Tune-text association patterns in Catalan: An argument for a hierarchical structure of tunes[1]

PILAR PRIETO I VIVES

Abstract

This article describes a variety of intonation patterns in Central Catalan and examines the process of tonal realization of these tunes over short sequences, namely, monosyllabic phrases and utterances containing just one stressed syllable. When faced with multiple association, Catalan displays at least three different procedures to adapt intonational contours: when the tune is composed of one pitch accent plus a boundary tone sequence, the general strategy used by this language is compression*; by contrast, when the tune is made out of two pitch accents plus an edge tone sequence the solution is either to delete (or fail to associate) the first pitch accent (a process which could be understood as tune* truncation*) or the second one. The contrast between compression and deletion strategies falls out directly from an autosegmental view of intonational contours: since a given metrically strong position cannot bear more than one pitch accent, compression is thus ruled out when melodic tunes contain a minimum of two pitch accents. The contrast between the failure to link the first or the second pitch accent, though, cannot be easily predicted if we follow standard autosegmental assumptions: since this framework assumes that*

1. A short version of this article was presented at the *IX Colloquium of Generative Grammar* (Universitat Autònoma de Barcelona, April 1999) and published in the proceedings (*Catalan Working Papers in Linguistics*, 1999). I would like to thank Eulàlia Bonet, Carme de la Mota and Gemma Rigau for their helpful observations and questions during the presentation of this paper. Finally, I am indebted to the editor, José Ignacio Hualde, and to Mary Beckman, Tim Face, Sónia Frota and an anonymous reviewer for their insightful comments on an earlier version of this paper. This work was partially supported by the participation in the following research grants: "Laboratori de Fonètica-IEC" (Pla de Recerca de Catalunya, 1999SGR00256), "La interpretación y la combinación de los rasgos gramaticales" (BFF2000-0403-C02-02) and "Modelos de organización articulatoria y procesos de cambio fonético" (BFF2000-0075-C02-01), the last two awarded by the Spanish Ministerio de Educación y Cultura.

0921–4771/02/014-0173

©Walter de Gruyter

all of the pitch accents have the same status, it offers no way to predict which pitch accent is going to associate to the text. The main goal of this article is to explore the implications of the Catalan compression data for the theory of tune-text association and the structure of pitch contours and to propose ways to modify standard autosegmental assumptions to accommodate the different compression strategies displayed by Catalan. It will be argued that the most convincing way to account for such contrasts has to rely on the postulation of a hierarchical structure for such tunes.

1. Introduction

Grønnum (1991) and Ladd (1996) have recently pointed out that languages tend to resort to two types of strategies to adapt intonational contours to monosyllabic utterances: *compression* (or complete realization of the melodic form on the segmental string) and *truncation* (or deletion of the initial or final part of the contour). English, for example, belongs to the group of strongly compressing languages: the complete rise-fall-rise pattern of the following English tune – expressed by the string of tones L*H..L$^-$..H% in Pierrehumbert's system (cf. *driving instructor!?*) – is "squeezed" onto the monosyllabic utterance *Sue!?*, that is, all the tones comprising the tune are associated and phonetically realized over a single syllable (cf. Ladd 1996: 133). The phonological representations below include both the initial linking between the tone units and their corresponding metrically salient positions and the tonal spreading of such tone units over the available unstressed syllables:

(1) a. driving instructor

L*H L$^-$ H%

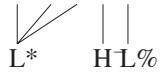
b. Sue!?

L*H L$^-$ H%

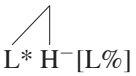
By contrast, languages like Hungarian (Ladd 1996, Grice et al. 2000) or Palermo Italian (Grice 1995) opt most generally for a truncation strategy. The low-rise-fall pattern of the Hungarian question intonation (L*..H$^-$..L% in autosegmental terms) illustrated below (cf. *Beszél a tanár?* 'Is the teacher talking?') is reduced to a simple rise when applied to a monosyllabic sequence like *sör?* 'beer'. Ladd (1996) claims that both pitch patterns have the same underlying phonological form (namely, L*..H$^-$..L%) and that the truncated pattern is accounted for by resorting to a language-particular restriction that disallows the

realization of more than two tones over a single syllable. In this case, syllables with an acute accent in the orthography indicate long vowels:

(2) a. Beszél a tanár?



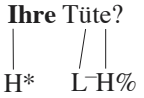
b. sör?



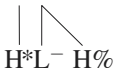
Tone languages display similar truncation phenomena. For example, the so-called underlying lexical tone 4 in Tamang surfaces with different tonal shapes depending on whether the word consists of one, two or three syllables: whereas bisyllabic words have the shape L–HM (the pitch contour starts with an initial rising gesture and then falls to a mid-level tone), monosyllabic words have a simplified L shape (the pitch contour consists of a low tone, a simple falling gesture).

Other languages solve situations of tonal crowding by using melodic contours which are completely different from the contour employed in longer sentences. In German, for example – a language which can also use tune truncation sporadically –, the rise question intonation is characterized by a rise-fall-rise pattern associated from the most prominent word of the sequence up until its end. The following transcriptions illustrate the application of this contour to two texts with two different focus structures (cf. *Ist das **Ihre** Tüte?* 'Is this *your* bag?' vs. *Ist das Ihre **Tüte**?* 'Is this your *bag*?', Ladd 1996: 133):

(3) a. Ist das **Ihre** Tüte?

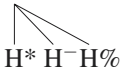


b. Ist das Ihre **Tüte**?



However, when this tune applies to utterances ending in a word with final stress (cf. *Ist das Ihr **Geld**?* 'Is this your *money*?'), German speakers can optionally use any of the two "simplified" contours shown below: either a high rising pitch pattern (H*..HH%, the contour most frequently used) or a low rising one (L*..LH%):

(4) a. Ist das Ihr **Geld**?

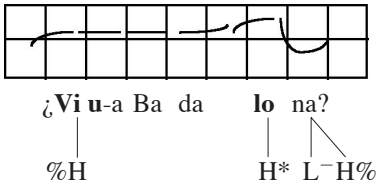


b. Ist das Ihr **Geld**?

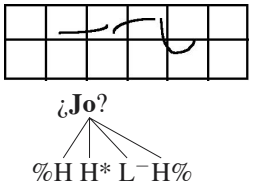
L* L⁻ H%

The first goal of this article is to describe the realization of a selection of pitch contours in Central Catalan and examine in detail the melodic changes these tunes undergo when realized over short utterances, namely, monosyllabic phrases and utterances containing just one stressed syllable. As we will see, when the tune consists of a single pitch accent, Catalan tends to favor a compression strategy. Below there are two sample pitch patterns illustrating the Catalan echo question tune (with the phonological form %H..H*..L⁻H%) applied to two texts of different length (*¿**Viu** a Badal**o**na?* '(Did you say) he/she lives in Badalona?' vs. *¿**Jo**?* '(Did you say) me?'). Even in the cases where the segmental string consists of a single syllable, all of the tones comprising the tune link to the available text:

(5) a.



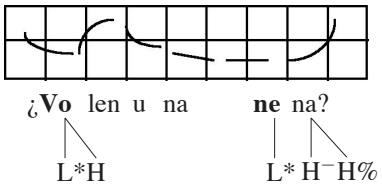
b.



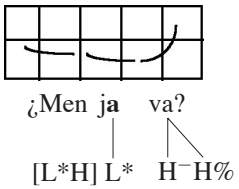
[All throughout the article Catalan tunes are represented by using both a stylisation of the F_0 contour with its corresponding autosegmental transcription. Syllables in boldface in Catalan orthography indicate syllables with lexical stress].

When dealing with two (or more) accent tunes, Catalan can adopt two possible strategies. First, truncation of the first part of the contour. For example, the rise question intonation tune has the phonological form L*H..L*..H⁻H% when applied to a text with two or more lexically stressed syllables (cf. *¿**Vo**len una **ne**na?* 'Do they prefer a girl?'). When realized over a short utterance with just one tonic syllable (cf. *¿Menj**a**va?* 'Did he/she eat?') or a monosyllabic word (cf. *¿**No**?* 'No?'), the first part of the tune (the first pitch accent) does not surface and the resulting contour is reduced to a simple rise (L*..H⁻H%).

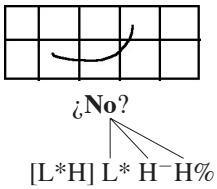
(6) a.



b.

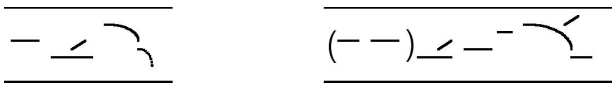


c.

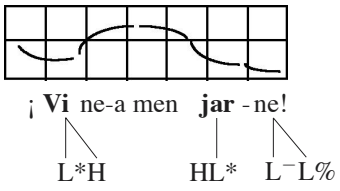


Second, Catalan can use another strategy to "adapt" intonational contours to short segmental strings, which we exemplify with the exhortative tune. When applied to utterances with two (or more than two) accented syllables, the exhortative tune consists of a low-rise-fall intonation pattern which can be described as a L*H accent associated with the first stressed syllable followed by a L*LL% edge contour (cf. *¡**Vi**ne a men**jar**-ne!* 'Come and eat some of this!'). If the segmental string contains only one stressed syllable (cf. *¡**Vi**ne!* 'Come!' and *¡Es**col**ta!* 'Listen!') then the contour surfaces as a L*H pitch accent plus a LL% boundary tone.[2] Oddly enough, the most prominent stressed syllable of the sentence (which is always the last one) adopts two distinct pitch shapes depending on sentence length, namely, HL* in long utterances and L*H in short utterances.

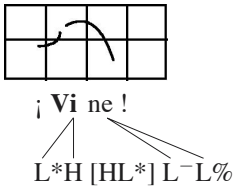
2. Bonet (1984) represents the contrast between the two exhortative pitch patterns as follows:



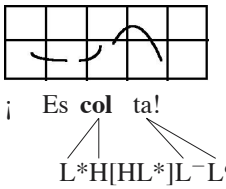
(7) a.



b.



c.



The well-known autosegmental assumption that a metrically strong position cannot bear more than one pitch accent provides a straightforward explanation for the fact that two (or more) pitch accent tunes fail to associate a given tone unit to the text when there is only one accentable position available. This well-known prosodic restriction accounts for the fact that one of the pitch accents making up the tune will be left stranded. Yet, how can we account for the contrast in behavior between interrogative and exhortative tunes with respect to tune-text association? That is, why it is that the first pitch accent fails to associate in the former case? The autosegmental assumption that all of the pitch accents making up intonational contours have the same status provides no principled way to predict which pitch accent should be associated to the text. In our view, an adequate theory of phonological representation and tune-text association should maintain the phonological identity of the interrogative and exhortative intonation as single linguistic choices (namely, L*H..HL*..HH% and L*H..HL*..LL% respectively) and should be able to predict their different phonetic manifestations when applied to different texts. This article discusses different ways to modify the standard metrical framework in order to account for the "compression data" and the behavior displayed by such tunes in Catalan. The type of data dealt with here is thus especially relevant as a testing ground for the adequacy of both phonological tonal representations and tune-text association procedures.

We will discuss two possible hypotheses regarding the phonological structure of pitch contours and the theory of tune-text association. One plausible solution is to advocate for a hierarchical structure for intonational tunes: building on the British-style configurational model's idea of "nucleus" and adapting some of Ladd's (1996) recent ideas on the topic, we propose to elaborate somewhat the internal structure of tunes, conceiving the head of the tune as the structural expression of the obligatory part of intonation contours – crucially, the Catalan data clearly demonstrates the independence between the metrical properties of a sentence and its pitch properties. Indeed, something will need to be said about the status of pitch accents in order to explain why some of them display a priority in association. A second possible option that will be entertained (and discarded) is the possibility of underspecifying the underlying tone units with regards to association properties. The fact that one of the phonological elements in Catalan exhortative tunes may surface either as a pitch accent or as a boundary tone depending on the number of accentable positions in the utterance may lead us to believe that this is a feasible solution. We will show that, leaving aside the high degree of ambiguity present in the actual association procedure of these unspecified units, the behavior of other Catalan contours does not allow for such an explanation.

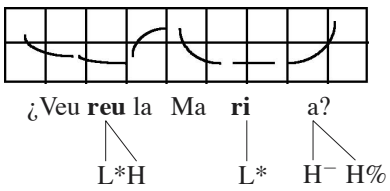
2. Tune-text association in the autosegmental-metrical model

The analysis presented here adopts one of the most widely recognized phonological approaches to intonation, namely, the autosegmental-metrical theory laid out by Pierrehumbert (1980) and followed by many researchers – the reader can find an introduction to this model in Pierrehumbert's 1980 thesis and, more recently, in Ladd's 1996 book. One of the basic assumptions behind this approach is the view that intonation contours in any language can be analysed as strings of phonological events or tones of two types: (a) **pitch accents** (represented as T*); and (b) **edge** or **boundary tones** (represented as T^{-} or T%). Pitch accents are local tonal events associated to metrically strong syllables which confer a special accentual prominence to these; on the other hand, boundary tones are tonal events associated to the boundaries of prosodic domains. It is therefore assumed that the important parts of intonational contours are localized events in the F_0 contour which are phonologically specified: in this framework, intonational contours are viewed as sequences of one or more pitch accents plus a combination of boundary tones (T*..(T*)..T^{-}T%) – the minimum size intonation contour is composed by one pitch accent plus an edge tone sequence, that is, T*..T^{-}T%. The F_0 contour in between these points is phonologically unspecified and is obtained in the phonetics component by an interpolation function. Even though the metrical model recognizes that the

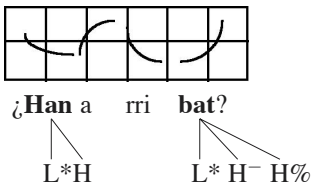
most prominent accent in the sentence is generally the last one, it recognizes no internal structure to intonation contours and thus denies any theoretical status to the notion of nucleus. In fact, one of the differences between the autosegmental approach and early configurational approaches is that nuclear contours are being reanalyzed as a combination of an utterance-final pitch accent plus a boundary tone sequence.

Within the metrical model, therefore, a given tune is conceived as a possible phonetic realization of a unique linear string of phonological units. Let us take a look at the rise question intonation in Catalan, which can be described as a sequence of two underlying pitch accents, L*H and L* (aligned with the first and last stressed syllable of the utterance respectively) plus the edge tone sequence H⁻H% (associated with the end of the intonational phrase) – the combination H⁻H% is indicating that the sentence ends in a sharp rise. The following two sample interrogative contours (*¿Veu**reu** la Mar**i**a?* 'Are you going to see Mary?' and *¿**Han** arri**bat**?* 'Did they arrive?') illustrate the relationship between the phonological units and the metrically salient positions in the sentence and reveal the importance of the location of the stressed syllables in "predicting" the final shape of the contour. Indeed, the first stressed syllable of the utterance is always pronounced with a falling tone followed by a rise aligned with the posttonic syllable (L*H), the last syllable is pronounced with a low tone (L*) and the sentence boundaries with a sharp rise (H⁻H%). The rest of the F_0 movements are obtained through interpolation, which explains the fact that F_0 transitions between phonological units are more abrupt in shorter sentences like *¿Han arri**bat**?*

(8) a.



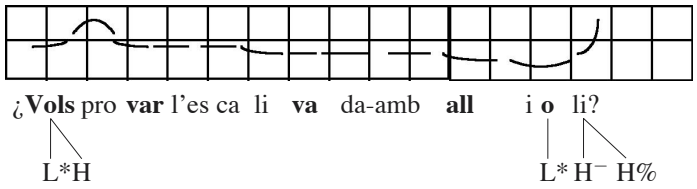
b.



The implementation of rise question intonation in longer utterances clearly demonstrates the role of the first and last stressed syllables as docking sites for the two pitch accents making up the tune. The difference between the following contour (cf. *¿**Vols** pro**var** l'es-c-ali**va**da amb **allio**li?* '¿Would you like

to taste 'escalivada' with 'allioli'?') and the two contours above resides exclusively in the temporal adaptation of the overall pitch shape of the tune: the interpolation between the first and the last pitch accent is less steep due to the increase in segmental material in between these points, thus appearing like a "stretched out" version of the same tune.

(9)



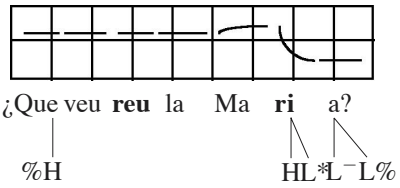
Thus, the autosegmental conception of tunes insightfully captures the fact that the same intonation contour yields to different phonetic forms depending on the metrical structure of the sentence, in particular the number and location of major stressed syllables in the utterance. Phonetic interpolation functions easily explain how melodic tunes get "adapted" to the segmental material available in sentences and how they are "compressed" or "stretched out" in order to accommodate to the temporal requirements of the text. Yet, as we will see in the next section, the standard metrical assumptions on the structure of phonological tunes fail to adequately predict the behavior of different tunes when involved in extreme cases of accommodation of phonological structure to short texts.

3. Tune-text association patterns in Catalan

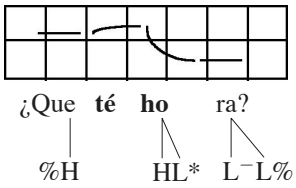
3.1. Compression cases

3.1.1. Falling question intonation. Many distinctive tunes in Catalan consist of a single pitch accent plus an edge tone sequence. One of these tunes is a type of polar question optionally starting with the particle *que* which is intonationally characterized by a final falling pattern. The semantic difference between this falling contour and the rising interrogative contour seen in the previous section resides basically on the higher degree of politeness the falling tune conveys (cf. Prieto 2002a for more details). Falling question intonation is characterized by a steady high tone which spans from the beginning of the sentence up until the last stressed syllable (%H) followed by a high-falling pitch movement aligned with the most prominent stressed syllable in the utterance (HL*) and by a low boundary tone sequence (L⁻L%) which reaches the bottom range of the speaker. Perceptual impressions of the contour clearly indicate that the contour contains only one accented syllable (a specially prominent syllable) which always falls on the last stressed syllable of the utterance.

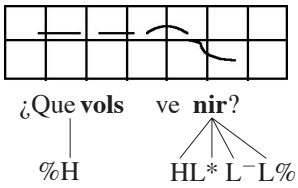
(10) a.



b.

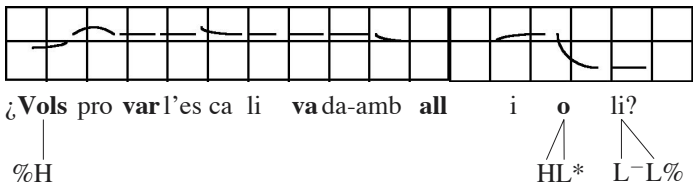


c.



In long utterances, the high pitch level is maintained all throughout the sentence (declining only in a very slight way) [3] up until the last pitch accent. After that, the final pitch pattern is associated in exactly the same way to the right end of the text (cf. *¿**Vols** provar l'es-c-alivada amb allio**li**?* '¿Would you like to taste 'escalivada' with 'allioli'?').

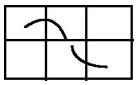
(11)



As we can see below, when this contour is applied to monosyllables or sentences with one stressed syllable (cf. *¿Que **ve**?* 'Is he/she coming?' and *¿**Ve**?* 'Is he/she coming?'), the complete rise-falling pitch pattern is phonetically realized over the available segmental material.

3. In other languages it has also been reported that declination is suspended in interrogative sentences (cf. Ladd 1996).

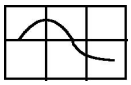
(12) a.



¿Que **ve**?

%H HL* L⁻L%

b.



¿**Ve**?

%H HL* L⁻L%

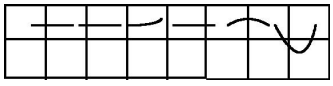
3.1.2. Echo questions. The intonation pattern illustrated in (13) corresponds to a reiterative-type question which conveys an additional meaning of surprise and insistence on the part of the speaker. It has been called "insistence tune" by some descriptive work on Catalan intonation (cf. Prieto 1995, 2001a) (cf. *¿No vol ve**nir**?* '(Did you say) he/she does not want to come?' and *¿Viu a Vila**mal**la?* '(Did you say) he/she lives in Vilamalla?'). The right edge of the contour ends in a rise-fall-rise pitch movement. In autosegmental terms, this pitch pattern can be described as an underlying tone sequence made up of an initial high boundary tone %H followed by a H* pitch accent and a L⁻H% boundary tone sequence.

(13) a.

¿**No** vol ve **nir**?

%H H*L⁻H%

b.



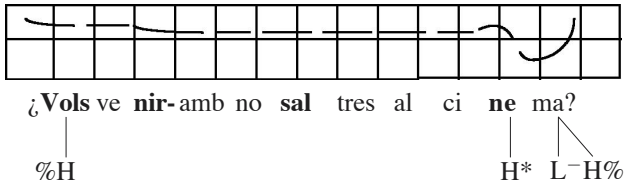
¿**Vi** u-a Vi la **ma** lla?

%H H* L⁻H%

As in the falling question intonation, when this contour is applied to long utterances, the stretch of high pitch spans from the start of the utterance up until the last stressed syllable (cf. *¿**Vols** ve**nir** amb no**sal**tres al ci**ne**ma?* 'Would you like to go to the cinema with us?'). The high pitch level is maintained all

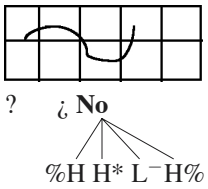
throughout the utterance declining in a very slight way all along the sentence. After that, the nuclear contour is associated to the right edge of the sentence:

(14)

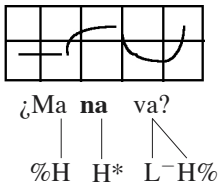


Similarly, when the text consists of a single syllable (cf. *¿**No**?* '(Did you say) no?') or a sequence containing just one stressed syllable (cf. *¿Ma**na**va?* '(Did you say) he/she used to boss you around?') then the entire string of tones associates with the available text.

(15) a.



b.

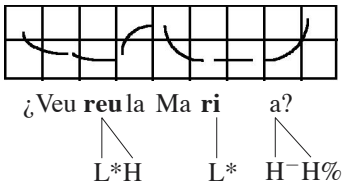


3.2. A "truncation" case: The rise question intonation

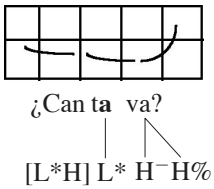
Let us examine the behavior of the rise question tune reviewed in Section 2. As we noted before, the rise question tune can be expressed by means of the following string of underlying tones: two pitch accents (L*H, L*) plus two edge tones (H⁻H%). Indeed, when the text contains two stressed syllables or more (cf. *¿Veu**reu** la Ma**ri**a?* 'Are you going to see Mary?') the first pitch accent L*H attaches to the first metrically strong syllable and the second L* to the last one. Finally, edge tones (HH%) link to the utterance-final posttonic syllables. Hence, the first and last tonic syllables of the phrase behave as the two anchoring sites for the two pitch accents of the tune and the sentence-medial stressed syllables are generally unaccented. Such behavior is probably due to the fact that interrogative sentences only have a single focused constituent.

Let us take a look at the shape of this contour when the sequence contains just a single syllable (cf. *¿**No**?*) or one lexically stressed syllable (*¿Can**ta**va?* 'Did she sing?'). In such a case, the first pitch accent of the rise question tune is left unrealized and the resulting contour surfaces as a simple rise (L* H-H%).

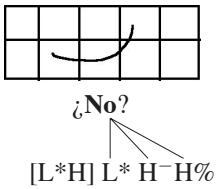
(16) a.



b.



c.



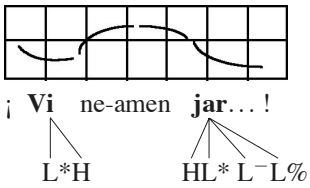
The neutral location for the nuclear accent (the most prominent accent in the sentence) in yes-no questions is always on the last stressed syllable of the utterance. Interestingly, in the truncated forms, this is precisely the accent that associates to the text, that is, the "obligatory" part of the intonation contour. Following a recent proposal by Ladd (1996: 217 ff.), one could suggest that intonation contours are hierarchically structured and that the nucleus is the central and obligatory part of pitch contours, something that would account for the fact that the nuclear pitch accent is the one to surface in this case. Yet, the examples in the next section will convince us that this proposal cannot be maintained for Catalan.

3.3. "Deletion" cases

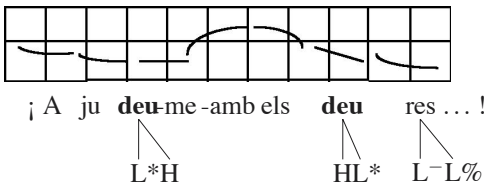
3.3.1. Exhortative tune. Let us take a look at one of the most common ways to express a soft command in Catalan. When realized over utterances with two (or more than two) lexically stressed syllables (cf. *¡**Vi**ne a men**jar**!* 'Please, come and eat!') or *¡Aju**deu**-me amb els **deu**res!* 'Please, help me with my

homework!'), the exhortative contour consists of a low-rise-fall pattern. The initial low-rise movement is associated with the first stressed syllable (L*H). After that, the high pitch is maintained up until the last stressed syllable of the utterance, where the pitch falls rapidly (HL*).[4] Finally, the pitch gradually falls over the utterance-final posttonic syllables (L⁻L%). Hence, the underlying transcription of this pitch pattern is L*H..HL*..L⁻L%. Finally, let us also remark that the greatest prominence in all exhortative tunes always lies on the last tonic syllable.

(17) a.

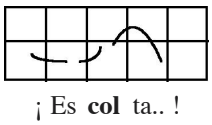


b.



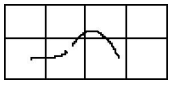
The examples in (18) show the melodic form of the exhortative tune when applied to short sequences, namely, a single syllable (*¡**Va**..!* 'Please, do it... !) or sequences containing just one stressed syllable (cf. *¡Es**col**ta..!* 'Listen to me!', *¡**Vi**ne..!* 'Come here!'). Crucially, the stressed syllable is pronounced with a low tone followed by a rise (L*H) and, after that, the pitch falls gradually in a "morendo-type" way until the end of the sentence (L⁻L%).

(18) a.



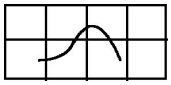
4. Let us recall the phonetic and phonological differences between the shape of the rising interrogative contour (L*H... L*) and the exhortative contour (L*H... HL*): while in the first case the pitch immediately falls down after the first pitch accent, in the exhortative tune the high pitch is maintained up until the last stressed syllable of the utterance.

b.



¡ **Vi** ne.. !

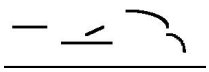
c.



¡ **Va**.. !

Apparently, one might think we are dealing with two independent and unrelated pitch patterns. In fact, in her description of Central Catalan intonation, Bonet (1984: 78, 80, 84) claims that the exhortative tune can surface as two possible contour shapes and that speakers choose one or the other depending on the number of lexical categories the sentence contains. According to her, the first tune (i) applies to sentences which contain a single lexical category (e.g., Noun, Verb, Adjective or Adverb), and the second (ii) to sentences containing more than one lexical category.

(i) With one lexical category

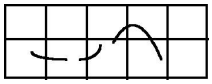


(ii) With two lexical categories

There are two pieces of evidence in favor of reanalyzing the abovementioned contrast as a function of the number of accents rather than the number or lexical categories the sequence contains. First, the fact that phrases containing two lexical categories (cf. *¡Nena maca …!, ¡Tia Maria…!*) "surprisingly" adopt the pitch pattern typical of sentences with one lexical category can be readily explained once we realize that these utterances are actually pronounced with a single accented syllable (***ma**ca*, *Mar**i**a*). Second, this claim is consistent with the autosegmental idea that the metrical structure is a crucial prosodic feature yielding to important phonetic differences in pitch contours. Hence, even though apparently we are dealing with a case of "allotony" (two independent pitch tunes chosen as a function of the number of lexical categories the utterance contains) we claim that the two pitch contours share the same underlying phonological source (namely, L*H..HL*..LL%). The mechanisms of tune-text association should be the key components in predicting the different manifestations of this contour when applied to different texts.

Contrary to what happened in the truncation case reviewed in the previous section, in this case the nuclear accent HL* is the one left stranded in the truncated form.

(19) a.



¡ Es **col** ta.. !

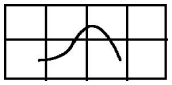
L* H [HL*] L⁻L%

b.

¡ **Vi** ne.. !

L*H [HL*] L⁻L%

c.



¡ **Va.. !**

L*H [HL*] L⁻L%

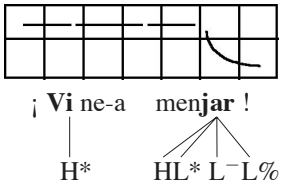
The Catalan speakers we questioned (10 in total) felt that the main accent of such utterances was unquestionably located in the last stressed syllable. Thus, the main accent (or nuclear syllable, which signals the main focus of the sentence) is realized as either L*H or as HL* depending on the metrical structure of the sentence. This demonstrates that the claim that the nucleus is necessarily the obligatory part of intonation contours cannot be maintained for Catalan.

Let us briefly discuss what the phonological characterization of the exhortative tune should be. If one wants to maintain the phonological identity of this tune as a single linguistic choice and account for the different association behavior of the underlying tone units, then we will have to seriously consider modifying some standard metrical assumptions regarding the phonological representation of tunes. Following a recent suggestion by Ladd (1996), we will propose to adopt a more elaborate view of intonation structure in the sense that the head of the tune structure will be then identified as the obligatory part of the contour. A second possible option that will also be dealt with in the discussion section would imply to allow association properties (to edges or to metrically strong syllables) to be unspecified underlyingly, that is, the proposal that certain H and L tonal elements are not intrinsically accent tones or boundary

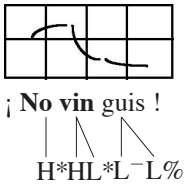
tones. Before focussing on the theoretical consequences of these two proposals, let us examine the behavior of other Catalan tunes with regards to multiple association.

3.3.2. Imperative tune. The melodic configuration of Catalan imperatives is illustrated below with sentences with two lexically stressed syllables (cf. *¡**Vi**ne a men**jar**!* 'Come and eat!', *¡**No vin**guis!* 'Do not come!'). The contour starts at a high pitch level and continues high until the pitch drops rapidly during the nuclear stressed syllable (the last stressed syllable of the utterance). Hence, imperative intonation in Catalan may be analyzed as a linear sequence of two pitch accents (H* and HL*) followed by a LL% edge tone sequence.

(20) a.

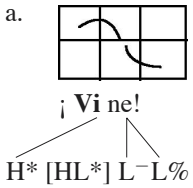


b.

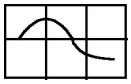


When the imperative tune is applied to short texts such as *¡**Vi**ne!* 'Come here!' or *¡**Fuig**!* 'Get out!' we apparently get a different pitch contour. The stressed syllable is pronounced with a rising accent (H*) and the posttonic material (cf. *¡Vine!*) with a falling. Crucially, the nuclear syllable is pronounced with a rising accent (H*) in short utterances and with a falling accent (HL*) in longer utterances. Again, we should remark the "surprising" fact that the pitch accent that is left unassociated corresponds precisely to the nucleus of the intonation contour.

(21) a.



b.

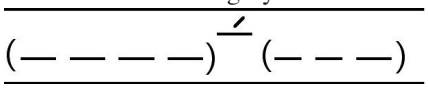


¡ **Fuig** !

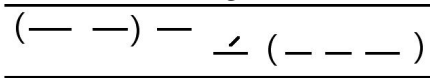
H* [HL*] L⁻L%

Bonet (1984: 70, 72, 75) claims that the behavior of the imperative tune in Catalan is identical to the exhortative contour seen in the previous section. According to her, this intonation contour adopts two distinct melodic shapes depending on the number of lexical categories the sequence contains. As she puts it, "utterances containing only one lexical category (Noun, Verb, Adjective o Adverb) choose the tune in (i), whereas utterances containing more than one choose a different tune (ii)".

(i) With one lexical category



(ii) With two lexical categories

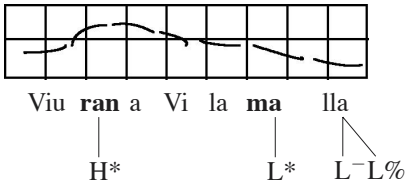


As with the exhortative tunes, there are strong arguments for the proposal that the different contour shapes the imperative tune adopts can be straightforwardly accounted for as a function of the number of metrically strong positions the sentence contains. Again, this standard autosegmental assumption readily accounts for the fact that some phrases containing two lexical categories (cf. *Nen dolent!*, *Noia del jersei vermell!*) "oddly" adopt the pitch pattern corresponding to sentences with one lexical category. We will claim that both contours have the same underlying phonological form H*..HL*..LL% and that phonological structure itself will account for its particular adaptation to different text-types.

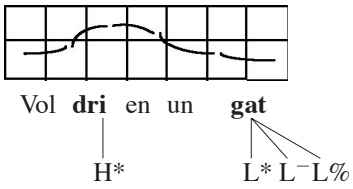
3.3.3. Declarative contours. (22) illustrates two sample declarative contours in Catalan (cf. *Viu**ran** a Vila**ma**lla* 'They will move to Vilamalla', *Vol**dri**en un **gat*** 'They would like to have a cat'). Statements are characterized by a rising pitch gesture aligned with the first stressed syllable of the utterance (H*) followed by a falling F_0 pattern – longer utterances may involve more than one prenuclear H* accent. Generally, the last stressed syllable of the word (the most prominent syllable in the sentence) is pronounced with a falling pitch movement which we interpret as a L* pitch accent – for a different interpretation

of nuclear and prenuclear pitch accent of Catalan declarative sentences, see Estebas (2000).

(22) a.

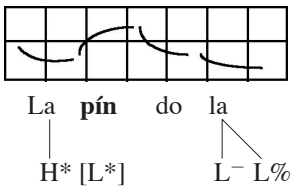


b.

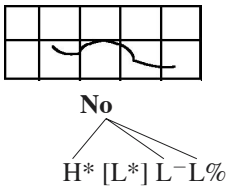


When applied to monosyllables (cf. ***No***) or utterances containing only one metrically strong position (cf. *La **pín**dola* 'The pill'), the rising gesture is associated with the accented syllable and the falling gesture comes afterwards. Thus, Catalan statement intonation consists "minimally" of a H* pitch accent followed by a L⁻L% boundary tone sequence.

(23) a.



b.



As in the case of exhortative and imperative tunes, the most prominent stress of the sentence links up with two different phonological tone units, H* or L*, depending on the number of metrically strong syllables the sentence contains. Again, we will argue that these contours have a common underlying form and that surface variation follows directly from certain conditions on the association mechanism between accents and stressed positions and on tune representation itself. The following section explores the implications of the Catalan data

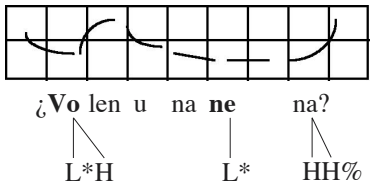
for issues like the structure of pitch contours (Section 4.1) and the theory of tune-text association (Section 4.2).

4. Discussion

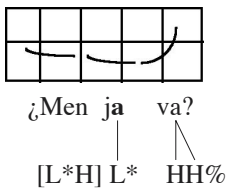
In the preceding section we have distinguished three possible strategies Catalan uses when adapting intonational contours to very short utterances. When dealing with a one-accent tune, Catalan opts for *compressing* the contour: the falling interrogative contour and the echo-type questions are examples where all of the tones are realized over a very short segmental string. By contrast, when the tune consists minimally of two pitch accents, then there are two possibilities. Let us briefly compare them. The examples in (24a) show three sample rise question tunes (L*H..L*..HH%): when the utterance contains just one stressed syllable, speakers opt to associate only the final part of the contour, leaving the first accent tone unassociated – this is clearly an instance of what Ladd (1996) has named *truncation*. (24b) illustrates the behavior of exhortative tunes: by contrast, when this contour is applied to short texts, it is the second pitch accent rather than the first which fails to associate.

(24) a. Rise question intonation

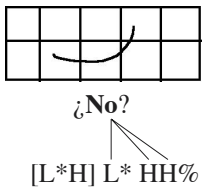
(i)



(ii)

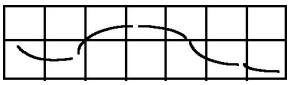


(iii)



b. Exhortative intonation

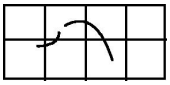
(i)



¡ **Vi** ne-a men **jar** - ne!

L*H HL* LL%

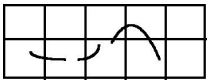
(ii)



¡ **Vi** ne !

L*H[HL*] LL%

(iii)



¡ Es **col** ta!

L*H[HL*] LL%

As noted earlier, compression of a two (or more) accent tune is automatically ruled out over sequences containing only one stressed syllable, provided the well-known assumption that one metrically strong position is not allowed to bear more than one pitch accent. Yet, autosegmental standard assumptions offer no principled way to distinguish the contrast in association behavior displayed by the rising interrogative (24a) and the exhortative contours (24b). Why is it that in (24a) the second pitch accent is the one that links to the text, whereas in (24b) it is the first one? How can we handle the different behavior between the rise question contour and the exhortative contour? If we assume that the *automatic/default* tune-text association procedure works from left-to-right, the second accent tone would always be the one to be left floating.

One possible solution for the cases above would be to write phonological rules which "deassociate" or "fail to associate" the truncated tone(s), as Grice (1995: 84 ff.) does for Palermo Italian in a somewhat different context. [5] In

5. Grice (1995: 84ff.) argues that phonological tune truncation is responsible for the cases of partial truncation (or 'curtailment', as she puts it) of the tune in phrases ending in a monosyllable or a word with final stress. She argues that a boundary tone needs a secondary association to a tone-bearing unit in order to be fully realised, that is, a syllable that is completely free for association. Therefore, phrases ending in a monosyllable or word with final stress do not fulfil the requirements for secondary association since the pitch accent occupies the final syllable in the phrase, leading to a less fully realised tone. A less fully realised L tone, for example, means that there is some evidence for a falling gesture but the fall is not completed so the pitch reaches somewhere in the middle of the range.

this way, the tune can keep the same phonological identity and the different outcomes are obtained through the application of specific phonological rules of tone deletion. Crucially, this analysis relies on the acceptance of powerful and unconstrained phonological rules which can delete any tonal element of a given tune. An alternative path which appears to be far more appealing would involve encoding in a different way the underlying representation of the tunes under discussion in a way that one can indicate priority association of a given tone element over others in the same tune. In what follows we discuss the modifications we propose to the standard autosegmental view to accommodate the intonational phenomena reviewed in this article.

4.1. A hierarchical view of intonation contours

One of the first options that comes to mind to solve the accent selection cases is the postulation of a hierarchical view for intonational tunes, a view which was initially proposed by the British model of intonation and recently advocated within the metrical model by Ladd (1996). Indeed, a hierarchical structure for tunes would have clear implications for tune-text association patterns in the sense that it could encode which tonal element is the obligatory one, the first one to be associated to the text, and ultimately explain why pitch contours differ in the selection process of the tone units that will be phonetically realized. As we will see, though, we face a slight problem in trying to explicitly relate the obligatory part of a pitch contour to the most prominent accent of the sentence (traditionally, the nucleus).

The classical British-style proposal regarding pitch contour structure is illustrated below: intonational tunes are divided into three parts, called head, nucleus, and tail. The nucleus basically refers to the most prominent syllable in the sentence and the melodic movement associated to it, which is generally located at the end of the intonation group. The head is identified with whatever precedes the nucleus and the tail with whatever follows it. Moreover, within the British tradition, intonation contours are generally divided into two sections: (a) nuclear or terminal contour (which consists of a nucleus and a tail) and (b) prenuclear contour (which includes the head and the prehead).

[I] [came with my] [bro] [ther]
Prehead Head Nucleus Tail

As Ladd (1996: 209) points out, "according to the founding work in the British school [...] only the nucleus is obligatory, so that on a monosyllabic utterance the contour consists of the nucleus alone. In an utterance with more syllables, the nucleus occurs on the most prominent stressed syllable, which is normally also the last stressed syllable." According to this, the nuclear contour (nucleus+tail) should work as very intuitive notion when intonation contours are adapted to short sequences in the sense that this part of the contour should be the one kept, as follows:

Yes
Nucleus+Tail

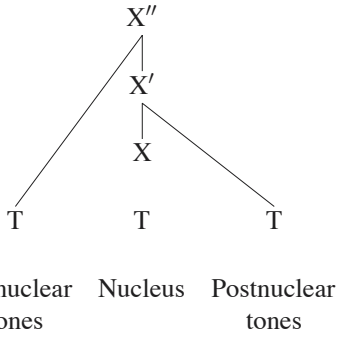
Most of the traditional work on intonation has implicitly or explicitly accepted that the nucleus is one of the essential components of intonation contours, [6] that is, the central or most prominent part of the tune which usually associates with the last accent of the sentence and which is the only obligatory part of the contour. Thus, the nucleus has been regarded as an amalgam of the following three properties:

(1) most prominent accent of the sentence;
(2) located almost always at the end of the sentence;
(3) an obligatory part of the pitch contour.

Yet, recent studies have shown that at least properties (1) and (2) can function somewhat independently. Taking up the configuration model ideas and authors like Liberman (1975), Ladd (1996) has recently suggested that the metrical model should recognize a more elaborate structure to intonation contours to motivate some special properties displayed by different parts of tunes. Ladd (1996: 219) posits the following internal structure for intonational contours (expressed in terms of X-bar theory) which distinguishes three main parts to intonation contours: 1) the nucleus, which he conceives as the essential and the obligatory most important part of intonation contours; 2) the prenuclear elements, which constitute a single linguistic choice (one of more accent tones)

6. In fact, the notion of nucleus and nuclear contour, initially developed by the British school of intonation, has traditionally constituted a widely accepted component of intonation description: it is very close to the notion of *tonema* proposed by Navarro Tomás, the notion of *intonème* of the French tradition, the *terminal contour* of the American school or the *root configuration* of the Dutch school. Moreover, many linguists have recognized that pitch phenomena located at the end of phrases are the most important part of intonational contours. Quilis (1975), for example, argues that "intonationally, what is important is the pitch activity localized at edges of the melodic group and in all syllables with lexical stress, especially the last one."

that can be optionally deleted or truncated; and 3) the postnuclear elements which form a close group with the nuclear tone and often surface as edge tones, "even though they may also surface as accents under certain circumstances." (Ladd 1996: 220). According to Ladd, "[this structure] treats the nucleus as the 'head' of the tune, the tail (redefined as the tones that surface either as phrase tones or postnuclear accent) as the 'complement', and the prenuclear accent as an 'adjunct'." – see Ladd (1996: 219ff.) for more details.



The proposal by Ladd departs in some important respects from the classical British analysis. The postulation of postnuclear pitch accents, for example, has been based on close inspection of the behavior of interrogative contours in languages like Greek and Romanian.[7] The typical interrogative contour in Romanian has the phonological form L*..H*..L-L% (cf. the two examples below from Ladd 1996: 212–213). The fact that the main prominence of the sentence falls on the first stressed syllable calls out for the need to recognize the existence of postnuclear accents (that is, realized on lexically stressed postnuclear syllables) which are subordinated in prominence to the nuclear pitch accent – for more examples of postnuclear accent tones, cf. Grice (1995) for Palermo Italian. As we can see, Ladd's proposal readily accounts for the fact that the L* pitch accent is the tune's most prominent and obligatory accent of such contour.

(25) a. Ai va ˈzut ˈregele?
L* H* L⁻L%
'Did you see the king?'

7. There are minor differences between the phonetic realization of Greek and Romanian tunes: while in Greek the HL sequence always aligns with the sentence-final syllable, in Romanian it spreads over the two final unstressed syllables. See Ladd (1996) and Grice et al. (2000) for a more detailed analysis of the Greek example.

b. Ai vaˈzut a fisul aˈcesta?
L* H* L⁻L%
'Did you see this poster?'

Thus, the existence of postnuclear accents in several languages has convincingly demonstrated that it is not necessarily the case that the main prominence is located at the end of the utterance. Accordingly, Ladd's structure always dissociates the nucleus from its wrongly believed canonical position at the end of the sentence. However, Ladd's proposal faces several problems when we try to extend it to the Catalan exhortative-type cases: crucially, it predicts that the nucleus of the contour (the obligatory part of the tune) should dock on the main prominence of the sentence. This prediction is not borne out: in fact, the obligatory accent L*+H links to the main prominence only when the utterance contains one accentable position; in longer utterances, this accent links to the first accentable position, which does not bear the main prominence. These facts clearly argue for the independence between the metrical/prominence properties of syllables and their melodic realization: in other words, one thing is the metrical prominence assigned to a given syllable and something else is its pitch properties.

Hence, the behavior of exhortative-type tunes in Catalan demonstrates that properties 1 ("most prominent accent of the sentence") and 3 ("an obligatory part of the pitch contour") of the concept of nucleus can also function somewhat independently. Thus, we basically adopt Ladd's structure of intonational tunes, with the proviso that the head of the structure has to be interpreted exclusively as the obligatory part of pitch contours. In other words, the way pitch units percolate down to the relevant stressed positions need not be encoded in the underlying structure of tunes. The following structures correspond to the exhortative (27a) and rise question tunes (27b) in Catalan. The head (in boldface) identifies the compulsory part of the contour and the rest of the string corresponds to the prenuclear or postnuclear material.

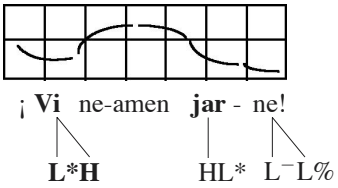
(26) a. X″ b. X″
X′ X′
X X
T T T T T
L*H HL*LL% L*H **L*** H⁻H%

The preceding underlying representations can easily predict the different outcomes the interrogative and exhortative-type tunes produce in Catalan. Being

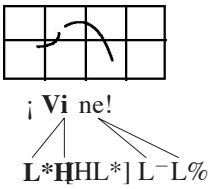
the tune is an abstract property of a phrase, the following tune-text association mechanism will be needed for accents to percolate down to the relevant stressed positions: (i) If we are dealing with a two (or more) accent tune, automatic/default tune-text association from left-to-right. (ii) If one of the accents in the tune is marked as the nucleus, priority association would work docking this accent first. This process predicts that different accents may appear linked with the main prominence in the same tune, depending on the metrical structure of the string. The following examples illustrate the end result of applying the *automatic/default* left-to-right tune-text association and *priority association* to texts of different lengths:

(27) a. Exhortative intonation

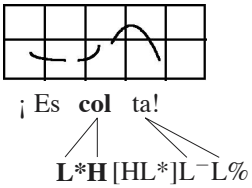
(i)



(ii)

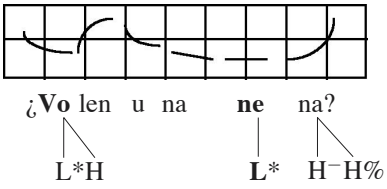


(iii)

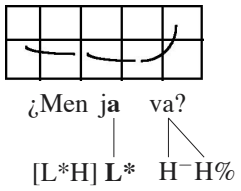


b. Rise question intonation

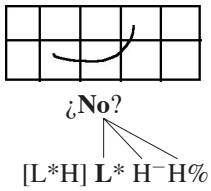
(i)



(ii)



(iii)



In sum, we claim that by assuming a more elaborate intonation structure we can easily account for the different association patterns Catalan tunes display: specifically, we can maintain the phonological identity of the exhortative/interrogative tune-types as a single linguistic choice and predict its outcome in texts with different metrical structure. The Catalan data under discussion have also demonstrated that the traditional assumption that metrical and intonational aspects of prosodic structure are inherently related cannot be maintained crosslinguistically: as we know, sentence-level prominence is assigned in a parallel metrical structure, independently of pitch structure, and the relationship it displays with pitch structure can perhaps be established in language-particular grounds.

4.2. Underspecification of H and L units

Let us briefly discuss an alternative solution that could potentially account for the Catalan compression data. Following a recent suggestion by Ladd (1996: 217ff.), one could claim that association properties (to edges or to metrically strong syllables) of underlying tone units which make up intonational contours might be unspecified. Ladd (1996) advances this proposal in connection with the behavior of the Romanian yes-no questions we saw before. In short utterances, the first pitch accent (the nuclear accent) associates to the first metrically strong position and the unspecified HL sequence is treated as a boundary sequence. That is, depending on the metrical structure of the sentence, H can surface as either an accent tone (H*) or as a boundary tone (H⁻).

(28) a. Ai va'zut 'regele?
L* H* L⁻L%
'Did you see the king?'

b. 'regele?
L* H⁻L%
'The king?'

In order to handle the metrical and tonal adaptation properties of interrogative contours in Romanian, Ladd proposes two modifications to the standard metrical view of intonation contours. First, he recognizes the existence of postnuclear pitch accents, that is, accents which can appear after the nucleus. Second, he proposes that underlying tones making up intonational tunes should not be specified for association properties, that is, they do not have to be underlyingly treated as accent tones or edge tones. As he puts it, "the principle that the tune is a property of a phrase, and is thus more abstract than a string of tones, seems inescapable. The elements of tunes are abstract tones, and they are not intrinsically either accent tones or edge tones (i.e., not intrinsically either starred or unstarred)." (Ladd 1996: 220). Specifically, the Romanian tune is characterized as a sequence of a L* accent followed by an unspecified HL postnuclear sequence, as follows:

(29)
X"
X'
X
T T
L*HL

If we adopt such a view, Catalan exhortative contours could be interpreted as a phonological string of tones consisting of a L*H pitch accent (the obligatory pitch accent) followed by an underspecified HL tone sequence. [8] The final string

8. Mary Beckman has suggested to test a variant of the underspecification approach on our data such as the one used by D'Imperio (2000: 37ff.) to analyse interrogative contours and narrow focus sentences in Neapolitan Italian. In this language, narrow focus constituents are analysed as a L+H* focal pitch accent (or a L*+H interrogative pitch accent) and a following HL⁻ phrase accent. If there is only one stressed syllable in the narrow focus constituent, the contour merges into a single peak, but if the constituent provides two docking sites for accents then the phrase accent is docked onto the second stressed syllable. This approach could be easily

HL could surface either as a pitch accent (HL*, associated with a lexically stressed syllable) or as a boundary tone (H⁻L%, associated with the right edge of the phrase), depending on the number of accentable positions the utterance contains. In principle, the HL string would associate from left-to-right to the segmental material available: if there is a metrically strong position left in the sentence, it will attach to it; if not, it will align with the posttonic syllable, constituting an edge tone. However, if one does not specify in a more concrete way how these unspecified HL tone units have to relate to the text when there are two stressed positions in the text, we can actually generate a wide range of possible outputs such as H*..L⁻L%, H*L..L⁻L% or HL*L⁻L%, two of which are ungrammatical.

(30) Exhortative tune: L*H HL

a. *¡ **Vi** ne-a men **jar** - ne!
L*H H* L⁻L%

b. *¡ **Vi** ne-a men **jar** - ne!
L*H H*L L⁻L%

c. ¡ **Vi** ne-a men **jar** - ne!
L*H HL* L⁻L%

The same ambiguity problem is applicable when trying to generate the imperative tune – note that the third possible output is the only grammatical one:

(31) Imperative tune: H* HL

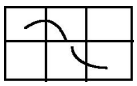
a. *¡ **Vi** ne-a men **jar** !
H* H* L⁻L%

b. *¡ **Vi** ne-a men **jar** !
H* H*L L⁻L%

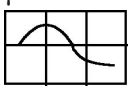
c. ¡ **Vi** ne-a men **jar** !
H* HL* L⁻L%

adapted to account for the two patterns of exhortative intonation, but not for the imperative patterns.

Leaving aside these ambiguity effects (which could be overcome with a higher degree of specification of the underlying tone elements) such an abstract representation of tunes would be wrongly predicting that imperative tunes (with the phonological form H*...HL) should obligatorily have a surfacing H element as a boundary tone when applied to short utterances, which is clearly not the case. Let us remember the pitch shape of the imperative tune in such circumstances (namely, H*...L⁻L%):

(32) a. 

¡ **Vi** ne !

b. 

¡ **Fuig** !

Even though the Catalan data at hand clearly does not allow for a solution that relies on the underspecification of association properties, we believe that this is an issue which deserves to be further investigated.

5. Conclusions

This article has described in detail how intonational contours in Catalan are associated with segmental strings of different metrical structure and length and has described the strategies this language uses when the phonological elements of the intonational tune cannot be realized over specially short segmental strings. The Catalan data dealt with in this article challenge the idea that there is a simple typological difference between compressing and truncating languages with respect to multiple association (Grønnum 1991, Ladd 1996). In fact, the picture appears to be more complex than that: Catalan displays three different procedures of contour adaptation (compression, truncation and deletion) depending on the particular intonation contour we are dealing with.

The contrast between compression and the other two "deletion" strategies follows directly from the assumptions of the autosegmental model, showing its superiority over other representational models. Given that two pitch accents cannot associate to a given tone-bearing unit, Pierrehumbert's model of tonal representation readily predicts that a two pitch-accent tune will not be able to completely associate to texts containing only one metrically strong position. Yet, what the metrical model does not foresee is which tone element will be the one to associate to the text. The article has explored the implications of the Catalan data for the theory of tune-text association and the structure of

pitch contours and has proposed some modifications of the standard metrical assumptions. First, building upon recent suggestions by Ladd (1996), we have basically argued for a somewhat more elaborate structure of pitch contours that can single out which element is the head of the tune (in the sense of the obligatory part of a tune). By assuming a richer underlying representation we are able to easily explain the different outcomes by a left-to-right association of the pitch units involved in the phonological tune with the metrically strong positions available in the sentence. The behavior of pitch contours in Catalan constitutes a compelling argument against the concept of nucleus as both the most prominent and the obligatory structural part of intonational contours. The fact that a nuclear syllable may adopt different melodic shapes clearly demonstrates the independence between metrical/prominence properties of syllables and their pitch properties.

Universitat Autònoma de Barcelona

References

Bonet, Eulàlia (1984). Aproximació a l'entonació del català. Master's thesis, Universitat Autònoma de Barcelona.

D'Imperio, Mariapaola (2000). The role of perception in defining tonal targets and their alignment. Doctoral dissertation, Ohio State University.

Estebas Vilaplana, Eva (2000). The use and realisation of accentual focus in Central Catalan with a comparison to English. Doctoral dissertation, University College London.

Grice, Martine (1995). *The Intonation of Interrogation in Palermo Italian: Implications for Intonation Theory*. Tübingen: Niemeyer.

Grice, Martine, D. Robert Ladd and Amalia Arvaniti (2000). On the place of phrase accents in intonational phonology. *Phonology* 17: 143–185.

Grønnum, Nina (1991). Prosodic parameters in a variety of regional Danish standard languages, with a view towards Swedish and German. *Phonetica* 47: 188–214.

Ladd, D. Robert (1986). Intonational phrasing: the case for recursive prosodic structure, *Phonology Yearbook* 3: 311–340.

— (1990). Metrical representation of pitch register. Between the Grammar and Physics of Speech. In *Papers in Laboratory Phonology I*, John Kingston and Mary Beckman (eds.), 35–37. Cambridge: Cambridge University Press.

— (1994). Constraints on the gradient variability of pitch range, or, Pitch level 4 lives!. In *Phonological Structure and Phonetic Form. Papers in Laboratory Phonology III*, Patricia A. Keating (ed.), 43–63. Cambridge: Cambridge University Press.

— (1996). *Intonational Phonology*. Cambridge: Cambridge University Press.

Hirschberg, Julia and Gregory Ward (1992). The influence of pitch range, duration, amplitude and spectral features on the interpretation of the rise–fall–rise intonation contour in English. *ournal of Phonetics* 20: 241–251.

Pierrehumbert, Janet (1980). The phonetics and phonology of English intonation. Doctoral dissertation, Massachussets Institute of Technology.

Prieto, Pilar (1995). Aproximació als contorns entonatius del català central. *Caplletra*, *Revista Internacional de Filologia* 19: 161–186.

— (1999). Patrons d'associació de l'estructura tonal en català. *Catalan Working Papers in Linguistics* 7: 207–218.
— (2002a). Entonació. In *Gramàtica del català contemporani,* Joan Solà et al. (eds.). Barcelona: Edicions 62.
— (2002b). *Entonació. Models, teoria, mètodes*. Barcelona: Ariel Lingüística.