

The role of the prenuclear F0 region in the identification of German questions and statements

Caterina Petrone* & Oliver Niebuhr⁺

*ZAS, Berlin, Germany; ⁺LPL, Aix-en-Provence, France

petrone@zas.gwz-berlin.de, oliver.niebuhr@lpl-aix.fr

Many languages are able to signal questions and statements solely on an intonational basis. For example, German and Neapolitan Italian can differentiate yes/no questions from statements by the utterance-final intonation that starts at the nuclearly accented syllable. However, while the distinction between yes/no questions and statements is indicated by terminal falling vs. continuously rising intonations in German (cf. von Essen 1964), the Neapolitan intonations are always terminal falling. Instead, it is the late vs. early timing of the nuclear F0 peak pattern that signals the contrast between yes/no questions and statements (cf. D'Imperio 2000). However, Petrone (2008) showed that the intonational domain of the question-statement contrast in Neapolitan Italian is actually much larger. In addition to the timing difference of the nuclear peak, there is a difference of the F0 shape in the context of the preceding prenuclear accent. In statements, the F0 falls rapidly from the prenuclear F0 maximum to the end of the prosodic word, whereas the F0 falls in questions are shallower and take a convex shape. This allows native listeners to identify yes/no questions and statements well before they hear the nuclear pitch accent pattern. Recently, a similar shape difference of the F0 fall was also observed in connection with the prenuclear peak patterns of German yes/no questions and statements (that are not distinguished by syntactically). In order to test its perceptual relevance, the present paper presents a perception experiment that was performed in analogy to Petrone (2008).

The stimuli were based on the two-pitch-accent utterance “KatheRIna sucht ‘ne WOHnung” (Katherina looks for a flat), which was produced naturally with 5 intonation patterns by a trained phonetician: (1) H* H+L* L-%, (2) H* H* L-%, (3) H* L*+H L-%, (4) H* L*+H H-%, (5) H* L*+H L-% (cf. Grice and Baumann 2000). The patterns (1)-(3) differed by the timing of the nuclear peak, but had an almost constantly aligned prenuclear H*, which was followed by a comparably steep F0 fall. The prenuclear H* alignment in (4)-(5) was also roughly the same as in (1)-(3). The decisive difference to (1)-(3) was that the F0 fall after the prenuclear peak maxima was shallower and had a convex shape. In addition, the intonation in (4) did not end in a terminal fall, but in a continuous rise. For each production, 2 gating conditions were created by removing the section after “KatheRina”, i.e. leaving only the prenuclear pattern, and after “sucht”, i.e. leaving the prenuclear pattern and part of the following low plateau. The complete utterances were also included in the experiment as a control condition. The 15 stimuli of the 3 conditions were repeated 5 times in a randomized order and judged by 11 native speakers of German on the basis of a semantic differential, in which the question-statement difference was represented by the 7-point scales ‘astonished – not astonished’, ‘questioning – not questioning’, ‘uncertain – certain’. The judgements were analyzed by co-variance models with mixed effects. The results (cf. Fig.1-3) show that the judgements were affected by prenuclear shape, but not by nuclear timing differences. While the stimuli with the intonations (1)-(3) were all judged comparably as ‘not astonished’, ‘not questioning’, ‘certain’ in all 3 conditions, the stimuli with the patterns (4)-(5) shifted the judgements significantly towards the question configuration ‘astonished’, ‘questioning’, ‘uncertain’. For this shift to occur, it was already sufficient to present only the prenuclear sections up to “Katherina”, which contained the shallow, convex fall, although the shift was larger for the complete utterances. So, also terminal falling intonations can signal a question in German utterances that are not marked syntactically. Overall, the findings underline that the relationship between utterance-final rise and fall on the one and question and statement on the other hand is much more complex in German than claimed in many textbooks (cf. also Kohler 2004; Dombrowski and Niebuhr 2005). Moreover, the findings on German and on Neapolitan Italian together challenge the concept of a linear decomposition of the intonation contours of utterances, in which only the nuclear accent pattern is relevant for the question-statement distinction. Rather, the findings suggest an analysis like in Chinese, in which the question-statement difference is a global effect that modifies the individual lexical tones (Ma et al. 2004). However, the modified units in Neapolitan Italian and German are not lexical tones, but pitch accents.

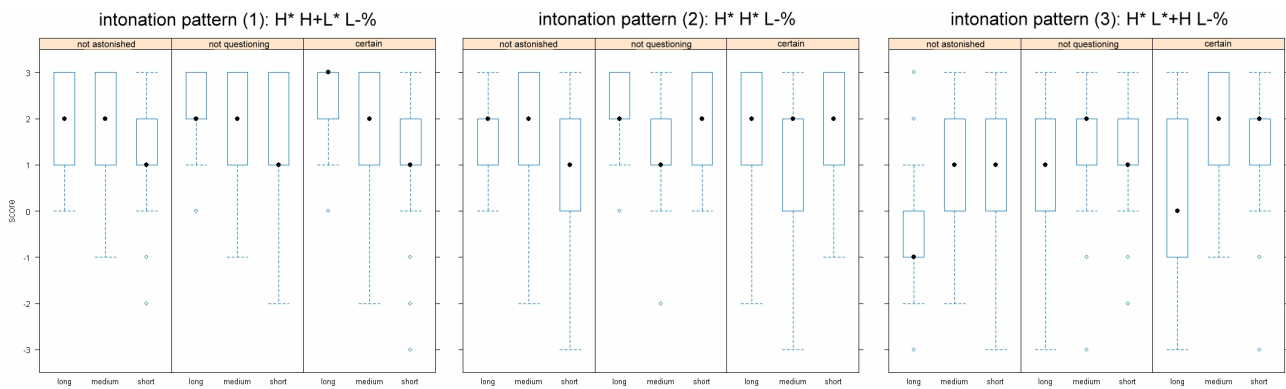


Figure 1. Boxplots of the listeners' judgements on the three 7-point scales (-3 to +3) 'astonished – not astonished', 'questioning – not questioning', 'uncertain – certain', yielded across the 11 subjects and 5 repetitions of the stimuli with the intonation patterns (1)-(3) presented up to the end of "KatheRIna" (gating condition 'short'), of "KatheRIna sucht" ('gating condition 'medium'), and of the complete utterance "KatheRIna sucht 'ne WOHnung" (Katherina looks for a flat).

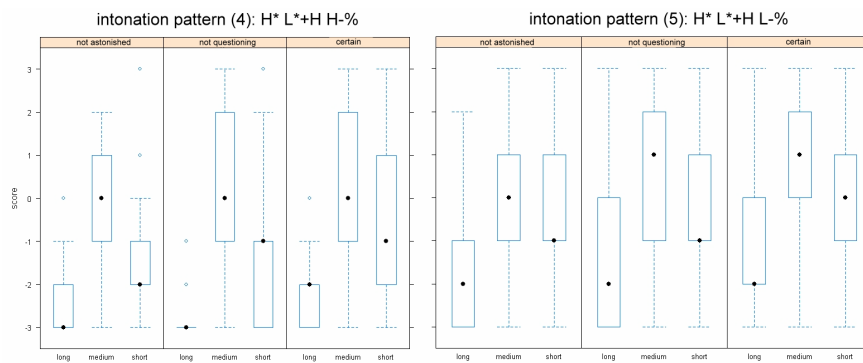


Figure 2. Boxplots of the listeners' on the three 7-point scales (-3 to +3) 'astonished – not astonished', 'questioning – not questioning', 'uncertain – certain', yielded across the 11 subjects and 5 repetitions of the stimuli with the intonation patterns (4)-(5) presented up to the end of "KatheRIna" (gating condition 'short'), of "KatheRIna sucht" ('gating condition 'medium'), and of the complete utterance "KatheRIna sucht 'ne WOHnung" (Katherina looks for a flat).

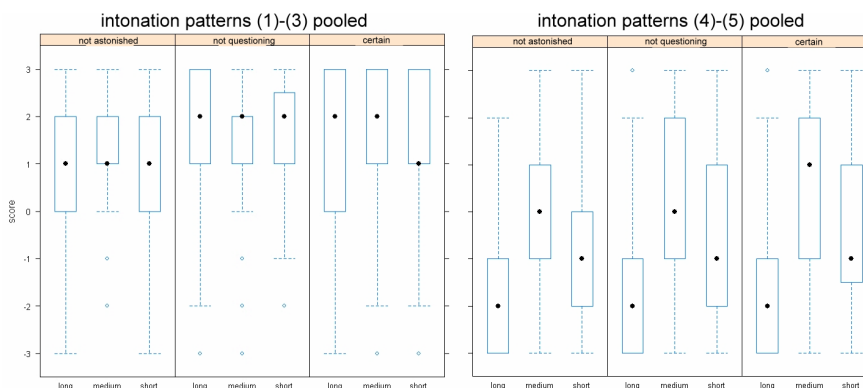


Figure 3. Boxplots of the listeners' on the three 7-point scales (-3 to +3) 'astonished – not astonished', 'questioning – not questioning', 'uncertain – certain', yielded across the 11 subjects and 5 repetitions of the stimuli with the intonation patterns (1)-(3) and (4)-(5) presented up to the end of "KatheRIna" (gating condition 'short'), of "KatheRIna sucht" ('gating condition 'medium'), and of the complete utterance "KatheRIna sucht 'ne WOHnung" (Katherina looks for a flat).

References

D'Imperio, M. (2000). *The role of perception in defining tonal targets and their alignment*. PhD thesis, Ohio State University.

Dombrowski, E., O. Niebuhr (2005). Acoustic patterns and communicative functions of phrase-final rises in German: activating and restricting contours. *Phonetica* 62, 176-195.

von Essen, O. (1964). *Grundzüge der hochdeutschen Satzintonation*. Ratingen: A. Hehn

Grice, M, S. Baumann (2000). Deutsche Intonation und GToBI. *Linguistische Berichte* 181, 1-33.

Kohler, K.J. (2004). Pragmatic and attitudinal meanings of pitch patterns in German syntactically marked questions. In G. Fant, H. Fujisaki, J. Cao and Y. Xu (Eds.). *From traditional phonology to modern speech processing – Festschrift for Professor Wu Zongji's 95th Birthday* (pp. 205-215). Beijing: Foreign Language Teaching and Research Press.

Ma, J. K.-Y., V. Ciocca, T.L. Whitehill. (2004). The effects of intonation patterns on lexical tone production in Cantonese. *Proceedings of the International Symposium on Tonal Aspects of Languages (TAL), Beijing, China*, 133-136.

Petrone, C. (2008). *Le rôle de la variabilité phonétique dans la représentation des contours intonatifs et de leur sense*. PhD thesis, Université de Provence.