On the accented/unaccented distinction in Western Basque and the typology of accentual systems

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1. Introduction

Beckman (1986) draws a distinction between stress-accent and non-stress-accent (i.e., pitch-accent) languages. Stress-accent languages, such as English, convey accentual prominence by a combination of phonetic cues, including pitch, intensity and duration. Non-stress-accent languages, on the other hand, use only pitch as a correlate of accent. Tokyo Japanese is an example of the latter group.

Since in Japanese duration plays a very important role in establishing phonological contrasts (both between short and long vowels and between single and geminate consonants), a question that naturally arises is whether the phonological role of duration is responsible for the fact that this feature is not used as a correlate of accent in this language. It appears to us that the validity of Beckman's typology can be tested with a language like Northern Bizkaian (NB) Basque which shares some important features with Tokyo Japanese but which crucially lacks durational contrasts in its phonology. A first feature that NB Basque dialects have in common with Tokyo Japanese is a lexical distinction between accented and unaccented words with most words belonging to the unaccented class (Hualde 1991, 1999). In addition, in both languages lexically accented words always surface with a H*+L pitch-accent on a given syllable (in NB Basque, lexically unnaccented words do not bear any pitch-accent, unless they are in final place in the preverbal focus position, on in isolation, in which case they are also associated with a H*+L contour). A third common feature is that accentual phrases are marked out by an initial rising boundary %LH-, with the high target loosely associated with the second syllable. NB Basque, on the other hand, crucially differs from Japanese, as mentioned, in not making any phonological contrasts of length. In other words, there are no long vowels or geminate consonants. Since duration is not employed in a lexically contrastive manner, Basque allows us to test whether this feature could be used as a correlate of accent in prosodic systems of the Tokyo Japanese type. Two hypotheses are entertained:

Hypothesis A: Stress-accent and pitch-accent are fundamentally different phenomena. Pitch-accent languages employ only contrasts in pitch, regardless of

whether or not duration is used to convey phonological contrasts in the language. This is, we believe, Beckman's (1986) position.

Hypothesis B: If duration is not phonologically contrastive, languages will make use of durational differences to enhance the perception of accentual prominence, regardless of other prosodic properties.

In this paper we first establish that NB Basque has a lexical distinction between accented and unaccented words, similar to that of Japanese, as has been previously claimed (Hualde 1991, 1993, 1999, Hualde, Elordieta & Elordieta 1994, Elordieta 1997, Jun & Elordieta 1997). Second, we examine the role of duration as a correlate of accent in NB Basque. Under Hypothesis A, we would expect duration to play no role to cue accent in NB Basque, since its prosodic system agrees in fundamental respects with that of standard Japanese. Under Hypothesis B, on the other hand, we would expect to find consistent durational differences between accented and unaccented syllables in this language, since duration plays no role in establishing phonological contrasts in the language.

2. Data gathering procedure

Two female speakers in their twenties from the Northern Bizkaian area, MB and IS, were the subjects of the study. These two speakers are from different towns within this area and speak somewhat different dialects: MB is a speaker of the dialect of Bermeo and IS speaks the dialect of Markina. In spite of some differences in accentuation, the dialects of these two towns fit the characterization of the NB prosodic system which we have given above (for differences in accentual patterns between these two dialects, see Hualde 2000). As virtually all Basque speakers from this area, our subjects are bilingual in Spanish. At the time of the recording, both subjects were conducting graduate studies in the U.S.

From each of the two subjects five repetitions of 30 randomized sentences, with pauses between repetitions, were recorded and digitized directly onto a SunSparc10 station running Entropic ESPS/WAVES+. The sampling rate was 8kHz. Sentences were given to the subjects on index cards (one sentences per card) written in their respective local dialects which, as mentioned, are slightly different, and with a Spanish translation. The accuracy of the sentences was checked with the subjects before recording. One reason why the Basque sentences were accompanied by Spanish translations is that many pairs of sentences are real minimal pairs: segmentally identical but accentually different. The total number of recorded sentences was 300 (30 sentences x 5 repetitions x 2 speakers). The five repetitions of the last two sentences were discarded for speaker IS because of confusion in some repetitions, yielding 140 utterances measured for speaker IS (Markina) and 150 for speaker MB (Bermeo).

Segmentation of the target syllables for durational purposes was done manually using ESPS/Waves+, based on waveform, spectrogram, and listening. F0 measurements were taken from the pitch contour at the mid point of the initial

syllable and at all local F0 maxima in the pre-verbal phrase. The total duration of certain syllables, as explained in section 4, was also measured.

3. Test for establishing the accented/unaccented distinction:

In order to establish the validity of the accented/unaccented distinction we look at the value of pitch-accentual peaks after both lexically accented and lexically unaccented words in otherwise identical contexts. In Japanese an accented word that follows another accented word will be downstepped i.e. it will have a lower F0 value than if it followed an unaccented word (Poser 1984, Beckman & Pierrehumbert 1986). Jun & Elordieta (1977) suggest that in Basque as well a lexically accented word triggers downstep of a following accent, but a lexically unaccented word does not. The prediction is then that accentual peaks will be downstepped after another H*+L accent and, therefore, will show lower values than in a context where no other pitch-accent precedes. We look at downstep effects both within constituents and across syntactic constituents.

3.1. Downstep of lexical accents within syntactic constituents

We constructed pairs of minimally different sentences where a given accented word was preceded by either an accented or an unaccented word with the same or nearly the same segmental make-up, with both words in the same constituent and in preverbal position:

(1) Conditions:	[Word1	Word2]	(V + AUX)
A.	Unaccented	Accented	
B.	Accented	Accented	

In order to establish the existence of the downstepping effect, we measured the value of the accentual peak in Word 2 under both conditions. Examples of two sentences forming a contrasting pair are given below (see the appendix for the complete list of recorded sentences for one of the two dialects). Target syllables are underlined. The spectrograms and pitch tracks for one repetition of these two sentences by subject IS are also provided in Figure 1.

(2) Example of contrasting pair (Markina)
a. [lagunan <u>á</u>muma] ikusi dot.'I saw [the friend's (sg) grandmother].'
b. [lagúnen <u>á</u>muma] ikusi dot.'I saw [the friends' (pl) grandmother].'

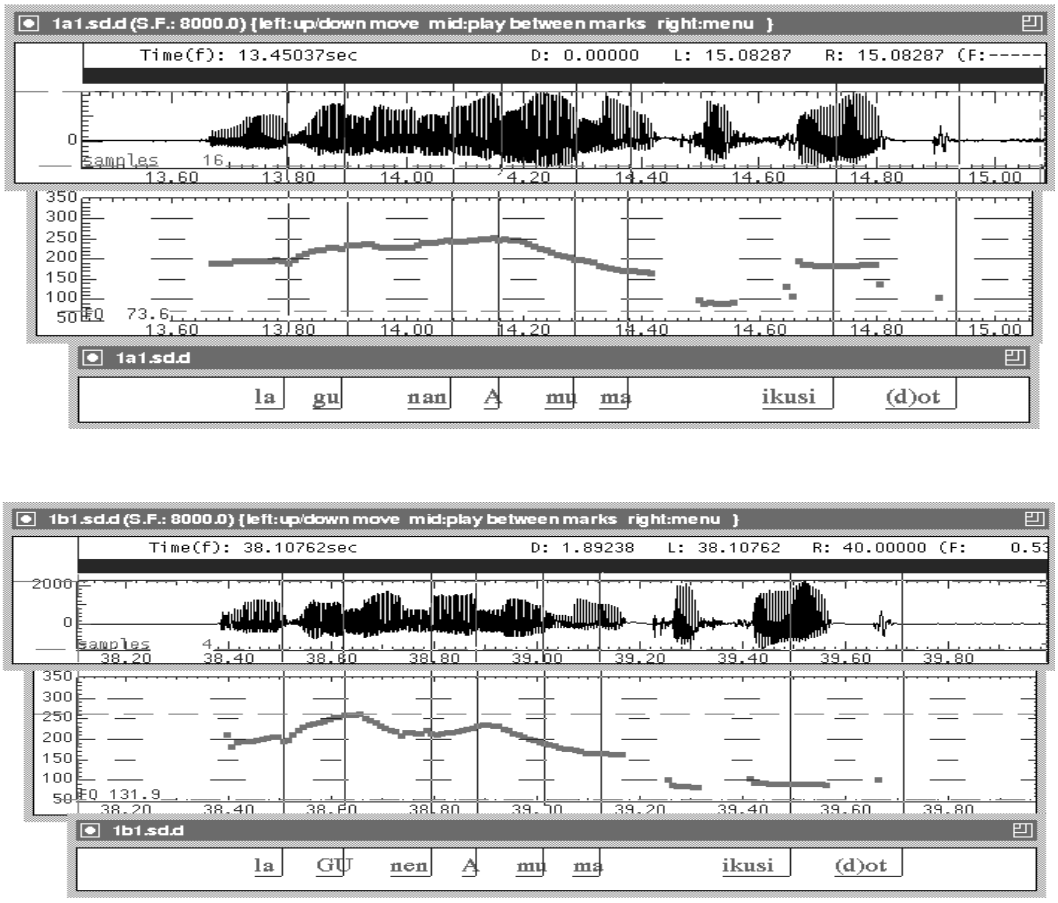


Figure 1. Sound wave, pitch track and label for a contrasting pair of sentences under conditions A and B.

In agreement with the analysis in Jun & Elordieta (1997) (cf. also Elordieta et al. 1999), the two pitch contours shown in Figure 1 can be characterized by the following tonal specifications in the model proposed in Pierrehumbert (1980), Pierrehumbert & Beckman (1988) and other work:

(3) Phonological analysis of tonal contours

a.	[la gu nan á mu ma]	b. [la gú nen á mu ma]
	%L H- H*L	%L H*L H*L

From the obtained pitch contours, we observe two things:
1) the F0 peak of the first accent in the (b) sentences, which is the first word in the phrase, has very similar values to the peak of the only accent in the (a) sentences, which is in the second word. That is, the value of the first accentual peak appears

to be relatively constant regardless of its distance from the beginning of the utterance under normal, broad-focus, conditions (the average values for the first accentual peak over 5 tokens of the sentences in (2b) is 267Hz and, for the accentual peak in the five repetitions of (2a) by this speaker, 265Hz).

2) The F0 peak on the target word (e.g. *ámuma*) is much lower when it follows another accented word in the sentence than when it follows an unaccented word (for (2b) the average value is 221Hz vs. 267Hz in (2a)).

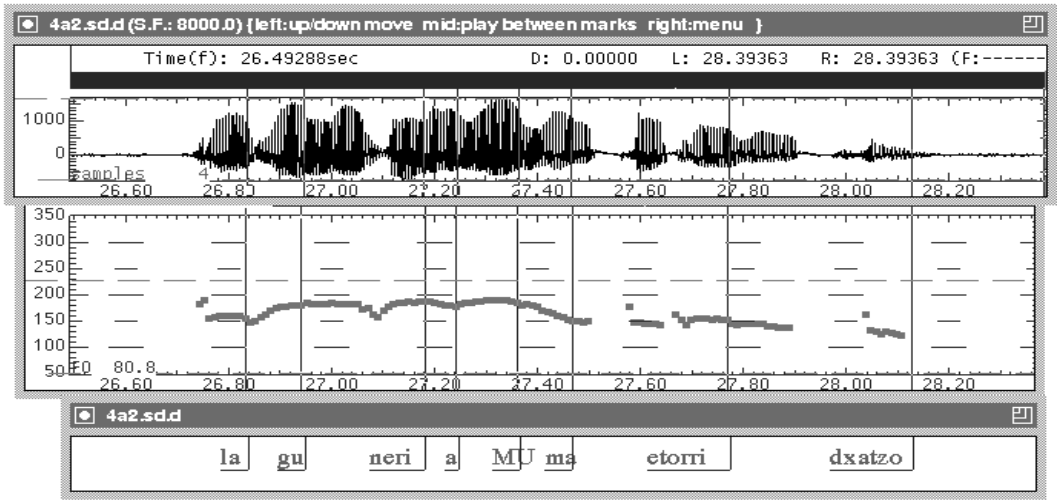
3.2. Downstep across syntactic constituents

In order to test whether syntactic boundaries block downstep, we constructed pairs of minimally different sentences in which target words appear in different syntactic constituents. Example sentences from the Bermeo dialect are given below. The pitch tracks for one of the repetitions of these two sentences by MB are provided in Figure 2 (Notice, incidentally, that the word for grandmother has a lexical accent on the first syllable for IS but on the second syllable for MB):

(4) Downstep across syntactic boundaries (Bermeo version)

a. [laguneri] [amúma] etorri dxatzo. '[to the friend] [grandmother] arrived.'

b. [lagúneri] [amúma] etorri dxatzoye. '[to the friends] [grandmother] arrived.'



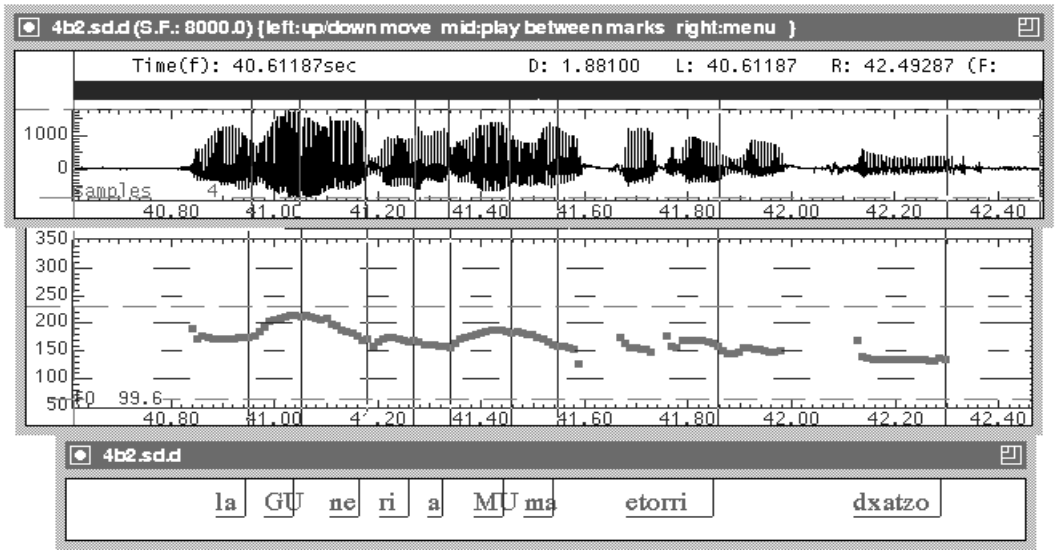


Figure 2. Sound wave, pitch track and label for two sentences in which target words are in separate syntactic constituents for conditions A and B (speaker MB, Bermeo).

As can be observed from the pitch contours in fig. 2, the same downstepping effects are found across syntactic constituents as within constituents. In these specific examples, the peak value for the target word when it follows an unaccented word is 260Hz. After another accented word it is 228Hz (these are average values over 5 tokens of (4a) and (4b) for speaker MB).

3.3. Downstep of 'derived' accents

In Basque, lexically unaccented words do not bear any pitch-accent unless they are in phrase-final preverbal position (which is the focus position), in which case they are also associated with a H*+L contour. This accent falls on the final syllable of the word in Bermeo and on the penultimate in Markina (see Hualde 2000). Following Jun & Elordieta (1997), we will refer to the accent carried by a lexically unaccented word in the focus position as 'derived accent' (indicated here with a grave accent mark). In order to test whether this 'derived accent' is affected by a preceding accent or not, we constructed pairs of minimally different sentences where a derived accent is preceded by either an accented or an unaccented word, as the following example illustrates:

(5) Downstepping of derived accents (Bermeo examples)

a. [lagunen amarì] gertatu dxatzo. 'it happened [to the friend's (sg) mother]'

b. [lagúnen amarì] gertatu dxatzo. 'it happened [to the friends'(pl) mother]'

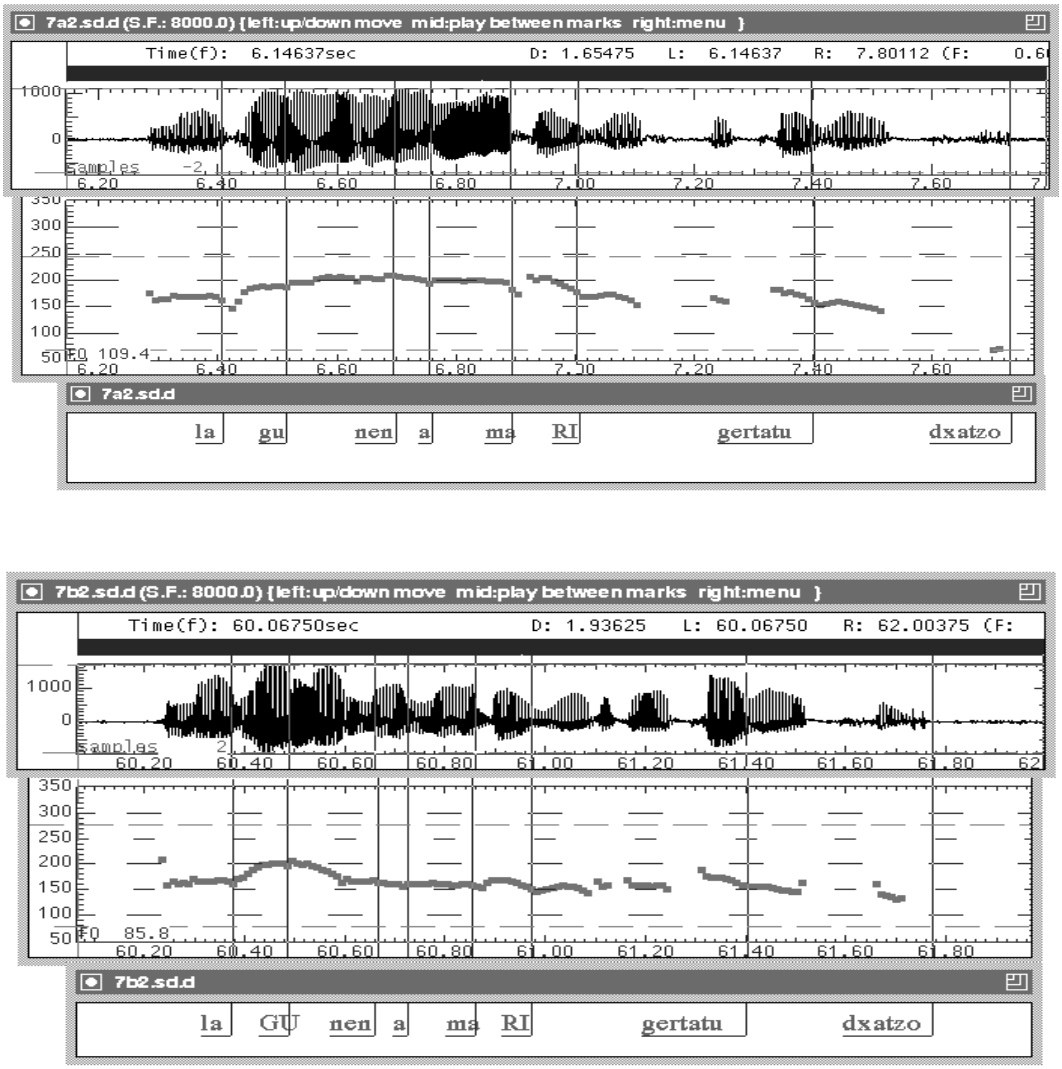


Figure 3. Sound wave, pitch track and label for the words with 'derived' accents in conditions A and B (subject MB, Bermeo).

As we may observe in the pitch contours in fig. 3, 'derived accents' are also downstepped by preceding lexical accents (263Hz vs. 201Hz in these examples, averaging over 5 repetitions). In fact in these examples the peak value for the 'derived accent' when preceded by an unaccented word, sentence (5b), is close in height to the peak value of the first accent in (5b).

3.4. Downstep results

In all three contexts tested, accents in condition B are lower than in condition A. This is true for every contrasting pair and for both subjects. Pooling all the data from these three contexts together we obtain the following results:

(6) Downstep: Mean values and standard deviations

Subject 1: IS, Markina		MEAN	STDEV	N0.
Condition A (Unac–Acc)	Accent Peak	262 Hz	13.06 Hz	64
Condition B (Acc–Acc)	1st Accent Peak	268.83 Hz	12.49 Hz	65
	2nd Accent Peak	213.92 Hz	11.54 Hz	65
Subject 2: MB, Bermeo				
Condition A (Unacc–Acc)	Accent Peak	197.83 Hz	7.28 Hz	65
Condition B (Acc–Acc)	1st Accent Peak	204.85 Hz	7.34 Hz	65
	2nd Accent Peak	172.08	9.55 Hz	65

Two-factor repeated measures analyses of variance were performed on the peak height realizations of the target word with the context (A and B) and word as fixed factors and repetition as a random factor. The results for both speakers are given in Table 1. Significant results are marked by an asterisk.

FACTORS	df	F	Sig. (alpha=.05)
Context A vs. context B	1, 103	582.749	.000*
Word	12, 1248	2.579	.005*
Context * Word	12, 1248	1.487	.141

FACTORS	df	F	Sig. (alpha=.05)
Context A vs. context B	1, 104	612.930	.000*
Word	12, 1248	6.495	.000*
Context * Word	12, 1248	6.730	.000*

Table 1. ANOVA tests for pitch peak for Subject 1 (upper panel) and Subject 2 (bottom panel).

As seen in Table 1, the test results for both subjects show a significant difference between pitch peak height on the target word depending on whether it follows an accented word or an unaccented word. (There is also a significant effect of the word on pitch. In addition, for subject 2 only, the interaction between the two factors is significant.)

For both speakers, then, the target syllable has a significantly higher F0 in context B than in context A. This is explained under the hypothesis that in context B the target word is preceded by an accented word which triggers downstep of a following accent, whereas in context A the preceding context does not include any pitch-accents and hence there is no environment for the downstep effect. This proves the existence of a distinction between lexically accented and unaccented words.

4. Duration

We compared the duration of the syllable bearing the first accent in context B, with the duration of the segmentally identical unaccented syllable in exactly the same position in context A, as illustrated in the examples in (7), where the measured syllables are bolded:

(7) Duration (Markina examples)
1a. [la**gu**nan ámuma] ikusi dot. 'I saw [the friend's (sg) grandmother].'
1b. [la**gú**nen ámuma] ikusi dot. 'I saw [the friends' (pl) grandmother].'

Measurement of the duration of the target syllables shows small and inconsistent differences between accented and unaccented syllables. Both subjects have tokens within minimal pairs that were longer under accent in some productions but shorter in others. The averaged durational values show that subject IS tended to produce slightly longer syllables in accented words while subject MB tended to do the opposite (some tokens had to be discarded because it was impossible to segment the target syllable precisely):

(8) Duration: Mean values and standard deviations

Subject 1: IS, Markina			*Subject 2: MB, Bermeo*	
	unaccented	accented	unaccented	accented
Mean	79.19 ms.	84.78 ms.	87.95 ms.	85.39 ms
St. dev.	16.47 ms.	15.81 ms.	22.03 ms.	20.95 ms.
Number	69	69	71	75

Analyses of variance were performed on the syllable duration realizations of the target words with the presence/absence of pitch accent on the word and word as fixed factors and repetition as a random factor. The results for both speakers are given in Table 2. Significant results are marked by an asterisk.

FACTORS	df	F	Sig. (alpha=.05)
Absence or presence of PA	1, 110	17.014	.000*
Word	13, 1430	32.291	.000*
Context * Word	13, 1430	.880	.576

FACTORS	df	F	Sig. (alpha=.05)
Absence or presence of PA	1, 116	.037	.848
Word	14, 1624	34.543	.000*
Context * Word	14, 1624	1.705	.064

Table 2. ANOVA tests for duration for Subject 1 (upper panel) and Subject 2 (bottom panel).

For Subject 1 (who has slightly longer accented syllables), the presence or absence of pitch accent on the target word significantly affects the duration of the syllable. No such effect is observed for Subject 2 (who produced on average longer unaccented than accented syllables). There is also a significant effect of word on the duration for both speakers. The interaction of the two factors is not significant for either subject.

In spite of the fact that the statistical analysis employed indicates that accent affects syllable duration for one of the two subjects, IS, the durational differences found are so small that we believe they could not be perceptually detectable. In addition, subject MB shows a very small non-significant difference (about 2.5 ms. in mean values) in the *opposite* direction. On the basis of these data, we conclude that duration does not appear to play a role to convey accentedness in the Northern Bizkaian Basque prosodic system. Hypothesis A is thus preliminarily supported.

5. Discussion

The results from this paper support the view that there is a fundamental distinction between stress-accent and non-stress-accent (pitch-accent) languages. In stress-accent languages accentual prominence is signaled by a combination of phonetic cues, including pitch-excursions and duration. In pitch-accent languages, pitch is the only correlate of accentual prominence. Duration is not employed for this purpose even if, as it is the case in Northern Bizkaian Basque, it is not used contrastively in the phonology and could potentially be recruited as an accentual cue without jeopardizing segmental distinctions. We believe that our results offer strong support for Beckman's (1986) typology.

Appendix

Test sentences:

Syllables that were measured for duration are in bold. Syllables that were measured for F0 peak are underlined. In syllables that are both bolded and underlined, both measurements were taken. Lexically accented syllables carry an acute accent mark and a grave accent is used in words with 'derived' accent. Brackets around constituents are used in examples and translations for ease of identification. Also for the reader's convenience the English translations follow the Basque word order as closely as possible. Sentences from only one dialect are

provided for the sake of space (There are only slight differences between the dialects. In particular, Markina Basque makes a distinction between sg /a/ and pl /e/ in some case endings that is not made in Bermeo, where all sg/pl pairs in the examples are segmentally identical).

Markina

1a. [la**gu**nan ámuma] ikusi (d)ot 'I saw [the friend's (sg) grandmother]'
1b. [la**gú**nen ámuma] ikusi (d)ot 'I saw [the friends' (pl) grandmother]'
2a. [Fi**de**len amatàla] ekarri dau 's/he brought [Fidel's apron]'
2b. [Fi**dé**lan amatàla] ekarri dau 's/he brought [Fidela's apron]'
3a. [**o**nen gisonan eríñotza] gustéte(n) jate 'I like [this man's bay leaf]'
3b. [**ó**nen gisónen eríñotza] gustéte(n) jate 'I like [these men's bay leaf]'
4a. [la**gu**nai] [ámuma] etorri (j)ako '[to the friend] [grandmother] arrived'
4b. [la**gú**nei] [ámuma] etorri (j)akue '[to the friends] [grandmother] arrived'
5a. [**o**ni mutillai] [ámu] galdu (j)ako '[to this boy] [the fishing-hook] got lost'
5b. [**ó**nei mutíllei] [ámu] galdu (j)ako '[to these boys] [the fishing-hook] got lost'
6a. [**a**ri gisonai] [mállu] jausi (j)ako '[to that man] [the hammer] fell'
6b. [**á**rei gisónei] [mállu] jausi (j)ako '[to those men] [the hammer] fell'
7a. [la**gu**nan amài] pasau (j)ako 'it happened [to the friend's (sg) mother'
7b. [la**gú**nen amài] pasau (j)ako 'it happened [to the friends' (pl) mother'
8a. [Fi**de**len àma] loditxu da '[Fidel's mother] got fat'
8b. [Fi**dé**lan àma] loditxu da '[Fidela's mother] got fat'
9a. [onen gisonan bièrra] gustéte(n) (j)ate 'I like [this man's work]'
9b. [**ó**nen gisónen bièrra] gustéte(n) (j)ate 'I like [these men's work]'
10a. [gure la**gú**nen ámuma] etorri da '[our friends' (pl) grandmother] has arrived'
10b. [súen la**gú**nen ámuma etorri da '[your (pl) friend's (pl) grandmother] has arrived'
10c. [gure la**gu**nan ámuma] etorri da '[our friend's (sg) grandmother] has arrived'
10d. [súen la**gu**nan ámuma] etorri da '[your (pl) friend's (sg) grandmother] has arrived'
11a. [**o**nen amúman amatàla] galdu da '[this grandmother's apron] got lost '
11b. [**ó**nen amúmen amatàla] galdu dau ' [these grandmothers' apron] got lost'
11c. [**o**nen lagunan amatàla] galdu du 'we lost [this friend's apron]'
11d. [**ó**nen lagúnen amatàla] galdu du 'we lost [these friends' apron]'
12a. [éuren la**gu**nan ámuma] etorri da '[their friend's (sg) grandmother] arrived'
12b. [éuren la**gú**nen amúma] etorri da '[their friends'(pl) grandmother] arrived'

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