Prosodic effects on phrasing: Clash avoidance in Catalan

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A R T I C L E   I N F O

A B S T R A C T

This paper empirically investigates the effects of the presence of stress clash on phrasing decisions in Catalan. An interesting fact about Catalan phrasing, initially noted by Oliva (1992) and also reported by Prieto (2005a), is that the presence of a clash in this language can optionally trigger prosodic restructuring. Five native speakers of Central Catalan read 32 stress-clash and non-stress-clash sentence pairs at normal and fast speech rates, for a total of 320 utterances. The results clearly show that speakers adjust prosodic phrasing so that clash situations are avoided. Catalan speakers tend to get around stress clash by deleting the first stress in the clash and grouping the two words into one phonological phrase, thus avoiding potential prosodic breaks between the two words. This shows that the phonological construction of phonological phrases cannot rely exclusively on syntactic information, but rather that metrical structure needs to be accessible. All in all, this article offers empirical support for one of the predictions of metrical phonology, namely that languages tend to alternate between metrically strong and weak syllables and that stress clash situations are avoided crosslinguistically.

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1. Introduction

One of the contributions of prosodic and metrical phonology has been to uncover a principle that seems to hold crosslinguistically, which is that the overall rhythmic pattern of utterances tends to be organized such that there is an alternation of strong and weak syllables (see, among others, Liberman and Prince, 1977; Hayes, 1980; Selkirk, 1984, 1986; Nespor and Vogel, 1986, 1989). In other words, languages tend to avoid strings of adjacent strong syllables, as well as strings of adjacent weak syllables. These generalisations are expressed by Selkirk's Principle of Rhythmic Alternation (Selkirk, 1984). This principle states that every strong position on a metrical level n should be followed by at least one weak position on that level, and, conversely, that any weak position on a metrical level n may be preceded by at most one weak position on that level.

It is also well known that when languages show rhythmic patterns that are not in conformity with the alternation principle (i.e., clash or lapse contexts) they tend to be resolved. Stress clash situations, for example, tend to be resolved crosslinguistically through the use of a variety of repair strategies. One of the strategies frequently used in English is the so-called **stress** or **accent shift**, also referred to as **rhythm rule**. This process applies when two stresses appear in adjacent or near-adjacent syllables, by moving the fist stress to an earlier full vowel within the word (e.g., *achromatic lens* > *achromatic lens*; *thirteen men* > *thirteen men*; Liberman and Prince, 1977; Prince, 1983; Selkirk, 1984; Gussenhoven, 1991; Shattuck-Hufnagel et al., 1994, among others; throughout this article, stressed syllables will be underlined). In Catalan, on the other hand, **destressing** and **deaccenting** of the first accent involved in the clash is the general strategy for clash repair (*deu nens* > *deu nens* 'ten children'; Oliva, 1992; Prieto et al., 2001; but see also Prieto,

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2005b for another strategy used in Catalan). This strategy has also been documented in Italian (Farnetani and Kori, 1983; Nespor and Vogel, 1989), and Spanish (Pamies Bertrán, 1994; Atria Lemaitre, 2009), as well as in Greek (Arvaniti, 1994). **Tonal repulsion** or **overlap** are two other options used by languages, a process that can be understood as an Obligatory Contour Principle effect: for example, the presence of competing rising pitch movements can be resolved by anticipation of the first gesture or delay of the second (Bruce, 1977 for Swedish, Silverman and Pierrehumbert, 1990 for English, Prieto, 2005b for Catalan; see also Nespor and Vogel, 1989; Helsloot, 1995 for Italian) or by a change in pitch accent type, such as two immediately adjacent pitch accents realized as a rising followed by a falling jump (see Helsloot, 1995 for Italian).

One of the goals of this paper is to expand our knowledge about how clash resolution may vary across languages, both in terms of the conditions that govern its applications, and its realization. On the other hand, we are specially interested in how the clash resolution strategies interact with sentence-level phenomena like pitch accent placement and phrasing decisions. One of the shortcomings of most descriptions of clash resolution strategies, also pointed out by Grabe and Warren (1995:96), is that most of the examples consist of two-word sequences which are concatenations of words in citation form prominence patterns, thus devoid of surrounding context. Except for very few studies, we do not find analyses of clash data at the sentential level. When stress clash *is* analyzed at the sentential level, it has been found that intonational prominence and phrasing are clearly intertwined with this stress clash. For example, Liberman and Prince (1977) pointed out that stress shift does not apply if the stress shift word is the terminal nuclear element of an intonational phrase. Similarly, Nespor and Vogel (1989) suggested that the domain of stress shift is the phonological phrase and that it does not apply across phonological phrase boundaries. For French, Post (1999, 2000) found that clash resolution is bounded by the phonological phrase, and moreover, that the optional application of clash resolution provides evidence for the restructuring of phonological phrases. She accounts for the French results in terms of interacting constraints that regulate accent placement (NoClash and Lapse), metrical prominence, and alignment constraints (regulating mappings between the syntactic and prosodic phrasing structures, as well as those between prosodic phrasing and metrical structures), and proposes that phrasing and accentuation are intimately related in French (see also Gussenhoven, 2004).

This article investigates experimentally one of the most common clash resolution strategies found in Catalan, namely destressing and deaccenting.[1] In a recent study, Prieto et al. (2001) demonstrated through a set of perception experiments that Catalan listeners show a high degree of perceptual confusion between sequences of two stressed syllables in a clash environment (e.g., *camí net* 'clean path') and other homophonous sequences with one final stress (e.g., *caminet* 'little path'). This demonstrates that Catalan uses a general clash resolution strategy that consists of a systematic destressing of the first syllable in the clash sequence. The upper panel in Fig. 1 illustrates the accent deletion phenomenon with the target utterance *El camí net és allà* 'The cleared path is there'. The example shows that the first stressed syllable in the clash environment is totally deaccented and lacks the presence of a rising pitch accent (L+H*). By contrast, the lower panel in Fig. 1 shows the phonetic realization of a near-minimal pair utterance with no clash, *La camisa neta és allà* 'The clean shirt is there'. In this case the first stressed syllable is produced with a rising pitch accent L+H*.

A very interesting fact about Catalan phrasing, initially noted by Oliva (1992) and also reported in Prieto (2005a), is that stress clash resolution plays an important role in phrasing decisions in this language. Recent work on Catalan phonology shows that although tonal repulsion is available as a stress clash resolution strategy in the language, the preferred option for resolving stress clashes is destressing or deaccenting of the first stress involved in the clash (Bonet and Lloret, 1998; Oliva, 1992; Prieto et al., 2001; Wheeler, 2005). In his study of Catalan phrasing, Oliva (1992:131) suggests that the presence of a clash can optionally trigger p-restructuring. The example in (2a) shows how the stress clash situation present in the first sentence (that is, between *comprarà* and *llibres*) is resolved by placing both words within the same phonological phrase (or p-phrase), thus allowing for the deletion of the first stress. By avoiding the stress clash situation, speakers show a clear preference for sentences with no clash, even if its resolution is not obligatory. By contrast, the example in (2b) shows that when the stress clash situation is not present (between *comprava* and *llibres*) there can be a phrase break separating the two target words.

(2) a.   (*Comprarà llibres*) (*de sintaxi*)
        '(S)he will buy syntax books'

     b.   (*Comprava*)ɸ (*llibres de sintaxi*)ɸ
        '(S)he used to buy syntax books'

As we will see below, evidence for phonological phrasing in Catalan comes from stress/accent and intonation data (see Prieto, 2005a for further details). Catalan speakers place a prominent stress (what we will call p-phrase prominence) and an accent on the last tonic syllable of a p-phrase, and speakers produce an F0 continuation rise at the right boundary of a p-phrase, i.e., an H- boundary tone (Frota et al., 2007; Feldhausen, 2010). The two graphs in Fig. 2 illustrate the waveform, spectrogram, and F0

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[1] Catalan can optionally resolve clash situations through tonal repulsion of two immediately adjacent prominent syllables (cf. Prieto, 2005b). In this case, the two pitch accents are phonetically realized and the first one is generally aligned earlier in time to the first syllable. It seems that speakers can make use of this option when they want to emphasize or highlight the two words. In Italian, it is also possible to have two directly adjacent accented syllables within the same phrase (Helsloot, 1995).
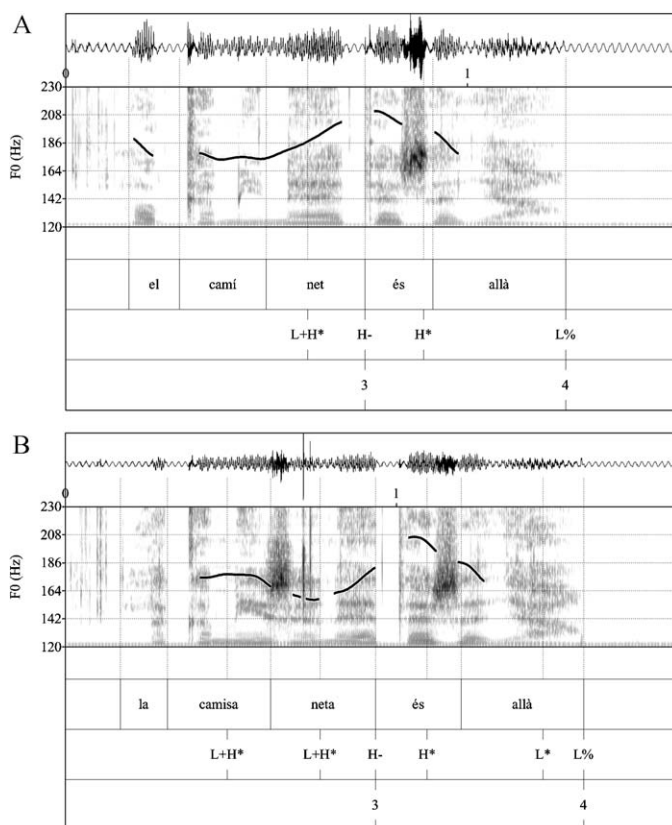
Fig. 1. Waveforms and F0 contours of two Catalan utterances. Upper panel: *El camí net és allà* 'The cleared path is there' (stress clash condition). Lower panel: *La camisa neta és allà* 'The clean shirt is there' (no stress clash condition).

contour of two Catalan utterances, one without stress clash (*En Joan*) (*llegia*) (*llibres de sintaxi*) 'John used to read syntax books', and another one with stress clash (*En Joan*) (*llegeix llibres*) (*de sintaxi*) 'John reads syntax books', as produced by speaker JB. In the case with no stress clash (upper panel), the F0 contour displays an H- boundary tone separating the three prosodic phrases, and the continuation rise is placed after the verb *llegia*. By contrast, in the case of the stress clash utterance, the continuation rise is placed after the two target words in clash position (*llegeix llibres*), i.e., after the object *llibres*. The word *llegeix* in this case is prosodically unaccented.

The main goal of this study is to investigate in a systematic fashion the role of clash avoidance in prosodic boundary placement in Catalan read speech. Though the potential effect of clash avoidance on phrasing has been noted in the literature, this tendency has not been experimentally proven. Our goal is thus to quantify the effects of this constraint and test whether clash avoidance is an important factor in phrasing decisions in Catalan.

This study will test experimentally the effects of clash avoidance on phrasing and pitch accent placement, thus putting us in a better position to clarify the relationship between metrical structure and phrasing also pointed out in other languages (see Liberman and Prince, 1977; Selkirk, 1984 for English, Post, 1999, 2000 for French). It is not surprising that, given the strong relationship between stress/accentuation and prosodic phrasing (for example, the rightmost word in a p-phrase obligatorily receives a prominent stress), phrasing can also be used as a strategy to create more eurhythmic utterances. In the Catalan case, speakers presumably group the two syllables/words within the same p-phrase boundary and then eliminate the first stress in the clash.

The article will be organized as follows. Section 2 presents the methodology of the production experiment, section 3 describes the results of the experiment, and section 4 discusses the implications of these results for improving our understanding of the interaction between phonology, syntax, and metrical structure in speech production.

2. Methodology

2.1. Materials

In our materials, quasi-minimal pair sequences involving clash and no-clash sequences were placed in different positions in the utterance, in such a way that we could easily test for the effects of the presence vs. absence of a clash environment on phrasing. The sentences in (3) show representative examples of the pairs of utterances that were used to test conditions on
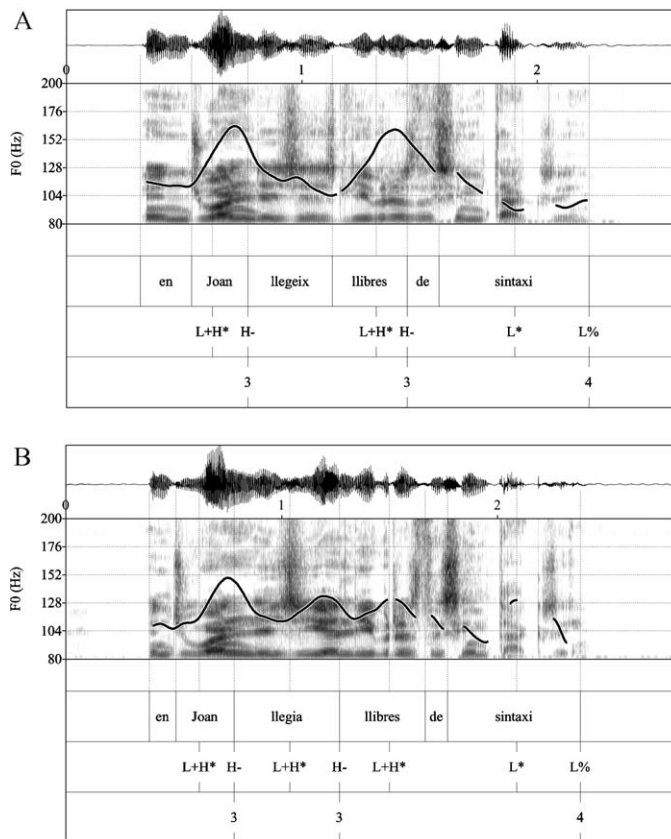
Fig. 2. Waveforms and F0 contours of two Catalan utterances as produced by speaker JB. Lower panel: (*En Joan*) (*llegia*) (*llibres de sintaxi*) 'John used to read syntax books' (no stress clash condition). Upper panel: (*En Joan*) (*llegeix llibres*) (*de sintaxi*) 'John reads syntax books' (stress clash condition).

SVO groupings consisting of 4 prosodic words, and shorter VP and NP projections consisting of 3 prosodic words. The reason for including these three structural conditions is that we will thus be able to evaluate the robustness of the effects on different sentence types. On the other hand, according to Prieto's (2005a) work, the default phrasing pattern in all these target materials (SVO, NP, and VP structures) is predicted to have two prosodic constituents, with a prosodic break between the two target words, that is, between the words in clash and no-clash environments. That is, our working hypothesis is that, regardless of sentence structure, the presence of the clash environment will affect the default presence of a phrase break between the two target words.

(3) <u>Clash condition</u>   <u>No-clash condition</u>

SVO structures

La Maria <u>beu</u> <u>ai</u>gua destil·lada   La Maria be<u>via</u> <u>ai</u>gua destil·lada
The Mary drinks water distilled   The Mary drank water distilled

'Mary drinks distilled water'   'Mary used to drink distilled water'

En Joan lle<u>geix</u> <u>lli</u>bres de sintaxi   En Joan lle<u>gia</u> <u>lli</u>bres de sintaxi
The John reads books of syntax   The John read books of syntax
'John reads syntax books'   'John used to read syntax books'

VP structures

Compra<u>rà</u> <u>lli</u>bres de sintaxi   Compra<u>va</u> <u>lli</u>bres de sintaxi
Will buy books of syntax   Bought books of syntax
'(S)he will buy syntax books'   '(S)he used to buy syntax books'

Comprar<u>à</u> <u>ma</u>pes de Barcelona	Compr<u>a</u>va <u>ma</u>pes de Barcelona
Will buy maps of Barcelona	Bought maps of Barcelona
'(S)he will buy maps of Barcelona'	'(S)he used to buy maps of Barcelona'

NP structures

Un <u>nen</u> <u>d'</u>ulls angelicals	Una <u>ne</u>na <u>d'</u>ulls angelicals
A boy of eyes angelic	A girl of eyes angelic
'A boy with angelic eyes'	'A girl with angelic eyes'

Un <u>sac</u> <u>ple</u> d'herbes	Un <u>sac</u> ple<u>net</u> d'herbes
A sack full of herbs	A sack full.dim of herbs
'A sack full of herbs'	'A sack full of herbs'

The full set of reading materials consisted of a total of 16 pairs of sentences, 7 pairs corresponding to SVO structures, 5 pairs corresponding to NP structures, and 4 pairs corresponding to VP structures. For the full list of utterances, see Appendix A.

2.2. Speakers and task

Five speakers of Central Catalan (MV, GG, RC, JB, NA) read the 32 stress-clash and non-stress-clash sentence pairs into a laptop computer in random order in a quiet room. They were asked to read each sentence twice, first at a normal speech rate and then at a faster speech rate. A total of 320 utterances were obtained and prosodically analyzed by the author (32 utterances × 2 speech rates × 5 speakers).

2.3. Prosodic labeling

For the prosodic analysis, we used the latest Catalan version of ToBI, Cat_ToBI (Prieto et al., 2009; Prieto, in press; Aguilar et al., 2009). Evidence for prosodic phrasing in Catalan comes from stress/accent and intonation data (see Prieto, 2005a for further details). Catalan speakers place a prominent stress (what we will call the p-phrase prominence) and an accent on the last tonic syllable of a p-phrase. Moreover, speakers can optionally produce an F0 continuation rise at the right boundary of a p-phrase, which we label a H- boundary tone. Frota et al. (2007) examined the phonetics and phonology of prosodic boundaries in such positions in five Romance languages, among them Catalan. They found that the two dominant boundary tones in statements (located at the end of the first prosodic constituent) were either the continuation rise or the sustained pitch. By contrast, intonational phrase-final edges were generally signaled by a low boundary tone (L%) and a wider inventory of boundary tone combinations (see also Feldhausen, 2010).

Fig. 3 illustrates the waveform, F0 contour, and Cat_ToBI labeling of two Catalan utterances, one with stress clash (*Comprarà llibres*) (*de sintaxi*) '(S)he will buy syntax books' (upper panel) and the other one without stress clash (*Comprava*) (*llibres de sintaxi*) '(S)he used to buy syntax books' (lower panel), as produced by JB. As expected, the F0 contours show an H-boundary tone separating the two prosodic phrases: in the lower utterance, the first H- tone is located after the verb, clearly separating the two target words; in the upper utterance, the continuation rise is located after the two target words, with no break in the middle of the stress clash.

The transcription was performed by listening to the audio file and looking simultaneously at the pitch track. Another argument for the use of the H- label was the alignment, as the H boundary peak in the data is always aligned with the end of the prosodic phrase.

In the Cat_ToBI system, there are two levels of intonational phrasing that are coded as Break Indices 3 and 4, depending on the strength of the prosodic boundary (see Prieto et al., 2009; Prieto, in press). In labeling our data, we transcribed only levels 3 and 4 as clear instances of the presence of an intonational phrase boundary. Level 3 break indices (BI 3) correspond to the end of minor prosodic units or *intermediate* phrases (ips), intonationally defined subconstituents *within* intonational phrases. There are two strong arguments to justify the existence of such an ips-level break. The first argument is a perceptual one. When transcribing Catalan prosody, transcribers clearly perceive two different levels of disjuncture. It is the end of the weaker disjuncture that has been designated a Level 3 Break Index in the ToBI system, while the strong disjuncture corresponds to a Level 4 Break Index. The second argument relates to intonational marking. Like the intonational phrase, the intermediate phrase is tonally marked after its final pitch accent (albeit not as strongly as the intonational phrase), but the inventory of boundary tones that appear in this position is of a different (but partially overlapping) class. Typically, H- boundary tones, also called "continuation rises", are those that mark the end of an intermediate phrase, and this is the indication that we will take that a prosodic boundary is present in our data (see also Feldhausen, this volume).
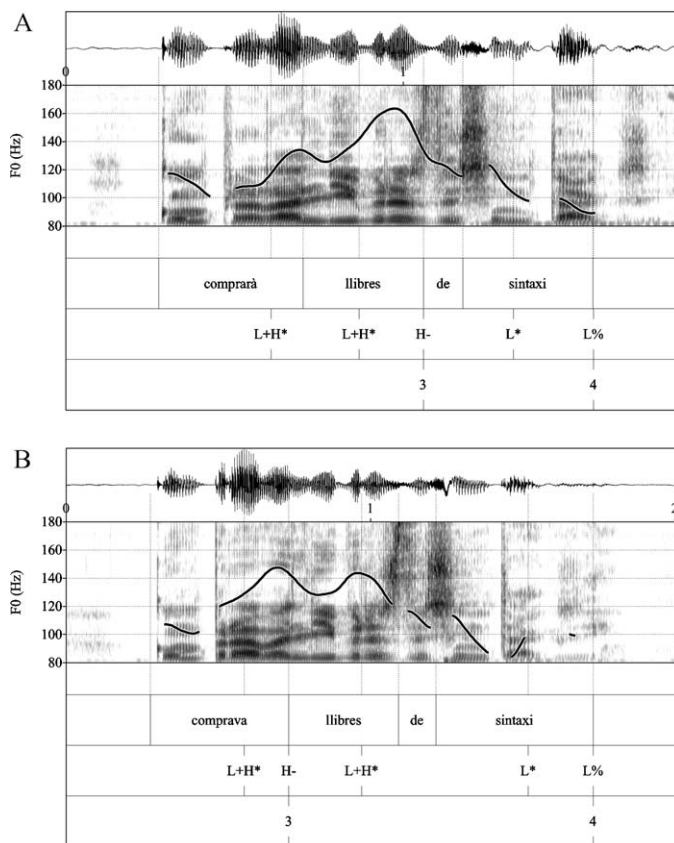
Fig. 3. Waveforms and F0 contours of two Catalan utterances as produced by speaker JB. Upper panel: (*Comprarà llibres*) (*de sintaxi*) '(S)he will buy syntax books' (stress clash condition). Lower panel: (*Comprava*) (*llibres de sintaxi*) '(S)he used to buy syntax books' (no stress clash condition).

3. Results

The data reported in this section quantifies the effects of the presence of stress clash on prosodic phrasing, namely, on the presence or absence of an intonational phrase break between the two target words. The five graphs in Fig. 4 show the mean proportion of the presence of intonational phrase breaks in the data as a function of the stress clash condition (stress clash = grey; no-clash condition = black), for all 5 speakers. The reported data includes the results for both slow and fast speech. The graphs show a very consistent tendency across speakers, namely, that the sentences with clash trigger significantly fewer cases of intonational phrase breaks between the two words, at both slow and fast speech rates. First, we see differences across subjects with respect to the number of intonational phrase breaks they use (between 45 and 70% in no-clash situations and between 4% and 27% in clash situations, depending on the speaker). Yet they all consistently produce more phrase boundaries in target word sequences with no clashes.

The following two graphs in Fig. 5 show two prototypical examples of phrasing patterns in clash vs. no-clash conditions. The two graphs illustrate the waveform, spectrogram, and F0 contour of two Catalan SVO utterances, one without stress clash (*La Maria bevia*) (*aigua destil·lada*) 'Mary used to drink distilled water' (lower panel), and the other with stress clash (*La Maria*) (*beu aigua*) (*destil·lada*) 'Mary drinks distilled water' (upper panel), as produced by JB. In the case with no stress clash (lower panel), the F0 contour displays an H- boundary tone separating the two prosodic phrases, and the continuation rise is placed after the verb *bevia*. By contrast, in the case of the stress clash utterance, the continuation rise H- is located after the two target words in clash position (*beu aigua*), i.e., after the object *aigua*. The word *beu* in this case is prosodically unaccented.

On the other hand, the following graph in Fig. 6 illustrates the waveform, spectrogram, and F0 contour of the Catalan utterance with no stress clash (*En Joan*) (*comprava llibretes*) (*de sintaxi*) 'John used to buy syntax booklets'. In this case, the speaker (RC) has unexpectedly produced the sentence with no phrasing break between the words *comprava* and *llibretes*). The target F0 contour clearly displays an H boundary tone after the noun *llibretes*. This production can be contrasted with the prototypical phrasing production shown in Fig. 2, where a phrase break appears between the two target words.

To analyze the effects of speech rate, we now show the phrasing results separated by the two speech rate conditions. The five graphs in Fig. 7 show the mean proportion of presence of intonational phrase breaks between the two target words as a
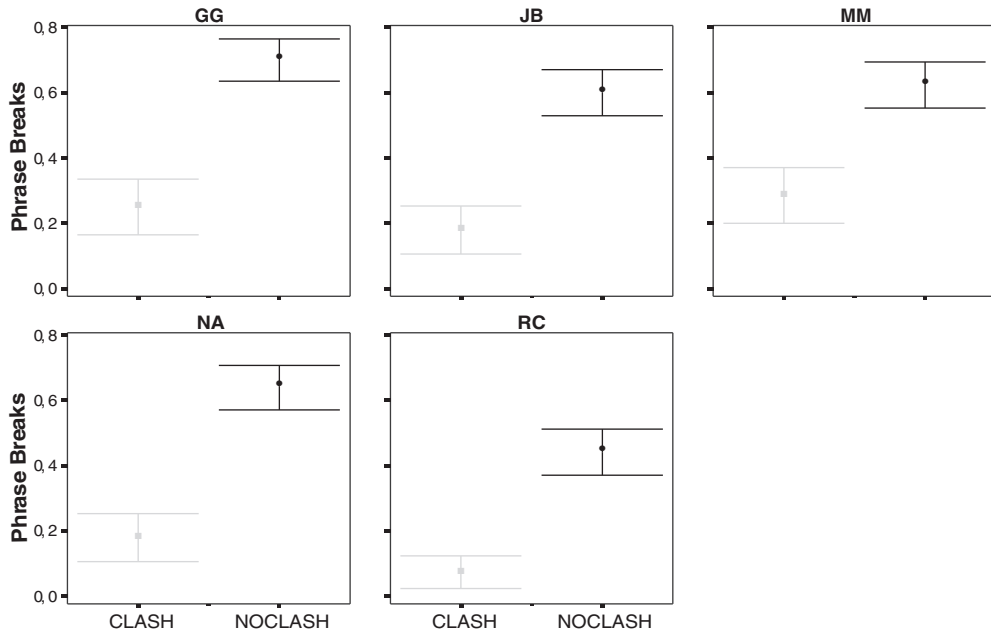
Fig. 4. Mean proportion of presence of prosodic phrase boundaries in the data as a function of the clash condition (stress clash = grey; no-clash condition = black) for all 5 speakers. The height of the error bars represents standard errors.
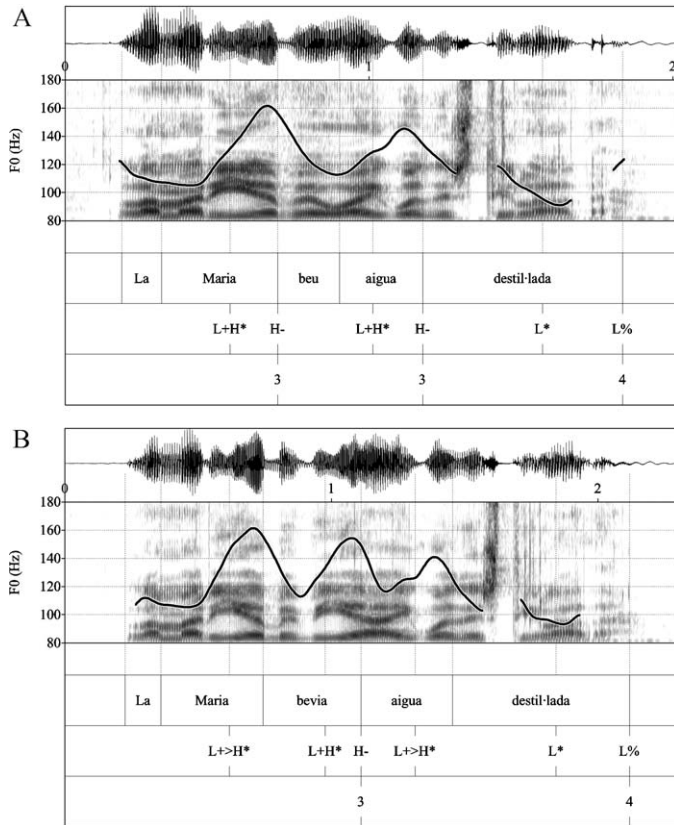

Fig. 5. Waveforms and F0 contours of two Catalan utterances as produced by speaker JB. Upper panel: (*La Maria*) (*beu aigua*) (*destil·lada*) 'Mary drinks distilled water' (stress clash condition). Lower panel: (*La Maria bevia*) (*aigua destil·lada*) 'Mary used to drink distilled water' (no stress clash condition).
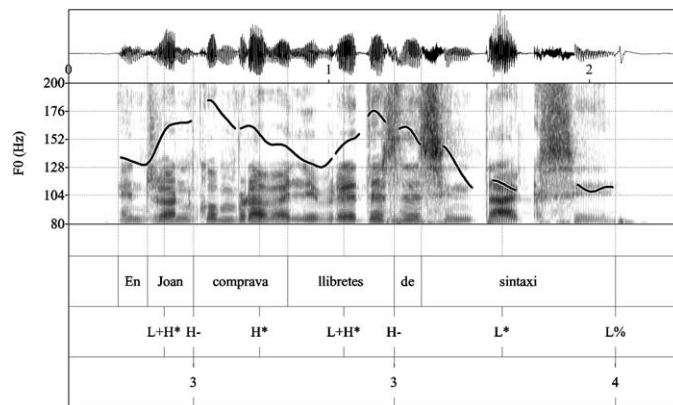
Fig. 6. Waveform, spectrogram, and F0 contour of the Catalan utterance with no stress clash (*En Joan*) (*comprava llibretes*) (*de sintaxi*) 'John used to buy syntax booklets'.

function of stress clash (*x*-axis) and speech rate (fast = grey, slow = black), for all 5 speakers. Except for subject RC, who shows no clash differences between the fast and slow conditions, the speakers show a consistent tendency to produce more intonational phrase breaks in slow speech, in both clash and no-clash conditions. Though this effect is not as strong as the clash effect, it is safe to say that speech rate has a clear effect on phrasing decisions.

An analysis of variance was performed on the data. The analysis revealed a main effect of stress clash on phrasing decisions, at $p < 0.001$, and a main effect of speech rate, at $p < 0.05$. Crucially, the interactions between clash*speech rate were non-significant, meaning that the clash effects are similar across speech rate conditions and conversely. Finally, speaker*clash, speaker*rate interactions were also non-significant, indicating that clash and speech rate effects were consistent across speakers.

Finally, we wanted to investigate the potential effects of utterance type on our materials, which contained long SVO structures and short VO and NP structures (see examples in Appendix A). The five graphs in Fig. 8 show the mean proportion of presence of phrase breaks in the data as a function of stress clash conditions and utterance type (SVO = grey, VO/NP = black), for all 5 speakers. Expect for subject NA, all speakers exhibit more phrase breaks in SVO-type sentences than in VO/NP structures, for both clash and no-clash conditions. A potential explanation for this consistent behavior is the fact that longer utterances have a higher tendency to be separated into more than one prosodic unit. Remember that SVO structures have 4 prosodic words and VO/NP structure have 3 prosodic words. [NB: in the legend the "VO" label comprises both subtypes of utterances, namely, VO and NP utterances.]
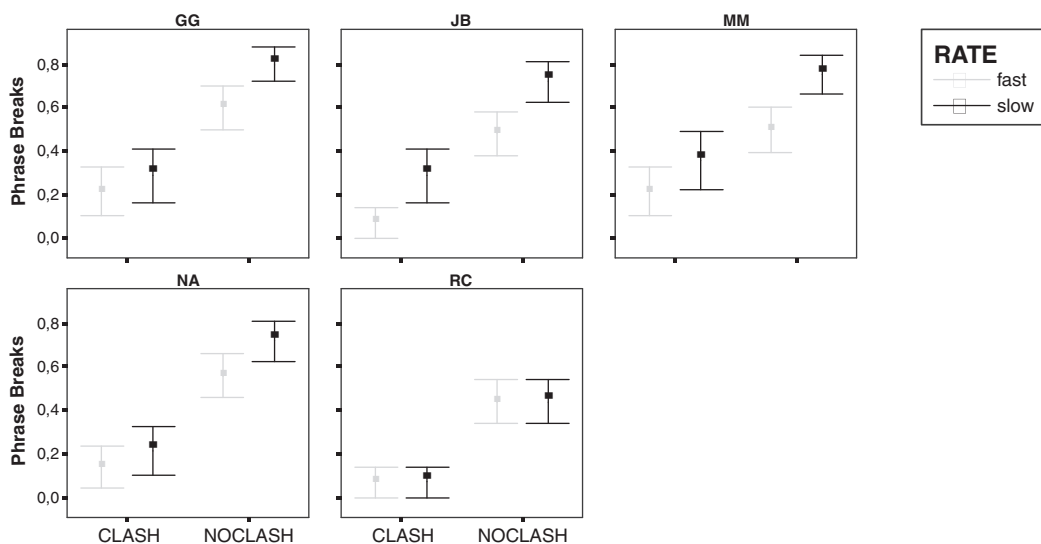

Fig. 7. Mean proportion of presence of prosodic phrase boundaries in the data as a function of the clash condition (*x*-axis) and speech rate (fast = grey, slow = black), for all 5 speakers. The height of the error bars represents standard errors.
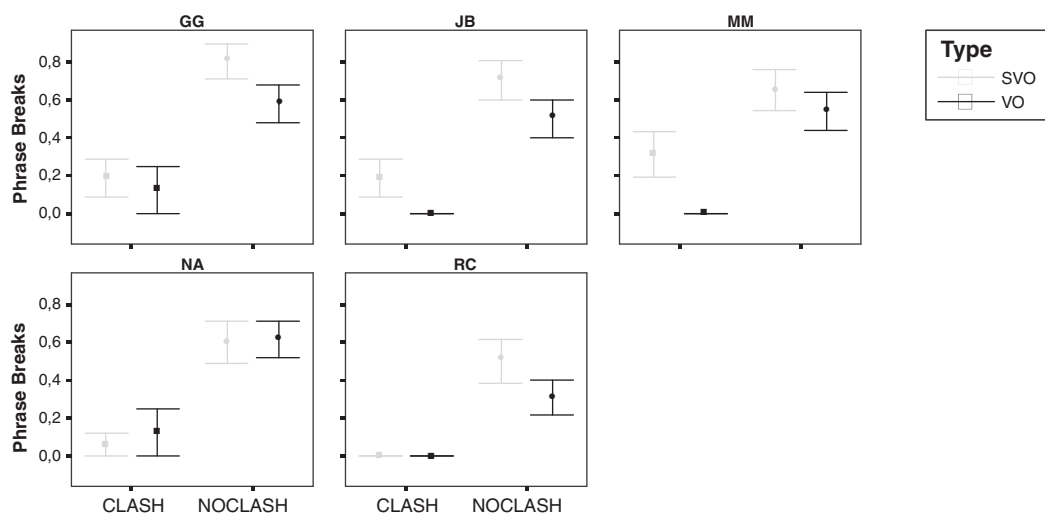
Fig. 8. Mean proportion of presence of prosodic phrase boundaries in the data as a function of the presence of the clash condition (*x*-axis) and utterance type (SVO = grey, VO/NP = black), for all 5 speakers. The height of the error bars represents standard errors.

4. Discussion and conclusions

The results of the production experiment presented in this article demonstrate that Catalan speakers' phrasing decisions are partially dependent on the metrical structure of the sentence. In order to avoid two clashing stresses, Catalan speakers tend to group the two words in clash and eliminate the first stress (as was initially observed by Oliva, 1992). This article thus offers empirical evidence for the inclusion of a prosodic markedness constraint like NoClash (that is, a condition that disfavors having two adjacent stressed syllables) that would play a major role in phrasing decisions in Catalan (see also Prieto, 2005b). This prosodic condition can be understood as a constraint which has the role of increasing the eurhythmic properties of sentences in the sense of creating regular and balanced stress periods. Following up on Prieto's (2005a) analysis of Catalan phrasing, our results show that the p-phrase construction in Catalan cannot solely rely on syntactic information but rather must also refer to prosodic well-formedness constraints. In this specific case the NoClash condition needs to be taken into account as a relevant constraint on prosodic phrasing. All in all, these results offer clear empirical support for one of the central predictions of metrical phonology, namely, that stress clash situations will tend to be avoided crosslinguistically.

The results also show that when stress clash phenomena are analyzed at the sentential level, there is a clear interaction between intonational prominence, phrasing, and metrical structure, supporting earlier proposals in this respect (e.g., Liberman and Prince, 1977; Nespor and Vogel, 1989 for English, and Post, 1999, 2000 for French, among others). Increasingly, crosslinguistic data shows that there is a very close, systematic relation between accent placement, phrasing decisions, and the application of clash resolution strategies across languages, and this needs to be studied further. An example at hand is the phenomenon of final vowel deletion in Icelandic. In Dehé (2008), the author shows the relevance of phonological phrasing in explaining this phenomenon. Like in the Catalan case, it is a fact that syntax cannot fully define the contexts of final vowel deletion in this language, and eurhythmicity is also shown to play an important role.

In our view, our results have implications for the two competing views researchers have adopted about the phenomenon of stress shift in English (Liberman and Prince, 1977; Selkirk, 1984; Gussenhoven, 1991; Shattuck-Hufnagel et al., 1994, and Grabe and Warren, 1998, among others).[2] These views are: (1) a rhythm-based account, according to which clash resolution would result from a shift of the stress to an earlier syllable in the stress shift item (i.e., affecting metrical structure; e.g., Liberman and Prince, 1977; Selkirk, 1984); and (2) a pitch-accent-based approach, whereby the stress shift affects phrase-level pitch accent placement (Bolinger, 1981; Gussenhoven, 1987, 1991, 2005; Shattuck-Hufnagel, 1991; Shattuck-Hufnagel et al., 1994). Horne (1990) provided partial experimental support for this latter analysis. She tested Gussenhoven's claim that the middle of three potential pitch accents would be deleted in utterances like *Dundee's marmalade*. She compared these sequences with similar sequences with no stress clash. Her results showed that at least in some target utterances the pitch accent on the syllable *dee* was not realized, consistent with Gussenhoven's proposal.

The results reported in the present article appear to be most straightforwardly accounted for by the deletion account of stress shift, bringing Catalan in line with earlier findings for English and French (see, e.g., Gussenhoven, 2005). Since in Catalan stress or accent deletion is an optional process which depends on actual phrasing decisions that apply at the phrasal level, the automatic stress shift predicted by the rhythm-based account does not account for this variability in the data nor its dependence on the phrasing decisions. Rather, the Catalan data supports the view that rhythmic stress clash and shift phenomena might be

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[2] I would like to thank an anonymous reviewer for pointing this out to me.

better recast in terms of an integrated theory of phrasal phenomena, namely, phrasing and pitch accent placement (see Grabe and Warren, 1995; Shattuck-Hufnagel et al., 1994, among others). This approach would need to be empirically tested through corpus studies that include pitch accent and phrase boundary labels. In sum, an adequate theory of prosodic phrasing has to recognize the complex interaction and contribution of syntactic and prosodic (and eurhythmic) effects on phrasing.

Acknowledgments

Appendix A. Materials for the reading task

Clash condition	No-clash condition
SVO structures	
La Maria beu aigua destil·lada	La Maria bevia aigua destil·lada
'Mary drinks distilled water'	'Mary used to drink distilled water'
La Maria beurà aigua destil·lada	La Maria beu aigüeta destil·lada
'Mary will drink distilled water'	'Mary drinks distilled water'
La Maria beu aigua	La Maria bevia aigua
'Mary drinks water'	'Mary used to drink water'
En Joan llegeix llibres de sintaxi	En Joan llegia llibres de sintaxi
'John reads syntax books'	'John used to read syntax books'
En Joan llegirà llibres de sintaxi	En Joan comprava llibretes de sintaxi
'John will read syntax books'	'John used to buy syntax booklets'
La Joana diu moltes mentides	La Joana deia moltes mentides
'Joana tells many lies'	'Joana used to tell many lies'
La Joana dirà moltes mentides	La Joana dirà moltíssimes mentides
'Joana will tell many lies'	'Joana will tell very many lies'
VP structures	
Comprarà llibres de sintaxi	Comprava llibres de sintaxi
'(S)he will buy syntax books'	'(S)he used to buy syntax books'
Comprarà mapes de Barcelona	Comprava mapes de Barcelona
'(S)he will buy maps of Barcelona'	'(S)he used to buy maps of Barcelona'
Comprarà pòsters de Barcelona	Comprava postals de Barcelona
'(S)he will buy posters of Barcelona'	'(S)he used to buy postcards of Barcelona'

<u>Veig</u> <u>do</u>nes africanes	<u>Veig</u> <u>do</u><u>na</u>sses africanes
'I see African women'	'I see big African women'

NP structures

Un <u>nen</u> <u>d'ulls</u> angelicals	Una <u>ne</u>na <u>d'ulls</u> angelicals
'A boy with angelic eyes'	'A girl with angelic eyes'
Un <u>fill</u> <u>d'ulls</u> angelicals	Una per<u>so</u>na d'u<u>llets</u> angelicals
'A son with angelic eyes'	'A person with little angelic eyes'
Un <u>sac</u> <u>ple</u> d'herbes	Un <u>sac</u> ple<u>net</u> d'herbes
'A sack full of herbs'	'A sack full of herbs'
Un <u>sac</u> <u>ple</u> d'herbes aromàtiques	Una <u>sa</u>ca <u>ple</u>na d'herbes
'A sack full of aromatic herbs'	'A sack full of herbs'
A<u>quell</u> <u>bon</u> company	A<u>que</u>lla <u>bo</u>na companya
'This good.ms colleague'	'This good.fs colleague'

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