

**The intonation of interrogation in Palermo Italian;  
implications for intonation theory**

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## Abstract

In Palermo Italian yes-no interrogatives, if the last syllable of a phrase is unstressed, the nuclear pitch contour is rising-falling, whereas if it is stressed, the contour is simply rising. Such context-dependent variation cannot be adequately accounted for within a British-style approach to intonation. By contrast, autosegmental pitch accent studies of intonation, where nuclear pitch configurations are expressed in terms of H(igh) and L(ow) tones, are shown to offer the flexibility necessary to do so. These tones are incorporated into a hierarchical structure in which they have either an accentual or a primarily delimitative function. In the former case, tones are part of a Pitch Accent which has an association to a syllable; in the latter case, tones are associated to nodes dominating higher prosodic constituents, either the intermediate phrase or the intonation phrase, and are realised as boundary tones.

Building on current analyses, a model is proposed in which tones in the Pitch Accent are also hierarchically structured, involving two levels: the Supertone and Tone. This enriched Pitch Accent structure not only explains apparent inconsistencies in phonetic alignment in Palermo Italian, but also accounts for equivalent consistency in alignment in English. In addition it allows leading tones in Palermo Italian to be treated in a qualitatively different way from leading tones in English.

The Palermo Italian interrogative marker consists of a L\*+H Pitch Accent. There is no paradigmatic contrast on the intermediate phrase boundary tone (it is always L) which means that its function is purely delimitative. This tone is only fully realised when a postaccentual syllable is available to carry it; technically, it requires a secondary attachment to a syllable. The absence of the falling part of the L\*+H L (L) configuration in phrases with no postaccentual syllable is thus explained.

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## **Chapter 1 Introduction**

The development of a theory of intonation often involves recourse to a body of data comprising a set of contours used more or less consistently by a group of speakers. A phonological analysis of such a body of data might treat it as a manifestation of an independent system, and adopt a method of analysis which follows the phonemic principle, viz. one which captures all the functional distinctions within that system whilst ignoring any formal characteristics which have little or no functional value. However, if the aim of intonational research is to discover facts about intonation as a universal system, it is worthwhile to develop a system of primitives which accounts adequately for the intonation contours used in a number of different languages.

One of the aims of this thesis is to provide taxonomic information on features of Palermo Italian. This is not only so that an analysis of this particular variety can be performed, but also so that a new body of data can be made available as a testing ground for theories of intonation which have been derived from the analysis of other systems. It is also deemed necessary to take another look at a number of accounts of English intonation (developed by, amongst others, Pierrehumbert and Beckman, and Ladd) and to investigate their advantages and shortcomings regarding the analysis of (i) the contours currently described in the literature, and (ii) a number of contours which have been referred to in past work and have since been largely ignored. The main purpose here is to build on the foundations laid by the above authors, in order to provide a framework of intonational analysis which is flexible enough to account for both Palermo Italian and (at least British RP) English. Optimally, such a framework should at once provide for a phonological analysis of the intonation of each language as a system, and shed light on the nature of the differences between the two systems. In this way, the above mentioned universal aim would be adhered to.

To the author's knowledge, there has so far been no published analysis of the intonation of Italian spoken in Palermo. As a result, a number of corpora have been drawn up to form the basis of the descriptive and theoretical parts of the thesis. These corpora involve a relatively homogeneous group of speakers, all born and currently living in Palermo, of middle class and with a university or equivalent further education. Such a homogeneous group was chosen because, even within Palermo itself, there is a considerable degree of geographical and sociological

accentual variation. It is the theoretical aims stated above which motivate the concentration in the investigations on a set of contours used consistently by a group of informants, rather than on data obtained from an exhaustive sociolinguistic survey.

According to Lindsey (1985:3), intonation is "no more than the intersection of a set of phonological (specifically tonal) structures and a set of semantic-pragmatic functions (here termed  $\pi$ -functions)". Here, as in Lindsey's study, the  $\pi$ -function under investigation is interrogation, specifically as it is manifested in polar (yes-no) questions. Whilst English has the choice of using either tonal or other morpho-syntactic means to realise this  $\pi$ -function, Italian relies solely on tonal means. This makes it possible to perform a more consistent analysis of the realisation of this function. For instance, the phrase "Glielo porta domani" may be used as an information-seeking question ("Is she bringing it to him tomorrow?"), or as a statement of fact ("She's bringing it to him tomorrow."); their differentiation relies on the intonation contour. Provided with the opportunity straightforwardly to investigate the intonation contour whilst keeping segmental factors constant, the majority of Italian analysts have taken the distinction between statements and polar questions as a starting point, a lead which will be followed in the present study.

Palermo Italian differs in a number of ways from what has been described in text books as Standard Italian, specifically with regard to its manifestation of the interrogative  $\pi$ -function; it exhibits a terminal fall in polar questions which in Standard Italian have terminal rises. However, this terminal fall is preceded by a rise, and, in certain contextually-determined situations, the terminal fall is altogether absent. It will be shown that, alongside Standard Italian varieties, as well as alongside English, it is the rising element which signals interrogation. The ability to formally account for the contextually-dependent absence of the terminal fall is one of the challenges a theory of intonation must be able to meet.

## **1 The concept of the nucleus**

There has always been some debate in intonological circles as to the existence or otherwise of a nucleus. However, it has never been denied that in many languages, the final accented syllable and unstressed adjacent syllables have some special form, and often express some special function.

Although Palmer (1922) is the originator of the term "nucleus" which is the "stressed syllable of the most prominent word in the Tone-Group", Cruttenden (1990) points out that Alexander Melville Bell and David Charles Bell, (the first of whom taught Henry Sweet) had used the term "emphasis" with a meaning very close to the term "nucleus" as it is used within the British school today:

"Thus, as it were in a picture, the more essential parts of a sentence, are raised, as it were, from the level of speaking; and the less necessary, are, by this means, sunk into comparative obscurity." [punctuation as in original] (A. Bell, 1835:xlii-xliii, quoted by Cruttenden, 1990:3)

Since it is specifically claimed that it is the intonation contour on and around the "nucleus" which differentiates polar questions from statements, the focus in the following chapters will be on that part of the intonation contour.

## **2 Chapter outline**

The British-school definition of the "nucleus" is discussed in chapter 2 with respect to its domain. It is examined within a componential analysis of the Tone-Group, proposed by Palmer (1922). Such an analysis of the Tone Group (or Tone Unit as it is often referred to), although with a slightly different inventory of component parts, continues within the school today; see Crystal (1969), O'Connor and Arnold (1973), Gimson (1980), Couper-Kuhlen (1986) and Cruttenden (1986). However, an area of little consensus is the mapping of the nuclear tone onto the nuclear syllable and tail. In order to reach a maximum intersection across the studies investigated, a single indivisible component in place of the latter two is therefore proposed as the domain of the nuclear tone.

This structural analysis is adopted in chapter 3, where a first attempt is made at describing Palermo Italian intonation. Two questions are addressed: (i) what intonational form is used to signal interrogation? and (ii) can this form be adequately described using the model proposed? A partial answer is given to (i) and a negative answer to (ii), which leads to the investigation in chapter 4 of whether a more appropriate model has been adopted by Italian analysts. In the selection of Italian studies surveyed, the intonational form signalling interrogativity is shown to differ from one variety to another and, in all but one case, from Palermo Italian too. All of the studies appear to rely on models which are rooted in the tradition of analysis in other languages, predominantly English or French.

One problem with the British analysis is shown to be the fact that each component is characterised by a combination of perceived pitch and stress, there being no strict separation between the pitch contour and the rhythmic structure arising from the choice of words. An alternative approach to the componentialisation of intonation contours, the theory of autosegmental phonology, is discussed in chapter 5.

Goldsmith (1976) lays out the principles of this theory, developing his analysis with examples from "tone languages", and tentatively applying the approach to English as an "intonation language". One of the main tenets of the theory is a formal separation between tune and text; tones in the tone tier and vowels in the phoneme tier are synchronised at strategic points by means of the principle of association. This has instigated a considerable body of subsequent work in which attention is directed not only to the underlying phonological association but, more specifically, to the alignment of the segmental structure with peaks in fundamental frequency (and, to a lesser extent in perceived pitch). In this chapter, work by Hirst, Ladd, Bruce and Garding and Pierrehumbert and Beckman is surveyed with the intention of distilling the aspects of each study which might prove useful in accounting for the Palermo data.

Chapter 6 returns to the domain of the "nucleus", first discussed in chapter 2. This time, however, the assumption that the nuclear tone is mapped onto the nuclear syllable and what follows it (the tail) is brought into question. It is shown that, even within the British school, the left edge of the nuclear domain is not as fixed as is often suggested. Kingdon (1958) observed that a contrastive prehead, which enhances the already emphatic nature of certain nuclear tones, can be realised in the absence of a prehead syllable. The preaccentual initial pitch excursion in nucleus-initial tone units cannot, in fact, be treated as contrastive by the majority of analysts within the British school; such pitch movement is considered to be an onglide and has no phonological status.

This is also shown to be true for a number of autosegmental pitch accent analysts. Ladd, for instance, is in accord with the British view, allowing only for trailing tones in bitonal pitch accents (i.e. the "starred tone" is always to the left, e.g.  $L^*+H$ ,  $H^*+L$ ). However, certain analysts within this tradition (such as Pierrehumbert and colleagues) can accommodate this initial pitch as a leading tone of a bitonal pitch accent, viz.  $L+H^*$  and  $H+L^*$ . Whereas in the particular context he discusses, Kingdon considers the contrastive pitch to be prenuclear, delaying the



onset of the nuclear tone, Pierrehumbert (1980) incorporates the leading tone into the nuclear domain. The fact that the functional load borne by leading tones is smaller than that borne by trailing tones is given as the reason why many analysts ignore contrastive pitch in this early position.

A solution is proposed for English Pitch Accents, allowing the nuclear domain to be extended to the left, but treating this leftwards extension as a proclitic element. This is achieved by means of an enriched Pitch Accent structure consisting of two levels: Supertone and Tone. A leading Tone in a Pitch Accent is dominated by a weak Supertone, whereas starred and trailing Tones are always dominated by a strong, branching left-headed Supertone. The strong Supertone is considered to be the core of the Pitch Accent.

In Chapter 7, a corpus is discussed whose aim was to record a number of statement-question pairs which differ only as a function of their intonation contour; such recordings were carried out in order to maximise naturalness. A number of utterances are singled out for detailed description, especially with regard to the synchronisation of peaks and troughs in the fundamental frequency traces with segmental landmarks in the utterance. In certain cases, such peaks are taken to correspond to H and L tones within the autosegmental pitch accent approaches referred to in chapters 5 and 6. Such an approach is shown to account for the data presented, as well as for phenomena noted in chapter 3. A model is developed within the autosegmental framework which captures both "allophonic" variation and distinctive contrasts within the language. Such a framework makes full use of leading as well as of trailing tones.

The Pitch Accent structure proposed for Palermo Italian reflects the high functional load borne by leading tones; they are shown to be better accounted for as part of the core of the Pitch Accent (the part dominated by the strong supertone) rather than as proclitic elements. Thus, in Palermo Italian, the Pitch Accent node does not branch; it dominates one Supertone node which, in turn, dominates maximally two Tones. The Supertone may be right or left headed, and Pitch Accents with leading tones are represented with a right-headed Supertone.

Furthermore, differences in detail between the alignment of tones in Palermo Italian and English are accounted for by the differing Pitch Accent structures proposed in chapters 6 and 7.

Chapter 8 sums up the findings of the previous chapters and points to the wider implications of the research undertaken.

## **Chapter 2 The British nucleus-plus-head approach**

### **1 Introduction**

The purpose of this chapter is to describe the approach to intonation adopted by the British school, and to point out its advantages and disadvantages for the description of a corpus in a language which has hitherto not been analysed.

The British approach to intonation, which has been used extensively for the transcription not only of English but of a number of other languages, relies on a long tradition of auditory analysis. The term 'nucleus-plus-head' refers to the development within that approach in which tone units are analysed into component parts ('functional units') rather than indivisible tunes. Such componentialisation began with the work of Palmer (1922) who subdivided intonation contours into a prenuclear portion which he called the 'head', a 'nucleus' and a 'tail'. Further subdivisions of the prenuclear portion of the contour into 'prehead' and 'body' were introduced by Kingdon (1958); O'Connor and Arnold developed the theory for didactic purposes, reconstituting the components into a number of typically occurring 'tunes', whilst acknowledging the importance of the constituent analysis as a starting point. Gimson's (1980) introductory text on English pronunciation also takes a didactic line in his chapter on intonation, although he does not do any reconstitution. For the description of fine phonetic detail of the kind found in spontaneous corpora, the whole theory was elaborated by Crystal (1969). The most recent comprehensive work, that of Couper-Kuhlen (1986), continues along similar lines to Crystal, describing recorded conversations, but to a greater degree of precision. Another recent study by Cruttenden (1986) describes and develops the British approach in the context of a number of other theories.

Common to all but the very early work within the British school outlined above, is the definition of the tone unit. This will be our starting point. We shall then take pairs of constituents in turn and examine the evidence for a clear-cut componential analysis, both in terms of whether the distinction between them is unambiguous, and whether it is appropriate to disregard any transitional phenomenon which, by definition, occurs outside the domain of both of the adjacent constituents. Finally, we shall discuss which aspects of the theory are retained, and which are modified, for the analysis of Palermo Italian reported on in the following chapter.

## 2 The tone unit

According to Crystal the tone unit is a stretch of utterance consisting of an obligatory element, the nucleus, and three optional elements, the prehead, the head and the tail. He represents the structure of the 'tone unit' as

(Prehead) (Head) Nucleus (Tail),

where the optional elements are in brackets.

The definitions of the four components of the tone unit rely on a set of underlying assumptions concerning the rhythmic structure of English, in particular, a distinction between unstressed, stressed and accented syllables. Crystal makes this distinction explicit. A 'stressed' syllable is a syllable which is perceived as prominent in relation to the other syllables in a given tone unit. This prominence is due to any or all of a number of phonetic features including increased loudness (acoustic correlate: amplitude), increased length (acoustic correlate: duration) and unreduced vowel quality (acoustic correlate: spectral profile), and may involve pitch prominence (acoustic correlate: F0).

Crystal (1969:162) points out that we probably " 'read in' rhythmic regularity" when we hear an utterance, i.e. the fact that we expect a relatively regular rhythm leads us to perceive regular peaks of prominence which may have no acoustic correlate at all. He warns the reader not to be sidetracked into a detailed discussion of rhythmic prominence. This is probably because his approach is auditory, and an investigation into the complex interactions between acoustic correlates of stress would be well beyond the scope of such a study<sup>1</sup>.

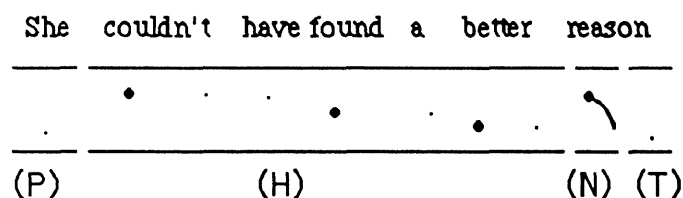
Crystal also distinguishes syllables which are simply stressed from those which have the additional specification of being accented. An accented syllable is considered more prominent than a plain stressed syllable by virtue of the fact that it involves a pitch obtrusion - either a jump or glide. The extra acoustic correlate of accent is

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<sup>1</sup> It is also a reflection of the fact that the rhythmic structure of English, stress-timed with the head of the foot on the leftmost syllable, is taken for granted.

thus F0 change. Unstressed syllables may be pitch prominent, but these are not considered accented. This will be discussed further in section 3.1.

A tone unit with the full complement of Prehead (P), Head (H), Nucleus (N) and Tail (T), as in the example below, can be used to illustrate the domain of each component<sup>1</sup>:



The 'nuclear syllable'<sup>2</sup> is generally said to be the last accented syllable in a tone unit from which or upon which there is a pitch change; it is usually, although it need not necessarily be, a lexically stressed syllable, (i.e. a syllable marked in the lexicon as potential bearer of prominence). In the above example, this is the first syllable of 'reason', on which there is a pitch glide.

The nuclear syllable can be distinguished from plain accented syllables in a number of ways. Syntagmatically, it is the last accented syllable of the tone unit; paradigmatically, the nuclear syllable can carry a greater range of pitch movements (if no tail is present) than other types of accented syllable. However, it is more than just the last accented syllable: the nuclear tone, which it (partly) carries constitutes the 'peak of prominence' of the tone unit (Crystal:1969:209). This concept underpins the British work described here; the primacy of the nucleus (although involving the nuclear syllable and the tail) has led to the categorisation of tone units into major groups according to nucleus type.

The tail is made up of all syllables following the nuclear syllable, which, in the above example, is only one, the last syllable of 'reason'.

<sup>1</sup> The two parallel lines represent the top and bottom of the speakers pitch range: the heavy dots a 'stressed' syllable and the small dots an 'unstressed' syllable. Accented syllables are not specially marked, because pitch obtrusion is determined relative to preceding or following stressed and/or unstressed syllables.

<sup>2</sup> The fact that we use the term 'nuclear syllable' rather than 'nucleus' will be explained later.

The head begins on what Crystal refers to as the 'onset', the first accented syllable of the tone unit. In the above case the head begins on the syllable 'could' and extends up to but does not include the nuclear syllable; the end of the head is on the last syllable of 'better'.

The prehead comprises all the syllables before the onset; here there is only one syllable in the prehead, the syllable 'she'. It is possible for a stressed syllable to occur in the prehead provided that it is not accented. It is also possible for a prehead syllable to be pitch prominent, provided it is not stressed. A prehead may occur immediately before a nuclear syllable with no intervening head.

In the next section, we shall discuss the merits and demerits of this four-part componentialisation of the tone unit.

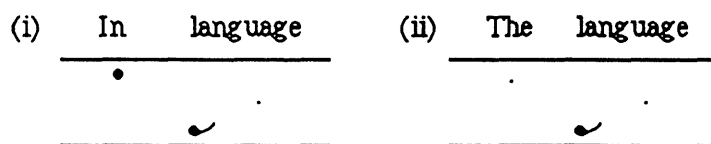
### 3 Componentiality

As we have seen, the definition of each component relies on prominence lent by a combination of rhythm and pitch. In the following section, we shall take each adjacent pair of tone unit constituents and examine whether they can be consistently distinguished and whether the boundary between them is clear cut.

#### 3.1 The prehead-head distinction

The distinction between prehead and head is particularly problematic in cases where the prehead has a different pitch height from what follows. The inherent difficulty involved in deciding whether a syllable is stressed or not, is increased if the pitch of the syllable obtrudes; pitch obtrusion lends prominence and can lead to the perception of stress. There is one case where this cannot happen: stress is precluded if the vowel quality of the syllable nucleus is reduced. However, since not all vowels undergo the same degree of reduction, there are often inconsistencies in transcription.

An example of such inconsistency is shown in the following two examples:



Although the configurations are similar in shape, they may have a different transcription simply because of the spectral quality of the vowel in the first syllable. In the first syllable of (i), 'in', the vowel quality is appropriate for either a stressed or unstressed syllable; the prominence lent to the syllable by the pitch obtrusion might therefore lead to the transcription of an accented syllable in this position, thus making the first syllable the onset of a head<sup>1</sup>. This cannot happen in (ii) because the reduced vowel quality in 'the' (with a schwa) precludes the analysis of the high pitched syllable as stressed. The pitch prominence cannot therefore be interpreted as an accent; the first syllable can only be a prehead.

Setting aside the problems in distinguishing stressed, unstressed and accented syllables, another question to be asked of a componential analysis is whether it has the facility for elements of a tune to be carried by different components. For instance, we take a look here at the interchangeability of the prehead and the head.

O'Connor and Arnold's (1973) tune, the 'Low Bounce' involves

<u>Prehead</u>	<u>Head</u>	<u>Nucleus</u>
	high	low rise
high		low rise

The prehead may be low only if followed by a high head:

low	high	low rise
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This tune does not occur without a prenuclear component. For O'Connor and Arnold, the presence of high pitch just prior to the nucleus is necessary to functionally demarcate this tune from another, the 'Take Off', where there is no such high pitch: "...no criticism is implied, such as is found with the Take-Off..."(1973:62) and "when there is no head, the High prehead is used to avoid the scepticism of the Take-Off." (1973:65).

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<sup>1</sup>This example is taken from the Esprit SAM project "numbers passage" on CD Rom (Eurom-0); transcriptions of the same recording by a number of analysts represented the intonation of "In" as either a high prehead or a high head. One analyst transcribed a fall-rise nuclear tone starting on "In". There was no consensus transcription.

Thus, if four tone units are compared:

	<u>Prehead</u>	<u>Head</u>	<u>Nucleus</u>
(i)	high		low rise
(ii)	low		low rise
(iii)	high	high	low rise
(iv)	low	high	low rise

(i) would be considered functionally closer to (iii) and (iv) than to (ii). However, the fact that there is high pitch before the nucleus is not captured in a purely componential account, even though, intuitively, it appears to be the falling-rising combination which is important. In other words, whereas a holistic tune approach might describe a 'falling-rising' tune, a componential approach would proffer different analyses, depending on whether the rising movement were carried by stressed and/or unstressed syllables.

The advantage gained by applying the British nucleus-plus-head approach is that, by dividing tone units into component parts, all tone units with a particular nuclear tone can be grouped together. It is argued (inter alia, by Crystal:1969) that this is the most important generalisation to be captured. In other words, in

(v)        -                        -                        low rise

there is only a rising movement, but this belongs to the same major class of tone unit as (i) through (iv)<sup>1</sup>. A holistic tune approach would not capture this.

In order to investigate the role of the nuclear tone in grouping tone units, a closer look at the part of the tone unit which carries the nuclear tone is in order. This is done in the following section.

### **3.2 The nucleus-tail distinction**

In this section, we discuss the definitions offered by various intonologists of the nucleus, nuclear syllable and tail. We examine the distinction between the nuclear tone as a pitch movement and the domain over which it is manifested. Finally, we

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<sup>1</sup>What happens just before the nucleus will be discussed in detail in chapter 6.



discuss the advantages and disadvantages of a very narrow phonetic transcription method for the characterisation of nuclear tails.

### 3.2.1 The nucleus, the nuclear syllable and the nuclear tone

The literature on intonation makes use of the term 'nucleus' to denote either the nuclear tone, the tonal (or pitch) movement, or the nuclear syllable, described above as the syllable in the tone unit on which or from which there is a pitch change. Most analysts within the British tradition claim that the nucleus occurs on the word which is focussed, most important, new, etc. However, attention will be concentrated here on phonetic aspects of the nucleus rather than on the reasons a speaker might have for placing the nucleus in a particular position in a tone group. O'Connor and Arnold (1973) and Cruttenden (1986) consistently use the term 'nucleus' for the syllable and 'nuclear tone' for the tonal movement. However, Crystal(1969), Gimson (1980) and Couper-Kuhlen (1986) all use the term 'nucleus' to mean either. The following table shows how 'nucleus' and other terms are used:

<u>AUTHOR</u>	<u>SYLLABLE</u>	<u>TONAL MOVEMENT</u>
O'Connor and Arnold (1973)	nucleus (p14)	nuclear tone (p15)
Crystal (1969)	nuclear syllable (p142), nucleus (p208) <sup>2</sup>	nucleus (p142) <sup>1</sup> , nuclear tone (p142)
Gimson (1980)	nuclear syllable (p267), nucleus (p267) <sup>4</sup>	nucleus (p265) <sup>3</sup>

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<sup>1</sup>Crystal (p142): 'This obligatory, and usually kinetic tone I shall refer to as the nucleus of the tone unit (or nuclear tone)'

<sup>2</sup> Crystal (p208): 'Prehead Head *Nucleus* Tail'

<sup>3</sup>Gimson (p265): '... with the nucleus (falling, rising or a combination of the two) on the appropriate syllable'

<sup>4</sup> Gimson (p267): 'When syllables follow the nucleus - the *tail*...'

Couper-Kuhlen (1986)	nucleus (p79) <sup>1</sup>	nucleus (p86) <sup>2</sup> , nuclear movement (p86)
Cruttenden (1986)	nucleus (p56) <sup>3</sup>	nuclear tone (p57)

In the remaining analysis, the term 'nucleus' will be avoided in favour of the less ambiguous, even if also less eloquent, 'nuclear tone' and 'nuclear syllable'. Having established the nuclear tone as a pitch movement, we now examine its domain.

### 3.2.2 The domain of the nuclear tone

Cruttenden (1986:57) uses the term 'nuclear tone' to refer to "what starts at and follows the nucleus" (emphasis added). In other words, the nuclear tone occurs on both the nucleus and the tail.

According to Crystal (1969:223), "by far the most frequent pattern" of the tail is when it continues the direction of the nuclear tone, although it may also begin by doing so and then level out. He adds that levelling of the tail is uncommon in rising tones. This levelling occurs either because the speaker's voice range limits have been reached, or because the speaker chooses to level out the tail in order to convey a particular attitude (such as irony, sarcasm or boredom<sup>4</sup>). Apart from cases where levelling occurs, he claims that tails are 'usually non-distinctive'.

Gimson appears to differ from Crystal in two respects:

- (i) He claims that 'unaccented syllables following a falling *nucleus* (= nuclear syllable) remain on a low level', they do not therefore follow in the same direction as the nuclear syllable.
- (ii) In the case of rising nuclei he claims that the unaccented syllables not only continue but may also 'effect' (1980:267) the rise, (i.e. there is not necessarily a

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<sup>1</sup>Couper-Kuhlen (p79): '...the nucleus is the most prominent syllable in a tone unit'

<sup>2</sup>Couper-Kuhlen (p86): '...nuclei - unless they are monosyllabic - are more often than not 'spread' over the tail or part of it'

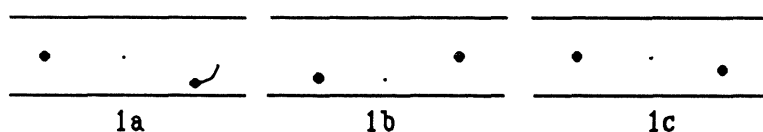
<sup>3</sup>Cruttenden (p56): '...The occurrence of similar tones starting from the nucleus'

<sup>4</sup>He is referring to a phenomenon which has since been widely referred to as stylised intonation, as discussed in detail by Ladd (1978).

rise on the nuclear syllable itself). In fact, he claims that, if there is a tail, the pitch movement rarely begins on the nuclear syllable: 'with a tail, the rise is achieved by means of a relatively low pitch on the nuclear syllable with an ascending scale on the following syllables'.<sup>2</sup>

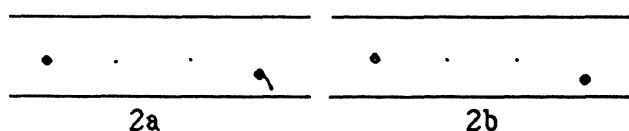
The situation is further complicated since he also adds that when a low rising glide occurs on a short syllable of the type described above and there is no tail [see 1a], it may be substituted by 'a relatively high level pitch in relation to a preceding low pitch [see 1b], or even a slightly lowered level pitch in relation to a preceding mid or high pitch' [see 1c] (1980: 267):

eg 'Can she cook?'



1a, 1b and 1c are all transcribed intralinearly with a low rising nucleus on the syllable 'cook'. Similarly, he transcribes both a low falling glide (see 2a) and a 'low level pitch in relation to a preceding higher pitch' (see 2b) (1980:267) as a low falling nucleus in his interlinear transcription:

eg 'What have you got?'



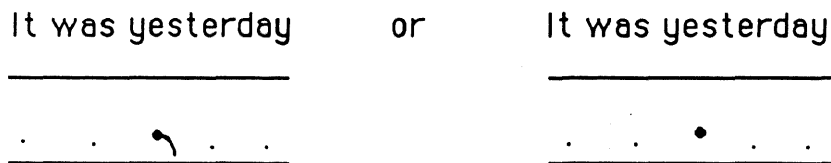
On the grounds of functional similarity, he implies that patterns 1a, 1b and 1c are variations on one pattern and 2a and 2b are variations on another. However, the interlinear representations of 1c and 2b are identical. There is an implication here that the starting point of the nuclear syllable, when short, can carry pitch

<sup>2</sup>In such a case, if the head also happens to be at the same pitch level as the nuclear syllable, the latter would be no more pitch prominent than the first tail syllable. We can only assume that, in such situations, the nuclear syllable is recognised as such either because it is the lexically stressed syllable (assuming native speakers know which syllable in a word is lexically stressed), or if it is not, e.g. in 'Did you say intralinear?' where the nuclear syllable is 'tra', because it is perceived as prominent in some way other than by pitch (eg by loudness, length or vowel quality).

movement which would have been attributed to an onglide. In short, 1c has a fairly low pitch which, it appears, substitutes for the jump down to low for the start of the low rise as well as the rise up from the low start of the nuclear tone. Similarly, 2b has a fairly low pitch which substitutes both for a low start (relative to the previous syllable) and a low end, of a low fall. This shows that the boundary between nuclear and prenuclear pitch phenomena can be somewhat blurred.

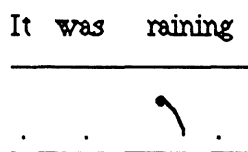
Couper-Kuhlen (1980) recognises that too little importance has been attributed to the tail, since it actually 'contributes to the shape and identification of the nucleus' (=nuclear tone), but agrees with Crystal stating that 'rises are typified by upward pitch movement *on or beginning on* a prominent syllable' (= the nuclear syllable).

Some of the differences in where the rise or the fall exactly occur may depend on the segmental constitution of the nuclear syllable. According to Crystal, a pitch jump is functionally identical to a glide and occurs when the voiced part of the nuclear syllable is too short to carry the pitch glide (e.g. a syllable containing a short vowel followed by a voiceless consonant). Gimson (1980:267) gives both possibilities, a glide or a pitch jump, for the following tone unit:



making no mention of a functional difference between the two. If Crystal's assumption that the occurrence of a glide is phonetically determined is correct, then we must assume the overall rate of delivery of the tone unit, the actual duration of the short syllable or the duration of voicing to be possible determining factors.

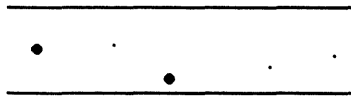
In the following example, Gimson shows a glide on the nuclear syllable 'rain', leaving little room for pitch movement on the tail syllable 'ing'<sup>1</sup>.



<sup>1</sup>He actually marks no movement at all on the tail syllable.

Whereas in the following, he shows no glide at all on the nuclear syllable. This is not surprising, considering the segments involved in the nuclear syllable: a voiceless syllable onset<sup>and</sup> a short vowel:

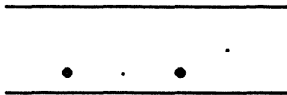
Are you comfortable?



Cruttenden argues that although the occurrence of a pitch jump or glide normally depends on the phonetic criteria outlined by Crystal (e.g. duration of voiced stretch), such realisations are not obligatory, and a speaker can choose to use a jump from a long vowel to a following syllable and a glide on a short vowel (1986:54). Jumps which occur where glides are expected sound 'abrupt', whereas glides occurring instead of jumps tend to sound either 'soothing' or 'reproachful'. He adds that whereas glides are frequent in English, jumps are predominant in German. We shall return to the issue of glides and jumps, examining them from Couper-Kuhlen's point of view, in section 3.2.3 below.

In the above examples it has been shown that, for whatever reasons, the nuclear pitch change can take place on both the nuclear syllable and the tail. If it takes place on neither it is because both are uttered on level pitches, the change in pitch being a jump from the level of the nuclear syllable to the level of the tail. O'Connor and Arnold (1973:19) provide such an example:

Don't be silly



There has been little discussion so far of cases where such an important phenomenon in the utterance (the pitch change) takes place in a position which can only be analysed as being *between* two elements of the tone unit, in this case, between the nuclear syllable and the tail. This is because each component of the tone unit is seen to be independent, and no room is made for transitional phenomena; they are, in fact, ignored.

### 3.2.3 Couper-Kuhlen: Steep slope, gradual slope and flattening

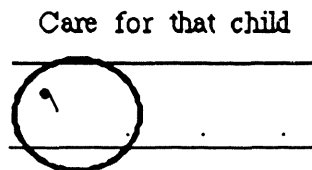
The most detailed auditory approach develops further the notation of Crystal.

In a section on tails, Couper-Kuhlen (1986:86-88) discusses steep slope, gradual slope and flattening. These will be examined in turn.

### 3.2.3.1 Steep slope

She discusses the 'slope' of the 'prolongation of the nuclear movement' (1986:86), which, if we also take into account that the section is entitled 'tails', we can assume to mean 'the movement on the tail'. However, *steep* slope occurs when the pitch falls steeply on the nuclear syllable or from the nuclear syllable to the first syllable of the tail, by which time the entire pitch movement has been accomplished. Since there is no pitch change on the tail, (in fact, all the examples given have a low level tail), it might be preferable to apply the adjective *steep* not to the pitch movement *on* the tail but rather to that *before* the tail. Again, the transition between the nuclear syllable and the tail is at issue.

In the following example (p87) of steep slope,



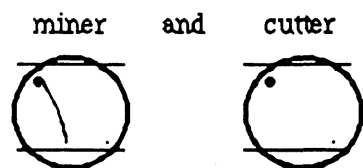
the pitch movement is accomplished by a glide on the nuclear syllable *plus* a jump down from the end of the glide to the first syllable of the tail (within the encircled part above). Couper-Kuhlen (1986:87) marks steep slope but does not mark the width of the nuclear movement. In her diacritic tonetic transcription system she is able to mark nuclear tones as wide [w] and narrow [n]<sup>1</sup>. If neither of the diacritics are present, which is the case here, then we assume the pitch movement to be of 'normal width'.

However, earlier on in the chapter (pp79-80) she adheres to the view that the tunes of miner [•\.] and cutter [•.] are intonational 'allotones'.

If this is so then the term 'wide' might be better applied to the whole portion enclosed in the circle, otherwise

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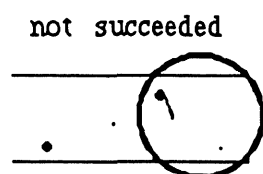
<sup>1</sup>Couper-Kuhlen borrows these diacritics from Crystal (1969). However, whereas Crystal uses them to refer to stretches of utterance, Couper-Kuhlen uses them to refer to nuclear tones.



must be classified in different ways, the first as having a 'wide nucleus' and the second as having a 'steep slope on the tail'. This is counter-intuitive, given the extremely different segmental make-up of the examples. It is difficult to place the emphasis on speaker choice in the face of such glaring segmental differences; the pitch jump on 'cut' in 'cutter' must largely be due to the short voiced stretch.

Even if we take into account Cruttenden's observations about jumps sounding abrupt and glides sounding soothing or reproachful, the fact remains that the segmental content of the two words is not at all similar and this undoubtedly has some effect on the realisation of the nuclear tone. It is perhaps the case that a glide-jump distinction is only available in less extreme cases, such as the example discussed by Gimson of "It was yesterday". However, even there, a glide might be produced as a function of rate of delivery, another interacting factor which would increase the duration of the voiced stretch and thus favour a glide.

Crystal (1969:151) marks the whole portion of the tone group reproduced here as wide; it might therefore be considered to have what Couper-Kuhlen calls 'wide nucleus'.



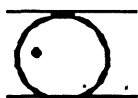
The problem with the above conclusion is that if we count 'wide' to cover the encircled portion, then 'steep slope' would be a redundant feature in the classification of nuclear tones since a wide high falling nuclear movement is identical to a high falling nuclear movement with steep slope.

Given the great effect of segmentals on the wide-steep distinction, one term covering both would make fewer non-functional distinctions. This approach is preferred in the study reported on in chapter 3.

### 3.2.3.2 Gradual slope

Couper-Kuhlen's note: 'Obviously length of tail interacts with slope. A very steep descent (or rise) on a lengthy tail will often mean that the final syllables level out' (1986:86-87) does not seem to be consistent with the fact that, in most of her examples, the fall is completed by the first syllable of the tail, the *length* of the tail being therefore irrelevant. She refers to *gradual* slope when the tail continues the pitch movement. It appears that, in her view, pitch movement only occurs on the tail in the case of gradual slope. She also claims that gradual slope is 'the unmarked variant, or the norm for tails' (p87). Most British analysts agree that this is the case for rising nuclear tones but they would not all argue that the unmarked falling nucleus is spread over the tail, at least not to the same degree as rises. O'Connor and Arnold (1973:15) give the example of

Seventy



where the fall is completed within the circle as in the above examples. It could be argued that such a sharp fall is typical of their clipped peremptory style of speech, and that Couper-Kuhlen is describing a less 'advanced RP' variety. The sample of speech provided in the accompanying tape bears this out. However, in her section on simple falls (p90), she herself gives only examples where the pitch movement is completed by the first syllable of the tail.

Gradual falls and rises include, by definition, the syllables on the tail, and may therefore be levelled out if the tail is long.

### 3.2.3.3 Flattening

What Crystal refers to as 'levelling' (1969:223-224), discussed above, corresponds to a certain degree to Couper-Kuhlen's 'flattening'<sup>1</sup>. However, it seems that flattening may only occur where there would otherwise be gradual slope. In the example below Couper-Kuhlen (1986:88) claims that the final syllable would have

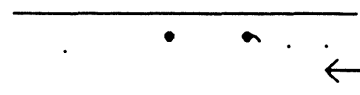
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<sup>1</sup>However, if levelling refers mainly to stylised contours, such as those discussed by Ladd (1978), levelling can refer to a type of contour which has been described by Gussenhoven (1983) as 'half completion' and by others as 'curtailed' contours. See Johnson and Grice (1990) for a discussion of the types of contour involving level or near-level tones.



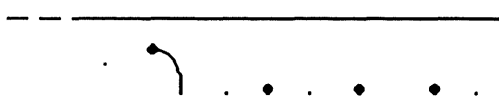
been lower if the tail had not been marked as 'flattened'; this lower position is indicated by the arrow:

which were fallible



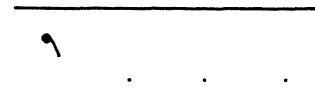
In the same section on tails she also mentions 'endpoint', 'the pitch level which the endpoint of the tail reaches' (p87). She argues for the marking of extremely high or low endpoint. She argues that even in cases of wide pitch movement the endpoint may 'stop short of the extreme' (p90). However, a matter of pages earlier, the following example is marked with 'extremely low endpoint' (p87):

.....support of Erin now David



whereas the following is not (p87)<sup>1</sup>:

Care for that child



although the end of the tail seems to be at the same level in both examples<sup>2</sup>.

Although this section has been concerned with Couper-Kuhlen's description of tails, it has been shown that the nuclear syllable and tail function as a more or less indivisible unit. The shape of either can be greatly influenced by the segmental structure of the syllables concerned, and the shape of each is dependent to a large

<sup>1</sup>Couper-Kuhlen uses the diacritic ['] to indicate steep slope and [⊥] to indicate low endpoint, which, in the case of falls, are placed under the diacritic for the falling tone ['].

<sup>2</sup>It is always possible that different pitch ranges are indicated by the upper and lower lines, although this is not explicitly stated. If this were the case, perhaps a global range parameter might be a more meaningful way of expressing the distinction between the two examples.

degree on the shape of the other. Such problems lead to the proposal in section 4 to treat them as one indivisible unit rather than two.

### 3.2.4 The interdependence of nuclear syllable and tail

There is a difference in status between the nuclear syllable and the tail in that the former is the syllable which is psychologically most important (i.e. the lexically stressed syllable of the focussed word). The nuclear syllable is obligatory, whereas the tail is not. This is, of course, not to say that the tail doesn't carry distinctive pitch movements: complex tones which have been somewhat neglected in this account almost invariably involve the tail (if there is one).

The importance of the nuclear syllable and the relative lack of importance accorded to tails may have been behind Crystal's statement that the pitch contours of tails are 'automatically determined by the direction of the nuclear tone' (1969:223).

However, the analysis is simplified if we see the nuclear tone is an abstract pitch movement which must be synchronized with a segmental layer made up of both the nuclear syllable and the tail. In this case, the pitch of both the nuclear syllable and the tail is determined by the direction of the nuclear tone. We shall return to this issue in section 4.

### 3.3 The head-nuclear syllable transition

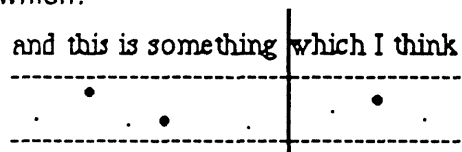
When classifying heads, Crystal (1969:229-231) takes into account the pitch level of the onset. He also uses the pitch at the beginning of the nuclear tone in order to create subcategories of heads requiring 'marked' pitch height on the nuclear syllable. However, this does not affect his major categories; even if the pitch of a nucleus following a rising sequence of stressed syllables is lower than the preceding stressed syllable, the head is still categorised as rising rather than rising-falling. Couper Kuhlen (1986:84-86) does not consider the pitch of the beginning of the nuclear tone as significant, hence her comment that monosyllabic heads cannot be classified as rising or falling<sup>1</sup>; a step up from the onset syllable in a monosyllabic head to the nucleus would not make the head a rising one. She states clearly that her head classifications are 'wholly independent of nuclear type'.

By contrast, the issue of whether the nuclear tone classifications are wholly independent of head type is less clear-cut. In the following example transcription

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<sup>1</sup>unless, presumably, they actually carry a pitch glide

which she analyses into two tone units (1986:80), the second one beginning on *which*:



In the first tone unit where *this* is the nuclear syllable, she states that the rising pitch movement from *and* to *this* is irrelevant in determining whether the nuclear tone is classed as falling or rising. It is, in fact, described as a falling tone because of the following low pitch on *is*. Likewise, the nuclear tone in the following tone group is determined by the pitch movement from *I*, the nuclear syllable, to *think*, the tail.

However, Couper-Kuhlen's system of relative pitch height, like Crystal's, takes into account the transition between the head (or prehead) and the nuclear syllable: "nuclear pitch height is relative to the height of the preceding syllable" (1986:91). This is also true of Cruttenden. Thus, the boundary between the head and the nucleus is seen to be irrelevant in one regard and important in another. However, it is never considered to be as important as the direction of pitch movement on and after the nuclear syllable. It is this point which must be emphasised, and which Couper-Kuhlen was most probably indicating in stating that "What the pitch of the voice does on the syllable before the prominent syllable is of no relevance in determining whether the nucleus is falling or rising." (1986:80). It is of no relevance in signalling nuclear tone direction but of some importance in signalling nuclear tone height. The hierarchy of importance relies on the fact that direction is more important than height of starting point. This could be said to be the consensus view amongst all nucleus-plus-head approaches.

#### 4 A working model

For the purposes of the Italian study described in the next chapter, the principle of componentiality is strictly adhered to; this is done in order to allow for an investigation of the different components in isolation, as well as the transitions between them.

Owing to the problems encountered when treating the nuclear syllable and tail as separate entities (reported on in 3.2), they are collapsed into a 'nuclear unit' which corresponds to the single indivisible domain of the nuclear tone; it encompasses the

nuclear syllable, the tail and the transition between them. Such a proposal reduces the tone unit to three constituents:

(Prehead) (Head) Nuclear Unit

The mapping between the segmental structure and the tune: the prehead tune, the head tune and the nuclear tone, is thus simplified, and a componential analysis can more easily be performed.

This type of division is not new, however. Within a different, although British, tradition, Halliday (1967)<sup>1</sup> proposes an indivisible unit, 'the tonic' as the domain of the nuclear tone; in his terminology the 'tonic' is the domain of the 'tone'. He does not subdivide the 'tonic' into independent components. The 'tonic syllable' is equivalent to the nuclear syllable, but it is still part of the 'tonic', there being no posttonic element or tail. The nuclear unit proposed here is thus equivalent to Halliday's tonic.

In order to elucidate the nature of the transitions between the head and nuclear syllable (discussed in 3.3), a syntagmatically non-relational method of classifying the height of nuclear falls and rises is adopted. For instance, in this method, 'high' would refer to the position within the speaker's range<sup>2</sup>. The height refers to the starting point of the nuclear tonal movement; thus [<sup>ˈ</sup>ˈ] is a high fall, as is [<sup>ˈ</sup>ˈ], and [<sup>ˈ</sup>ˈ] and [<sup>ˈ</sup>ˈ] are both mid (not low - as they begin on a mid pitch) falls.

Couper-Kuhlen's fine distinctions regarding width and endpoint (discussed in 3.2.3) are collapsed into a single dimension of width which refers to the whole of the nuclear unit. The endpoint is not recorded separately, but rather inferred from a combination of starting point height and width.

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<sup>1</sup>Halliday's work pays more attention to functionality than to minute phonetic detail. The phonetic detail he does uncover is often neglected, together with his ideas on the relationship between intonation and grammar, which have suffered much criticism from Crystal, especially at the time of writing his 'Prosodic systems and the Intonation of English'. Nonetheless, Halliday's tonic has been retained by Brazil (1985) and, conceptually adopted by Nolan (1984) in the form of a "nuclear accent unit".

<sup>2</sup>This is an adaptation of O'Connor and Arnold's method of describing nuclear pitch height, to be discussed further in chapter 3

Heads and preheads are defined as ending on the syllable before the nuclear syllable and their end height as well as starting height is recorded. The distinction between head and prehead has been shown to be difficult to maintain in cases where the pitch of a syllable obtrudes in relation to what precedes or follows it (see 3.1). However, an attempt will be made to maintain this distinction, whilst bearing in mind that the division between the two categories is not as watertight as it might at first appear.

The next chapter will apply this working model to a corpus of spontaneous speech in Palermo Italian, and will discuss in particular the nature of the transitions between the different components which have been recorded and what functional value they have.

## Chapter 3 A British-style analysis of Palermo Italian

### Preface

In this chapter, reference is made to the author's auditory analysis of a spontaneous corpus of Palermo Italian. This analysis was originally carried out in partial fulfilment of the requirements for the degree of MA at Reading University.

The transcriptions were performed within the British auditory tradition, assuming that, with certain adjustments, Palermo Italian intonation could be analysed using the techniques and principles developed within this approach. There were no considerations of pitch accent or autosegmental analysis. It is for this reason that the results are referred to here, since they will be compared to an instrumentally corroborated autosegmental pitch accent analysis of Palermo Italian in chapter 7.

Since the transcriptions were performed as part of another degree program, they will only be summarised here. They will serve as a catalogue of spontaneous intonation patterns. In the interests of objectivity, the interlinear (• .) transcriptions made for the purposes of the MA dissertation have not been altered (a) with regard to the position of a dot in the vertical interlinear space and (b) the decision to label a syllable stressed or unstressed (one exception to this is pointed out in the text). Although the basic analysis remains unaltered, some of the data are presented in a different light; a number of previously unnoticed inconsistencies are pinpointed for further discussion in chapter 7.

### 1 Introduction

The object of study is the intonation of the local variety<sup>1</sup> of Italian spoken in Palermo, the capital of Sicily. Of particular interest is how speakers of this variety signal interrogation in yes-no questions. As in most varieties of Italian, yes-no questions and statements are distinguished solely by their intonation contours, there being no syntactic or morphological markers for interrogation in this context. Two basic questions arise:

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<sup>1</sup>The concept 'local Italian' is invoked here because the Italian spoken in Palermo differs substantially from the Italian spoken in other parts of the region (Sicily), both in terms of its segmental phonological characteristics and its intonation. Thus, the concept of "regional Italian" as discussed, for instance, by Lepschy and Lepschy (1977) is insufficiently precise to describe the variety under investigation.

What intonational form is used to signal interrogation?

Can this form be adequately described using a model of intonation based on the nuclear tone?

The first of these questions is given consideration in section 3 below. It is then given a more precise answer in section 4. The second is addressed in sections 4 and 5.

### 1.1 Corpus details

A problem generally encountered when conducting a corpus-based analysis of interrogative utterances relates to their low frequency of occurrence, making a sufficient number for an adequate count very difficult to obtain. Fries (1964) overcame the problem of recording yes-no questions by recording a number of television and radio programmes in which a number of panellists attempt to discover the precise vocation, occupation or special activity of another person who may give no information other than yes or no answers<sup>1</sup>. The corpus thus contained a high proportion of yes-no questions.

Lee (1980) has since discussed Fries' results, suggesting that the type of intonation used might depend, amongst other things, on the distribution of yes-no questions throughout the data. In most English yes-no questions, however, morphological and syntactic markers operate in conjunction with intonation, although where the context clearly requires a question, even a syntactic statement with falling intonation may be interpreted as a question. In contrast to English, Palermo Italian makes exclusive use of intonation as a marker of interrogation. Nonetheless, it is acknowledged here that interrogation may not always be signalled explicitly.

Since the recording of a radio or television programme in Palermo Italian was not possible, recordings were made of a similar type of game played by a number of Palermo Italian speakers in the home of one of the speakers. A number of recordings were made of different occasions during the Christmas vacation, a period during which a number of games are customarily played. Informants knew that they were being recorded, but were unaware of the purpose. The quality of the recordings was affected by their informal setting but it is hypothesised that the performance of the speakers was minimally affected by the recording situation; the

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<sup>1</sup>This kind of game is otherwise known as "20 questions" or "What's my line?".

microphone was placed in a central position, speakers were not asked to speak into the microphone and the cassette recorder was left unmonitored during the session.

Parts of each recording were played to a number of native speakers who were asked their impressions as to how 'interested' the speakers sounded. This was done in an unsystematic way with the sole aim of authenticating the data on the assumption that speakers who sound interested when asking questions, are motivated and are actually involved in a communicative act. A restricted corpus of the games where native judges claimed speakers to be most interested was selected for special attention. The main part of the restricted corpus consisted of a recording of a number of speakers who had a rapid rate of delivery and whose speech often overlapped.

Of the group of speakers in the restricted corpus, seven were aged between 24 and 28, and two between 62 and 65. All were born and live in Palermo<sup>1</sup>.

## **2 Transcription**

Initially, every recording in the restricted corpus was transcribed using a phonetic interlinear transcription method where stressed syllables were marked [•] and unstressed syllables [·]. A sample transcription was checked by two British intonologists.

The working model proposed in chapter 2, section 4 is used to analyse these interlinear transcriptions into tone units consisting of, maximally, a prehead, head and nuclear unit<sup>2</sup>, and minimally a nuclear unit.

The nuclear unit is preceded in the interlinear transcriptions by a broken line.

Despite the discussions on pitch glides and jumps in 3.2.2 of chapter 2, challenging Crystal's assumption that there is no functional difference between the two, it was decided to do the initial transcription without marking glides except in cases of complex tones which usually involve a change of pitch direction on one syllable, or

---

<sup>1</sup>Recordings were made of two speakers from another part of Sicily, but their intonation was regarded to be substantially different from the Palermo speakers; in this account, their speech has been ignored.

<sup>2</sup>As discussed in chapter 2, the tail was not treated as independent of the nuclear syllable; the term 'nuclear unit' is used to designate the segmental domain of the nuclear tone.



nuclear units of one syllable (i.e. where there was no tail). This decision was made for various reasons: there appeared to be phonetic gradience rather than a clear-cut distinction between glides and jumps (see chapter 2, section 3.2.3 on slope); segmental phonetic factors such as the length of the vowel and the degree of voicing on the surrounding consonants played an important role in determining whether there was a perceived glide, and, if so, to what extent.

The head was not overtly marked; it was recognised as beginning on the first syllable transcribed with a heavy dot. This means that a prehead may consist only of unstressed syllables. This decision is intended to make transcription simpler and more consistent<sup>1</sup>.

### **3 Formal analysis of the core corpus**

The core corpus was analysed into 247 tone units. The categories needed for the description of this corpus are laid out below.








#### **3.1 Nuclear tones**

The nuclear tones listed were described according to direction, beginning point and range. We consider simple and complex tones.

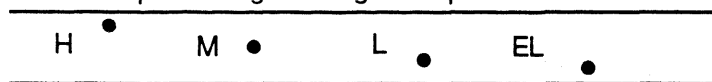
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<sup>1</sup>Problems involved in making a distinction between heads and preheads were discussed in chapter 2.

### 3.1.1 Simple Tones

<u>Tone</u>	<u>Beginning point</u>	<u>Range</u>	<u>Examples</u>	<u>Frequency of occurrence</u>
Fall	High (H)	Narrow (N)		6 %
		Wide (W)		40 %
	Mid (M)			16 %
				8 %
Level	High (H)			4 %
	Low (L)			20 %
Rise	Low (L)	Narrow (N)		3% <sup>1</sup>

The terms high, mid, low and extra low are illustrated by the following four points within the pitch range of a given speaker.



The term 'low fall' has not been used, in order to avoid the analogy with Crystal's low fall in English which has, in fact, a mid starting point. For consistency, these tones are all classified according to their beginning pitch (within the speaker's range).

The term 'narrow' implies that less than 1/2 of the pitch range<sup>2</sup> is covered and the term 'wide' that the pitch movement stretches over more than 3/4 of it. For this reason no categories of narrow or wide mid falls or extra low falls are made. The few rises recorded were all narrow in range.

<sup>1</sup>These figures do not sum to 100% because of rounding down in calculation.

<sup>2</sup>The speaker's pitch range is assessed auditorily.

### 3.1.1.1 Falling tones

The majority of tones in the corpus were falling (70%). Examples of high wide and high narrow nuclear tones are given below:

1.

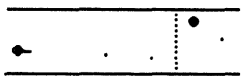
Ma viene d'inverno?



(But does he come in the Winter?)

2.

Eh ... di pensiero?



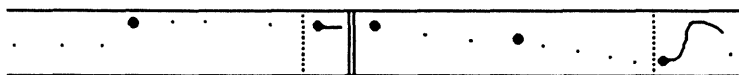
(Er ... mental?)

### 3.1.1.2 Level tones

A special note on the distribution of the level nuclear contour is in order. This contour is used in non-final hesitation cases. The duration of the syllable is usually increased relative to non-hesitation non-final nuclear tones. This is analogous to cases which Crystal claims are ambiguous: where one transcriber perceived a level nuclear tone, another did not perceive nuclearity. He states that the "main area of confusion is with drawled tones, though these usually lack the prominence of nuclear function, being lax, quietly articulated, and usually occurring on grammatical words." (1969:217). Some of the above features are common to Palermo Italian level contours, especially that they are drawled and accompanied by hesitation (pauses or false starts). An example of such a level nucleus is in the first part of the following:

3.

E' un lavoro che - che puo' anche non essere retribuito?



(Is it a job which could also be unpaid?)

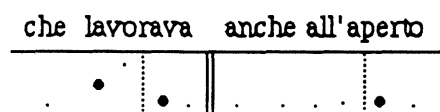
In this case, the hesitation occurs on 'che' (which) and the level pitch and drawl on the modal verb 'puo' (can).

Since the high level contours in the corpus were of this type, we conclude that the high level tone is not a full member of the nuclear tone set (see, again, discussion of level tones in Crystal:1969).

Low level tones occurred in two types of (intonational) context.

(i) They occurred in cases such as the second tone unit transcribed below:

4.

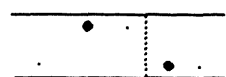


Such a tone unit has been reanalysed as being subordinate in some way to the first. A similar case is reanalysed and discussed in section 3.3.2 on falling heads (type 2) in example 11: "Il prete per benedire la casa", where "il prete" constitutes one tone unit, and "per benedire la casa" a second, subordinate one<sup>1</sup>.

(ii) They occurred in cases where the preceding pitch was high, such as in the first tone unit of example 4 above, and in the following example:

5.

Che sta facendo?



(What's he doing?)

It is arguable whether the syllable 'sta' is actually stressed, rather than just pitch prominent. In either case, the fact that the prenuclear pitch is high is what is of interest here.

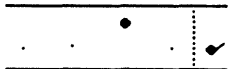
### 3.1.1.3 Rising tones

It appears that rising tones too have a defective distribution in the data analysed. Apart from the cases of rises uttered by speakers of local varieties outside Palermo, rises only occurred on words in which the final syllable was stressed, such as in the following example of a monosyllabic word:

<sup>1</sup>It is acknowledged that cases such as the latter have been analysed for English as simply a continuation of the nuclear contour.

6.

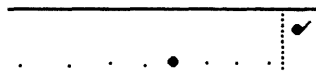
Gliel'ha detto lui?

(Did he say it?)

There were no high rises in the restricted corpus, although there were two in the material recorded and analysed in less detail. One of these was as follows:

7.

Prevalentemente in città?



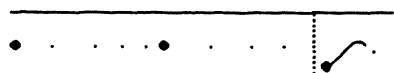
(predominantly in town?)

### 3.1.2 Complex tones

The frequency of transcribed complex tones was very low (only 5 occurrences in the whole corpus). It was noted that there appeared to be a certain amount of gradience between high fall (with rising onglide) and rise-fall. In fact, all cases of transcribed rise-fall had fully voiced syllable onsets and/or diphthongs in the nuclear syllable, as in the following example:

8.

E' un attivita' be' retribuita?

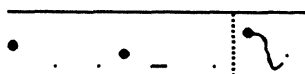


(Is it a well paid activity?)

One case of a fall-rise was recorded:

9.

E' un lavoro mentale?



(Is it an intellectual job?)

Note that the pitch immediately before the nucleus is very low.

### 3.2 Types of Prehead

Five types of prehead were listed, low (85%), mid (10%), high (2%), falling (1%) and rising (1%). Falling and rising preheads are not provided for in British English inventories<sup>1</sup>.

### 3.3 Types of Head

Nine types of head were described. The head is defined as ending on the syllable before the nuclear syllable and the transition between the two is not taken into account in the classification. The categories used are described and exemplified below.

#### 3.3.1 Falling 1

This is a falling series of (rhythmically) stressed and unstressed syllables. In longer tone units there is a tendency towards a levelling out after the fall.

10.

*E' un lavoro che si svolge in miniera?*



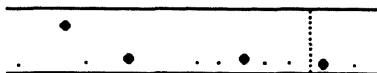
(Is it a job which is done in the mines?)

#### 3.3.2 Falling 2

This is a sharp fall followed by a levelling out at a low pitch.

11.

*Il prete per benedire la casa.*



(The priest to bless the house.)

This type of head was originally listed and the argument was put forward that 'casa' had the perceptual prominence of a nucleus despite the absence of dynamic pitch. But it is analysed in chapter 7 as exemplifying "early focus", in which a major phrase consists of two minor tone units, the first ending on 'prete' and being the stronger of the two. Thus, the second phrase is in some way subordinate to the first, as in example 4 above.

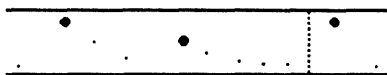
<sup>1</sup>This is the case in published work on British English known to the author.

### 3.3.3 Falling 3

This is a falling series of stressed syllables from which any unstressed syllables fall.

12.

Occorrono mezzi di trasporto?



(Is a means of transport necessary?)

### 3.3.4 Falling 4

This is a falling series of stressed syllables with any unstressed syllables continuing on the same pitch as the previous stressed syllable.

13.

In tutte le stanze no.



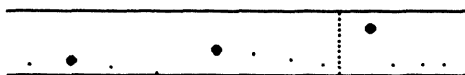
(Not in all the rooms.)

### 3.3.5 Falling 5

This is a rising series of stressed syllables from which unstressed syllables form a gradual descent.

14.

Ci sono tuoi amici che lo praticano?



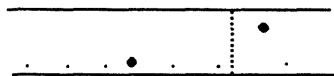
(Are there any of your friends who do it?)

### 3.3.6 Low

A low level sequence of syllables.

15.

E per esempio le scarpe?



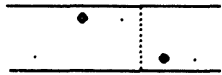
(And shoes for example?)

### 3.3.7 High

A high level sequence of syllables.

16.

Che sta facendo?



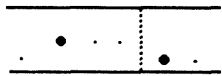
(What's he doing?)

### 3.3.8 Mid

A mid level sequence of syllables.

17.

In minima parte.



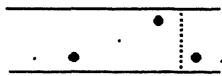
(To a small extent)

### 3.3.9 Rising

A gradually rising series of stressed and unstressed syllables.

18.

Ma cu ciu faffari?

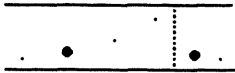


(Who makes us do it?)

This is the one case where the marking of a stressed syllable has been questioned in retrospect, as indicated in the alternative transcription below:

19.

Ma cu ciu faffari?



(Who makes us do it?)

The syllable 'faf' is pitch prominent but not stressed. The pitch prominence has the effect of 'setting off' the low pitch on the following syllable. It is also of interest that examples 16-19, all involving a head which ends higher than the beginning point of the nuclear tone are transcribed with a low level nucleus. Although there was no discussion in Grice (1984) of problems in distinguishing extra low narrow falls from low level nuclear tones, it is difficult to be certain that a consistent distinction can be maintained. What appears to be functionally more important here is the transition from a high pitch at the end of the head to a relatively low pitch on



the nuclear syllable. More will be said about unstressed high syllables immediately before the nucleus in the following chapter, as it is a common pattern in standard Italian declarative utterances.

### 3.4 Frequency of occurrence of prenuclear contours

The frequency of occurrence in the data of the above illustrated heads is as follows:

Falling 1	23%
Falling 2	10%
Falling 3	2%
Falling 4	3%
Falling 5	1%
Low	18%
Mid	7%
Rising	4%


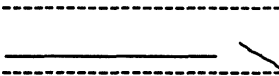
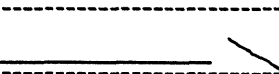
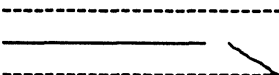

In addition, 24% of the tone units had no head, 13% of which had a prehead and 11% no prenuclear tune at all.

## 4 Functional analysis of the core corpus

### 4.1 Questions and statements

The initial hypothesis was that questions were distinguished from other categories of utterance, especially statements, by the nuclear tone alone; the high fall being used for questions and the mid or extra-low fall for statements. However, the situation was not as clear-cut as this: the mid falling tone was used in some yes-no questions as well as statements. In fact, the interpretation of an utterance as a question or statement appeared to depend on the prenuclear contour with which the mid tone was combined.

The following table shows which utterance types were signalled by a number of combinations of prenuclear contours and a mid fall nuclear tone:

<u>Prenuclear contour</u>	<u>Utterance type</u>	
Falling 1	Yes-no Question	
Low	Yes-no Question	
Low prehead	Yes-no Question	
Mid	Statement	
Rising	Statement	

It is clear from the outline of the tunes that the yes-no question forms involve an upward movement towards the beginning point of the nuclear unit; the end of the pre-nuclear tune must therefore be lower than the beginning point of the nuclear unit. In the case of the statement, the end of the head must be higher than (or the same as) the pitch at the start of the nuclear unit<sup>1</sup>. Thus, the functional contrast between questions and statements is being signalled by the pitch movement (or jump) on a part of the tone unit which has little or no status, being simply a transition between two of its components.

The following table shows the combinations of nuclear tones and heads, classified according to their end pitch, and whether they are used in questions (+Q) or other utterance types(-Q)<sup>2</sup>.

<sup>1</sup>This can be seen not just in the case of the mid fall nuclear tone, but as was noted above, and typically, in the case of extra-low falls.

<sup>2</sup>A group of 13 tone units are excluded from the count; these are all non-final elements of lists which will be discussed in 4.2 below.

Type of Head (end)	Type of Nuclear Tone					
	FALL	LEVEL	FALL	LEVEL	RISE	FALL
	high narrow	high wide	mid	low	low	xlow
LOW	+Q	+Q	+Q	+Q	-Q	+Q
MID				-Q	-Q	-Q
HIGH		-Q	-Q	-Q	-Q	-Q

The table gives additional support to the hypothesis that it is the rising transition which signals interrogation.

If the height of the nuclear tone were specified in relation to the the pitch of a preceding syllable, as in Crystal (1969), Couper-Kuhlen (1986) and Cruttenden (1986) which were discussed in section 3.3 of chapter 2, yes-no questions could be said to have high falls, and statements low falls.

There is an exception in the table, the rising nuclear tone, which can be considered a contextually determined phenomenon; words with final stress have a rise instead of a high fall.

#### 4.1.1 Complex tones

Rising-falling complex tones involved a fall down to the beginning point of the nuclear syllable, having a rise in the first part of the nuclear tone. The falling-rising tone had a rising transition between the head and nuclear unit (i.e. a rise up to the beginning point).

#### 4.2 Lists

Thirteen contours were excluded from the analysis in 4.1 above. These were all non-final items in lists. They were analysed as follows:

Prenuclear tune	Nuclear tone		
	high	mid	
	w	n	
Falling 5 head	1		
Mid head		1	
Low head	4	2	1
Low prehead	3		
No head/prehead			1

These contours have the same structural description as yes-no question contours in terms of their nuclear and head tunes, as well as the transition between them. They were distinguished from yes-no questions in Grice (1984) by being transcribed as drawled. It is clear from further auditory analysis that there is a difference in timing of the pitch movement, the impression being that the rising transition begins earlier than in yes-no questions, but this difference is not easy to record within the British-style analysis carried out. In both earlier and later studies, the analysis of the nuclear tone as a high or mid fall was the same in yes-no questions and lists; it was either a rhythmic or a pitch-timing difference which was recorded.

## 5 Main observations and conclusion

The main findings of the above analysis are as follows:

1) The nuclear tone of yes-no questions in this variety of Italian is typically a mid or high fall; such tones sometimes occur in statements too. However, what distinguishes yes-no questions from statements is the pitch at the end of the head (or prehead) before the nuclear fall: in the former it is lower and in the latter it is higher. It is therefore the transition between the head and the nuclear unit which signals interrogativity, entailing a rise or skip up. This contravenes the componentiality principle mentioned in chapter 1.

2) Non-final clauses (particularly in lists) may also have high or mid falls preceded by a low pitch; they are nonetheless distinguished from yes-no questions solely by intonational means. Although, when excised from context, non-final clauses are syntactically indistinguishable from yes-no questions, they do not always sound interrogative, despite the jump up in pitch. The auditory impression of these contours is that the rise up to the start of the fall begins earlier.

3) A few non-interrogative contours contained high pitched unstressed syllables prior to the nuclear syllable which could not easily be described as belonging to a head - at this stage, little can be said about them as there were too few examples in the corpus, but they are discussed later in the thesis (in chapter 4 with regard to Standard Italian, and in chapter 7 with regard to Palermo Italian).

4 ) Yes-no questions with a final stressed syllable have what can be transcribed as a rising nucleus.

5 ) A number of interrogative contours can be transcribed as having a rise-fall nuclear tone; their nuclear syllable typically contained fully voiced onsets and/or diphthongs. The transition between head and nuclear unit in these cases was falling rather than rising, a problem to which a solution is suggested in chapter 7.

6 ) Crystal (1969), Cruttenden (1986) and Couper-Kuhlen (1986) all take the transition jump from the last unstressed syllable in the head to the nucleus as the criterion for classifying tones as high (jump up) or low (jump down), rather than the position in the speaker's pitch range. This approach allows the description of the [ $\pm$ interrogative] distinction as being manifested by a high fall in questions and a low fall in final clauses of statements. In a way, such an analysis extends the domain of the nucleus to the left: the syllable before the nuclear syllable is referred to in the classification of the nuclear tone, although its broad class, determined according to the direction of movement, is not affected (see the quote from Crystal below)

However, non-final clauses and questions (both involving a jump up) cannot be distinguished by broad class alone. In addition, broad class analysis would require a rising monosyllabic nucleus (observation 4) to be described as an allotonic variant of the high fall. This is counter-intuitive, given the consensus view as to the "basic division of nuclear tones into rising and falling" (Crystal:1969:210). On the other hand, the rise-fall and fall distinction in 5 above is less problematic for the British-style approach, as the final pitch direction is the same.

Thus, it can be seen that it is not possible to account for all the observed data satisfactorily using a British-style nucleus plus head approach; one is led into a

series of inconsistencies in the analysis. Referring back to the two questions posed in the first paragraph of the introduction of this chapter, it can be seen that

- ( i ) The common factor in all interrogatives is the rise, either as a skip up to the nucleus or as a rise within the nuclear syllable (as discussed in 4 and 5), and
- ( ii ) this form cannot be adequately described using a model of intonation based on the nuclear tone, at least with the British tradition of analysis.

Given the inappropriateness of the British school to analysing Palermo Italian intonation, it is reasonable to think that Italian analysts may have better equipment with which to perform the analysis. It is to these analysts that we turn in the next chapter.

## Chapter 4 Auditory Studies of Italian Intonation

### 1 Introduction

In this chapter, we shall discuss a number of auditory treatments of Italian intonation, with the expectation that auditory accounts by Italian specialists will capture the major meaningful distinctions within the intonation system they are describing. The studies dealt with in detail below all describe what is claimed to be Standard Italian accents. However, they do not all appear to be describing the same variety. In order to explain the lack of uniformity in the intonational forms described, we shall preface a consideration of these accounts with a discussion of the status of a so-called Standard in Italian.

#### 1.1 Varieties of Italian

Lepschy and Lepschy (1977:63) claim that Standard Italian not only 'does not exist in actual usage but is not even an ideal to which existing varieties strive to conform'. However, although there is no counterpart to British RP, certain regional varieties are considered to be more prestigious than others. The cultural or economic importance of a town or area is reflected in the prestige attributed to the accent associated with it. Since Italy's unification into a Nation State was, in European terms, relatively recent, Rome does not serve as its cultural and economic centre in the same way as London does for England.

Since the first writings in what was called the Italian language were based on the dialect of Tuscany, a Tuscan accent has always had considerable prestige. However, the popular expression coined once Rome had become the seat of the Italian government (which occurred as late as 1870): '*Lingua toscana in bocca romana*' (the Tuscan language spoken by Romans) was an indicator of the change in attitude towards the Florentine or Tuscan accent in favour of the accent of the new capital. Although the Tuscan origins of the language were still acknowledged, the expression reflected, according to Camilli (1965:154), the belief that the Romans spoke the literary language 'better' than the Tuscans. Milan and the 'industrial triangle' (Milan, Turin and Genoa) have since become Italy's financial and commercial centre. As a result, some social groups now consider the accent of Milan to be the most prestigious (see Galli de' Paratesi:1985).

In the literature on Italian intonation there have been a number of approaches to the issue of which Italian intonation to describe. Agard and Di Pietro (1965) and

Fiorelli (1965) claim to describe a standard variety. Chapallaz (1979) bases her account of Italian intonation on the pronunciation of speakers from various places within a geographical area bounded by Rome to the South and Florence to the North. She thus does not refer to one local or even regional variety but makes generalisations about a number of varieties. Lepschy (1978) described his own accent, that of an educated speaker from Venice. Other studies have merely claimed to investigate 'Italian' intonation without reference to any particular variety, describing the speech of individual Italian informants (Fogarasi:1975, Ames:1969).

A comparison of the various studies on Italian intonation should take into account that it is not always the same variety which is being described, even if they are all dealing with the Italian language as spoken by educated speakers. In this chapter we deal almost exclusively with accounts of what the respective authors describe as Standard Italian.

## **1.2 Auditory treatments of Italian intonation**

D'Eugenio (1982:235) wrote in the introductory paragraphs of his chapter on Italian intonation: 'The existing material on the subject looks almost insignificant if compared with the number of scholarly studies devoted to English intonation. To start with, there is no basic work... all we have is a series of articles and some brief sections in books dealing with Italian phonetics'.

Even amongst these studies, there is no general consensus as to which theoretical approach is best suited to Italian. The two most frequently cited works, by Chapallaz and Agard and Di Pietro, are based upon entirely different approaches. Chapallaz (1960, 1962, 1964, 1979) describes whole tunes on the basis of the model of British English propounded by Armstrong and Ward (1926), whereas Agard and Di Pietro follow the American model of Trager and Smith (1951), subdividing the speaker's pitch range into four phonemic levels. D'Eugenio (1982) adopts an approach which combines componential aspects of the British-style analysis as described in chapter 2 (e.g. Crystal:1969) with the levels approach of the American school (e.g. Trager and Smith: 1951), and Canepari (1976, 1979, 1980, 1985) develops a system which draws heavily on the work of Halliday (1967).

Common to most studies is the assumption that an investigation of Italian intonation should begin by examining the role of intonation in distinguishing yes-no questions



from statements. However, the intonational form used to signal this functional contrast is not characterised in the same way in all accounts. We shall examine whether this is due to the fact that the models differ in the way they capture intonational forms, or to the fact that the forms differ from one variety to another. Lepschy and Lepschy (1977:62) have implied the latter when they refer to the fact that, in Italian, 'the use of intonational systems as part of the grammar' may vary across accents.

There follows a survey of some of these studies along with discussion of the theoretical approaches employed in each account, and their appropriateness for describing the particular intonational phenomena discussed in chapter 3. In particular, we shall examine how these treatments characterise yes-no questions, statements and non-final list items, both in terms of the general shape of the intonation contours, as well as the exact location of distinctive pitch. The survey will take the following format: (1) a brief summary of the descriptive framework used to perform the analysis, (2) a description of the basic tunes described; in order to aid comparison of the forms across models (an interlinear interpretation will be provided of the patterns described), and (3) an investigation of exactly where distinctive pitch is said to occur, particularly in relation to the nuclear syllable.

## **2 Agard and Di Pietro**

Within the context of a contrastive study of the sound systems of 'Standard' Italian and 'American' English, Agard and Di Pietro (1965) provide a 'phonemic' account of Italian intonation. They first illustrate perceived pitch with a line above the orthographic text and then perform a phonemic analysis within the American structuralist tradition (Trager and Smith:1951, Pike:1945). In section 2.1, we shall give a short description of the framework within which they have worked, and in section 2.2 we shall describe the patterns they propose for polar questions, statements and non-final list items.

### **2.1 Descriptive framework**

Agard and Di Pietro use the same framework for describing English and Italian. They describe pitch patterns as a series of levels; low, middle, high and overhigh, symbolised in this case by the superscript numbers <sup>1,2,3</sup> and <sup>4</sup> respectively. These

superscript numbers are placed at strategic positions, 'pitch points', in the phrase. They are as follows (with optional points in parenthesis):

(INITIAL)      (PRECENTRAL)      CENTER      (PREFINAL)      FINAL

where the CENTER occurs on the syllable with "phrase stress" corresponding to what has been described in the previous chapters as the nuclear syllable. The pitch movement may be unidirectional (falling or rising) from the CENTER to the FINAL point, or it may be bidirectional (falling-rising or rising-falling); in the latter case, a PREFINAL point specifies the level at the pivot. After the FINAL point there is a 'TERMINAL CONTOUR' which may be rising (↑), falling (↓) or unchanged (→). From the examples given, "unchanged" appears to mean that the pitch is levelled out (see discussion of levelling in chapter 2) as illustrated by the "phonemic" and "phonetic" transcriptions of the following phrase (1951:61):

1.

/<sup>2</sup> That's <sup>3</sup> "all<sup>2</sup> →/



where the CENTER is level 3, the FINAL point level 2, and the TERMINAL CONTOUR is "unchanged".

Most of the examples given show the TERMINAL CONTOUR following the direction of the change in pitch between the FINAL and what precedes it. However, Agard and Di Pietro do give examples where a semantic contrast is produced when the TERMINAL CONTOUR signals a reversal of direction, e.g. (1965:65):

/<sup>3</sup>come si <sup>1</sup>"chiama<sup>1</sup> ↓/ 'What is your name?<sup>1</sup> (signalling no involvement)

/<sup>3</sup>come si <sup>1</sup>"chiama <sup>1</sup> ↑ / 'What is your name?' (signalling curiosity in relation to the speaker's personal experience)

where " is placed before the nuclear syllable, the number 1 before it is the CENTER, and the number 1 at the end of the word 'chiama' is the FINAL pitch point.

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<sup>1</sup>Wh questions are described as having the same basic pitch contour as statements.

## 2.2 Basic Patterns

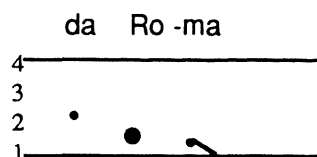
Agard and Di Pietro describe their two "basic patterns" as consisting of the following primary contours<sup>1</sup>: / 1"1↓/ (CENTER 1, FINAL 1, falling TERMINAL) for statements and /3"3↑/ (CENTER 3, FINAL 3, rising TERMINAL) for yes-no questions; these are BP I and BP II respectively. However, the way they are said to typically combine with precontours is of particular interest.

When the CENTER of BP I is preceded a) by one or more unstressed syllables, the pattern is /2 1"1↓/, b) by one or more stressed syllables, the pattern is /3 1"1↓/ and c) by one or more stressed syllables, which, in turn, are preceded by an unstressed syllable, the pattern is /2 3 1"1↓/. When the CENTER of BP II is preceded by any material at all, regardless of stress patterns, it is on a mid pitch, the pattern being /2 3"3↑/.

Below are interlinear transcriptions of the two Basic Patterns with the following precontours: (a) unstressed INITIAL, (b) stressed INITIAL and (c) unstressed INITIAL and stressed PRECENTRAL.

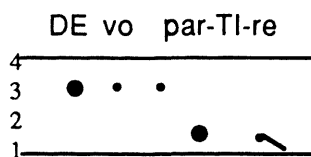
### 2. BPI

(a)



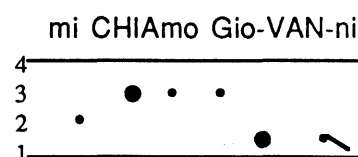
(From Rome.)

(b)



(I must leave.)

(c)

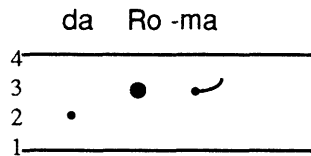


(My name is Giovanni.)

<sup>1</sup>This is a term from Pike (1945) who divides the intonation contour into "precontour" (equivalent to the British prenuclear contour, i.e. head and prehead) and "primary contour" (equivalent to the British nucleus and tail components).

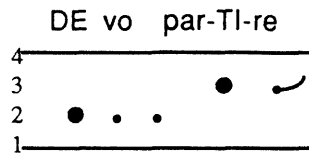
## 3. BP II

(a)



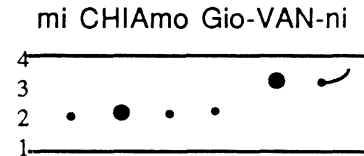
(From Rome?)

(b)



(Must I leave?)

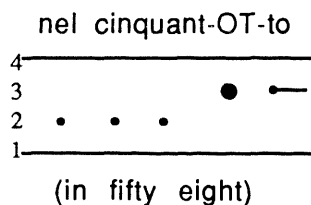
(c)



(Is my name Giovanni?)

According to Agard and di Pietro, the "unchanged" TERMINAL CONTOUR signals "more coming" (1965:66), and is typically used in non-final phrases. There is no specific mention of list items, although examples include lists of numbers. An example such as the following appears to be in a context in which the intonation pattern of non-final list elements could be used.

4.



### 2.3 Location of distinctive pitch

The fact that the same pitch contour is transcribed before and after the stressed syllable (i.e. on the CENTER and FINAL) implies that any pitch movement occurs either before it (a jump or glide up to or down to it) or after it (a glide or jump down from or up from it). Thus in BP I, generally used in statements, there is a fall before the nuclear syllable (from level two or three to level one), and the pitch on the nuclear syllable has no linguistically relevant pitch change, since both the CENTER and the FINAL are at level 1. In BP II, used in yes-no questions, there is a rise before the nuclear syllable (from level two to level three) and, again, no linguistically significant pitch change throughout the nuclear syllable (which is at level 3). The above observations are not simply a result of notational conventions; the Basic Pattern proposed for English statements does, by contrast, allow for a linguistically relevant pitch change on the nuclear syllable. The English BP I

involves a fall from level 3 on the CENTER to level 1 on the FINAL point, represented as /3"1↓/.

Agard and di Pietro do not make any provision for unstressed syllables to carry distinctive pitch unless they are at the boundary of a phrase, either at the beginning, in which case they can carry the pitch assigned to the INITIAL point, or at the end, in which case they carry the TERMINAL CONTOUR. In other positions, they remain on the same pitch level as the stressed syllable which they follow.

### 3 Chapallaz

Chapallaz's work on Italian intonation has appeared in a series of articles (1960, 1962, 1964) and a chapter of her book on Italian pronunciation (1979, second edition: 1986). She does not explicitly set out to provide a contrastive study of Italian and English intonation, although her book is primarily aimed at an anglophone audience.

#### 3.1 Descriptive framework

Chapallaz describes phrase length tunes or "sense groups". Following the approach of Armstrong and Ward (1926, second edition: 1931), she does not subdivide these tunes into smaller units<sup>1</sup>. Since she considers tunes to be indivisible entities, she categorises them according to the shape of the whole pattern, rather than according to the final portion of the contour (as was the case in Agard and di Pietro's account). She makes no explicit reference to a nucleus or tonic, although her classification of tunes suggests that there is an implicit recognition of such a concept. In fact, Chapallaz points out that the "focal point of a sense group [is] usually the last part. This means that the final stressed syllable, under ordinary circumstances, is also the most important" (1979:162). Her classification of "stressed syllable" can be interpreted in a similar way to what Kingdon (1958) calls "fully stressed" or what Crystal refers to as "accented". Kingdon claims that the nucleus is associated with the "last fully stressed syllable of the group" (1958:6). Whereas Kingdon distinguishes between different degrees of stress and Crystal distinguishes stress

---

<sup>1</sup>Armstrong and Ward explicitly declared that they did not consult previous studies on intonation, although they used the interlinear transcription system of Klinghardt (1923) with minor, typographically motivated changes.

and accent, Chapallaz has only a binary distinction for the purposes of her account of intonation; either a syllable is fully stressed, or it is not stressed at all.

Chapallaz transcribes any syllables after the "focal point" with a light dot reserved for the transcription of unstressed syllables, even if they are lexically stressed. The focal point then becomes the last syllable of the group to be transcribed as stressed; it is therefore akin to the nucleus or tonic. Consequently, in the following exposition, reference will be made to the nucleus where Chapallaz had made reference to the final stressed syllable.

As in English, the default position for the Italian nucleus is on the stressed syllable of the last lexical item in the group. However, there are cases where this trend can be overridden, as discussed in section 3.3 below.

### 3.2 Basic Patterns

Chapallaz describes three Basic Patterns, I (falling), II (falling-rising) and III (rising-falling). BP I is used in statements, BP II in yes-no questions, and BP III in non-final clauses, particularly in narrative speech, and on non-final list items. The general shape of each of the Basic Patterns is illustrated and exemplified below:

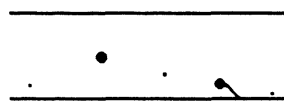
5.

(I) falling



eg

Mi chiamo Rossi.



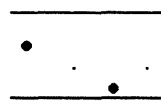
(My name is Rossi) (p180)

6.

(II) falling-rising



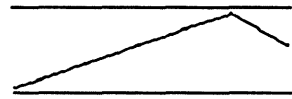
eg  
E' finito?



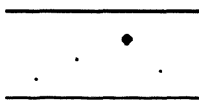
(Is it finished?) (p192)

7.

(III) rising-falling



eg  
Ha subito...

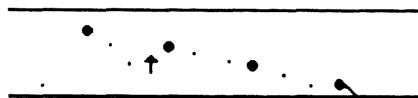


(He underwent...) (p200)

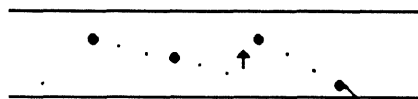
Basic Patterns I and II have an alternative realisation which Chapallaz describes as having "breaks" where, in a gradually descending scale of syllables, one or sometimes more than one stressed syllable is raised to a higher pitch than the preceding syllable; the descent then continues from the raised syllable. This is illustrated by various renderings of the sentence 'Ho spesso sentito parlare di Lei' (I've often heard about you):

8.

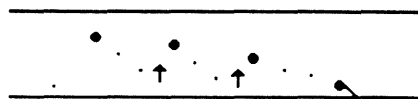
(a)



(b)



(c)

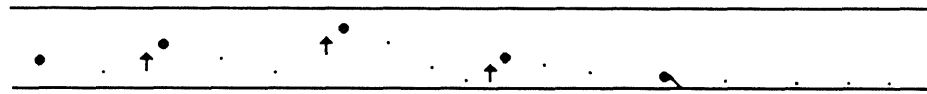


(p185)

A fourth example of a tune with breaks appears to be of a different type:

(d)

Non mi sento nemmeno di alzare un braccio stamattina.



(I don't even feel like lifting a finger this morning.) (p186)

In this example, Chapallaz describes the word "nemmeno", which is in the middle of the utterance, as the most important. This utterance could, however, be analysed as two phrases, the first one being a BP III-type, ending with "nemmeno", and the second being a BP I type, ending with "stamattina". In this case there is a nuclear tone on "nemmeno" as well as on "braccio".

### 3.3 Location of distinctive pitch

Chapallaz's account of Italian intonation resembles Armstrong and Ward's account of English quite closely. Not only are BP I and II transcribed in almost the same way, they are used in similar contexts, the only exception being that yes-no questions can be spoken with BP I as well as BP II in English. The major difference is one of detail between English and Italian BP I; in English, the pitch on the nuclear syllable actually falls: "within the last stressed syllable, the pitch of the voice falls to a low level" (Armstrong and Ward, 1926:4), whereas in Italian, there is usually a fall before the nuclear syllable and, on it, a "level or slightly falling pitch" (added emphasis) (Chapallaz, 1979:179).

In BP II, the final rise usually begins on the nuclear syllable. However, a variant of BP II involves a fall on the nuclear syllable, followed by a rise. In Italian, this fall-rise ending tends to have the effect of making questions sound "less peremptory" with a "gracious and even cajoling quality" (Chapallaz, 1979:198). Such a description closely resembles Armstrong and Ward's fall-rise ending to BP II, which, amongst other things, indicates "a wish to avoid appearing abrupt or dogmatic" and "a feeling of politeness" (Armstrong and Ward, 1926:56).

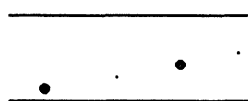
Chapallaz's BP III does not have an English equivalent in Armstrong and Ward's account. Although Chapallaz describes the basic tune as "rising-falling", consisting of high pitch on the nuclear syllable, followed by slightly lower pitch on any unstressed syllables, the absence of unstressed syllables implies the absence of a falling element to the tune. Furthermore, she describes a variation of this tune



which has the rise continuing on the postnuclear unstressed syllables. She claims that this is common in lists, an example of which is as follows:

9.

San Francesco,



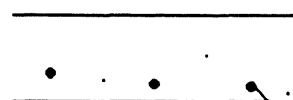
(Saint Francis) (p202)

This variation allows not only for contextually determined variation of the final pitch movement (no fall where no unstressed syllables are available to carry it), but also for context-free variation (unstressed syllables may form a rising sequence instead of a falling one). Variations on BP I and II preserve the final part of the tune, whereas the variation on BP III preserves the part of the tune up to the nuclear syllable, but not after it. It might be hypothesised that Chapallaz categorises this contour according to its functional similarity with unmodified BP III contours, rather than because its form is similar. On the other hand, it might be the case that Chapallaz observes a formal similarity which is not easily captured in terms of the nuclear tone approach; for instance, it might be that, for the categorisation of tunes into broad classes, the pitch before the nuclear syllable is as important as that on or after the nuclear syllable.

A case where the pitch before the nuclear syllable is prominent, although it does not imply a change of broad class, is the following variant of BP I:

10.

Non si vede nulla



(You can't see anything) (p186)

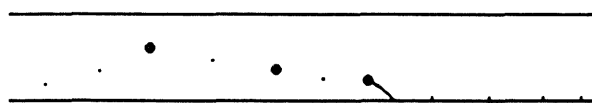
where a single high unstressed syllable precedes the nuclear syllable. There is a similar variant of BP II. Chapallaz claims that the wide pitch interval between the high unstressed syllable and the nuclear syllable "gives added importance to the word to which the final stressed syllable [=nuclear syllable] belongs." (1979:186).

Chapallaz gives a number of examples of cases where the "focal point" of the utterance occurs before the last lexically stressed item. This can occur in statements or Wh-questions followed by a 'short group of parenthetical nature' in the form of unstressed syllables on a low level pitch.

11.

eg

Non abbiamo molto tempo, mi pare

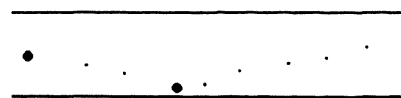


(We don't have much time, it seems) (p184)

She also gives an example of an early "focal point" in a Basic Pattern II tune, although she does not discuss it. However, the postnuclear material does not constitute a parenthetical group but rather a postposed subject:

12.

Non ti andava il lavoro?



(Didn't you feel like doing the work?) (p192)

Here the postnuclear syllables rise gradually<sup>1</sup> and no stress is marked on the lexically stressed syllable "vo" of "lavoro". It is possible to produce both of the above examples with an intonationally marked boundary of some kind after the nucleus; i.e. they could be phrased as follows:

[Non abbiamo molto tempo] [mi pare]

[Non ti andava] [il lavoro]

Furthermore, the location of the "focal point" is largely predictable.

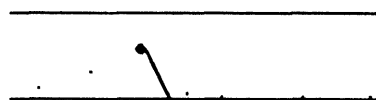
There are also examples of early focus in the section on 'emphasis for contrast':

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<sup>1</sup>We could analyse the above two examples as having a low level tail in tune I and a rising tail in tune II.

13.

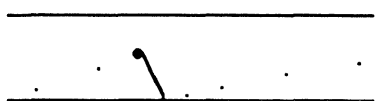
La signora mi chiama.



(The lady is calling me.) (p209)

14.

La signora mi chiama?



(Is the lady calling me?) (p209)

In these examples, the postnuclear part does not constitute a syntactic postposition or parenthesis. The default location of the "focal point" would be on the final lexical item "chiama" rather than the earlier item "signora". In such contrastive cases, where the nucleus occurs early in a group, there is a greater pitch excursion on the nuclear syllable itself; the pitch falls actually on the nuclear syllable rather than down to it, as is the case in non-contrastive utterances<sup>1</sup>.

## 4 D'Eugenio

### 4.1 Descriptive framework

D'Eugenio (1982) uses a similar phonetic interlinear transcription system to Chapallaz, although he claims to follow the analysis of Agard and Di Pietro, describing the basic elements of intonation as "a series of pitch levels and a terminal contour" (1982:232). However, in the introductory paragraphs of his chapter on intonation, he illustrates how a tone unit is subdivided into:

<sup>1</sup>It will be shown in chapter 7 that this is not always the case in Palermo Italian.

(prehead), (head)<sup>1</sup>, (body), nucleus, (tail) and terminal contour,

where the optional elements are in parenthesis. The major difference between this division of the tone unit and the British approach described in chapter 2 is the addition of the terminal contour following the tail.

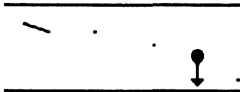
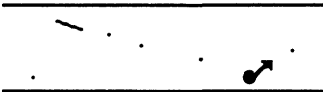
His account of Italian intonation is comparative, British English RP intonation being the object of comparison.

## 4.2 Basic Patterns

D'Eugenio discusses two basic tunes. Tune I consists of a falling head in which the syllables form a gradually descending scale or where each stressed syllable is on a slightly higher pitch than the (usually unstressed) syllable immediately preceding it<sup>2</sup>.

D'Eugenio claims that, in tune II, the nucleus 'falls in a low pitch and then the voice rises up towards a mid level on the nuclear syllable if no unstressed syllable follows' (1982:241) and 'any unstressed syllable occurring after the nucleus is generally spoken on a higher pitch level than the syllable that precedes it.' (1982:241) . However, he is later inconsistent with this position when he states that 'the voice pitch of the last fully stressed syllable falls in tune I and rises in tune II, as can be seen in the following examples (1982:236):

15.

BP I	BP I
Parto stasera	Desidera qualcosa?
	
(I' m leaving tonight)	(Do you want something?)

<sup>1</sup>D'Eugenio uses the terminology of Kingdon (1958), where "body" refers to what, within the British school, is now generally called the "head", and "head" refers to its first syllable. We shall continue to use the terms as they have been used in Chapter 2.

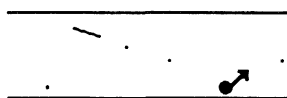
<sup>2</sup>This latter case is equivalent to Chapallaz's tune with "breaks".

It appears that, in the claims made on page 241, he intended to say that the nucleus rises from low to mid and it is the prenuclear tune which falls to low, since otherwise the example would have to show the nucleus falling before it rises.

According to D'Eugenio, non-final groups are spoken with tune II, e.g. (1982:241):

16.

Domenica scorsa... (andammo al cinema)



(Last Sunday... we went to the cinema)

He describes a 'neutral terminal contour' where he claims that 'the pitch of the voice remains at a mid or high level or rises very slightly', (1982:247), although there are no examples of such a slightly rising terminal contour. The examples illustrated all consist of a level head on the same pitch as the following level nucleus, e.g. (1982:248):

17.

Gradisci un bicchiere di... birra?



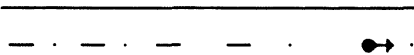
(Would you like a glass of... beer?)

This pattern occurs with unfinished phrases and is usually followed by a hesitation pause. It is also used in non-final list items, (p249)<sup>1</sup>:

<sup>1</sup>This can be compared with Agard and Di Pietro's example (1965:66):

2°uno2-> 2°due2-> 2°tre2->...

Uno due tre quattro cinque...

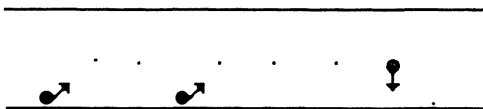


(One two three four five...)

which, like other types of non-final groups, can also be spoken with tune II eg (p249):

19.

## Dante Petrarca e Boccaccio



(Dante Petrarch and Boccaccio)

Germania ...



(Germany ...)

### 4.3 Location of distinctive pitch

According to D'Eugenio, the nucleus in BP I falls from mid to low; although it may be stepped down to as well, it does not necessarily have to be<sup>1</sup>. The distinctive pitch movement generally occurs actually on the nuclear syllable. The pitch in BP II generally involves a step down to the pitch on the nuclear syllable and a rise during it. D'Eugenio's account of Italian intonation differs little from his account of English in terms of the location of distinctive pitch.

## 5 Canepari

Canepari's work on Italian intonation can be found in the introduction to his book on phonetics (1979), in his book on regional and standard Italian pronunciation (1980) and his book on intonation (1985). In these works, he discusses the intonation of Italian, both "Standard" and regional<sup>2</sup>, as well as that of other languages such as English.

<sup>1</sup> See the example of the last element of the list "Dante, Petrarca e Boccaccio" in 19 above.

<sup>2</sup>Unfortunately, he does not describe Palermo Italian.

## 5.1 Descriptive framework

Following Halliday (1967), Canepari describes the tone group, which he calls intonia, as consisting of two main functional units or components: the pretonic (pretonia) and the tonic (tonia). Halliday's pretonic corresponds to what in chapter 2 was described as the prenuclear part of a tone unit which contains a head, that is, one of the following type:

(prehead)      head                  nucleus                  (tail)

When a prehead occurs immediately before the nucleus, i.e. in a tone unit of type:

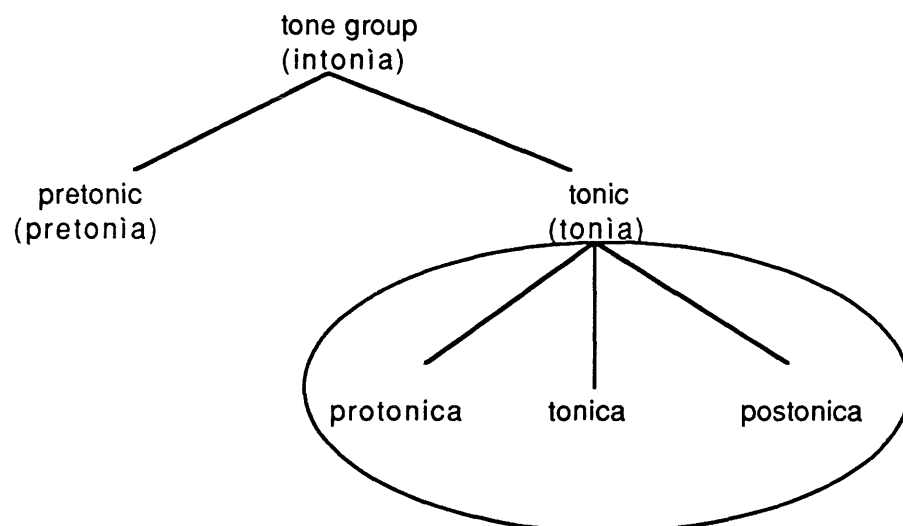
prehead                  nucleus                  (tail)

then the whole tune is classed as the tonic, including the prehead.

Although Halliday acknowledges the tonic syllable, the equivalent of the nuclear syllable, he treats the tonic as a functionally indivisible entity in so far as it constitutes the domain of the tone. He explicitly points out, for instance, that there is no 'posttonic' element (1967:14) (which is equivalent to the tail discussed in chapter 2). Canepari, on the other hand, considers that the domain of the tone should be further subdivided; he refers to a postonica which has an identical description to the tail (all syllables after the tonic - or nuclear - syllable). In addition, he considers what precedes the tonic syllable (the tonia), which he calls protonica<sup>1</sup> to be an independent functional unit too, even when there are stressed syllables in the pretonic part of the tone group (or, in other words, even when there is a head in the tone unit). Canepari's tone group can be represented as follows:

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<sup>1</sup>He uses the term "pretonica" in later work and "protonica" in earlier work, referring to the same phenomenon.

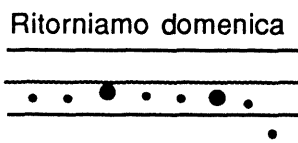


where the major division of the tone group into pretonic and tonic is taken from Halliday, and the encircled part represents Canepari's own subdivision of the tonic.

## 5.2 Basic Patterns

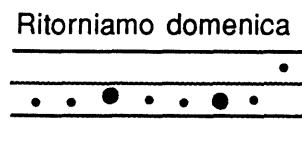
Canepari proposes three basic tunes, classified on functional grounds as (I) conclusive (used in neutral assertions), (II) interrogative (used in yes-no questions and requests for information), and (III) suspensive (used to signal that something interesting will follow, especially in narrative speech). These Basic Patterns are as follows:

### 20. BP I



(We'll come back on Sunday.)

### 21. BP II

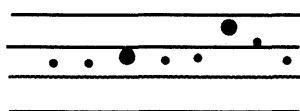


(Shall we come back on Sunday?)



## 22. BP III

Ritorniamo domenica



(We'll come back on Sunday,)

where the lines divide the speaker's pitch range up into three linguistically significant bands. Canepari claims that any pitch movement within one such band is not to be included into the phonological account.

### 5.3 Location of distinctive pitch

Canepari maintains that the postonica (the part of the tonic which follows the tonic syllable) is important because it carries the significant pitch movement in the tone group - unless the tonic syllable is final in the phrase<sup>1</sup>. He maintains that the pretonica is subject to much regional variation, although within a given variety it tends to be the same for every tune. An exception is the accent of Catania, where the pretonica is high only when followed by a "supensive tonic" (exemplified in section 5.2). In varieties which have a high pretonica, the pretonica part is usually realised on one or more unaccented syllables before the tonic syllable (or tonica). However, in the absence of such unstressed syllables, the tonic syllable bears this pitch movement<sup>2</sup>. Such a readjustment is additional evidence for positing the pretonica as an integral part of an indivisible tonic, rather than as a separate functional unit within it (cf. arguments in chapter 2 against the nuclear syllable and tail as separate constituent).

Nevertheless, the important contribution made by Canepari to the description of Italian intonation is the explicit acknowledgement that the pitch immediately prior to the tonic (or nuclear) syllable is linguistically significant. This will be further discussed in chapter 7, in the account of Palermo Italian intonation.

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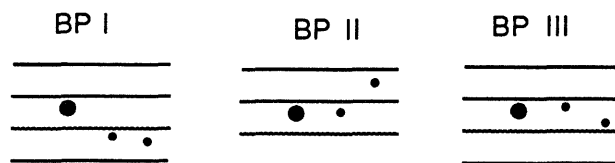
<sup>1</sup>Such an argument resembles those put forward in favour of the tail. They have been discussed in chapter 2 and will not be discussed further here.

<sup>2</sup>This phenomenon is akin to that of Kingdon's homosyllabic preheads, which will be discussed in some detail in relation to English intonation in chapter 6.

#### 5.4 Canepari's account of "Sicilian Italian"

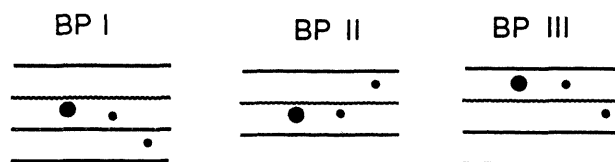
In his account of Sicilian Italian, Canepari describes the accent of Catania rather than that of Palermo. He gives only the tonic part of the intonation contours for regional varieties, which are as follows for Catania Italian:

23.



These differ from Standard Italian, which he schematises as follows:

24.



The major differences are that the fall in BP I is sharper in Catania Italian than in Standard Italian, and that, in BP III, the tonic syllable is at a mid pitch in Catania Italian whereas it is high in Standard Italian. The interrogative contour is described in the same way.

Although Canepari does not analyse Palermo Italian, the analysis in chapter 3 has presented the type of interlinear transcription of BP I, II and III which could be adapted to observe Canepari's three-banded division of the pitch range. Although, for the purposes of comparison, it would have been interesting to do this, it has not been done here; the decisions which would have had to have been made concerning the placement of pitch marks within appropriate bands would have required too much consideration of, or an unquestioned dependence on, the validity of such a tripartite division.

## 6 Fogarasi

Fogarasi's account is discussed here, although it comprises but a short paper, because the interrogative contours he describes are radically different from those

in any of the above accounts. Fogarasi describes what he calls "Italian intonation", although he does not give his source, whether it be his own competence of the language or that of a number of informants. The paper presents a contrastive study of Hungarian and Italian intonation; it is interesting to note that the intonation patterns used in Hungarian and Italian yes-no interrogatives are very similar, and are reproduced below:

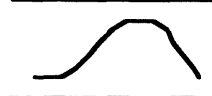
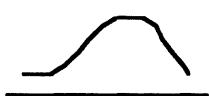
25.

HUNGARIAN

ITALIAN

Sze- re- lem?

Un a-mo- re?



(1975:10)

It might have appeared suspicious that the only radically different account of interrogative contours resembled the language with which Italian was being contrasted. However, it is the case that the rising-falling yes-no interrogative contours described resemble the Palermo Italian ones exemplified in chapter 3. Furthermore, the allophonic variant in the case of monosyllables is, in both languages, rising (cf. Varga:1984, Ladd:1981). Although Canepari's description of local varieties of Italian from 21 different regions did not contain such a contour, Fogarasi provides evidence that the Palermo Italian contour is not an isolated phenomenon amongst these local varieties<sup>1</sup>.

## 7 Conclusions

There is considerable variation regarding the different authors' descriptions of the Basic Patterns. We shall deal with each of the Basic Patterns in turn.

### 7.1 BP I

Agard and di Pietro and Chapallaz both describe BP I as having a jump down to the nuclear syllable with a low level or slightly falling pitch on or from it. D'Eugenio describes a fall (from mid to low) on the nuclear syllable, and Canepari a fall from it. Common to all approaches appears to be the downward pitch movement.

---

<sup>1</sup>An independent unpublished study by the present author found a similar interrogative pattern in Italian spoken in Crotone, Calabria.

## 7.2 BP II

Agard and di Pietro present a jump up to a high level on the nuclear syllable, followed by a final glide up at the end of the phrase, Chapallaz and D'Eugenio describe a jump down to low, followed by a rise on or from the nuclear syllable, and Canepari describes a rise from the nuclear syllable. The common element to all approaches appears to be the upward pitch movement.

## 7.3 BP III

Chapallaz details a jump up to the nuclear syllable, then a fall to mid on or from it, although the fall is not necessary: a variant of this tune involves a rise from the nuclear syllable. Canepari describes the same kind of rise then fall to mid, although he does not discuss the details of such a variant. Agard and di Pietro and D'Eugenio do not describe a pattern akin to Chapallaz's BP III, but describe a high level tone which is functionally similar.

## 7.4 Distinctive pitch

Agard and di Pietro and Canepari do not mark any pitch change through the nuclear syllable, implying that pitch change occurs before or after it. Agard and di Pietro account for pitch change after the nuclear syllable by means of the terminal contour, and Canepari does so by means of the "postonica" part of the tonic.

Chapallaz and Canepari both claim that unstressed syllables immediately before the nuclear syllable may signal meaningful contrasts; Canepari incorporates this formally as the "protonica" part of the tonic, whereas Chapallaz considers such syllables as (albeit functionally significant) variations on the Basic Patterns.

Chapallaz's tune III, which has a rising prenuclear and falling nuclear part has a variant in which the nuclear part is rising; in this case, it is the prenuclear part of the contour which is the fixed factor.

## 7.5 Relation to analysis of Palermo Italian

It has been shown in the above survey that a tune with a rising pitch on the nuclear syllable can be placed in the same functional category as a tune with a high falling pitch. This was shown to be the case in Chapallaz's account of BP III and its variants. There is a case of a functionally equivalent rise and high fall in interrogative contours in Palermo Italian, even though the rise is contextually

determined in Palermo Italian. A description of a rising-falling contour, provided by Fogarasi, does have a similar contextually determined rising variant, even though it is unclear from his exposition exactly where the rising and falling elements occur in relation to the nuclear syllable. What Fogarasi's account and the one in chapter 3 have in common is the fact that they both have the rising-falling contour in yes-no interrogatives; all other varieties have a rising element without the fall.

BP III, as described by Chapallaz and Canepari, is similar to the pattern used in both yes-no questions (which, functionally, should have BP II) and non-final list elements (here Standard and Palermo Italian have a similar form-function relation).

High unstressed syllables, as noted in chapter 3, are accounted for in a number of studies, and will be discussed further in relation to Palermo Italian in chapter 7.

## **7.6 Final remarks**

In this chapter, it has been seen that there is no proper consensus, either as to the form of the basic intonation patterns or how they should be characterised. Some commentators note the importance of immediately prenuclear pitch. In this respect, these treatments are more successful in accounting for the phenomena described in chapter 3. Canepari, for instance, accounts for unstressed prenuclear syllables within the "protonica". However, his framework cannot provide a principled way of accounting for all of the allophonic variants of the contour used in yes-no interrogatives in Palermo Italian.

It will be shown in the following chapters that an autosegmental theory of intonation can provide a mechanism for accounting for these allophonic variants, by formally separating boundary phenomena from tones associated with stressed (and a fortiori nuclear) syllables. Such a theory can also account for the position of distinctive pitch in the vicinity of the nuclear syllable, whether it is before, on or after it. In the following chapters, we shall investigate this theory further and adapt it for the description and analysis of Palermo Italian intonation.

## **Chapter 5 - Association in intonation models**

In the next two chapters, the phenomena referred to as association and alignment will be examined in detail. Both deal with the synchronising, at different levels of abstraction, of a segmental phonemic component such as /pɪn/ with a specification for its intonation.

At the most abstract level, vowels in a phoneme string may be linked to tones in a tonological string; each link is referred to as an association. The association comprises a link between the items in the two strings which leads towards their possible synchronisation at a realisational level. This synchronisation is referred to as alignment. In certain theories, associated elements are not always aligned with each other; as we shall see in more detail in chapter 6, an abstract link may undergo a process which causes one of the items to be shifted in time.

In this chapter, we shall concentrate on association - the linking of items on separate tiers of a phonological representation - a concept which has its origins in the theory of autosegmental phonology. Section 1 will examine this theory in some detail, paying particular attention to the doctoral dissertation of one of its main protagonists: Goldsmith (1976). Section 2 will consider a selection of more recent studies that have considerably extended the concept of association. We shall refer to this work as post-autosegmental.

### **1 Autosegmental association**

The seminal work on autosegmental phonology is John Goldsmith's doctoral thesis, submitted in 1976 and published in its original state in 1979. Section 1.1 will lay out the basic principles of his thesis, examining its applications to different types of languages. In section 1.2, a distinction will be made between universal and language-specific phenomena. In section 1.3, we shall consider the way autosegmental phonology accounts for the lowering of one tone with respect to a previous one - the phenomenon referred to as downstep.

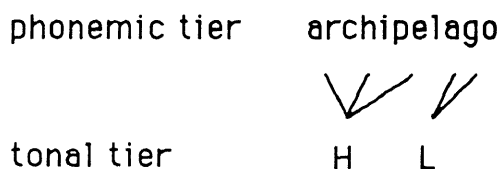
#### **1.1 The theory**

In his dissertation, Goldsmith refers to a long tradition of treating melodic or intonational phenomena as distinct from items at a segmental phonemic level: hence the established use of the term "suprasegmental". He formalises this distinction by

placing melodic and segmental phonemic items on separate tiers: a "tonal tier" for "tonemes" and a "CV tier" for "phonemes". The items in each of these tiers are of equal status and function as autonomous elements within their respective tiers.

African tone languages are the main object of his attention. However, he does make frequent references to English; for the purposes of this expository sketch, it will be mainly his English examples which we shall draw upon.

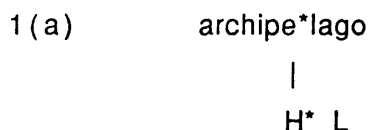
In the citation form of the word "archipelago" [ɑ:ki'peləgəʊ] (Goldsmith's convention of using orthography where possible is retained in this example), a possible rendition would involve a fall from a high to a low pitch. This is represented as HL, a specification in the tonal tier, which is mapped onto vowels in the phonemic (or CV) tier by means of association lines thus:



However, association lines are not drawn in an arbitrary way. Goldsmith makes a basic distinction between accentual and non-accentual languages. In non-accentual languages such as Mende, association is carried out by a process mapping one tone to one vowel, often from left to right, e.g.



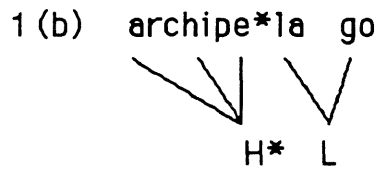
In accentual languages, such as English, tonal melody is linked to the phonemic tier in a different way. One tonal element and one vowel are each marked with an asterisk or "star". Association is carried out in two stages: first an association line links the starred segments (Goldsmith uses the term "segment" to refer to an item on either of the tiers) as in 1(a):



then readjustments are made to the association so that the following conditions are met:

- 1a. All tones are associated with at least one vowel.
  - b. All vowels are associated with at least one tone.
2. Association lines do not cross.

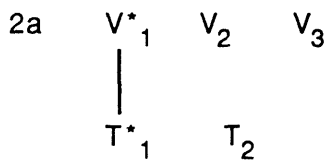
This would produce something like 1(b):



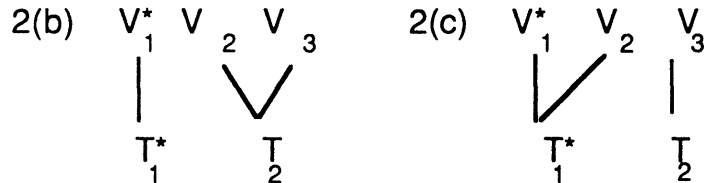
It is important that only minimal readjustments are made; i.e. that only as many association lines are added as are necessary to fulfil the conditions stated in 1 and 2 above, which are jointly referred to as the "well-formedness condition (WFC)" (Goldsmith 1979:27).

Both the well-formedness condition as stated here and the constraint that only minimal adjustments should be made were originally intended to apply universally to all languages, whilst the star diacritic is specific to accentual languages. The star does not only indicate a starting point for the association rules; starred vowels and tones have a certain prominence which other, unstarred segments do not have. A starred association is accorded special status during the readjustment rules so as to preserve the prominence of the associated elements. To this aim, a starred element remains associated with only one item wherever possible; if other elements can be reassociated (or spread) instead of the starred item, then this is the preferred arrangement. This preference is exemplified below where the initial association is between  $V^*_1$  and  $T^*_1$  as follows:





Of the following two readjustments :



2(b) is preferred over 2(c), although the same number of association lines has been added in both cases. Presumably, this is a way of ensuring that an accented syllable in English sounds prominent: in 2(b) the pitch change resulting from the transition from the first to the second tone occurs between the starred vowel and another element, whereas in 2(c) it occurs between two unaccented vowels. Since pitch movement lends perceptual prominence (inter alia, Bolinger:1958), it would make sense for the prominence to be lent to the accented syllable.

Goldsmith points out that one of the advantages of making the phoneme and tone tiers autonomous is that the citation form of words with a differing number of syllables may all have the same melodic representation, e.g. the representation  $H^* L$  in 3(a) and (b) below:

3(a)  $pi^*n$



3(b)  $pe^*ter$

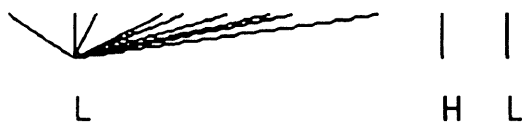


In line with nuclear tone analyses, context dictates whether this fall involves a phonetic glide from high to low pitch on one syllable, or a skip (or glide) from one syllable to another. In Goldsmith's terminology, 'pin' has a contour tone and 'Peter' two level tones, but this is only when the autosegmental tiers have been fully associated; underlyingly, they both have the specification  $H^*L$  on the tonal tier. Their functional equivalence is thus captured.

One problem for English, brought up in Liberman (1975) and referred to in a footnote by Goldsmith, is the fact that a representation such as

4(a):

especially elaborate precautions



where everything up to the stressed syllable in "precautions" is on a low pitch, represents the type of intonation contour produced in chanting, a particularly marked style of speech, rather than that used in normal conversation. He proposes a sparser specification, as in 4(b).

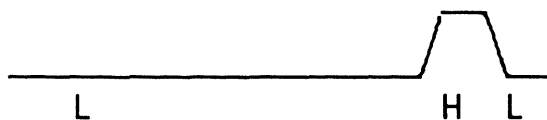
4(b)

especially elaborate precautions



where there is some kind of interpolation between L and H (realised as a gradual rise in pitch). This gives a more accurate reflection of what is produced in conversational speech. Schematic versions of pitch contours for 4(a) and 4(b) might look something like the following:

(a) especially elaborate precautions



(b) especially elaborate precautions



If this is to be accepted, Goldsmith points out that the WFC would only be partially valid if this were to be accepted. A modified version includes parts 1a and 2 only, as follows:

- 1a. All tones are associated with at least one vowel.
2. Association lines must not cross.

The use of the term "vowel" is shorthand for a segment which, in SPE (Chomsky and Halle: 1968) terms, has the feature [+syllabic]; segments without this feature are ignored in association rules. If, in principle, segments can be ignored, then parts 1a and 1b of the WFC could be reformulated referring loosely to "tone-bearing units" (Goldsmith 1979:156) rather than to a specific feature a given segment may contain. The reformulation of part 1 might look like the following:

- 1a. All tones are associated with at least one tone-bearing unit.
- 1b. All tone-bearing units are associated with at least one tone.

This would allow a separate specification as to which items constitute tone bearing units in each language type: for accentual languages, only certain vowels are tone bearing units (i.e. those which bear accent); for non-accentual languages, all vowels are tone bearing units. This interpretation means that the universal status of the WFC is maintained. As we shall see, the concept of accented syllables being tone-bearing units is crucial to the description of intonation within the frameworks discussed in section 2.

As mentioned above, segments on the phonemic tier are specified in terms of feature matrices. The feature [ $\pm$ syllabic] is one of a number of features in a typical representation for [pIn]. Goldsmith (1979:19) gives the following example:

shorthand:

p                      l                      n

matrices:

$\begin{bmatrix} +\text{consonantal} \\ -\text{nasal} \\ +\text{labial} \\ -\text{coronal} \\ \vdots \\ \vdots \end{bmatrix}$	$\begin{bmatrix} +\text{syllabic} \\ -\text{nasal} \\ -\text{labial} \\ -\text{coronal} \\ \vdots \\ \vdots \end{bmatrix}$	$\begin{bmatrix} +\text{consonantal} \\ +\text{nasal} \\ -\text{labial} \\ +\text{coronal} \\ \vdots \\ \vdots \end{bmatrix}$
---	--	---

H and L are represented in the same way,

shorthand:	H	L
feature matrices:	[+ high]	[-high]
	[-low]	[+low]

The use of the two binary features [ $\pm$ high] [ $\pm$ low]. allows for the representation of a mid tone within this paradigm:

M  
[+high]  
[+low]

Goldsmith's proposal of one mid tone differs from that of Liberman (1975) which has two tones in the mid range: one with [+high] and [+low], the other with [-high] and [-low].

## 1.2 Universal and language-specific phenomena

So far, we have seen how phonemic and tonal tiers are associated, first of all by an "initial association" and then by "readjustment rules". These rules are considered to be universal as they constitute ways of meeting the universal well-formedness condition.

In addition, autosegmental theory allows for language-particular rules, permitting both the addition and deletion of association lines, the changing of a segment's features, and even, within a given tier, the deletion of the segment itself. These rules are permitted within autosegmental theory, as long as adjustments are made at each step so as to ensure that the well-formedness condition is respected, e.g. a rule may cause one association line (A) to cross another (B); this can take place only if (B) is deleted by an adjustment rule in the next stage of the derivation. The adjustments are made to what is called the "chart" which consists of the two tiers and their related association lines.

In autosegmental phonology, when an item is deleted from one tier, associated items on other tiers are not necessarily deleted along with it (in fact, they rarely are). This aspect of autosegmental behaviour is referred to as stability. Tonal stability is evident in tone languages where a morpheme involving a vowel with a particular

tone is elided but the tone does not disappear. In the case below, taken from Lomongo, as described by Lovins (1971) and referred to by Goldsmith (1976:33), the first of two vowels spanning a word boundary is elided but its tone appears on the remaining vowel.

"his"	"book"		e	
balongo	bak a e	->	balong a k a e	(elision rule specifies
	^		\	deletion of element(s)
L H H	LH H H		L H H LH H H	on phonemic tier)

			e	
	->	balong	a k a e	(autosegmentally,
			\	the vowel is delinked
		L H H	LH H H	or disassociated
				from its tone)

	->	balong	a k a e	(the tone is then
			/ \	reassociated with an
		L H H	LH H H	adjacent vowel)

In the lexical representation, the final 'o' of 'balongo' is associated with a H tone. As the vowel 'o' is deleted, it is disassociated from the H tone. The H tone is then free to reassociate with another vowel (in fact, it must do, in order to fulfil the WFC). In this case, it is reassociated with the first vowel of the following word. A separate rule deletes the 'b' in 'bakae', but the process is irrelevant to the discussion here.

The fact that H is a tone which, at some point in the derivation, is without an associated segment on the phonemic tier is not unusual in autosegmental phonology. This possibility has led to the use of the term "floating tone" for a tone which is not associated with a vowel. In certain African tone languages, there are morphemes which consist solely of tones. These tones are also 'floating'. They are dealt with in the same way as tones which are disassociated during a derivation; they are associated with a vowel in an adjacent morpheme (see Clements and Ford (1979) for more on the theoretical status of floating tones).

### 1.3 Downstep

One final aspect of autosegmental phonology to be considered here is the way it accounts for the lowering of one tone with respect to the preceding one: the phenomenon referred to, amongst other things, as downstep. Goldsmith looks at Igbo (1979:58ff) which appears to have three tones, H, L and M(id) (or Drop). He argues that pitch and tone should be kept apart in any description, pitch being almost as "superficial" as F0 and tone being linguistically abstract. Accordingly, he claims that Igbo has 2 pitch registers, symbolised by a line for High tones (high register) and a line for Low tones (low register). Tones are placed on these register lines thus:

7.

-- H ----- high

----- L ----- low

Common in African languages is the "pulling down" (1979:61) of the High register. The following type of rule governs this process:

[+hi]	->	lowered	/	[+hi]
[+lo]		high register		
('M')				('H'or'M')

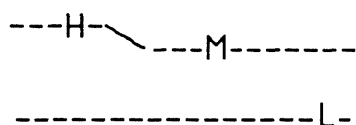
i.e. a Mid tone is realised on a lowered high register if it is preceded by a Mid or High tone, otherwise a mid tone is realised on an unlowered high register.

For instance, in a sequence:

H	M	L
<i>[+hi]</i>	<i>[+hi]</i>	<i>[-hi]</i>
<i>[-lo]</i>	<i>[+lo]</i>	<i>[+lo]</i>

the context for the rule (in italics) is met; the high register is therefore lowered as shown in the schema below:

8.



If the sequence were MML rather than HML, the same register lowering would take place, and, in fact, the phonetic realisations of the respective sequences would be identical.

The rule has an ambiguous status - it is not strictly phonological as it applies to the pitch register, which Goldsmith claims is very close to the phonetic representation. As we have seen, outside the scope of downstep, a degree of neutralisation takes place; that is, Mid tones are only phonetically distinct from High tones when they are immediately preceded by a tone with [+hi] in its specification.

We shall see in the following sections that later models also have problems defining the level at which downstep operates.

## 2 Post-Autosegmental work on association

A number of models have been developed since the work of Goldsmith, making use of its notational conventions and taking on board, to varying degrees, its theoretical basis. Common to all is the basic idea of tune and text as separate tiers although the association between them takes different forms. We shall refer mainly to work carried out on English and other so-called accentual languages (such as Swedish and Japanese). Accentual (as opposed to tonal) languages lend themselves to the type of sparse association suggested by Liberman (1975) where tones are associated with only certain vowels or syllables. Particular attention will be paid to work by Pierrehumbert, Beckman, Ladd, Hirst and Bruce. Where it is feasible, English examples will be given.

Within these studies, the major divergences from Goldsmith are twofold:

- a. Tones are not simply associated with vowels: Pierrehumbert (1980) associates them with stressed (metrically strong) syllables, Hirst (1983) associates them with stress feet, and Bruce (1987) uses a hybrid approach.
- b. Tones may also be associated with the boundaries of higher-level constituents, such as the intonation phrase (roughly corresponding to the tone

group). This may be implicit (e.g. in the use of the term "boundary tone" in Pierrehumbert:1980) or explicit (Hirst:1983, Beckman and Pierrehumbert:1986, Pierrehumbert and Beckman:1988).

## **2.1 Association at different levels**

In the following sections, each model will be examined in relation to how it deals with (1) the association of tones with vowels, syllables or feet, the products of which are often referred to as pitch accents; and (2) the association of tones with higher-level constituents as mentioned in (b) above.

We begin with a brief general word about these two categories of association:

### **2.1.1 Pitch Accents**

The term pitch accent is used by Bolinger (e.g. 1958, 1986) to refer to pitch configurations which accompany a prominent syllable. In the work described below, the configurations are further decomposed into combinations of H(igh) and L(ow) pitch levels of some kind. Bruce and Garding (1978) refer to High and Low turning points, Pierrehumbert refers to H(igh) and L(ow) tones, and Hirst(1983) and Ladd (1983) are closer to Goldsmith, referring to High and Low tones or peaks and valleys made up, inter alia, of the phonological features H(igh) and L(ow).

They all concur with Bolinger (1958) in their assumption that the pitch or F0 contour carries an important message at these strategic points. However, the strong claim implied by Bolinger and incorporated into Pierrehumbert's formal account that each pitch accent implies a separate choice on the part of the speaker is *challenged* by Ladd (1986) who posits a hierarchical structuring which allows for the grouping of a number of pitch accents (e.g. into a "head" as described by O'Connor and Arnold, Crystal etc.). This will be further discussed in section 2.2.3.

### **2.1.2 Downstep**

In addition, we shall examine how each of the models described account for the phenomenon of downstep referred to in 1.3 above.

### **2.1.3 Levels above the pitch accent**

Goldsmith's autosegmental phonology allowed tones to be associated only with vowels. It did not take higher constituents into account. Most of the work described below, on the other hand, allows for tones to be associated to the boundary of an intonation phrase. This is not particularly controversial if seen within the structuralist



framework (e.g. Trager and Smith:1951, Pike:1945) which has "terminal tones" or "terminal contours" at the end of intonation phrases. The motivation for tones at the boundaries of other constituents is less universally accepted.

## **2.2 Specific models**

### **2.2.1 Pierrehumbert (1980)**

#### **(1) Pitch accents**

Janet Pierrehumbert's account of English allows for seven pitch accents consisting of H and L tones in combination with a star diacritic:

H\*, L\*, H\*+L, H+L\*, L\*+H, L+H\* and H\*+H

The starred tone is marked for association, in Goldsmith's sense, with a tone bearing unit. According to Pierrehumbert, the tone bearing unit is a syllable rather than a vowel; furthermore, it is metrically strong. Goldsmith's work referred to Chomsky and Halle's (1968) structure, where each segment was defined as a feature matrix and occurred in a linear string; each segment was defined separately. Since there was no bracketing, there was no direct way of representing syllable structure. The information had to be inferred from features such as [ $\pm$ syllabic] i.e. [ $+$ syllabic] segments constituted, in effect, syllable nuclei.

Pierrehumbert has made use of later work which represents syllable structure in a more direct way. This enables her to define tone bearing units as certain types of syllable: metrically strong syllables. Metrical strength is determined according to a grid as in Liberman and Prince (1977).

For Pierrehumbert, alignment is broadly fixed by association; i.e. a starred tone is realised within the time span occupied by its associated starred syllable. This can be exemplified as follows: the F0 dip phonologically represented as L\* in the pitch accent L\*+H occurs during the portion of the signal corresponding to the metrically strong syllable with which it is associated. Thus, in<sup>1</sup>

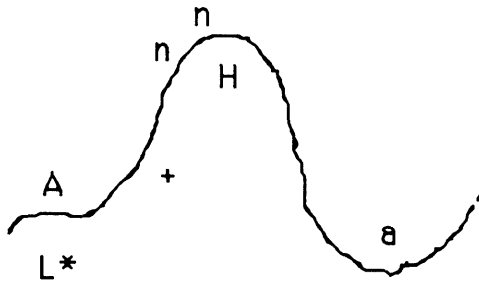
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<sup>1</sup> This is a close approximation to a F0 contour taken from Pierrehumbert (1980:256/147) - the second page number refers to that in a largely unmodified second edition of the thesis, distributed in 1987.

9.

L\*+H ... (other tonal material follows but is irrelevant here)

Anna



the F0 is low on the first syllable and high after this. The exact position along the time axis at which the F0 peak is reached depends on a number of factors, particularly how many tones and how much segmental material follow. These factors do not have any phonological status.

The only difference in timing to which she accords phonological status is that between pairs such as L\*+H and L+H\*. These are considered to be entirely different pitch accents. Later work with Steele (Pierrehumbert and Steele 1989:19) shows that, indeed, this distinction is perceived as categorical.

10.

t o A n n a

t o A n n a

L\*+H

L+H\*

In Pierrehumbert's model, the claim is made that tones represent targets directly in the F0 contour without any need for an intermediate representation.

Interpolation between these targets involves rules which are sensitive to the role of tones within the intonational structure (e.g. whether or not they are in a pitch accent, whether or not they are starred etc.). In her terms, these rules operate at the level of what she calls "phonetic realisation" which involves F0 plotted against time rather than a quantity such as perceived pitch.

An idea of the rules proposed can be gleaned from the following examples: between two successive H\* accents of sufficient separation, there may be a dip ("sag") between the two peaks, the two H\* peaks being, ceteris paribus, at the same height

above a slightly declining baseline; in the sequence L\* L\*, on the other hand, interpolation is linear; between L\* and H\*, interpolation is monotonic, there being a gradual rise.

However, despite the emphasis on the acoustic-phonetic details, it should be pointed out that perceived pitch is mentioned where F0 evidence requires corroboration, e.g. in the case of subordinate pitch accents which she calls echo accents (1980: ch 5, sect. 2; figs 5.10 - 5.12), or in certain cases of downstepped H\* tones which do not show up as a clear obtrusion in the F0 trace. She explicitly states about the word 'dots' upon which such a downstepped H\* occurs: "To the ear, 'dots' is clearly not deaccented." (1980: fig 6.8).

There is one case where a tone does not represent a target in the F0 contour. This is the trailing L tone of the H\*+L accent which is used in the representation of certain downstepped contours, as discussed below.

## **(2) Downstep**

In Pierrehumbert's model, downstep is triggered by an alternating sequence of H and L tones. In certain cases, the L tone is present simply to contribute to the triggering sequence; it has no direct manifestation in the F0 contour, i.e. it is not realised as a dip. Instead, it has the effect of lowering the F0 value of a following High tone. She refers to this type of tone as floating because it is not directly associated to a tone bearing unit.

To be exact, the trigger for downstep is as follows:

In any H L H sequence containing a bitonal pitch accent, <sup>e.g.</sup> (H\*+L H\*, H\* L+H\*, or a combination of a bitonal pitch accent and a phrase accent) the second H has the F0 value of the first, multiplied by a constant factor, k. The value of this constant factor (which must be between 0 and 1) is stipulated for the whole intonation phrase; the value used by Pierrehumbert is 0.6, (e.g. if the first H were at 200Hz, the second H would, ceteris paribus, be at 120Hz). The rule referring to the scaling of the second H is:

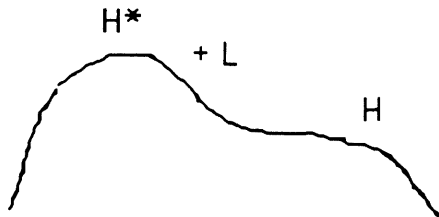
$$H_{i+1} = kH_i \quad \text{where } 0 < k < 1 \quad (1987:91 - \text{rule } 11)$$

An example of downstep involving the phonological sequence

H\*+L H

is realised in the F0 contour in the following way:

11.



### (3) Levels above the pitch accent

Pierrehumbert claims that the intonation unit consists of a sequence of tones in a flat (i.e. non-hierarchical) structure. This is not strictly the case as pitch accents consist of one or two tones packaged together, which suggests a degree of bracketing. Although the derivation of an intonation contour is from left to right, some rules are sensitive to the tonal structure of the whole pitch accent so the processing window for certain rules such as the one for downstep may have to include a bitonal pitch accent and a single tone, as in the sequence H L H mentioned in (1) above. In addition, she posits two types of tone which do not make up pitch accents: There are tones at the edges of the intonation phrase which are called boundary tones (T%) and tones which lie between the last pitch accent and T%, called the phrase accent (T<sup>-</sup>). (The superscript hyphen is dropped in later work by Pierrehumbert and colleagues; for typographical ease, it is also eliminated here.)

Thus, at the phrase level, she associates tones with the intonation phrase boundaries and with a position just before the boundary. The motivation for the boundary tone category appears to be the general argument about terminal tones as referred to in the American structuralist tradition. The phrase accent category is motivated by the work of Bruce, in which a phrase accent (= sentence accent or focal accent) is referred to as a separate tone (see section 2.2.4 for an account of Bruce's model). The existence of these phrasal tone types allows for a wide range of nuclear and prenuclear contours to be accounted for without, in the former case, the need for tritonal pitch accents (as suggested, for example, by Leben:1976, and Gussenhoven: 1983).

## 2.2.2 Ladd (1983) and subsequent work

### (1) Pitch Accents

D. Robert Ladd's representation of English intonation employs the following pitch accents:

H , L, HL, LH

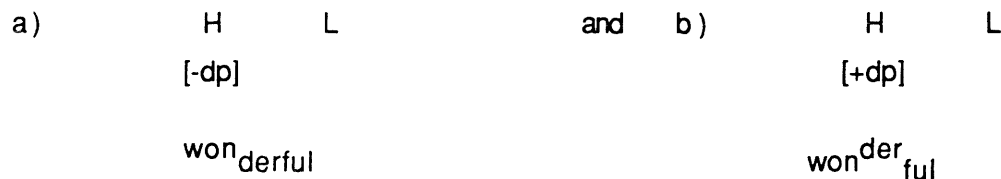
(Although, strictly speaking, Ladd's pitch accent is defined as including a boundary tone, the more common definition given in 2.2.1 will be used here.) Within any pitch accent, the leftmost tone is automatically associated with a metrically strong syllable. Thus, he does not need the star notation. He makes use of a sparse inventory of tones along with a set of binary features, in particular [ $\pm$ delayed peak], [ $\pm$ raised peak] and [ $\pm$ downstep]. He apportions functionality not only to tones but also to the binary features.

In Ladd's work, alignment is specified as distinct from association. The feature [ $\pm$ delayed peak] provides information which, in a number of other theories (e.g. Pierrehumbert's), is provided by the placement of the star on one or other of the tones in a bitonal pitch accent. He illustrates the feature [ $\pm$ delayed peak] by showing how it can be used to describe the distinction between a "plain" and "scooped" fall.

The categorisation of contours into these two types is well established in the literature on both sides of the Atlantic. What Ladd refers to as "scooped" contours is equivalent to Palmer's (1922) "intensified", Kingdon's (1958) "complex tone" - to be further discussed in chapter 6), Gunter's (1972) "humped descent" and Vanderslice and Ladefoged's (1972) [+scoop].

He explains that the two contours differ in the way the pitch peak (represented by the H tone) is aligned with the stressed syllable; they can be represented in the following way (where (a) is a plain fall and (b) is scooped:

12.



In a), the peak occurs during the stressed syllable and in b) it occurs later. Therefore, in Ladd's theory, if a syllable is associated with a tone, it does not necessarily have to be aligned with it; where the feature [+delayed peak] is present, the peak is typically aligned with some later item in the segmental string. If the syllable is final, it is aligned later in the syllable than it would have been without the feature [+delayed peak]

13.

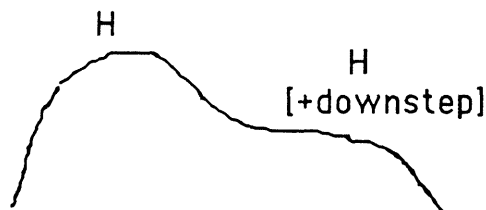


(In English, where delayed peak falls on a tone unit-final monosyllable, there is often a durational adjustment to accommodate the delayed peak - but this is a matter concerning details of phonetic realisation rather than phonological features.)

## (2) Downstep

Ladd's account of downstep employs the feature [ $\pm$ downstep] which is a property of the tone which undergoes the lowering. The fact that he does not posit a sequence of H and L tones as the trigger means that he does not need to argue for the existence of tones with no direct phonetic realisation. In fact, he criticises Pierrehumbert's use of the "floating" L tone. In the schema below, there are two H tones:

14.



The second H tone has the additional feature of [+downstep] which indicates that it has a lowered value.

One criticism levelled against the downstep feature is that it overgenerates, especially in that it allows for the first H in a phrase to be downstepped although there is a general consensus that this does not happen.

In Ladd 1986 he proposes that the downstep trigger be marked on the tone before the lowered tone; the above shape would have the representation: H! H where the ! diacritic signals that the following peak will be lowered. The idea is therefore captured that downstep cannot occur on an initial tone. This has a different disadvantage, should it be true that in English only H tones are downstepped (as is implied by Ladd), because the ! diacritic does not imply a choice of a H tone as its successor. But it is only an interim way of describing a phenomenon which he later accounts for in terms of a metrical analysis (see especially Ladd:forthcoming).

For Ladd, a string of tones (more accurately: tonal feature bundles) is realised at the phonetic level in terms of an equivalent number of pitch or F0 targets. As already pointed out, there are no floating tones in his model. Tonal feature bundles are related to points in the pitch curve. However, this relation is mediated by the fact that each feature has a different effect on the value of the tone on either the time or the F0 axis. Since features apply to one tone at a time and do not overlap, a name could, in principle, be given to each type of bundle (cf Hirst (1983), discussed in 2.2.3 below). These bundles could make up an intermediate level at which correspondence with the F0-time axis is simpler and more direct than at the underlying level. However, since in later work (Ladd:1990) he represents downstep in a hierarchical fashion, the concept of such an intermediate level in relation to Ladd's work is not taken further here.

Briefly, he represents downstep as a consequence of a metrical relationship between two nodes in a tree structure of the following type (1990:44):



There is recursion<sup>1</sup> in his representation, but this will not concern us here as we are principally investigating the effect of downstep on individual pitch accents. The above schema might be taken to be representative of the register specification for two successive pitch accents. The horizontal lines represent the register lines on which H and L tones are scaled; they are appropriately labelled. Note that where h is to the left and l is to the right, the register is narrowed, i.e. the l triggers a lowering of the register. This means that the first pitch accent would have a higher H and L tone, *ceteris paribus*, than the second.

By contrast, when l precedes h, the register lines are unaffected. Here, a first and second pitch accent would be scaled in the same way. This is not the only case (c.f. Hirst, discussed in 2.2.3 below) where there is an asymmetry between the scaling of high and low elements in a phonological representation.

### **(3) Levels above the pitch accent**

Ladd (1983b) incorporates boundary tones into his exposition but expresses doubts about their ad-hoc nature. He accounts for a variety of nuclear configurations in terms of his mono- and bitonal pitch accents, in combination with the feature [ $\pm$ delayed peak] and the final boundary tone. He acknowledges the logic behind positing the phrase accent for Swedish (see 2.2.4) but argues that such a construct is unnecessary for the description of English.

Later work by Ladd (1986, 1991, forthcoming) proposes a metrical model of intonational phrasing. He initially discusses two types of intonational phrase: (i) a major phrase, the boundaries of which can be discerned auditorily in terms of audible breaks (pauses, rhythmic breaks) and boundary tones, and (ii) a tone group (later called a minor phrase) which contains a nuclear pitch accent but no boundary tones. A major phrase may subsume a number of tone groups. He discusses hierarchical structure in general, proposing an analysis of head contours which allows for a single choice of head shape rather than a linear sequence of pitch accents, each chosen separately. The similarity in intonation pattern in:

15(a)            I read it to Julia

15(b)            I wanted to read it to Julia

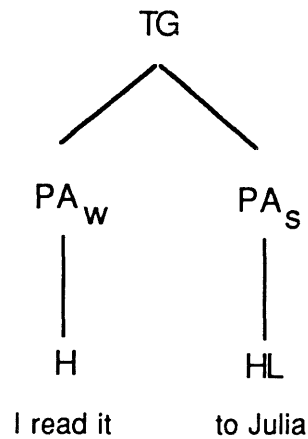
is captured in the following trees:

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<sup>1</sup>Recursion will be dealt with in another context in (3) below.

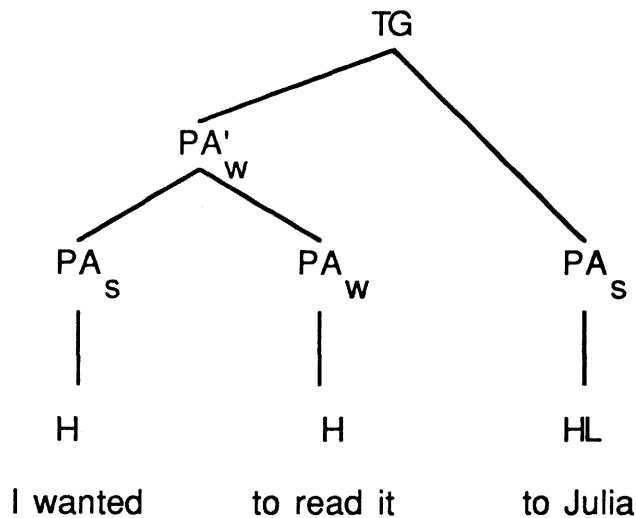


(a)



In the above tree there is only one Pitch Accent in the head. However, in the following tree,

(b)



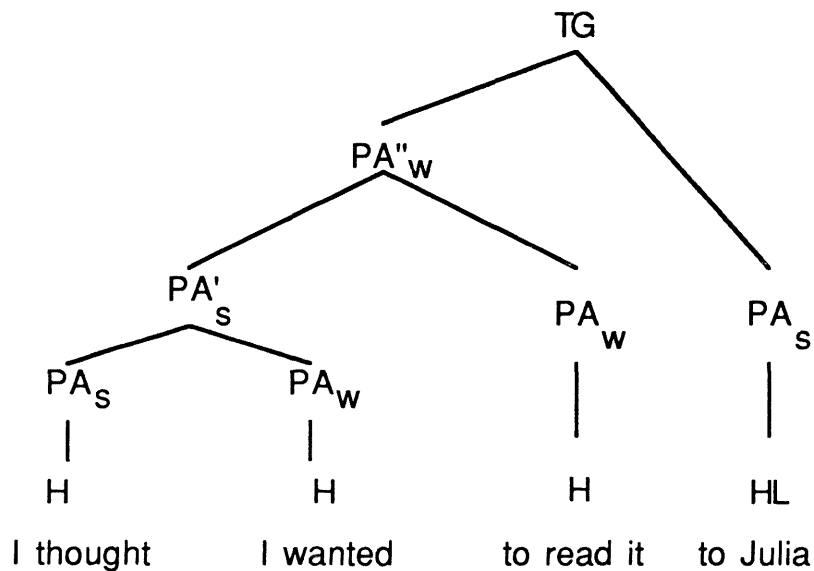
there are two Pitch Accents in the head, which is represented as a superordinate Pitch Accent (PA'). The choice of Pitch Accent type is made at this level.

In this approach, the advantages of describing heads as sequences of pitch accents are retained, but the coherence in e.g. falling/sliding heads etc. is captured in the hierarchical structure where all non-nuclear pitch accents are dominated by the head, or PA', node. Of course, it could be argued that this model undergenerates as it does not account for so-called "mixed heads" which often occur in conversational speech (see, for instance, Crystal:1969).

Using information on declination reset phenomena, he argues convincingly for recursiveness (1986:322) in intonational structure. The above example in 15(b) has recursion in that PA' dominates PA. However, since the PA' node could be conceived of as simply a separate constituent, the head, an extension of 15 is needed here to illustrate recursion in an unequivocal way:

(c) I thought I wanted to read it to Julia  
might be represented thus<sup>1</sup>:

(c)



However, this recursiveness is controversial as it violates Selkirk's "strict layer hypothesis" (SLH) which stipulates that each level in a given tree be non-recursive. We shall see that other accounts (Hirst, Pierrehumbert and Beckman) adhere to the SLH in that they have a distinct number of levels in a tree, all of which are named.

### 2.2.3 Hirst (1983,1986,1988)

#### (1) Pitch Accents

Daniel Hirst's model, used for the description of English and French, incorporates three tones, or T(onal) segments, H, L and D. These are made up of combinations of the two binary features [ $\pm$ high] and [ $\pm$ low], following the work of Goldsmith (1976) described in section 1 above. However, Hirst's account involves a more

<sup>1</sup>This is not the only representation; "I thought" could be dominated by an unbranching node of PA'' and "I wanted to read it" could be dominated by a branching PA'.

detailed phonetic specification: [+high] and [+low] do not simply entail higher or lower pitch than the predecessor; rather, there is an asymmetry in the relationship between the two features, [+high] involving slightly less change in pitch than [+low]. This can be seen in the way the two features combine to make up "T-segments" (equivalent to tones in the above expositions):

Features	T-seg	phonetic realisation (pitch height relative to previous T-seg)
[+high] [-low]	H	(higher)
[-high] [+low]	L	(lower)
[+high] [+low]	D	(slightly lower)

When the two features [+high] and [+low] are combined in one T-segment, rather than cancelling each other out, the effect of [+low] is greater than that of [+high], and there is thus a slight lowering of pitch.

It is important to explain here that, despite the fact that Hirst writes of raising and lowering pitch, the tones refer to pitch levels as target points rather than pitch movements. The pitch is raised or lowered so that the target may be reached.

A fourth tone, Mid [-high] [-low], is so named because of its position within a speaker's range rather than in relation to previous tones. It typically occurs at the beginning of an intonation unit, acting as a starting point in relation to which other tones can be scaled. It is treated with reservation in Hirst (1986).

Tones or T-segments are linked to the phonological structure via the Tonal Unit node (1988), roughly equivalent to the stress foot (in earlier work (1983) it was, in fact, the stress foot). Tonal Units involve one main pitch prominence in a similar way to pitch accents; Hirst classifies TUs as the domain of the "smallest linguistically relevant pitch contours" (1988:157). However, rather than there being an association between a syllable and a tone, as is the case with pitch accents reported on so far, there is one node, the Tonal Unit, which dominates at least one syllable, and one or two tones. The following representation attempts to capture the idea that both T-segments and syllables are attached to the same node but are on different planes:

16.



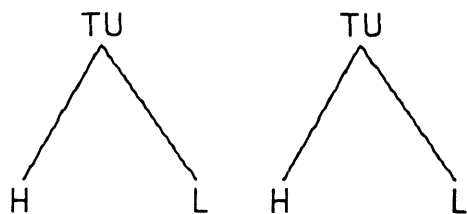
It is important to stress here that, according to Hirst, there are no tone bearing segments. The fact that H L is attached to the TU node means that these two tones (T-segments) must occur in the given order (H before L) and within the same time span as the 'phonemes' (P-segments) associated with the syllables attached to this node.

The synchronisation takes place at the level of the TU. There is some discussion as to whether they should be evenly spaced throughout the TU or whether the distance in time between targets should be a function of the distance in F0 (e.g. that there is a greater separation in time between H and L than between H and H). In either case, the assignment of time values for T-segments is carried out regardless of the syllabic or segmental phonemic make-up of the Tonal Unit. Thus, it would appear at first sight that the alignment oppositions indicated by placing a star on one of the tones in a bitonal pitch accent, or by posulating a peak delay feature, cannot be made within the theory as it stands. This matter will be returned to in section (3).

## (2) Downstep

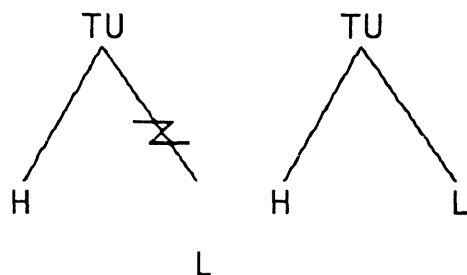
Hirst's third tone, D, corresponds to the downstepped H tone of other models described. Although it is listed as a separate tone, it is not present in underlying representations; it is derived in the following type of context: in a sequence of two Tonal Units with HL tones represented underlyingly as

17.(a)



an optional rule allows for the L tone in the first TU to be delinked as in the following graphic representation:

17.(b)



After delinking, the L tone is floating and is able to pass on some of its attributes to the following H tone. This is achieved through an assimilatory process whereby their features merge:

L	H		D		H	
[-high]	[+high]	->	[+high]	/	[+high]	_____
[+low]	[-low]	(opt)	[+low]		[-low]	

An underlying representation involving the sequence H L H may have what Hirst calls a surface representation HD and a F0 trace similar to the one below (the L tone from the second TU is not part of the context for downstep, and it is consequently not marked):

18.

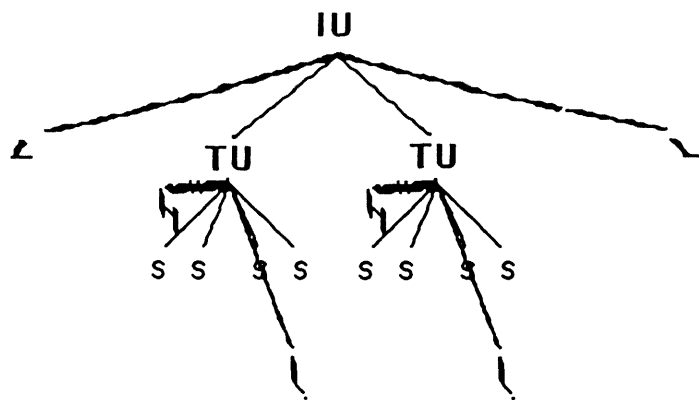


This representation can be considered intermediate between the underlying tree structure and the actual F0 or pitch curve. As a result, the relationship between H and the curve is explicit and unmediated. At this level, there are no features to interpret, only tones. Of these tones, none are to be by-passed; their history does not have to be recorded. Each symbol is translated into a F0-time value. These values are interpolated using a quadratic spline algorithm. Such an algorithm is blind to the underlying structure, it simply joins up the points by fitting parabolas between them.

### (3) Levels above the pitch accent

Hirst's model assigns tonal segments to a phonological representation using two "templates": the pitch accent-sized Tonal Unit, described in (1) above, and the Intonation Unit (IU), equivalent to the Tone Unit or Intonation Phrase. Tones linked to the intonation unit do not occur in the middle of a unit, as is the case for tones dominated by the TU node; they occur at the edges of the Intonation Unit. An attempt is made in the following tree structure to represent these facts graphically.

19.

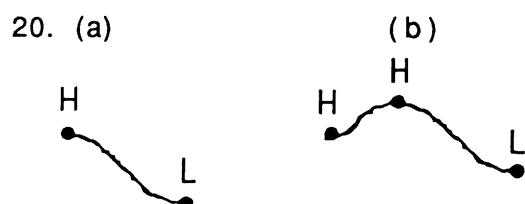


In their phonetic realisation, the two L tones occur at the leftmost and rightmost edges of the IU. However, they have no special relationship to the syllables in these positions; they merely coincide. Again, the tonal tier is on a different plane from the syllabic and segmental tiers, even if the first syllable coincides with the first tone and the last syllable with the last tone.

Thus, at an underlying level, he accounts formally for boundary tones and incorporates a phrase component into his model. He contrasts this underlying hierarchical structure with the strictly linear sequence of tones posited at the

surface level (as in the representation HD for the downstepped tone). In fact, boundary tones are included into the nearest TU within the Intonation Unit as part of the conversion to a flat structure. Implementation is then strictly left-to-right, each tone being scaled relative to its predecessor whether H, L or D.

Returning to the problem of representing delayed peak in Hirst's model, this appears to be possible through the incorporation of a floating tone into the inventory. As in a number of African languages, this is a morpheme consisting solely of a tone. In this case, Hirst calls it an emphatic morpheme. It is a H tone with its own node dominated directly by the Intonation Unit node and placed just before a Tonal Unit. This tone can be used to signal a peak delay, although only in a rather indirect way. If a TU with the tones H L is preceded by an emphatic H tone, then the sequence H H L is obtained. Since H always implies higher pitch than its predecessor, a sequence of two H tones produces a peak on the second. The difference between H L and H H L can be schematised thus:



The second peak in (b) is higher than the peak in (a). This is the difference between the two contours which Hirst wishes to draw to our attention. However, as a by-product of this insertion of an extra H tone, the peak of the contour is delayed. Note that there is still no specification of which syllable should be aligned with which tones; the delay is simply a consequence of there being three instead of two tones to be realised within the Tonal Unit. Despite the fact that the delay is evident in his estimated and measured time values for T-segments(1986:30), Hirst does not mention this explicitly.

#### 2.2.4 Bruce 1977,1983, 1987

The main protagonists of the Lund model are Eva Garding and Gösta Bruce, whose primary aim was to develop a model which would not only adequately describe but also generate the intonation of Swedish. It has since been applied to a number of languages (inter alia French, Greek, Chinese, Hausa, German). However, it is the account of Swedish which has influenced a number of models describing English, notably that of Pierrehumbert (1980) and subsequent work within that

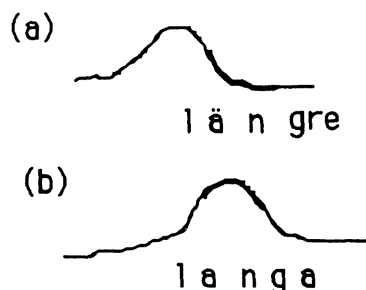
framework. We shall therefore present an overview of the model's application to the Swedish language.

### (1) Pitch accents

In Swedish, words are lexically specified as to the type of pitch contour they may bear as well as the position in which such contours may occur. Like English, one syllable is singled out as having main stress (equivalent to the metrically strong syllable) and plays the major role in the association of tune with text; unlike English, the type of contour associated with this stressed syllable is determined lexically. There are two "word accent" types (akin to pitch accents), generally referred to as Accents I and II. Despite a considerable degree of dialectal variation, the generalisation can be made that Accent I words have an earlier peak than Accent II words.

Bruce's (1977) dissertation gives an extensive account of the phonetics and phonology of the Stockholm variety. He provides an autosegmental analysis of Accent I and II word accents (akin to pitch accents), representing Accent I as HL\*, as sketched in (a) below, and Accent II as H\*L, in (b) below.

21.

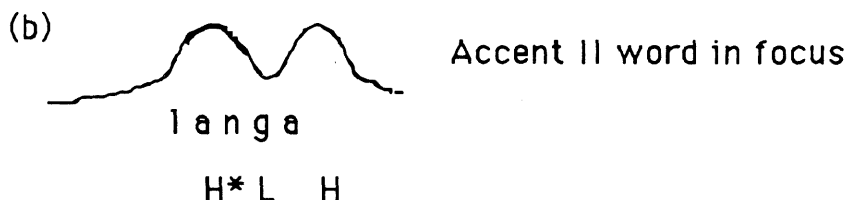
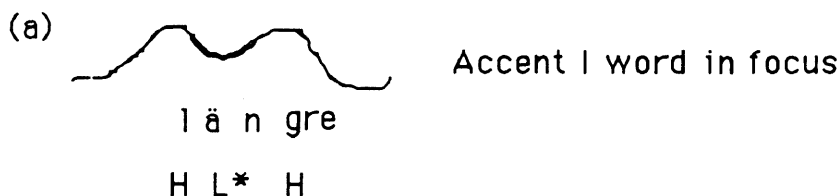


The bold lines indicate the F0 during the stressed vowel, which is in the first syllable in both examples.

The above figures are adapted from Bruce's (1977:48) examples of the above words in prefocal position. If the words had been in focus, they would have been followed by a "sentence accent" which, in Stockholm Swedish, constitutes an extra H peak (or, as he refers to it, F0 turning point), roughly as in the sketches below:



22.



Like Goldsmith (1976), he makes the assumption that the vowel (or syllable) is the tone bearer and that therefore all vowels (or syllables) must be associated with a tone. If there are three syllables to carry the H L H tonal sequence, then the association is straightforward: a one to one mapping of tones to syllables. However, when there are only two syllables, a reassociation rule must operate which, in the case of the H\* L pitch accent, attaches the L as well as the H\* to the first syllable and the H sentence accent to the second.

An example he refers to in (1987) illustrates the difference in association between an Accent II word followed by unstressed word which falls in the same stress group (foot) and an Accent II word in final position; both are focussed and consequently followed by a sentence accent:

23.

a)	non- final	fly:	ga	me	...	Accent II word in focus (s=syllable)
		s	s	s		
		H*	L	H	...	
b)	final	fly:	ga	#		(#=phrase boundary)
		s	s			
		H*L	H	...		

For the sake of clarity, words and tones not directly relevant to the argument are omitted (full examples in Bruce, 1987:43).

In both 23(a) and 23(b) Accent II is signalled by H\*L and the focal accent is signalled by means of a separate peak, H. However, although the H\* peak is consistently timed at the beginning of the vowel in the stressed syllable, (1987:44), the following L and H are variable in their timing relative to the segmental string.

He had pointed out (in 1983) that the foot or stress group might be better considered to be the relevant domain for association than the stressed syllable alone. This means, essentially, that all tones associated with a word accent occur during the foot dominating the accented syllable. He requires the starred tone to be phonetically aligned with the stressed syllable (which is the leftmost syllable of the foot). In accent II words, a trailing unstarred L tone of a bitonal pitch accent H\*L and a sentence accent H (also called "phrase accent" or "focal accent") follow the starred tone but remain within the foot. However, he does state that the timing of the sentence accent peak is much more variable than that of the pitch accent tones, even the unstarred ones. The experiments presented in (1987) bear this out, as can be seen from his example contours of "flyga" in a number of different environments (p48, fig 4). His main conclusion is that, indeed, the foot is the domain for association, and that its left boundary is "critically synchronised" (1987:49) with the starred tone of a pitch accent. Other tones he describes as "floating" in the sense that they are not directly associated to syllables - although they are not entirely free from association since they are linked in some way to the foot.

Bruce's (1983, 1987) account is similar to that of Hirst (1983) in his reference to a higher domain such as the foot. His account differs in the sense that he specifies an alignment of the head of the foot with a starred tone. Perhaps this alignment specification regarding the stressed syllable could be seen as an association to a foot via its head whilst unstarred tones are associated to the foot domain in a different way. As we shall see in section 2.2.5, Pierrehumbert and Beckman (1988) make use of a distinction between two types of association to higher nodes.

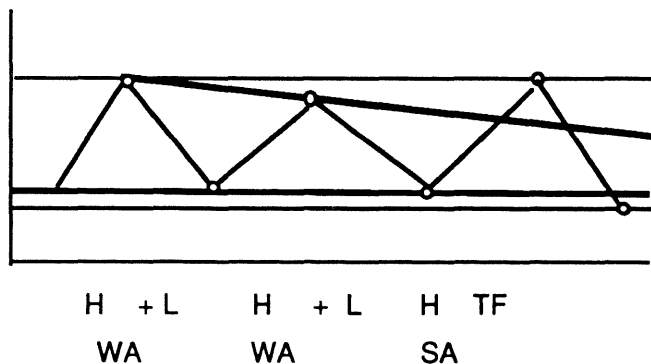
## **(2) Downstep**

In the Lund model, downtrends in general are represented as modifications in the tonal grid lines. The grid will be discussed in (3) below.

### (3) Levels above the pitch accent

An important aspect of the Lund model is the "grid" which can be considered to be the phrase component of the model. It consists, in e.g. Garding (1983) Bruce and Garding (1978), of a number of reference lines upon which the High and Low turning points are superimposed. According to Garding, it is the "global framework [...] within which the local pitch movements can develop" (1983:14). An example of the type of grid lines used is represented in the following diagram:

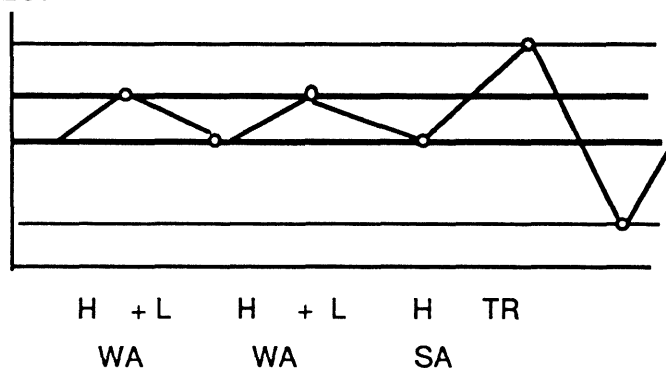
24.



adapted from Garding (1983:21). Interior lines (in bold) are the frame within which unemphatic word accent (WA) tones are scaled and the outer lines the frame for the sentence accent (SA) and terminal (%) tones. There is traditionally said to be a "terminal juncture fall" (TF) at the end of such contours.

Both inner and outer grids may be used for linguistic purposes. In fact, grid lines have a similar phonological status to the word accents. For instance, it was observed (Garding 1978) that yes-no questions with no inversion had a narrower inner grid for the pitch accent tones and a wider outer grid for the sentence accent and that the grid was reasonably level in questions but declining in statements. A grid for yes-no questions with no inversion is given below:

25.



adapted from Garding (1983:21).

Grids do not have to be monodirectional. In fact, they involve a "pivot" (a location at which the range or direction of the lines changes) in all but the simplest of syntactic constructions. A common grid shape for declarative sentences is rising in the first half of the sentence (e.g. the subject phrase) and falling in the second half (e.g. the predicate phrase).

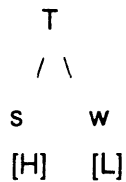
### **2.2.5 Beckman and Pierrehumbert 1986, Pierrehumbert and Beckman 1988**

In their article, Mary Beckman and Janet Pierrehumbert (1986) substantially modify Pierrehumbert's model of English intonation, using insights gained from their analysis of Japanese. Two years later, in a book-length treatment (Pierrehumbert and Beckman:1988), they formalise many of these ideas and, although the emphasis is on the tonal structure of Tokyo Japanese, the theoretical model advanced is claimed to have universal application. Languages other than Japanese are referred to throughout the text and a short chapter at the end of the book relates the theory to each of a number of languages in turn; one of these languages is English.

Because of Pierrehumbert and Beckman's emphasis on Japanese and the rather scattered nature of the references to English, the sections on pitch accents (1) and on higher level association (3) will first give a detailed account of their treatment of Japanese (a) and, subsequently, attempt to piece together the information given in both of the above cited works in relation to English (b). The attention accorded to Japanese in the following sections is motivated by the fact that certain tonal phenomena in Palermo Italian (analysed in chapter 7) have Japanese analogues, and by the fact that Pierrehumbert and Beckman's analysis of Japanese is more complete and provides a more coherent account of the theory.

#### **(1a) Pitch Accents – Japanese**

In Pierrehumbert and Beckman (1988) pitch accents are associated by means of a structure of the following type, where branches of the T node are labelled as either weak or strong:



The above tree represents the only pitch accent type available in Japanese. In fact, it is lexically linked; Japanese words already have pitch accents in the lexicon (rather like Swedish which, however, has two rather than one pitch accent). Whereas the discussion so far has involved the syllable as the tone bearing unit, Japanese has a smaller constituent which can bear tone: the (sonorant) mora. Pitch accents are therefore linked to morae in the lexicon.

As in earlier work, alignment is considered to be a phonetic consequence of association: the strong tone (H) "has priority in establishing the alignment of the accent" (1988:125).

### **(1b) Pitch Accents - English**

Beckman and Pierrehumbert (1986) reduce Pierrehumbert's English pitch accent inventory from 7 to 6:

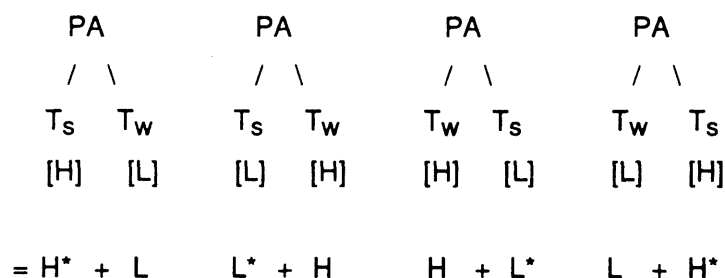
$H^*, L^*, H^*+L, H+L^*, L^*+H, L+H^*,$

thus eliminating the  $H^*+H$  accent. They propose (1988) that the English bitonal pitch accents be represented in a branching structure such as that for the Japanese H L pitch accent illustrated in (1a) above. The tone which is starred is considered to be the strong branch and the unstarred tone the weak one. Since the analysis in Pierrehumbert (1980) consisted of pitch accents with one or two tones, it would seem more logical, at least for English, for tones to be daughters of a pitch accent (PA) node instead of the tone being the node with no specification given to its branches. In this way the tonal tier has a degree of structure which is akin to the type of structure in the prosodic tree. For consistency, it could be considered an  $n$ -ary branching tree with exactly one strong branch, and with no recursion<sup>1</sup>.

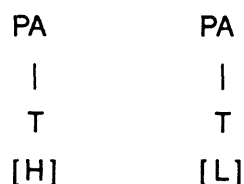
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<sup>1</sup>Since there are maximally two tones in a Pitch Accent, the branching structure could equally be binary.

Using this structure, the English bitonal inventory could be expressed thus:

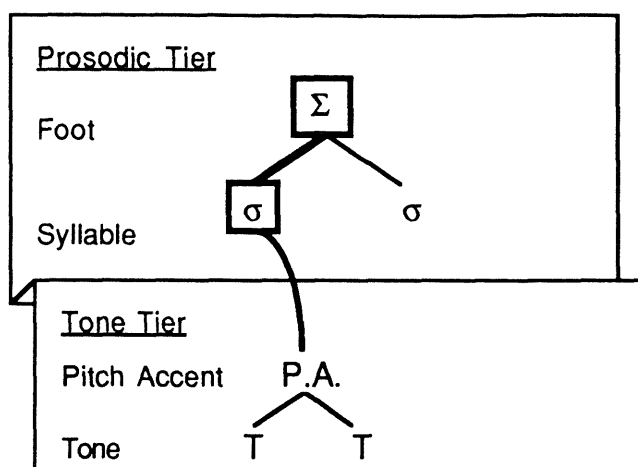


The monotonal inventory can be represented as follows:



There appears, from looking at the English inventory, that the structure involves a maximally binary branching structure. However, there is no a priori reason for limiting the number of branches in such a way. In fact, Japanese and Swedish limit branching even further, allowing Pitch Accents to have exactly two branches only. However, although in descriptions of intonational systems described strictly within Pierrehumbert's framework, only monotonal and bitonal pitch accents have been described; a number of Autosegmental accounts of intonation do posit tritonal Pitch Accents (viz. Leben:1976, Gussenhoven:1983); an n-ary branching tree would more easily accommodate such accounts.

As in Pierrehumbert (1980), the syllable is the minimal tone-bearing unit for English (1988:133). However, the pitch accent is associated with the metrical foot and the association percolates down the tree to the head of the foot (the metrically strong syllable). In their terms, "the [pitch] accent is a foot-level property that is attracted to the head syllable" (1988:159). This type of association is called "central". It involves the association passing through the strong branches of the tree as in the following diagram:



"Central" contrasts with "peripheral" association to higher nodes; the latter will be discussed in more detail in (3) below. In short, it leads to alignment of a tone with the edges, rather than the head, of a domain.

## (2) Downstep - Japanese and English

Pierrehumbert and Beckman also modify the rule for triggering downstep. They propose (1986) that all bitonal pitch accents trigger downstep (which they call catathesis) in the tone following them. It is possible for L tones as well as H tones to undergo this process, especially in Danish but also in English, unless, of course, L tones are already at the bottom of the range. In Japanese, too, L tones can undergo catathesis (1988:85); tones are scaled within an upper (h) line and a reference (r) line. Catathesis has the effect of lowering the upper line. This affects the values of both H and L tones as they have a smaller "F0 space" within which to be scaled. Furthermore, catathesis affects the L of the triggering pitch accent in Japanese.

Note that the use of lines within which to scale tones resembles Goldsmith's account of downstep and, to a certain extent, Garding's general use of the grid.

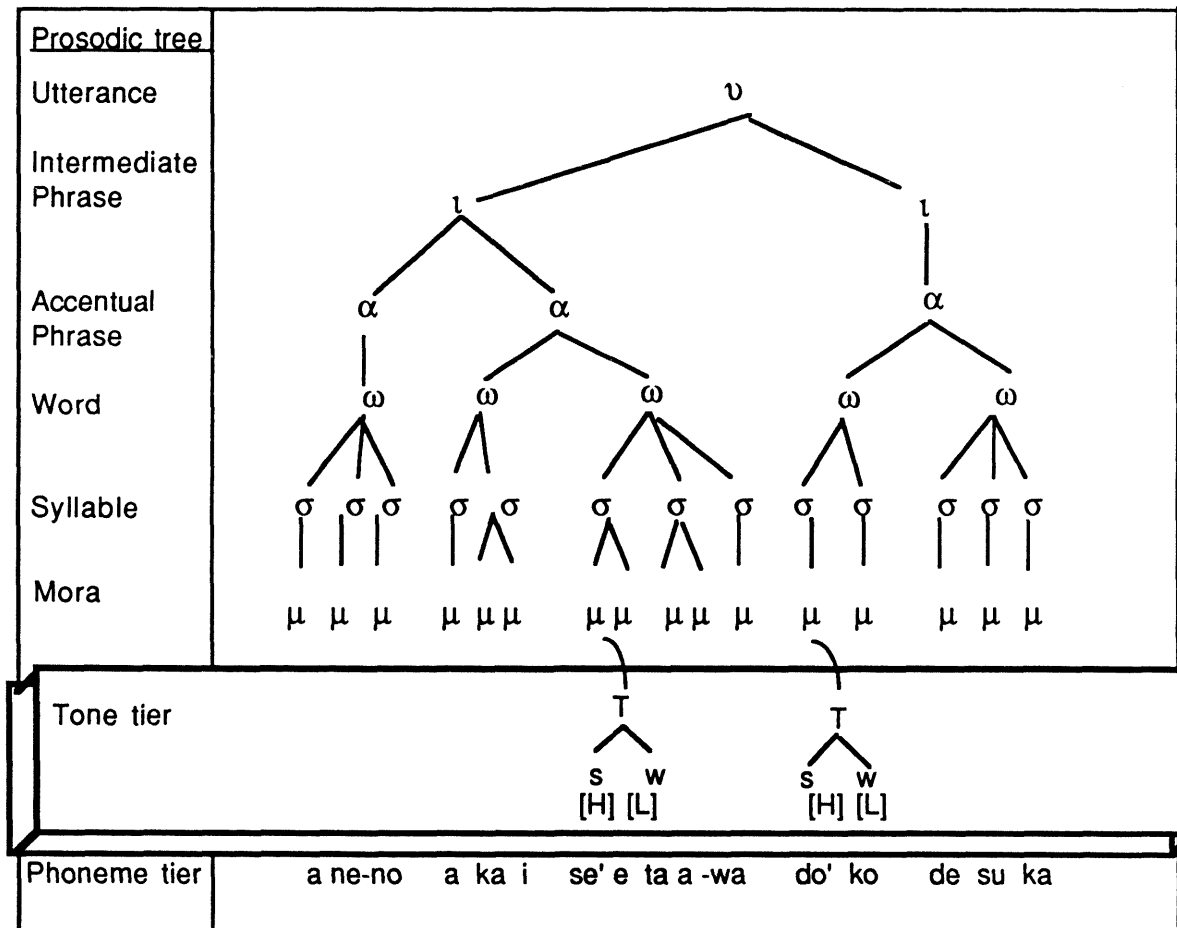
### (3a) Levels above the pitch accent - Japanese

In their study of Japanese (1988), Pierrehumbert and Beckman provide a detailed account of the prosodic tree and the types of association which link this tree to the tone tier. Much of the detail on association is relevant to later discussions, both of English in section (3b) below and of Italian in chapter 7. Consequently, a number of trees will be presented here which represent details of Japanese tonal association. They are adaptations of Pierrehumbert and Beckman's trees, and any changes have been made in the interests of clarity.

In (1), we have already discussed association to terminal elements of trees; in the case of Japanese, association to morae. Terminal elements are the types of constituent that are at the very bottom of the tree (sometimes called leaves). The following diagram shows this kind of association between a prosodic tree and the tone tier. Since it is the tone tier with which we are primarily concerned here, and it is important to think of it as if on a different plane from the prosodic tree, it is placed on a raised platform<sup>1</sup>:

27.

Association of tones to terminal elements of the tree



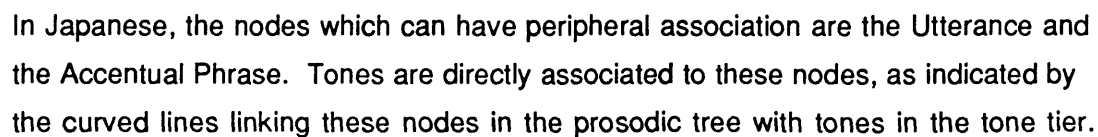
There are two associations, each between a mora and a T node in the tone tier. The associations are marked with curved lines. The curved lines attempt to make

<sup>1</sup>It should be noted that, strictly, the phoneme tier should also be represented as if it were on a different plane from the prosodic tree and tone tier.



In addition to associating directly with terminal elements, tones can also associate with nodes higher up the tree. These tones are often called "boundary tones". This kind of association is called "peripheral", as the tones which are associated to the node have to be placed at the edges of the constituent which they dominate; they must occur before or after all tones associated to a terminal element within a constituent. Peripheral association is illustrated in 28 below:

### Association of tones to higher nodes



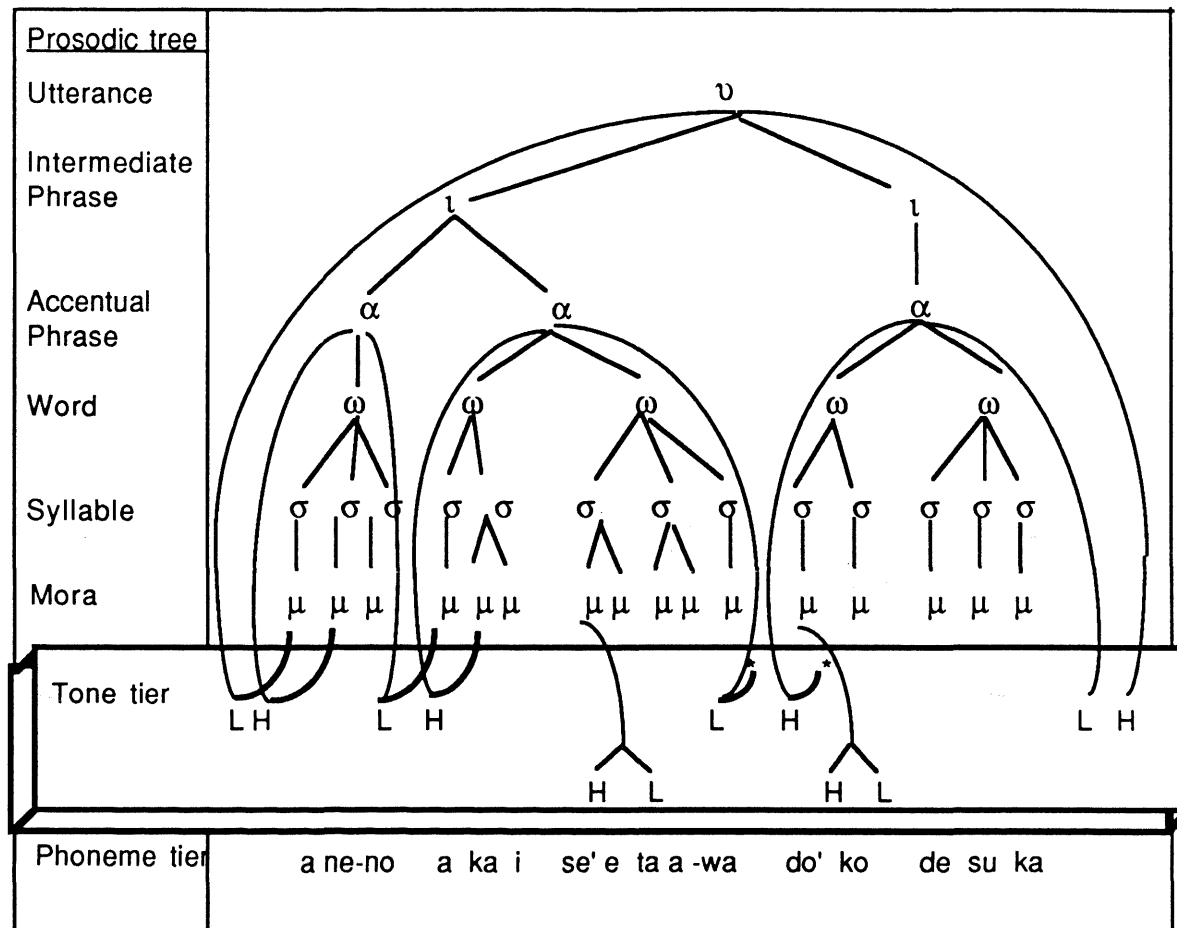
Just as with pitch accents which can only be HL, there is no paradigmatic variation in any of the boundary tone positions. The accentual phrase always has H as left-peripheral and L as right-peripheral tones; the utterance always has L as a left peripheral tone and, optionally, has H as a right peripheral tone. This existence of an optional tone implies that a structural position may be empty. Although this is true for only one position in Japanese, the possibility of empty positions has wide-reaching implications for Pierrehumbert and Beckman's model.

The model proposed by Pierrehumbert in (1980) for English claimed that for each structural position there was not only a paradigmatic H/L contrast, but that each such position was always filled. Pierrehumbert and Beckman (1988) claim that in Japanese there is no paradigmatic contrast in any of the positions nor must every position be filled. A reasonable assumption about the model would therefore be that language-specific parameters stipulate not only which higher nodes can have peripheral associations but also whether they have a paradigmatic contrast and whether they are optional or not.

In Japanese, peripherally associated tones may seek a secondary attachment to a mora. The utterance-initial L usually seeks a secondary attachment to the first mora of the utterance, the Accentual Phrase (AP) final L to the first mora of the following Accentual Phrase, the AP initial H to the second sonorant mora of the AP. Secondary association is marked in bold lines in 29 below:

29.

# Secondary association



There are four cases of secondary attachment: between the Utterance peripheral L and the first mora, the AP left peripheral H and the second mora, the AP right peripheral L and the first mora of the second AP, and the H tone at the left periphery of the second AP and the second mora of this second AP.

However, where a mora is already attached to a tone, secondary association is blocked. In other words, a terminal element must be free from association in order to undergo secondary association. This is the case of the first mora of the third AP and the right peripheral tone of the second AP. The illegality of the secondary association in these cases is symbolised with a star in the above tree.

Also, there can be no desequencing: the H tone at the left edge of the final Accentual Phrase cannot be associated to a tone after the HL pitch accent. Where there is no secondary association, the tone is not deleted, but neither is it fully realised. In

fact, Pierrehumbert and Beckman explicitly state that "In such cases, the timing of the phrasal H implies that its phonetic realisation will be practically invisible" (1988:132). As we shall see in chapter 7, the concept of secondary attachment is crucial for an adequate analysis of certain interrogative contours in Palermo Italian.

### **(3b) Levels above the Pitch Accent – English**

It is by examining the application of Pierrehumbert and Beckman's model to English that the radical divergence from Pierrehumbert (1980) becomes apparent. As we have already seen, there is no longer a strictly flat tonal structure.

Pierrehumbert's boundary tones and phrase accents, which might have appeared to be ad-hoc measures, introduced to account for the more complex patterns found in nuclear position in English, can now be fully incorporated as the product of peripheral association. Thus, these two tones are incorporated into Pierrehumbert and Beckman's model as peripheral tones for prosodic constituents, the former "phrase accent" as the terminal tone of the intermediate phrase, and the former "boundary tones" (T%) as left and right peripheral tones of the intonation phrase.

Figure 30 is an attempt to piece together Pierrehumbert and Beckman's statements about English in a tree structure similar to those presented above in the description of Japanese.

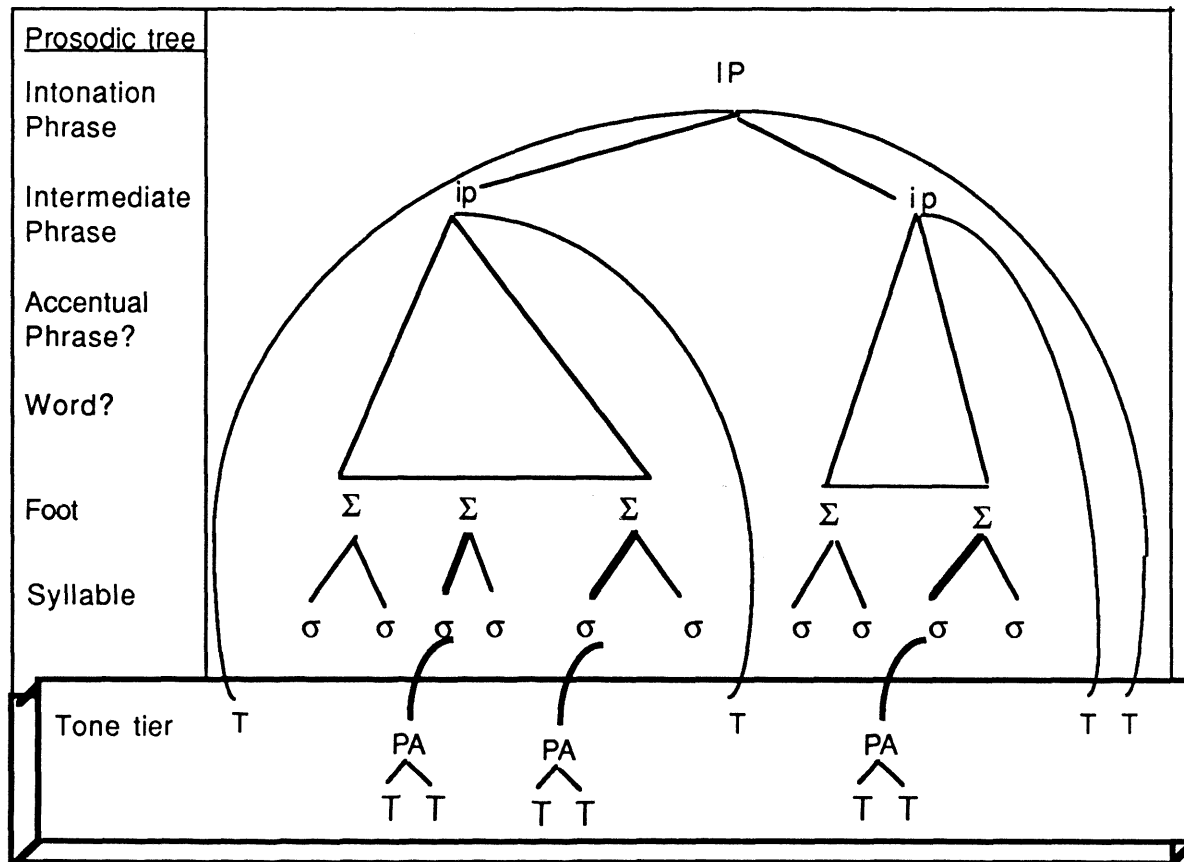
The prosodic tree is somewhat different from that used for the description of Japanese: the highest node in the English tree is the intonation phrase; this constituent does not appear in the Japanese tree, which, instead has the utterance node at the top<sup>1</sup>. The intermediate phrase is common to both languages as being the second node in the hierarchy. It has not been explicitly stated what structure lies between the intermediate phrase node and the foot node. In (1986), there is a suggestion that there may be motivation for the accentual phrase in English; and in (1988) the word is suggested as a prosodic constituent, based on results from studies by Steele and Liberman (1987).

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<sup>1</sup>This is not to say that there is no utterance node in English, but rather that there is no evidence in the form of boundary tones for such a domain.

As syllables are the minimal tone bearing units in English, they are represented as the terminal elements of the prosodic tree.

30.



There are two types of association in the above tree:

(i) central association of tones is symbolised by a bold line starting at the foot node and extending to the leftmost syllable node (which, in English, is the strongest). The curved line from the syllable to the PA node symbolises the association between them.

(ii) peripheral association of tones to the Intonation Phrase and the Intermediate Phrase nodes can be seen from the curved association lines which go from the node in question, directly to the tone tier without passing down through any lower nodes in the tree. There is a suggestion that the tone attached to the intermediate phrase may also be attached to the word node, but this has not been incorporated into the theory and is pending further results, so it is not included in the diagram.

It is claimed that the secondary assignment of "boundary tones" to terminal elements of the tree does not take place in English (1988:234).

### **3 Concluding remarks**

We have seen that association, as defined by Goldsmith, has evolved somewhat. Pitch accents, consisting of one or two tones, are generally considered to be distinct from boundary phenomena. The status of the latter has recently been clarified in formal accounts, where they are treated as peripheral tones of a constituent within some sort of metrical tree.

The original autosegmental representation - respecting the original WFC - consists of a rich specification of tonal structure at the abstract level and very little indeed is relegated to interpolation rules, since every vowel is associated with at least one tone. The relation between the underlying phonological and phonetic representations is therefore more direct. This rich specification is needed for the representation in accentual languages of chanted speech - a style which is generally considered to be simplified in some way. By contrast, the fact that non-accentual languages which use tone as lexical and morphological markers make use of a richer tonal specification is due to the heavier functional load which tones bear in those languages.

The ideas of Liberman, which were briefly touched upon in Goldsmith (1979), have been taken up in later years; representations now involve an underlying specification of tonal structure in the form of pivotal positions. That is, in the treatments mentioned, with the exception of Japanese, the tone bearing unit is now the accented (metrically strong) syllable. The actual phonetic interpretation is arrived at by a combination of phonological associations and interpolation rules, although with increasing emphasis on the latter. In the models of Pierrehumbert, Pierrehumbert and Beckman, and Ladd, interpolation involves a number of phonologically motivated rules. In Hirst's model, by contrast, interpolation is a purely mathematical way of joining up a string of target points. The former type of interpolation does not have to be monotonic, the latter is.

Thus, Hirst's predominantly hierarchical model uses a simple algorithm to interpolate between targets in a string, whereas Pierrehumbert's original (nominally) flat model has more complicated interpolation rules, sensitive to the structure into which tones are grouped. This difference can partly be explained by the fact that Hirst proposes an intermediate level between the tree in the phonology and the physical intonation contour - something like a broad phonetic transcription

at the segmental phonemic level without all the information to say what the syllable structure was or where the word boundaries lie.

Pierrehumbert and Beckman, on the other hand, are of the view that "we speak trees, not strings" (1988:160). A string with diacritics, indicating the structural position of certain tones (such as whether it is an intermediate phrase boundary, marked as a phrase accent, or an intonation phrase boundary marked with %) is merely a shorthand version of the tree. Synthesis models such as those of Ladd and Pierrehumbert and Beckman need access to the tree in order to calculate details of scaling and alignment.

The position held here is that, just as the segments in a broad phonetic string have to be interpreted with regard to their syllabic and word structure, so does the string of tones need extra structural information before it can be said to be explicit. The broad phonetic transcription relies on the transcriber's knowledge of the language and devices like spaces for word boundaries. A tonal transcription with a few diacritics could do a similar job in the transcription of intonation. But this does not constitute motivation for a separate level in the universal grammar or the grammar of individual languages.

It was originally claimed by Pierrehumbert and Ladd that reference lines such as Bruce and Garding's "grid" required a degree of forward planning which was not permitted in their strictly sequential models. However, their more recent work incorporates hierarchical structuring and allows for higher nodes to influence the pitch height of the stretches of utterance that they dominate. In fact work on both models at least superficially resembles Garding's work on the grid.

The distinction between phonological association and phonological alignment has proved useful in the way it allows for functional generalisations to be made. For instance, Ladd distinguishes a scooped fall from a plain fall by only one feature [ $\pm$ delayed peak], thus formally capturing the similarity between the two (i.e. that they are both falls or HL (L%) sequences). Pierrehumbert, on the other hand, would represent them as two distinct forms:  $H^* (L L\%)^1$  and  $L^*+H (L L\%)$ , one bearing no formal relation to the other. For Ladd, what must be captured is a) the functional similarity between the two HL sequences: one plain and one with delayed

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<sup>1</sup> An alternative form,  $L+H^*$ , and its relation to  $L^*+H$ , will be discussed in chapter 6.

peak, and b) the functional similarity between delayed peaks in different tone sequences. However, there is a problem with this, viz. that he is relying for the differentiation between the forms on semantic categories which are open to a great deal of interpretation. As he himself points out, the line between linguistic and paralinguistic effects is difficult to draw, (Ladd:forthcoming).

Some facets of timing can thus with profit be incorporated into the phonological component of a theory of intonation. At the same time, it is clear that some details of timing have to be relegated to the phonetic domain because they clearly make no categorical distinctions. The problem of deciding on the appropriate point at which timing phenomena should be incorporated into the phonology, and the categorical judgements which motivate such a decision, are parallel considerations in the following chapter.



## Chapter 6 Alignment

### Preface

We have seen that a treatment of the association of primitives on different autosegmental tiers is important for a formal account of the generation of intonation contours. In this chapter, we shall consider the alignment of the tonal set of primitives along the temporal axis. This can be important both for an account of acceptable variations in the positions of timing points in particular types of intonation contour, and in categorising different types of intonation contour.

The discussion in this chapter will highlight anew the uncertainty in the alignment of the left boundary of the nuclear domain, which was first brought up in chapter 2. As in Chapter 2, the focus will be on English, since this is the language common to the analyses under investigation. First, there will be a discussion of an auditory phonetician's approach to problems of tonal alignment which will observe a distinction between what could be considered tonal peak delay (in the case of Kingdon's complex tones below) and nucleus delay (in the case of Kingdon's homosyllabic preheads).

This will lead to a consideration of different autosegmental pitch accent treatments of tonal alignment, by asking how particular theorists account for the phenomena observed in that auditory phonetic analysis. By considering specifically the alignment of tones<sup>1</sup>, it will be seen that one particular type of analysis (of Pierrehumbert and associates) can more easily accommodate variation in alignment, because it implicitly allows for tonal anticipation as well as delay, whereas another type (of Ladd and others), which attributes more weight to the concept of nucleus, has a more 'impermeable' left nuclear boundary.

It is shown that a type of contour involving peak anticipation can satisfactorily be analysed within a Pierrehumbertian style framework, so long as a readjustment is made to the tonal inventory. At the same time, a coherent account of downstep and stepping-down stylised intonation contours results.

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<sup>1</sup>In autosegmental studies, the tone refers to a pitch level (rather than a pitch contour), roughly corresponding in the auditory domain to a pitch peak.

Although it is shown that tonal alignment can more flexibly be accounted for within this framework, some constraints are still required so that the aspects of tonal alignment peculiar to English can be accounted for, whilst maintaining an analysis sufficiently general to accommodate treatments of the intonation of other languages. What needs to be accounted for is that what occurs to the right of the nuclear syllable has more weight than what occurs to the left. It is shown that this can satisfactorily be done by treating leading tones in bitonal Pitch Accents as weaker than trailing tones. This is formalised by an enrichment of the structural analysis of the Pitch Accent by insertion of an intermediate level between the pitch accent and the tone. This new analysis is shown to maintain a coherent account of English intonation and, in particular, can be seen to formalise the admissibility of tones spanning the left boundary of the nuclear foot whilst at the same time maintaining the strength of the tone aligned with the nuclear syllable.

## **0 Introduction**

In chapter 5, mention was made of Ladd's (1983) feature [ $\pm$ delayed peak]. He considers "scooped" contours to be a natural class, distinguished from "plain" contours by their positive value for the above feature. The name of this feature encapsulates two assumptions: (i) it is the "peak" rather than the trough whose timing is affected, and (ii) the relevant turning point is subject to "delay" rather than anticipation<sup>1</sup>.

Although these two assumptions are widespread, it is necessary to question them. First, we shall engage in a closer examination of traditional ideas about peak alignment. The most detailed auditory phonetic account of this topic for English is that of Kingdon (1958). He examines two types of contour which might be considered to have a delayed peak: (A) tones involving a rise prefacing a fall or fall-rise and (B) a case where a prehead occurs on the first part of a nuclear syllable. The latter is not generally discussed in later work within the British school. We

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<sup>1</sup>To be more explicit, Ladd uses the term "peak" as a general for "accent peaks, accent valleys and boundary end point" (1983a:728); however, his discussion revolves around the application of features to peaks in the sense of pitch or F0 maxima, any mention of features applying to valleys being relegated to the status of footnotes.

shall first summarise his observations and then investigate how these two contour types might be accounted for in autosegmental pitch accent frameworks.

## 1 Kingdon

### 1.1 (A) Complex tones

First, a clarification of terminology is necessary: Kingdon's use of the term "complex tone" has a semantic basis. It differs from that in a phonetic account, such as Crystal (1969), where "simple" means unidirectional pitch movement (e.g. rise, fall) and "complex" involves a multidirectional contour (e.g. rise-fall, fall-rise, rise-fall-rise etc.). Kingdon's tonal inventory, using his own terminology, is as follows:

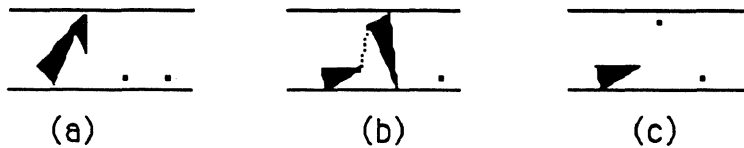
Simple tones			Complex tones		
1	rise	/			
2	fall	\	4	rise-fall	/ \
3	fall-rise	\ /	5	rise-fall-rise	/ \ /

Each of these tones may be low or high in the speaker's pitch range.

As we can see, Kingdon places the fall-rise tone in the simple category despite its phonetic shape. Semantically, he considers complex tones to be "more lively and emotional" versions of simple tones (1958:131). Tones 4 and 5 are thus modifications of 2 and 3 respectively. This modification is not only semantic but, in fact, phonetic also; it involves the prefixing of a rise to the contour, which causes the peak to be delayed.

Although there is a binary opposition between simple and complex tones, which is accorded phonological status in the sense that they are classified as independent tones, there is, within the set of complex tones, a considerable degree of variation as to the exact position of the peak. It can occur (a) late in the nuclear syllable, (b) early in the following syllable as part of a glide, or (c) as a high pitch between two low level pitches, the first in the accented syllable, as illustrated below (taken from Kingdon (1958:131-135):

1.



Presumably, the difference between (b) and (c) is that, in (b) the peak occurs at the beginning of the second syllable and falls during the rest of it, whereas in (c) the peak and glide occur later. In the above diagrams, dots imply that glides are not perceptually relevant.

Thus, within the phonological category of complex tone, there appears to be a phonetic continuum as to where exactly the peak occurs. This suggests that peak delay is phonetically gradient.

### 1.2 (B) Contrastive and homosyllabic preheads



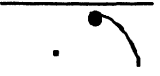

Kingdon discusses a class of contour where nuclear syllables are given extra emphasis. This is achieved, in part, by pronouncing all non-nuclear syllables as if they were unstressed. By definition, such contours can contain no head, given that a head requires there to be at least one stressed syllable before the nucleus. Any syllables preceding the nucleus in such contours therefore constitute a prehead.

He claims that emphasis is enhanced if the prehead is pronounced on a contrastive pitch. As we have already discussed in chapter 2, a prehead may be contrastive and carry a meaningful distinction. However, such a distinction is considered secondary to the distinction carried by the nuclear tone. One argument for the primacy of nuclear pitch movements is that a nuclear syllable carrying (at least the first part of) a nuclear tone is obligatory in well-formed tone units, whereas the prehead, head and tail are optional. It is to be remembered that, in much of the subsequent work within the British school, discussed in detail in chapter 2 (e.g. Crystal (1969), O'Connor and Arnold (1973), Couper-Kuhlen (1986)), it is generally accepted that the prehead pitch contour must occur on the prehead syllable(s). The following schema illustrates the interdependence of intonation and rhythmic structure:

<b>prehead</b>	<b>head</b>	<b>nucleus<sup>1</sup></b>	<b>tail</b>
unaccented syllables	from 1st accented syllable up to but not including nucleus	nuclear syllable	unaccented syllables

Thus, if there are no unaccented syllables at the beginning of a tone unit, no prehead contour can occur.

Kingdon, however, allows for a little more independence of tune and text; he allows the contrastive pitch of a prehead to be realised where there are no prenuclear syllables, i.e. in cases where the segmental material allows only for a nuclear tone (nuclear syllable  $\pm$ tail). Thus, in reply to a question such as "Where the hell do you think you're going?", emphasis may be added by means of a contrastive prehead not only in i) "to Lee" but also in ii) "Lee"<sup>2</sup>. The following are interlinear representations of replies (a) in a neutral context, such as in reply to "Where are you going?", and (b) with added emphasis as might be used in reply to the the former question:

- 2.
- |     |   |   |
|-----|---|---|
|     | (i)   | (ii)  |
| (a) | to Lee  | Lee   |
|     |  |  |
| (b) | to Lee  | Lee   |
|     |  |  |

Kingdon would represent intonation patterns associated with (bi) and (bii) as follows:

<sup>1</sup>The problem of defining the domain of the nuclear tone with reference to the nuclear syllable and unaccented tail syllables is discussed at length in chapter 2.

<sup>2</sup>The fact that a sonorant consonant is used in this example is discussed in section 1.3.

2(bi)            " to            L e e "  
                  | prehead | nucleus |  
  
                  (low) (high fall)

2(bii)           " L e e "  
                  |pre-| nucleus |  
                  head  
  
                  (low) (high fall)

He refers to cases such as in (bii) as homosyllabic preheads. They are achieved by:

"pronouncing the beginning of the stressed syllable (=nuclear syllable) on a pitch which will contrast with the tone to be used, and delaying the tone and its accompanying stress for a length of time sufficient to allow the initial unstressed contrasting pitch to be felt" (pp53-4)

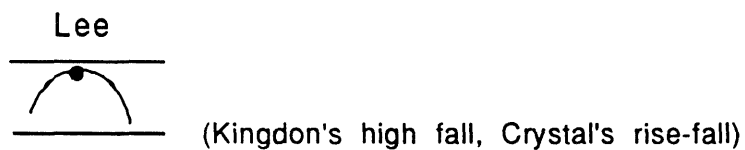
This type of delay, however, is analysed as a prehead occurring before the nuclear tone; it is not considered to be an integral part of it. Thus, where the nucleus is the first element in a tone unit, he allows for an initial contrastive pitch movement which is not part of the nuclear tone; rather, this contrastive pitch actually delays the nuclear tone. The contrastivity of the initial pitch in nucleus-initial tone units is contrary to the basic tenets of the British school where the pitch movement before a peak is generally referred to as an onglide and has no phonological status; it is merely an accident of production and cannot be described as contrastive. Neither can it constitute a prehead as there are no prehead syllables to carry it.

Even Crystal's (1969) boosters (e.g. ↑ which indicates that the syllable following the booster is on a relatively high pitch) relate to the height of a previous syllable<sup>1</sup>. Where there is no previous syllable, the booster can indicate that the tone unit is to start at a pitch which is higher or lower than the default onset level (he assumes the default beginning pitch for tone units to be around the middle of the speaker's range). He does not make special provision for a pitch movement such as is described by Kingdon as homosyllabic preheads. In fact, he would analyse the following form:

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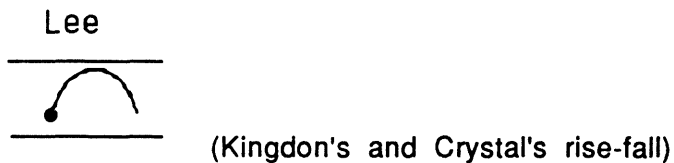
<sup>1</sup>This is also true of Couper-Kuhlen (1986), Cruttenden (1986), as pointed out in chapter 2.

2(bii)



as a different nuclear tone from the contour on "to Lee" in 2(bi) above. If the starting point is as low as it is in Kingdon's examples (op cit:55) he would classify it as a rise-fall, within the same category as a rise-fall of the following shape:

3.



The reader is invited to consider whether Crystal's decision is intuitively correct. Kingdon would not think so: the former is a fall with a contrastive homosyllabic prehead and the latter is a rise-fall complex tone. As we shall see later, Pierrehumbert and Hirschberg's (1990) theory of intonational meaning groups the two contours in a similar way to Kingdon (see section 2.1.2).

It is interesting to note that Kingdon does not contemplate a contrastive prehead before a complex tone; he considers a low prehead before a fall-rise (which, in his analysis, is a simple tone - number 3) but not a high prehead before a rise-fall (which is a complex tone - number 4). Although Kingdon himself does not explain his reasons for the omission, we might assume that it is because he already considers complex tones to involve delay and does not allow for a potential further delay if a contrastive prehead were to be realised on the same syllable as the nuclear tone.

### 1.3 Comparison of two types of delay: (A) and (B)

An example of how Kingdon schematises both types of delay is as follows:

4.



"Now"



"Now"

Classified as: tone 4

tone 2 HE (H=high, E=emphatic)

Page reference: p131

p55 (adapted from "there" and "really")

Both clearly involve delay, but, whereas A involves a delay simply in the pitch peak, B additionally involves a delay in the onset of what he considers to be the other concomitants of stress, defined as "the force employed in uttering the syllable" (1958:xxii).

The example given in 4(B) above is of a syllable with a nasal in its onset. It could equally involve a syllable beginning with a semivowel or a liquid, or even a syllable with no onset. Homosyllabic preheads can also be discerned where the syllable onset is a voiced plosive or fricative, or even a voiceless consonant. Kingdon claims that the pitch change in the latter case is "suggested by a change in the tension of the vocal cords" accompanied by a "slight change in pitch as the vocal cords begin to vibrate" (1958:54-55). We have somewhat neglected these phonetic details and concentrated on the case of syllables beginning with sonorants where pitch movement can be perceived directly.

In terms of the pitch movement involved, complex tones can only be derived by adding a rise before the simple tone contour:

simple

complex

fall

RISE-fall

fall-rise

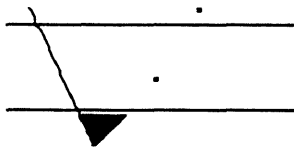
RISE-fall-rise

By contrast, the homosyllabic prehead may be low or high, instigating a rise or fall, as in the following examples where the movement attributable to the prehead is in parenthesis:



5.

tone 1                      high prehead + rise                      i.e. (FALL) rise

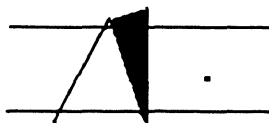


"All of them."

p55

6.

tone 3 low prehead + fall-rise                      i.e. (RISE) fall-rise



"You do."

p55

Thus, Kingdon's contour type A can only involve the delay of a peak, whereas his type B can constitute the delay of a trough as well as that of a peak.

## 2. Autosegmental pitch accent theories

Given that a distinction has been made by an intonation analyst between these two different types of delay, the question naturally arises whether later treatments have drawn the same distinction. The following section will evaluate the models of Ladd and Pierrehumbert (discussed in chapter 5) in respect of:

(1) their treatment of what Kingdon refers to as complex tones, and

(2) their treatment, if any, of the phenomenon described by Kingdon as contrastive and homosyllabic preheads, along with the pitch contour just before the nuclear syllable.

One might assume that, if Kingdon makes special provision for the transcription of pitch contours just before the nucleus, he might have observed the importance of this position (which would be transcribed in non-initial nuclear cases) and that there may be an argument for recording it as a defining part of the nucleus rather than as a final part of a prenuclear stretch. Therefore, in anticipation of this, we shall examine how these models make provision for contrastive pitch immediately prior to the nuclear or accented syllable. We shall examine the way (i) preceding high pitch and (ii) preceding low pitch are accounted for in this context.

As shown in chapter 2, pitch accent theories treat nuclear and non-nuclear pitch accents in a similar fashion, i.e. they draw from the same inventory. The essential difference is that nuclear pitch accents, by virtue of their final position in an intonation unit<sup>1</sup>, are followed by one or more extra tones which allow for a greater variety of pitch movement. As we have seen in chapter 5, Ladd allows for an intonation phrase boundary tone, and Pierrehumbert (1980) posits two additional tones, which are more formally defined in her later work with Beckman as boundary tones (Beckman and Pierrehumbert:1986, Pierrehumbert and Beckman:1988). These tones are always placed after the regular pitch accent tones and are formally independent from them. Thus, since delay involves the beginning part of the pitch accent, it should, in principle, apply to prenuclear and nuclear pitch accents alike (although it could be argued that nuclear tones typically occur in lengthened syllables which would favour peak or trough delay). Nonetheless, much of the discussion below will be centred around nuclear tones.

## **2.1 Complex tones**

### **2.1.1 Ladd**

In 1978, Ladd refers to peak delay as a gradient phenomenon, using functional criteria as a basis for determining "which of the semantic distinctions of intonation

---

<sup>1</sup>We shall refer to nuclear pitch configurations and nuclear pitch accents below, because we believe that the concept of nuclearity should be central to any theory of intonation (see Cruttenden's (1990) history of the nucleus). This is not the stance of Pierrehumbert and colleagues who accord no special status to the nuclear pitch accent; for them, it is merely followed by other tones which form part of the final pitch configuration of the phrase.

represent contrast between linguistic categories and which represent gradient variation" (1978:112). Scoop (peak delay) is classified as a gradient dimension because "in most cases, it merely adds a degree of emphasis, insistence, etc." (1978:112). However, Ladd only gives two example types:

7.

plain		scooped
oh <sub>h</sub>	vs	o <sub>h</sub> <sub>h</sub>
won <sub>derful</sub>	vs	won <sub>der</sub> <sub>ful</sub>

He does not contrast  $won^{de}_{rful}$  with, say,  $wo^{nde}_{rful}$  or  $wond^{erf}_{ul}$ .

Whereas Kingdon describes a binary semantic but a gradient phonetic distinction, Ladd (1978) describes a binary phonetic but gradient semantic distinction. His binary phonetic distinction involves two types of contour: plain and scooped, but he claims that the gradient semantic distinction prevents him from according independent status to scooped contours as separate tones. However, in a later study (1983a) where he decomposes nuclear and non-nuclear pitch accents into phonological features, he reverses his decision and considers the distinction to be binary [ $\pm$ delayed peak]<sup>1</sup>. This discrepancy is probably due to the fact that the phonetic distinctions most readily perceived correspond to phonological categories which are semantically interpretable.

Furthermore, there exists no established framework for describing these intonationally signalled distinctions.

---

<sup>1</sup> It is important to point out here that [H] and [L] are also considered by Ladd to be features of tones, just like [ $\pm$ delayed peak]. If we are to give equivalent status to all types of feature, then we have to assume a change of feature specification implies a change of tone as a phonological category. Thus, a tone with the feature [+delayed peak] cannot be considered to be an allotone of a tone which has an otherwise identical feature profile but is [-delayed peak].

Ladd's argument for the delay feature, along with features in general, is that they allow for cross-classification of contours, as shown in the schema below. These were discussed in chapter 5.

delay	[-del pk]	[+del pk]
tone sequence		
HLL	fall	rise-fall
HLH	fall-rise	rise-fall-rise

In feature terms, Kingdon's complex tones are formally defined by Ladd as a natural class [+del. peak], just as falls and rise-falls - both being HLL sequences - also constitute a natural class. Ladd therefore accounts in a structured way for Kingdon's observations about the relation between simple and complex tones.

### 2.1.2 Pierrehumbert and colleagues

Pierrehumbert's (1980) theory distinguishes Kingdon's simple/complex tones by classifying them as different pitch accents; if we translate Kingdon's two tones into Pierrehumbert's theory, the result is as follows:

Pitch accent type		
H*	L* + H	
fall	rise-fall	L L% Final tones
fall-rise	rise-fall-rise	L H%

At first glance, it appears that scooped contours simply involve a different pitch accent from plain ones. If this were the case, there would be no formal way of extracting from the data that L\*+H is a modified version of H\* any more than would be, say, H\*+L or any other pitch accent. An examination of later work by Pierrehumbert (and colleagues) indicates that this criticism is too simplistic.

Pierrehumbert and Hirschberg (1990) propose a componential semantic account of intonation contours, assigning semantic interpretations to each pitch accent type, each phrase accent and each boundary tone. They do not claim that H\* and L\*+H belong to a natural class; instead, they propose the pair: L+H\* and L\*+H as constituting a natural class because they both involve a sequence L+H. They motivate this decision semantically, giving the three examples below:

8.

(a)  $L^* + H \rightarrow L + H^*$  (b)  $L + H^* \rightarrow L + H^*$  (c)  $H^* \rightarrow L + H^*$

where they claim that in both (a) and (b), there is an implication that the word on which the Pitch Accent is realised is compared to a scale of alternatives; in (a) the value is not necessarily correct; in (b) the value is correct. In the case of (c), information is added without any implicit comparison to alternatives.

Pierrehumbert and Steele (1989) give an example of each of the three contours; they can be schematised thus (where only Pitch Accents are indicated):

9.

(a) Only a million<sup>ion</sup>aire      (b) Only a million<sup>illi</sup>onaire      (c) Only a million<sup>illi</sup>onaire

$L^*+H$        $L+H^*$        $H^*$

(Note that in American English, lexical stress falls on the first stressed syllable of the word millionaire.)

A modified table, taking into account these later claims about semantic interpretation of Pitch Accents is given below:

star position	star to right	star to left
tone sequence		
L+H L L%	fall	rise-fall
L+H L H%	fall-rise	rise-fall-rise

(This is, in fact, comparable to the earlier diagram of Ladd's model with delay instead of star position at the top.)

The Pitch Accent tonal sequence is L+H in all cases, but in one set of Pitch Accents, the starred tone is to the right, and in the other, the starred tone is to the left. So, a generalisation that can be made here is that scooped contours differ from plain contours by having the starred tone to the left. Pierrehumbert and Steele (1989) show that there is a categorical distinction (at least as far as production is concerned) between the L\*+H L H% and the L+H\* L H% contours.

One major problem with positing that scooped contours are signalled by a left-starred Pitch Accent is that the relation between H\*+L and H+L\* would have to be analogous in that H\*+L would have to be considered a scooped version of H+L\*. In other words, if scooping is a cue to emphasis, H\*+L would have to be more emphatic and insistent than H+L\*. Given the fact that H\*, which is neutralised with H\*+L in final position, is used in neutral declarative utterances (Pierrehumbert and Hirschberg, 1990:290), this is counter intuitive. In fact, the contrasts between the sequences L+H\* - L\*+H and H+L\* - H\*+L have never been treated as being analogous, except by Silverman (1987) in terms of the parameters of his pitch contour computation algorithm (page 5.28). In fact, there are formal differences: in terms of peak placement, L+H\* (unscooped) involves medial peak and L\*+H (scooped) involves late peak, whereas H+L\* ("unscooped") involves early peak and H\*+L ("scooped") medial peak. That is, in one case medial peak is unscooped and in another it is scooped (see Kohler (1991) for a discussion of the semantics of early, medial and late peak in German and English). Furthermore, the relationship would be difficult for Pierrehumbert to establish since, in her analysis, L in H\*+L is

never realised as a trough, and L\* in H+L\* is mid, rather than low, scaled in the same way as a downstepped H tone<sup>1</sup>. This will be further discussed in 2.2.2 below.

The fact that Pierrehumbert and Hirschberg (1990) and Pierrehumbert and Steele (1989) classify natural classes of contours according to the tonal sequence within the Pitch Accent, means that, in fact, they attribute more importance to phenomena before the nuclear syllable than after it. For instance, of the three tunes, according to the above model,

(a) L\*+H L H%      (b) L+H\* L H%      (c) H\* L H%

(a) and (b) form a natural class, being composed of a L+H tonal sequence. Ladd (in accordance with the British school) would classify (b) and (c) as the closer relations, being described as having the same nuclear pitch accent (or nuclear tone in the British school).

Ladd's analysis would yield:

10.

a) H   L   H%	b) H   L   H%	c) H   L   H%
[+dp]	[-dp]	[-dp]

The analysis suggests that b) and c) are functionally equivalent, as least as far as the nuclear pitch accent is concerned. Ladd would account for the dip in b) by positing a HL accent on "Only", the L from this accent then causing the dip before the H peak.

In a similar way, nuclear tone analyses such as Crystal(1969) would describe the a) contour as rise-fall-rise, and b) and c) contours as fall-rise. The dip in b) before the peak would have to be described as part of a low or falling head.

---

<sup>1</sup>Whereas the H tones in L\*+H and L+H\* are scaled in a similar way.

## 2.2 "Homosyllabic preheads" and other phenomena

### 2.2.1 Ladd

Ladd does not appear to deal with the phenomena described as homosyllabic preheads. Pitch accents may consist of one or two tones, and, in the latter case, it is the first tone which is associated with the metrically strong syllable. For Ladd, the nuclear pitch movement begins on the nuclear syllable. Thus, any movement before the nuclear syllable is outside the domain of the nucleus and does not play a part in the classification of the nuclear pitch accent<sup>1</sup>.

We shall examine below how he accounts for this "prenuclear" pitch movement.

#### (i) preceding high pitch

As Silverman (1990) points out, in cases where a high pitch precedes a H tone, Ladd classifies this H tone as a downstepped H. The following example from Ladd illustrates this (1983b:49):

11.   
Bis <sup>w</sup>ann haben Sie zuletzt Ihr <sup>A</sup>beitslosengeld bekommen

H		H		H	L
		[+d.s.]		[+d.s.]	

The high pitch preceding the downstepped tones, however, is not equivalent to Kingdon's high prehead, as downstepped tones do not occur in tone unit initial position. As noted in chapter 5, Ladd acknowledges that a downstepped tone occurs after another associated H tone, hence his (1986) representation of downstep as

H! H

with the symbol attached to the first H even though it is the second one which undergoes downstep. His metrical theory (Ladd:1990) (also discussed in chapter

---

<sup>1</sup>This principle may be extended to prenuclear pitch accents too: the first tone of a prenuclear pitch accent is always associated with the metrically strong syllable.



5) has the downstepped tone on the right branch of a binary branching node, hence to the right of another pitch accent. In the above example, the high pitches on "Ihr" and "be" are both preceded by a H tone in the previous pitch accent, "wann" and "Ar" respectively. In both cases the pitch remains high until just before the downstepped tone. Ladd invokes a new feature [ $\pm$ sustained pitch], the positive value of which would account for these level stretches. (Without this feature - or with its negative value - the pitch sags slightly between peaks.) It could be argued that this feature is an undesirable complication to the model, although he claims that there is motivation for this feature elsewhere in that it may also be used in the description of stylised contours. However, it is questionable whether the type of level pitch found in stylised intonation patterns is the same phenomenon as level stretches in heads. Johnson and Grice (1990) argue that the former constitutes true monotone whereas the latter often involves a degree of declination, and that the former involves isochronous rhythm whereas the latter does not.

### **(ii) Previous low pitch**

Ladd's theory does not have a uniform way of accounting for a dip in the pitch contour occurring just before the nuclear syllable. If the nuclear pitch accent is preceded by a H tone, the dip (or sag) might be due to a default interpolation mechanism in the absence of [ $+$ sustained pitch]. If it is preceded by a HL accent, there would be a dip in pitch between the two accents, although not only in the vicinity of the single H. In fact, the HL pitch accent could be selected to signal that there is a dip.

To account for a dip in initial position, Ladd's theory could presumably be extended to include an initial L boundary tone.

### **2.2.2 Pierrehumbert and colleagues**

Pierrehumbert accords the phenomena referred to in section (2) the same status as those in section (1): She considers the pitch immediately preceding the nuclear or stressed syllable to be distinctive. In fact, it is presented as no less distinctive than the pitch after it (for instance, in the nuclear tail). She does this by allowing the starred tone to be preceded by a leading tone. Whether the leading tone occurs on the same syllable as the associated tone or has a separate syllable upon which to manifest itself (in Kingdon's terms: whether the prehead is homosyllabic or not) is irrelevant, given Pierrehumbert's strict division between tune and text. One of her basic premises (in line with the American schools) is that any pitch accent can be

mapped onto any segmental string, as long as there is a stressed syllable with which to associate the starred tone in the pitch accent.

### (i) Preceding high pitch

Pierrehumbert posits the pitch accent  $H+L^*$  which differs from plain  $L^*$  by virtue of its initial high pitch. The correspondence is as follows:

12.

	Pierrehumbert	Kingdon
	$H+L^* \quad L \quad H\%$	high prehead (low) rising nucleus
vs	$L^* \quad H \quad H\%$	(low) rising nucleus
or	$L^* \quad L \quad H\%$	

The pitch accent  $H+L^*$  occurs not only in initial position in a tone unit: it may be preceded and/or followed by pitch accents, or followed by any phrase accent and boundary tone combination. A  $H\%$  boundary tone preceding  $L^*$  might give a similar result in initial position but could not account for similar configurations within the intonation unit. In addition, the timing of the pitch peak just before the trough, rather than at the intonation phrase boundary, leads to the preference of the  $H+L^*$  analysis.

One problem with the analysis is that  $L^*$  in this context tends to be mid pitched rather than low, so that the pitch falls during the stressed syllable and the low pitch is reached only because of the  $L$  phrase accent towards the end of the word on which the Pitch Accent is realised<sup>1</sup>. The  $H+L^*$  pitch accent is adequate for the description of (a) below:

13.

(a)

astronomical cost of the enterprise (is a bar to our plans)

$H+L^* \quad L \quad H\%$

---

<sup>1</sup>This is more technically the prosodic word; it is suggested in Pierrehumbert and Beckman (1988) that there may be a secondary association of the phrase accent (intermediate phrase right peripheral tone) to the prosodic word in the prosodic hierarchy.

but not for the description of (b) which would have to be analysed as below:

(b)

astronomical cost of the enterprise , (the difficulties in finding a good  
location, and the current economic  
L\* L H% climate, are all prohibitive)

where the high pitch before 'cost' could only be accounted for as part of a previous Pitch Accent, e.g. L\*+H on the first syllable of "Astronomical" (which has undergone stress-shift)<sup>1</sup>.

This example is analogous to one suggested to Carlos Gussenhoven (p.c.) by Bruce Hayes:

14.

(a)

Win<sup>nepe</sup> san<sub>kee</sub>

(b)

Win<sup>nepe</sup> sankee Steet Club. The...

This type of contour will be re-examined in section 3.3 below.

---

<sup>1</sup>The only theory where H of L\*+H is explicitly placed immediately before the next Pitch Accent is that of Gussenhoven (1983). In his model, "partially linked" contours shift the trailing tone to the right; a gradual rise is then the consequence of interpolation between the L\* and the delayed H. However, even Gussenhoven's model does not account for all cases of "early peak" contours (such as 25d in section 3.3 below).

## (ii) Preceding low pitch

The L+H\* accent accounts for Kingdon's contour as follows<sup>1</sup>:

15.	Pierrehumbert	Kingdon
	L+H* L L%	low prehead (high) falling nucleus
vs	H* L L%	(high) falling nucleus

In both frameworks, delay can only occur when the tone group begins on the nuclear syllable<sup>2</sup>. Kingdon considers this to be a special case which can only be found in emphatic utterances. Because of the basic interdependence of tune and rhythmic structure within his model, he has to make special provision for it, hence the term: "homosyllabic prehead". In Pierrehumbert's account, the process is more natural as there is, in principle, no limit to how many tones can occur on any one syllable.

By having the nuclear domain's left edge on the nuclear syllable, the assumption is made that natural classes involve contours describable as equivalent because their nuclear tone is the same.

British approaches consider contours with the same nuclear tone to be strongly related, the nuclear tone beginning on the nuclear syllable. There is also a generally agreed tendency to group contours ending in the same pitch direction, rise-falls and falls, for instance. Ladd's account formalises this claim. However, Pierrehumbert and colleagues provide semantic evidence for refuting such a claim because it ignores important material occurring prior to the nuclear syllable

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<sup>1</sup>Again, Gussenhoven's model can account for previous low pitch if there is a H\*L accent in initial position. In his analysis, in which the H tone is "spread", the trailing L tone is displaced to the right; this predicts a dip just before the next Pitch Accent.

<sup>2</sup>It should be noted that any of Kingdon's homosyllabic preheads could occur without there being delay, if delay is defined as being relative to the start of the vowel in the nuclear syllable, because the prehead would occur in the onset of the nuclear syllable. However, where there is no syllabic onset, as in "All of them" (1958:55), the delay does occur on the vowel.

(especially Pierrehumbert and Hirschberg:1990). Translated into British-style terminology, a falling head +high fall (rising transition from head to nucleus) is related to a rise-fall, whereas a high head + high fall (level transition) is not.

All of these issues remain only partially resolved. A number of experimental studies have begun to address some of them, e.g. Kohler (1987a, b), Pierrehumbert and Steele (1989), Gussenhoven and Rietveld (1991). What is common to all studies is the acknowledgement that semantic criteria are difficult to pin down in the absence of context. Most would also agree that it is not simply the fundamental frequency which contributes to the meaning of intonation contours but a complex interaction between a number of factors. A recent example of experimental investigation of some of these factors is Hirschberg and Ward (1992) where the rise-fall-rise contour is investigated; they provide evidence for the participation of pitch range and, to a lesser extent, spectral characteristics in the interpretation of this contour as either incredulous or uncertain<sup>1</sup>. They also mention that voice quality, not directly tested in their experiment<sup>2</sup>, might play a role in determining the interpretation. The fact that semantic criteria are hard to ascertain out of context, and the fact that other factors can influence the interpretation of the contours has led to the decision to place more emphasis on form and distribution in the following section, where radically different views concerning the nuclear domain are examined in more detail.

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<sup>1</sup>They claim that the difference between these interpretations is not linguistic, but rather affective, and therefore paralinguistic; if their claim is correct, the two contours can have the same phonological specification.

<sup>2</sup>They did not, for example, investigate voice-source characteristics, although they did investigate spectral features which are partially a manifestation of voice quality in its broader sense.

### **3 The domain of the nucleus**

#### **3.1 Introduction**

The question of the domain of the nucleus is the counterpart to the question of alignment of tones around the left nuclear syllable boundary. In considering the question of the placement of the nuclear boundary, other questions concerning the form of downstep and calling contours naturally arise. This section deals with such questions.

Ladd concurs with the majority of British nuclear tone approaches in his understanding of the nuclear domain. These classify nuclear tones according to the pitch movement on and after the nuclear syllable. Couper-Kuhlen (1986:80) explicitly states this:

"what the pitch of the voice does on the syllable before the prominent syllable or in order to get to the starting point for pitch movement on the prominent syllable is of no relevance in determining whether the nucleus is falling or rising".

According to this view, an onglide is merely an interpolation between a head (or prehead, or silence) and the starting point of a nuclear pitch movement.

By contrast, Pierrehumbert's nuclear pitch accent may include the specification of pitch levels in tones occurring immediately prior to the nuclear syllable. In this sense, its domain is radically different from the domain of the nuclear tone in the British school (including Kingdon) as well as from that of Ladd's nuclear pitch accent. Pierrehumbert's nuclear pitch accent may incorporate not only what Kingdon described as a homosyllabic prehead but also a prehead on any segmental string, or even part of a head.

Thus, Pierrehumbert makes distinctions which others would not describe as properly belonging to the nuclear contour.

It was pointed out in section 2 that "preceding high pitch" is accounted for by Ladd as part of a downstep contour, and by Pierrehumbert as  $H+L^*$ . We shall show that the form and distribution of these contours are identical in the examples both

authors give. That is, what for Ladd is a downstepped H tone, for Pierrehumbert is the starred L tone<sup>1</sup> of H+L\*. We shall then show that another contour exists in English (at least in British English), which (a) involves truly low pitch preceded by a peak, and (b) occurs in initial position in an utterance. We refer to this contour informally as early peak. As a result, we propose a new analysis of the pitch accent which will allow for downstep to be accounted for in an intuitively satisfying way, and distinguishes the H+L\* with true low pitch from the one with a mid pitch.

## 3.2 Downstep

### 3.2.1 Distribution

As we have seen in chapter 5, both Ladd and Pierrehumbert treat the shape:  
15.



as consisting of a downstepped H on the second part. Pierrehumbert claims that downstep is triggered by a particular tonal configuration: in earlier work, a HLH sequence incorporating at least one pitch accent (see 2.2.1 of chapter 5), and, in later work (with Mary Beckman) simply a bitonal pitch accent (see 2.2.5 of chapter 5). Ladd, on the other hand, uses the downstep feature and, in later work, a metrical tree (2.2.2 of chapter 5). The implication of the metrical tree approach is that a pitch accent can only be downstepped if it is preceded by another pitch accent.

Thus, downstep occurs on non-initial pitch accents. In both models, it is said to be iterative, i.e. all peaks after a downstepped peak undergo the effect of lowering until a phrase break is encountered.

---

<sup>1</sup>which happens to have mid pitch

### 3.2.2 Shape of downstep

The examples given in Chapter 5 of downstep, pertaining to the sequence described by Pierrehumbert (1980) as  $H^*+L\ H$  and by Ladd (1983) as  $H\ !H$ , involve two peaks which are quite close together. Had they been further apart, the shape would have been as follows (to avoid the inclusion of pitch movements due to intonation phrase peripheral tones, the contour is incomplete; the downstepped  $H$  could, in fact, be followed by another pitch accent as well as by boundary tones):

16.



$H$   
 $H^*+L$

d.s.  $H$   
 $H$

Ladd  
Pierrehumbert

There are, however, other shapes contours exhibiting downstep can take, as in the example below, also in non-final context.

17.



$H$   
 $H$

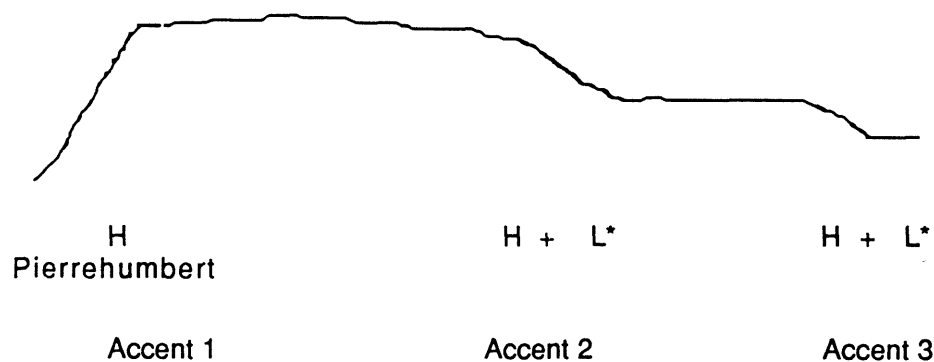
d.s.  $H$   
 $H + L^*$

Ladd  
Pierrehumbert

This contour does not contain a downstepped peak in Pierrehumbert's analysis as there is no trigger: there is neither the sequence  $H\ L\ H$  nor a bitonal pitch accent on the first peak. The drop to a mid-like level is a result of the rule used to calculate the height of  $L^*$  in a  $H+L^*$  accent. It involves multiplying the height of the previous  $H$  by a constant  $k$  ( $0 < k < 1$ ); this is the same constant as is used for calculating the height of a downstepped tone, as mentioned in section 1 above. In



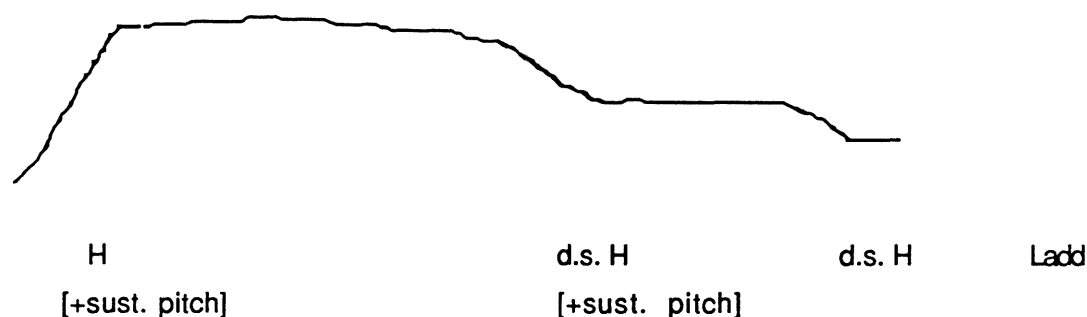
order to see the effect of actual downstep, a longer utterance is necessary, as in the following schematisation.  
18.



In this utterance, as predicted, the height above the baseline of the downstepped H is the same as that of the preceding L\*. Both are calculated by the same formula. In the sequence  $H_1 + L_1^*$   $H_2 + L_2^*$ , the pitch of  $H_2$  is calculated as  $k \cdot (\text{value of } H_1)$ ; likewise,  $L_1^*$  is  $k \cdot (\text{value of } H_1)$ .

The similarity between  $H + L^*$  when not downstepped, Accent 2, and  $H + L^*$  when downstepped, Accent 3, both in shape and scaling, is perhaps the reason why some analysts see no need for the  $H + L^*$  contour. Ladd proposes that the  $L^*$  in  $H + L^*$  could be reanalysed as a downstepped H preceded by a high pitch which has spread from a previous H. For this, he relies on the feature [+sustained pitch] which is a property of the first two tones of the following:

19.



The above shape occurs on the string (stars indicate accented syllables):

\* \* \*

"There are many intermediate levels"

It is the first of four examples of downstepped contours, originally analysed by Pierrehumbert (1980) as follows:

20.

(i)	H*	H+L*	<u>H+L*</u>	L L%
(ii)	H*+L	<u>H*+L</u>	<u>H*(+L<sup>1</sup>)</u>	L L%
(iii)	L*+H	<u>L*+H</u>	<u>L*+H</u>	L L%
(iv)	L+H*	<u>L+H*</u>	<u>L+H*</u>	L L%

Pitch accents which have undergone downstep are underlined. The only example in what Ladd refers to as the "family of contours" which does not have a downstepped pitch accent in second position is the first. It is also the only example which does not contain a sequence of like pitch accents (see footnote 1).

Ladd (1983a) proposes a more elegant analysis, analysing them as:

21.

(i)	H [+s.p.]	<u>HL</u> [+s.p.]	<u>HL</u>	(L%) <sup>2</sup>
(ii)	H	<u>HL</u>	<u>HL</u>	(L%)
(iii)	HL [+d.p.]	<u>HL</u> [+d.p.]	<u>HL</u> [+d.p.]	(L%)
(iv)	(L%) HL	<u>HL</u>	<u>HL</u>	(L%)

---

<sup>1</sup>Pierrehumbert proposed H\* here rather than H\*+L. However, in a final pitch accent, the opposition between H\* and H\*+L is neutralised; the trailing L is never realised as a trough, it merely acts to trigger downstep on a following tone.

<sup>2</sup>Boundary tones are in parenthesis because Ladd is sceptical about their status.

Here, the second and third peaks in all of the contours are downstepped; this is what Ladd claims the four contours mainly have in common. Examples (iii) and (iv) contain a sequence of like pitch accents (in terms of all features other than downstep). Examples (i) and (ii) do not: they contain two like tones, followed by one different tone.

Another set of contours which, according to Beckman and Pierrehumbert (1986) involve downstep (which they call catathesis) is considered below.

### 3.2.2.1 Calling contours

Beckman and Pierrehumbert (1986) refer to three calling contour types, all involving a step-down in pitch from high to mid:

The first is what is traditionally referred to as the calling contour (see Johnson and Grice:1990 for a review of these contour types). It simply involves a step down from high on the stressed syllable to a mid pitch (usually on the next strong syllable, if there is one) as in:

22.

(i) An<sub>na</sub>                      or              Aber<sub>nath</sub>y

The second, not discussed in Pierrehumbert (1980), has a "wheedling" quality (1986:278):

(ii) Ma<sup>ri</sup>anna

The third involves a low pitch before the high-mid step down:

(iii) Mari<sup>an</sup>na              or              A<sup>n</sup>na

Their analysis of these contours is as follows (downstepped tone is underlined):

23.

(i) H\*+L H L%

(ii) L\* H+L\* H L%

(iii) L+H\* H L%

Downstep occurs on all of the H phrase accents. However, whereas in (i) and (iii) the stepped down (mid) part of the contour is determined by a downstepped H tone, in (ii), it is the L\* in the H+L\* pitch accent which is responsible for (at least the

first part of) the mid pitch. This means that these contours are formally different in the sense that the mid pitch is underlyingly represented by a H tone in two cases and by a L tone (plus a H tone) in another.

Ladd's (1983) model would yield the following analysis of the above contours:

24.

(i)            H - -    L - -  
                              [-floor]

(ii)            LH        L - -  
                              [-floor]

(iii) L%        H - -    L - -  
                              [-floor]

We shall propose an alternative to Pierrehumbert's and Ladd's analysis of the four related downstepped contours and the three related calling contours in section 4; but first we turn to the contour with preceding high pitch which can occur in initial position, which will serve as additional motivation for our alternative analysis. This contour will be referred to as the "early peak" contour.

### 3.3 The early peak contour

American and British English may have similar inventories of intonation contours but it is doubtful whether they have exactly the same semantic interpretation for all of these contours. In the interests of accuracy of interpretation, the following examples refer to British English, the native language of the author.

An argument for referring to at least one unstressed syllable before the nuclear syllable could be put forward in the case of the three following utterances:

Context: "We go all the way to Sicily, having planned months in advance to get a decent warm break, and when we get there, what's the weather like?"

25

a) <sup>a</sup>bysmaɪ    b) Absolutely <sup>a</sup>bysmaɪ    c) It's <sup>a</sup>bysmaɪ

In all three cases, the pitch of the prenuclear syllable is high with respect to that of the nuclear syllable. A British-style analysis would involve the following descriptions: a) high prehead, low falling nucleus, and b) rising head, low falling nucleus. Example c) is problematic in that it would require the prehead to be

described as rising, a category not hitherto used, or as high, ignoring the rising pitch movement.

What is common to all three is a high pitch just before the nuclear syllable. On semantic grounds, one might expect the above examples to be distinguished from the following set where the high pitch is on the nuclear syllable rather than before it:

25'

a') <sup>aby</sup> <sub>smal</sub>    b') Absolutely <sup>aby</sup> <sub>smal</sub>    c') It's <sup>aby</sup> <sub>smal</sub>

In fact, within the British approach, the two sets are distinguished: the first has low falls and the second high falls. The high versus low distinction can refer to position within a speaker's range (O'Connor and Arnold) or in relation to a previous pitch (Crystal, Cruttenden). However, the prenuclear contour of example (c) cannot be described in any of these systems.

The problem in the above analysis of example (c) arises because there is no accent on the first word "it's". If it were accented, then the prenuclear stretch would involve a rising head.

Another contour which would be unanalysable in the same way as (c) is the following:

Context:        A neighbour keeps asking you where you are going. You try to ignore the question but they insist. You reply:

(d)    To <sup>the</sup> market.

In the case of (d), "to the", if pronounced with reduced vowels, cannot carry a pitch accent. As in example (c), the boundary tone would have to be low, so there would be no way of accounting for the high pitch within the British framework.

A contour which has the possibility of two accents involves the following:

18.

Context: A fellow student who is conversant with Abercrombie's work asks you who to attribute a certain quote to. You know they should know the answer, so you reply:

(e) Ab<sup>er</sup>crombie said it.

where there may be an accent on the syllable bearing secondary stress "Ab" of "Abercrombie", as well as on the main stress "crom"<sup>1</sup>. If contours (d) and (e) are semantically similar, it would follow that they ought to have a similar representation. We shall return to this below.

In Pierrehumbert's system, H+L\* would not be appropriate for the description of any of the contours, as the L\* in H+L\* falls to a level well above the baseline. Instead, all of the contours described in this section have low rather than mid pitch. The singleton L\* would have to be used to describe the low pitch. In Ladd's system, a single L tone is also used to account for the low pitch. The early peak contours presented so far would be analysed in Pierrehumbert's and Ladd's systems as follows: (phrase-peripheral tones are omitted):

26.

	contour	Pierrehumbert	Ladd
a)	a <sup>a</sup> bysmaI	H% L*	H% L
b)	Absolutely a <sup>a</sup> bysmaI	L*+H L*	LH L
c)	It's a <sup>a</sup> bysmaI	no analysis	no analysis
d)	To <sup>the</sup> market	no analysis	no analysis
e)	Ab <sup>er</sup> crombie said it	L*+H L*	LH L

---

<sup>1</sup> The pitch falls to a slightly lower pitch at the end of the utterance, but is not falling during the syllable "crom", and does not even have to fall immediately after it.

Likewise, there are difficulties in analysing the contour described in 2.2.2, which has a final rise rather than a slight fall.

(g) the cost of the enterprise,

The peak in on "cal" in (f) could be accounted for as part of a bitonal pitch accent associated with a previous syllable "ast": L\*+H (Pierrehumbert) and LH (Ladd). In (g) the peak on "the" can be described as a H% boundary tone. The problematic case is (h), in the same way as (c) and (d) are problematic.

#### 4 Alternative pitch accent analysis

**(1)** points to the necessity for a low L tone in H+L\*.

and (b) it consists of a sequence of different pitch accents, whereas the other contours have like pitch accents.

(3) shows that there is an inconsistency in the treatment of the three related stepping down calling contours,

(4) shows that their analysis does not distinguish leading and trailing tones in terms of their status within the pitch accent theory, although a number of established accounts discount leading tones altogether.

The alternative theory, presented below, aims to deal with all of the above problems.

#### 4.1 Truly low L tone in H+L\*

The alternative account proposes a similar scaling for L\* tones, whether they are in a monotonal pitch accent (L\*) or part of a bitonal accent (H-L\*, L\*+H)<sup>1</sup>.

#### 4.2 Downstep

It is proposed to account for the first of the four downstepped contours as

H-H\* H-H\* H-H\* L L%

As in Beckman and Pierrehumbert (1986), any bitonal pitch accent can be a downstep trigger; it triggers downstep in the following pitch accent or phrase accent. A slight modification is required so that only the second tone of a bitonal downstepped pitch accent can undergo lowering<sup>2</sup>. Since downstep is iterative, all tones after the lowered tone are affected in their scaling. The new inventory proposed involves a new pitch accent H-H\* (but see section 6.2 on neutralisation for a suggestion as to how H-H\* might actually be realised.). The analysis corresponds to the F0 contour in the following way:

---

<sup>1</sup>A hyphen (-) is used to link a leading tone with a starred tone, and a plus sign (+) is used for starred tones and trailing tones. This notational convention will be motivated later.

<sup>2</sup>It has been established that downstep can involve language specific stipulations. For instance, Japanese requires the stipulation that the second tone of the triggering pitch accent undergo lowering (Pierrehumbert and Beckman:1988).



27.



L%	H - H*	H - H*	H - H*
P.A.	1	2	3

In P.A. 1, the value of H is the same as that of H\*. In P.A. 2, H does not undergo downstep but H\* does. In P.A. 3, the scaling of H is affected by the downstep which the previous P.A. has undergone - an example of the effect of downstep on the scaling of previous tones. H\* in this last pitch accent undergoes downstep itself, triggered by the bitonal pitch accent in second position.

The new analysis allows for a consistent account of downstep, as follows:

28.

(i)	H - H*	<u>H - H*</u>	<u>H - H*</u>	L L%
(ii)	H* + L	<u>H* + L</u>	<u>H* + L</u>	L L%
(iii)	L* + H	<u>L* + H</u>	<u>L* + H</u>	L L%
(iv)	L - H*	<u>L - H*</u>	<u>L - H*</u>	L L%

All four examples involve downstep in second and third position (i.e. in all but initial position), and each has a sequence of three like pitch accents in the phonological representation.

### 4.3 Calling contours

In the proposed analysis, all three calling contours can be analysed as having a downstepped tone: either a phrase accent or pitch accent tone; as in the above examples, downstep is indicated with underscore.

29.

(i)  $An_{na}$

$H - H^* \underline{H} L\%$

or  $H^*+L \underline{H} L\%$  (H-H\* and H\*+L are neutralised in initial position,  
just as H\* and H\*+L are in final position -see section  
6.2 below)

(ii)  $Ma^{ri}anna$

$L^* +H \underline{H^*} H L\%$

(iii)  $Mari^{an}na$

$L - H^* \underline{H} L\%$

The only  $L^*$  in the above analyses signals a truly low pitch; this is on the first syllable of Marianna in (ii).

The upstep rule proposed by Pierrehumbert (1980) which raises a  $L\%$  after a phrase accent is retained in this exposition, although the elimination of boundary tones in such examples, as discussed in Bing (1979) and in Ladd (1980) is not ruled out as a possible analysis.

### **Merits and demerits of the new analysis so far**

The advantages are:

- $L^*$  in  $H+L^*$  is not of the same form as  $H^*$  which has been downstepped.
- The account of the four downstepped contours is more homogeneous.
- The account of the three stylised contours is more homogeneous.

The disadvantages are:

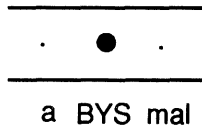
- The introduction of a new pitch accent:  $H-H^*$ , increasing the inventory, which still includes Pierrehumbert's  $H^*$ ,  $L^*$ ,  $L^*+H$ ,  $L+H^*$ ,  $H^*+L$  and  $H+L^*$ .
- There is no principled way of ruling out a further three pitch accents,  $L-L^*$ ,  $H^*+H$  and  $L^*+L$ , although no use has been suggested for them.
- Problem (4) has not been solved.

It is proposed in the following section to deal with problem 4, as well as the other two apparent disadvantages by introducing more structure into the pitch accent.

#### 4.4 Leading and trailing tones – their differing status

Let us take the word aBYSmal. It could be represented

30.



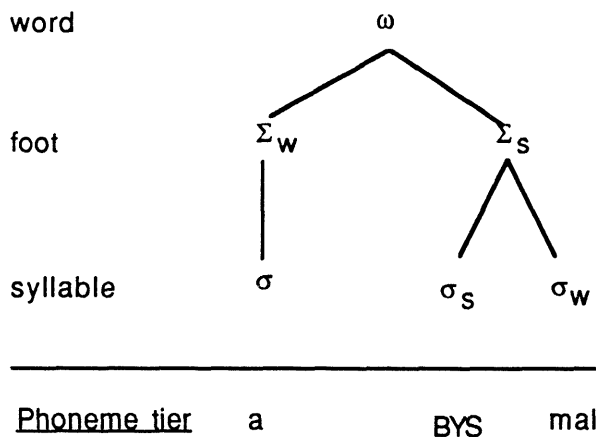
where the large dot indicates a stressed syllable and the small dots unstressed syllables. In some traditional analyses, the above word can be analysed into two feet. Abercrombie (1964:217) defines the foot in English as starting with "a stress and contain[ing] everything that follows that stress up to, but not including the next stress". The most important foot in the above word begins with the "stress" (strong syllable) 'BYS' and extends over the following unstressed syllable 'mal'. The initial syllable is viewed as belonging to another foot which has a silent stress and a 'following' weak syllable. What is clear from the above analysis is that the first syllable belongs to a foot with a different status from the second two syllables. If we consider the stress-pulse to be the head of the constituent, there is a possible alternative interpretation of the two feet; the second is a constituent with a head and the first is without a head. Such an analysis accords higher status to the second foot, given that it is the only one with a head.

Within the prosodic phonology framework, an example of an analysis which roughly corresponds to this latter interpretation is that of Nespor and Vogel (1986)<sup>1</sup>. They would analyse 'aBYSmal' as a prosodic word consisting of two feet. They represent the prosodic word as follows:

---

<sup>1</sup>Nespor and Vogel's analysis might be seen as closer to Jassem (1952) and Jassem, Hill and Witten (1984) who propose rhythmic units which roughly correspond to the prosodic word. According to Jassem et al, a stress-pulse in one word cannot be grouped together with following unstressed syllables if they are in a different word (defined to include clitics). This is also the case for Nespor and Vogel.

31

Prosodic tier

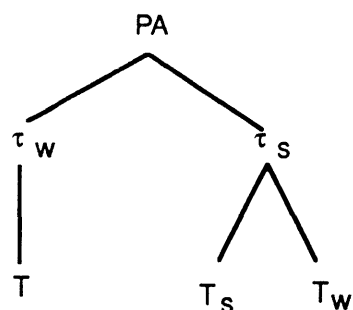
The main part of the prosodic word is the part under  $\Sigma_s$ ; this dominates two syllables, a strong one to the left (BYS) and a weaker one to the right (mal). The strong syllable is the head of the strong foot. It is thus the designated terminal element of the prosodic word. Before the strong foot is a degenerate foot, so called because it contains no head; this foot has only one syllable: 'a'.

Now, the Pitch Accent could be seen to have an analogous structure. In the analogy, the Pitch Accent node is equivalent to the prosodic word node. This dominates two nodes: a strong one and a weak one. Let us call these two nodes supertone nodes, which we represent as  $\tau$ . The strong  $\tau$  node ( $\tau_s$ ) dominates the main part of the PA which must have a head (a strong node) and can optionally have another weak node. Let us call these nodes tone nodes, which we represent as  $T_s$  and or  $T_w$ . The weak  $\tau$  node, which can be considered degenerate because it has no head, dominates a T which has no strength value. Below is a tree representing these analogies<sup>1</sup>:

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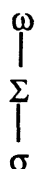
<sup>1</sup>A branching Pitch Accent structure has also been proposed by House (forthcoming) for the analysis of English stylised contours, although there are differences between the type of tree she employs and the one proposed here; her tree allows for recursion in line with Ladd's ideas on recursive prosodic structure, whereas the analysis proposed here adheres to Selkirk's strict layer hypothesis (to be discussed in more detail below).

32.



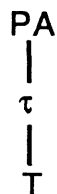
There are three factors which make the structures similar: (i) Not all nodes have to be filled; (ii) just as  $\Sigma_s$  dominates the most important part of the prosodic word, so the  $\tau_s$  node dominates the most important part of the Pitch Accent; and (iii) just as the minimal prosodic word is as follows:

33.



so the minimal Pitch Accent is:

34.

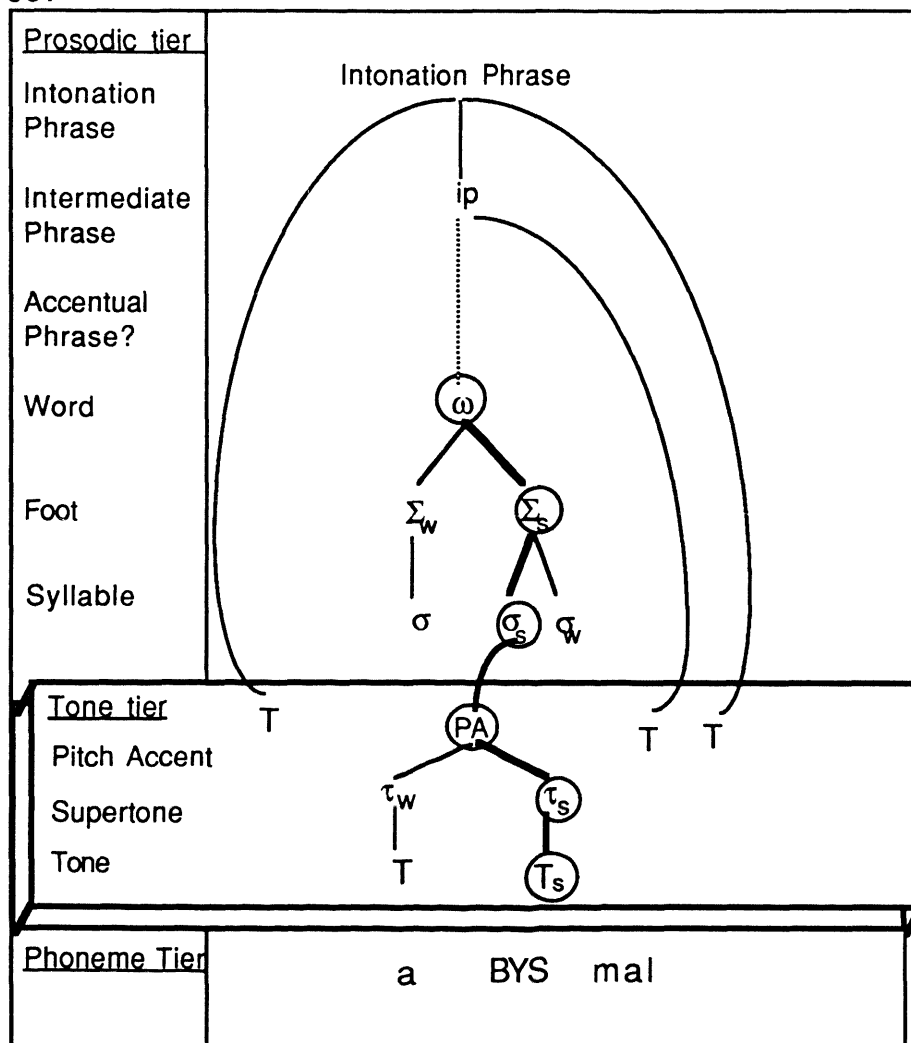


The strong T node is the designated terminal element of the Pitch Accent; it is the starred tone. According to Pierrehumbert and Beckman (1988), this tone aligns with the starred syllable (according to the above representation, this is the designated terminal element of the prosodic word).

It is important to clarify at this point that what is being proposed is a Pitch Accent node in the tone tier which has a hierarchical structure with two layers below the PA: the supertone ( $\tau$ ) and the tone (T). The association between the prosodic and tone tiers involves central association, as detailed in chapter 5. The following tree is a representation of how the two tiers are associated; the example utterance is "abysmal" with a H-L\* pitch accent but the representation is also valid for a L-H\*

Pitch Accent. In this case the PA branches but the strong supertone ( $\tau$ ) node does not:

35.



The bold lines trace the central association down the tree from the prosodic word node to the designated terminal element of that node ( $\sigma_s$ ). The relevant strong nodes are encircled. The association line spanning the prosodic and tone tiers links this syllable to the Pitch Accent node; the association then travels down the strong branches until it reaches the designated terminal element of the Pitch Accent ( $T_s$ ). It should be emphasised that the analogy between the PA and  $\omega$  structures does not imply a direct mapping between the two along the lines of Liberman (1975).

The PA structure proposed is compatible with the approach of Pierrehumbert and Beckman (1988), as it obeys the tenets of Selkirk's Strict Layer Hypothesis

(Selkirk:1984), reformulated by Nespor and Vogel (1986:7) as Principles 1 and 2:

Principle 1. A given nonterminal unit of the prosodic hierarchy,  $X_p$ , is composed of one or more units of the immediately lower category.

Principle 2. A unit of a given level of the hierarchy is exhaustively contained in the superordinate unit of which it is part.

Nespor and Vogel add two further principles:

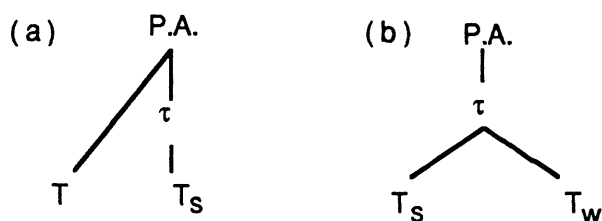
Principle 3. The hierarchical structures of prosodic phonology are n-ary branching.

Principle 4. The relative prominence relation defined for sister nodes is such that one node is assigned the value strong (s) and all other nodes are assigned the value weak (w).

All four principles are adhered to in the proposed modification to the Pitch Accent structure.

If Nespor and Vogel's principle 2 were violated, allowing for extra-metricity, the weak supertone node,  $\tau_w$ , would not be necessary. In this case, Pitch Accents would be represented as either (a) for T-T\* cases, or (b) for T\*+T cases:

36.

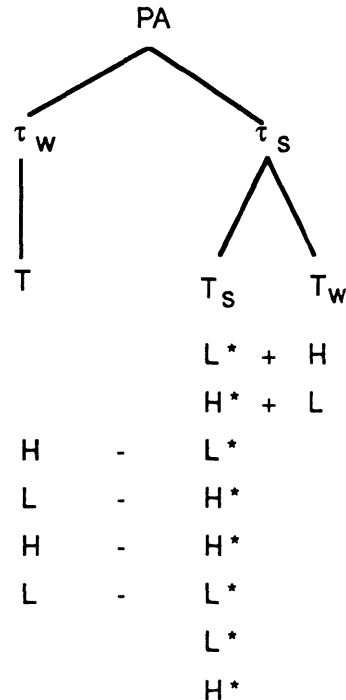


It is preferred, here, to adhere to all four of Nespor and Vogel's principles, although it is acknowledged that extrametricality (as, in principle, allowed for by Pierrehumbert and Beckman) would lead to an equivalent analysis in most respects.

## 5 Representation of English Pitch Accents with the enriched structure

The eight pitch accents are represented within the enriched Pitch Accent structure as follows:

37.



A hyphen (-) is used to indicate that the tones are not dominated by the same  $\tau$ , and a plus sign (+) to indicate that they are.

In the pitch accent for English, the minimal representation is a strong supertone ( $\tau$ ) node and a strong tone (T) node. If the supertone is branching, it is always left-headed.

The above Pitch Accent structure has three slots in which a tone T may occur. However, it is proposed that all three slots are never filled in the same pitch accent; instead it is stipulated that, for English, either the PA node branches or the  $\tau_s$  node branches.

Such a stipulation can be incorporated into a system in a less ad hoc way if use is made of licensing principles from a theory such as Government Phonology (Kaye, Lowenstamm and Vergnaud:1990). Applied to the PA node, the strong item ( $T_s$ ) can



license adjacent slots from left to right or from right to left, but not both. This means that Ts can be preceded or followed by a T, but it cannot be preceded and followed by a T<sup>1</sup>.

Just as Nespor and Vogel's four principles have been seen to be observed at the end of the last section, so another important principle is observed by this analysis. This is the Obligatory Contour Principle, which rules out adjacent like tones. It has been shown to apply to different languages in more or less restricted ways.

Here, as far as the proposed account of English is concerned, it only applies to sister tones (i.e. tones within the same immediately superior domain). This means that H - H\* and L - L\* are not ruled out because they are not in the same  $\tau$  domain. On the other hand, H\*+H and L\*+L are ruled out because they are sister nodes under  $\tau_S$ .

If the above principles are all adhered to, then only the eight pitch accents in the inventory are generated.

## **6 Validation of the new pitch accent inventory and structure**

A reanalysis of Beckman and Pierrehumbert's contours, referred to in (1986) (English examples only) is given below. Where the analysis differs from that of Beckman and Pierrehumbert, this will be indicated by  $\Delta$ . The original figures, with Beckman and Pierrehumbert's numbering (as below), are reproduced in Appendix 1. In the proposed analysis, T<sup>b</sup> is the intermediate phrase boundary and T<sup>B</sup> the intonation phrase boundary. These symbols are used to aid the reader in distinguishing between the two types of boundary tone and trailing and leading tones of Pitch Accents.

---

<sup>1</sup>Suppose that the order of Ts and Tw could be switched, then a bitonal pitch accent would still be maximal according to the above principles: T<sub>S</sub> would only be able to license the T adjacent to it, and not the other. This is, however, a hypothetical situation, as there is no evidence in English for a switch of strong weak ordering.

Figure 1		H*	H*	L <sup>b</sup> L <sup>b</sup> B			
		H*+L	H*	L <sup>b</sup> L <sup>b</sup> B			
		L*	H*	L <sup>b</sup> L <sup>b</sup> B			
Figure 2		L*	H*	L <sup>b</sup> L <sup>b</sup> B			
		L*	H*	L <sup>b</sup> L <sup>b</sup> B			
	Δ	L - L*	H - H*	L <sup>b</sup> L <sup>b</sup> B			
	Δ	L - L*	H - H*	L <sup>b</sup> L <sup>b</sup> B			
Figure 10		L*	H*+L	H <sup>b</sup> L <sup>b</sup> B			
Figure 11		H*+L	H*+L	H*+L	H*+L	H*+L	L <sup>b</sup> L <sup>b</sup> B
Figure 14	Δ	L*+H	H - H*	L <sup>b</sup> L <sup>b</sup> B			
Figure 15		H*+L	H <sup>b</sup> L <sup>b</sup> B				
	Δ	L - L*	H - H*	H <sup>b</sup> L <sup>b</sup> B			
		L - H*	H <sup>b</sup> L <sup>b</sup> B				
		L - H*	H <sup>b</sup> L <sup>b</sup> B				
		L - H*	H <sup>b</sup> L <sup>b</sup> B				
Figure 16		L*+H	L <sup>b</sup> H <sup>b</sup> B				
		L*+H	L <sup>b</sup> H <sup>b</sup> B				
Figure 22		H*	L <sup>b</sup>	H*	L <sup>b</sup> L <sup>b</sup> B		
		H*	H*	L <sup>b</sup> L <sup>b</sup> B			
Figure 23		L*	H <sup>b</sup>	L*	H <sup>b</sup>	L*	H <sup>b</sup> H <sup>b</sup> B
Figure 24		H*	L <sup>b</sup>	H*	L <sup>b</sup>	H*	L <sup>b</sup> L <sup>b</sup> B

As can be seen, the account does not diverge greatly from Beckman and Pierrehumbert's. Differences include the following:

### 6.1 L-L\* Pitch Accent

In figure 2 (c) and (d), the analysis is as follows:

I really don't allow Marianna

L-L\*                      H-H\* L<sup>b</sup>L<sup>B</sup>

Beckman and Pierrehumbert had proposed H+L\* as the second Pitch Accent. This accent cannot be employed here, since the proposed model requires L\* to fall to a low pitch early in the stressed syllable. As mentioned earlier in section 2.2.2, there is a difference between a peak followed by a low pitch and one followed by a mid (downstepping) pitch. The examples referred to above, which have a H intonation phrase boundary tone rather than a L, are repeated below:

(a)

astronomical cost of the enterprise                      (is a bar to our plans)

L\*                      H+L\* L                      H%                      (Beckman and Pierrehumbert)

L-L\*                      H-H\* L<sup>b</sup>                      H<sup>B</sup>                      (proposed model)

(b)

astronomical cost of the enterprise                      (the difficulties in finding a good location, and the current economic climate, are all prohibitive)

L\* (+H?)                      L\* L                      H%                      (Beckman and Pierrehumbert)

L\*                      H-L\* L<sup>b</sup>                      H<sup>B</sup>                      (Proposed model)<sup>1</sup>

---

<sup>1</sup> The first Pitch Accent could be L\* or L-L\*; it is difficult to tell whether L\* of the following H+L\* Pitch Accent is downstepped or not, also see 6.2.

## 6.2 Neutralisation

In initial position and after a singleton accent (which does not trigger downstep), the distinction between  $H^*+L$  and  $H-H^*$  is neutralised; in this context, both have the effect of triggering downstep on the following accent and both involve a single peak. There is neutralisation in Beckman and Pierrehumbert's theory too, in the case of final  $H^*$  and  $H^*+L$  (since the only function of the  $L$  in  $H^*+L$  is to trigger downstep). This is also the case in the proposed model. Thus, in certain cases,  $H^*$ ,  $H^*+L$  and  $H-H^*$  are all neutralised (in final position after a singleton accent or in a single accented utterance where the final pitch accent is also the first).

In final position, the Pitch Accents  $L-L^*$  and  $L^*$  are also neutralised.

Neutralisation of  $L-L^*$  and  $H-H^*$  can best be illustrated with reference to Pierrehumbert and Beckman's type of phonetic implementation, a illustration of which is reproduced in appendix 1 as figure 7.1 (1988:177). Leading tones, having no direct association to a syllable, are initially represented as points, whereas starred tones are represented as horizontal lines (i.e. with a given duration). These points and the ends of the lines are interpolated. After a few minor adjustments, the whole shape is filtered. The  $L$  or  $H$  points (if they are from a  $L-L^*$  or a  $H-H^*$  Pitch Accent) are so close to the  $L^*$  or  $H^*$  lines, that they are effectively filtered out

## 6.3 Downstep in only the second tone of a bitonal pitch accent - implications

The fact that in the proposed model only the second tone of a bitonal pitch accent is downstepped, means that the second peak, or shoulder, between "Ma" and "ri" in 38.

I rea<sup>lly</sup> d<sup>on't</sup> believe Ma<sup>ri</sup>a<sup>n</sup>na

cannot be downstepped, as it is the result of alignment with the first tone of a bitonal Pitch Accent. A more familiar example to British ears would be:

39 (i)

I rea<sup>lly</sup> d<sup>on't</sup> see the di<sup>f</sup>ference  
 $L^*+H$                    $H-H^*$        $L L\%$

which could quite reasonably have the alternative pronunciation:

(ii)

I really don't see the difference  
 L\*+H                  H-H\*    L L%

The observation that the peak (or shoulder) in the second Pitch Accent in Beckman and Pierrehumbert's example (fig 14) does not necessarily have to be lower than the first was made for independent reasons by Carlos Gussenhoven (p.c.).

#### 6.4 Validation - conclusion

To conclude, the proposed analysis accounts for downstep and calling contours in a coherent way. It can account adequately for Beckman and Pierrehumbert's (1986) contours, although it fails to account for downstep in a particular case where it is maintained to exist. Independent work (Gussenhoven, p.c.) had questioned the existence of catathesis in this case, however. It also distinguishes two contours which have been distinguished independently (Hayes, p.c. to Gussenhoven) and which can also be distinguished in a British-style analysis: a high (pre)head + low fall-rise and a high (pre)head + low rise.

### 7 Conclusion

Kingdon's two types of delay, (A) involving the delay of the pitch peak alone, and (B) involving the delay of the onset of the nuclear tone have been the starting point of the discussion of the nuclear domain.

The first (A) occurs in complex tones; it is accounted for in later work within the British school in the same way. Ladd employs a feature [+delayed peak] applied to a H tone to account for it, and Pierrehumbert a starred L tone followed by a peak (H tone). In descriptions of English, this type of delay refers only to the delay of a pitch peak, i.e. a H tone; it is not usually applied to L tones (except Gussenhoven:1983).

The second type of delay (B) involves a delay in the onset of the concomitants of stress, including the pitch peak. What is characterised as a distinctive prehead tune, usually occurring on the unstressed syllable(s) prior to the nuclear syllable, can, in the absence of such syllables, actually occur on the nuclear syllable itself. Prehead tunes involved in such a process may be high or low. If we take an example

of a high prehead followed by a low tone, we are in a certain sense discussing the anticipation of a peak, rather than its delay. Of course, the current British-style analyses allow for preheads to be contrastive, but they do not consider the tune to be present if there are no prehead syllables. Thus, the examples (section 1.2, examples 2(bi) and (bii)) showing "Lee" and "to Lee" to have the same intonational specification, are counter to the strict componentiality principle employed within the British school and discussed in detail in chapter 2. Ladd's analysis has much in common with the British school in this respect; for him, the nuclear tone begins on the nuclear syllable, and anything prior to that does not belong to the nuclear domain.

Pierrehumbert's analysis, allowing for leading tones in a bitonal pitch accent, incorporates tonal phenomena immediately prior to the nuclear syllable into the nuclear domain - into the nuclear pitch accent. However, it is debatable whether, in an account of English, the nuclear domain should be extended to the left. Examples have been given where current analyses cannot account for certain prenuclear material without appealing to leading tones. However, the semantic impact of a leading tone does not appear to be as great as that of a trailing tone. Kingdon's example will serve to illustrate this:

40.

(a) to  $L_e^e$       (b)  $L_e^e$       (c)  $L_e^e$       (d) to  $L_e^e e$

These would be analysed by Kingdon as follows:

- (a) low prehead + high fall
- (b) low prehead + high fall
- (c)                      high fall
- (d) low prehead + high fall rise

Kingdon classifies (a) and (b) in exactly the same way; (c) has a different classification, but still the same nuclear tone. In terms of the intonation pattern, the semantic distance between (a) and (b) is negligible, that between (a) or (b) and (c) is greater, but greatest of all is that between (a) or (b) and (d). This is because, in English, what happens before the nuclear tone is less important than what happens during or after it.

An approach has been proposed here which incorporates a leftwards extending Pitch Accent, but making this extension a proclitic element. This model has been

motivated for the analysis of English. In the next chapter, we shall investigate whether or not a similar Pitch Accent structure is appropriate for the description of Palermo Italian. But, first, we shall present the detail of Palermo Italian intonation, especially regarding the alignment of peaks and troughs with the segmental and rhythmic structure of the tokens under investigation. This will be done in the first part of chapter 7. Only then will the difference in alignment of Pitch Accents in English and Palermo Italian become clear, and further motivation for the enriched Pitch Accent structure presented here be evident.

## **Chapter 7: Reanalysis of interrogative intonation in Palermo Italian**

### **1 Precursors to the analysis**

In the previous two chapters, a number of points have been discussed which have a bearing on the analysis of Palermo Italian intonation to be advanced in this chapter. Each of these points can be shown to be corroborated by the ways in which they contribute to the description of this language variety.

Goldsmith analyses intonation contours into a series of level tones. Bruce represents tones in the phonology as turning points in the F<sub>0</sub> contour, either High (maxima) or Low (minima). Pairs of points function as word accents, the first or second of which is aligned with the stressed syllable of the word, whilst the other occurs at a reasonably set distance from it. In Stockholm Swedish, one point has no connection to word accents; it occurs near the end of a highlighted constituent. This is the sentence accent or phrase accent. Pierrehumbert takes the level tones, their relation to the F<sub>0</sub> contour, the concept of bitonal accents with differing alignment specifications, and the phrase accent, and sets up a system for the description of English. She is able to account for all English contours using a small set of primitives. Her major achievement is that there is a paradigmatic H/L contrast in all of the structural positions she posits (pitch accents - monotonal and bitonal - phrase accent and boundary tone), and these positions are, for the most part, filled (any exceptions being accounted for in a principled way). Like Bruce, in bitonal accents, the "starred" syllable may occur in second as well as first position; this means that a pitch accent tone may occur before the stressed (or nuclear) syllable.

The association of tones with a hierarchical structure, rather than a flat string, has been investigated, for instance, by Liberman (1975) who had tone and text trees matched by well-formedness conditions and by Hirst (1983) who proposed a single multidimensional tree. Pierrehumbert and Beckman (1988) also introduce a hierarchical representation into their analysis, providing a formal account of a single prosodic tree and permissible types of association to its nodes. The phrase accent and boundary tone are reintroduced as domain-peripheral tones of the intermediate phrase and intonation phrase.

Finally, cases of tones being neither fully realised nor deleted, which were first dealt with by Leben (1976), have been elegantly accounted for by Pierrehumbert



and Beckman (1988), who produce an analysis involving the concept of secondary attachment.

## **2 Implications for the analysis of Palermo Italian**

The pitch accent theories described in chapters 5 and 6 rely on instrumental data for their corroboration. In keeping with this methodology, a new corpus was designed with the aim of

- i) collecting a number of utterances which, functionally, differ solely in their intonation contour
- ii) eliciting renditions which are as natural-sounding as possible
- iii) making recordings of sufficient quality for them to be digitised, for their fundamental frequency to be estimated, and for analysis and resynthesis to be performed on a selection of them.

Recordings were made in two varieties of Sicilian Italian: that of Palermo and that of Catania<sup>1</sup>. Corpus details will be presented in the following sections.

### **2.1 Type of utterance needed**

There was a need to include in the corpus non-interrogative utterances with which to compare the interrogatives. In order to make this comparison, not only the segmental string but also the items highlighted had to be identical; such control can best be exercised if the tokens are read aloud from a prompt text.

A number of yes-no question and statement pairs, differing only in their intonation, were prepared for use in a reading exercise. These were supplemented by a number of non-final clauses with the same segmental content, again differing only in their intonation contour. For example, the string 'Glielo porta domani' was included in the corpus as a yes-no question (Will he bring it to her tomorrow?), as a simple statement (He will bring it to her tomorrow.) and as a non-final clause in a more complex statement as follows: "Glielo porta domani, dopo domani e la settimana prossima." (He will bring it to her tomorrow, the day after and next week.). Punctuation was used as an indicator of utterance type. This design of materials satisfied aim (i) mentioned under 2 above.

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<sup>1</sup>The Catania data were collected for comparative purposes and have been reported on in Grice (1991).

Highlighting was controlled by preceding each token to be read aloud with a context indirectly indicating not only the target speech act<sup>1</sup> (interrogative/declarative) but also the word to be highlighted. Highlighted words had final, penultimate and antepenultimate stress, allowing for both reduced and full accentual patterns to be realised. These were positioned both early and late in the utterances, which cases are referred to respectively as early and late focus<sup>2</sup>.

All of the tokens were based on utterances excised from recordings of spontaneous speech in either free conversation or a game situation by speakers of the same regional variety. This strategy was directed towards aim (ii) under 2 above (which will be further considered in 2.2 below). The style of Italian used reflected the style in which most of the informants themselves had spoken in earlier pilot recordings.

## **2.2 Elicitation method**

Obtaining natural-sounding intonation, especially from naive informants, is a difficult task. The elicitation method is therefore worth mentioning here.

A typical recording session included a brief conversation between the informant and another native speaker, followed by a "20 questions"-type game (described in chapter 3) where the speakers took it in turns to ask questions. At a certain point in the game, the person answering questions was allowed to sum up the information passed on up to that point. This procedure ensured that a number of spontaneously occurring questions and statements would be produced. Finally, the informant was asked to read aloud the sets of sentences described in the prompt text described below in section 2.3.

Recordings were made in an informal context, in the home of one of the informants. A small cassette recorder with a lapel microphone was used. Subjects had the

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<sup>1</sup>In Searle (1969), speech acts refer to speaker's intentions. The context instructs the subject to simulate a number of intentions, such as to seek or give information, seek confirmation etc.

<sup>2</sup>Here the term focus indicates the intention on the part of the speaker to highlight an item (cf Gussenhoven:1983) in response to a set of instructions in the written context. It does not refer to the way this highlighting is achieved, which would presuppose an a priori theoretical analysis of the intonation patterns.

freedom to sit and move as they wished. In an earlier pilot study where a mounted directional microphone was used, subjects had complained that the microphone inhibited their movement. They felt that if they were unable to gesticulate, they would be unable to produce natural-sounding speech. Consequently, in the main recordings, a lapel microphone was used, since it does not have these disadvantages.

Subjects were allowed to repeat a token if they felt that they had produced an utterance which (a) sounded unnatural or (b) did not simulate the desired effect indicated in the instructions in the prompt text described in 2.3 below.

### **2.3 Sentence material**

The prompt text contained a list of question and statement pairs which was randomised. Most items to be read aloud were preceded by a context providing information about the type of speech act to be simulated in the reading and about the word or words to be highlighted. These were intended to guide the reader to a particular reading of each item. The intention was to provide as homogeneous a corpus as possible.

Below is an illustration of some of the items included in the prompt text and the type of context provided (here underlining is used to indicate syntactic constituents):

( a )

translation of context

(We know that someone has told him/her but you want to specify who it was)

token to be read aloud

**Gliele'hai detto tu.**

syntactic analysis

Oi Od V S (Oi=indirect object, Od=direct object, V=verb, S=subject)

literal translation

to him/her it have said you

translation

You said it to him/her.

comments

Since the subject 'tu' is postposed, and therefore in a marked position it is usually highlighted. This is in accordance with a general tendency to place highlighted material at the end of the sentence. This is reinforced by the context which indicates that 'you' should be the focus of the sentence.

( b )

translation of context

(We have been speaking about a job and you are interested in knowing where this job is done eg in the open air)

token to be read aloud

**Si fa fuori questo mestiere?**

syntactic analysis

I V A O (V=verb, A=adverbial, I=Indef subj O=obj)

literal translation

(Indefinite subject) does outside this job

translation

Is it done outside, this job?

comments

The context tells the informant to highlight 'outside' and disambiguates the sentence since *fare fuori* can mean 'do away with' as well as 'do outside'. With the meaning of 'outside', the context suggests that *fuori* should be highlighted.

( c )

translation of context

(No context was given )

token to be read aloud

**E' Giovanni che è partito?**

syntactic analysis

V S Conj V (V=verb, S=subj, Conj=conjunction)

literal translation

(It) is Giovanni that left

translation

Was it Giovanni that left?

comments

This is a cleft sentence. Since the default item to be highlighted is prejudiced by the syntax, no context is provided.

Only two pairs can be described as not having Standard Italian syntax; these were included in the first page of the prompting text :

**A NApoli si sposa.** (She's getting married in Naples.)

**A NApoli si sposa?** (Is she getting married in Naples?)

**DoMAni glielo porta.**(He'll bring it to her tomorrow.)

**DoMAni glielo porta?** (Will he bring it to her tomorrow?)

where the adverbials 'a Napoli' (in Naples) and 'domani' (tomorrow) are in initial position in the sentence. One of these items is as follows:

translation of context	(We know that he will bring it to him/her but
you	want to specify exactly <u>when</u> )
token to be read aloud	<b><u>D</u>o<u>M</u>ani <u>g</u>lielo <u>p</u>orta.</b>
syntactic analysis	A Oi Od V (Oi=indirect object, Od=direct object,V=verb,A=adverbial)
literal translation	tomorrow to him/her it he/she brings
translation	S/he's bringing it to him/her tomorrow
comments	We expect the speaker to highlight the adverbial as the context suggests.

The above word order is possible in the Italian spoken in a number of regions, but it is often marked, indicating surprise or disbelief. However, as a result of dialectal interference, it is considered by at least some speakers of Sicilian Italian as unmarked. It is therefore often used in the Palermo variety of Italian in preference to the forms with the adverbial in final position.

In introducing these four sentences at an early stage in the reading, it was intended to encourage informants to read in their local accent. This decision was based on an earlier pilot study which revealed that some informants radically changed their intonation patterns from speaking spontaneously to reading. It is well documented that intonation in reading differs from that in spontaneous speech (for Italian see Ames:1969). However, the difference in the case of questions was categorical (i.e. a rising-falling pattern in spontaneous speech and a falling-rising pattern in reading). The falling-rising pattern approximates to the so-called Standard Italian as described, for example, by Chapallaz(1979). However, all of the informants

produced a rising-falling contour when reading the questions with preposed adverbials as listed in the four examples above<sup>1</sup>.

## **2.4 Speakers**

The five speakers whose recordings are analysed in detail were aged between 27 and 36, three female and two male. All were born in Palermo and have continued to live there up to the present. They have all attended courses in further education.

## **3 Description of "nuclear" contours found in the corpus**

There follows a brief description of the types of contour found in the corpus. For each of the examples given below and included in the figures, there are a number of spontaneously produced tokens, the intonation of which is given the same phonological analysis. It is believed, therefore, that none of the contour types represented below are patterns specific to a reading style. Furthermore, the problems described in the pilot study, referred to in 2.3 above, where speakers used a different pattern in reading from that used in spontaneous speech, were not encountered at all in this study.

We shall concentrate on contours on and around the highlighted constituent; these can be followed by a prosodic break even if they are early in an utterance. In certain cases, however, a highlighted word may be followed by an accent without an intervening boundary. These will also be informally described here.

The convention will be followed that the highlighted word be underlined and the syllable with the main stress be in capital letters.

### **3.1 Yes-no interrogatives**

Yes-no interrogatives were elicited with late focus and early focus, as outlined in 2.1. These will be examined in turn.

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<sup>1</sup>The above impressions were corroborated by asking native speakers to make informal judgements as to whether such falling-rising contours sounded 'natural' or 'interested'. Native speakers remarked that the falling-rising contours sounded less authentic, and unnatural; some remarked that the speaker sounded as if he or she were attempting to mimic a standard newsreader's accent.

### 3.1.1 Late focus

The corpus contained both information seeking and confirmation seeking questions. The former are exemplified in figure 1, the text of which is given below:

- |         |                                |   |
|---------|--------------------------------|---|
| 1 (i)   | Gliel'hai detto <u>TU</u> ?    | (Did <u>you</u> tell her?)                    |
| 1 (ii)  | E' un lavoro <u>masCHile</u> ? | (Is it a <u>masculine</u> job?)               |
| 1 (iii) | Glielo porta <u>doMANi</u> ?   | (Is she bringing it to her <u>tomorrow</u> ?) |

In 1(i), the pitch rises on the nuclear syllable and tends towards a plateau or a slight fall: a rise-plateau-slump, in Cruttenden's (1986) terminology. In 1(ii), the pitch is already fairly high at the beginning of the nuclear syllable; it peaks at the end of it and falls to low on the final syllable. In 1(iii) the pitch rise begins and ends on the vowel of the nuclear syllable, and is fairly steep. It is followed by a fall to low.

Confirmation seeking questions, which often have an incredulous or surprised overtone, are in figure two. The text is given below:

- |        |                               |                                       |
|--------|-------------------------------|---------------------------------------|
| 2 (i)  | E' andato a <u>MAlaga</u> ?!  | (He's gone to <u>Malaga</u> ?!)       |
| 2 (ii) | Glielo porta <u>doMANi</u> ?! | (He's bringing it <u>tomorrow</u> ?!) |

In 2(i), the pitch rises on the stressed syllable 'MA' and starts to fall on the next syllable (between 'l' and 'a'). In 2(ii), the pitch trajectory is similar to that in 1(iii) until the final syllable which, instead of falling to low, falls to mid and then forms a plateau. In some examples of the same type as 2(ii), a slight rise can be observed towards the end of this final syllable.

### 3.1.2 Early focus

In the two examples in figure 3,

- |        |                               |   |
|--------|-------------------------------|---|
| 3 (i)  | <u>TU</u> gliel'hai detto?    | ( <u>You</u> said it!?)                 |
| 3 (ii) | Ma è <u>anDAto</u> al cinema? | (But has he <u>gone</u> to the cinema?) |

there is a rise in pitch on the stressed syllable, followed by a plateau or slightly falling pitch. Then there is a final fall coinciding with the final stressed syllable,

which is perceived as accented. It is consequently not immediately apparent which should be considered the nucleus. In utterances with this contour, there is an implication of doubt as to the truth of the proposition expressed.

The more common manifestation of early focus is for the rising-falling pattern observed on yes-no question nuclei to appear not only on the highlighted word but also on the last word of the utterance. Figures 4(i) and (ii) are illustrations of this; the text is the same as in 3(i) and (ii):

4 (i)            TU gliel'hai detto?            (Did you say it?)

4 (ii)            Ma è anDAto al cinema?            (But did he go to the cinema?)

A similar pattern obtains in cases where there is a major syntactic boundary between two constituents, as is found in the constructions in figure 5, with cleft sentences (i and ii) and a sentence-initial complement (iii), the texts of which are:

5(i)            E' GioVANni che è parTito?            (Was it Giovanni who left?)

5 (ii)            E' LUI che te l'ha DAto?            (Was it he who gave it to you?)

5 (iii)            Si fa FUOri questo meSTIEre? (Is it done outdoors, this job?)

There is a rising falling movement on the highlighted word with the same pattern as the yes-no question nuclei in example 1 (except that the fall is often not to low but to mid) and then a rising falling movement on the final word of the utterance of a similar type with a fall to low. A close look at 5(i) reveals that the pitch falls to mid on the postnuclear syllable 'ni' of 'Giovanni'; it then reaches a low value on the following word 'che' which is part of the next syntactic constituent. In 5(ii), the nucleus is on a monosyllable 'lui', so the mid pitch is reached on 'che' instead.

Variation in the endpoint of a falling movement is also observed in declarative utterances with syntactic breaks, as will be shown in 3.2, following.

### 3.2 Non-final Items in lists

Figure 6 is an illustration of an utterance consisting of more than one phrase. The text follows:



- 6 Glielo porta doMA<sup>n</sup>i, dopo doMA<sup>n</sup>i e la settimana prossima.  
(He'll bring it to her tomorrow, the day after tomorrow and next week.)

Looking at the whole of this utterance, one thing is particularly noticeable: the first phrase terminates with a low pitch on 'domani', the second with a mid pitch on 'domani', and the third (and final) with a low pitch. The perceptual consequence of this is that there appears to be a stronger juncture between the first and second phrases than between the second and third phrases. On the first and second phrases, the pitch is rising on the stressed syllable and falls on the final syllable.

Although the form of this F<sub>0</sub> contour might somewhat resemble the contour described in yes-no interrogatives (1(ii) and (iii) and 5(i), (ii) and (iii)), it is perceptually distinct<sup>1</sup>. A comparison of a non-final interrogative utterance, 5(i), and a non-final declarative (see figure 7)<sup>2</sup>:

- 7 dopo doMA<sup>n</sup>i (the day after tomorrow)

reveals that there is, in fact, a difference in the form of the F<sub>0</sub> contours: in 7 the pitch rise begins well before the stressed syllable (just before 'do' of 'doMA<sup>n</sup>i'), whereas in 5(i) it does not begin until after its onset (on the vowel of 'VA' in 'GioVAN<sup>n</sup>i'). Their similarity lies in the position of the high turning point, which is at the end of the stressed syllable in both.

---

<sup>1</sup>As we shall see, this perceptual distinction reflects a functional distinction.

<sup>2</sup>It is not useful to directly compare the medial phrase of the declarative "Glielo porta domani, dopo domani e la settimana prossima." (which is presented in figure 7) with that of an interrogative "Glielo porta domani, dopo domani e la settimana prossima?", as the latter is rendered with a more or less level pitch with no audible boundary until the final word "prossima", on which is a contour of the type found in, say, 1(i) or 1(ii). For this reason, a question type where a non-final accent is permitted is chosen for comparison. It is only in this way that the rising-falling type of accent in non-final interrogative and non-final declarative phrases can be compared.

### 3.3 Declaratives

As in interrogatives, declarative contours can be divided into those with early focus and those with late focus.

#### 3.3.1 Late focus

The unmarked tonal form used to signal broad focus, where the nucleus is placed on the final word of the utterance, is illustrated in figure 8. The texts are:

- 8 (i) Glielo porta doMAni. (He'll bring it to her tomorrow.)  
 8 (ii) E' diVERso. (It's different)

In the above contours the pitch falls on the stressed syllable. However, the fall is approached from above; it begins on the previous syllable in both cases. In 8(i), there is a preceding accent on 'porta'; the pitch reaches a high point on this accent and falls slightly until the prenuclear syllable 'do'. It then begins a rapid fall which is completed near the end of the nuclear syllable. In the case of 8(ii), the pitch rises up to a peak on the syllable 'di' and falls from there; it is also completed on the stressed syllable.

A more marked contour, which is often used to signal contradiction of a previous proposition, and can sometimes imply narrow focus on the relevant item, is the contour in figure 9, the text of which is:

- 9 (i) Ma é un lavoro masCHile! (But it's a man's job!)

Here the pitch is approached from below, it starts its fall just after the beginning of the stressed syllable and continues falling to the end of the utterance. The main factor distinguishing this contour from those in figure 8 is the timing of the fall. In figure 9(i), the fall starts at the beginning of the stressed syllable and continues falling after the end of this syllable, whereas in figure 8, the fall starts before the stressed syllable and reaches a plateau by the end of the stressed syllable.

The beginning of the fall does not have to be preceded by such a low pitch. The height of the fall, relative to the previous syllable appears to be a gradient phenomenon, depending on the amount of contradiction conveyed. A contour with attenuated contradiction is given in figure 9(ii); the text is the same as in 9(i).

### 3.3.2 Early focus

In declaratives with early focus, there appears to be a considerable compression of the pitch range of the second accent. Perceptually, the stressed syllable is salient, but the F0 track shows only a slight pitch excursion<sup>1</sup>. Figure 10(i) and (ii) are examples of the unmarked falling contour exemplified in figure 8 above.

- 10(i)            DoMA<sup>n</sup>i glielo porta.            (Tomorrow he'll bring it to her.)  
10(ii)           E' GioVAN<sup>n</sup>i che è partito.    (It was Giovanni who left.)

The fall is completed on the stressed syllable of the highlighted word and is followed by a low stretch. In 10(ii), there is a slightly raised pitch on the stressed syllable of the utterance-final word. A slight pitch excursion can be observed in a number of examples with a similar structure but different segments. It is therefore unlikely that it is the result of segmental coarticulation effects. In fact, a small pitch excursion can also be observed in figure 10(iii) where a different pitch accent is used on the highlighted item:

- 10(iii)           E' LUi che te l'ha dato.    (It was he who gave it to you.)

10(iii) is another example of the contour exemplified in figure 9(i) above, as used in contradictory utterances. Note that the fall is completed on the post-stressed syllable.

It is interesting to note that both the unmarked (and often broad focus) and the contradictory (and also possibly narrow focus) falling contour can occur in either an early or late position within an utterance. The possibility for an unmarked contour to occur in an early focal position is not available in Standard Italian where early focus necessarily implies narrow focus, and narrow focus necessitates a contour of the type exemplified in 10(iii).

---

<sup>1</sup> At this point it is important to point out that the the perception of stress leads to the interpretation of the F0 excursion (even if it is small) as a manifestation of accent. This interpretation is made in the belief that an F0 contour cannot be treated as a single dimension, disregarding factors such as amplitude and spectral quality, which are known to contribute towards the perception of accent. Consequently, since such factors have not been explicitly examined in this study, perceptual data is used to supplement the F0 data.

### 3.4 A note on the "head" contours

There are many examples where the intonation contour occurring prior to the highlighted material is identical for both interrogatives and declaratives. An example of this is provided in the comparison of figure 1(iii) with figure 11,

	Prehead	Head	Nucleus	Tail
1 (iii)	Glielo	porta do	MA	ni?
11	Glielo	porta do	MA	ni.

where the shape of the two contours differs only around the nuclear region; the prenuclear pitch accent peak is late in the stressed syllable 'por' in both cases. We take this as evidence in favour of our assumption that the head contours do not play an important role in signalling interrogation. They are thus peripheral to the analysis in 4 below.

## 4 Analysis of "nuclear" intonation patterns

In this section, a qualitative rather than quantitative analysis of the intonation patterns is conducted as corroboration for an emerging phonological analysis. The principal aim is to account for allophonic variation in interrogative contours. However, since it is clear that interrogatives cannot be systematically examined in isolation, such contours are analysed in contrast with the non-interrogative contours exemplified in section 3 above. The result is that all contours included in the corpus will be accounted for within a general phonological analysis, although it is acknowledged that not all possible contours in this variety of Italian may be covered.

In the following section, all of the figures informally described in section 3 will be referred to. In each case, the text of the utterances will be repeated.

In performing a formal analysis of the described nuclear contours, the starting point is the determination of their significant turning points. Once determined, it is necessary to identify the structural position which each turning point occupies. This section examines these issues, firstly by considering yes-no interrogative contours and proposing an analysis of them, then by investigating whether evidence from other contour types provides corroboration for this analysis.

## 4.1 Interrogative contours

The three information-seeking polar questions with narrow focus on the final word of the phrase:

- |         |                                |   |
|---------|--------------------------------|---|
| 1 (i)   | Gliel'hai detto <u>TU</u> ?    | (Did <u>you</u> tell her?)                    |
| 1 (ii)  | E' un lavoro <u>masCHlle</u> ? | (Is it a <u>masculine</u> job?)               |
| 1 (iii) | Glielo porta <u>doMA</u> ni?   | (Is she bringing it to her <u>tomorrow</u> ?) |

have functionally equivalent nuclear intonation contours; an auditory British-style nuclear tone analysis of these contours will not yield the same description for all of them. Depending on phonetic accuracy, (i) may be perceived as a rise or rise-plateau, (ii) a high fall, and (iii) a high fall or rise fall.

### 4.1.1 Number of structural positions

Within the approach that we have dubbed "post-autosegmental", involving pitch accent and boundary tones, the nuclear pitch movement (i.e. the pitch movement from the nuclear syllable<sup>1</sup> region up to the end of the phrase) might be phonologically represented in a number of ways.

Setting aside the example 1(i) which will need special consideration at a later stage, the falling movement might be characterised as a sequence of two tones

H     L

which would represent the fact that the pitch falls. However, since the fully voiced string in (iii) also had a perceptible rise, and since the auditory analysis in chapter 3 indicated that this rise was important as an interrogative marker, HL may be ruled out in favour of

L     H     L.

---

<sup>1</sup>The term nuclear syllable is adopted here to refer to the stressed (rhythmically prominent) syllable of the word which is highlighted. Later, the term nuclear pitch accent will refer to a pitch accent associated with such a syllable.

In addition, however, confirmation-seeking yes-no questions may have a slightly rising terminal, as shown in figure 2:

- 2 ( i ) E' andato a MAlaga?! (He's gone to MAlaga?!)  
 2 ( ii ) Glielo porta doMA*ni*?! (He's bringing it tomo*rr*ow?!)

Again, there is narrow focus on the final word of the phrase. The rise is manifested as only a slight upturn in pitch; in the bisyllabic context, the preceding fall typically appears to be curtailed. Otherwise, in terms of the timing of the initial rise, they are similar to the contours in examples 1(i) and (ii).

Consequently, an additional tone must be suffixed to the LHL sequence to adequately describe this contour:

L      H      L      H

It is therefore suggested here, based on the evidence presented so far, that Palermo Italian has four structural positions available for the description of nuclear pitch configurations. If it is accepted that an elegant analysis would fill all structural positions (notwithstanding a principled method for ruling out specific combinations - see for instance Hayes and Lahiri:1991), then a consequence of the above analysis of the rising-falling-rising contours in figure 2 is that the rising-falling contours in figure 1(ii) and (iii) would have to be analysed as follows:

L      H      L      L

#### 4.1.2 Type of structural position

Given the type of analysis discussed in chapters 5 and 6, the above contours LHLL and LHLH would include a pitch accent and one or more boundary tones. A preliminary analysis might consider a tritonal pitch accent which is combined with a H or L boundary tone, as follows:

	P.A.			Boundary
fig 1 contours	L	H	L	L
fig 2 contours	L	H	L	H

A consideration of the full range of yes-no interrogatives produced, however, leads us to reject such an analysis. As we have seen, in some questions, the focus may be placed on a constituent which is not final in the utterance. Figure 3 shows two examples of this kind of question contour, the segmental content of which is given below (where the highlighted item is underlined):

3 (i) TU gliel'hai detto? (You said it!/? Was it you who said it?)

3 (ii) Ma è anDAto al cinema? (But did he go to the cinema?)

In the above cases, there is a rise on the accented syllable, but no following fall. This leads to the analysis of this contour as a pitch accent L H with no immediately following boundary:

P.A.  
L H

There is a fall at the end of the phrase where a boundary tone would be expected<sup>1</sup>. This contour is evidence for a bitonal pitch accent LH in interrogative utterances. It is therefore reasonable to suggest that the falling pitch in examples 1(ii) and 1(iii) and the falling-rising pitch in 2(i) and (ii) are attributable to tones unassociated with any pitch accent, at the periphery of the intonation phrase; in other words: boundary tones. A reanalysis of the contours would thus give:

	P.A.	Boundaries
fig 1 contours	L H	L L
fig 2 contours	L H	L H

It will be argued in section 7, in fact, that, in Palermo Italian, it is the pitch accent (PA) involving the LH sequence which bears the interrogative marker.

---

<sup>1</sup>A full analysis of 3(i) and (ii) will be presented in section 7.

Additional corroboration for the analysis of the above contours as having bitonal pitch accents and two boundary tones comes from a closer look at early focus questions of the type given in figures 4 and 5. For example, in

5(i) E' GioVANni che é parTito? (Was it Giovanni who left?)

'ni' of 'Giovanni' carries a fall to mid. It is argued here that there is a boundary after the highlighted constituent, but that it is not as strong as the one at the end of the whole utterance.

Following Beckman and Pierrehumbert (1988), discussed in chapter 5 (section 2.2.5), 5(i) could be analysed as one intonation phrase dominating two intermediate phrases as follows:

{ [E' Giovanni] [che é partito] }

where {} = intonation phrase, [] = intermediate phrase

In this case, focus determines phonological phrasing, as has been observed by other analysts (inter alia, Poser:1984 for Japanese, Hayes and Lahiri:1991 for Bengali).

The mid pitch after Giovanni can thus be represented as an intermediate phrase boundary tone and the low pitch after 'partito' a combination of intermediate phrase and intonation phrase boundary tones<sup>1</sup>.

The implication is that an intermediate phrase boundary L tone is, ceteris paribus, not as low as an intonation phrase boundary L tone. That is, the mid level reached is a consequence of the strength of the boundary - a boundary L tone of an intermediate phrase is assigned a weaker prominence than a boundary L tone of an intonation phrase<sup>2</sup>. This suggestion will be discussed further below.

---

<sup>1</sup>The assumption here is that both the intermediate phrase boundary tone and the intonation phrase boundary tone are present in the phonological analysis. An explanation of the phonetic consequences of such a combination will be discussed in sections 5 and 6 below.

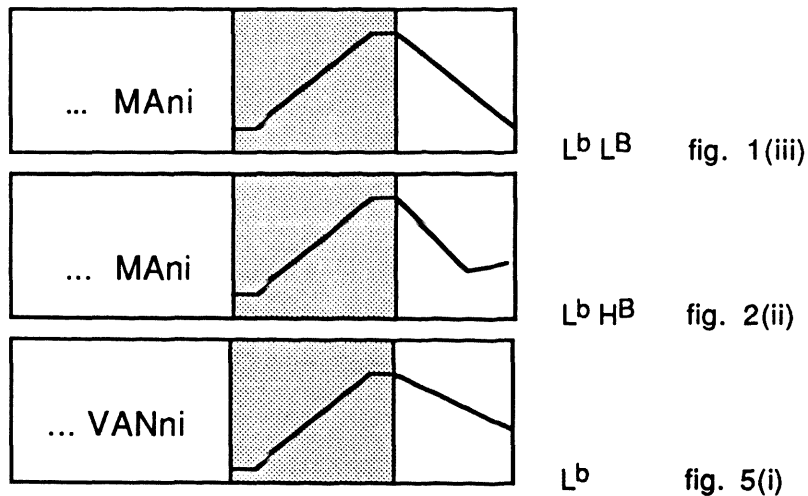
<sup>2</sup>Assuming that with L tones, increasing prominence involves lowering pitch, in contrast to H tones where increasing prominence involves raising.



This definition of boundary tone type leads to a reanalysis of the hitherto exemplified contours ('b' designates an intermediate phrase boundary, 'B' an intonation phrase boundary):

	P.A.	b	B
fig 1 (ii,iii)	L H	L	L
fig 2	L H	L	H
fig 5	L H	L	-

A schematic reminder of their form (where the nuclear syllable is in a shaded area) is given below:



Having formally analysed the contours in the interrogative set<sup>1</sup>, the analysis should remain applicable to the formal analysis of contours in the other utterance types. In other words, the validity of this analysis must be corroborated in the context of a wider range of utterances. These will be dealt with in the next section.

---

<sup>1</sup>The case of the monosyllabic nucleus in figure 1(i) will be held in abeyance (there is evidence of the LH pitch accent, but no immediately apparent way of accounting for the fact that the fall is curtailed). An explanation will be offered in section 5.

## 4.2 Non-interrogative utterance types

### 4.2.1 Listing contours

A similar (but not identical) form to the rising-falling interrogative contour is found in non-final phrases of declarative utterances, especially when the items are presented in a list, as shown in figure 6:

- 6 Glielo porta doMA<sup>n</sup>i, dopo doMA<sup>n</sup>i e la settimana PROSS<sup>i</sup>ma.  
(He'll bring it to her tomorrow, the day after tomorrow and next week.)

This utterance can be analysed into two intonation phrases, with a further subdivision of the second intonation phrase into two intermediate phrases as follows:

(1)	(2 i)	(2ii)
{ [Glielo porta domani] }	{ [dopo domani] }	{ [e la settimana prossima] }

The F<sub>0</sub> trace for this utterance shows a fall to low at the right periphery of both intonation phrases, but only a fall to mid at the intermediate phrase boundary (after 'dopo domani').

The phonological analysis proposed for the contour in the utterance medial phrase (2i):

7. dopo doMA<sup>n</sup>i (the day after tomorrow)

is a LH pitch accent on 'MA', followed by an intermediate phrase boundary L but no intonation phrase boundary tone, as follows:

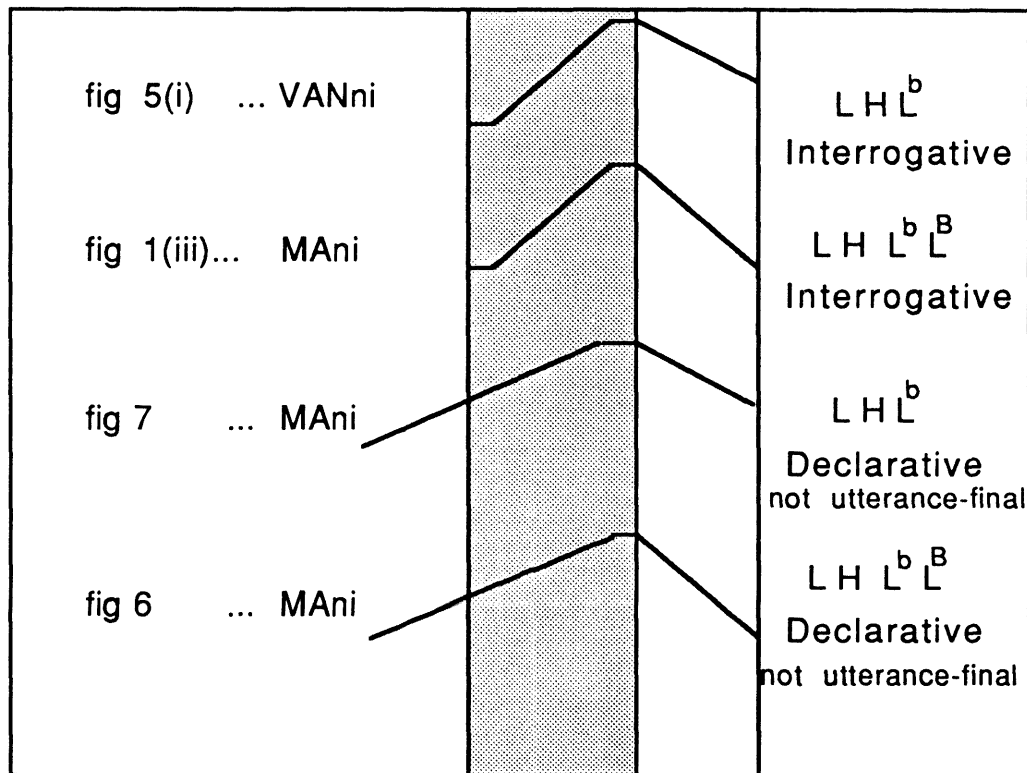
P.A.	b	
L	H	L

The initial phrase of the same utterance (1) has a fall to low and is analysed:

P.A.                      b                      B

L                      H                      L                      L

However, the intonation patterns in the above examples are formally and functionally different from those in the interrogatives. With regard to form, there is a difference in the timing of the rise which is schematically represented below:



It can be seen that the timing of the H turning point is the same in all four examples, but the timing of the L turning point, i.e. the beginning of the rise, is earlier in the declarative utterances. However, despite these differences, the phonological analyses offered (to the right of each contour) do not capture this distinction; the sequence of tones accounting for figure 5(i) is identical to that accounting for figure 7; similarly, that accounting for figure 1(iii) is identical to that for figure 6. As there is a cue to interrogativity in the former type of contour and no evidence of such a cue in the latter, the two types of intonation pattern do not appear to be variants of the same contour. It is therefore necessary to account for this difference if the phonological system proposed is to give an adequate account of the phenomena observed.

One way of distinguishing the two contours in the phonology would be to appeal to distinctive association (symbolised by the star) as discussed in chapter 5, and to describe one contour as LH\* and the other as L\*H. Bearing in mind that, in Pierrehumbert's system, alignment with the stressed syllable is a consequence of association, the choice of LH\* for the non-final phrases in declaratives would appear to be justified: only the H is aligned with the stressed syllable, the L tone precedes it and would therefore be an obvious candidate for a leading accent. However, the decision to apply L\*H to interrogative contours would need further corroboration, since both tones are aligned with the stressed syllable. We leave these matters for discussion in section 6; suffice it to say that the phonological analysis requires there to be two types of LH pitch accent.

#### 4.2.2 Declaratives

The utterances in the corpus used for direct comparison with the yes-no interrogatives were declaratives<sup>1</sup>, and these, like the main objects of study, also had a phrase-final fall. However, a major distinction between them is the direction of pitch movement over the nuclear syllable; it is rising in the interrogative and falling in the declarative contours.

The best way of accounting for this fact is to analyse the falling contour over the nuclear syllable as a sequence of a H and a L tone which have a link to the nuclear syllable (rather than to, say, a boundary), viz. a HL pitch accent. These HL pitch accents have been shown in 3.3.1 to be of two basic types, differing in their alignment with the nuclear syllable, schematically:

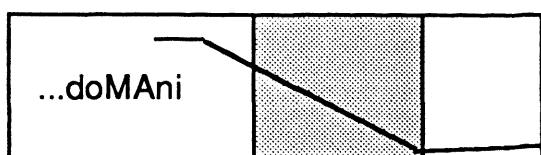


fig. 8(i)

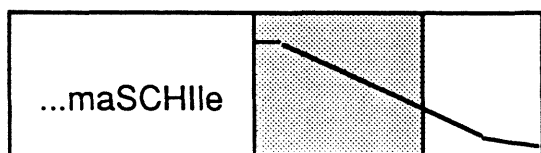


fig. 9(i)

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<sup>1</sup>Here we refer to single phrase declarative utterances, final phrases of all multi-phrase declaratives, and non-final phrases of declaratives which did not constitute lists.

This difference in alignment lends itself easily to a binary association distinction. The first contour (fig 8) can be described as HL\*: the H is before the stressed syllable and the L is aligned with it. The second contour (fig 9) can similarly be described as H\*L, where the H is aligned with the stressed syllable and the L occurs after it. The only apparent inconsistency in the account is that the alignment with the stressed syllable is different in each case: early in H\*L and late in HL\*. We shall deal with this in section 6.

If we consider the two types of HL pitch accent in terms of an analysis such as Pierrehumbert's (1980), the Palermo Italian HL\* accent is considerably different from the English one<sup>1</sup>. It is necessary to mention this here since the existence of the H+L\* contour in English is particularly controversial<sup>2</sup>. First, most analyses of English do not allow for a leading tone in a pitch accent (see Ladd:1983, Gussenhoven:1983) and tend to account for the prenuclear high pitch as either part of a preceding accent or attributable to a boundary tone. Second, it is very similar in form to a downstepped H tone; in fact Pierrehumbert's (1980) scaling rules offer the same mechanism for calculating the height of the L\* in H+L\* as for a downstepped H (i.e. multiplying the value of a previous H by a constant).

However, it has been argued in chapter 6 that English does, in fact, have a counterpart to the Italian HL\*. This is referred to as "true H+L\*" which (i) can occur in contexts which rule out downstep, and (ii) in cases which do not rule it out, is linguistically contrasted with a downstepped H tone.

A similar analysis is proposed here for Palermo Italian. In the example given in 8(i),

8(i) Glielo porta doMANi. (He'll bring it to her tomorrow.)

---

<sup>1</sup>This is not surprising in itself, since phonological categories need only be consistent within the language system they describe; the fact that /p/ in French has an entirely different manifestation from, say, /p/ in English does not prevent anyone from referring to /p/ in a description of either language.

<sup>2</sup>as was discussed in chapter 6.

the nuclear pitch accent is preceded by another accent. Here the context does not rule out downstep, as the preceding accent could arguably be a trigger for it. However, the pitch falls to the bottom of the speaker's range; it reaches the floor value towards the end of 'MA', and subsequently forms a plateau which extends to the end of the utterance<sup>1</sup>. This rules out downstep because downstepped tones are scaled by a constant factor which is not sufficiently large to produce such a low value after only one application.

In the example given in 8(ii):

8(ii) E' diVERso. (It's different.)

the pitch accent associated with 'VER' cannot be downstepped either as there is no evidence of an accent on the first syllable<sup>2</sup>. Neither can the high pitch on 'di' be attributed to an initial boundary tone, as the pitch is relatively low at the boundary and rises gradually through the first two syllables to reach a peak in the second half of 'di'. The solution to incorporate it within the pitch accent centred on 'VER' appears thus to be the only option.

The HL\* pitch accent proposed for Palermo Italian is, given all of the evidence, not open to the same criticism as Pierrehumbert's H+L\*. Furthermore, whereas the H+L\* accent is said to be fairly infrequent in English (Pierrehumbert and Hirschberg:1990), the Italian HL\* accent is very common, being used in neutral declaratives. It can be said that its common occurrence as indicating what appears to be an unmarked function lends itself to a tonal description which is not derived by any means (e.g. downstepped); but rather part of a basic inventory.

---

<sup>1</sup>In some examples in the corpus, there is a gradual drift upwards rather than a plateau. It is argued here that such a drift is the result of the speaker having reached the bottom of the range on L\*, often producing creak, which is not sustained to the end of the utterance.

<sup>2</sup>This is difficult to corroborate since Italian does not have the degree of vowel reduction which can be used in English as evidence of a syllable being unstressed and therefore unaccentable (c.f. the example in chapter 6: to <sup>the</sup> mark<sub>et</sub> where the first two syllables have a schwa vowel and thus cannot bear a pitch accent.

Let us now turn to the contour analysed as H\*L, typically used in contradictory (and often narrow focus) statements, as in 9(i):

9 (i)            Ma é un lavoro masCHlle!    (But it's a man's job!)

This contour lends itself to an analysis as H\*L since the H\* is consistently aligned with the stressed syllable and the L target usually occurs after it. The position of the L in H\*L is more easily observed in early focus declaratives, such as in figure 10(iii):

10(iii)        E' LU che te l'ha dato.        (It was he who gave it to you.)

where the L is reached on 'che', the post-stressed syllable.

In H\*L, the fall ends reasonably consistently in the middle of the poststressed syllable. If the fall is not completed by this point, there is a change to a flatter gradient before the end of the utterance.

The temporal consistency in the endpoint of the fall is taken as evidence that the analysis should include a L tone in the pitch accent, rather than accounting for the fall as simply a combination of H\* and a low boundary tone<sup>1</sup>.

The analysis so far has dealt with most of the contours described in section 3. However, in order to account for the allophonic variant of the LH contour on a monosyllable in figure 1(i), association rules will have to be given in more detail. This will be done in section 5 with the help of a prosodic tree.

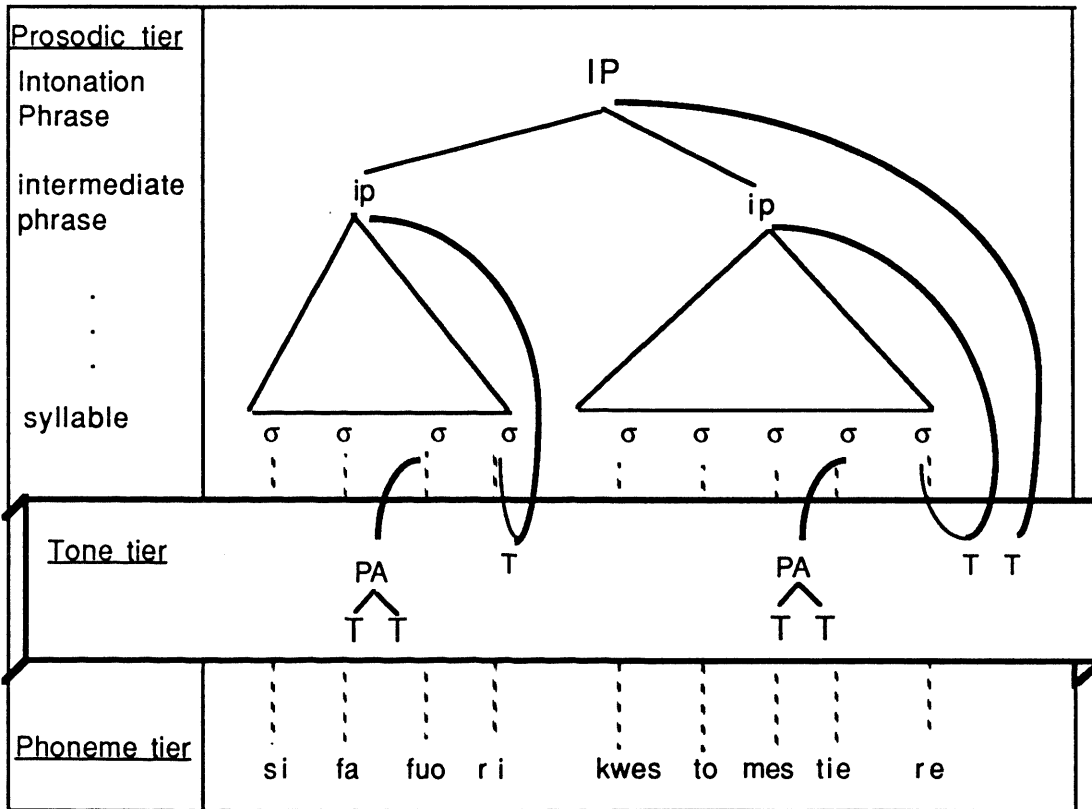
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<sup>1</sup>Such an assumption was not made, however, by Pierrehumbert (1980) who analyses English nuclear falls consisting of a rapid fall then a plateau as H\* L<sup>b</sup> L<sup>B</sup>. It will be shown later in this chapter that L<sup>b</sup> undergoes secondary association with the final syllable of the phrase; this is another reason why L<sup>b</sup> cannot be responsible for the sharp fall from the H tone.

## 5 The prosodic tree in Palermo Italian

A more detailed account of association can be provided with the help of a prosodic tree, inspired by the trees described in Pierrehumbert and Beckman (1988) and discussed at length in chapter 5 (section 2.2.5).

The tree proposed for Palermo Italian is as follows:



In the above tree, there are three types of line: straight solid lines are used to symbolise relations between a node and a parent or daughter node (for instance, each ip is a daughter of IP), curved lines symbolise association between the prosodic and tonal tiers in the tree, and dashed lines indicate an association between items on the prosodic and phoneme tiers<sup>1</sup>. The triangles under the ip nodes indicate that there is a degree of structure between the ip node and the terminal elements of the tree which, in Palermo Italian, are syllables; the specification of these levels will be discussed in the sections which follow.

<sup>1</sup>The association between syllables and phoneme segments is more complicated than indicated here: syllable structure must be taken into account. This is, however, irrelevant to the current arguments and is therefore left unspecified.



Between the prosodic and tone tiers, three types of association can be observed in the above tree:

- ( 1 )    **central** association between syllables and pitch accents. The curved lines between them symbolise this association.
- (2)    **peripheral** association of tones to the Intonation Phrase node and the Intermediate Phrase node. These associations are represented as curved lines from the node on the prosodic tier directly to the tone tier.
- (3)    **secondary** association between the tone associated to the intermediate phrase node and the final syllable within the intermediate phrase domain.

These types of association will be examined in turn:

### 5.1    **Central association**

The tree shows an association between pitch accents and syllables. However, although syllables are the minimal tone bearing units, a pitch accent is not attached arbitrarily; the associated syllable is always the head of a foot. It may thus be argued that the pitch accent has what Pierrehumbert and Beckman (1988) have called a "central" attachment to a foot.

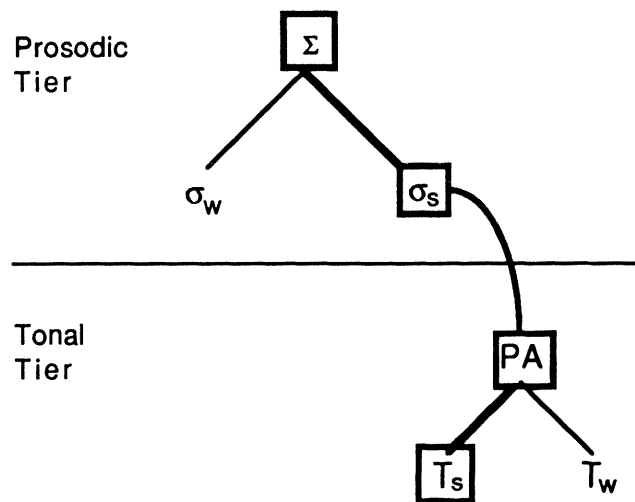
Central attachment<sup>1</sup> can be given the following general description: A node on a given tier in a given tree has an association to an item on another tier. The association could be construed as an attribute of the node in question, encoding its association to an item on another tier. It is proposed here that this attribute is passed down through all the strong branches of the nodes it dominates until a single terminal node is reached. Only one terminal node is reached because, as discussed in chapter 5, the trees proposed are n-ary branching with exactly one strong branch at each node. The terminal node reached is the designated terminal element of the higher node which originally had the attribute to pass down. This terminal node then bears the association line which links, say, the prosodic tier to the tone tier.

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<sup>1</sup>Following Beckman and Pierrehumbert's (1988) usage, the terms attachment and association are equivalent.

However, the node which originally had the attribute does not necessarily lose it by having passed it down the tree; for example, it is not ruled out that the association to the higher node might have some effect on the phonetic realisation of the tones associated to nodes within its domain.

The proposal here for Palermo Italian is that there is a central attachment between a pitch accent and a foot node<sup>1</sup>. The association passes down through the strong branch of the foot to its designated terminal element: the metrically strong syllable. This syllable's inherited association with the Pitch Accent is symbolised by the curved line in the diagram below:



As is shown above, the syllable is not associated directly with a tone, but rather to a pitch accent which has its own internal structure: one tone at the end of a strong branch, the other at the end of a weak one. Pierrehumbert and Beckman's idea of central assignment can therefore be extended to the tone tier. However, the headedness of the Pitch Accent node is, unlike that of the foot, variable; the Pitch Accent may be right or left headed.

It is argued here that it is primarily the Pitch Accent node which is associated to the syllable, but that alignment takes place between the strong tone of this PA and the syllable. The fact that the pitch accent itself has an association accounts for certain details of timing to be discussed in section 6. (It will be argued that, when the

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<sup>1</sup>In section 7, we propose that certain pitch accents have a central attachment even higher up the tree.

strong tone is to the left, it is the left edge of the syllable that is used as the alignment point, and when the strong tone is to the right, it is the right edge.)

## **5.2 Peripheral association**

When peripheral association takes place, a non-terminal node in the prosodic tier is directly associated with an item in the tone tier. The association does not pass down through any lower nodes in the tree. The reason that this association is referred to as peripheral is that a tone associated in such a way aligns with the periphery of the domain dominated by the node in question.

In Pierrehumbert and Beckman's (1988) account of Japanese, a peripherally assigned tone must have a secondary association to be fully realised. They claim that this is not the case in English where, in fact, secondary association does not occur at all; the peripherally assigned tone is simply manifested at the end of the final syllable in the domain. However, when two domains are coterminous (as is often the case with intermediate phrases and intonation phrases), Pierrehumbert and Beckman stipulate that "peripheral tones for higher nodes occur outside those belonging those to lower nodes" (1988:164). This means that in English, where a L tone is associated to the intermediate phrase node and a H tone is associated to the intonation phrase immediately above it, the phonetic realisation of the two boundary tones is not simultaneous; L occurs before H.

In Palermo Italian, both the IP and the ip nodes have a right-peripheral association to a tone; however, it is not necessary to stipulate a tone ordering rule, as Pierrehumbert and Beckman have done for English, because the intermediate phrase boundary tone has a secondary association to the final syllable, so only the IP is associated with the periphery alone.

## **5.3 Secondary association**

According to Pierrehumbert and Beckman (1988), secondary association is a link between a syllable and a tone which already has a peripheral association. This is symbolised by the curved line between the last syllable in each intermediate phrase and a tone T. It can only take place between a terminal tone and an unattached syllable (i.e. if a syllable is already associated to an item in the tonal tier, then a peripheral tone cannot attach to it). Whether a tone undergoes secondary attachment or not, it maintains its primary association to the higher node.

It is proposed here for Palermo Italian that only one type of peripheral tone seeks a secondary association - the one attached to the intermediate phrase node - and that the intonation phrase boundary tone never has a secondary attachment<sup>1</sup>.

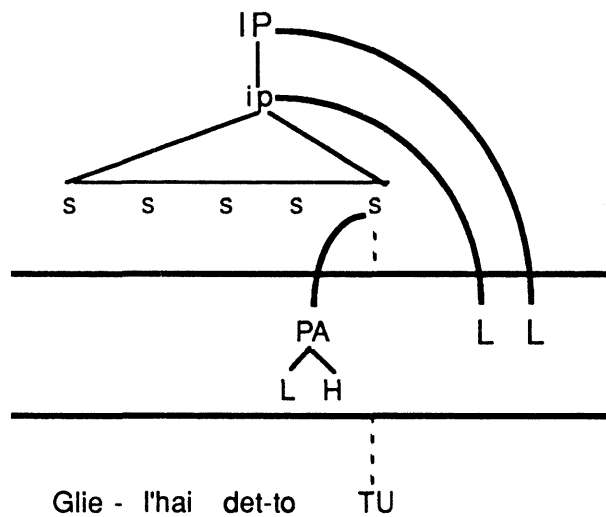
Since Italian has variable stress-placement, there are, of course, words which have stress in positions before the penult; these, if accented, do not affect the process of secondary association, as they leave the final syllable unattached. There is, however, a small set of words without a poststress syllable, either because they have final stress or because they are monosyllables. One such case is that of the monosyllable in nuclear position in figure 1(i), schematised below:



In this case, the pitch accent is associated to the final syllable of the IP. The relevant part of the tree representing this utterance would be as follows:

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<sup>1</sup> A tentative hypothesis for why only the intermediate phrase boundary tone should seek a secondary attachment relies on the fact that the majority of words in Palermo Italian (and Italian in general) have penultimate stress, which means that nuclear pitch accents are often associated to the penultimate syllable of a phrase, leaving only one syllable free for secondary association, which would naturally associate with the adjacent (innermost) boundary. This is, of course, purely speculative and would require additional corroboration, perhaps using diachronic evidence; it is beyond the scope of the investigation here.



Since the final syllable is associated with a pitch accent, it is not free for secondary association. The intermediate phrase boundary tone thus remains attached to the intermediate phrase node but has no secondary association to a syllable.

Pierrehumbert and Beckman claim that, for Japanese, tones without a secondary attachment do not have a full realisation. This is incorporated in their phonetic realisation rules for a Japanese synthesis system. In this system, tones which have no secondary attachment are modelled in such a way as to have only a small effect on the F0 contour, whereas tones associated to syllables are realised fully. Briefly, their primitives are targets which either have a roughly mora-sized duration (i.e. the target level is sustained) which is the case if the tone is associated to a syllable, or are represented as points, which is the case if the tone is not. These entities are linearly interpolated between and then filtered with a mora-sized rectangular window. The idea is that targets with durations the size of the filtering window are robust, whereas those which are only represented as points (albeit having been interpolated) tend to be partially smeared out in the filtering. However, since their phonetic implementation does not claim to simulate human cognitive and productive processes, details of phonetic implementation in a synthesis model are not crucial to the argument.

What is of interest here is that the concept of secondary association allows us to account for why 'tu' only bears a rise-plateau. The rise is attributable to the LH pitch accent, the plateau(slump) is the result of a low tone without a secondary attachment. Even though there is no low pitch, the lowering effect can be observed on the latter part of the syllable 'TU'; hence the plateau or slump. Thus, secondary

attachment allows for the rise on 'TU' to be analysed as a contextually determined variant of the rising-falling interrogative pattern:  $L^*H L^bL^B$ .

### 5.3.1 Additional evidence for secondary association

Stipulating that only the intermediate phrase boundary tone may seek a secondary attachment to a syllable provides a way of accounting for two other contour shapes so far described.

First, it explains the fact that there is no evidence of two consecutive target points where the phonological analysis yields  $L^bL^B$ , for example in the  $L^*H L^bL^B$  contour schematised below where there is a smooth fall from the H peak:



$L^bL^B$  figure 1(iii)

In any intonation phrase, the boundary tone  $L^B$  is always assigned greater prominence than the boundary tone of an intermediate phrase which it dominates. Since the greater the prominence, the lower the L tone, then two targets would be expected to consist of one at a mid pitch followed by one at a low pitch. Such a sequence is not observable. However, if  $L^b$  is attached to the final syllable and can be realised as a target and  $L^B$  has no secondary association and can therefore only have a reduced effect, it is feasible to suggest that it simply lowers the value of  $L^b$ . In other words,  $L^b$  by itself means mid pitch,  $L^b$  and  $L^B$  together mean low pitch.

Second, it accounts for the fact that the rise in the confirmation seeking yes-no interrogatives, schematised below:



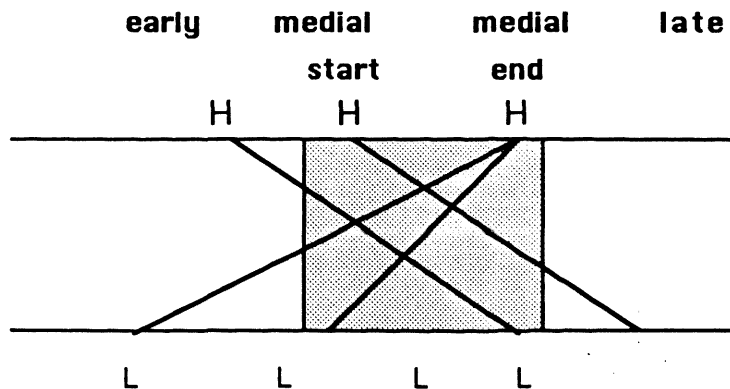
$L^bH^B$  fig. 2(ii)

is not very high: if the  $H^B$  tone does not have an attachment to a syllable, then it cannot be fully realised as a H target; it simply affects the fall to the  $L^b$  target, causing a plateau or slight upturn.

We shall now return to the issue of timing to discuss the adequacy of the proposal of a two way timing opposition distinguishing the HL and LH pitch accents.

## 6 Timing considerations

The timing of the H in what have been analysed in section 4 as L\*H contours is generally such that it occurs within the nuclear syllable (often on the vowel, in fact). This means that both the L and the H fall on the nuclear syllable. It was mentioned in 4.3 that this might lead to difficulty in deciding which of the two tones should be starred (or strong, in the sense of the tree in 5 above). In fact, a narrower phonetic description of the contours described thus far causes us to question the validity of a timing opposition which is simply binary. The following schema represents the timing of the LH and HL contours as they would be manifested before L<sup>b</sup> and L<sup>B</sup> boundary tones although, for simplicity, the boundary phenomena are not marked (the domain of the nuclear syllable is shaded):



The schema leads us to consider four timing positions: early (prenuclear), medial start (near the start of the nuclear syllable), medial end (near the end of the nuclear syllable) and late (postnuclear). A comparison of the phonological analysis offered in section 4 (where the L\*H and LH\* opposition was introduced with reservations) with the above phonetic timing observations yields the following:

Utterance type	Type of Tone					
	Pitch Accent				Boundary	
	early	medial start	medial end	late	b	B
Y-N interrogative		L *	H		L	L
Non-final phrase	L		H *		L	L
Neutral declarative	H		L *		L	L
Assertive declarative		H *		L	L	L

The first impression is thus that the phonological analysis does not map onto the phonetic description in a principled way: starred tones can be near the start or near the end of the nuclear syllable, and unstarred tones do not appear to occur at a consistently defined distance from the starred tone. However, there are gaps in the phonetic system which suggest that there may be more timing distinctions than a linguistic model would require.

An alternative way of accounting for the phonetic differences would be to refer back to the tree structure in 5 above. There it is argued that it is the pitch accent rather than simply a tone that is associated with the nuclear syllable. There is a general consensus (inter alia, Pierrehumbert 1980, Beckman and Pierrehumbert 1986) that the strong or starred tone must occur more or less within the time slot occupied by the tone bearing unit with which the pitch accent is associated. In line with this consensus, the following general timing specifications are considered where T can be L or H:

In the case of T\* T, T\* occurs near the left edge of s\* and T some distance after T\* (i.e. if left branch of P.A. is strong, align left edge of P.A. with s\*).

In the case of T T\*, T\* occurs near the right edge of s\* and T some distance before T\* (i.e. if right branch of P.A. is strong, align right edge of P.A. with s\*).

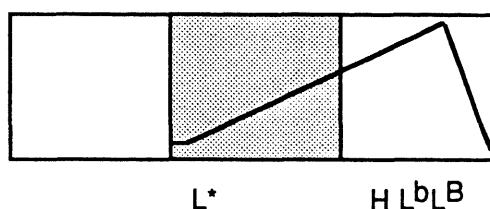


Translated into the phonetic four-way timing opposition, the above timing specifications can be schematised as follows:

early		med	med	late
		start	end	
		T*		T
T			T*	

However, the schematic representation is inaccurate in two ways: (1) it does not accurately describe the H in L\*H pitch accents, which it places too late, and (2) it places the L of LH\* in the same position as H of HL\*, whereas L of LH\* occurs earlier. It is proposed here that these two discrepancies can be accounted for in a principled way; they will be dealt with in turn.

(1) The schema places T of T\*T on the postnuclear syllable; but this is not correct in the case in L\*H. Now, it is to be expected that the alignment requirements for the unstarred tone are less stringent than those for the starred tone, given the starred tone's stronger link with the starred syllable. However, this in itself does not provide a reason for H of L\*H occurring consistently on the stressed syllable rather than later. Let us consider what contour would obtain if the above specifications were followed for L\*H. The penultimately stressed word 'doMA<sup>n</sup>i' would constitute a typical context. If the H occurred on the postnuclear syllable then it would have to be closely followed by the two boundary L tones which are also designated to occur there (as the postnuclear syllable is the final syllable). This could be schematised as follows:



However, there is a problem with this contour. Phonetically, there are production constraints: the H L<sup>b</sup> transition would appear likely to have a gradient which is too sharp. It might be expected that such "tonal crowding" (cf Silverman and

Pierrehumbert:1990) would instigate an adjustment in the interests of ease of articulation. This could be achieved by a number of possibilities: for instance (i) target undershooting or (ii) shifting the position of one or more targets. What in fact appears to happen is the second of these options, as the pitch height of the H tone is not especially reduced.

Phonologically, the proposed analysis in section 5 involves  $L^b$  having a secondary association with 'ni'. Informally:

do	MA	ni
$L^*$	H	$L^b$

The H tone does not have an anchor point to a syllable and would therefore be a candidate for temporal adjustment. It could thus be argued that such temporal adjustment is responsible for the earlier position of H in  $L^*H$ . This process could be dubbed tonal repulsion (as discussed in Silverman and Pierrehumbert:1990, albeit in a different context) and involves the unanchored H tone shifting to a position roughly midway between the two L tones which are flanking it. In other words, H has to squeeze in between two L tones which are designated to occur on adjacent syllables. It is proposed here that, in order to maximise its height, it occurs in a position approximately equidistant from the two L targets.

Corroboration for this analysis is provided in cases where there is no  $L^b$  boundary associated with the immediately postnuclear syllable: the H peak occurs in the 'late' position. Examples of this include figure 3(i), where there is no boundary immediately after the pitch accent, and figure 2(i), where there are two postnuclear syllables before the boundary.

In the other T\*T pitch accent -  $H^*L$  - there is no need for tonal repulsion if it is followed by  $L^b L^B$ . This is because tonal repulsion is construed as a readjustment at the phonetic level, designed to maximise the chances for an unstarred tone to reach its target by adjusting its position in time in relation to tones flanking it with a fixed position (because starred or with a secondary association). A sequence of three L tones ( $LL^b L^B$ ) would not necessitate such an adjustment as they would not be sufficiently different from each other in height to pose the kind of production problems suggested for a  $L^*HL^b$  sequence.

Tonal repulsion occurs on the H tone on the word 'TU' (fig. 1(ii)) discussed above, but for different reasons. Here two tones (L\*H) had to be fitted onto one syllable as they were both associated via the pitch accent. L<sup>b</sup> and L<sup>B</sup> did not squeeze onto the syllable because they had no association with it, as discussed in section 5 above.

(2) The second inaccuracy in the schematic four-way representation of timing is related to the fact that, if the pitch accent (L\*H) in which tonal repulsion takes place is ignored, there is a greater distance between L and H in the LH (L H\*)sequence than in the HL sequences (H\*L, H L\*). Motivation for such a discrepancy can be obtained from production constraints; according to Ohala (1978) and Ohala and Ewan:1973, rises take, *ceteris paribus*, longer to produce than falls.

It has been argued by Pierrehumbert and Beckman (1988) that any tone which has an association (primary or secondary) with a syllable is aligned at a specific point in the syllable. This is stipulated individually for each language (for English, at the end of the syllable nucleus; for Swedish, early in the syllable). Such a view is attractive as it allows for a given language to treat all associated syllables in the same way. However, it is not the view adopted here.

It has been shown above that a starred tone's alignment with a syllable depends on the structure of the pitch accent of which it is a constituent. Furthermore, it is proposed here that the alignment of a tone which has a secondary association to a syllable takes into account the primary association<sup>1</sup>. The syllable with which it is secondarily associated provides the timing slot within which the tone can be realised, but, given that the tone has a primary association to the ip node at its right periphery, it is associated to the syllable's right edge.

Thus, the primary association determines the timing within the syllable rather than the secondary association. This is in contrast to Pierrehumbert and Beckman, who argue that, although the association to the syllable is a secondary one, it plays a primary role in determining the alignment of the tone. It is claimed here that

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<sup>1</sup>The word 'primary' refers to the fact that association takes place in two stages: first, central and peripheral, and then, if there are unattached syllables in the right places, secondary.

making primary association the more determining factor in alignment is more natural.

In this section, it has been proposed that, in Palermo Italian, the timing of tones in relation to the nuclear syllable is more than just a matter of invariable alignment of the starred tone with left or right periphery, and alignment of the trailing or leading pitch accent tones according to a time constant. Instead, timing of the tones depends on certain production constraints, viz. tonal repulsion of unlike tones and the differing durations of falls and rises in similar contexts, and also on the internal structure of the pitch accent.

## **7 How is interrogation signalled?**

It has been shown that yes-no interrogatives in Palermo Italian have a rising(-falling) nuclear intonation pattern. In section 7.1, the fact that rising and rising-falling pitch patterns are perceptually related in Palermo Italian, but not in English, will be explained by comparing word and foot structure in the two languages. In section 7.2, a phonological analysis of boundary tones suggests why they do not bear the interrogative marker, and why, instead, it is carried by the pitch accent. In section 7.3 an attempt is made to determine whether the interrogation marker may be associated at the phrase-level, or whether it should simply be associated to a constituent low down in the prosodic hierarchy<sup>1</sup>.

### **7.1 Location of the interrogative marker on the tone tier**

All (ip and IP) phrase-final contours analysed end in either a falling or a falling-(slightly)rising contour regardless of whether they are final or non-final in an utterance, or declarative or interrogative. The phonological analysis always involves an intermediate phrase peripheral L<sup>b</sup> tone. It is proposed that, in this structural position, there is no paradigmatic contrast between L and H; in terms of the prosodic tree, only a L tone can have a (right) peripheral association with the intermediate phrase node. This is akin to Bruce's (1977) account of Stockholm Swedish where the phrase accent, which could be construed as a boundary of a similar constituent, has no paradigmatic contrast. The major difference is that Palermo Italian has a L, whereas Stockholm Swedish has a H tone.

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<sup>1</sup>The term 'prosodic hierarchy' refers here loosely to the hierarchical structure in the prosodic tier.

The lack of paradigmatic contrast limits the tone's functional role; it can only have a delimitative function (i.e. its position signals a boundary). This corroborates the view that the falling part of the rising-falling movement observed in yes-no interrogatives does not contribute to the signalling of interrogation. It is thus only the rising part, analysed as a L\*H pitch accent, which can be construed as an interrogative marker.

However, a paradigmatic opposition is available for the intonation phrase boundary tone which often follows L<sup>b</sup>: it has been shown to be H<sup>B</sup> or L<sup>B</sup>. Since this contrast is available and since this is the preferred location for an interrogation marker in the majority of languages, two tentative explanations are provided below as to why this is not the location selected for Palermo Italian; the first is phonetic and the second phonological.

( 1 ) Amplitude is particularly low on final unstressed syllables in Palermo Italian<sup>1</sup>; they are often devoiced. Consequently, the end of the intonation phrase might not be an optimal environment for signalling such an important function. Nonetheless, it may be the case that the low intermediate phrase boundary tone has an influence on the amplitude, and perhaps even the voicing; it is not clear which is the cause and which is the effect<sup>2</sup>.

( 2 ) Internal motivation within the phonological analysis proposed here comes from the fact that H<sup>B</sup> cannot have a secondary attachment. The reader is reminded here that it has been argued herefor Palermo Italian, and by Pierrehumbert and Beckman (1988) for Japanese (but not for English) that tones are only fully realised if they are associated with a terminal element of the prosodic tree (a syllable for Palermo Italian and a mora for Japanese). If H<sup>B</sup> cannot have a secondary attachment, it can only have a partial realisation. Such a structural position is unlikely to be selected as the location of a functional marker as important as interrogation, particularly in yes-no questions which do not signal

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<sup>1</sup>This is not the case in a number of Northern varieties of Italian.

<sup>2</sup>However, it is interesting to note that, in the local Sicilian dialect, word-final vowels are considerably reduced, both in amplitude and spectral profile. The dialect's effect on Palermo Italian is evident in other areas; it would therefore not be surprising if it was shown to be responsible for the reduction of amplitude in final syllables in Palermo Italian.

interrogation by any other means, either syntactic (e.g. subject-aux inversion) or morphological (e.g. an interrogative particle).

As was discussed in section 4 above,  $H^B$  occurs in certain questions. However, it does not appear to play the major role in signalling interrogation. It is not observed in other types of utterance (as far as the author is aware) and therefore, phonologically, it does not combine with any other pitch accent-boundary tone combination; it thus has only one context -  $L^*H L^bH^B$ .

It is the invariant nature of the intermediate phrase boundary tone  $L^b$  (the fact that it can only be a L tone) which explains why the H of the  $L^*H$  interrogative-marking pitch accent always occurs at or very close to the right nuclear syllable boundary;  $L^b$  always provides a phonetic context for tonal repulsion.

## **7.2 Association of the interrogative marker on the prosodic tier**

Assuming that the interrogative marker resides in the pitch accent, we now consider with exactly which node it is associated on the prosodic tier. It can be argued that, rather than central association taking place at the foot node, as was suggested in section 5 above, the association might originate higher up the tree.

All of the examples of yes-no questions analysed have a  $L^*H$  pitch accent on the strong syllable within the word which the speaker intends to highlight. It is proposed here that the interrogative  $L^*H$  pitch accent, which serves as the interrogative morpheme, is centrally associated to the intermediate phrase node, and that the association marker is passed down through the strong branches of the tree to the strongest foot, and from there to the strong syllable of that foot (which is the "nuclear" syllable).

Examples dubbed late focus can all be accounted for by the default condition that the rightmost word in the intermediate phrase dominates the "nuclear syllable". The basic shape of the contours is, schematically:

fig 1 (ii) and (iii)





fig 1 (i)

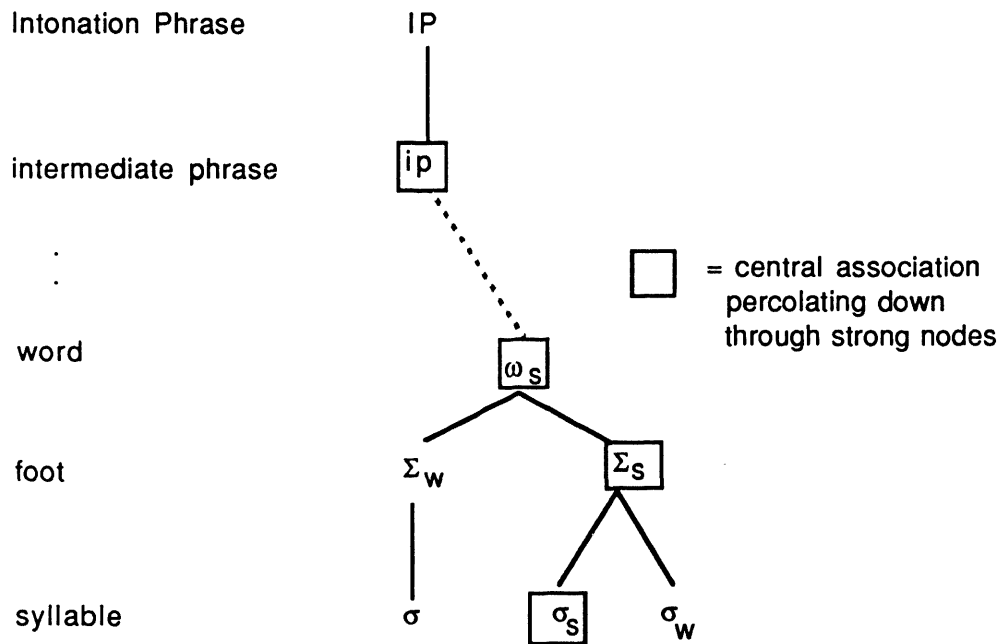


fig 2



 = strongest syllable  
 of highlighted word  
 = unspecified material  
 early in the phrase

The above examples consist of one intermediate phrase, and the rightmost word in the ip is the strongest. It is shown below how the association to the PA,L\*H (which signals interrogation), is passed down the tree; from  $ip_s$  to  $\omega_s$ , from  $\omega_s$  to  $\Sigma_s$ , and from  $\Sigma_s$  to  $\sigma_s$ :



In the examples cited, there are other prosodic words in the intermediate phrase. These are not included in the tree; their existence is implied by the fact that the line from ip to  $\omega$  is slanting<sup>1</sup>.

<sup>1</sup>We adopt the convention here that, where there is ambiguity, a vertical line is used to indicate that a given node dominates only one node, and a slanting line is used to indicate that it dominates more than one.

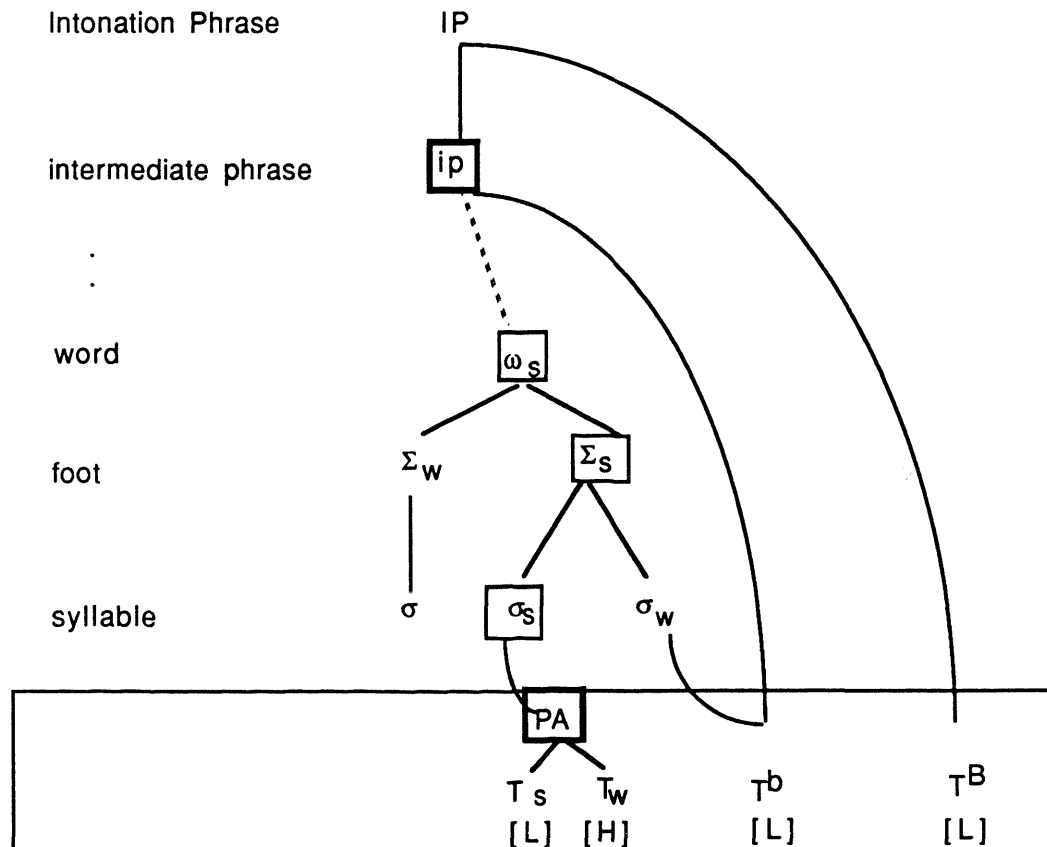
An example of such a contour is in fig 1(iii), the final (nuclear) part of which is analysed as having a L\*H pitch accent, followed by L<sup>b</sup> L<sup>B</sup>. This is given below, where {} and [] respectively indicate IP and ip boundaries:

fig 1(iii)     { [ Glielo porta doMA<sup>n</sup>i ]     }

| \ | |

L\*H L<sup>b</sup> L<sup>B</sup>

Incorporated into a more detailed prosodic tree, it can be represented thus:

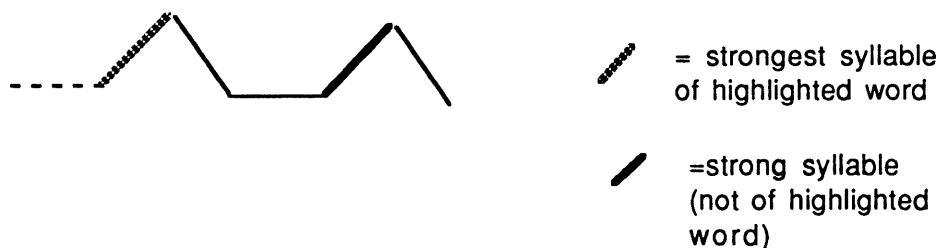


The major association between PA on the tone tier and ip on the prosodic tier is indicated with a bold box, whereas nodes which inherit this "association attribute" are marked with a plain box.

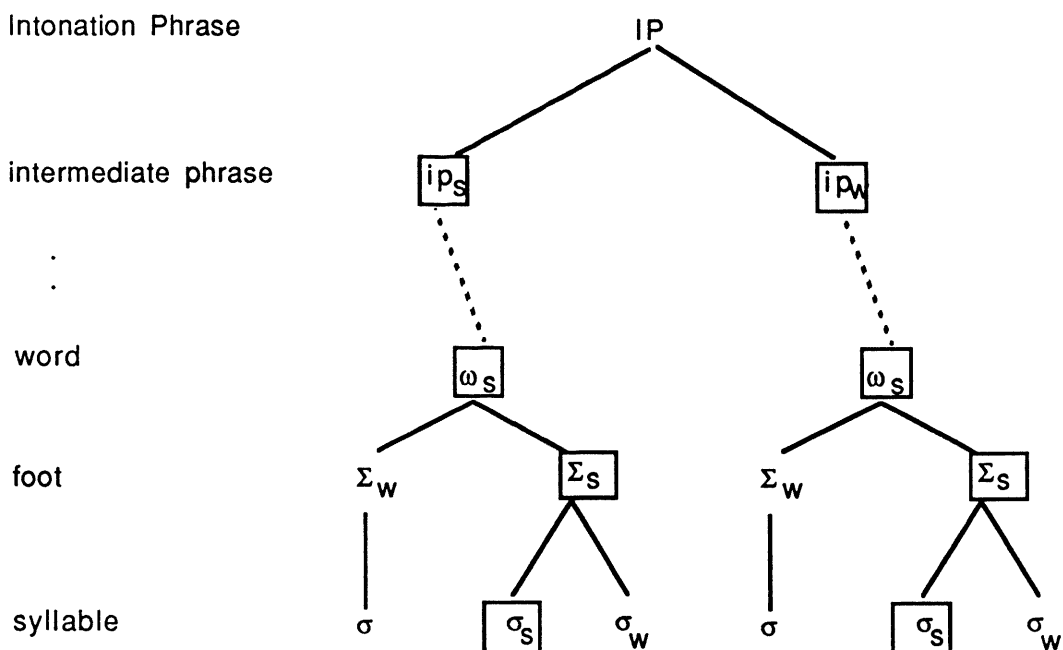
All of the contours in figures 1 and 2 can be represented in a similar way. Differences involve changes which do not affect the general argument, i.e. in the number of feet in the word, number of syllables in the feet, presence or absence of secondary association, or differences in the intonation phrase boundary tone type.



A different type of interrogative contour is found in figures 4 and 5, which have the basic shape:



Examples from figures 4 and 5 are analysed as consisting of two intermediate phrases within one intonation phrase. The highlighted part of the question is in the first ip, on its final pitch accent. However, the pitch accent used to signal interrogation - L\*H - is used on both ip final pitch accents. This is accounted for by stipulating that interrogatives have an association to an interrogation marker at every ip node. The presence of these markers, inserted at the level of the ip, indicate that there is interrogation; whereas the strength between the ip nodes and their daughters indicate where in the interrogative structure lies the focus. The following tree indicates the route the association to the interrogative marker takes down the tree and the strength relations of the nodes in the tree:



An example analysis of this type of contour is:

fig5(i) { [ E' GioVANni ]<sub>s</sub> [ che è parTito ]<sub>w</sub> }



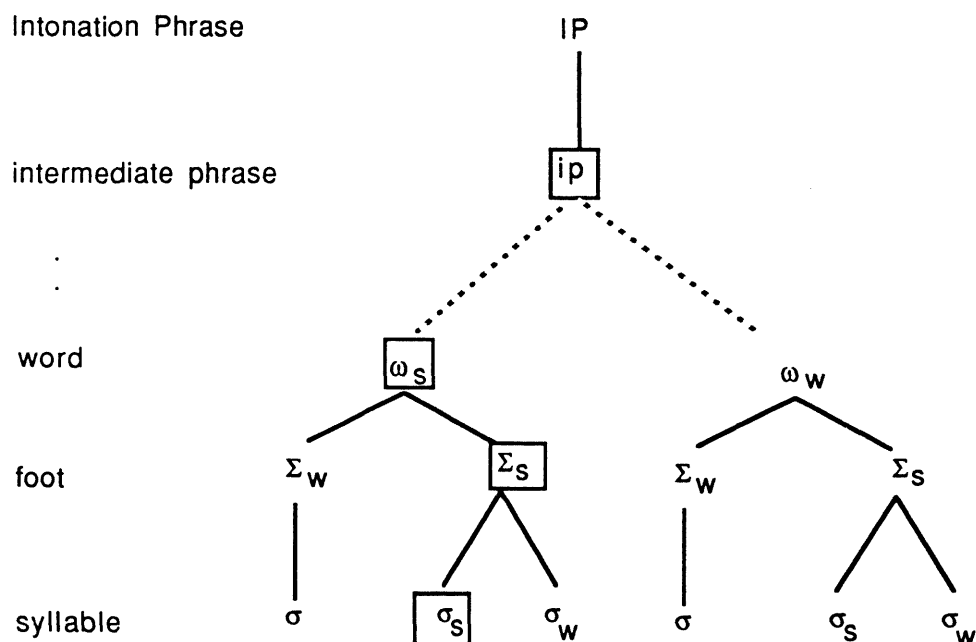
A British-style analysis of the example 5(i) would involve two tone groups with a nuclear tone on 'Giovanni' and another on 'partito'; one tone group would be ruled out because 'Giovanni', being by far the most salient, would have to be analysed as having a nuclear tone, and this would preclude a following accent such as that on 'partito'. The analysis proposed here captures the fact that the utterance is one unit whilst acknowledging the fact that there is a minor boundary after the highlighted constituent. Two "nuclear" pitch accents (in the sense that each is the main pitch accent of its intermediate phrase) are thus accounted for. It also captures the fact that the first of the two "nuclear" pitch accents is stronger than the second; it is associated to the stronger of the two ip nodes.

Such a structure does not violate the assumptions about tree-building adopted so far, and it is in keeping with the proposals on central association presented earlier in the chapter: the interrogation marker is only passed down through the strong nodes. We shall now show that, in intermediate phrases with more than one pitch accent, the interrogative marker is not passed down to the weak nodes, even if they are to the right of the focussed item.

Such cases occur in the examples in figure 3, which have the following shape:



where there is a rise on the early focus item and a fall on the last stressed syllable of the utterance. They can be analysed as consisting of one intermediate phrase with the strong word node on the left, rather than the right, which has been the case in the previous examples. The following tree illustrates this:



These contours have a L\*H pitch accent on the strongest syllable of the strong word (to the ) and a HL\* pitch accent on the strongest syllable of the weak word (to the right). The boundary tones then follow. This may be represented as follows:

{ [ E' anDAto al cinema ] }

$\begin{array}{cccc} | & | & \backslash & | \\ L^*H & HL^* & L^b & LB \end{array}$

The type of pitch accent occurring early in an intermediate phrase does not appear to affect the signalling of interrogation. It has been shown in section three that the head portion of the contour can be identical in some cases of question-statement pairs in the corpus. The HL\* in final position in the last examples discussed (fig. 3 contours) is proposed elsewhere as the neutral unmarked pitch accent. It is suggested here that when a highlighted item is shifted from default, final position to a location earlier in an interrogative utterance, it is either (i) incorporated into a non-final intermediate phrase, and may be followed by L\*H pitch accents in later intermediate phrases, or, less commonly, (ii) allowed to occur in initial position

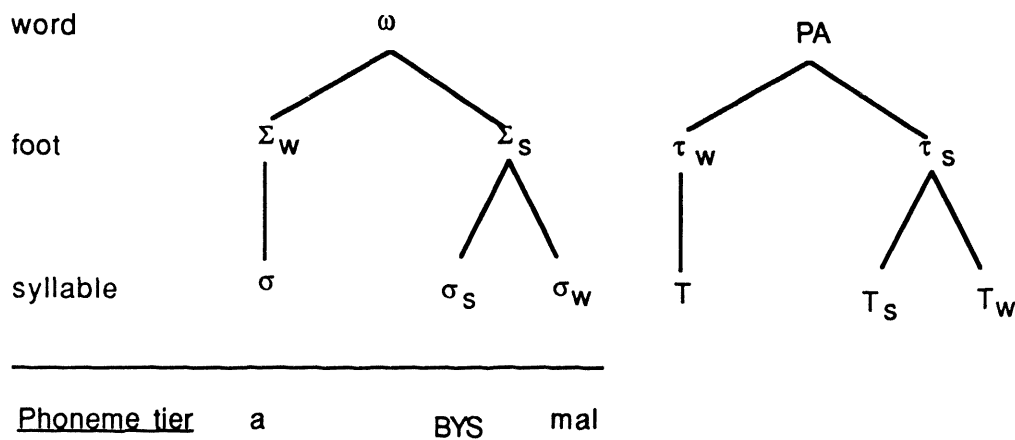
with the proviso that any pitch accent following it will be restricted in the form it can take to the neutral, unmarked form<sup>1</sup>.

### 7.3 Pitch accent structure

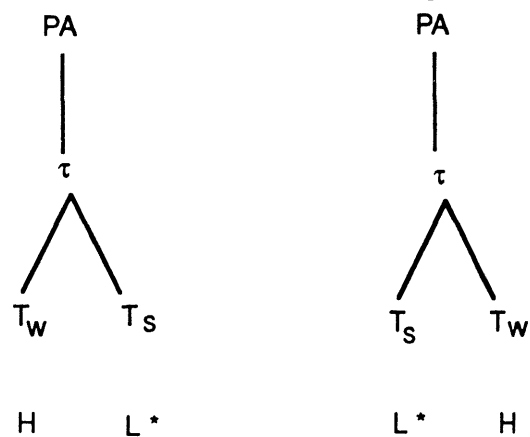
It is of interest here to examine whether the richer pitch accent structure proposed for English in section 4 of chapter 6 would improve our account of Palermo Italian.

In English, the pitch accent structure was analogous in some way to the prosodic word structure:

#### Prosodic tier



For Palermo Italian, the following structures are proposed :

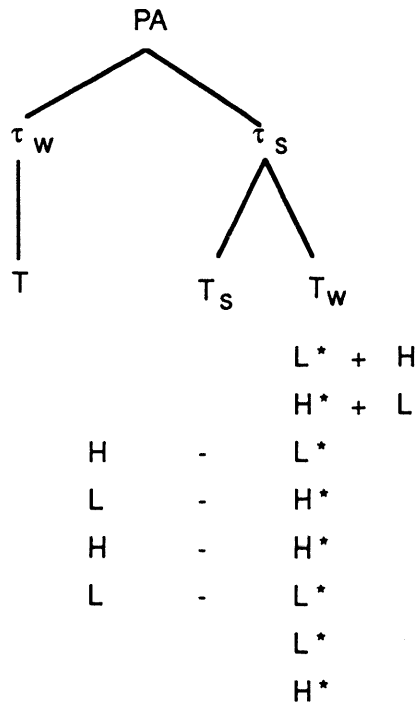


<sup>1</sup>Hence the analysis of the degenerate postnuclear accents in figure 10 as (HL\*) in the summary analyses in section 9 (cf. Pierrehumbert's degenerate pitch accents (1980:figure 6.8), referred to in chapter 5 section 2.2.1 above).

There are two differences between the English and Palermo Italian pitch accents; in Palermo Italian, there is no  $\tau_w$  node, the  $T_w T_s$  under  $\tau_s$  may occur in either order (as  $T_s T_w$  or  $T_w T_s$ ).

The revised English inventory proposed in chapter 6 has eight pitch accents,  $L^*+H$ ,  $H^*+L$ ,  $H-L^*$ ,  $L-H^*$ ,  $H-H^*$ ,  $L-L^*$ ,  $L^*$  and  $H^*$ :

English



The Palermo Italian contours described so far, which include four pitch accents, are analysed here in the following way, two have a weak-strong ordering of nodes under  $\tau_s$ , and two have a strong-weak ordering under  $\tau_s$ <sup>1</sup>:

---

<sup>1</sup>We have not solved the question of the possibility of monotonal pitch accents. If there are such PAs in Palermo Italian, it would be difficult to decide on the alignment of their tones, as they are at once leftmost and rightmost. The data here are too restricted to answer this question.

# Palermo Italian

(a)

PA

$\tau$



L\*

H

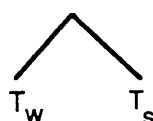
H\*

L

(b)

PA

$\tau$



L

H\*

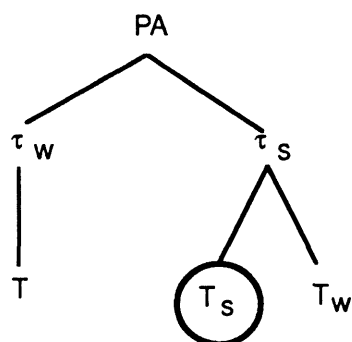
H

L\*

As indicated above, the Palermo Italian structures never fill a position dominated by  $\tau_w$ . Justification for this analysis is drawn from an examination of the discrepancies between Pierrehumbert and Beckman's timing specifications and those proposed for Palermo Italian in section 6 above.

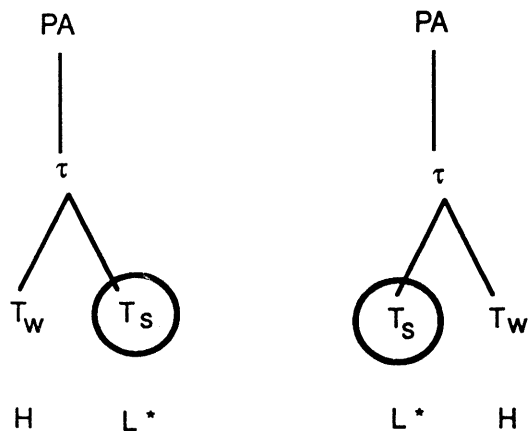
Pierrehumbert and Beckman argue that the starred tone is always aligned with the same part of the starred syllable, regardless of whether it is in a monotonal or bitonal pitch accent, and, if bitonal, regardless of whether it is preceded or followed by an unstarred tone. The tree proposed explains this: the starred tone is always in the same position in the tree. By contrast, Palermo Italian, allowing the strong-weak nodes under  $\tau_s$  to be in either order, does not always have the starred tone in the same structural position; it may be on the right or left branch of  $\tau_s$ .

The position held here is that the alignment of starred syllables is the same only if they are in the same structural position. This is the case for starred tones in English; starred tones are always represented as being at the encircled position below:



Alignment rules are only sensitive to position within the tree and the strength of the node. Whether  $\tau_w$  or  $T_w$  are present or not does not affect the strength of  $T_s$ : it is always a strong T node dominated by a strong  $\tau$  node, and it is always on the left-most branch of  $\tau_s$  (where left-most is also a valid description even if it is the only T). Such an account explains why Pierrehumbert and Beckman treat the alignment of starred tones with starred syllables in the same way in all pitch accent types.

This sensitivity holds for Palermo Italian also. The reason  $L^*$  in  $L^*H$  is not aligned in the same way as  $L^*$  in  $H L^*$  is because the  $L^*$  is on the left branch of the  $\tau_s$  node in the former case and on the right branch in the latter, as indicated below:



The additional structure in the pitch accent (with an extra  $\tau$  level) does not radically modify the analysis proposed in previous sections of this chapter. This is because in Palermo Italian, the PA does not branch; instead of the earlier specification



the new structure is



The new analysis provides further insight into the hypotheses on timing advanced in section 6, and accounts for the apparent inconsistency in the timing of starred tones in Palermo Italian.

## 8 Relation to auditory analysis in chapter 3

The main observations of chapter 3 were as follows:

- 1 ) The transition between head and nucleus signals interrogation - if it involves a skip or glide up.
- 2 ) Non-final list clauses have a similar description to yes-no questions. They are discriminated auditorily by an earlier start to the rising "transition".
- 3 ) High pitched unstressed syllables immediately before a low level or extra low falling nucleus were recorded.
- 4 ) Yes-no questions with a final stressed syllable had a rising nucleus. It appeared that an "allophonic" variant of a fall was a rise.
- 5 ) A number of rise-fall nuclear tones were recorded, which may also be allophones of the fall. A fall-rise tone with a rising transition was also transcribed.
- 6 ) The common factor in interrogatives is the rise, either as a skip up to or as a movement on the nuclear syllable.

We shall examine each of these observations in turn and see how the theory proposed in this chapter accounts for them:

- 1 )  $L^*H$  is the pitch accent which is used in all yes-no questions; this is the rising element. It may be followed by  $L^b L^B$  or  $L^b H^B$ . See also point 5 below.
- 2 ) Non-final list clauses are analysed as having a different type of LH pitch accent:  $LH^*$ . This accounts for the timing difference.
- 3 ) High pitched unstressed syllables immediately before a low level or very low falling nuclear tone can be described by the pitch accent  $HL^*$  (followed by  $L^b L^B$ ).
- 4 ) The rise in the stressed final syllable cases is  $L^*H$ . The fall is not properly realised because the  $L^b$  tone is not reassociated with a syllable (secondary type association), as there is no "tail" syllable available for association.
- 5 ) The rise-fall nuclear tones are, in Palermo Italian, allophonic variants of the "rising transition + fall tones"; they are both  $L^*H$  ( $L^b L^B$ ). It is hypothesised that so many cases of high fall, rather than rise-fall, were transcribed because the position of the peak in the Palermo Italian interrogative contours was usually towards the end of the nuclear syllable. In English, there is an opposition between  $H^* L^b L^B$  and  $L^*H L^b L^B$ , but the peak in the latter type of pitch accent usually falls



considerably later than in the Palermo Italian L\*H. Appendix 2, figure 12, contains F0 traces of English H\* and L\*+H Pitch Accents, followed by L<sup>b</sup> and L<sup>B</sup>. The text of these is "Well I think he's Omani". Note that the position of the peak in figure 1(iii) (Glielo porta domani) is between the position of the peak in figure 12(i) and that of figure 12(ii).

The fall-rise tone with a rising transition is transcribed as L\*H L<sup>b</sup> H<sup>B</sup>.

In Palermo Italian, the Low ip boundary causes the shift leftwards of the end point of the rise. English is different from Palermo Italian in two major respects: (i) it has a paradigmatic contrast on the ip boundary tone, and (ii) it allows for a greater amount of pitch modulation on one syllable. The latter has been expressed in phonological terms: it allows for tones to be realised without an association to a syllable and does not therefore need secondary association. However, another consequence of this facility for pitch modulation could be that there is a correspondingly reduced degree of tonal repulsion in contexts where tones must be mapped onto a small amount of segmental material. More research would be necessary to corroborate this hypothesis.

6 ) The common factor in interrogatives is the L\*H pitch accent.

It appears that the analysis proposed in this chapter has resolved the main problems brought up by the auditory analysis in chapter 3. However, the fact that we were able to pinpoint such problems shows that auditory analysis with a strict set of guidelines is a powerful tool and should not be underestimated. The work of Gerry Knowles (1984), whose auditory model can account for anticipation or delay of the pitch peak, points in this direction.

## 9 Analysis of contours - summary

There follows a systematic analysis of the contours presented in the descriptive section (3) according to the theory developed throughout this chapter.

Key: []=boundaries of intermediate phrase(ip), L<sup>b</sup>=boundary tone of ip  
 {}=boundaries of intonation phrase(IP), L<sup>B</sup>=boundary tone of IP  
 |=primary association, associating either syllables with pitch accents (and thus indirectly with tones), or boundaries with tones.  
 \=secondary association (associating L<sup>b</sup> and final syllable within ip)

- |         |  |   |
|---------|--|---|
| 1 (i)   | {[Gliel'hai detto <u>TU</u> ? ] }                          | (Did <u>you</u> tell her?)                    |
|         | <br>L*H   L <sup>b</sup> L <sup>B</sup>                    |   |
| 1 (ii)  | {[E' un lavoro <u>masCHile</u> ?] }                        | (Is it a <u>masculine</u> job?)               |
|         | \    <br>L*H   L <sup>b</sup> L <sup>B</sup>               |   |
| 1 (iii) | {[Glielo porta <u>doMA ni</u> ?] }                         | (Is she bringing it to her <u>tomorrow</u> ?) |
|         | \    <br>L*H   L <sup>b</sup> L <sup>B</sup>               |   |
| 2 (i)   | {[E' andato a <u>MAlaga</u> ?!] }                          | (He's gone to <u>Malaga</u> ?!)               |
|         | \    <br>L*H       L <sup>b</sup> H <sup>B</sup>           |   |
| 2 (ii)  | {[Glielo porta <u>doMANi</u> ?!] }                         | (He's bringing it to her <u>tomorrow</u> ?!)  |
|         | \    <br>L*H       L <sup>b</sup> H <sup>B</sup>           |   |
| 3 (i)   | {[ <u>TU</u> gliel'hai detto?] }                           | ( <u>You</u> said it!?)                       |
|         | \    <br>L*H           HL*   L <sup>b</sup> L <sup>B</sup> |   |

- |         |   |  |
|---------|---|--|
| 3 (ii)  | {[Ma è <u>anDAto</u> al cinema?] }  | (But did he <u>go</u> to the cinema?)  |
|         | $\begin{array}{ccccc}   & &   & \backslash &   &   \\ L^*H & & HL^* & & L^b & L^B \end{array}$                |  |
| 4 (i)   | {[ <u>IU</u> ] [gliel'hai detto?] }   | (Did <u>you</u> say it?)               |
|         | $\begin{array}{ccccc}   &   & &   & \backslash &   &   \\ L^*H & L^b & & L^*H & L^b & L^B \end{array}$        |  |
| 4 (ii)  | {[Ma è <u>anDAto</u> ] [ al cinema? ] }   | (But did he <u>go</u> to the cinema?)  |
|         | $\begin{array}{ccccc}   & \backslash &   & \backslash &   &   \\ L^*H & L^b & L^*H & & L^b & L^B \end{array}$ |  |
| 5 (i)   | {[E' <u>GioVANni</u> ] [che é partito?] }   | (Was it <u>Giovanni</u> who left?)     |
|         | $\begin{array}{ccccc}   & \backslash &   & \backslash &   &   \\ L^*H & L^b & L^*H & L^b & L^B \end{array}$   |  |
| 5 (ii)  | {[E' <u>LUI</u> ] [ che te l'ha DAto?] }  | (Was it <u>he</u> who gave it to him?) |
|         | $\begin{array}{ccccc}   &   & &   & \backslash &   &   \\ L^*H & L^b & & L^*H & L^b & L^B \end{array}$        |  |
| 5 (iii) | {[Si fa <u>FUOri</u> ] [questo meSTIEre?] }   | (Is it done outdoors, this job?)       |
|         | $\begin{array}{ccccc}   & \backslash &   & \backslash &   &   \\ L^*H & L^b & L^*H & L^b & L^B \end{array}$   |  |
| 6       | {[Glielo porta doMAni,] ...}  | (He'll bring it to her tomorrow,)      |
|         | $\begin{array}{ccc} &   & \backslash &   \\ & LH^* & & L^b \end{array}$                                       |  |
| 7       | ... [dopo doMAni] ...   | (the day after tomorrow)               |
|         | $\begin{array}{ccc} &   & \backslash &   \\ & LH^* & & L^b \end{array}$                                       |  |

- |         |  |   |
|---------|--|---|
| 8 (i)   | {[Glielo porta <u>doMANi</u> . ] }   | (He'll bring it to her tomorrow.)         |
|         | $\begin{array}{c}   \quad \backslash     \\ \text{HL}^* \quad \text{L}^b \text{L}^B \end{array}$   |   |
| 8 (ii)  | {[E' diVERso. ] }  | (It's different)                          |
|         | $\begin{array}{c}   \quad \backslash     \\ \text{HL}^* \quad \text{L}^b \text{L}^B \end{array}$   |   |
| 9 (i)   | {[Ma é un lavoro <u>masCHile</u> ! ] }   | (But it's a <u>man's</u> job!)            |
|         | $\begin{array}{c}   \quad \backslash \quad   \\ \text{H}^* \text{L} \text{L}^b \text{L}^B \end{array}$   |   |
| 10 (i)  | {[ <u>DoMANi</u> glielo porta.] }  | ( <u>Tomorrow</u> he'll bring it to her.) |
|         | $\begin{array}{c}   \quad \quad   \quad \backslash   \\ \text{HL}^* \quad \quad (\text{HL}^*) \text{L}^b \text{L}^B \end{array}$                       |   |
| 10(ii)  | {[E' <u>GioVANni</u> che è partito. ] }  | (It was Giovanni who left.)               |
|         | $\begin{array}{c}   \quad \quad \quad   \quad \backslash     \\ \text{HL}^* \quad \quad \quad (\text{HL}^*) \text{L}^b \text{L}^B \end{array}$         |   |
| 10(iii) | {[E' <u>LUI</u> che te l'ha dato. ] }  | (Was it he who gave it to you?)           |
|         | $\begin{array}{c}   \quad \quad \quad   \quad \backslash     \\ \text{H}^* \text{L} \quad \quad \quad (\text{HL}^*) \text{L}^b \text{L}^B \end{array}$ |   |

## Chapter 8 Summary and Conclusion

### 8.1 Summary

This section will examine each chapter in turn, and summarise its main conclusions and its contributions to the thesis in general.

In chapter 2, the British Approach to intonation was examined in some detail. The division of the tone unit into four essentially independent components: prehead, head, nucleus and tail, was taken as a starting point. It was pointed out that the definition of each component relies on the distinction between (i) stress as rhythmic prominence, (ii) accent as rhythmic and pitch prominence and (iii) pitch prominence alone. There are two main orientation points within a tone unit: the beginning of the head, the first accented syllable, and the nucleus, the final accented syllable. However, the distinction between exponents of (ii) and those of (iii) is far from clear-cut. It is therefore possible for a pitch prominent prehead syllable to be perceived as an accented head syllable. It was also shown that the terms "nucleus", "nuclear syllable" and "nuclear tone" are used inconsistently, and, in fact, preclude a successful break-down of tone units into independent components. A working model was proposed for the analysis of Palermo Italian, involving three constituents: prehead, head and nuclear unit. The latter consists of the nuclear syllable and the tail which together represent the domain of the nuclear tone.

In chapter 3, an analysis of Palermo Italian was performed, using the working model proposed in chapter 2. It was found that a rise in the transition between two components, the head and the nuclear unit, had the function of signalling interrogation. The contour typically used to signal interrogativity was a rising transition plus a falling nucleus. There were two contextually determined (allophonic) variants, (i) a rising-falling nucleus and (ii) a rising nucleus. It was shown that only the former can be accounted for within the British model, where final direction of movement is often taken as a criterion for analysing tones into the same broad class. Furthermore, it was shown that non-final items in lists often have a rising transition plus a falling nucleus, although the timing of the rise in relation to the segmental structure was perceived to be different; it was not possible to account adequately for this distinction. Lastly, a number of preaccentual unstressed syllables were observed to be pitch prominent; their existence complicated the analysis of heads and preheads. Notably, it was necessary to posit

rising and falling preheads, two categories not hitherto used in British-style analyses.

Chapter 4 examined the existing literature on Italian Intonation and pointed out that the British-style analysis had not been successfully applied to any variety of Italian. It was shown that interrogativity is signalled in different ways in different varieties, although the predominant pattern involves a rise at the end of the phrase-length unit. One account, presumably of a different variety from the others described, did have a rising-falling contour similar to that found in Palermo Italian. It was found that non-final list items are described as having a similar contour to those used in Palermo Italian, and unaccented pitch prominent syllables were commonly referred to.

Chapter 5 investigated a different approach to the componentialisation of intonation contours, that advanced by the autosegmentalists. The simplest representation of the autosegmental theory is that proposed by Goldsmith in his seminal work (1976) where he describes an abstract association between a vowel in a phoneme string and a tone in a tonological string which leads to a synchronisation at the realisational stage of the associated vowel and tone. More recent work within that tradition (strands represented by Bruce, Hirst, Pierrehumbert and Ladd) was shown to incorporate, *inter alia*, the concepts of pitch accent and boundary tone. Such recent work generally appeals to prosodic structure, either implicitly (the use of the term "boundary tone" implies a tone associated with the periphery of a constituent) or explicitly. It was concluded that just as a string of phoneme segments has to be interpreted with regard to syllabic and word structure, a string of tones has to be interpreted with regard to prosodic structure. The different accounts require the involvement of at least two levels in a hierarchical structure: a lower level such as the foot, and a higher level such as the intonation phrase.

In chapter 6, two types of delay discussed by Kingdon were taken as a starting point; these involved (i) the delay of the pitch peak and (ii) the delay of the onset of the nuclear tone. The former type was shown to be accounted for in later analyses within the British school, and in autosegmental pitch accent analyses such as those of Pierrehumbert and of Ladd. The latter type of delay was said to occur only in nucleus-initial phrases; contrastive pitch which would have been realised on a prehead was, in the absence of such, realised on the nuclear syllable. This led to an investigation of whether contrastive pitch just before a nuclear tone could be part of

its defining characteristics. It was established that contrastive pitch can occur in this position, and that it cannot be consistently accounted for with a standard British-style analysis. Furthermore, it does not fit in with a Ladd-style analysis; Ladd, like the British analysts, takes the onset of the nuclear syllable as the left edge of the nuclear domain. Pierrehumbert incorporates such phenomena into the nuclear domain as the leading part of a bitonal pitch accent (L+H\* or H+L\*). However, there are problems with her analysis vis-a-vis the H+L\* pitch accent, which does not involve a low pitch on the starred syllable, but rather one which appears to be downstepped. An alternative analysis is proposed which reanalyses the H+L\* pitch accent as having a low pitch on the stressed syllable, and accounts for the examples with mid pitch as downstepped, without the use of a L tone. Reflecting the fact that, in English, the semantic impact of a leading tone is less than that of a trailing tone, the leftwards extension of the nuclear domain was treated as a proclitic element. This was achieved by introducing into the Pitch Accent hierarchy a separate level of structure between the Pitch Accent (PA) and tone (T) levels: the supertone ( $\tau$ ). A leading tone was then represented as dominated by a degenerate  $\tau$  node, whereas starred and trailing tones were both dominated by a strong  $\tau$  node.

Chapter 7 comprises an account of Palermo Italian which draws on concepts discussed in the previous chapters. Using a corpus as a basis, interrogative and declarative renditions of a number of sentences were compared. These included focussed items early and late within an utterance. It was shown that, if the nucleus occurred in intonation phrase final position, an adequate account of the contours necessitated four tones in the nuclear region. Furthermore, corroboration was given for a decomposition of these contours into a bitonal pitch accent and two domain-peripheral tones, the domains being the intermediate and intonation phrases. Pitch accents did not necessarily occur in intonation phrase final position; they also occurred before an intermediate phrase boundary, as well as remote from intonationally marked boundaries.

The most common interrogative contour was analysed as a L\*H pitch accent followed by two low boundary tones, L<sup>b</sup> and L<sup>B</sup>. Pierrehumbert and Beckman's concept of secondary association, first introduced in chapter 5 with respect to Japanese, was employed to account for the allophonic variant which displayed no fall. It was shown that the intermediate phrase boundary tone, L<sup>b</sup>, is typically reassociated with the final unaccented syllable of a phrase; and where there is no such syllable, it is not fully realised. This is why there was, in cases of final stress, a rise followed by a

slight fall which did not reach a low pitch, or even fall at all but rather a plateau effect towards the end of the rise. Another type of Palermo Italian yes-no question contour, one involving a rise in final position, is also analysed as having a L\*H pitch accent; the final rise is accounted for by a H intonation phrase boundary, H<sup>B</sup>. The common factor in the different interrogative contours was shown to be the pitch accent L\*H.

Pitch prominent unstressed syllables occurring preaccentually were accommodated as leading tones in a bitonal pitch accent: either LH\*, as in non-final clauses (often of lists), or HL\* as in final clauses of neutral declaratives. The difference in timing between the non-final list items and yes-no question contours was indicated by a different association: LH\* instead of L\*H. Finer details of timing were accounted for by employing the enriched Pitch Accent structure developed in chapter 6. The Palermo Italian Pitch Accent was shown to dominate only one supertone branch,  $\tau_s$ . All pitch accent tones are therefore dominated by a strong supertone node, the T T\* Pitch Accents having right-headed and T\*T having left-headed structures. Headedness of the supertone structure was shown to influence timing; the starred tone of left-headed PAs was aligned earlier in the starred syllable than of right-headed PAs. Pierrehumbert and Beckman's claim that the starred tone is always aligned at the same position in the starred syllable in the same way is explained by the fact that, in English, the starred tone is consistently associated with a left-headed supertone node.

## **8.2 Conclusion**

Assuming the existence of the nucleus, the discussion in this thesis presents evidence for one instance of what is probably a common phenomenon, viz. the interpretation of the form of the nucleus through an analysis derived from auditory classification of English Intonation. Lepschy (1968) observed that this is a problem for Italian; he quotes Hall: "one of the greatest mistakes in recent linguistics has been the attempt to force the description of all languages into the mould of patterns first worked out for English." (Hall, 1964:117-118).

The difficulties encountered when trying to analyse Palermo Italian, using a definition of the nuclear tone and its domain which was finely tuned for English might have led to the abandonment of a componential analysis, including the nuclear tone itself. This would not have been the first time Italian had been analysed using a holistic tune approach. Chapallaz took this approach in her studies of Italian



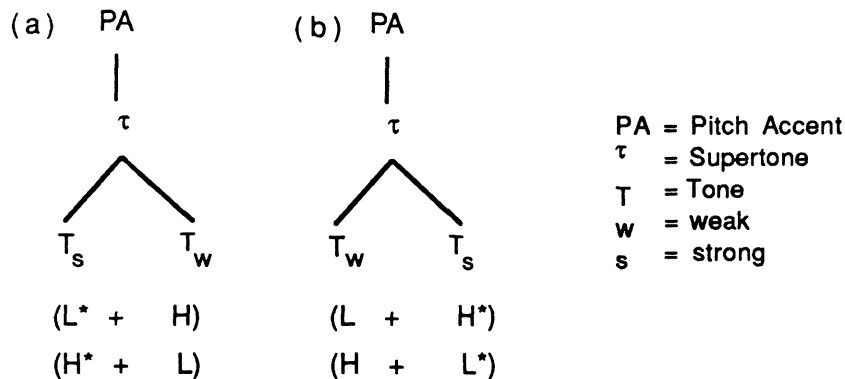
intonation (1960, 1962, 1964 and 1979). She performed her analysis in full cognisance of O'Connor and Arnold's<sup>1</sup> account of English intonation (1961, second edition:1973) which refers to tunes as consisting of prehead, head, nucleus and tail.

However, despite the inadequacies of the British componential approach, it has been assumed here that the solution is not to revert to a whole tune approach, but rather to search for a more appropriate method of breaking down the tunes. Much of the thesis has had the aim of developing an alternative analysis which (i) provides an adequate analysis of Palermo Italian, and (ii) is sufficiently general to be successfully applied to English too. In order to meet the second requirement, a certain amount of English data has necessarily been referred to.

Such an approach takes autosegmental phonology as a starting point. It has been shown that an autosegmental pitch accent analysis can account for leading tones before the nuclear syllable.

Palermo Italian Pitch Accents have one of the two following structures:

Palermo Italian



This means that the supertone structure can be left or right headed.

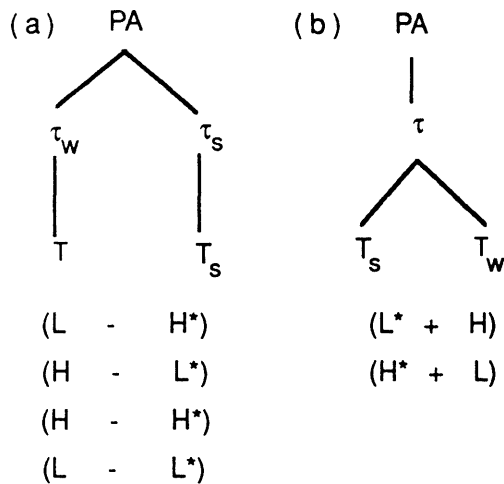
It has been argued that the alignment of the strong tone with a strong syllable is sensitive to whether the supertone node is left or right headed. In (a), alignment of the tone is later in the syllable than in (b).

By contrast, English Pitch Accents have one of the two following structures:

---

<sup>1</sup>who belonged to the same school.

English



Here the Pitch Accent can branch and the strong supertone ( $\tau_s$ ) node is always left-headed; this can be schematised as follows, where the cross indicates an illegal branch:



This accounts for Pierrehumbert and Beckman's claims about the alignment of starred syllables being consistent, be a Pitch Accent mono or bitonal, and be it right or left-headed; in the case of English Pitch Accents, it is the left-headedness of the supertone node which is constant, and from this derives the consistency in alignment.

What superficially might appear to be a similar pattern, a peak preceding a low pitch on the stressed syllable, does not have the same phonological representation in English and Palermo Italian. Whereas in English the H tone is dominated by a weak supertone ( $\tau_w$ ), the Palermo Italian counterpart is dominated by the strong supertone, or core of the Pitch Accent ( $\tau_s$ ). The English H is thus more peripheral than the Palermo Italian H<sup>1</sup>.

---

<sup>1</sup>The fact that, in Palermo Italian, the H+L\* Pitch Accent is the one which is used in neutral declarative utterances might be taken as further corroboration for the integration of the H tone into the core of this Pitch Accent.

In addition to the characterisation of preaccentual pitch, the autosegmental pitch accent approach also provides a framework in which postaccentual pitch can be consistently accounted for. The British-style nuclear tone is treated as a Pitch Accent followed by two boundary tones. Pierrehumbert and Beckman's concept of secondary association has provided a mechanism which accounts for an allophonic variant of the rising-falling pitch movement used to signal interrogation. This is the rise which occurs only in cases of final stress. The phonological analysis of the rise and the rise-fall is as follows:

Pitch Accent	ip boundary tone	IP boundary tone
<b>L*+H</b>	<b>L</b>	<b>L</b>

The fall after the rise is a consequence of the L boundary tones. It has been proposed here for Palermo Italian, that in order for a boundary tone to be fully realised, it must be associated not only with the higher constituent at whose boundary it occurs, but also to a syllable. This association to a syllable takes place at a second stage in a two-part association process in which tones are first associated with (metrically) strong syllables and constituent boundaries; the tones associated with the latter then undergo a secondary linking to the nearest syllable within the given constituent. There are a number of constraints on this secondary linking, some universal, and some language specific. A universal convention is that association lines cannot cross (for instance, an association cannot be made between a peripheral tone and a syllable which precedes a preceding Pitch Accent). A language-specific convention employed for the description of Italian is that only intermediate phrase peripheral tones may have secondary attachment. It appears that the existence of secondary association is a language-specific parameter; Pierrehumbert and Beckman propose that it operates in Japanese, but not in English<sup>1</sup>. What appears to be generally applicable across languages which do have secondary association is the fact that a

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<sup>1</sup>English is special in that it allows for a wide range of complex pitch movements to be realised on one syllable. This is often achieved through a lengthening of the syllable concerned, although the extent of the pitch excursion can also be somewhat curtailed (Leben (1975) claims that this can happen at the phonological level as well as in phonetic realisation). However, such curtailment is generally less than that observed for Italian (or in fact, a large number of non-Germanic languages). It appears that the phonology of (at least RP) English intonation does not require the secondary attachment of a tone to a syllable for it to be properly realised.

syllable must be unassociated (i.e. must not have been associated in the first stage of the process) in order to undergo secondary association.

Secondary association accounts for the intonation pattern in an interrogative (L\*H L<sup>b</sup> L<sup>B</sup>) rendering of the following phrase:

'Hanno fatto un faLO'?

where the syllable 'lo' is stressed and is therefore associated with the L\* of L\*H. There is no free syllable to which the ip peripheral L tone can be secondarily linked. Since tones which are not attached to a syllable are only partially realised, there is only a slight fall, better characterised as a slump. This contrasts with the full fall found in cases with postaccentual syllables, such as

'Glielo porta doMA<sup>n</sup>i'?

where the ip peripheral tone has a secondary attachment to the final syllable 'ni' which would have been left unassociated after the first stage of the association process. The allophonic variation is thus systematically accounted for.

Furthermore, the formal separation of boundary tones and Pitch Accent tones allows for alternative interrogative contours, involving a rising-falling and a rising-falling-rising movement, to be described with a common Pitch Accent; the difference lies in the choice of tone in the IP boundary position, which, in the latter case, is H rather than L. Thus, the generalisation can be made that interrogation is signalled by means of a L\*H Pitch Accent.

The fact that the interrogative marker is a LH sequence, or rise, is in keeping with the universal tendency of questions to exhibit a rising contour, although it is generally claimed that this rise occurs phrase finally (inter alia, Bolinger:1978, Ohala:1983, 1984, Cruttenden:1981). A number of hypotheses have been advanced here as to why the rise should occur non-finally, including the lack of paradigmatic contrast of the tone at the intermediate phrase boundary and the operation of secondary association. Similar contours signal interrogativity in a number of other languages, amongst others, Hungarian (Varga:1984, Ladd:1981), Rumanian (Romportl:1973, Ladd:1981, Dascalu:1975), Czech (Romportl:1973), Bengali (Hayes and Lahiri:1991), and Bulgarian, Russian and Brazilian Portuguese (Hirst

and Di Cristo: forthcoming). It is hoped that the analysis of Palermo Italian interrogative intonation proposed here will in some way shed light on the form of interrogation in these other languages, and will contribute to the debate on whether it is high or rising terminals which signal interrogation, or whether it is simply high or rising pitch near the end of the phrase.

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## **Appendix 1**

### **Figures to Chapter 6**

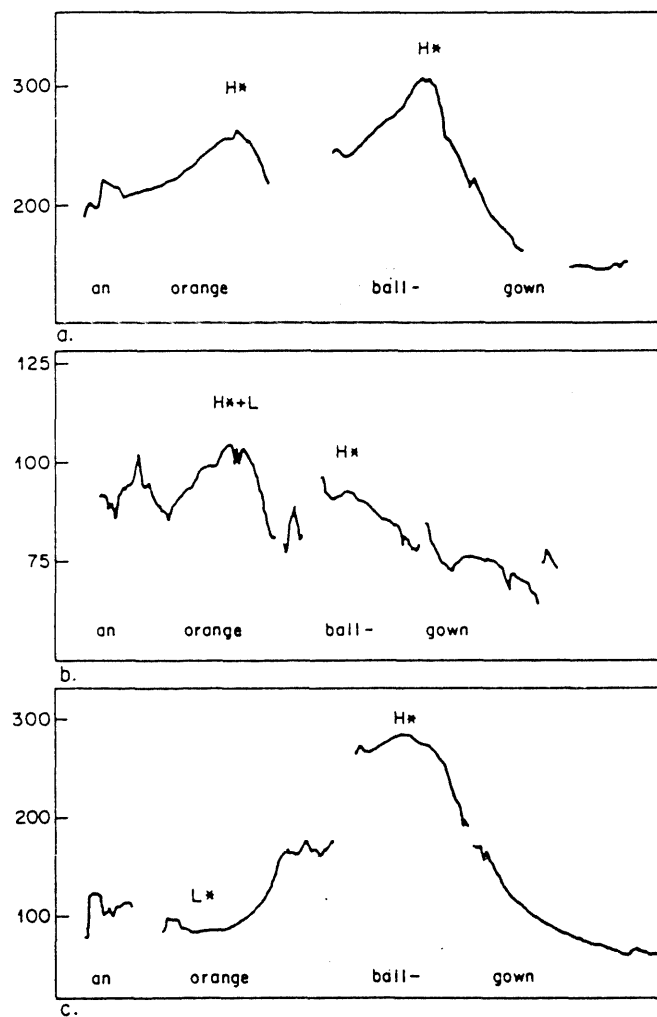


Figure 1

Utterance *an orange ballgown* with (a) H\* H\* L L % – standard declarative intonation; (b) H\*+L H\* L L % – a downstepping accent on *orange*; (c) L\* H\* L L % – surprise-redundancy contour.

Figures reproduced from Beckman and Pierrehumbert (1986) - original numbering.

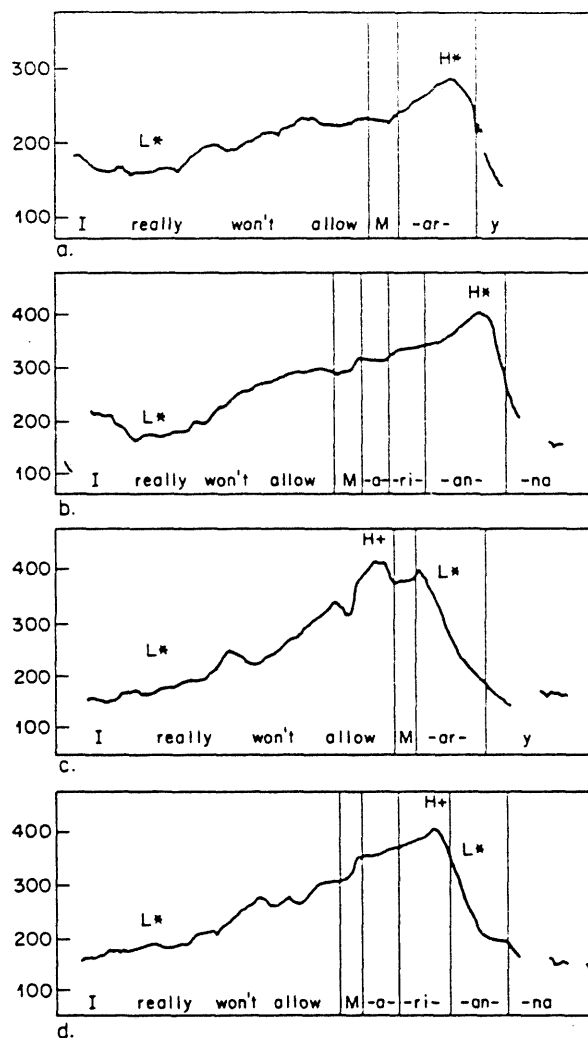


Figure 2

Utterance *I really won't allow Mary/Marianna* with a  $L^*$  pitch accent on *really* and either (a)–(b) a single tone  $H^*$  accent or (c)–(d) a bitonal  $H + L^*$  accent on the name *Mary* or *Marianna*.



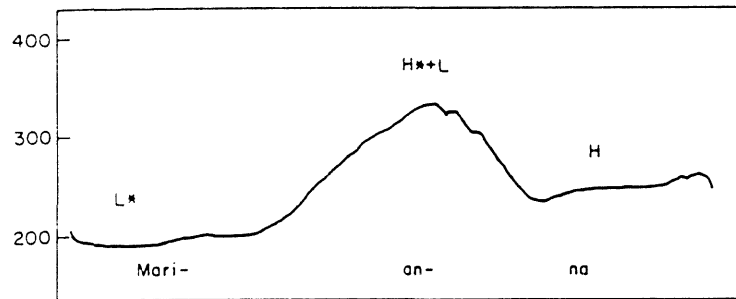


Figure 10

A typical 'calling' contour, ending at an Fo level which has led some authors to posit an English mid tone.

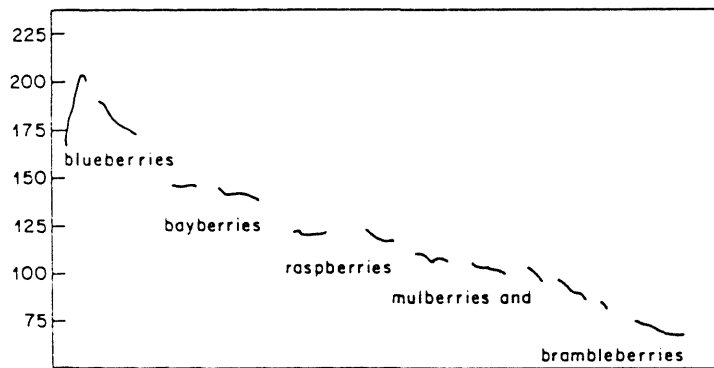


Figure 11

An Fo contour in which many applications of catathesis have produced a descending staircase.

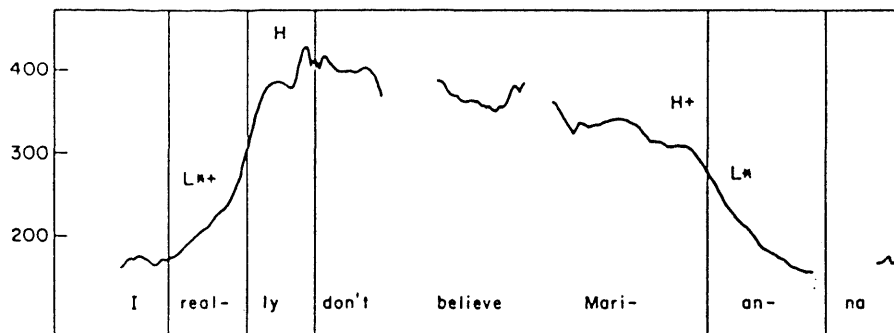


Figure 14

Utterance *I really don't believe Marianna*, with a scooped rise ( $L^* + H$ ) on *really* and a stepped-down accent ( $H + L^*$ ) on *Marianna*.

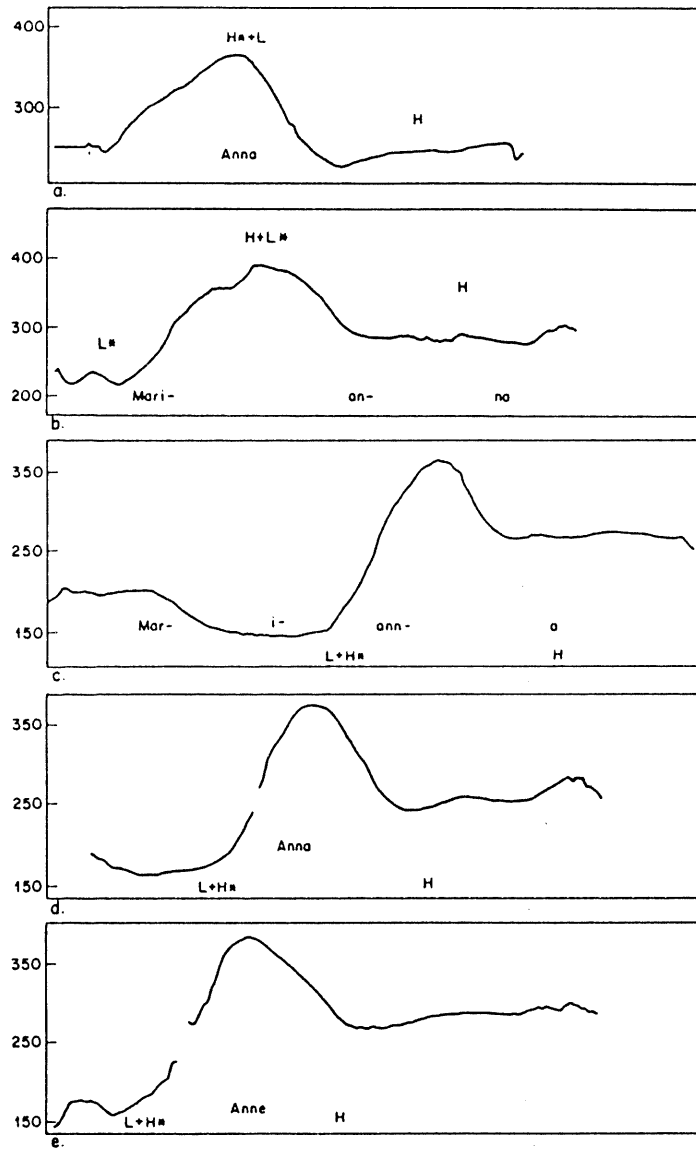


Figure 15

Three types of calling contours – analysed as (a)  $H^*+L$   $H$   $L$ %, (b)  $H+L^*$   $H$   $L$ % and (c)–(e)  $L+H^*$   $H$   $L$ %.

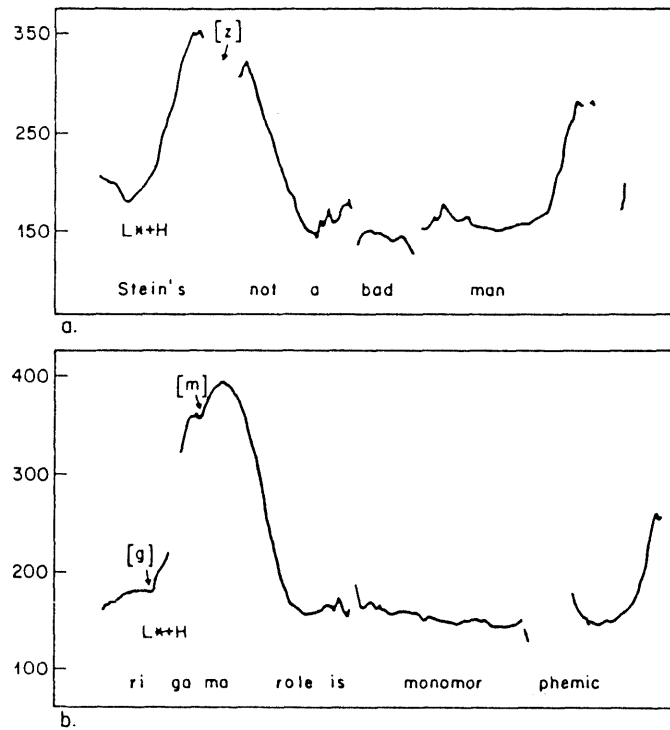


Figure 16

A scooped fall-rise contour (L\*+H L H%) on (a) *Stein's not a bad man* and (b) *rigamarole is monomorphic*.

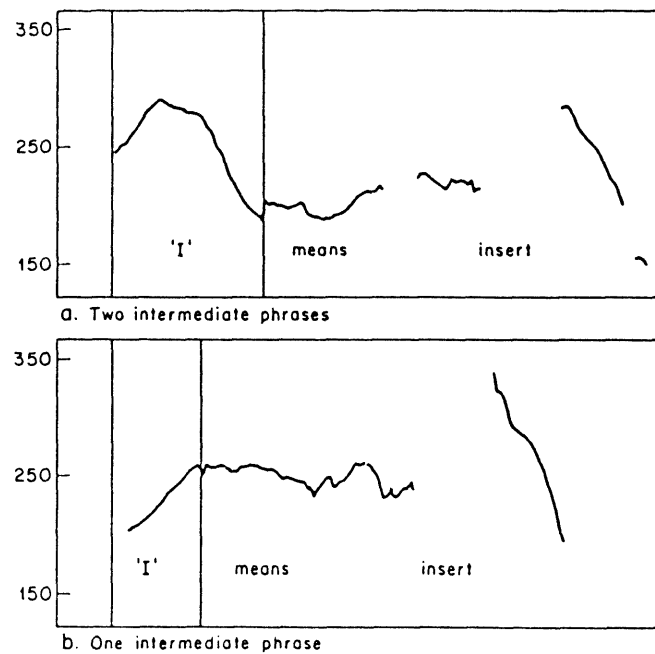


Figure 22

Utterance "I means insert" said with (a) an intermediate phrase break after "I", and (b) no phrase break.

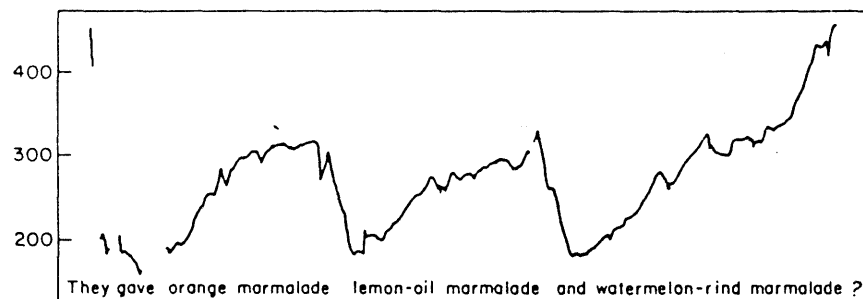


Figure 23

F<sub>0</sub> contour for utterance *They gave orange marmalade, lemon-oil marmalade, and watermelon-rind marmalade?* produced as a simple list with question intonation.

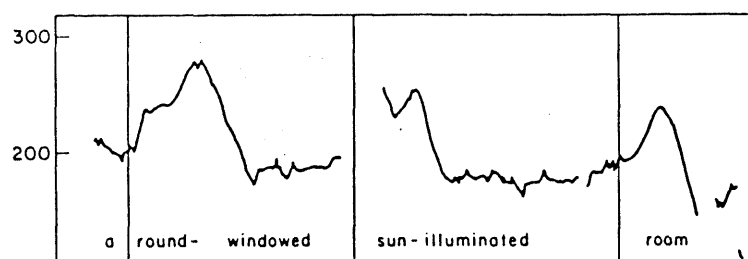


Figure 24

F<sub>0</sub> contour for utterance *a round-windowed, sun-illuminated room.*



## **Appendix 2**

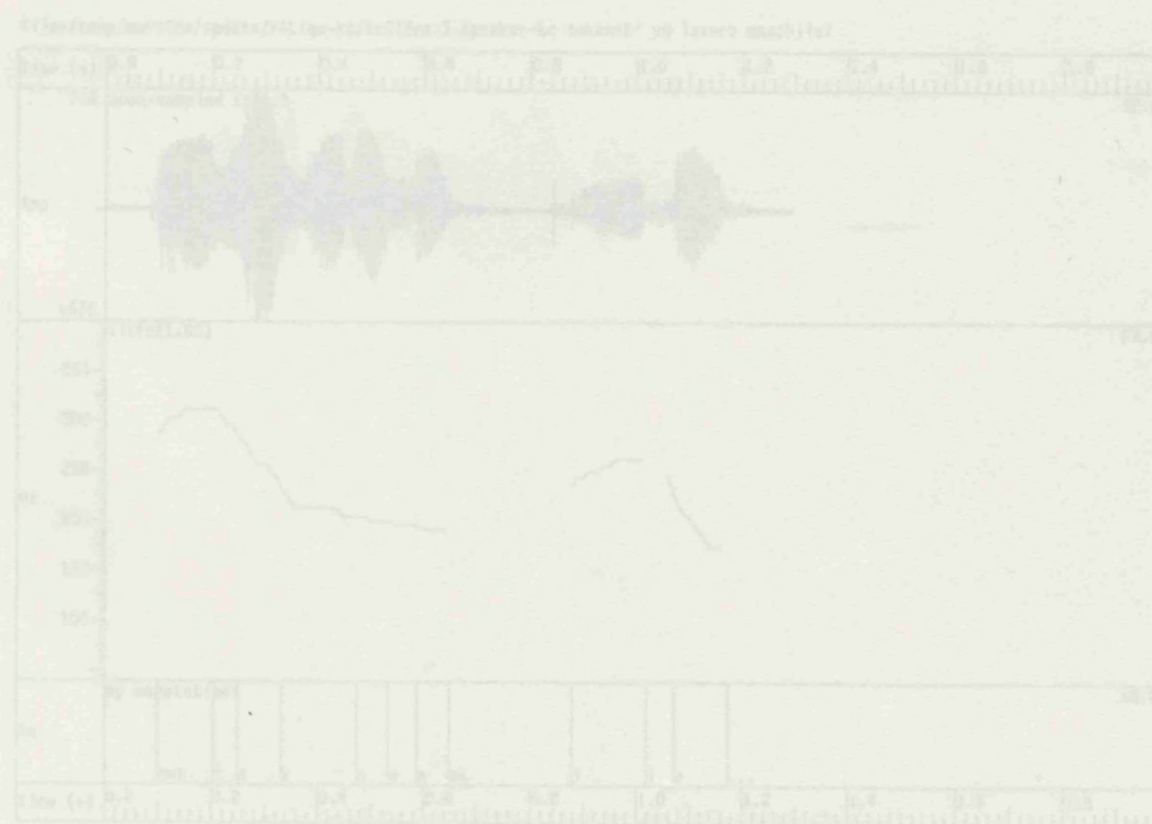
### **Figures to Chapter 7**

The following figures are each of a speech pressure waveform, a fundamental frequency trace (calculated using the cepstral algorithm, contained in the API program of the ILS software package) and annotations using the SAM phonetic alphabet, SAMPA (for the latest inventory of symbols, see Wells et al (1992).

The figures were created using the speech processing part of the SFS system, developed by Mark Huckvale at UCL.

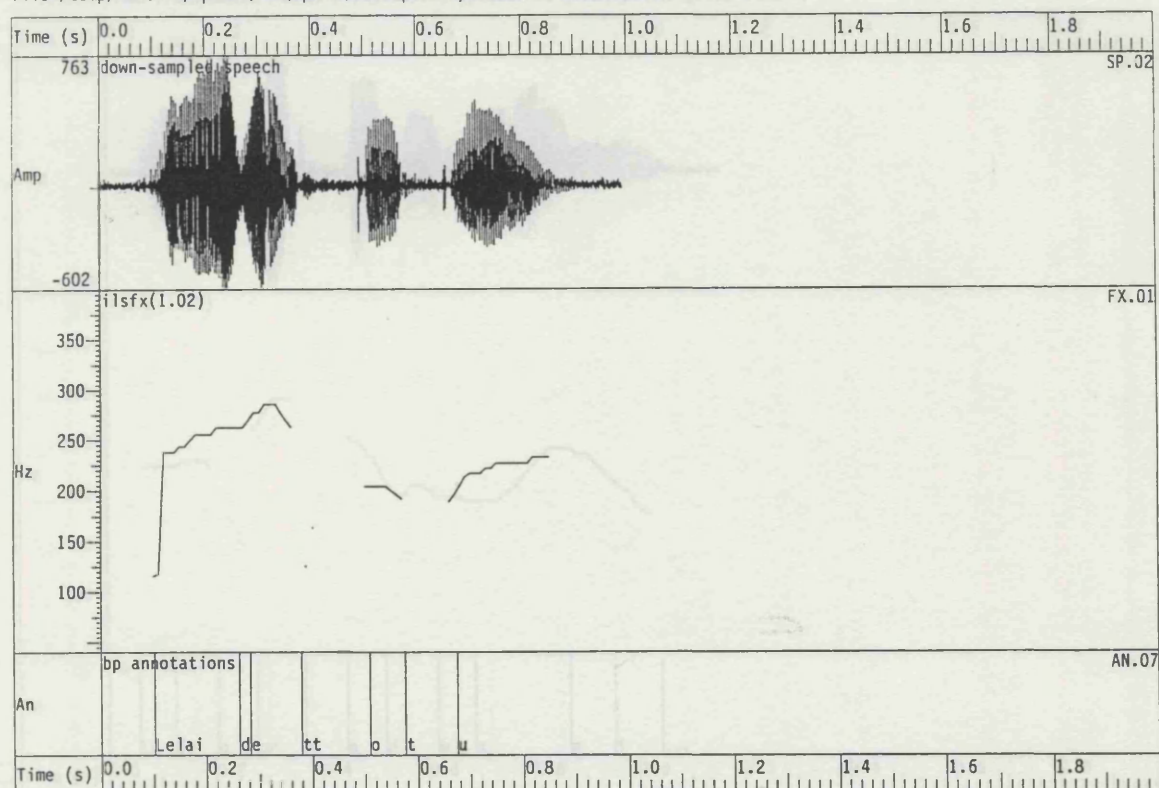


1 (i)



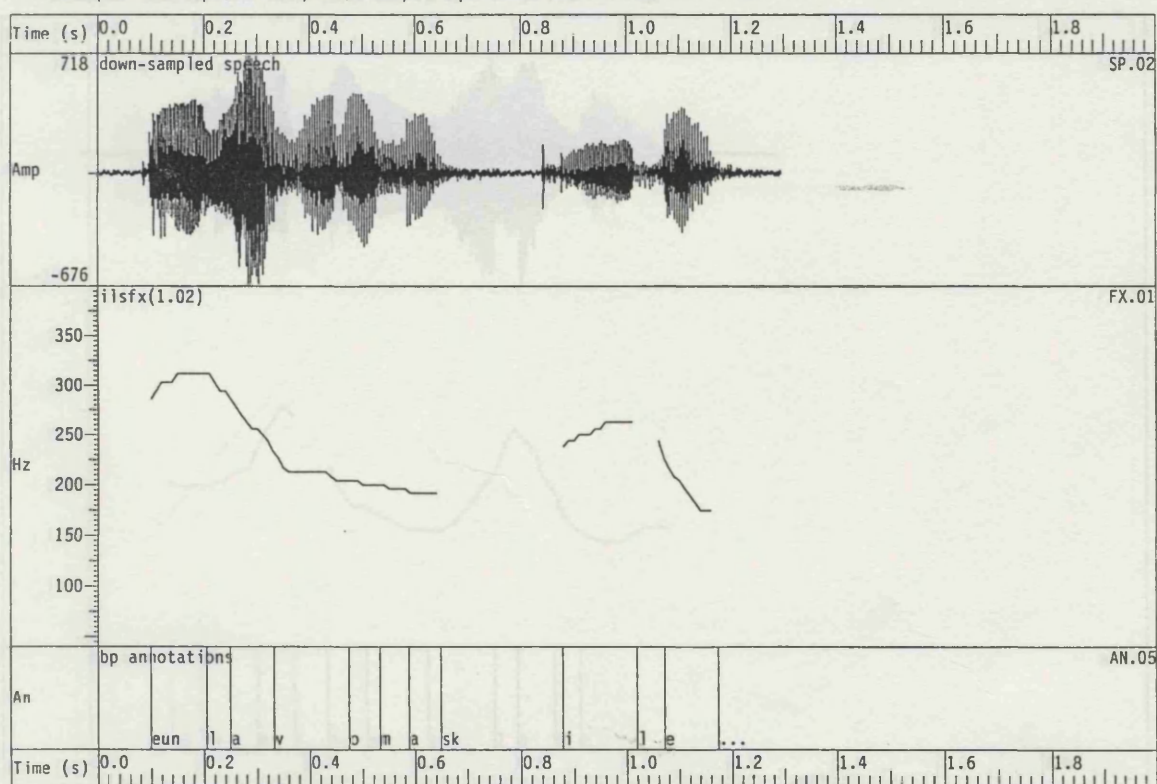
1 (ii)

file=/temp/martine/spdata/PAL/qu-kc/kc003pa.1 speaker=kc token=Gliel'hai detto tu?



1(i)

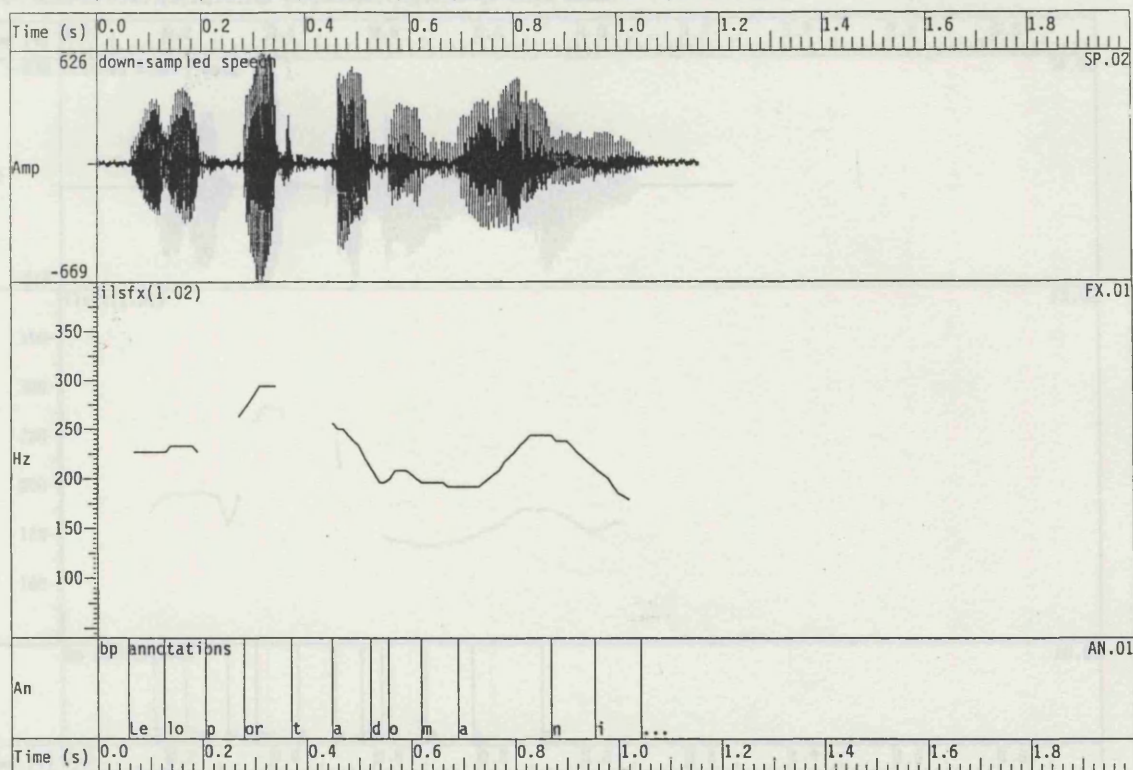
file=/temp/martine/spdata/PAL/qu-kc/kc016pa.3 speaker=kc token=E' un lavoro maschile?



1(ii)

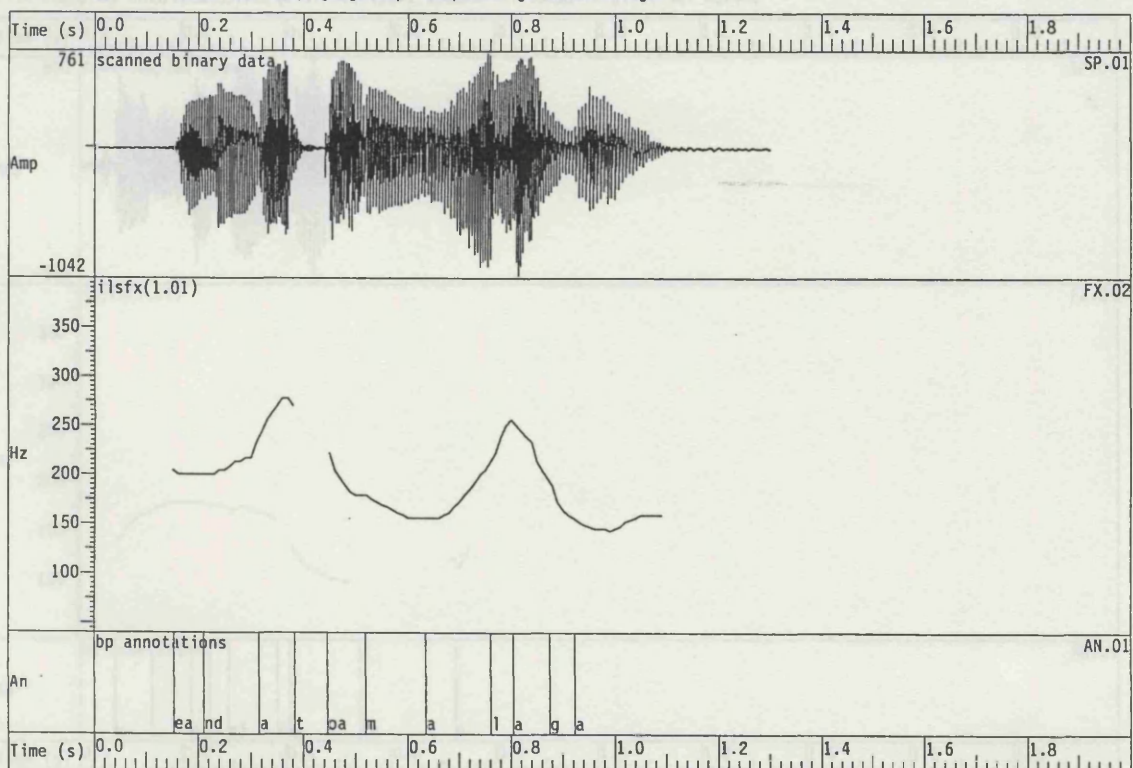


file=/temp/martine/spdata/PAL/qu-kc/kc002pa.3 speaker=kc token=Glielo porta domani?



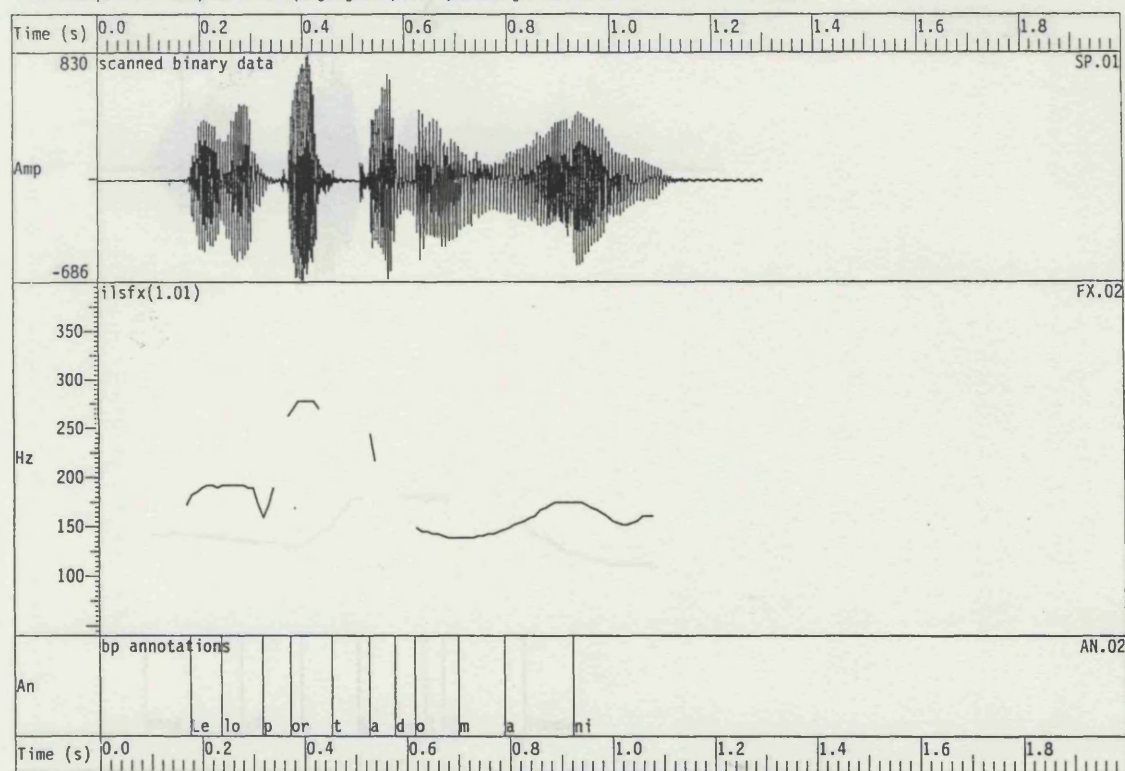
1(iii)

file=/temp/martine/spdata/PAL/qu-gs/gs033pa.1 speaker=gs token=malaga



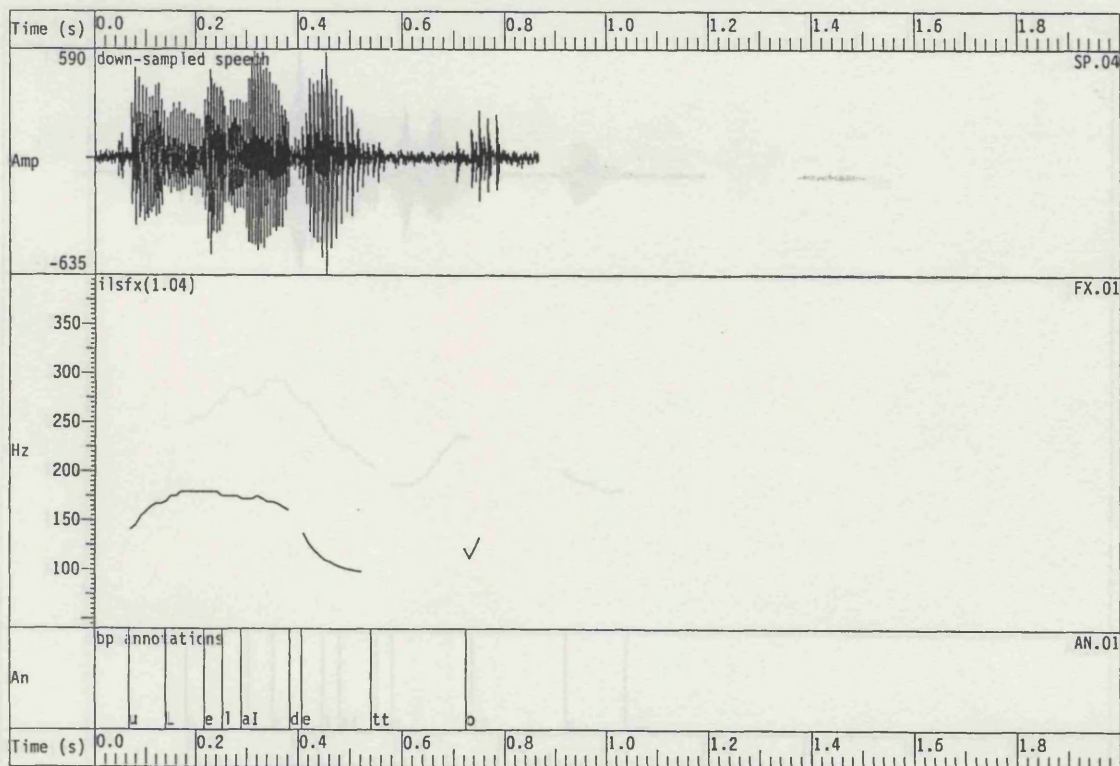
2(i)

file=/temp/martine/spdata/PAL/qu-gs/gso2upa.1 speaker=gs token=domani



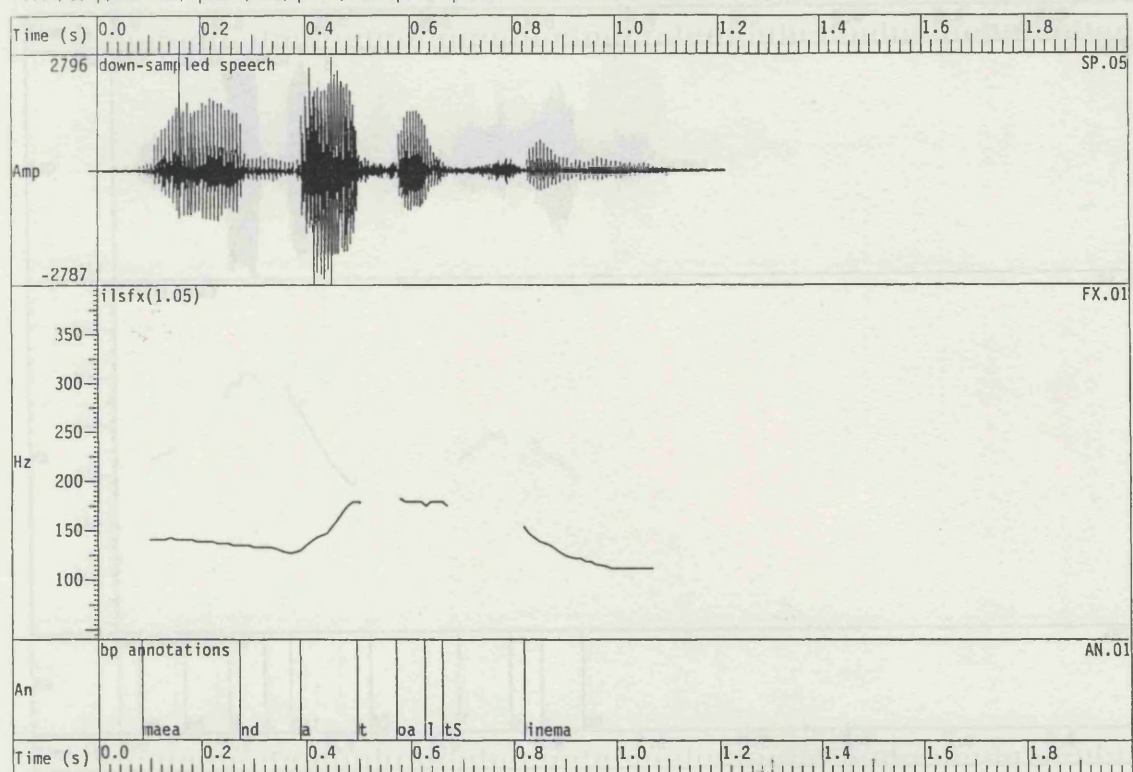
2(ii)

file=/temp/martine/spdata/PAL/qu-sl/s1004pa.1 speaker=sl token=Tu gliel'hai detto?



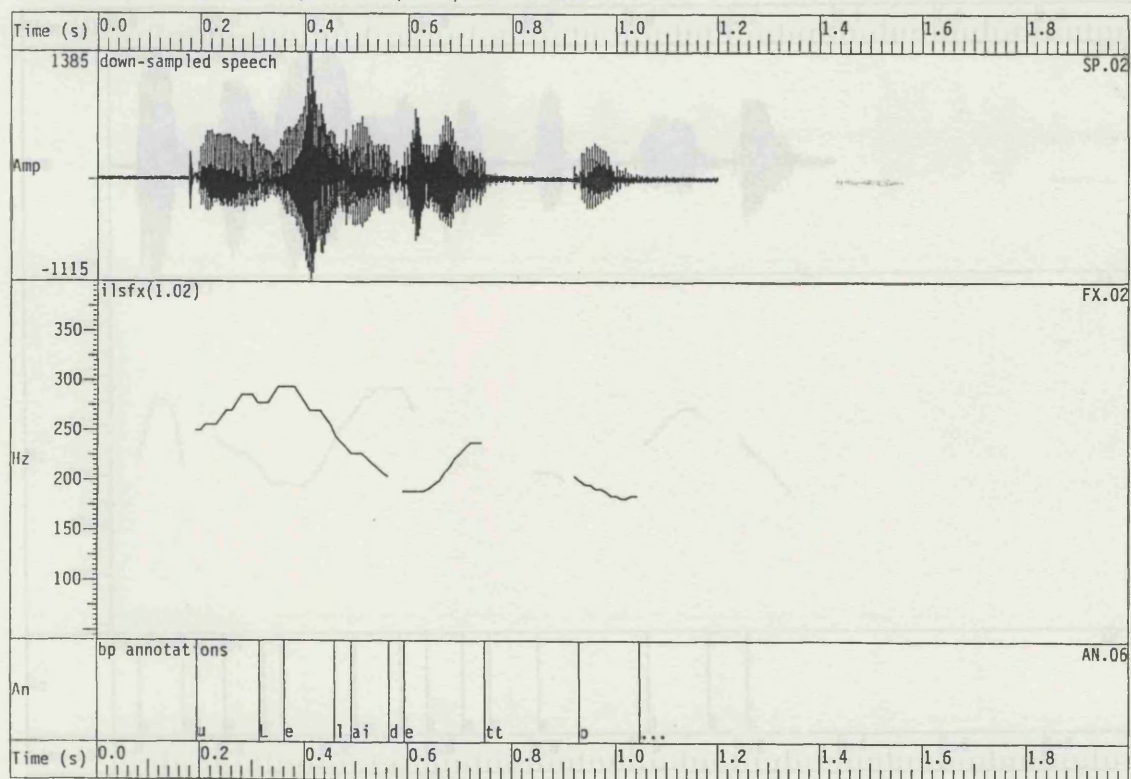
3(i)

file=/temp/martine/spdata/PAL/qu-dc/dc9iipa.1 speaker=dc token=Ma e' andato al cinema?



3(ii)

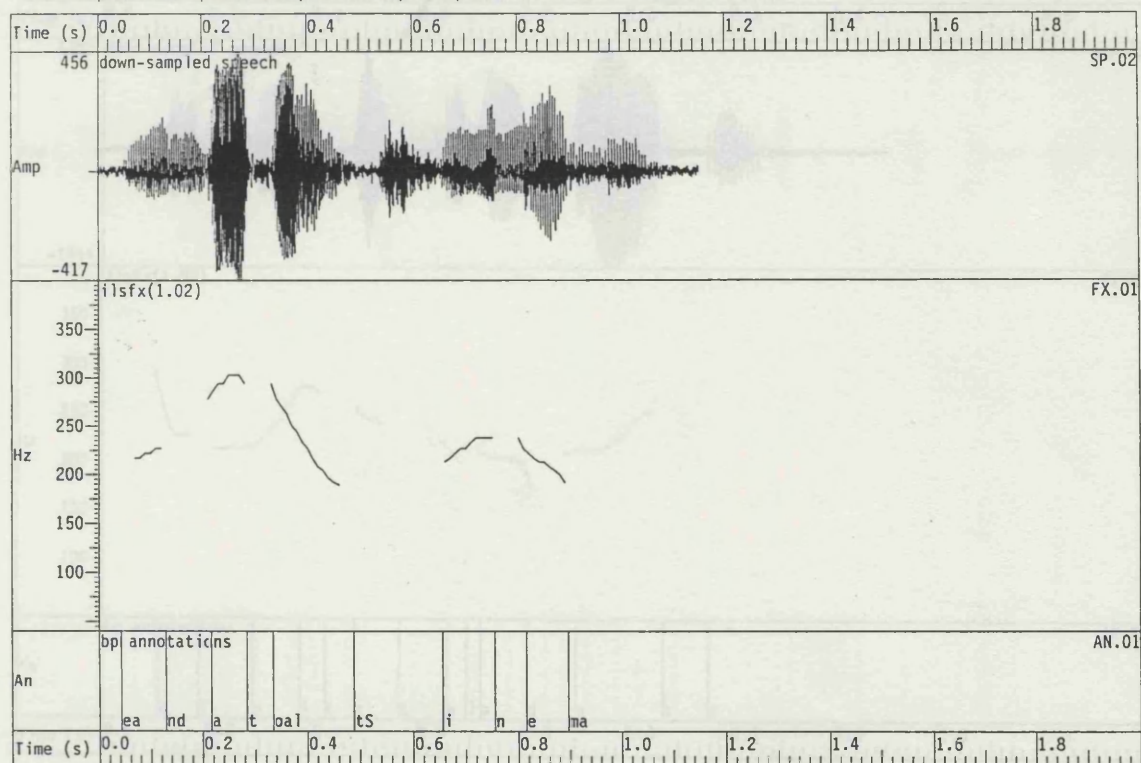
file=/temp/martine/spdata/PAL/qu-kc/kc004pa.1 speaker=kc token=4



4(i)

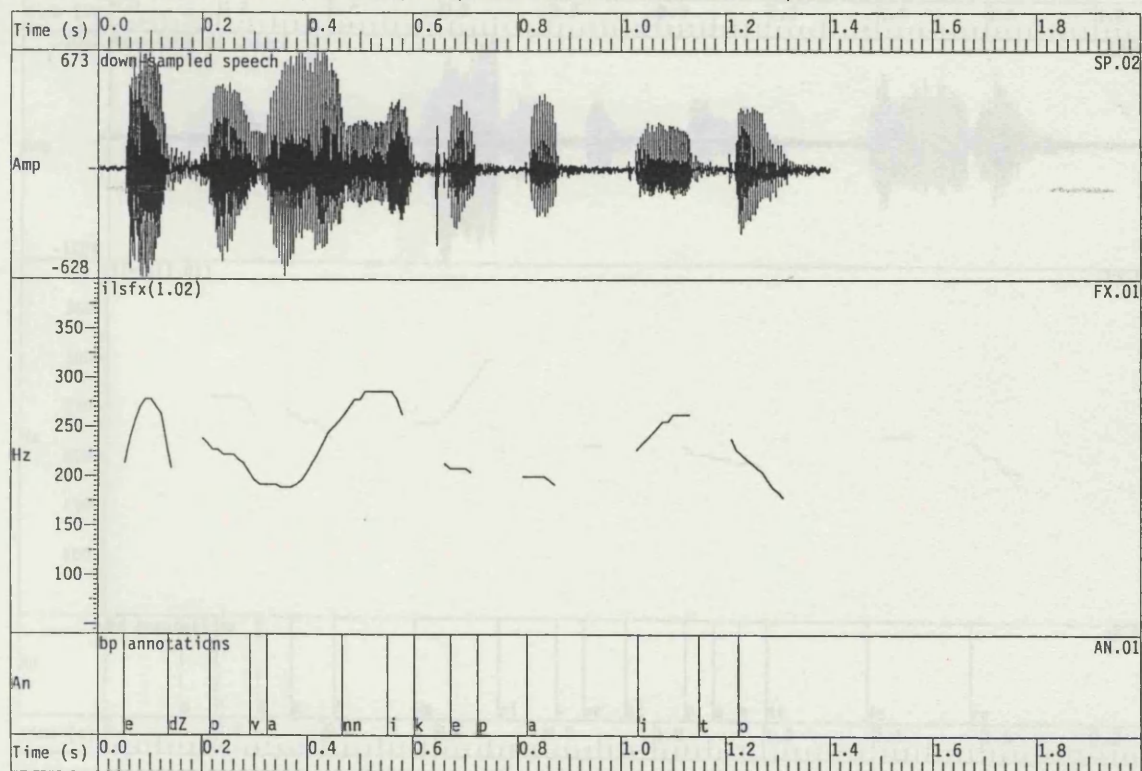


file=/temp/martine/spdata/PAL/qu-kc/kc009pa.3 speaker=kc token=E' andato al cinema?



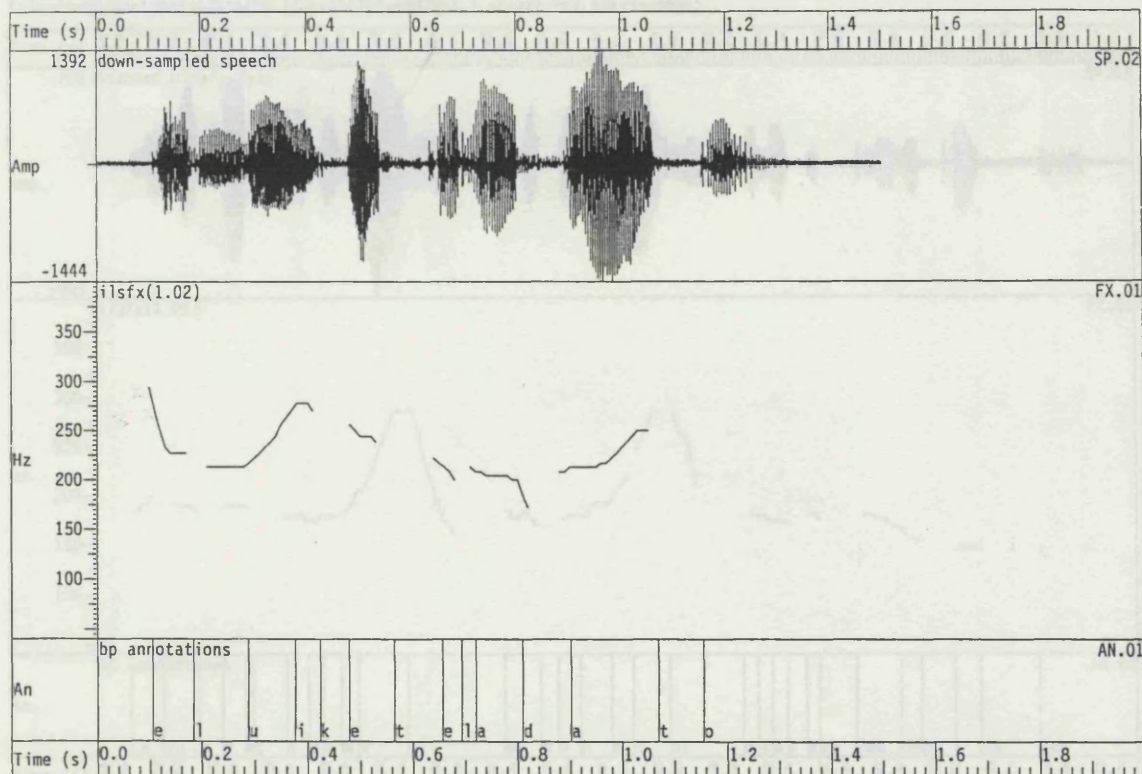
4(ii)

file=/temp/martine/spdata/PAL/qu-kc/kc013pa.2 speaker=kc token=E' Giovanni che e' partito?



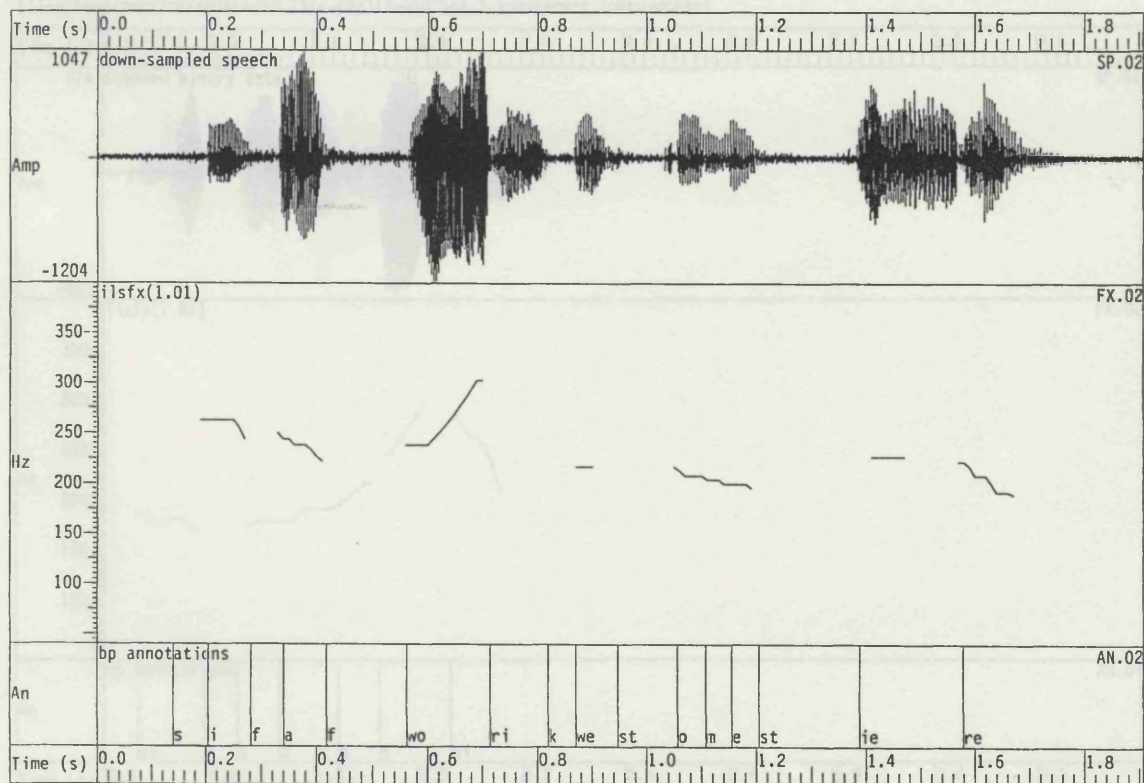
5(i)

file=/temp/martine/spdata/PAL/qu-kc/kc012pa.1 speaker=kc token=1



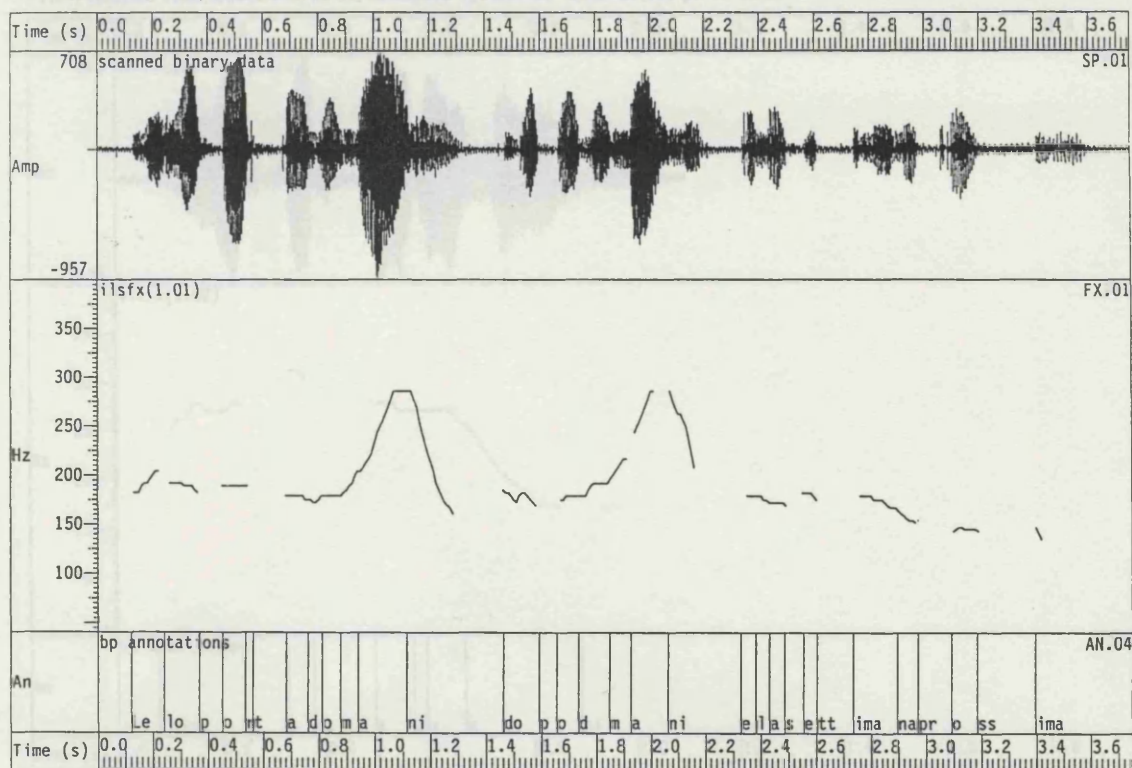
5(ii)

file=/temp/martine/spdata/PAL/qu-kc/kc010pa.1 speaker=kc token=1



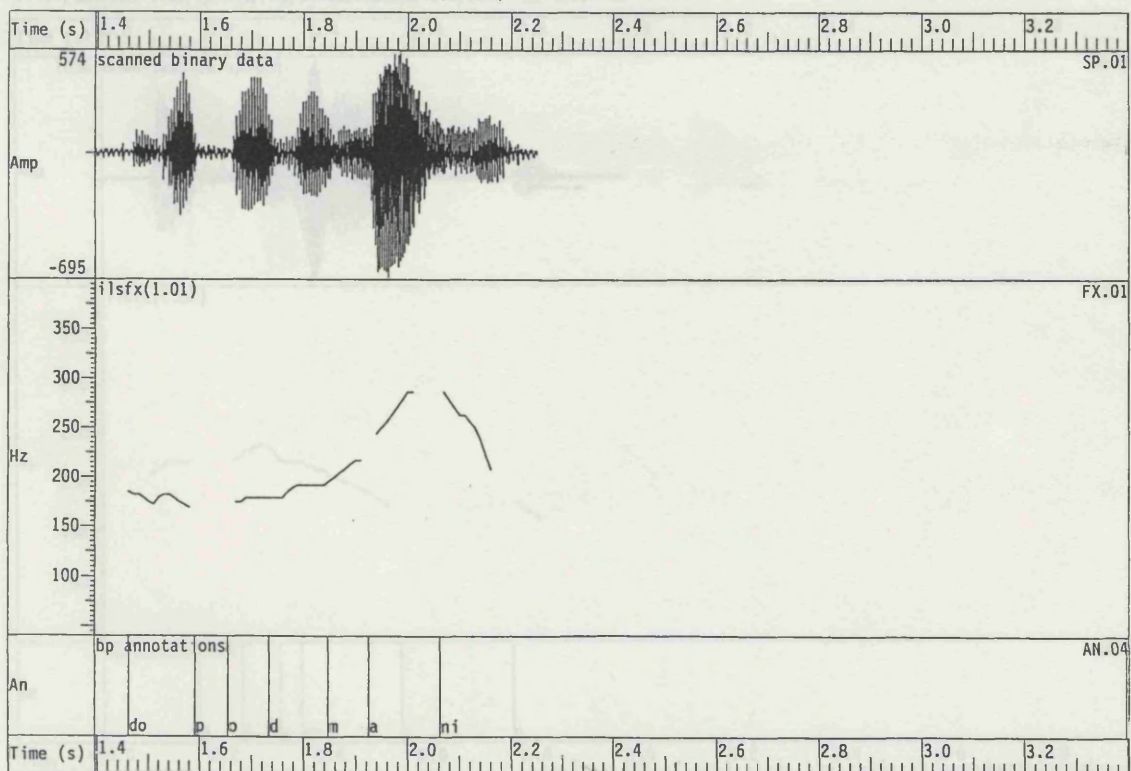
5(iii)

file=/temp/martine/spdata/PAL/lis-eb/l13-eb02bpa.1 speaker=eb token=domani



6

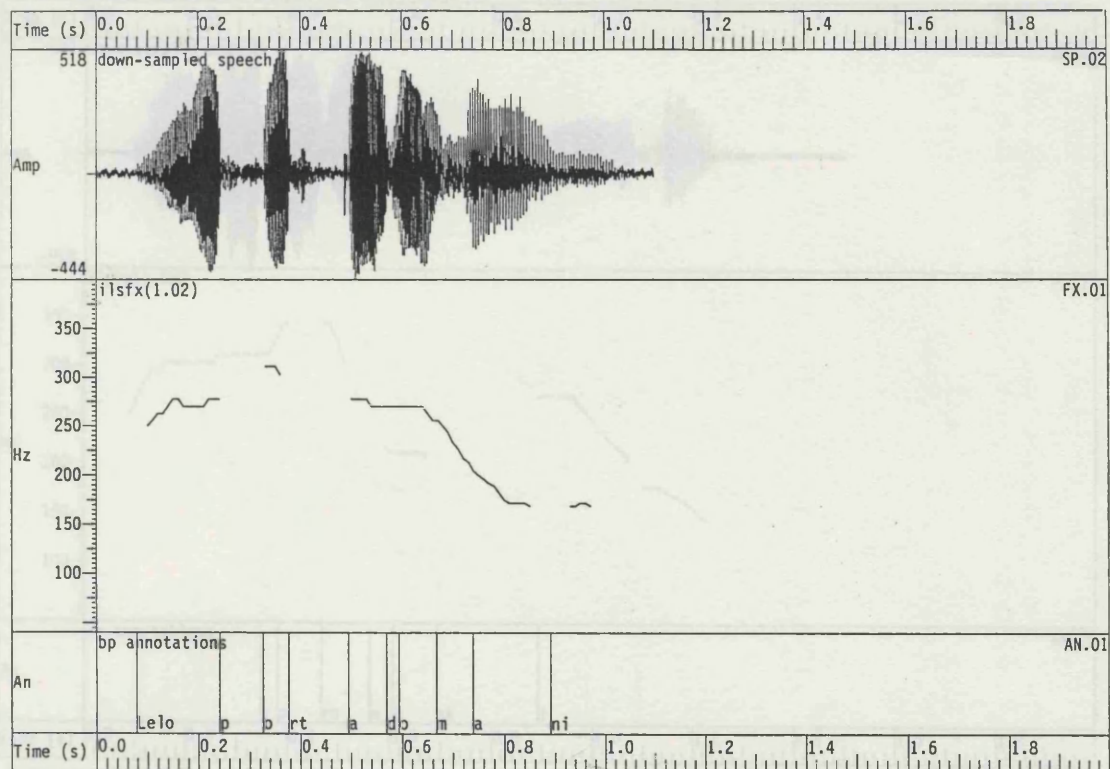
file=/temp/martine/spdata/PAL/lis-eb/l13-eb02bpa.1 speaker=eb token=domani



7

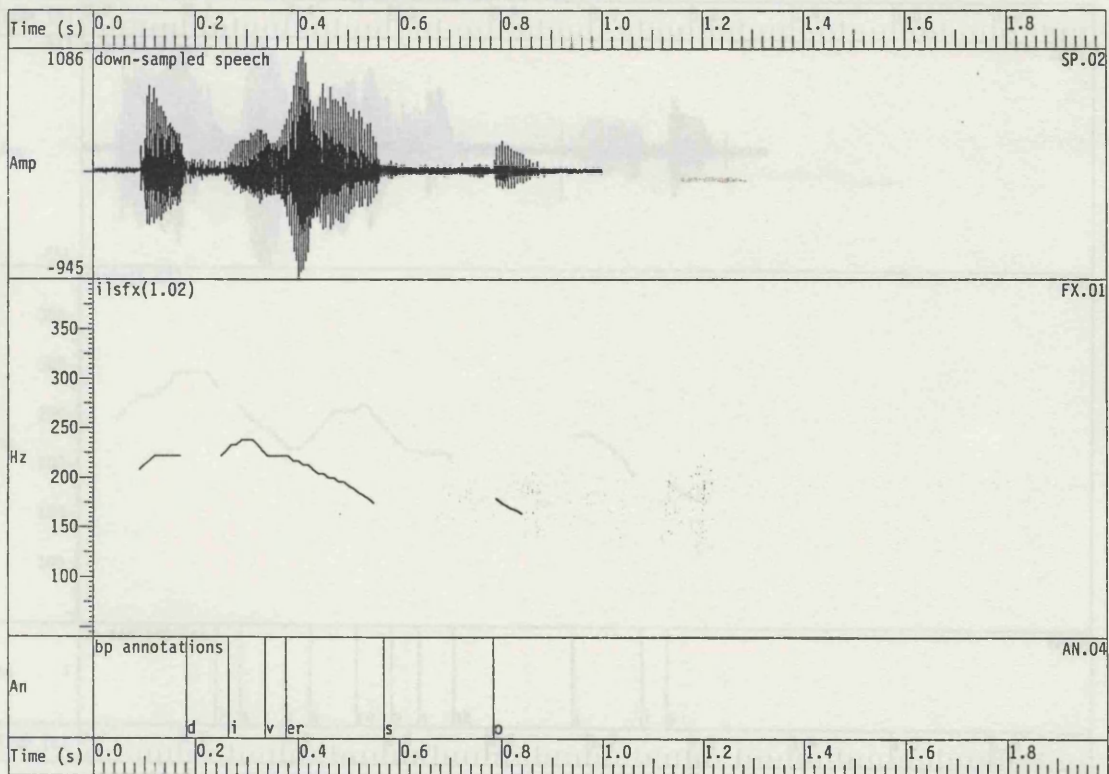


file=/temp/martine/spdata/PAL/st-kc/kc02bpa.3 speaker=kc token=Glielo porta domani.



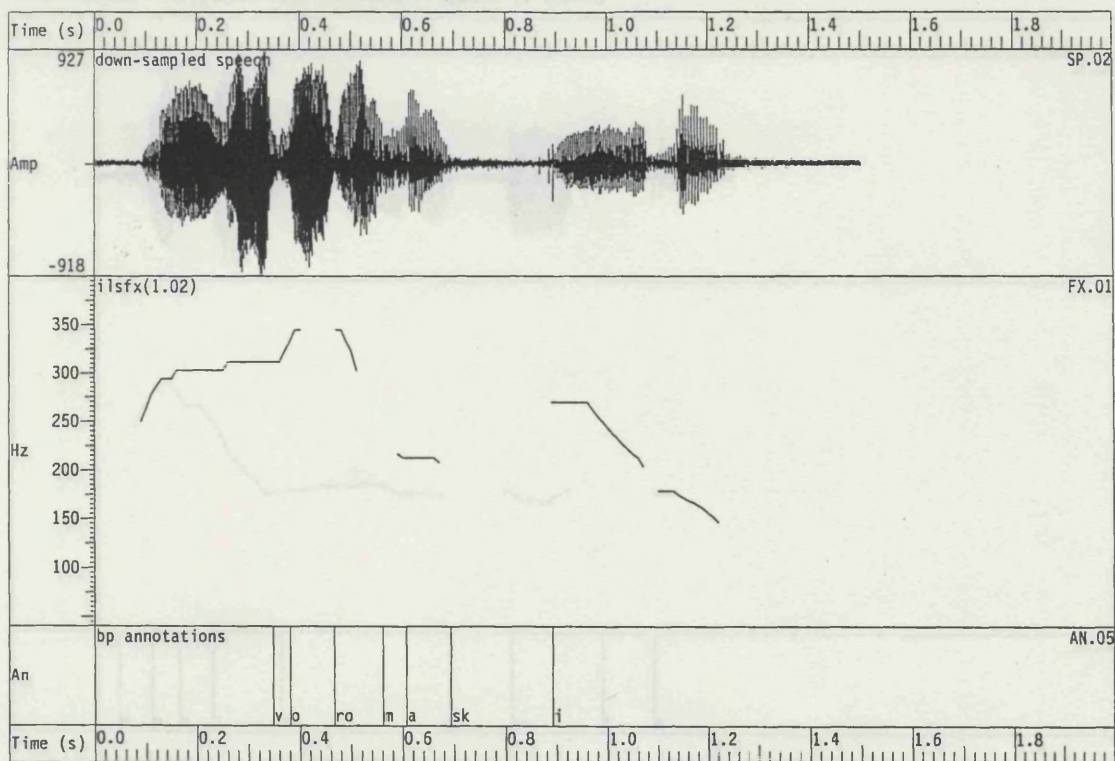
8(i)

file=/temp/martine/spdata/PAL/st-kc/kc08bpa.1 speaker=kc token=8b



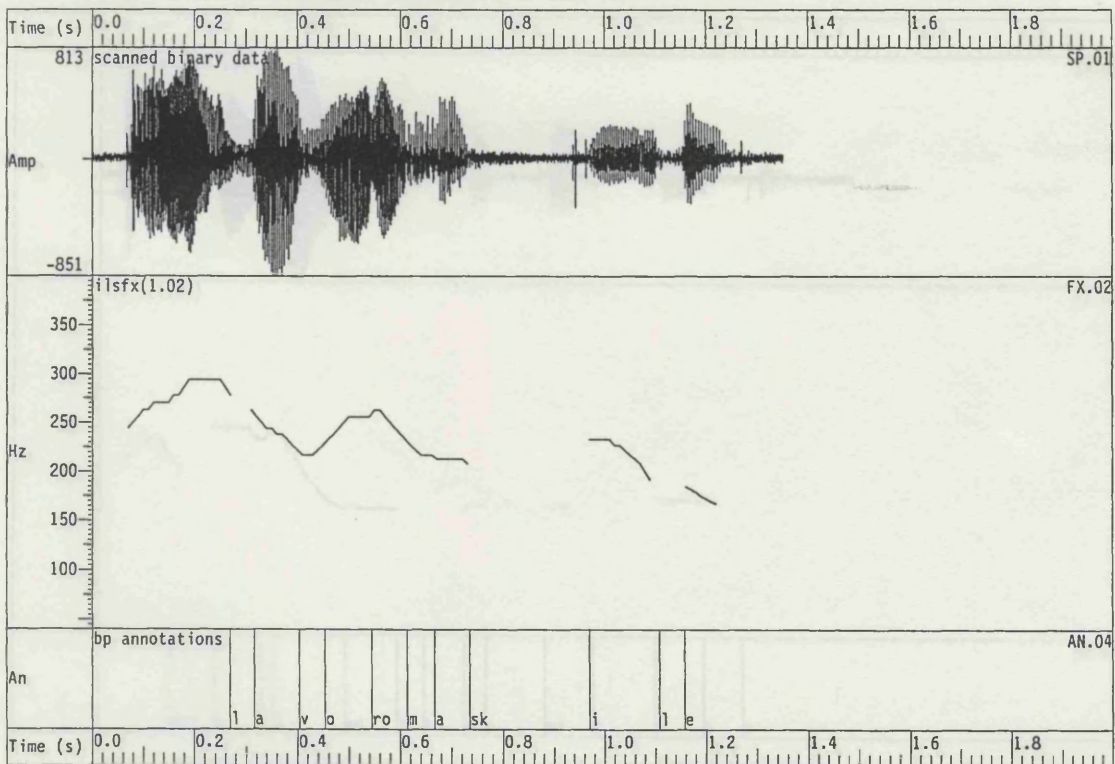
8(ii)

file=/temp/martine/spdata/PAL/st-kc/kc16dpa.1 speaker=kc token=16d



q(i)

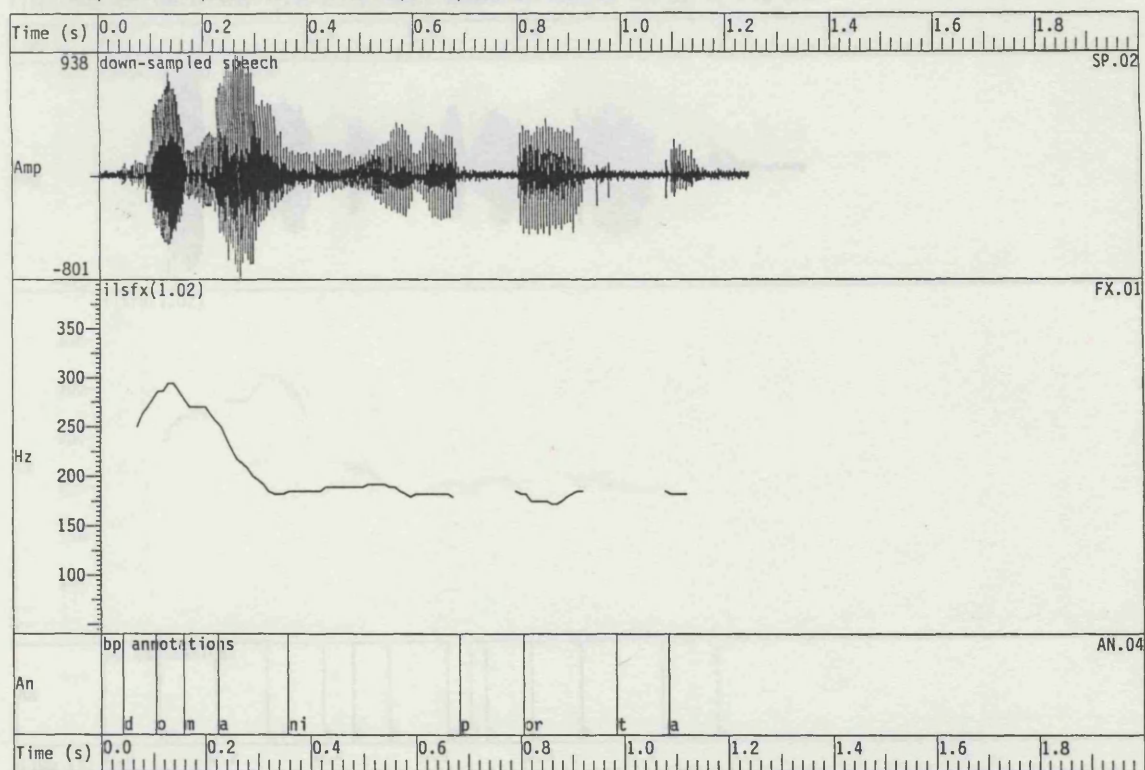
file=/users/martine/spdata/st-kc/kc16cpa speaker=kc token=16c



q(ii)

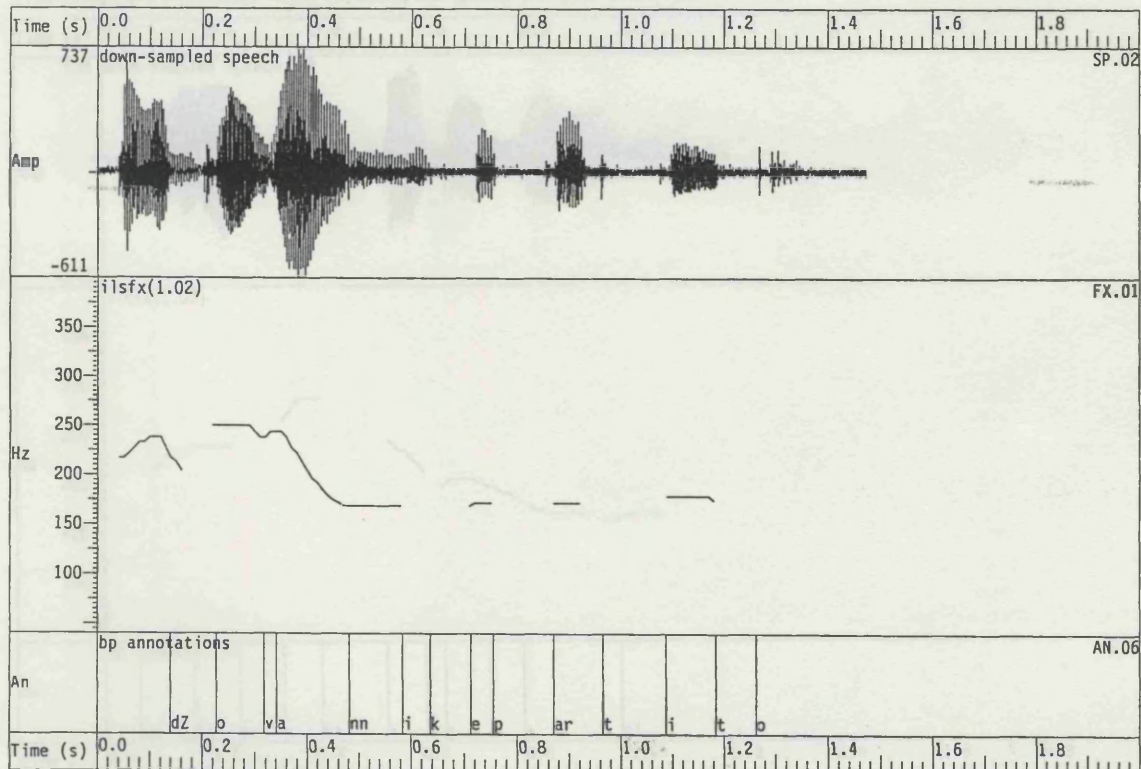


file=/temp/martine/spdata/PAL/st-kc/kc01bpa.1 speaker=kc token=1



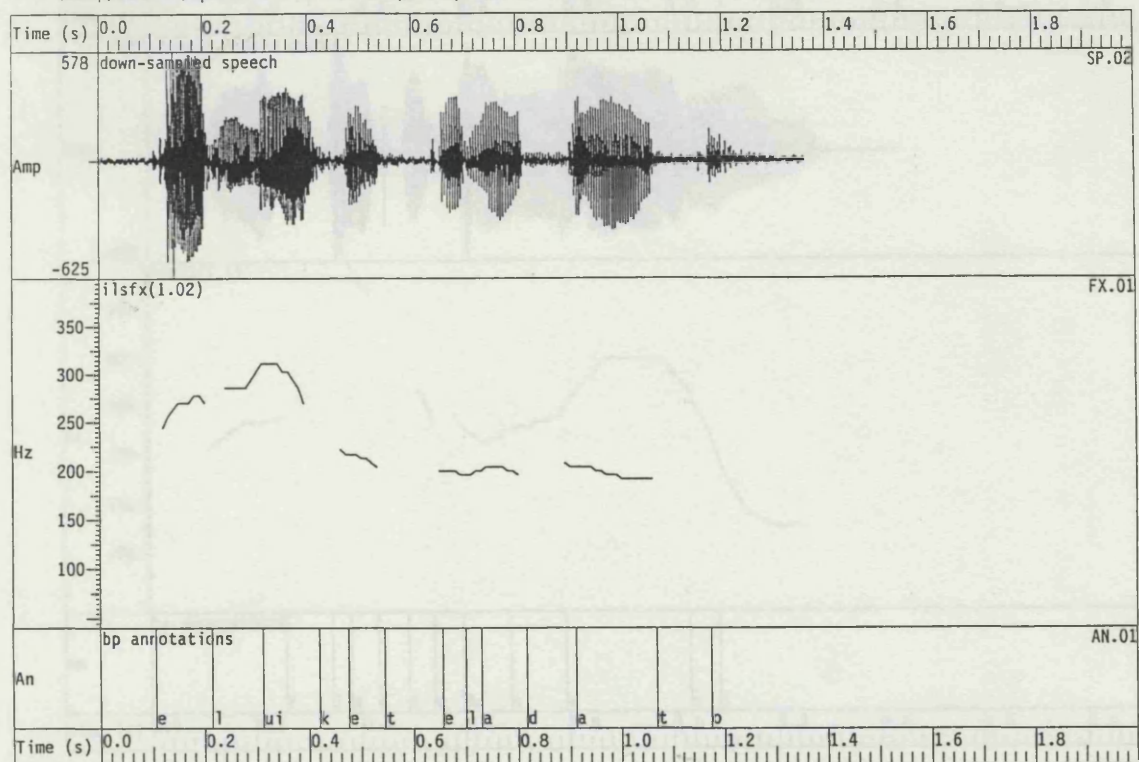
10(i)

file=/temp/martine/spdata/PAL/st-kc/kc13bpa.1 speaker=kc token=13b



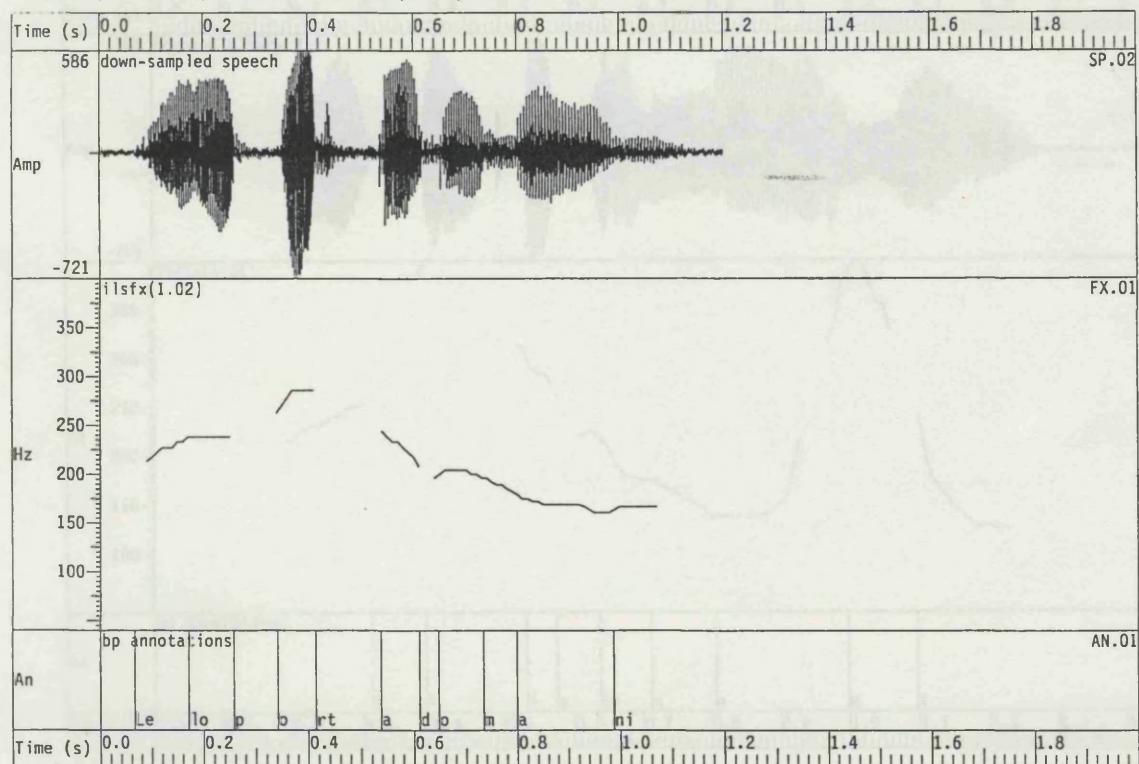
10(ii)

file=/temp/martine/spdata/PAL/st-kc/kc12bpa.2 speaker=k token=E' lui che te l'ha dato.



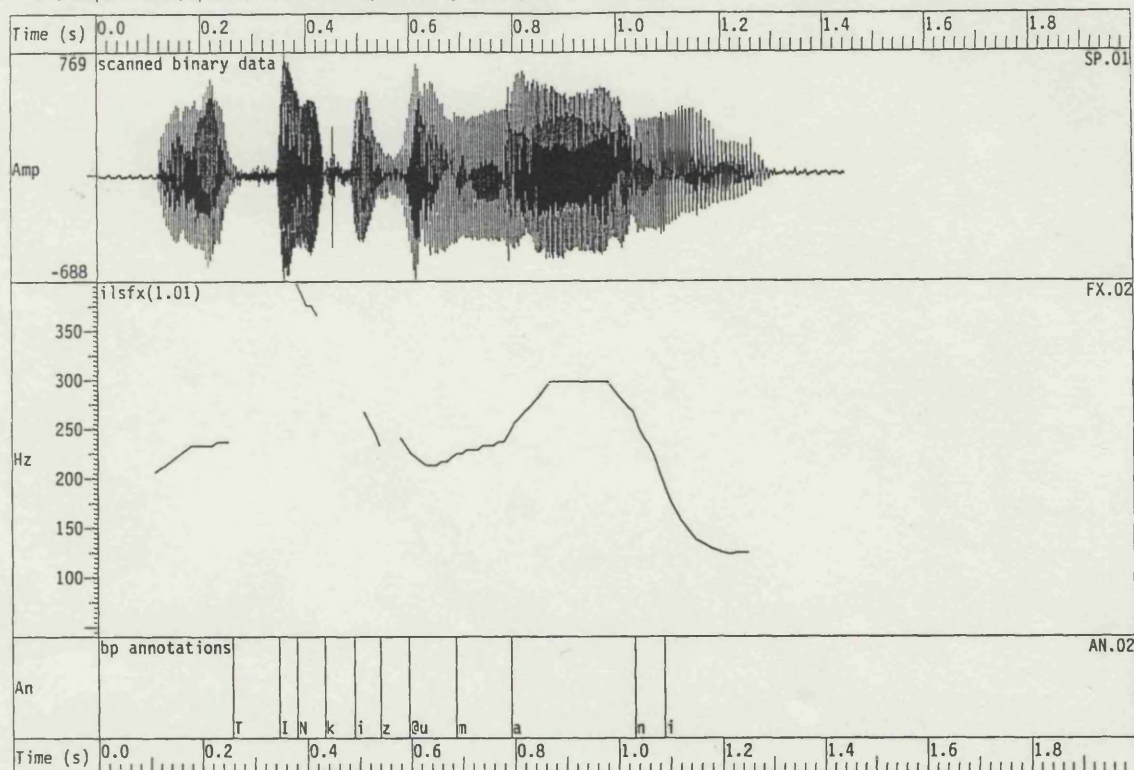
10(cii)

file=/temp/martine/spdata/PAL/st-kc/kc02cpa.2 speaker=k token=Glielo porta domani.



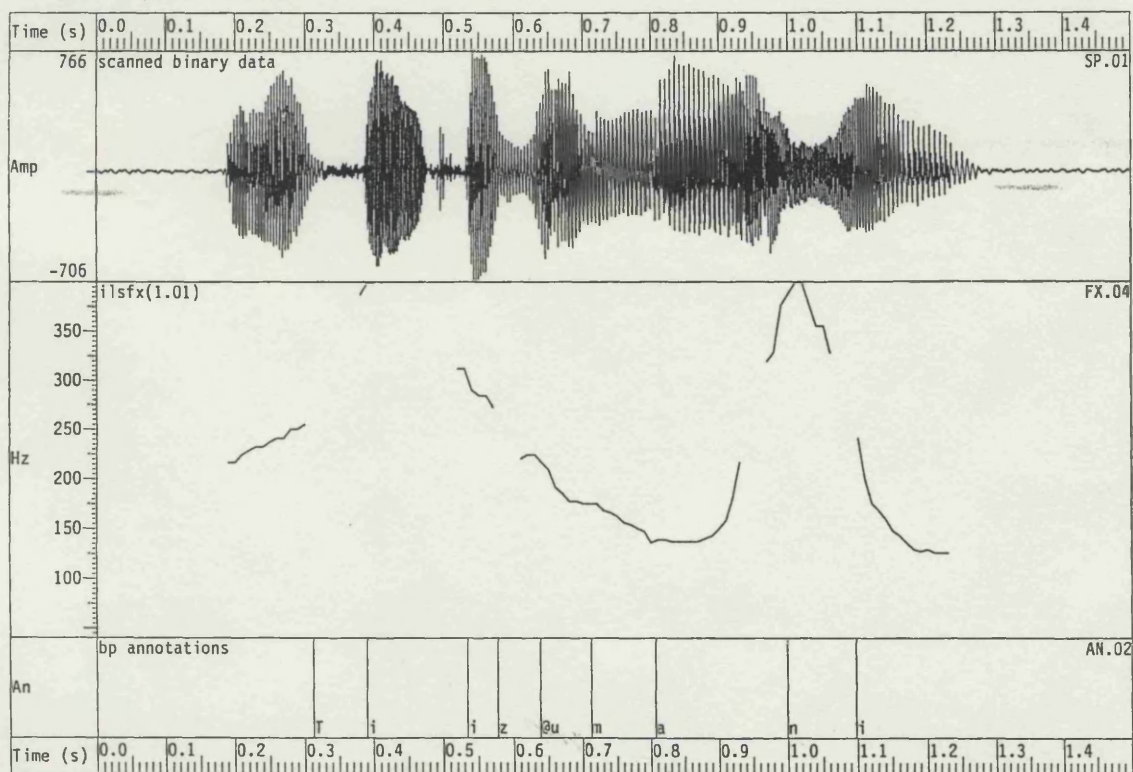
11

file=/temp/martine/spdata/PAL/seminar/jh02fhf speaker=jill house token=Well I think he's Omani



12(i)

file=jh02frf speaker=jill house token=Well I think he's Omani



12(ii)