising merely from the association of a phrasal edge tone with a lexically stressed syllable? To answer this question, we carefully examined how the question tokens in our subset fit into their discourse context.

In sum, our goal was to determine if there are objective criteria for distinguishing pitch accents from unassociated phrasal edge tones, and nuclear accents from post-nuclear accents.

The subset of 43 examples that we selected for close phonetic analysis was distributed as shown in Table 2.

	No accent	High rise	Low rise
Compound	8	2	-
<i>you</i>	6	2	2
<i>that</i>	11	3	3
<i>them</i>	5	1	-

Table 2. Distribution of analyzed final words

### 3. RESULTS AND DISCUSSION

In some cases, the final pronoun is accented for information structure reasons because it is focused in some way. For example, in (11) the referent (the sixth) was mentioned more than 4.5 seconds before the pronoun, and there is an intervening topic shift. The accent is used to direct attention back to the referent for a second topic shift.

(11) Is **anybody** **coming** before **that**?  
 L\*                    L\*                    H\*H-H%

410.61 412.82 A: Tova's coming the sixth I think  
 410.59 411.03 B: yeah  
 413.13 414.77 B: The sixth. Why was she going to  
 (( )) [distortion]  
 414.08 416.62 A: yeah and she's going to some  
 relatives or something I don't know  
 416.68 417.94 B: uh-huh that's nice  
 418.36 418.72 A: yeah  
 419.14 420.99 B: uh-huh is **anybody coming**  
 before **that**?

In other cases, there is contrastive focus on the pronoun, as in (12), where the pattern of prominence on 'I' and 'you' evokes the contextual premise, 'you sound staticky to me'.

(12) Do **I** sound **staticky** to **you**?  
 L\* H\* H\*H-H%

8.91 14.62 B: {breath} I think this is a really bad connection because, there's a d- there's a little bit of a lag.

15.04 17.39 A: And it's, it's really staticky. Do **I** sound **staticky** to **you**?

The exchange in (13) illustrates well how information structure affects prosody. A says 'they don't know me', and then B asks, 'Do I know you', deaccenting the final pronoun because it is given and non-contrastive. Then A reciprocates, 'Do I know you?', placing a pitch accent on the final pronoun to signal contrast.

(13) 642.13 644.02 B: wait a second this is being recorded Michelle

644.33 645.82 A: I don't care they don't know me

645.21 646.39 B: oh okay

646.63 647.05 A: {laughing breath}

647.26 647.89 B: do I know you

L\*H-H%

647.36 648.82 A: {breath} do I know you  
 L\*H-H%

Because the final H\* accented pronoun in examples (11)-(13) are focused, we classify these accents as nuclear.

In other examples that we annotated H\*H-H%, however, there is no indication from the context that the final word is focused, and so any pitch accent on such words would have to be classified as post-nuclear.

This situation is particularly evident in final nominal compounds. Since it is the first word of a compound that receives lexical stress, we would expect the second noun to be unaccented, as indeed we thought it was in (14).

(14) Did you **get** my **post** card?  
 H\* !H\*H-H%

However, in (15), we annotated the second noun with a high pitch accent.

(15) Did you **get** her **post** **card**?  
 L\* L\* H\*H-H%

As can be seen in Figures 1 and 2, acoustic cues to the difference between the two tokens of 'card'

include a small difference in relative duration: 'card' takes up 54.2% of the total length of the compound in (14) but only 51.6% in (15). In terms of pitch movement, the rising slope begins with 'card' in (15), whereas the rise begins with 'post' or even 'my' in (14). The perception of prominence is correlated with the beginning of the rise. Because the final noun in (15) is not focused in any way, we would classify any pitch accent that does occur there as post-nuclear.

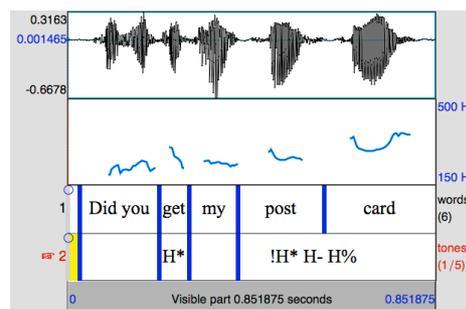


Figure 1. Final unaccented 'card' (14)

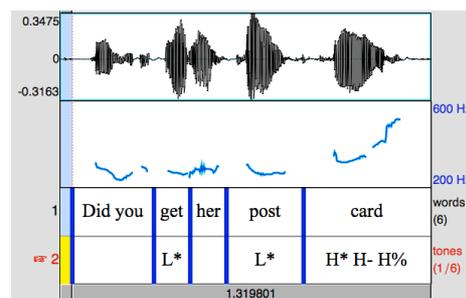


Figure 2. Final high-accented 'card' (15)

The final pitch accent in (16) is also a good candidate for a post-nuclear accent. In terms of information structure the pronoun seems identical to the unaccented final pronoun in (17). In both cases the proposition denoted by the pronoun has just been activated by the speaker, so no shift in attention is needed. Also, no contrast is being expressed.

(16) Do you **know** that?  
 L\*H-H%

1096.37 1099.60 B: eh Lizzy Lizzy everybody feels that way whose worth his salt.

1097.98 1099.00 A: (( ))

1100.06 1100.83 B: Do you **know** that?

(17) Did you **know** that?  
 H\* H\*H-H%

289.03 290.07 A: Is he working now?  
 290.63 292.55 B: No, in fact he got laid off. Did you **know that**?

The acoustic basis for the perception of prominence on the final pronoun in (17) compared to (16) again lies in the pattern of pitch movement, as can be seen by comparing Figures 3 and 4. In (16), the rise begins with 'know', which rises from 253 to 320 Hz. (67 Hz. total), and continues on 'that', which rises from 344 Hz. to 464 Hz. (120 Hz. total). Because the rise begins on 'know', this word is perceived as prominent. By contrast, in (17), 'know' is quite flat (rising only 9 Hz. from 250 to 259). 'That' is quite flat also (rising only 6 Hz. from 284 to 290). However, there is a 25 Hz. step up from 'know' to 'that'. This upstep seems to localize the perception of the rise onset on 'that', which makes it sound prominent.

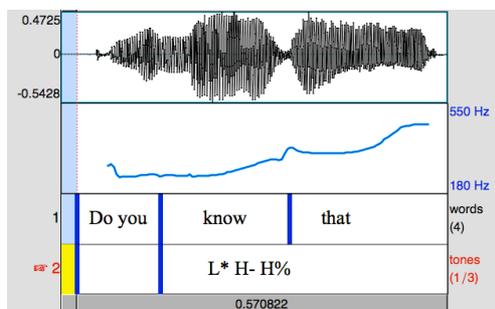


Figure 3. Final unaccented 'that' (16)

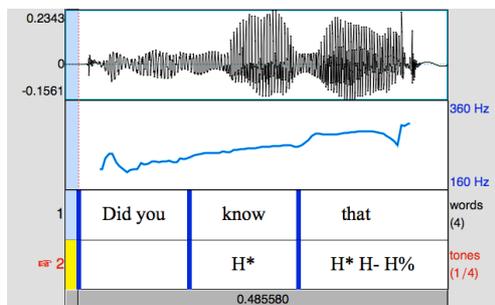


Figure 4. Final high-accented 'that' (17)

Because this prominence on 'that' in (17) does not appear to be conditioned by information structure, this pitch accent is a post-nuclear accent. This happened twice on 'that', once on 'them', and twice on compounds, always with H\*.

In our other examples, too, we found that the pitch movements on pronouns and compound head nouns that we had annotated as unaccented continue a rise that begins on the preceding pitch-

accented word. By contrast, the final words that we had annotated with pitch accents (whether focused or not) exhibit a rise that begins on that word and is independent from any earlier rise.

#### 4. CONCLUSION

While the perception of prominence justifying pitch accent annotation seems to be conditioned by multiple factors, including duration, energy and vowel quality, we conclude that pitch rise onset should be taken as the primary criterion for distinguishing pitch accents from unassociated edge tones in polar questions. We also propose that the criterion for distinguishing nuclear accents from post-nuclear accents should be that the former but not the latter exhibit information structure focus.

#### 5. REFERENCES

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