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Prosody and Language Contact: An Experimental Investigation of Interrogative Strategies in Navarro-Labourdin Basque

Maia Duguine, Aritz Irurtzun

CNRS-IKER, Château Neuf, 15 place Paul Bert. 64100, Bayonne (France).

maia.duguine@iker.cnrs.fr, aritz.irurtzun@iker.cnrs.fr

Abstract

We report the outcome of a production experiment addressing the intonation of different interrogative strategies in Navarro-Labourdin Basque (a variety spoken in France that has received no attention in the intonational literature do far). We study *wh*-movement, *wh-in-situ* and polar questions and show that the final raise associated to *wh-in-situ* and polar questions is very similar, which gives support to the hypothesis that in certain languages a single intonational Q-morpheme may underlie both types of constructions ([2]). Following [1] we suggest that this property of Navarro-Labourdin Basque may derive from its close contact with French, a language with similar interrogative properties.

Index Terms: interrogatives, intonation, syntax-prosody interface, Basque, language contact

1. Introduction

In this paper, we consider the proposal in [2] that *wh-in-situ* strategies can be licensed by an intonational morpheme. We explore the validity of this analysis with an intonational production experiment in Navarro-Labourdin Basque (a variety that has received no attention in the intonational literature so far).

1.1. Cheng and Rooryck (2000) on French *wh-in-situ*

[2] explore *wh-in-situ* constructions in French, illustrated in (1). They observe that they share some properties with polarity (*yes/no*) questions such as (1), which are marked only by intonation. In particular, both are realized with a rising intonation, unlike regular *wh*-questions.

(1) a. *Jean a acheté quoi?*
Jean has bought what

What did Jean buy?

b. *Jean a acheté un livre?*
Jean has bought a book

Did Jean buy a book?

Cheng and Rooryck take these similarities to indicate that the two constructions are based on the same licensing mechanism. They propose that French has a Q-morpheme which is underspecified as to whether it has a [wh] or a [yes/no] feature and which is thus compatible both with *wh-* and polarity constructions. At PF this morpheme is realized with a rising contour (see also [3, 4, 5]).

1.2. Basque: A new *in situ* strategy in an obligatory *wh*-movement language

Basque is an SOV language usually characterized as a language with *obligatory wh-movement*, which results in strict adjacency between the *wh*-phrase and the verb.

Now, [1] uncovered a new interrogative strategy used by young speakers of the Navarro-Labourdin variety of Basque, which is unavailable to older speakers of this dialect, or in other Basque dialects. It produces constructions in which the *wh*-phrase and the verb are not necessarily adjacent to each other. For instance, the example in (2), where an element intervenes between the *wh*-word and the verb, is grammatical for the speakers using this strategy, but not for other speakers:

(2) *Nork ura edan du?*
who water drink AUX

Who drank water?

[1] argue that underlying these cases is an *in situ* interrogative strategy. They show that no interrogative displacement takes place in these constructions, which share a range of syntactic and semantic properties with French *wh-in-situ*. These syntactic and semantic similarities lead [1] to postulate that a catalyst for the emergence of *wh-in-situ* in Navarro-Labourdin Basque is a transfer from French, made possible by other 3rd factor effects like an innate bias for movementless operations, in a situation of language contact.

1.3. Hypothesis

There is a number of reasons that make the analysis in [2] worth considering as an account of *wh-in-situ* in Navarro-Labourdin Basque. To begin with, it makes sense if [1] are right about *wh-in-situ* resulting from transfer from French. Furthermore, Basque *wh-in-situ* has many syntactic and semantic properties in common with French *wh-in-situ*. Finally, and more importantly, like French, Basque allows polarity interrogatives that only differ from non-interrogatives in their intonational patterns.

The emergence of the *wh-in-situ* construction in Navarro-Labourdin Basque could be interpreted as follows under the analysis in [2]. Standard Basque has a Q-morpheme which is specified with a [yes/no] feature and which gives polarity constructions their typical interrogative contour. In Navarro-Labourdin Basque this Q-morpheme becomes underspecified, and thus it is also compatible with *wh*-constructions, hence allowing *wh*-phrases to remain *in situ*. If this analysis is on the right track, we expect the *wh-in-situ* constructions to be realized with the same contour as polar questions.

2. Methods

Our experiment is the first that assesses the prosody and intonation of different types of interrogatives in Navarro-Labourdin. We designed a questionnaire mainly composed by sonorant segments and where the syllables to be compared had to be as similar as possible across items and conditions. We used the seg-

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ments /no/-/ni/ on the ergative subject or dative indirect object[1], /li/ on the direct object, and /ra/ on the lexical verb. The questionnaire included three different conditions (*wh-in-situ*, *wh*-movement and polar question constructions). Below is a sample of the test items for the three conditions:

(3) a. *Nok liliak eraman ditu? [wh-in-situ]*
who.ERG flowers take AUX

Who took the flowers?

b. *Nok eraman ditu liliak? [wh-movement]*
who.ERG take AUX flowers

Who took the flowers?

c. *Nik liliak eraman ditut? [polar Q]*
I.ERG flowers take AUX

Did I take the flowers?

6 female participants pronounce these sentences in as natural a way as possible. Each participant produced 3 renditions of each item, which amounts to a total of 162 utterances (6 speakers x 9 items x 3 renditions). We measured duration, and intensity and F0 maxima, minima and means in each of the accented syllables and F0 maxima of the last two syllables. This amounts to a total of 1404 measurements.

3. Results

Figures 1, 2 and 3 present smoothed pitch contours of time-normalized utterances for each experimental condition (n = 54).

The acoustic measurements on the accented syllables /no/, /li/ and /ra/ attest large differences in F0 across conditions, as can be seen in Tables 1, 2 and 3, respectively.

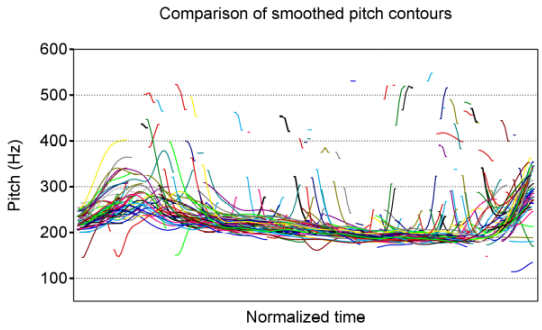

Figure 1: *Time-normalized pitch contours for wh-in-situ constructions.*

[1]On the first element we took the syllable onset and nucleus as the segment to measure. We did this in order to avoid the "noise" generated by final ergative case markers /-k/.

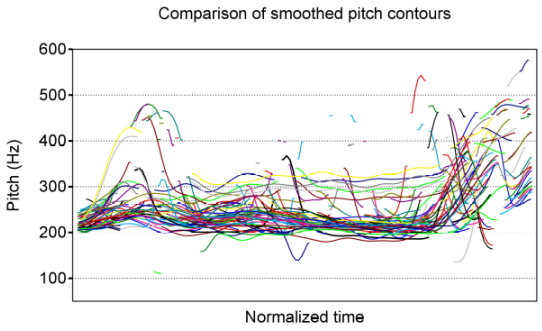

Figure 2: *Time-normalized pitch contours for polar question constructions.*

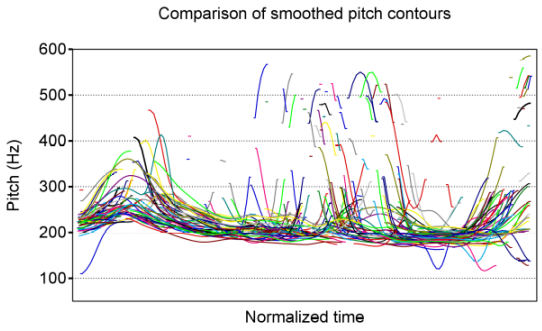

Figure 3: *Time-normalized pitch contours for wh-movement question constructions.*

Table 1: *Measurements for syllable /no/ in wh-in-situ, polar questions, and wh-movement conditions*

/no/	wh-in-situ	Polar Qs	wh-movement
Duration	0.13 (SD=0.03)	0.13 (SD=0.03)	0.11 (SD=0.03)
Max dB	81.97 (SD=5.75)	80.97 (SD=5.70)	80.75 (SD=6.19)
Min dB	70.61 (SD=7.23)	69.43 (SD=8.42)	70.75 (SD=7.17)
Mean dB	77.75 (SD=5.91)	77.33 (SD=6.72)	77.12 (SD=6.06)
Max Hz	271.89 (SD=39.54)	255.94 (SD=43.68)	256.68 (SD=36.75)
Min Hz	218.87 (SD=25.40)	213.29 (SD=10.42)	217.16 (SD=20.37)
Mean Hz	245.24 (SD=28.09)	236.33 (SD=23.03)	236.19 (SD=22.89)

Table 2: *Measurements for syllable /li/ in wh-in-situ, polar questions, and wh-movement conditions*

/li/	wh-in-situ	Polar Qs	wh-movement
Duration	0.14 (SD=0.02)	0.12 (SD=0.02)	0.15 (SD=0.02)
Max dB	79.27 (SD=6.91)	78.98 (SD=6.54)	75.58 (SD=7.11)
Min dB	71.15 (SD=7.22)	71.41 (SD=7.09)	68.22 (SD=6.55)
Mean dB	74.57 (SD=7.28)	74.52 (SD=7.17)	71.91 (SD=6.81)
Max Hz	231.56 (SD=13.90)	248.03 (SD=7.17)	201.76 (SD=16.77)
Min Hz	214.11 (SD=12.42)	224.39 (SD=24.55)	183.23 (SD=9.65)
Mean Hz	221.79 (SD=12.04)	235.27 (SD=25.85)	191.38 (SD=11.16)

The comparison of the prosody of *wh-in-situ* and polar questions shows notable differences. Even if duration and intensity values are similar for both conditions, F0 scaling values are sharply different in *wh-in-situ* and polar questions. Overall, polar questions employ a higher F0 range (coinciding with

Table 3: *Measurements for syllable /ra/ in wh-in-situ, polar questions, and wh-movement conditions*

/ra/	wh-in-situ	Polar Qs	wh-movement
Duration	0.10 (SD=0.01)	0.10 (SD=0.02)	0.10 (SD=0.02)
Max dB	78.04 (SD=6.13)	78.90 (SD=6.71)	80.59 (SD=6.53)
Min dB	68.97 (SD=5.82)	70.10 (SD=6.54)	71.27 (SD=7.45)
Mean dB	75.00 (SD=5.96)	76.03 (SD=6.49)	77.45 (SD=6.85)
Max Hz	206.70 (SD=10.35)	237.34 (SD=32.18)	248.52 (SD=22.67)
Min Hz	192.52 (SD=8.36)	220.78 (SD=35.79)	213.39 (SD=15.47)
Mean Hz	199.39 (SD=8.80)	228.21 (SD=32.25)	227.81 (SD=17.93)

the observations by [6, 7] for Northern Bizkaian Basque), and tunes are very different in both conditions. This can be clearly observed in the divergent trajectories of F0 maxima, as represented in Figure 4.[2]

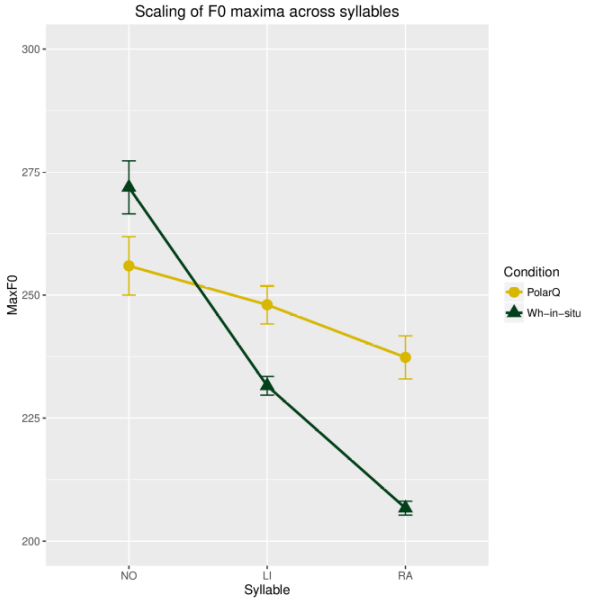

Figure 4: *Scaling of F0 maxima (in Hz) for polar questions and wh-in-situ constructions.*

A Bayesian estimation of differences between conditions using the Markov chain Monte Carlo model in [8, 9]with a default MCMC sample of 100,000 parameter values revealed the following significant differences in the prosody of *wh-in-situ* and polar questions: at syllable /no/, F0 maxima, means and minima are higher in the *wh-in-situ* condition than in the polar question condition. However, at syllable /li/ the situation reverses and F0 maxima are higher in the polar question condition than in the *wh-in-situ* condition, and F0 means and minima are lower in the *wh-in-situ* than in the polar question condition. Last, at syllable /ra/ F0 maxima, means and minima are higher in the polar question condition than in the *wh-in-situ* condition.

Comparing *wh-in-situ* and *wh*-movement constructions is more complicated, for they have different word orders. For instance, while subject *wh-in-situ* questions of sentences with transitive predicates such as (3a) have the direct object sandwiched between the interrogative subject and the verbal complex, the corresponding *wh*-movement constructions have "object-verb inversion", as in (3b).

Figures 1-3 and tables 1-3 show a number of differences between these two conditions. For instance, F0 maxima are sharply divergent, and when plotted together they display crossing paths from the first accented syllable (/no/ in both conditions) to the second one (/li/ in the in situ condition and /ra/ in the *wh*-movement condition), and again to the third one (/ra/ in the in situ condition and /li/ in the *wh*-movement condition). A Bayesian estimation of differences using the BEST model by [8, 9] and an MCMC of 100,000 possible parameters assessed the statistical differences in F0 maxima in all positions.

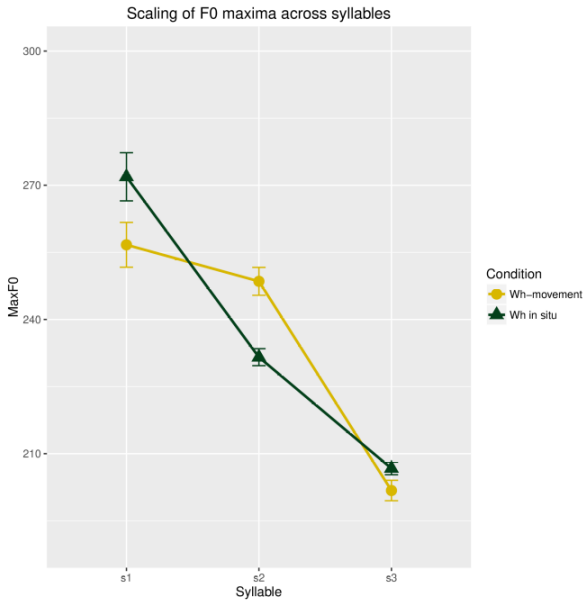

Figure 5: *Scaling of F0 maxima (in Hz) for wh-in-situ and wh-movement questions.*

Let us now focus on the sentence-final rise. We measured F0 maxima in the penultimate and final syllables and calculated the difference in Hertz and in the logarithmic scale of semitones. Table 4 gives the mean values and standard deviations for the three conditions.

Table 4: *F0 maxima rising (in semitones) from the penultimate syllable to the final syllable*

	wh-in-situ	wh-movement	Polar Qs
Hertz	111.17 (SD=55.81)	58.11 (SD=37.02)	122.45 (SD=40.27)
Semitones	7.50 (SD=3.50)	4.29 (SD=2.53)	7.32 (SD=2.06)

Figure 6 presents a violin plot displaying the density values for the scale of the final rise (in semitones) across conditions (mean values and the area corresponding to the mean +/- SD appear with a white pointrange).

A Bayesian MCMC model with 100,000 possible parameters confirmed the difference between the polar question condition and *wh*-movement condition as well as the difference between the *wh-in-situ* and the *wh*-movement condition. However, it did not reveal a statistically credible difference between the polar question condition and the *wh-in-situ* condition. As reported in Table 4, the means and standard deviations of these two conditions are very similar, but this does not mean that there

[2] In the plot in Figure 4 the first point on the X axis is labeled /no/, but it summarizes the pooled measurements of /no/ and /ni/.

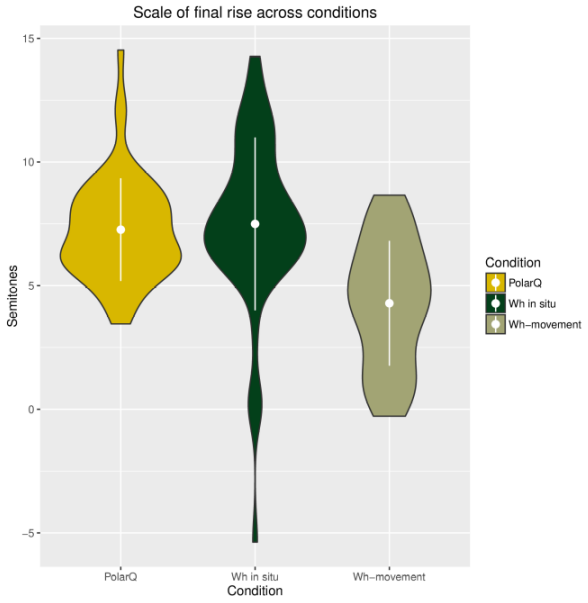

Figure 6: *Scale of the final rise (in semitones) across conditions.*

is no difference between them. In fact, the MCMC model comparison estimates a mean of 7.69 for the first group (*wh-in-situ*) and a mean of 7.1 for the second group (the polar question) with estimated standard deviations of 2.71 and 1.72 respectively; the difference between the means is 0.596, with over %88 possible mean values above zero.

Psychoacoustic studies suggest that a change in 1.5 semitones is at the very lowest bound of the human perceptibility threshold for pitch (cf. [10]). If we take a range of ± 1.5 as a conservative region of practical equivalence (the ROPE, cf. [9]), we see that a substantial part of the highest density interval (HDI) for mean values would fall inside of the ROPE, with a tiny fraction falling outside it. This trend notwithstanding, we do not have enough precision in the estimate of the differences to declare that final rises in *wh-in-situ* and polar question conditions are equal.

4. Discussion

Wh-in-situ constructions have a very marked pitch accent on the *wh*-word, followed by a sharp drop in F0, and a final rise. *Wh*-movement questions are also characterized by the major stress being on the *wh*-word, similar (albeit lower) F0 values in the following verb, and a smaller final rise. And polar questions have smaller pitch excursions throughout the sentence until a marked final rise, which is close to that of *wh-in-situ* questions.

All in all, the results of the experiment show sharp differences between *wh-in-situ* and polar questions. However, our findings converge with those found by [3] in French, in that *wh-in-situ* questions are typically accompanied by a final rise, similar to that of polarity questions. Both conditions have different tunes overall, but we must consider that other prosodic phenomena are also present in *wh-in-situ* constructions (see also [4]). Therefore, the fact that [2]'s proposal does not assume transfer of whole tunes from one construction to the other, but just the extension of use of a Q morpheme which surfaces as a final rise, give plausibility to this explanation for the Navarro-Labourdin Basque pattern.

5. Conclusion

[2] argue that *wh-in-situ* in French is licensed by prosody; the typical rising tune of an information-seeking polar question is what licenses the *wh-in-situ* strategy. We have conducted a production experiment in Navarro-Labourdin, a dialect of Basque displaying both *wh-in-situ* and *wh*-movement questions, and shown that even though the overall intonational contours of *wh-in-situ* and polar questions differ sharply, their final rises are very similar (and different from *wh*-movement questions). This gives plausibility to [2]'s analysis of the licensing of *wh-in-situ*, as well as [1]'s analysis of the emergence of *wh-in-situ* in Navarro-Labourdin as a result of contact with French.

6. Acknowledgements

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