

*On the place of phrase accents in intonational phonology**

Martine Grice

University of the Saarland

D. Robert Ladd

University of Edinburgh

Amalia Arvaniti

University of Cyprus

1 Introduction

Many theories of intonational phonology have granted some special status to pitch features that occur at the edges of prosodic domains, contrasting them with prominence-lending pitch configurations. The standard American structuralist theory that flourished in the 1950s (Trager & Smith 1951) drew a clear distinction between PITCH PHONEMES and JUNCTURE PHONEMES, the former constituting the body of a contour and the latter describing the movements at the contour's end. Parallel to this development, a distinction was also drawn within the Prague School between the cumulative and delimitative functions of tonal phenomena (Trubetzkoy 1958), the former including prominence, the latter domain-edge marking. Bolinger (especially 1970) distinguished 'accent' from 'intonation': ACCENT referred to the distinctive pitch shapes that accompany prominent stressed syllables (now generally known, following Bolinger, as pitch accents), while INTONATION included, among other things, distinctive pitch movements at the ends of contours. A distinction very similar, but not identical, to Bolinger's is made in the theory of intonation developed at the Institute for Perception Research (IPO) in the Netherlands (Cohen & 't Hart 1967, 't Hart *et al.* 1990), namely between PROMINENCE-LENDING and NON-PROMINENCE-LENDING pitch movements.

This basic distinction is reflected in the standard autosegmental theory of intonation based on Bruce (1977) and Pierrehumbert (1980) (for a general review of this theory, see Ladd 1996). All versions of this theory

* We would like to thank our speakers, Dora Alexopoulou, Ioana Chitoran, Johanna Monien, Gudrun Schuchmann, Stamatia Spiliopoulou, Manuela Wedgwood and Maria Xanthou. We also gratefully acknowledge insightful comments from Sónia Frota, Carlos Gussenhoven, Geoff Lindsey, László Varga, two anonymous reviewers and an associate editor.

assume a distinction between pitch accents and boundary tones. In addition, however, from the very beginning of the theory a second kind of edge-related element, distinct from ordinary boundary tones, has been posited by many researchers, known variously as the sentence accent (Bruce 1977), phrase accent (Pierrehumbert 1980, Beckman & Pierrehumbert 1986, Pierrehumbert & Beckman 1988) or phrase tone (early ToBI documentation). PHRASE ACCENT is the term we shall adopt in this paper.

Although the phrase accent has gained broad acceptance as a phenomenon relating to the intonation of Swedish, it has been the subject of much debate as far as other languages are concerned. First, it has been argued that the phrase accent constitutes an unnecessary complication to accounts of English and other Germanic languages. Second, even in those analyses that do include a phrase accent, its exact theoretical status is somewhat unclear.

Our goal in this paper is to present instrumental and impressionistic evidence for the existence of the phrase accent across a range of languages and to clarify its theoretical status. However, rather than simply adding the phrase accent to the inventory of possible tone types, we argue that it can be derived through a combination of association properties of tonal entities already present in intonation theory. Phrase accents are primarily boundary tones, but whereas ordinary boundary tones occur at the very edge of the constituent to which they are attached, phrase accents may exhibit an additional or alternative tendency to co-occur with a stressed syllable or some other designated tone-bearing unit. The fact that they may co-occur with stressed syllables gives rise to the question as to whether some of them are in fact pitch accents. We shall show, however, that this stress-seeking aspect of the phrase accent is secondary to its phonological edge affiliation, and that the fact that phrase accents often prefer to co-occur with stressed syllables does not make them fully fledged pitch accents.

1.1 Phrase accents in Bruce's analysis of Swedish

The original proposal for the phrase accent (or 'sentence accent', as he termed it) was part of Bruce's analysis of Stockholm Swedish word accents. As is well known, stressed syllables in non-monosyllabic words in Swedish are lexically specified to bear one of two distinctive pitch patterns, generally known simply as Accent 1 and Accent 2 (monosyllables all have Accent 1). The phonetic realisations of this distinction vary considerably from dialect to dialect and from one sentence context to another, and for a long time the essential or invariant phonetic basis of the distinction was an important puzzle in Scandinavian linguistics. Bruce showed that the true basis of the word-accent distinction is the temporal alignment of a fall in pitch relative to the stressed syllable: whereas in Accent 2 the fall occurs throughout the vowel of the stressed syllable, in Accent 1 the fall begins in the vowel preceding the stress.

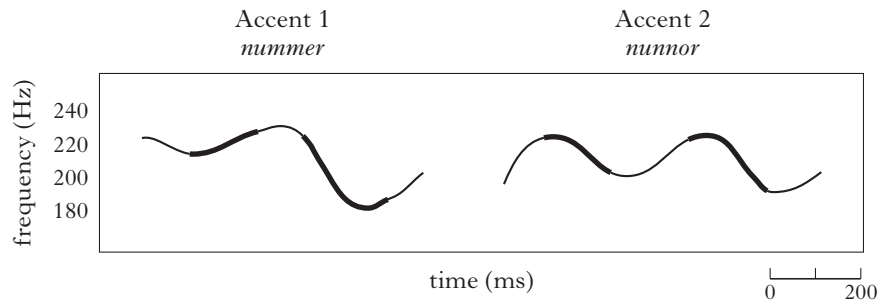


Figure 1

The Swedish word-accent distinction according to Bruce (1977), adapted from Ladd (1996: 32). Citation forms are shown for the words *nummer* 'number' (Accent 1) and *nummor* 'nuns' (Accent 2)

Furthermore, the primary or focused lexical pitch accent in a phrase is followed by an additional peak, which in turn precedes another fall at the end of the sentence. This additional peak is the phrase accent. In certain contexts, however, it is somewhat misleading to describe the phrase accent phonetically as an 'additional' peak. This is especially the case in Accent 1 citation forms. Since the accentual fall for Accent 1 begins in the preceding syllable, it is simply truncated when (as is often the case in citation forms) the accented syllable is utterance-initial, and the voicing simply begins low. There is then a rise to the phrase-accent peak, followed by the fall to the utterance-final low. Figure 1 shows both the distinction between Accent 1 and Accent 2 citation forms and a schematic diagram of Bruce's analysis of the Accent 1 contour. It is important to note from this figure that, in Bruce's conception, the rise in pitch during the accented syllable in Accent 1 citation forms is nothing but the transition from the low of the (truncated) accentual fall to the high of the phrase accent. It seems reasonable to suggest that the difficulty of 'solving' Swedish word accents results in part from the fact that the correct analysis requires us to disregard this rise in pitch, i.e. not to treat it as the essence of the accent contour even though phonetically it spans the accented vowel. The reason for emphasising this point will become clear shortly.

1.2 Phrase accents in other languages

Pierrehumbert's analysis of English (1980), which marks the real beginning of the autosegmental theory of intonational phonology, borrowed Bruce's notion of the phrase accent in order to account for a falling pitch movement typical of declarative utterances (corresponding to Bolinger's 'A accent' or the 'falling nuclear tones' of various British school descriptions, e.g. Crystal 1969, O'Connor & Arnold 1973). Since the fall begins on the final accented syllable, is completed fairly rapidly and is followed by a low level pitch, the most obvious way to apply Pierrehumbert's notation might have been to treat it as the reflex of a bitonal accent $H^* + L$ followed by a $L\%$ boundary tone. Instead, Pierrehumbert

argued that there are two separate elements involved in the falling movement, a high pitch accent (e.g. H* or L + H*) and a low tone which she refers to as a phrase accent (L-). Interpolation between L- and L% would then account for the low level stretch. That is, she analyses the fall in pitch, which Bolinger and the British school treat as the essence of this intonational pattern, as a transition from the H* of the pitch accent to the phrase-accent L-. This analysis is thus strikingly analogous to Bruce's treatment of the rise in Accent 1 citation forms in Swedish: a pitch movement that spans an accented syllable is nevertheless not regarded as a pitch accent, but as the transition from the true pitch accent to a subsequent element of the contour.

However, as noted above, Pierrehumbert's proposals for the phrase accent in English have met with a mixed reception. Ladd (1983) provides an extensive theoretical critique of the phrase-accent idea, arguing among other things that it is motivated entirely by theory-internal considerations (in particular, the fact that Pierrehumbert needs the H* + L accent for her analysis of downstep). Three main problems with the notion of phrase accent in Pierrehumbert's analysis have been reported. First, the phrase accent is said to occur between the nuclear pitch accent and the final boundary tone at the end of the intonation phrase, but it is unclear what exactly determines its timing. Second, unlike Swedish phrase accents, which are marked by a clear peak, English phrase accents extend over a longer stretch, the obtrusion corresponding to English L- phrase accents being particularly difficult to detect. Third, if we consider H- phrase accents, the analysis of rising tunes predicts a difference between the sequences L* H- and L* + H H-. This distinction is difficult to maintain, since the phrase accent H- takes the same value as the trailing H of the L* + H pitch accent, making the presence of the phrase accent after the trailing H tone impossible to detect empirically.

Like Ladd's proposals in relation to English, several adaptations of Pierrehumbert's analysis to other languages have dispensed with the phrase accent, analysing, for example, falling nuclear accents as H* + L or the equivalent. Among others, we may cite Gussenhoven's (1988) analysis of Standard Dutch, which forms the basis of the new ToDI transcription system (Gussenhoven *et al.* 1999), the analyses of German by Uhmann (1991) and Féry (1993) and Frota's recent analysis of Portuguese (2000). Nevertheless, the phrase accent has remained a part of the orthodox autosegmental analysis of English intonation (e.g. it is incorporated into the ToBI standard; Silverman *et al.* 1992, Pitrelli *et al.* 1994, Beckman & Elam 1997) and has regained a place in the analysis of German (e.g. in the GToBI system: Grice *et al.* 1996, Reyelt *et al.* 1996). It has also been adopted in some form in the analysis of a number of other languages, including Bengali (Hayes & Lahiri 1991), Italian (Grice 1995, Grice & Savino 1997, D'Imperio 1999, Avesani *et al.* 1995, Hirschberg & Avesani 1997) and Greek (e.g. in the Greek ToBI system (GRToBI): Arvaniti & Baltazani 2000; see also Arvaniti 1998, Arvaniti *et al.*, ms, Arvaniti & Ladd, ms).

Following Beckman & Pierrehumbert (1986), moreover, the phrase accent has gained a clearer theoretical status in intonational phonology, rather than simply lodging somewhere between the last pitch accent and the utterance-final boundary tone. In Beckman & Pierrehumbert's conception, the phrase accent is seen as the edge tone for a level of prosodic structure smaller than the intonation phrase. The original Pierrehumbert boundary tone (e.g. L%) marks the edge of intonation phrases, while the phrase accent (e.g. L-) marks the edge of what Beckman & Pierrehumbert call the intermediate phrase. This theoretical understanding is explicitly adopted in Grice's and Avesani's work on Italian, and Arvaniti & Baltazani's work on Greek.

1.3 Secondary association of phrase accents

Pierrehumbert & Beckman (1988) raise further possibilities for phrase accents in their work on Japanese tone structure, with their notion of 'secondary association'. Underlyingly, they distinguish between accent tones, which are associated to a specific tone-bearing unit (TBU), and phrasal tones, which have a peripheral association to a specific prosodic domain (e.g. a phonological word), and are not linked to a particular TBU. However, they acknowledge that phrasal tones may acquire additional links – SECONDARY ASSOCIATIONS – either to a specific TBU or to another boundary. For example, the Japanese phrasal H is associated underlyingly with the left edge of an accentual phrase, but on the surface it is linked to a specific mora: the first sonorant mora of an initial unaccented long syllable or the second sonorant mora of the accentual phrase, if the first syllable is short.

With regard to the English phrase accent, Pierrehumbert & Beckman suggest that it is linked not only to the right edge of the intermediate phrase but also to the right edge of the nuclear word (thus acting as a right boundary tone for that word). This type of double association is a way of accounting for the fact that in English the phrase accent corresponds to a stretch of the contour rather than to a single maximum or minimum. It thus potentially solves some of the empirical problems about where the phrase accent 'occurs'.

The notion that peripheral tones can have secondary associations to TBUs has been extensively used by Gussenhoven (1999, 2000) in an analysis of the intonation of Venlo and Roermond Dutch (Limburg-Rhineland area dialects with a word-accent distinction). Basing himself on the notion of 'alignment constraints' from Optimality Theory (McCarthy & Prince 1993), Gussenhoven (2000) shows how a range of superficially diverse contours can be accounted for with a fairly simple tonal analysis and a number of interacting constraints. The key to his analysis is the assumption that boundary tones can be aligned both with the right edge of the phrase and with an additional 'leftmost' position, and that the tone may have a secondary association as long as there is a free mora available for it to dock onto. The exact details of association are dictated by the

interaction of alignment constraints and by the tonal and segmental composition of the phrase.

On the face of it, Gussenhoven is dealing with a rather different problem from the ‘phrase-accent’ problem, namely the interaction of lexical and phrase-level pitch features. On the face of it, too, he differs from Pierrehumbert & Beckman on certain key points; in particular, Gussenhoven does not assume any distinction between ‘phrase accent’ and ‘boundary tone’. Nevertheless, it will be apparent throughout this paper that the phenomena dealt with by Gussenhoven are very similar to the ones under discussion here, in the sense that both papers ultimately deal with the secondary association of phrasal tones. We return to a more detailed discussion of Gussenhoven’s work in §2.1.5.

In what follows, we will argue that Pierrehumbert & Beckman are essentially correct in suggesting that phrase accents may have a secondary association; in fact, we shall provide evidence from a variety of languages that these secondary associations are the norm rather than the exception. *A fortiori*, we accept the notion of the phrase accent, not only for English but for all the languages discussed here (and probably for all languages with European-type intonation systems). That is, we reject Ladd’s early critique of Pierrehumbert, and accept the basic claim of her analysis of the English nuclear falling contours, namely that the fall is a transition from an accent to some sort of peripheral tone. We will show in this paper that by adopting the notion of phrase accent we can account for certain tonal alignment patterns that are difficult to accommodate within models which do not recognise the existence of phrase accents. However, *contra* Pierrehumbert & Beckman, we will also show that phrase accents generally have secondary associations to specific TBUs – syllables in the languages discussed here – rather than to the edges of constituents.



2 Phrase accents in Eastern European question intonation

Much of our evidence for phrase accents comes from the yes/no question intonation pattern found in several languages in the eastern half of Europe, which we will refer to as the EASTERN EUROPEAN QUESTION TUNE (EEQT).¹

The essence of the EEQT is a low nuclear accent (L*) followed by a final rising-falling pitch movement which (as we shall show shortly) can best be analysed as a sequence of a high phrase accent (H-) and a low boundary tone (L%), a claim first discussed at length by Ladd (1983, 1996). Consider the following pair from Hungarian (where the word

¹ The exact geographical extent of this pattern is uncertain. However, its existence has been established in Hungarian (de Sivers 1965, Fogarasi 1975, Varga 1983, 1996, Kornai & Kálmán 1988, Rosenthal 1992, Gósy & Terken 1994, Ladd 1996), Greek (Arvaniti *et al.*, ms, Baltazani & Jun 1999) and some varieties of Romanian (Dascălu 1975, Ladd 1983, 1996) and Serbo-Croatian (Lehiste & Ivić 1980).

containing the nuclear accent is in upper case, and word stress, which is always on the first syllable, is marked with an IPA stress mark):²

- (1) a.  b. 
- 'REGGEL 'hétkor?
morning seven.time
'seven in the MORNING?'
- 'reggel 'HÉTKOR?
'SEVEN in the morning?'

When the intention is to emphasise or focus on *reggel* 'morning' (i.e. 'seven in the morning' rather than 'seven in the evening'), or when there is no particular focus within the phrase, then *reggel* is low and the rise-fall spans the last two syllables of the whole utterance. When the intention is to focus on 'seven', as opposed to some other hour, the pitch is low on *hét-* and the final rise-fall occurs on the final syllable *-kor*. That is, the pattern with a clear local pitch peak on *hét-* (1a) is precisely the intonation pattern that does not focus on 'seven'. On the basis of this and other examples we assume that the analysis of the EEQT as a sequence of a low nuclear accent and a high phrase accent is correct; for more discussion the reader is referred to de Sivers (1965) and Ladd (1983, 1996).³ Below, we will demonstrate that the alignment of the phrase accent peak in the EEQT in general is very precisely determined by language-specific rules, and that in some languages the phrase-accent peak may seek a lexically stressed syllable.

2.1 Association of the H- phrase accent in the EEQT

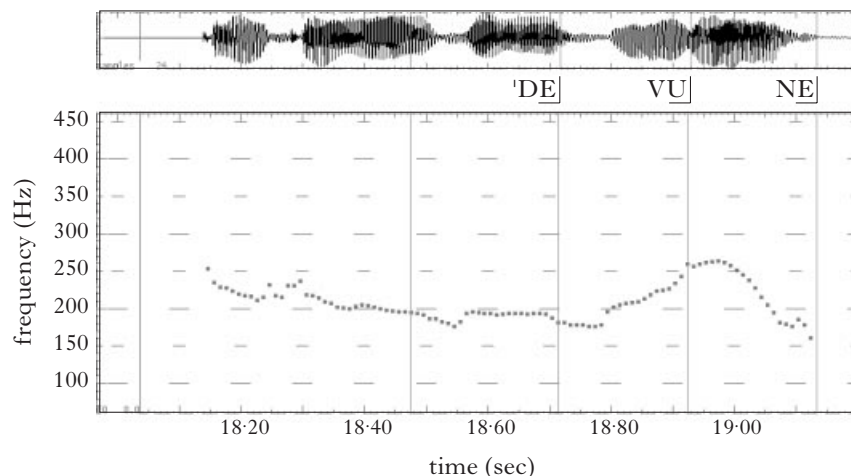
While the general phonological analysis just sketched applies to all the languages that have the EEQT, when we consider details of phonetic timing we find that there are subtle variations on the basic pattern, variations that appear to be highly constrained. The main differences have to do with the way the H- phrase accent is aligned with the segmental string.

2.1.1 *Standard Hungarian.* In Standard Hungarian there is broad agreement that the situation is as follows: the phrase accent occurs on the penultimate syllable of the utterance,⁴ unless that syllable is nuclear, in

² In Hungarian orthography, acute accent marks indicate vowel length.

³ Varga (1998), however, argues against classifying the LHL contour as composed of pitch accent L and phrase accent H (followed by L boundary tone). His reasons are related to his holistic treatment of the contour's meaning. He refers to Ladd's early rejections of Pierrehumbert's L phrase accent in English falling contours and to Féry's decision to eliminate the phrase accent from her account of German.

⁴ The only slight deviation is in one of Varga's alternative realisations of the Hungarian question contour, where there is a rise to a peak immediately after the accented syllable. The pitch then stays high up to the penultimate syllable in the phrase. He refers to this contour as 'front-rising' (1996: 140). However, he claims that the contour in (2) is the typical form (see also Varga 1983). See §2.3 on Transylvanian varieties for a contour which fits the description of Varga's 'front-rising' contour.


*Figure 2*

Standard Greek ton KOROI'DEVUNE?
 'Do they TEASE him?' (Example (3a))

which case the phrase accent goes to the final syllable. If the final syllable is also the nuclear syllable, then in principle all three tones – nuclear L^* , phrase accent H - and final boundary $L\%$ – should be realised on a single syllable. In practice what happens is that the resulting rising-falling contour may be truncated, leaving only the rise.⁵ This is widely reported in the literature (see for example de Sivers 1965, Ladd 1983, Varga 1983). Varga describes the contour on phrase-final stressed syllables (which, since Hungarian has fixed stress on the first syllable of words, must be monosyllables) as follows:

This contour goes up and down in the syllable when it appears on a monosyllabic utterance...but the falling part may be physically missing especially if the syllable is short or ends in a voiceless consonant. (1996: 117)

The two cases shown in (1a) and (1b) above illustrate the two patterns that do not involve nuclear accent on the final syllable. As it happens, in (1a) the phrase-accent peak occurs on a lexically stressed syllable (*hét-*), but this is a coincidence, as can be seen from the following:

- (2) 
 'REGGEL 'kilencor?
 'nine in the MORNING?'

in which the phrase-accent peak occurs on the unstressed syllable of *kilenc-* 'nine'.

⁵ See Ladd (1996) for a general discussion of truncation as a phonetic phenomenon, and Grabe (1998) for evidence of truncation in German.

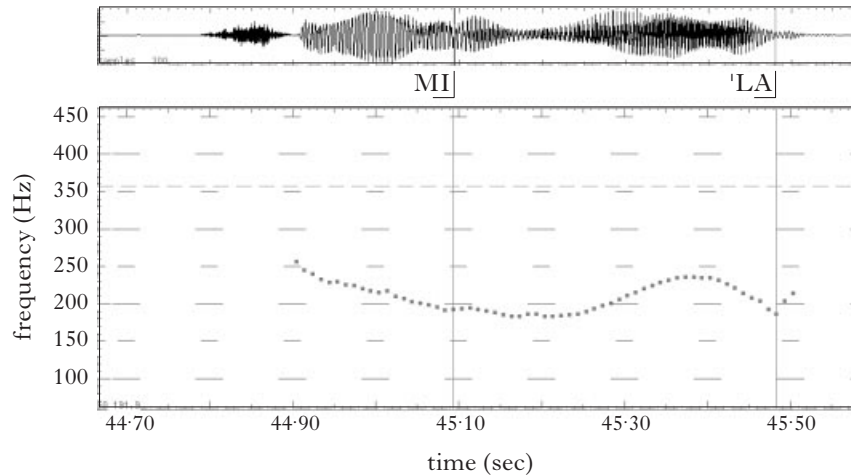


Figure 3

Standard Greek 'su MI'LA?
 'Does s/he SPEAK to you?' (Example (3b))

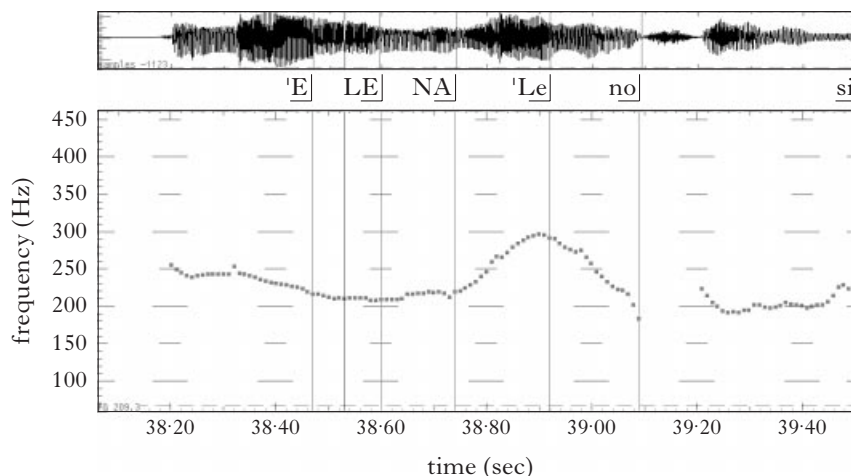
Given the above timing facts, we analyse the phrase accent in Hungarian as having a secondary association to the penultimate syllable, unless this syllable is already occupied by the nuclear pitch accent, in which case the phrase accent is shifted rightwards onto the final syllable.

2.1.2 *Standard Greek.* In Standard Greek the situation differs in two respects from that in Standard Hungarian. The first difference is relatively trivial: if the last word of the phrase bears the nuclear accent, then the phrase accent occurs not on the penultimate of that word, as in Standard Hungarian, but on the final syllable. This is the case regardless of the position of lexical stress, which, in this variety of Greek, can be on any of the last three syllables of a word. Examples of F0 traces where the lexical stress is antepenultimate and final are given in Figs 2 and 3 (examples (3a) and (3b)) respectively.

The phonetic alignment details of the examples in (3) can be verified by impressionistic observation, but are also documented in detail experimentally in Arvaniti (in press, a) and Arvaniti *et al.* (ms) (similar results are presented in Baltazani & Jun 1999).

- | | |
|---|--|
| (3) a. ton KOROI'DEVUNE?
him tease.3PL
'Do they TEASE him?' | b. su MI'LA?
you speak.3SG
'Does s/he SPEAK to you?' |
|---|--|

The second and more important difference between Standard Greek and Standard Hungarian is in the position of the phrase accent when the nuclear accent is on a non-final word in a phrase. Whereas Standard Hungarian retains the penultimate syllable as the location for the H-peak in this case (as in (2) above), in Standard Greek the peak occurs on the

*Figure 4*

Standard Greek 'tin 'ELENA 'Lenosi?

'[Are you asking about] ELENA Lenosi?' (asking about the first name)
(Example (4a))

lexically stressed syllable of the final word. Observe thus the difference between Fig. 4 (example (4a)), where the peak occurs on the antepenultimate syllable and Fig. 5 (example (4b)), where it is on the final syllable.

- (4) a. 'tin 'ELENA 'Lenosi?
the Elena Lenosi
'[Are you asking about] ELENA Lenosi?' (asking about the first name)
b. 'tin 'ELENA Milo'na?
'[Are you asking about] ELENA Milona?' (asking about the first name)

It is important to recall that, as in Standard Hungarian, the H-peak in these examples does not bring about emphasis or focus even though it occurs with the stressed syllable and thus appears somewhat like an ordinary accent. The meaning of (4a) has the focus on *Elena*, as indicated by the capital letters in the example and corresponding gloss; if we wanted to focus on the surname *Lenosi*, we would have the pattern shown in Fig. 6 (example (5)), with the stressed syllable of *Lenosi* low and the phrase accent on the utterance-final syllable.⁶

- (5) 'tin 'Elena 'LENOSI?
'[Are you asking about] Elena LENOSI?' (asking about the surname)

⁶ The contour shown contains a prenuclear accent on [e] of *Elena*; this is not obligatory but is likely. Discussion of prenuclear accents in the EEQT is beyond the scope of this paper.

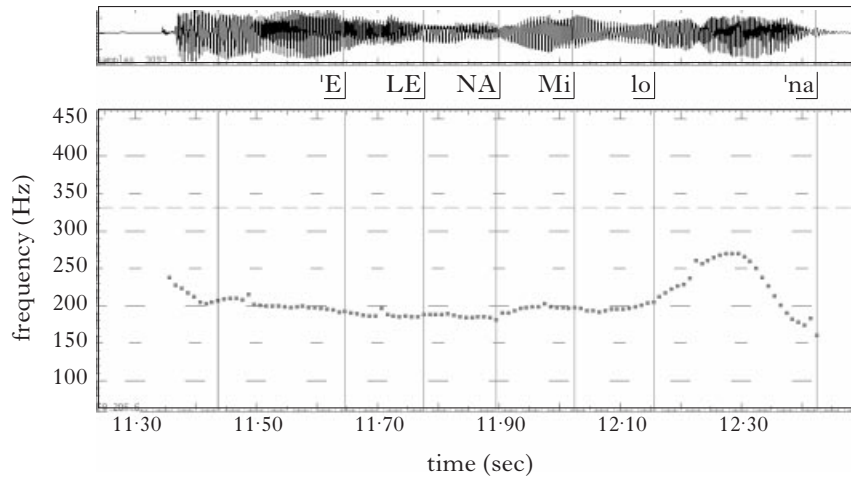


Figure 5
Standard Greek 'tin 'ELENA Milo'na?
 '[Are you asking about] ELENA Milona?' (asking about the first name)
 (Example (4b))

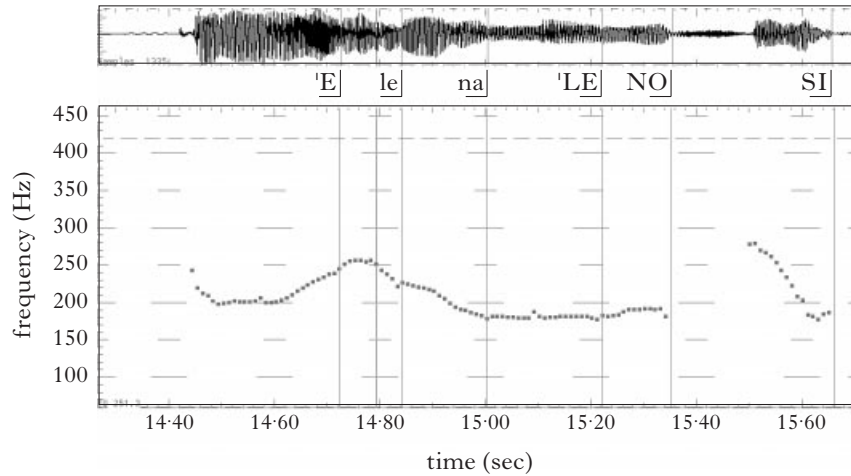
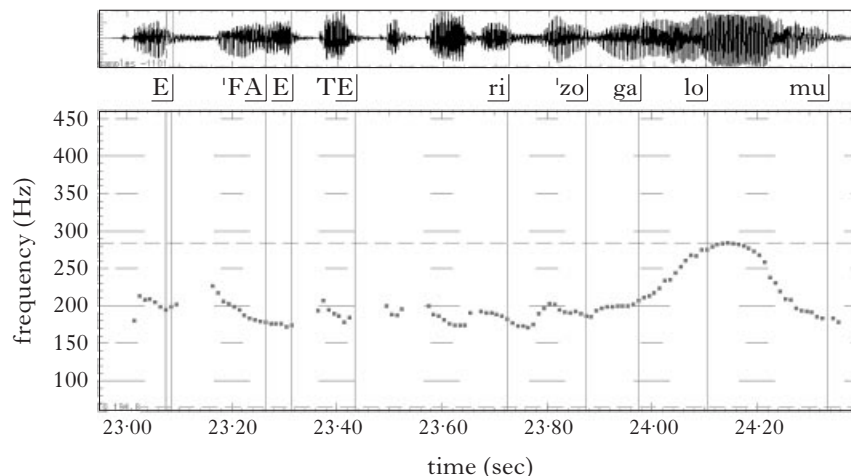


Figure 6
Standard Greek 'tin 'Elena 'LENOSI?
 '[Are you asking about] Elena LENOSI?' (asking about the surname)
 (Example (5))

We therefore analyse the Standard Greek phrase accents as having secondary association to a postnuclear lexically stressed syllable. If there is no such syllable (i.e. when the final word bears the nuclear accent), then there is instead a secondary association to the final syllable in the phrase.

2.1.3 *Cypriot Greek.* Cypriot Greek is analysed by Arvaniti (1998) as

*Figure 7*

Cypriot Greek E'FAETE pu to ri'zogalo mu?

'HAVE YOU EATEN some of my rice pudding?' (Example (6a))

having essentially the same question tune as Standard Greek. However, unlike Standard Greek, the H- phrase accent in Cypriot Greek never has a secondary association to a stressed syllable. The peak is always on the final syllable. This is illustrated in Fig. 7 (example (6a)), where the lexical stress of the postnuclear word is four syllables from the end.

- (6) a. E'FAETE pu to ri'zogalo mu?
eat.2PL.PAST of the rice-pudding mine
'HAVE YOU EATEN some of my rice pudding?'
b. e'faete pu to RI'ZOGALO mu?
'Have you eaten some of my RICE PUDDING?'

If we compare the F0 trace in Fig. 7 (example (6a)) with that of an utterance where the nuclear stress is on the final lexical word, shown in Fig. 8 (example (6b)), we can observe that in both cases the pitch peak corresponding to the H- phrase accent is on the same syllable, the clitic *mu*. In other words, the above examples clearly show that, unlike Standard Greek, in Cypriot Greek the peak is timed without taking the word stress into account.

In this respect, Cypriot Greek is thus similar to Standard Hungarian.⁷ However, Arvaniti's study indicated that, although all speakers consistently aligned the peak with the final syllable when the nucleus was in the final word, there were differences across speakers in their timing of the H- phrase accent when the nucleus was in a non-final word. Whereas some

⁷ Cypriot Greek is like Standard Hungarian in another respect. Unlike Standard Greek, Cypriot Greek truncates the L% of the yes-no question tune when the nuclear syllable is final in the phrase; in such cases yes-no questions in Cypriot Greek end in a rise.

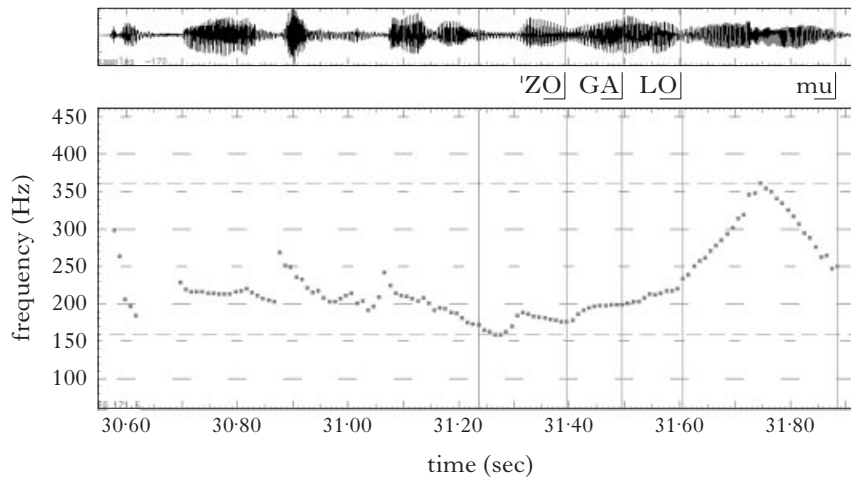


Figure 8
 Cypriot Greek e'faete pu to RI'ZOGALO mu?
 'Have you eaten some of my RICE PUDDING?' (Example (6b))

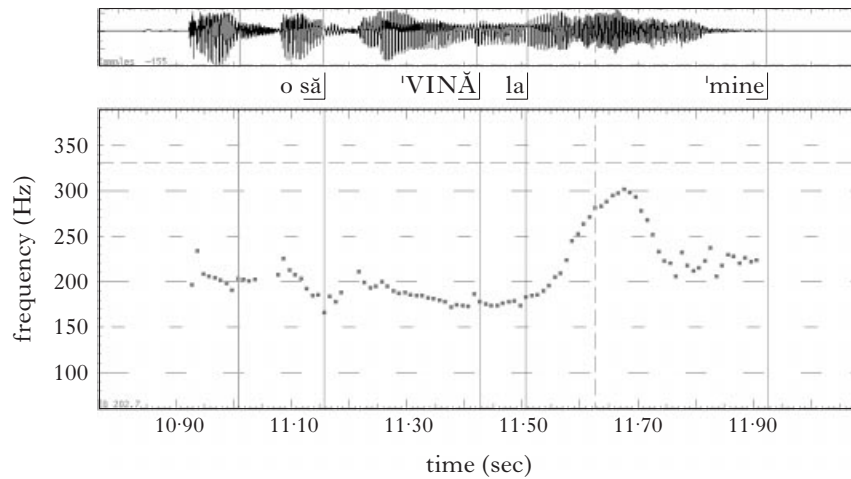


Figure 9
 Standard Romanian o să 'VINĂ la 'mine?
 'Will s/he COME to my place?' (Example (7a))

speakers consistently timed the peak in relation to the final syllable, as is the case in (6a) above, others timed it on the penultimate syllable instead. Since each speaker was consistent within his or her own speech, the variation is presumably due to idiolectal or dialectal influences, and we will not comment on this further here.

2.1.4 *Standard Romanian.* Standard Romanian is in many respects like Standard Greek. In cases where the final word bears the nuclear accent,

*Figure 10*

Standard Romanian 'MAMA 'vine 'repede? (Dascălu 1975: 478)
 'Is MOTHER coming quickly?' (Example (7b))

the phrase accent is timed on the final syllable. If the nuclear accent is on an earlier word,⁸ the phrase accent occurs on a postnuclear stressed syllable (Dascălu 1975, Ladd 1996), as can be seen in Fig. 9 (example (7a)) and Fig. 10 (example (7b)), where the phrase accent is on the stressed syllable of, respectively, *mine* and *repede*.

- (7) a. o să 'VINĂ la 'mine?
 will COMP come to me
 'Will s/he COME to my place?'
 b. 'MAMA 'vine 'repede?
 Mother comes quickly
 'Is MOTHER coming quickly?' (Dascălu 1975: 478)

There are two differences between Standard Romanian and Standard Greek, however. One is that in Standard Romanian there appear to be two distinct question intonation patterns, the EEQT and something else that we might call a 'low-rise'. The distinction between the two can be seen in the two alternative intonational treatments of postnuclear words in yes-no questions.

In certain cases it appears possible to have a *low* phrase accent and a *high* boundary tone following the L* nucleus, contrasting with the normal EEQT sequence of a high phrase accent and a low boundary tone. The most neutral tune for the question *Ai înțeles-o pe Elena* ('Did you understand Elena?') is apparently not (8a) (which is what we would expect on the basis of Standard Greek), but rather (8b).

- (8) a. L* H- L%
 ai INȚE'LES-o pe E'lena?
 have understood-her OBJ-MRKR Elena
 'Did you understand Elena?'
 b. L* L- H%
 ai INȚE'LES-o pe E'lena?

⁸ In the unmarked case, the nucleus is on the verb in Romanian. This is in fact the case in all of the East European yes-no question intonation patterns discussed here.

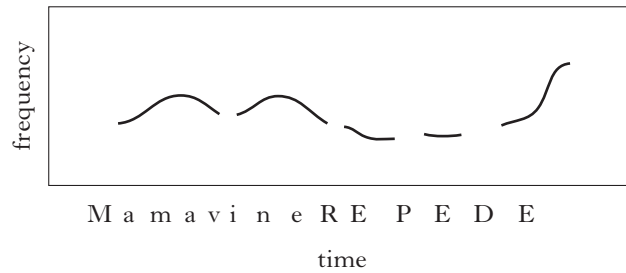


Figure 11

Standard Romanian 'Mama 'vine 'REPEDE? (Dascălu 1975: 478)
 'Is Mother coming QUICKLY?' (Example (9))

According to one Standard Romanian speaker, the variant in (8a) strongly focuses on the verb, as if to say 'Are you sure you understood Elena?', whereas (8b) is more neutral (although, as is usual in the languages considered here, the focus is still felt to be on the verb; see note 8). The existence of these two patterns does not materially affect the analysis of the EEQT in Standard Romanian; after all, many languages (including English) have two or more clearly distinct possible tunes that convey different pragmatic overtones in addition to interrogation. However, it does mean that in dealing with question intonation in Standard Romanian we must be careful to specify which pattern we are talking about.

The other difference between Standard Romanian and Standard Greek is seen in Fig. 11 (example (9)). When the nuclear accent occurs on the final word of a sentence, we generally observe a steady rise from the stressed syllable to the end of the phrase, rather than the rise followed by a phrase-final fall that we see in Standard Greek.

- (9) 'mama 'vine 'REPEDE?
 'Is Mother coming QUICKLY?' (Dascălu 1975: 478)

There are two possible interpretations of this difference. The first would be to assume that we are seeing 'truncation' of the sort found in Hungarian when the EEQT is applied to a final nuclear syllable. That is, we could say that the H- occurs on the final syllable of the phrase, and the fall to the following L% is not realised phonetically. However, it may be more plausible to say that when the nucleus is on the final word, the 'low rise' intonation (8b) is used in preference to the EEQT (8a). A comparable 'phonological' restriction on the use of question intonation patterns that are otherwise pragmatically distinct is found in some varieties of German: the falling-rising question contour (discussed in §3.2 below) sounds rather awkward on sentence-final stressed syllables and is generally replaced by a simple rise (Féry 1993: 91, Ladd 1996: 133–134).

2.1.5 *Interim summary: phonological analysis of the EEQT.* The analysis of the EEQT in the four language varieties just sketched – Standard Hungarian, Cypriot Greek, Standard Greek and Standard Romanian –

involves the following tonal melody: L* (pitch accent) H- (phrase accent) L (boundary tone). In all cases, the L* pitch accent is on the nuclear syllable and the L boundary tone is at the very edge of the phrase, and may even be truncated. Where the languages or language varieties differ is in the syllable they select as docking site for the secondary association of the H- phrase accent. An overview is given in Table I. There we can see that both Standard Hungarian and Cypriot Greek select a syllable which is identified in relation to the end of the phrase, either final or penultimate. Standard Greek and Standard Romanian, on the other hand, select a lexically stressed syllable, and only when the nuclear accent is in the final word of the phrase do they select a syllable whose position is at or near the end of the phrase. (In this and subsequent tables, the Hungarian phrase accent is associated with the penultimate syllable unless that syllable is already associated with the nuclear syllable.)

	<i>nuclear accent in non-final word</i>	<i>nuclear accent in final word</i>
Standard Hungarian	penult	penult
Standard Greek	postnuclear stress	final
Cypriot Greek	penult/final	final
Standard Romanian	postnuclear stress	final

[Table I. Secondary association of H- phrase accent in the EEQT]

The association of the H tone in the EEQT has been analysed somewhat differently by Gussenhoven (1999: 129–130). In his account of this tune, he uses the concept of secondary association only in cases where the H peak occurs on a stressed syllable, in which case the H tone has a secondary association to its first mora. In cases where the peak is realised close to the phrase edge, he relies on alignment with that edge. Our analysis therefore differs from Gussenhoven's in two ways. First, we treat not only phrase accents occurring on stressed syllables but also those occurring on final and penultimate syllables, whether stressed or unstressed, as cases of secondary association. Second, since secondary association to stressed syllables does not appear to be affected by syllable weight in any way, we maintain that the tone-bearing unit for the languages we are dealing with here is the syllable.

2.2 Copying of the H- phrase accent

In the cases of the EEQT discussed so far, the H- phrase accent corresponds to a single peak in the pitch contour. However, in the varieties of Romanian and Hungarian spoken in Transylvania, questions normally exhibit a high F0 plateau following the nuclear accent. This pattern may occasionally be found in Standard Romanian and Standard Hungarian as

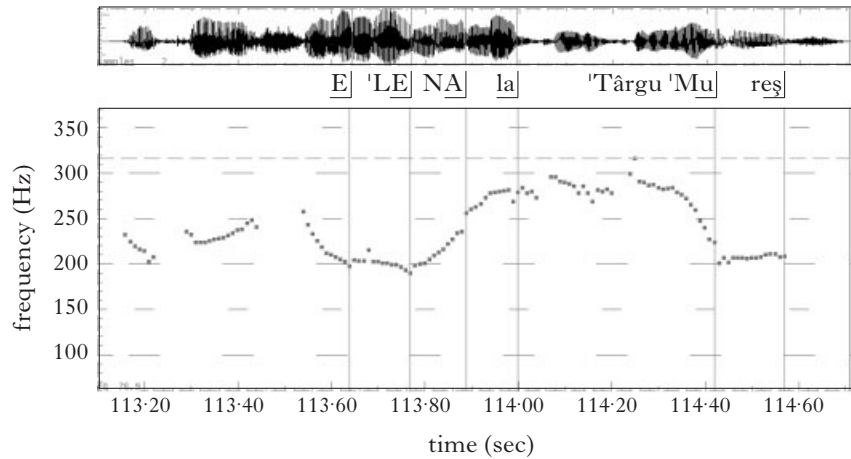


Figure 12

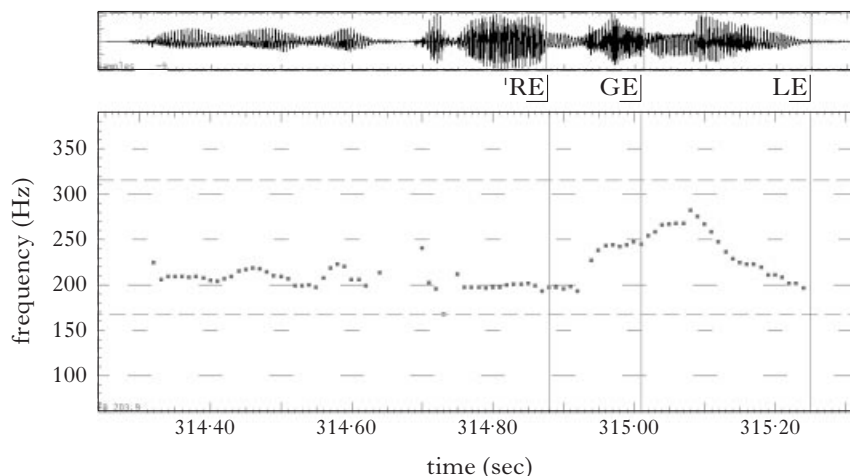
Transylvanian Romanian locu'ia și E'LENA la 'Târgu 'Mureș?
 'Did ELENA use to live in Târgu Mureș too?' (Example (10))

well (see note 4 for a description of a variant of the Standard Hungarian EEQT which fits this description). We will show that the high plateau can be straightforwardly derived from the H- phrase accent by tone spreading – or more precisely, what we will call tone copying. This means that the Transylvanian question contour can be analysed as an underlying L* H- L% sequence, i.e. exactly like the other variants of the EEQT encountered so far.

2.2.1 *Transylvanian Romanian.* The basic pattern in Transylvanian Romanian, described by Ladd (1981, 1983), involves a sharp rise from the nuclear syllable and a high plateau extending up to near the beginning of the last postnuclear stressed syllable in the phrase. This contour is illustrated in Fig. 12 (example (10)).

- (10) locu'ia și E'LENA la 'Târgu 'Mureș?
 lived also Elena at Târgu Mureș
 'Did ELENA use to live in Târgu Mureș too?'

Recall that in Standard Romanian, the F0 peak corresponding to the H- phrase accent occurs on the last postnuclear stress. This makes it plausible that the end of the high plateau in the Transylvanian Romanian question contour corresponds in some sense to the H- phrase accent of the Standard Romanian EEQT. The difference between the two varieties is that in Standard Romanian the rise from the L* nuclear accent to the H- phrase accent peak is gradual and increases in slope just before the peak (i.e. it is concave), whereas in Transylvanian Romanian the F0 rises quite abruptly from the L* nuclear accent (i.e. it is convex) and stays up, thereby creating the plateau.

*Figure 13*

Transylvanian Romanian ai vă'zut 'REGELE?
 'Did you see the KING?' (Example (11))

We could analyse this difference as the spreading or multiple association of the H- tone, but for reasons that will become clearer shortly we prefer to say that the H- tone is *copied*. Specifically, we analyse the plateau as being the result of two occurrences of a H- phrase accent tone, one associated with the *nuclear syllable* and one with the appropriate *post-nuclear stressed syllable*. Linear interpolation between them ensures the level stretch between the two 'corners' in the contour. With either a multiple association or a copying analysis, however, the high plateau can be explained as the reflex of the H- phrase accent. This analysis is thus superior to that of Ladd (1983), who proposed that the Transylvanian Romanian question contour has a distinct L* + H nuclear accent. In our analysis, the different dialects of the same language have the same phonological sequence: L* H- L%, and differ merely in the way the H- is associated with the text.

There is a further difference between Transylvanian Romanian and Standard Romanian. In cases where the nuclear accent is on the final word, as we saw earlier (§ 2.1.4), the final L% is not normally audible in Standard Romanian. In Transylvanian Romanian, by contrast, in these cases there is a rise in F0 which is then followed by an audible drop to the L%. This difference is consistent with our analysis, which predicts that in these (as in all other) cases, Transylvanian Romanian aligns the H- immediately after the L* nuclear accent. The fact that the H- is aligned immediately after the L* means that in this variety there is no tonal crowding, even if the nucleus is on the final word of the utterance; therefore there is no pressure to truncate the L% boundary tone (or to adopt a variant tune), as happens in Standard Romanian (see § 2.1.4). This is indeed the case, as shown in Fig. 13 (example 11)). We analyse this in

the same way as the first occurrence of H- in the plateau contour: as an association of the H- with the nuclear syllable.


- (11) ai vǎ'zut 'REGELE?
 have.2SG seen king.DEF
 'Did you see the KING?'

Table II summarises the association facts.

	<i>nuclear accent in non-final word</i>	<i>nuclear accent in final word</i>
Standard Romanian	postnuclear stress	final syllable
Transylvanian Romanian	nuclear syllable <i>and</i> postnuclear stress	nuclear syllable

[Table II. Secondary association of H- phrase accent in Standard and Transylvanian Romanian]

2.2.2 *Transylvanian Hungarian.* The Transylvanian Hungarian EEQT pattern is similar to the Transylvanian Romanian one in that it involves a postnuclear plateau rather than a peak. As in Transylvanian Romanian, the transition from L* to H- in Transylvanian Hungarian is realised as a sharp rise from the nuclear syllable. However, as would be predicted from our analysis and from the differences between Standard Romanian and Standard Hungarian, in Transylvanian Hungarian the plateau extends up to the penultimate syllable rather than up to the final lexical stress in the phrase, as illustrated in (12).

- (12) 
 LÁTTAD Ildikót?
 see.2SG Ildiko
 'Did you SEE Ildiko?' (Ladd 1983: 752)

This means that the basic facts of Standard Hungarian and Transylvanian Hungarian are as shown in Table III.

	<i>nuclear accent in non-final word</i>	<i>nuclear accent in final word</i>
Standard Hungarian	penult	penult
Transylvanian Hungarian	nuclear syllable <i>and</i> penult	penult

[Table III. Secondary association of H- phrase accent in Standard and Transylvanian Hungarian]

Note further that the second occurrence of the H- phrase accent – the one associated with the penultimate syllable – can also be downstepped, as noted by Ladd (1983: 752):



This provides evidence for our tone-copying analysis, according to which we are not dealing with a single H tone having multiple associations, but rather with multiple tones. That is, the phrase accent is copied to two locations, the nuclear syllable and the penultimate syllable. The second of these may then undergo downstep. The mechanism of tone copying is dealt with in more detail in § 5, both for calling contours, which are also analysed as having downstepped phrase accents, and for the different variants of the EEQT.

3 Falling-rising and falling contours in Greek and German

We now turn to falling-rising contours, in which the phrase accent is a L tone instead of H. We investigate such contours in Greek and in German, and then consider whether simple falls can be analysed in the same way as the falling part of falling-rising contours.

3.1 Wh-questions in Standard Greek

We begin by considering the phonetic details of the falling-rising contour in Standard Greek wh-questions, as reported by Arvaniti (in press, b) and Arvaniti & Ladd (ms). In Standard Greek, as in many languages, the nuclear accent in wh-questions is on the wh-word. (This is not true in English or most other Western European languages; cf. Culicover & Rochemont 1983: 139–147, and see Ladd 1996: 170ff for discussion.) The normal realisation of this nuclear accent is with a peak on the wh-word followed by a low-level stretch, followed in most cases by a boundary rise on the last syllable.⁹ For example, see Fig. 14 (example (14)):

- (14) 'PU me peri'meni?
where me waits
'WHERE is s/he waiting for me?'

The contour in Fig. 14 is thus, informally speaking, a mirror image of the Transylvanian variant of the EEQT, which has a *low* nuclear accent,

⁹ Actually, Arvaniti & Ladd show that when there is no tonal crowding, the peak aligns early in the first postnuclear vowel, as it does in so-called 'prenuclear accents' in Greek, as reported in Arvaniti *et al.* (1998).

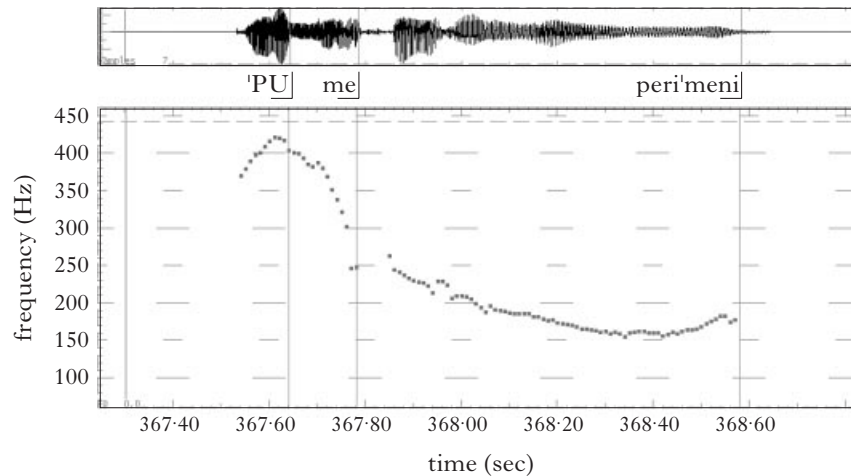


Figure 14
 Standard Greek 'PU me peri'meni?
 'WHERE is s/he waiting for me?' (Example (14))

followed by a *high* level stretch, followed by a boundary fall. This parallelism suggests that the low level stretch of the Standard Greek wh-question contour might be analysed as the reflex of a L- phrase accent. Moreover, given the stress-seeking behaviour of the H- phrase accent in the Standard Greek EEQT, we might expect to find evidence for similar behaviour of the L- phrase accent in the wh-question contour as well.

Arvaniti & Ladd's instrumental study makes it clear that the location of postnuclear stressed syllables does have an effect on the exact phonetic realisation of the low stretch of F0. Specifically, Arvaniti & Ladd manipulate the number of unaccented syllables between the wh-word and the following lexically stressed syllable, and show that the F0 fall is faster when the postnuclear lexically stressed syllable immediately follows the wh-word than when two or three unstressed syllables intervene. For example, in (15) (Fig. 15) with a stressed syllable immediately following the nuclear syllable, the fall from the peak is faster than in (14) (Fig. 14), in which three syllables intervene.

- (15) 'PU 'menune?
 where live.3PL
 'WHERE do they live?'

This means that the extent of the low level postnuclear stretch of contour is determined at least in part by the location of lexically stressed syllables. In the context of the type of analysis proposed in the paper so far, we would say that the L- phrase accent – or one copy of it – is associated to the first lexically stressed syllable after the nuclear accent. As it happens, the end of the low stretch is generally on the vowel of the final syllable in

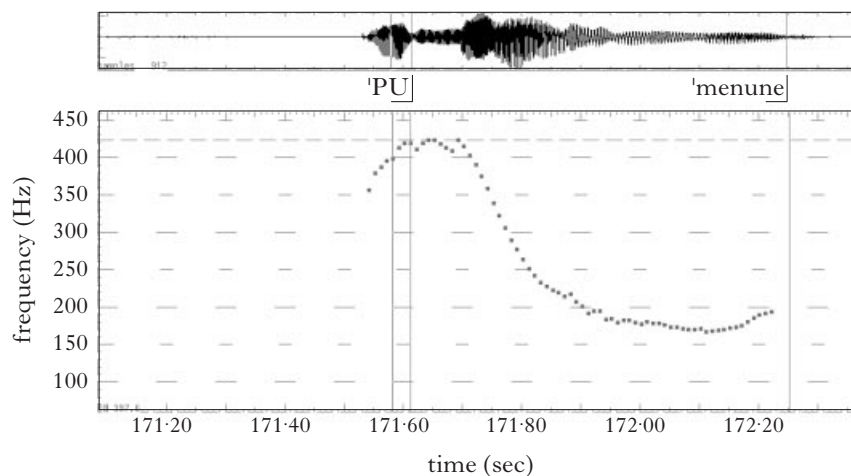


Figure 15
Standard Greek 'PU 'menune?
 'WHERE do they live?' (Example (15))

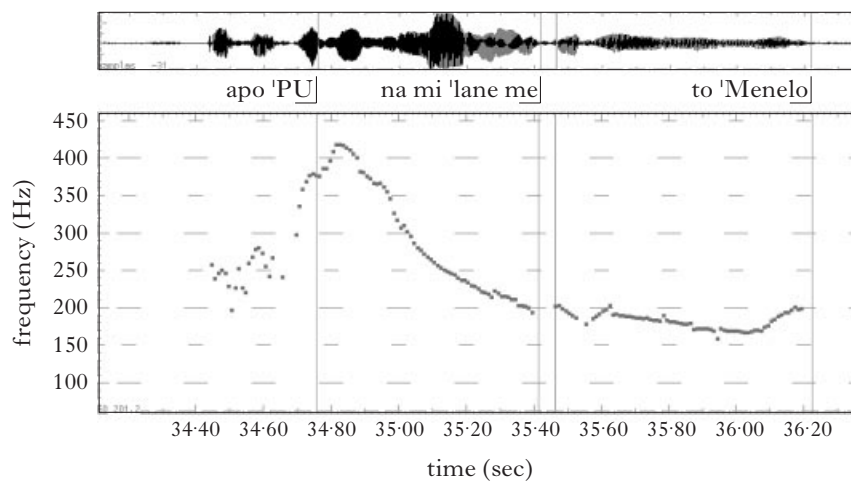


Figure 16
Standard Greek apo 'PU na mi 'lane me to 'Menelo?
 'WHERE could they be speaking with Menelos from?' (Example (16a))

the phrase, suggesting an association of a phrase accent L- to that syllable as well.

In their investigation of longer questions involving more than one postnuclear stressed syllable, Arvaniti & Ladd found that the fall from the peak to the low level stretch was strongly affected by the position of the *first* postnuclear stressed syllable: it was much steeper in questions like (16b) (Fig. 17), where the first postnuclear syllable immediately follows

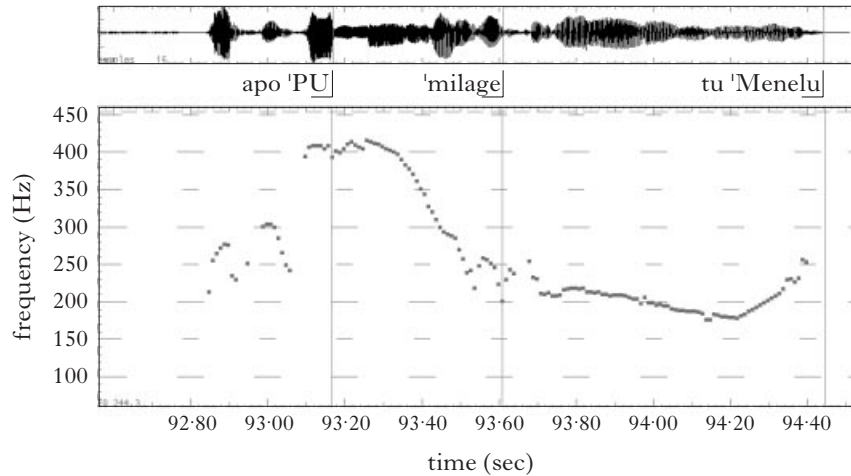


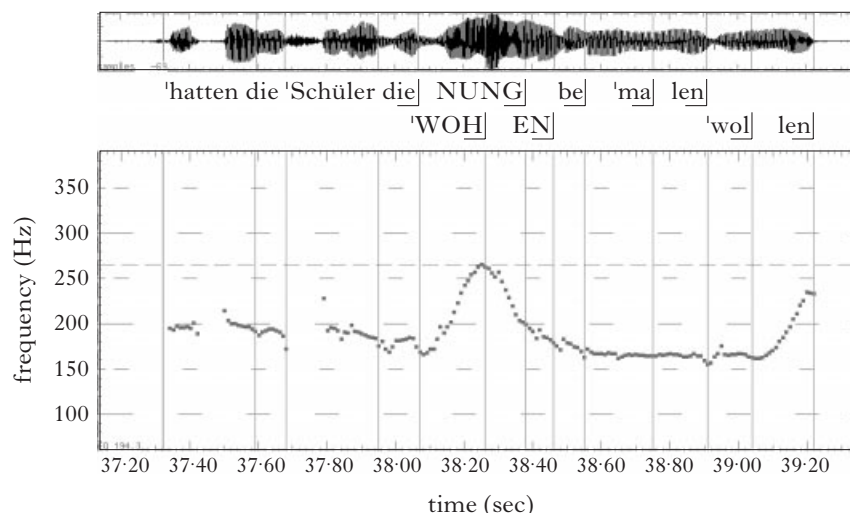
Figure 17

Standard Greek apo 'PU 'milage tu 'Menelu?
 'WHERE was s/he speaking to Menelos from?' (Example (16b))

the wh-word's stressed syllable, than in questions like (16a) (Fig. 16), in which there are two intervening unstressed syllables. These longer sentences confirm that the beginning of the low level stretch largely depends on the position of the first postnuclear stressed syllable.

- (16) a. apo 'PU na mi'lane me to 'Menelo?
 from where PART speak.SUBJ.3PL.PRES with the Menelos
 'WHERE could they be speaking with Menelos from?'
 b. apo 'PU 'milage tu 'Menelu?
 from where speak.3SG.PAST.CONT the Menelos
 'WHERE was s/he speaking to Menelos from?'

This is not what we would expect if the low level stretch were a trailing L tone of a H* + L pitch accent. If it were such, we would not expect the beginning of the low stretch to be affected by the position of postnuclear stresses, but rather by the position of the peak corresponding to the H* tone of the nuclear pitch accent. This claim was made explicitly by Pierrehumbert (1980) and Beckman & Pierrehumbert (1986: 257): 'the starred tone is phonologically linked to the strong syllable, and the unstarred tone of a two-tone accent precedes or follows it at some given space in time'. The alignment behaviour of the low level stretch, however, is completely consistent with an analysis in which a L- phrase accent, like the H- phrase accent in Standard Greek yes/no questions, associates with a postnuclear lexically stressed syllable. That is, Arvaniti & Ladd's findings can best be analysed in terms of stress-seeking behaviour on the part of the L- phrase accent, analogous but not identical to the stress-seeking behaviour of the H- phrase accent in the Standard Greek, Standard Romanian and Transylvanian Romanian EEQT. Similarly to

*Figure 18*

German 'hatten die 'Schüler die 'WOHNUNGEN be'malen 'wollen?
 'Had the pupils wanted to decorate the FLATS?' (Example (17a))

the EEQT contour, this stress-seeking behaviour is evident only if there is an available postnuclear stressed syllable; if there is no such syllable available, as happens when the nucleus is on the final word (e.g. in questions consisting of the wh-word alone), then the phrase accent associates with the final syllable.¹⁰

Finally, note that it is possible for Standard Greek wh-questions to be realised without the final F0 rise; the low level stretch just continues to the end of the utterance. Arvaniti & Ladd's data show that the presence or absence of the final rise does not affect the timing of the beginning of the low stretch. This means that stress-seeking behaviour is likely to be characteristic of the L- phrase accent in Standard Greek wh-questions, regardless of whether the overall contour is falling-rising or simply falling.

3.2 Falling-rising contours in German

We now examine a German falling-rising contour which is very similar to the Greek wh-question contour. This contour is used to realise polite requests for information or action (Féry 1993), or information-seeking questions with positive polarity (Pheby 1975), and may have the syntactic form of a yes/no question (with the verb in first position in the sentence).

In the recent literature it has been analysed both as H*+L H% (Uhmman 1991, Féry 1993), where L is part of the nuclear accent, and as H* L- H% (Grice *et al.* 1996, Reyelt *et al.* 1996), where L is a phrase

¹⁰ This last claim is based on informal observation of a number of F0 contours, in which the rise for the H% starts as late as the onset of the vowel in the final syllable. We interpret this to mean that both the H% and the L- are associated with the last syllable.

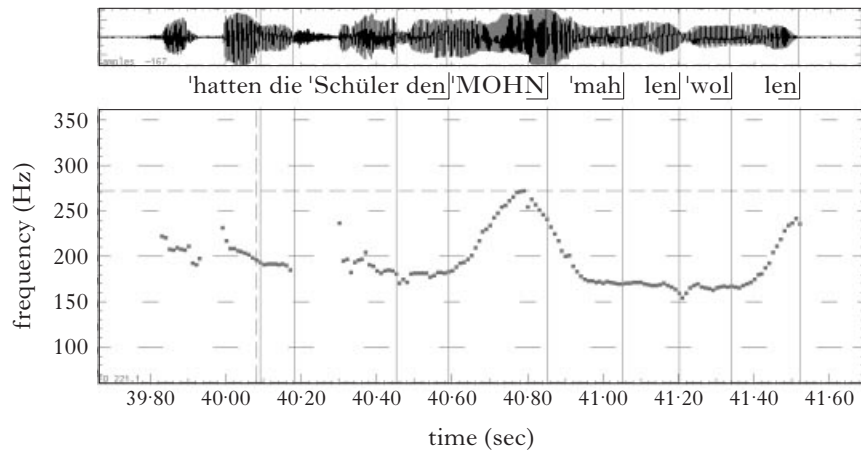


Figure 19

German 'hatten die 'Schüler den 'MOHN 'mahlen 'wollen?
 'Had the pupils wanted to grind the POPPY SEED?' (Example (17b))

accent. The difference between these analyses reflects the disagreement over the status of the phrase accent in the Pierrehumbert & Beckman analysis of English discussed in §1.3. However, for German there is now instrumental evidence that the analysis involving the L- phrase accent is correct.

This is provided by Grice & Benz Müller (1998) and Benz Müller & Grice (1998), whose experiments lead to the same kind of conclusion reached by Arvaniti & Ladd for the Standard Greek wh-question contour: the slope of fall from the nuclear H* peak in the German fall-rise depends on the number of unstressed syllables that follow the nuclear syllable. For example, the F0 fall is much more abrupt in Fig. 19 (example (17b)), where the nuclear syllable and postnuclear stressed syllable are adjacent, than in Fig. 18 (example (17a)), where there are three intervening syllables.

- (17) a. 'hatten die 'Schüler die 'WOHNUNGEN be'malen 'wollen?
 had the pupils the flats decorate want
 'Had the pupils wanted to decorate the FLATS?'
 b. 'hatten die 'Schüler den 'MOHN 'mahlen 'wollen?
 had the pupils the poppy-seed grind want
 'Had the pupils wanted to grind the POPPY SEED?'

Grice & Benz Müller (1998) thus conclude that the beginning of the low flat stretch (referred to as the 'elbow') is affected by the position of the postnuclear lexically stressed syllable. Furthermore, they show that the elbow typically occurs precisely on that syllable (this was the case in 94 % of the falling-rising contours analysed) and that the low stretch extends up to the final syllable in the phrase (81 % of cases).

These results on the timing and spread of the low level stretch strongly suggest that the analysis of L as independent from the nuclear pitch accent is correct. That is, if L were part of a H*+L nuclear pitch accent, the timing of L should be independent of the position of following stressed syllables and should be affected by the position of the H* peak; according to Pierrehumbert & Beckman (1988) cited in §3.1 above, L should follow the H* peak at a given space in time. Since this is not the case, and given the timing of the elbow and the end of the low stretch, this contour is analysed in the same way as the contour used in Greek wh-questions: a L-phrase accent tone is associated to both the postnuclear stressed syllable and the final syllable in the phrase.

Furthermore, it appears that in German there is a degree of optionality as to which lexical stress the elbow synchronises with. In (18) it can be on *wa-* or *ma-*, i.e. on the second half of the compound or on the first word following the compound. We shall see in §5.1 that exactly this variation occurs in calling contours too.

- (18) 'hatten die 'Schüler den 'WOHNWAGEN 'malen 'wollen?
 had the pupils the caravan paint want
 'Had the pupils wanted to paint the CARAVAN?'

In cases where the nuclear syllable is the final lexical stress in the phrase, then the association of the L- phrase accent with the final syllable ensures that the contour is falling-rising, albeit with a single valley rather than a low flat stretch. In Fig. 20 (example (19)) we see that the valley corresponding to the L- tone is realised on the final syllable.

- (19) 'malen die 'Schüler die 'WOHNUNGEN?
 paint the pupils the flats
 'Are the pupils painting the FLATS?'

As in Greek, there are obvious similarities between the realisation of the low level stretch in the German fall-rise and the high level stretch in the Transylvanian variants of the EEQT. However, it is important to point out the differences in the way the tones are associated.

In the Transylvanian contours, the phrase accent docks onto the *nuclear* syllable, and *either* the postnuclear lexical stress *or* a syllable near the end of the phrase (penult). In the German fall-rise and the Greek wh-question contours, by contrast, the phrase accent does *not* associate with the nuclear accent, but does associate with *both* a postnuclear lexically stressed syllable *and* a syllable near the end of the phrase (final).

We suggested above that for Standard Greek wh-questions there is no important difference between falling and falling-rising contours with respect to the association of the L- phrase accent. The same appears to be true of German. Grice & Benzmüller (1998) analysed falling contours in broad and contrastive focus declaratives and in commands and found that the elbow of the fall (where the pitch reached the baseline) occurred on a lexical stress in 91 % of cases. The location of the beginning of the flat

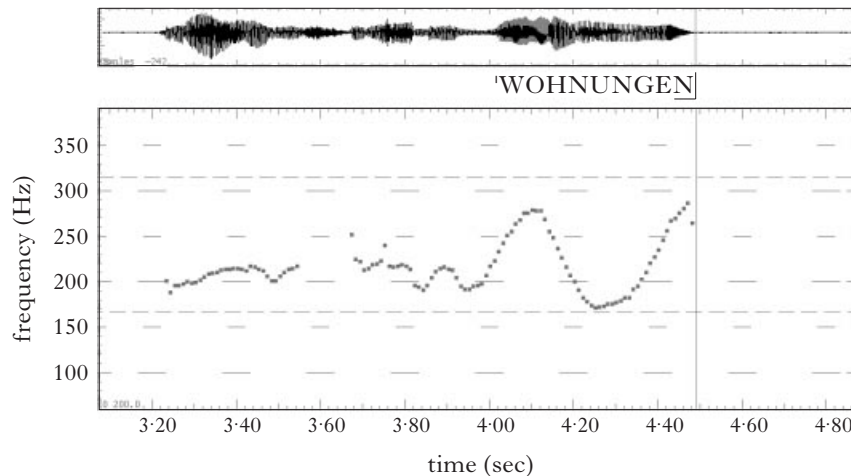


Figure 20

German 'malen die 'Schüler die 'WOHNUNGEN?
 'Are the pupils painting the FLATS?' (Example (19))

stretch was thus comparable with that for the fall-rise. The end of the flat stretch was of course the end of the utterance. It can be assumed that the nuclear pitch accent and the phrase accent are the same in both contours, the difference between the contours being in the final boundary tone ($H\%$ in fall-rises and $L\%$ in falls).

4 Implications for English intonational phonology

We are now in a position to consider the issue raised in the first section of the paper, namely Pierrehumbert's extension of Bruce's phrase accent concept to the analysis of 'falling' nuclear accents in English. As we saw, there has been considerable disagreement about whether to treat such accents – in both English and other languages – as bitonal $H^* + L$ accents (e.g. Gussenhoven 1984, 1988, Ladd 1983, Grabe 1998) or as sequences of a $(L+)H^*$ accent and a $L-$ phrase accent (e.g. Pierrehumbert 1980, Beckman & Pierrehumbert 1986, Pierrehumbert & Beckman 1988, Beckman & Elam 1997). The data from Standard Greek *wh*-questions, and from the more closely related German yes-no questions, make it plausible that at least some 'falling' nuclear accents in English are appropriately analysed in Pierrehumbert's terms, i.e. as involving a nuclear accent peak and an independently associated phrase accent.

4.1 Simple fall-rises

Let us first consider the English falling-rising question tune, which is very similar in form and function to the German falling-rising contour described in the preceding sections. This is common in polite questions in

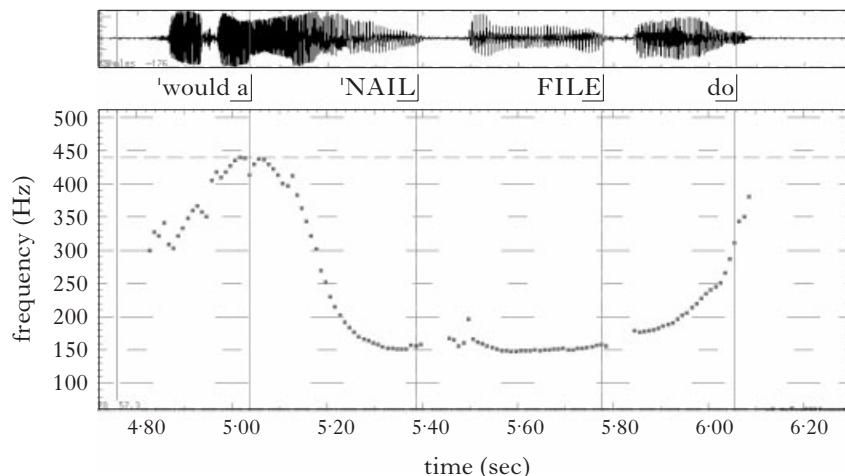


Figure 21
English QFR (Halliday's tone 2)
 'would a 'NAILFILE do? (Example (20))

Standard British English, though uncommon in American, where it tends to sound imperious or condescending (Ladd 1996: 122–123). For example, see Fig. 21 (example (20), from Halliday 1970: 103):

(20) 'would a 'NAILFILE do? (have you got a screwdriver ... ?)

This question fall-rise (QFR) contour has often been overlooked in discussions of English intonation, but it is definitely included in the system of Halliday (1970), who refers to it as a variant of tone 2, and transcribes it as 2.

The QFR is not the same as the English implicational fall-rise (IFR) (Halliday's tone 4), which has been the source of much discussion in the literature on English intonation (e.g. Kingdon 1958, Gimson 1962, Crystal 1969, O'Connor & Arnold 1973, Ward & Hirschberg 1985). The main difference between the two seems to be that the IFR (tone 4) has an obligatory onglide in the nuclear syllable, i.e. the nuclear pitch accent is $L + H^*$, whereas the QFR (tone 2) has no such onglide, and is presumably best analysed as H^* .¹¹

However, the QFR and IFR are similar in one respect, which is most relevant to the topic of this paper, namely in what happens phonetically during the low stretch following the nuclear fall. In all of Halliday's examples of the QFR, the final rise is transcribed as beginning on the final foot of the phrase, i.e. on the final stressed syllable (except if the final foot

¹¹ Actually, some of Halliday's 2 examples have a step down onto the nuclear syllable, suggesting that a $H + !H^*$ pitch accent is possible here as well. However, we will not discuss this point further; the most important difference between QFR and IFR seems to reside in the presence or absence of the leading rise in pitch on the nuclear syllable.

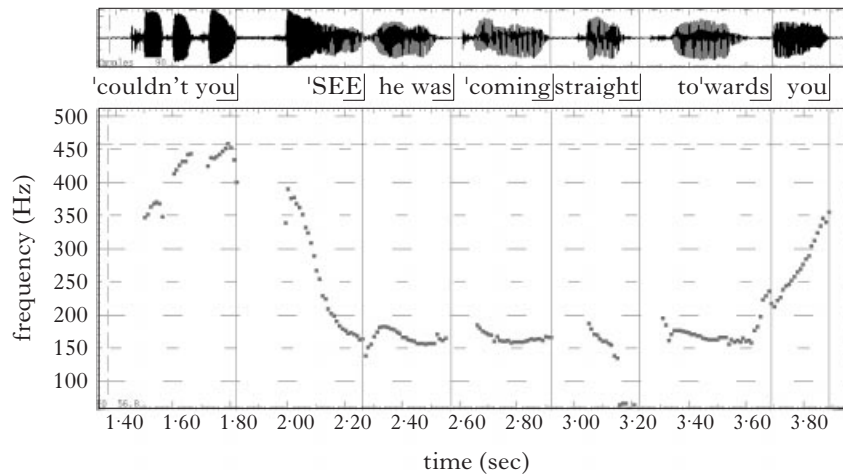


Figure 22

English QFR (Halliday's tone 2)
 'couldn't you 'SEE he was 'coming 'straight to'wards you?
 (Example (21))

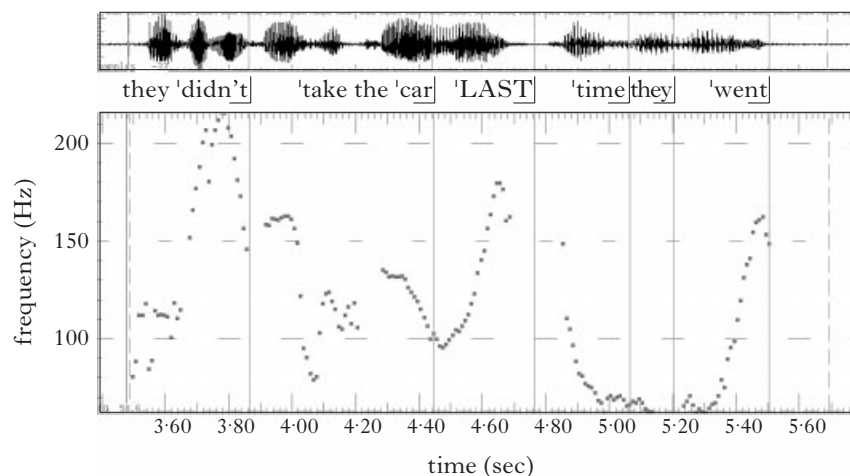
is a possible intonational tag, e.g. vocative or adverbial, in which case the rise begins on the foot immediately before it). Halliday (1970: 103) indicates the beginning of the rise by a dot under the relevant stressed syllable (see Fig. 22 for the F0 trace):

(21) 'couldn't you 'SEE he was 'coming 'straight to'wards you? (I thought it was obvious ...)

In his examples of tone 4 (the IFR), one of which is in (22) (Fig. 23), he does not explicitly transcribe the onset of the rise (1970: 11).

(22) they 'didn't 'take the 'car 'LAST 'time they 'went

On the basis of impressionistic data it is obviously difficult to draw firm conclusions; detailed phonetic experiments would provide the basis for a more definitive analysis. However, a plausible analysis is that in both the QFR and the IFR there is a phrase accent L-, which is copied to two locations: the nuclear syllable and the final lexical stress in the phrase (excluding tags). The proposed association of the L- in the English contours is thus identical to that of the H- in the Transylvanian Romanian variant of the EEQT discussed in §2.2.1. This in turn makes these English falling-rising contours different from the Greek and German contours discussed above, because in the latter the L- is associated with the first lexical stress (after the nucleus) and with the final syllable in the phrase.

*Figure 23*

English IFR (Halliday's tone 4)
 they 'didn't 'take the 'car 'LAST 'time they 'went
 (Example (22))

4.2 Compound fall-plus-rise tunes

The idea that the L- may have specific docking sites is relevant to the problematical relationship between Halliday's tones 2 and 4, on the one hand, and 'compound' or 'divided' falling-rising tunes, on the other. In the latter, the nuclear pitch contour is said to be divided into two parts, a falling part and a rising part, with the falling part somehow primary ('phonetically dominant', in the phrase used by Crystal 1969: 219). Such tunes have been posited in a number of traditional British studies (e.g. Kingdon 1958, Gimson 1962, Crystal 1969, O'Connor & Arnold 1973), and show up in Halliday's analysis (1970) as the 'compound' tones '13' and '53', i.e. consisting of a fall (tone 1 or tone 5) and a low rise (tone 3).¹² The British scholars claim that in compound tones there is a pragmatic choice as to where the flat stretch ends and the rise begins. Specifically, the rise is a subordinate accent, used for marking 'secondary or subsidiary' information (Halliday 1970: 43; see also O'Connor & Arnold 1973: 85). This means that, unlike what happens in tones 2 and 4, the rise does not necessarily begin on the head of the last foot in the phrase.

An example of such a contour is given in Fig. 24 (example (23)), which Halliday (1970: 88) analyses as having two tonics, where the first, on *rea-* of *reasonable*, is falling and the second, on *costs*, is low rising.

(23) it seems perfectly `REASONABLE to take the ,costs into account

¹² Halliday's distinction between tone 1 and tone 5 seems to correspond to the autosegmental distinction between (L+)H* L- and L*+H L-. The theoretical issues surrounding the 'compound' tones are the same in both and in what follows we restrict our attention only to the '13'.

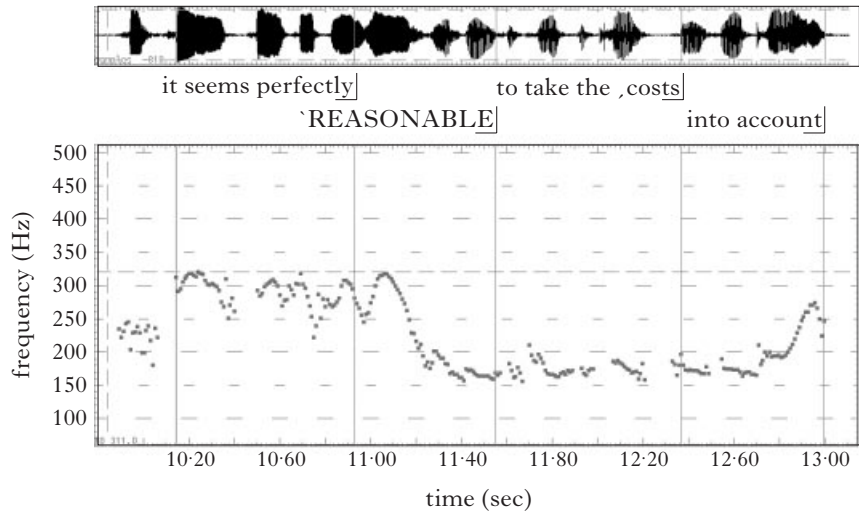


Figure 24

English compound fall-plus-rise (Halliday's tone 13)
 it seems perfectly `REASONABLE to take the ,costs into account
 (Example (23))

(In this and following examples, we use the British School tonetic stress marks, where ` is used to mark the falling tone, , the low rise.)

Here 'taking costs into account' is considered subsidiary information to the primary question of whether the speaker finds such an action reasonable or not. The rise, in Halliday's account, is a subordinate accent highlighting this subsidiary information. The placement of the subordinate accent is governed by the same factors that affect nuclear accents: if we compare the subordinated infinitival clause in (23) to its main clause counterpart (24), we find that the position of the subsidiary accent in (23) is identical to that of the nuclear accent in (24), *viz.* on *costs*.

(24) he took the `COSTS into account

The same parallelism is seen in (25):

- (25) a. the `HOUSE is on fire
- b. I was `SURE the ,house was on fire

As Ladd has pointed out (1996: 216), the theoretical status of the compound fall-plus-rise contours was never very clear in the British nuclear-tone tradition, because the subordinate part of the contour involves what is effectively a 'postnuclear' accent – a paradox under traditional assumptions. However, if we analyse them in the terms proposed here they are essentially unproblematical. The nuclear or primary accent (the one marked with the falling tonetic stress mark in the traditional British notation) is a high accent of some sort (e.g. H*, L + H*, L* + H, H + !H*), and the phrase accent (L- in all cases) is associated with

the most prominent postnuclear lexically stressed syllable (the one marked with the low-rise tonetic stress mark).

The ‘postnuclear accents’ cease to be paradoxical once we grant that English phrase accents, like phrase accents in the cases we have examined throughout the paper, may associate not only with a specified default such as the penultimate or final syllable, but also with lexically stressed syllables. To be sure, the pragmatic prominence of the word with which the L- phrase accent associates in (23) makes it seem more like a ‘real accent’, and may have contributed to the ‘compound’ analysis of the British tradition. However, from the point of view of the analysis presented here, the pragmatic prominence is simply one end of a scale of association with postnuclear prominence, from mere metrical prominence within a compound (as in the German QFR, example (18), and in calling contours which will be discussed in §5 below), through lexical stress in the phrase-final word (Standard Romanian, Transylvanian Romanian and Standard Greek EEQT) or immediately postnuclear word (German QFR and English QFR and IFR), to lexical stress in a postnuclear word with pragmatic prominence (English compound fall-plus-rise contours).

Table IV provides a summary of the secondary association docking sites for the languages and tunes analysed so far.

EEQT	<i>nuclear accent in non-final word</i>	<i>nuclear accent in final word</i>
Standard Hungarian	penult	penult
Transylvanian Hungarian	nuclear syllable <i>and</i> penult	penult
Standard Greek	postnuclear stress	final
Cypriot Greek	penult/final	final
Standard Romanian	postnuclear stress	final
Transylvanian Romanian	nuclear syllable <i>and</i> postnuclear stress	nuclear syllable
 FALL-RISE		
Standard Greek	postnuclear stress <i>and</i> final	final
German	postnuclear stress <i>and</i> final	final
English (QRF, IFR and compound tune)	nuclear syllable <i>and</i> postnuclear stress	nuclear syllable ¹³

[Table IV. Summary: secondary association of phrase accents in EEQT and fall-rise contours]

¹³ We have not discussed here what would happen in the English fall-rises if the nuclear accent is in the final word. We tentatively assume that English L- would associate in the same way as Transylvanian Romanian H-, i.e. with the nuclear syllable.

4.3 Extension to English falls

As with the Standard Greek *wh*-questions, the analysis just presented can be readily extended from falling-rising contours to falling contours. That is, we assume that various types of ‘falls’ and ‘fall-rises’ are identical except for the presence or absence of a final boundary tone. We therefore conclude that Pierrehumbert’s original descriptive insight – that English ‘nuclear falling’ (including falling-rising) tunes consist of a high pitch accent of some sort and a separate low phrase accent – is correct. We accordingly predict that in both types the L- has a secondary association with the nuclear syllable, and is realised as soon after the accentual H as possible. Existing instrumental evidence on this point is limited and inconclusive, and we leave this as a point for further investigation. A further uncertainty arises from the fact that in the falling-rising tunes discussed so far the L- phrase accent has two docking sites, the nuclear syllable and the metrically (and/or pragmatically) most prominent post-nuclear syllable. In a falling contour with a long low postnuclear stretch, there is no obvious phonetic event (like the beginning of the final rise) that would provide evidence of docking on the most prominent postnuclear syllable. Whether more subtle evidence can be found must also be left for future instrumental research.

5 Secondary association as tone copying


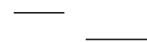

In this section we discuss in more detail the mechanism of tone copying proposed for the Transylvanian varieties of the EEQT. We begin by taking a look at the calling contour, a contour which has tones associated in the same way as the phrase accents discussed in the previous sections, namely to a postnuclear stressed syllable and/or to a phrase peripheral syllable. In §5.1 we examine the association details of the varieties of this contour in English, German and Dutch and discuss the mechanisms of tone spreading and splitting proposed by Gussenhoven (1993) to account for these. In §5.2 we propose a modification of Gussenhoven’s account, collapsing tone spreading and splitting into one single mechanism of tone copying. We use this to derive both the alignment of the tones in the calling contours already examined, and the phrase accents in the EEQT and the fall-rises in Greek, German and English.

5.1 The calling contour

The calling contour, or vocative chant, as it was referred to in early autosegmental studies (Lieberman 1975, Leben 1976), is analysed by Ladd (1978) and Gussenhoven (1984) as a stylised variant of the nuclear fall. The main properties of the stylised fall are that the fall is from high to mid rather than from high to low, and that the fall is in the form of a step down from a high plateau to a mid level stretch. The step down to mid level is analysed by Pierrehumbert (1980) as the reflex of a downstepped H-

phrase accent. This analysis is adopted by Ladd (1996) and is assumed here.¹⁴

It is undisputed that the step down may occur on a stressed syllable. In fact, it has been observed (Lieberman 1975) that it occurs on the strongest metrical prominence following the nuclear syllable: in order of preference, therefore, on a word stress or a foot stress. In the absence of a suitable stressed syllable, the !H- goes to the final syllable of the phrase. In (26), we can see how the !H- phrase accent is placed on the syllable with word stress in (a), with foot stress in (b) and with the final syllable in (c). The analysis below ignores the phrase-final boundary tone, which is irrelevant here.


- (26) a.  b.  c. 
 'Abernathy 'dear 'Aber-nathy 'Pame-la
 H* !H- H* !H- H* !H-

More frequent and varied use is made of this intonation pattern in German than in English (Gibbon 1976). Taking advantage of this difference, Grice & Benzmüller (1998) recorded a subset of their data as stylised step-down contours and confirmed for German that the step down occurred in the same place as the L- in the plain fall and fall-rise contours: on the postnuclear lexically stressed syllable. Furthermore, in the examples of the stylised step down involving compound nouns, there was the same type of variability as in the fall-rise: the step down could occur either on the second half of the compound or on the following word, e.g. in (27), where the nucleus is on *WOHN*, the step down occurs either on *wagen*, the second half of the compound, or on the stressed syllable of *malen*.

- (27) die 'Schüler 'hatten den 'WOHNWAGEN 'malen 'wollen
 the pupils had the caravan paint want
 'The pupils had wanted to paint the CARAVAN'

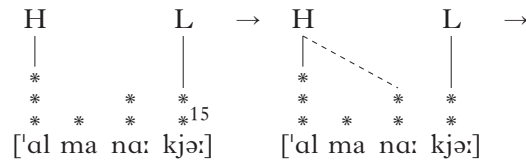
The calling contour in Dutch is somewhat different from the English and German ones, in that it is possible to have not just one but a sequence of downstepping plateaux, or terraces. Gussenhoven (1993: 42) shows such an example, reproduced in (28), which has four levels.

¹⁴ In saying that the step down of the calling contour is the reflex of a downstepped H- phrase accent, we do *not* assume the abstract phonological analysis of downstep proposed by Pierrehumbert (1980), which requires the preceding nuclear accent to be analysed as H* + L so as to 'trigger' downstep of the phrase accent. Rather, we assume that downstep in the European languages is an independent phonological manipulation of pitch range; this assumption is embodied in the ToBI transcription standard for English and in related systems for other languages (e.g. GToBI, ToDI, GRTToBI). See Ladd (1996: 105–106) for a discussion of the idea that recognising the existence of downstep in English is logically independent of accepting a specific phonological analysis of it.

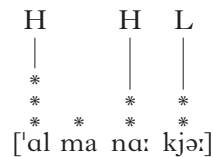
- (28) 
 'nɛ: palma nɑ: kjə: *nep almanakje* 'little fake almanac'
 fake-almanac+DIM

Gussenhoven analyses this contour as HL, where the H tone accounts for the first three terraces ([nɛ:palmana:]) followed by a L tone on the final syllable ([kjə:]). The H tone undergoes a process of spreading onto each foot, then splitting, producing three separate tones. The second and third of these tones may then each in turn undergo downstep. This is how the one H tone can represent three different levels. Gussenhoven's analysis of spreading, splitting and downstep of a calling contour on ['almana:kjə:] 'little almanac' is adapted in (29).

- (29) a. *H-spreading*



- b. *H-splitting*



- c. *H-downstep*

Downstep H after H (in the chanted call) (1993: 44)

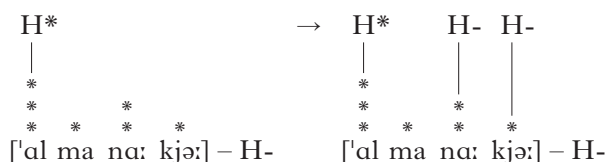
5.2 Tone copying

Our analysis of the Transylvanian variants of the EEQT as involving a *copying* of the H- phrase accent (§2.2) is inspired by Gussenhoven's notion of tone splitting. However, there are several differences between our analysis and Gussenhoven's. In our analysis, it is the phrase accent which is copied, not a pitch-accent tone. We would analyse the calling contour in English and German as H* !H-, where the H- phrase accent is primarily associated with the boundary of the phrase and is then copied to the appropriate docking site, the strongest metrical stress after the nucleus. The pitch accent and phrase accent are not copies of the same tone, but rather separate entities. This analysis can readily be extended to Dutch, with H* on the nuclear syllable and duplicates of a !H- tone on the following feet. The final syllable would also be associated with a copy of !H- rather than L. As illustrated in (30) below, the copies of the phrase accent are made simultaneously, without one site being attributed more

¹⁵ Gussenhoven adds an extra beat to the final syllable if it is not already a foot. This is why the final weak syllable in ['almana:kjə:] has a beat level 2 in the grid.

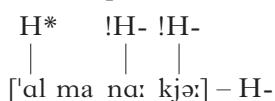
importance than the other. That is, the phrase accent is at once copied from the boundary to the final syllable and to a postnuclear stressed syllable (or, as would be needed to account for example (28), for instance, to the final syllable and more than one postnuclear stressed syllable). The association to the boundary is indicated with a horizontal association line. This representation indicates the primary association to the phrasal node, an association, following Pierrehumbert & Beckman (1988), on a different plane from the association to tone-bearing units such as the syllable.¹⁶

- (30) *Phrase-accent copying from boundary to secondary association sites (docking sites are postnuclear stressed syllables and final syllable)*

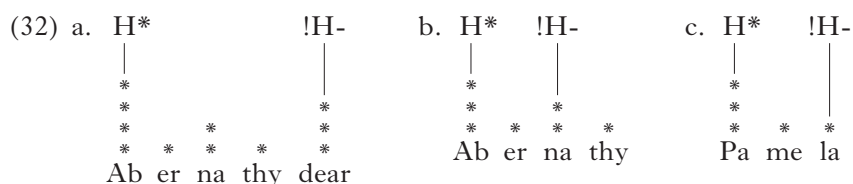


If (30) is followed by Gussenhoven's downstep rule, as in (29c), the result is a sequence of three H tones, the second and third of which are downstepped, as shown in (31).

- (31) *Downstep*



This short look at the stylised fall shows that the properties of this contour are very much compatible with the phrase-accent analysis presented for the other contours in this paper. Not only do these postnuclear tones get associated to postnuclear stressed syllables, but they may associate to phrase-final syllables too. An application of phrase-accent copying to the English calling contour in (26) would yield the structures in (32):



It is clear from (32) that the calling contour phrase accent can associate

¹⁶ In the derivations below we merely indicate that the phrase accent and boundary tone are peripheral tones, without specifying the domain or domains to which they belong. We return to this point briefly in §6. We believe that the underlying primary association of phrase accents with one specific type of phrase boundary or another is a separate issue from the fact of their secondary association with an ordinary TBU.

with word stress or with the final syllable ((a) and (c), respectively), but that, unlike the other contours dealt with in this paper, it can also associate to foot stress. The calling contour opens up yet another possibility for the association of phrase accents.

The Dutch version of the calling contour discussed above is different from the English and German calling contours in two ways: whereas the English and German phrase accents are associated to the strongest metrical stress, their Dutch counterpart may associate to a number of stresses. Whereas the English and German phrase accent takes the final syllable as docking site only in the absence of a postnuclear prominence, the Dutch one may be associated to the final syllable regardless of whether there is a preceding association to a postnuclear stress or not. Table V summarises the differences:

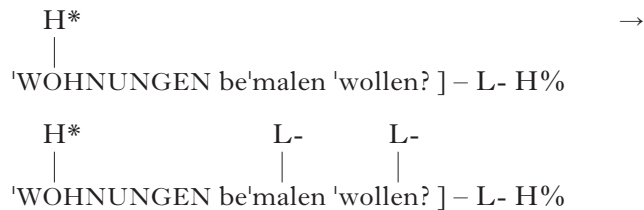
	<i>postnuclear stress available</i>	<i>no postnuclear stress available</i>
German/English	postnuclear stress	final syllable
Dutch (<i>optional variant</i>)	postnuclear stress(es) and final syllable	final syllable

[Table V. Association of !H- phrase accent in calling contours]

Comparison of Table V with Table IV reveals that the association details of the !H- phrase accent in the Dutch calling contour are parallel to those of L- in the Standard Greek and German fall-rise contours.

In (33) we derive the German fall-rise contour given in (17a), using the phrase-accent copying mechanism as proposed for the calling contour:

- (33) *Phrase-accent copying* (German fall-rise)
(docking sites are postnuclear lexical stress and final syllable in phrase)

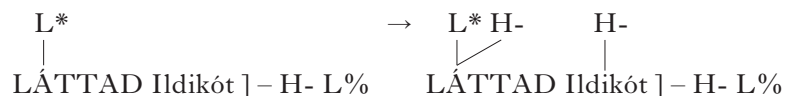


Here we can observe that the copying obtains an association of the L-phrase accent not only to the final syllable in the phrase but also to the first postnuclear lexical stress. However, as already pointed out, the analysis of copying as opposed to multiple association is not crucial for this type of contour, since there is no downstepping involved.

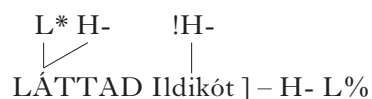
Another contour which does contain downstep is the Transylvanian Hungarian EEQT. This contour can also be derived by phrase-accent

copying, as shown in (34), where copies of the H- phrase accent are associated to the nuclear syllable and the penult.

- (34) a. *Phrase-accent copying* (Transylvanian Hungarian EEQT)
(*docking sites for H- are nuclear syllable and penult*)



- b. *Downstep* (optional in EEQT)



As in Gussenhoven's Dutch examples, only a H tone following another H is downstepped. We leave aside the issue as to whether or how the L% boundary tone is attached to the final syllable, as it does not affect the analysis here.

6 Conclusion

We have argued that there is evidence for the 'phrase accent' as a part of intonational phonology in a range of European languages, and we therefore reject adaptations of Pierrehumbert's original autosegmental analysis, in which, for example, falling melodies are treated as H*+L. In our view, Pierrehumbert was correct in analysing the 'H' and the 'L' as distinct phonological elements: a pitch accent and a phrase accent respectively.

More specifically, we have proposed that phrase accents are edge tones with a secondary association to an ordinary tone-bearing unit. These secondary associations can be to syllables which are at or near the periphery of the phrase (e.g. to the penultimate or final syllable). However, they can also be to syllables which are a considerable distance from the phrase edge, in which case the docking site is a stressed syllable. Such secondary associations give rise to tonal configurations that may resemble ordinary pitch accents, but do not signal focus or prominence in the same way, reflecting their essentially peripheral nature.

Throughout the paper, we have remained deliberately agnostic about the type of prosodic constituent with whose edge the phrase accent is primarily associated. One possibility, of course, is that it is associated with the edge of the 'intermediate phrase', as in Beckman & Pierrehumbert's revision of the original Pierrehumbert analysis, while the 'boundary tone' is the peripheral tone for the edge of an intonation phrase. There is a certain amount of evidence in favour of this view, and, as noted in the introduction, it has been adopted in numerous recent analyses of European

intonation systems. At the same time, however, there is considerable disagreement about the taxonomy of phrase-size units in the prosodic hierarchy (cf. Ladd 1996: ch. 6, Shattuck-Hufnagel & Turk 1996), which makes us reluctant to link our discussion here to one specific view of prosodic structure. What is important, in our view, is that our findings about secondary association appear generally valid regardless of what the underlying source of the phrase accent turns out to be.

In short, there appear to be two possible ways of generalising beyond the findings reported here. The first possibility is that there is a clear distinction between the intermediate phrase and the intonation phrase, and that the 'phrase accent' is the peripheral tone for the former whereas the 'boundary tone' is the peripheral tone for the latter; in this case, one theoretical question is why peripheral tones for one level seek secondary associations whilst those for a higher level do not. The second possibility is that there is not necessarily a distinction between different levels of prosodic phrase, but that there are certain peripheral tones ('phrase accents') which seek secondary associations and others ('boundary tones') which do not. In this case, the theoretical question is to account for the difference in behaviour without reference to levels of prosodic structure. Possibly a Gussenhoven-style account in terms of interacting constraints (Grice & Truckenbrodt, in preparation) could elucidate the reasons for the different behaviour. In any case, the choice between these two possibilities is left for future research.

Appendix: the speech data

1 Informants

The Standard Romanian speaker is a female educated native of Bucharest, aged about 30, who has lived outside Romania for more than ten years but still uses Romanian regularly. The Transylvanian Romanian recordings were made by a female native speaker from Sibiu in her mid-20s, who had lived in Edinburgh for six months at the time of recording. The Standard Greek recordings of yes-no questions were made by a female native speaker from Athens in her mid-20s, who had lived in Edinburgh for six months at the time of the recording. The recordings of wh-questions were made by a female native speaker from Athens in her late 20s, who had lived in Edinburgh for several years at the time of the recording. The wh-question recordings are part of experimental materials for a study on the intonation of wh-questions; the yes-no question examples were recorded specifically for the present study, but agree in every detail with the data of Arvaniti (in press, a) and Arvaniti *et al.* (ms). The Cypriot Greek recordings were made by a female native speaker from Nicosia in her mid-20s, who had lived in Edinburgh for six months at the time of the recording, and agree entirely with the results of Arvaniti (1998). The German examples were recorded as part of the experiment reported in Grice & Benz Müller (1998). One speaker is a student in the Phonetics Department at the University of the Saarland in her late 20s, the other a professionally trained speaker in her mid-30s. Both are speakers of Northern Standard German. The English examples

were taken from cassettes accompanying the textbook by Halliday (1970). None of the recordings was made by the authors themselves.

2 Transcriptions

Standard orthography is used in all but the Standard and Cypriot Greek examples, where a transliteration is used (<g> is a voiced velar or palatal fricative, depending on context; <d> is a voiced interdental fricative), and the Dutch calling contour, which, following Gussenhoven, is transcribed phonetically.

REFERENCES

- Arvaniti, Amalia (1998). Phrase accents revisited: comparative evidence from Standard and Cypriot Greek. In *Proceedings of the 5th International Conference on Spoken Language Processing*. Vol. 7. Sydney: Australian Speech Science and Technology Association. 2883–2886.
- Arvaniti, Amalia (in press, a). The intonation of yes-no questions in Greek. In *Proceedings of the 14th International Symposium on Theoretical and Applied Linguistics*. Thessaloniki: Department of Theoretical and Applied Linguistics, Aristotle University of Thessaloniki.
- Arvaniti, Amalia (in press, b). The intonation of wh-questions in Greek. *Studies in Greek Linguistics* 21.
- Arvaniti, Amalia & Mary Baltazani (2000). Greek ToBI: a system for the annotation of Greek speech corpora. In *Proceedings of the 2nd International Conference on Language Resources and Evaluation (LREC 2000)*. Athens. 555–562.
- Arvaniti, Amalia & D. Robert Ladd (ms). Scaling and alignment of pitch targets in Modern Greek wh-question intonation. University of Cyprus & University of Edinburgh.
- Arvaniti, Amalia, D. Robert Ladd & Ineke Mennen (1998). Stability of tonal alignment: the case of Greek prenuclear accents. *JPh* 26. 3–25.
- Arvaniti, Amalia, D. Robert Ladd & Ineke Mennen (ms). Quantitative F0 descriptions require reference to local targets: the intonation of Greek polar questions and emphatic statements. University of Cyprus & University of Edinburgh.
- Avesani, Cinzia, Julia Hirschberg & Pilar Prieto (1995). The intonational disambiguation of potentially ambiguous utterances in English, Italian, and Spanish. In Kjell Elenius & Peter Branderud (eds.) *Proceedings of the 13th International Congress of the Phonetic Sciences*. Vol. 1. Stockholm: KTH & Stockholm University. 174–177.
- Baltazani, Mary & Sun-Ah Jun (1999). Focus and topic intonation in Greek. In Ohala *et al.* (1999). 1305–1308.
- Beckman, Mary E. & Gayle Ayers Elam (1997). Guidelines for ToBI Labelling. Available at http://www.ling.ohio-state.edu/phonetics/e_tobi/etobi_homepage.html.
- Beckman, Mary E. & Janet B. Pierrehumbert (1986). Intonational structure in English and Japanese. *Phonology Yearbook* 3. 255–310.
- Benzmüller, Ralf & Martine Grice (1998). The nuclear accentual fall in the intonation of Standard German. In Artemis Alexiadou, Nanna Fuhrhop, Ursula Kleinheinz & Paul Law (eds.) *ZAS Papers in Linguistics: papers from the conference 'The word as a phonetic unit'*. Berlin. 79–89.
- Bolinger, Dwight (1970). Relative height. In Pierre Léon, Georges Faure & André Rigault (eds.) *Prosodic feature analysis*. Montréal: Didier. 109–125. Reprinted in Dwight Bolinger (ed.) (1972). *Intonation*. Harmondsworth: Penguin. 137–153.

- Bruce, Gösta (1977). *Swedish word accents in sentence perspective*. Lund: CWK Gleerup.
- Cohen, A. & J. 't Hart (1967). On the anatomy of intonation. *Lingua* **19**. 177–192.
- Crystal, David (1969). *Prosodic systems and intonation in English*. Cambridge; Cambridge University Press.
- Culicover, Peter & Michael Rochemont (1983). Stress and focus in English. *Lg* **59**. 123–165.
- Dascălu, Laurenția (1975). What are you asking about? (On the intonation of emphasis in 'yes-no' questions.) *Revue Romaine de Linguistique* **20**. 477–480.
- D'Imperio, Mariapaola (1991). Tonal structure and pitch targets in Italian focus constituents. In Ohala *et al.* (1999). 1757–1760.
- Féry, Caroline (1993). *German intonational patterns*. Tübingen: Niemeyer.
- Fogarasi, M. (1975). Problemi di contrastività Italo-Ungherese nell'intonazione interrogativa. *Annales Universitatis Scientiarum Budapestinensis de Rolando Eötvös Nominatae (Sectio Linguistica)* **6**. 93–104.
- Frota, Sónia (2000). *Prosody and focus in European Portuguese: phonological phrasing and intonation*. New York: Garland.
- Gibbon, Dafydd (1976). *Perspectives of intonation analysis*. Bern: Lang.
- Gimson, A. C. (1962). *An introduction to the pronunciation of English*. London: Arnold.
- Gósy, Maria & Jacques Terken (1994). Question marking in Hungarian: timing and height of pitch peaks. *JPh* **22**. 269–281.
- Grabe, Esther (1998). *Comparative intonational phonology: English and German*. Nijmegen: MPI Series in Psycholinguistics.
- Grice, Martine (1995). *The intonation of Palermo Italian: implications for intonation theory*. Tübingen: Niemeyer.
- Grice, Martine & Ralf Benz Müller (1998). Tonal affiliation in German falls and fall-rises. Poster presented at the 6th Conference on Laboratory Phonology, York.
- Grice, Martine, Matthias Reyelt, Ralf Benz Müller, Jörg Mayer & Anton Batliner (1996). Consistency in transcription and labelling of German intonation with GToBI. In H. Timothy Bunnell & William Idsardi (eds.) *Proceedings of the 4th International Conference on Spoken Language Processing*. New York: Institute of Electrical and Electronic Engineers. 1716–1719.
- Grice, Martine & Michelina Savino (1997). Can pitch accent type convey information-status in yes-no questions? In *Proceedings of the ACL 97 Workshop on Concept to Speech Generation Systems*. Madrid. 29–38.
- Grice, Martine & Hubert Truckenbrodt (in preparation). Hybrid tones in Optimality Theory.
- Gussenhoven, Carlos (1984). *On the grammar and semantics of sentence accents*. Dordrecht: Foris.
- Gussenhoven, Carlos (1988). Adequacy in intonation analysis: the case of Dutch. In van der Hulst & Smith (1988). 95–121.
- Gussenhoven, Carlos (1993). The Dutch foot and the chanted call. *JL* **29**. 37–63.
- Gussenhoven, Carlos (1999). Tone systems in Dutch Limburgian dialects. In Shigeki Kaji (ed.) *Proceedings of the Symposium on Cross-Linguistic Studies of Tonal Phenomena: Tonogenesis, Typology and Related Topics*. Tokyo: ILCAA, Tokyo University of Foreign Studies. 127–143.
- Gussenhoven, Carlos (2000). The boundary tones are coming: on the nonperipheral realization of boundary tones. In Michael B. Broe & Janet B. Pierrehumbert (eds.) *Papers in laboratory phonology V: acquisition and the lexicon*. Cambridge: Cambridge University Press. 132–151.
- Gussenhoven, Carlos, Toni Rietveld & Jacques Terken (1999). TODI: transcription of Dutch intonation. Available at <http://lands.let.kun.nl/todi>.
- Halliday, M. A. K. (1970). *A course in spoken English: intonation*. London: Oxford University Press.

- Hart, J.'t, René Collier & A. Cohen (1990). *A perceptual study of intonation: an experimental-phonetic approach*. Cambridge: Cambridge University Press.
- Hayes, Bruce & Aditi Lahiri (1991). Bengali intonational phonology. *NLLT* 9. 47–96.
- Hirschberg, Julia & Cinzia Avesani (1997). The role of prosody in disambiguating potentially ambiguous utterances in English and Italian. In A. Botinis, G. Kouropetroglou & G. Karayiannis (eds.) *Intonation: theory, models and applications*. Athens. 189–192.
- Hulst, Harry van der & Norval Smith (eds.) (1988). *Autosegmental studies on pitch accent*. Dordrecht: Foris.
- Kingdon, Roger (1958). *The groundwork of English intonation*. London: Longmans, Green & Co.
- Kornai, András & László Kálmán (1988). Hungarian sentence intonation. In van der Hulst & Smith (1988). 183–195.
- Ladd, D. Robert (1978). Stylized intonation. *Lg* 54. 517–540.
- Ladd, D. Robert (1981). On intonational universals. In Terry Myers, John Laver & John Anderson (eds.) *The cognitive representation of speech*. Amsterdam: North Holland. 389–397.
- Ladd, D. Robert (1983). Phonological features of intonational peaks. *Lg* 59. 721–759.
- Ladd, D. Robert (1996). *Intonational phonology*. Cambridge: Cambridge University Press.
- Leben, W. R. (1976). The tones of English intonation. *Linguistic Analysis* 2. 69–107.
- Lehiste, Ilse & Pavle Ivić (1980). The intonation of yes-or-no questions: a new Balkanism? *Balkanistica* 6. 45–53.
- Liberman, Mark Y. (1975). *The intonational system of English*. PhD dissertation, MIT. Published 1979, New York: Garland.
- McCarthy, John J. & Alan S. Prince (1993). Generalized alignment. *Yearbook of Morphology 1993*. 79–153.
- O'Connor, J. D. & G. F. Arnold (1973). *Intonation of colloquial English*. London: Longman.
- Ohala, John J., Yoko Hasegawa, Manjari Ohala, Daniel Granville & Ashlee C. Bailey (eds.) (1999). *Proceedings of the 14th International Congress of Phonetic Sciences*. Berkeley: Department of Linguistics, UCB.
- Pheby, John (1975). *Intonation und Grammatik im Deutschen*. Berlin: Akademie-Verlag.
- Pierrehumbert, Janet B. (1980). *The phonetics and phonology of English intonation*. PhD dissertation, MIT.
- Pierrehumbert, Janet B. & Mary E. Beckman (1988). *Japanese tone structure*. Cambridge, Mass.: MIT Press.
- Pitrelli, John F., Mary E. Beckman & Julia Hirschberg (1994). Evaluation of prosodic transcription labelling reliability in the ToBI framework. *Proceedings of the 1994 International Conference on Spoken Language Processing*. Vol. 1. Yokohama: Acoustical Society of Japan. 123–126.
- Reyelt, Matthias, Martine Grice, Ralf Benz Müller, Jörg Mayer & Anton Batliner (1996). Prosodische Etikettierung des Deutschen mit ToBI. In Dafydd Gibbon (ed.) *Natural language and speech technology*. Berlin & New York: Mouton de Gruyter. 144–155.
- Rosenthal, Sam (1992). The intonation of simple sentences in Hungarian. In *Proceedings of the Formal Linguistics Society of Midamerica* 3. 287–310.
- Shattuck-Hufnagel, Stefanie & Alice Turk (1996). A prosody tutorial for investigators of auditory sentence processing. *Journal of Psycholinguistic Research* 25. 193–247.
- Silverman, Kim, Mary Beckman, John Pitrelli, Mari Ostendorf, Colin Wightman, Patti Price, Janet Pierrehumbert & Julia Hirschberg (1992). ToBI – a standard for labeling English prosody. In John J. Ohala, Terrance M. Nearey, Bruce L. Derwing, Megan M. Hodge & Grace E. Wiebe (eds.) *Proceedings of the 1992*

- International Conference on Spoken Language Processing*. Edmonton: University of Alberta. 867–870.
- Sivers, Fanny de (1965). L'unité intonationnelle d'interrogation en hongrois. *La Linguistique* **1**. 75–112.
- Trager, G. L. & H. L. Smith (1951). *An outline of English structure*. Norman: Battenburg Press. Revised edition 1957, Washington: American Council of Learned Societies.
- Trubetzkoy, N. S. (1958). *Grundzüge der Phonologie*. Göttingen: van der Hoeck & Ruprecht. Translated 1969 by Christiane A. M. Baltaxe as *Principles of phonology*. Berkeley & Los Angeles: University of California Press.
- Uhmann, Susanne (1991). *Fokusphonologie : eine Analyse deutscher Intonationskonturen im Rahmen der nicht-linearen Phonologie*. Tübingen: Niemeyer.
- Varga, László (1983). Hungarian sentence prosody: an outline. *Folia Linguistica* **17**. 117–151.
- Varga, László (1996). Hungarian intonation contours. In László Varga (ed.) *The Even Yearbook 2*. Budapest: Eötvös Loránd University. 111–144.
- Varga, László (1998). The intonational phrase and secondary intonational phrase formation in Hungarian. In László Varga (ed.) *The Even Yearbook 3*. Budapest: Eötvös Loránd University. 251–263.
- Ward, Gregory & Julia Hirschberg (1985). Implicating uncertainty: the pragmatics of the fall-rise. *Lg* **61**. 747–776.