MINIMUM SIZE CONSTRAINTS ON INTERMEDIATE PHRASES

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ABSTRACT

In Northern Bizkaian Basque (NBB), Intermediate Phrases (ips) align by default with the left edge of syntactic phrases. The main intonational cue of ips is partial pitch reset at their left edges. A minimal size constraint applies on ips occurring at the left edge of an Intonational Phrase (IP), requiring that they consist of at least two Accentual Phrases (APs). Following [9]'s idea that certain prominent positions demand augmentation, the NBB facts show that the left edge of an IP can also be a phonologically prominent position.

Keywords: minimum size, intermediate phrases, intonational phrases, prominent positions

1. INTRODUCTION

As described in [1], [4], in Northern Bizkaian Basque (NBB) there are three levels of intonational phrasing: Accentual Phrases (APs), Intermediate Phrases (ips) and Intonational Phrases (IPs). Downstep applies to accents in an AP, as illustrated by the F0 contour in Figure 1, a rendition of sentence (1) by a female speaker of NBB (for ease of illustration, only pitch accents are shown, without AP boundary or phrasal tones; accented syllables are boldfaced):

(1) H*+L !H*+L !H*+L
[Maia**lé**nen la**gú**nen libu**rú**ak] gustaten dxákes
Maialen-gen friends-gen books-abs like aux
'They like Maialen's friends' books'

[1], [4] argue that downstep does not apply to APs in different syntactic phrases, as shown in Figure 2, corresponding to sentence (2), uttered by the same speaker (syntactic boundaries are indicated by square brackets).

(2) H*+L !H*+L H*+L
[Maia**lé**nen lagu**ná**ri] [libu**rú**ak] gustaten dxákes
Maialen-gen. friends-dat books-abs like aux
'Maialen's friends like books'

Drawing a parallelism with Tokyo Japanese, where downstep is blocked across ips (cf. [6], inter alia), [1] claimed that each syntactic phrase is mapped as an ip in intonational structure. Thus, the APs in (1) are contained in the same ip and downstep applies throughout, whereas the APs in (2) are contained in different ips and the third accent is not downstepped with respect to the previous accent. The preverbal material in the utterances of Figs. 1-2 would have the AP and ip structures in (3) and (4), respectively, where AP boundaries are marked by round brackets and ip boundaries are marked by braces):

(3) $_{ip}\{_{AP}$(Maialénen) $_{AP}$(lagúnen) $_{AP}$(liburúak)$\}$
(4) $_{ip}\{_{AP}$(Maialénen) $_{AP}$(lagunári)$\}$ $_{ip}\{_{AP}$(liburúak)$\}$

Figure 1: F0 contour of *Maia**lé**nen la**gú**nen libu**rú**ak gustaten dxákes*. The second and third accents are downstepped.

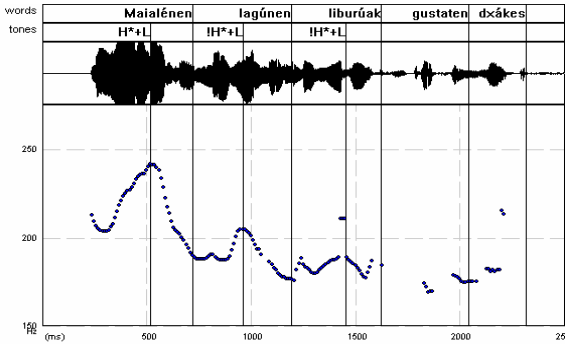
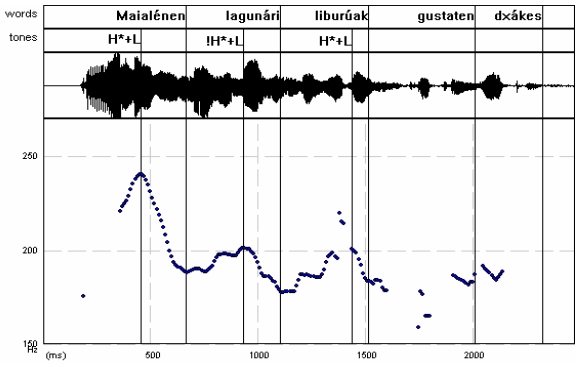


Figure 2: F0 contour of *Maia**lé**nen lagu**ná**ri libu**rú**ak gustaten dxákes*. The third accent is not downstepped.

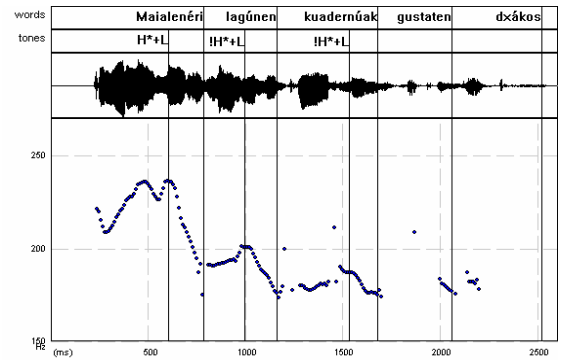


However, if the first syntactic phrase contains only one AP, the first accent in the second phrase is downstepped with respect to the single accent in

the first phrase. This can be observed in Figure 3, an F0 contour of sentence (5) uttered by the same speaker as in Figs 1-2. [1] argues that a syntactic phrase containing only one AP cannot constitute an ip, and forms part of an ip together with the APs in the following syntactic phrase. That is why the second accent is downstepped. Hence, the AP- and ip-structure for cases like (5) would be the one in (3), despite the difference in syntactic structure.

(5) H*+L ¡H*+L !H*+L
[Maiale**né**ri] [la**gú**nen kuader**nú**ak] gustaten dxákos
Maialen-dat friends-gen notebooks-abs like aux
'Maialen likes the friends' notebooks'

Figure 3: F0 contour of *Maiale**né**ri la**gú**nen kuader**nú**ak gustaten dxákos*. The second and third accents are downstepped.



[1], [4] concluded that in NBB there is a minimum size constraint demanding binarity on ips: the initial ip in an IP must contain at least two APs (cf. [2], [7], [8], [10] for prosodic binarity constraints). Non-initial ips within an IP are not subject to this constraint, as evidenced in Fig. 2, where only one AP (*liburúak*) forms the second ip.

Several issues remain open: First, as shown in [1], in NBB APs may consist of two or more words in which one or more unaccented words precede accented ones (e.g., $_{AP}$(*lagunen libu**rú**a*)). The question arises whether binarity is calculated in terms of APs or in terms of phonological words, i.e., can two-word syntactic phrases constitute a well-formed IP-initial ip, even if those words only form one AP? Second, [1] observed that a focalized AP always projects an ip boundary to its left. Thus, if the second AP in (5) were focalized it would start a new ip and downstep would not apply to its accent. However, this claim was based on the speech of one speaker, and hence needs to be confirmed with experimentally designed data. Third, what is the phonological relevance of these NBB intonational phrasing constraints? This paper tries to provide answers to these questions.

2. METHOD

The corpus consisted of five sentence types, all with three accents, borne by lexically accented words: [AAA], [AA]-[A], [A]-[AA], where A stands for an accented word and square brackets represent syntactic phrasings; another type was [UA]-[AA], where the first syntactic phrase has two words, one lexically unaccented (U) and one lexically accented, both forming one AP; finally, [A]-[**AA**], where the words in the second phrase are focalized. There were six sentences per type. [UA]-[AA] sentences were designed to answer the first question, i.e., whether the presence of an unaccented word in the IP-initial phrase would provide minimum size to form an ip even if the two words only form one AP. [A]-[**AA**] sentences would prove whether focus induces ip-boundaries to the left of focalized words. The third issue will be discussed after the first two issues are resolved.

The whole corpus consisted of 450 utterances (5 syntactic-prosodic types x 6 sentences x 5 speakers x 3 repetitions). Five female native speakers (ages 34-44) of a local variety of NBB were recorded in a quiet room in their town, Lekeitio, using a professional microphone and a minidisc digital recorder. The recorded utterances were digitized into a PC and analyzed acoustically with the software PitchWorks (Scicon, R&D).

In each utterance, we measured the Hz value of the peaks in the three H*+L accents (i.e., P1, P2, P3). The (in)existence of ip-boundaries would be detected by comparing pitch differences between the first and second peaks and the second and third peaks. In [AA]-[A] utterances, if the difference P2-P3 were close to zero or negative (as in Fig. 2), there would be evidence for an ip-boundary between the second and third APs, as pitch reset would have applied. An ip-boundary would also have to be assumed if the difference P2-P3 were positive but significantly smaller than in utterances without a syntactic boundary (i.e., partial pitch reset would have applied).

3. RESULTS AND DISCUSSION

The pitch difference between P2 and P3 was compared across utterance types for all speakers (cf. Table 1). A two-way ANOVA was run with P2-P3 as the dependent variable and Type (of sentence) and Speaker as factors. Significant

effects of both Type and Speaker were found ($F(4,431)=530.80$, $p<0.001$ and $F(4,431)=28.132$, $p<0.001$, respectively). There was a significant difference between the small positive P2-P3 difference in [AA]-[A] and all other sentence types, which do not have a syntactic break between the second and third APs, all at $p<0.001$. These results indicate that partial pitch reset applies at the left edge of the third AP in [AA]-[A] utterance types and hence that an ip-boundary exists there, confirming previous findings by [1], [4] (and making it clear that partial and not total pitch reset applies). But an interaction was also found between the two independent factors, Type and Speaker ($F=12.332$, $p<0.001$), so separate one-way analyses were run for each speaker with P2-P3 as the dependent variable and Type as a factor. We concentrate on the minimal pair that interests us in this paper, namely [AA]-[A] and [A]-[AA]. The P2-P3 differences per speaker are in Table 2.

Table 1: P2-P3 difference (in Hz) for all sentence types, for all speakers (standard error in parenthesis).

	AA-A	A-AA	AAA	UA-AA	A-**AA**
P2-P3	7.76 (0.77)	19.37 (1.01)	14.47 (0.70)	17.61 (1.02)	62.43 (2.06)

Table 2: P2-P3 difference (in Hz) for [AA]-[A] and [A]-[AA] for each speaker (stand. err. in parenthesis).

P2-P3	Spkr1	Spkr2	Spkr3	Spkr4	Spkr5
[AA]-[A]	1.68 (1.78)	3.66 (1.63)	9.88 (1.53)	11.56 (0.98)	12.61 (0.80)
[A]-[AA]	10.70 (2.09)	18.93 (2.51)	27.48 (1.43)	16.73 (1.34)	22.99 (1.75)

For four of the five speakers, the difference between [AA]-[A] and [A]-[AA] was significant (Speaker 1, $p=0.013$; Speakers 2 and 3, $p<0.001$; Speaker 5, $p=0.008$). For Speaker 4, however, the difference was not significant ($p=0.652$). This can be explained by differences in speech rate, as Speaker 4's utterances were on average 11% shorter than the other speakers'. As faster speech rates facilitate more inclusive prosodic constituents ([3], [5]), Speaker 4 would tend to have ips that contain more APs than are observed at normal speech rates, overriding mappings between syntactic and intonational structure. This is evidenced by the fact that [AA]-[A] utterances are not significantly different from [AAA] ($p=0.212$).

The absence of an ip-boundary between the first and second APs in [A]-[AA] utterances is confirmed by the lack of pitch reset, as evidenced by the rather big differences between P1 and P2, illustrated in Table 3, for all speakers. P1-P2 differences are similar in all utterance types, with or without a syntactic boundary after the first AP (except for the focus type, to be discussed below). An interaction was found between Type and Speaker ($F=5.011$, $p<0.001$), so separate calculations were made per speaker (cf. Table 4). The only finding was that for Speaker 2, the P1-P2 difference in [A]-[AA] is significantly smaller than the one in [AAA] ($p<0.001$). For Speaker 5, it is smaller than in [AA]-[A] ($p=0.039$). This might suggest that for some speakers there is a residue of a prosodic boundary in [A]-[AA], but the evidence is not strong enough to draw a solid conclusion.

Table 3: P1-P2 difference (in Hz) for all sentence types, for all speakers (standard error in parenthesis).

	AA-A	A-AA	AAA	UA-AA	A-**AA**
P1-P2	34.30 (1.65)	31.57 (1.24)	37.40 (1.21)	32.19 (1.24)	2.06 (1.60)

Table 4: P1-P2 difference (in Hz) for each utterance type, for each speaker (standard error in parenthesis).

P1-P2	Spkr1	Spkr2	Spkr3	Spkr4	Spkr5
[AA]-[A]	27.37 (2.43)	31.58 (2.56)	28.73 (3.02)	34.96 (5.48)	50.20 (1.78)
[A]-[AA]	27.77 (1.77)	30.72 (1.88)	20.37 (2.25)	40.81 (2.18)	38.65 (2.78)
[AAA]	26.37 (1.82)	47.51 (1.77)	29.44 (1.71)	38.12 (1.82)	45.78 (2.69)
[UA]-[AA]	25.07 (2.80)	26.36 (1.94)	27.13 (2.23)	39.13 (1.41)	44.81 (1.59)
[A]-[**AA**]	-4.76 (1.84)	2.66 (1.98)	6.76 (2.11)	-6.60 (4.60)	11.52 (4.34)

Importantly, there are no significant P1-P2 differences between [UA]-[AA] and [A]-[AA], [AAA] or [AA]-[A]. As explained above, in [UA]-[AA] the unaccented word forms one AP with the following accented word. Thus, in [UA]-[AA] the single AP containing U and A in the first syntactic phrase joins the following APs in the next phrase to form an ip, with the same end result as in [A]-[AA]. That is why there are no significant differences in P1-P2 between [UA]-[AA] and [AAA] or [AA]-[A], either. The answer to the first open question is thus that the binarity constraint for IP-initial ips holds of number of APs, not number of words. This is a natural conclusion: ips can impose constraints on the constituents that they immediately dominate, i.e., APs, not Phonological Words, which are dominated by APs.

As for the second issue, from the results in Tables 3-4 it can be concluded positively that focus does induce ip-boundaries to the left of focalized constituents, overriding minimality constraints.

Thus, the P1-P2 difference in [A]-[**AA**] cases is significantly smaller than the one in [A]-[AA] cases ($p<0.001$ for all speakers). That is, there is partial pitch reset after the first syntactic phrase and there is hence an ip-boundary there, even though the first phrase only contains an AP. For Speakers 1 and 4, P2 is even higher than P1 (i.e., there is total pitch reset before the second AP).

The last issue to be dealt with is the relevance of these results for prosodic and intonational phonology and also for phonological theory in general. Minimum size constraints on prosodic constituents such as the phonological word and higher constituents such as the Major Phrase or the Phonological Phrase are well-known [2], [7], [8], [10], inter alia). However, the case that occupies us has an important aspect that needs to be tackled: why only IP-initial ips need to be minimally binary, and IP-internal ips are not subject to this constraint (cf. Fig. 2, corresponding to sentence (3))? My proposal is inspired by [9]'s theory of phonological augmentation in prominent positions. There are markedness constraints that make specific reference to phonologically "strong" positions, such as: "Stressed syllables must be heavy", "Stressed syllables must have low-sonority onsets", "Long vowels must have high-sonority nuclei", "Initial syllables must have onsets", "Roots must bear stress". [9] calls these constraints *augmentation* constraints, as they call for the presence of perceptually prominent characteristics in strong positions, making these positions more perceptually salient. The prominence of some strong positions such as initial syllables and roots is psycholinguistic in nature, namely their importance for early-stage word recognition and word segmentation. [9] claims that augmentation constraints in these positions are essentially prosodic, not segmental, otherwise segmental contrasts that are essential for word and root recognition would be lost. Apart from "Initial syllables must have onsets" and "Roots must bear stress", [9] mentions tentatively root minimality effects as augmentation constraints. The idea I want to put forward here is that there are strong positions in prosodic or intonational structure above the level of the word as well. The facts on prosodic phrasing in NBB suggest that the left edge of an IP is a strong position that attracts augmentation, i.e., initial ips in an IP are strong positions where augmentation markedness constraints hold, more concretely minimality constraints: IP-initial ips must be minimally binary, containing at least two APs. Thus, initial ips of IPs would be the parallel strong position in intonational structure to initial syllables of words. This conclusion would provide additional evidence that there is something fundamental in phonology to initial positions of prosodic constituents.

4. CONCLUSIONS

This paper has presented evidence for the existence of strong positions in intonational structure that demand augmentation, in the sense of [9]. IP-initial ips in NBB have to be minimally binary, i.e., must contain at least two APs. This has been demonstrated through an experimental analysis of utterances with different syntactic phrasings that give rise to different intonational phrasings.

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