TECHNOLOGY FOR PROSODIC VARIATION

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Abstract[1]

This contribution is included in the "Corpora of Spoken Dialects of the Basque Language-EDAK" project, which aims to create the prosodic multimedia atlas of the Basque language. It presents the first outcome taking into account data from two localities situated in the Western part of the Basque territory: Ondarroa and Larrabetzu. Although both belong to the Biscayan dialect, they have a different accentual system.

Apart from the computer tools being used in the project, this paper deals with the sociolinguistic differences that exist in both localities between two generations (adults and young people) and the geolinguistic differences between these two localities.

Key words: *prosodic variation, technology, Basque language, sociolinguistic variation, geolinguistic variation.*

1. Introduction

The research into Basque prosody has increased considerably in recent years, above all on account of different researchers like G. Elordieta, I. Gaminde and J. I. Hualde.

Even if we assume that this research constitutes great progress in the field, the fact that none of it takes the space of the Basque language as a whole into consideration, and that this work has been carried out using different methodologies has prompted the EUDIA research team to embark on the EDAK project (Corpora of Spoken Dialects of the Basque language).

This research project has two bases: to take an in-depth look at the knowledge of Basque prosodic variation, and to use methodological aspects of the AMPER[2] project.

This paper sets out to present the technology we are using and to submit the first partial analysis of our data.

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[1] This research has been funded by the Ministry of Science and Innovation of the Spanish Government (HUM2007-65094).

[2] "Atlas multimedia de l'espace romanique" (Contini 1992, Romano 2001). For bibliography about the AMPER project see M. Contini, A. Romano, L. de Castro Moutinho & E. Fernández Rei "L'avancement des recherches en géoprosodie et le projet *AMPER", EFE,* ISSN 1575-5533, XVIII, 2009, pp. 109-122.

The first part deals with the itinerary the data has undergone between the recording of them and their publication. We have paid special attention to the technology used to record, to mark and label the data, and subsequently to analyse them.

The second part presents the data in which two generations in the same locality are compared in order to show sociolinguistic variation, and data from the two localities to show geolinguistic variation.

2. The use of technology

Our research team was already familiar with the features of automated technology. So we opted for free software. Nowadays, there is more available and there are more means for accessing the new free technology; there is abundant software, which is becoming increasingly efficient and enables the proposed aims to be achieved without any reduction in quality.

We are convinced that in the near future we will have all the technologies we need free of charge, even though some are not yet available.

2.1. Data gathering

For the data gathering and sound recording we used only laptops, which were equipped with "Audacity" software[3] and USB microphones (PC Headset 960 USB).[4] Once the sound had been recorded, various copies were made in a range of mediums: CD, hard disc, etc. and they were kept on different premises.

The use of laptops allowed the sound material to be managed more effectively and more rapidly. It also facilitated the management of the technical support or means we had, so it could be used either in the data gathering or in the analysis (Aurrekoetxea, Sánchez & Odriozola 2009).

97192: Etorri da? [Has he come?]	V14
97193: Erosi du? [Has he bought it?]	V15
97194: Laguna sartu da? [Has the friend come in?]	V16
97195: Laguna, etorri da? [The friend, has he come in?]	V17
97197: Erosi du ogia? [Has he bought the bread?]	V18
97198: Zer ikusi du? [What has he seen?]	V19
97199: Non ikusi du? [Where has he seen it?]	V20
97200: Zer ikusi du alabak? [What has the daughter seen?]	V21
97201: Alabak, zer ikusi du? [The daughter, what has she seen?]	V22

Questions used to gather the data for this contribution.

2.2. Sound annotation

The annotation task was carried out using the SFSWin program.[5] Even if this tool offers the possibility of conducting automatic annotation, it was decided that it should be done manually because of the way the gathering was structured.

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[3] *http://audacity.sourceforge.net/*
[4] *www.logitech.com.*
[5] *http://www.phon.ucl.ac.uk/resource/sfs/download.htm.*

Figure 1 shows an annotated sound file: the beginning of the annotation of each question is marked by a "V" followed by a numerical code referring to the number of the question; and the end of the question is marked by the sign "/". We only annotated the "good" answer; in other words, the answer that corresponded to the question and that produced the word sequence we were seeking; we did not take into account the sound produced by the research, nor the translations, which we did not consider to be valid.

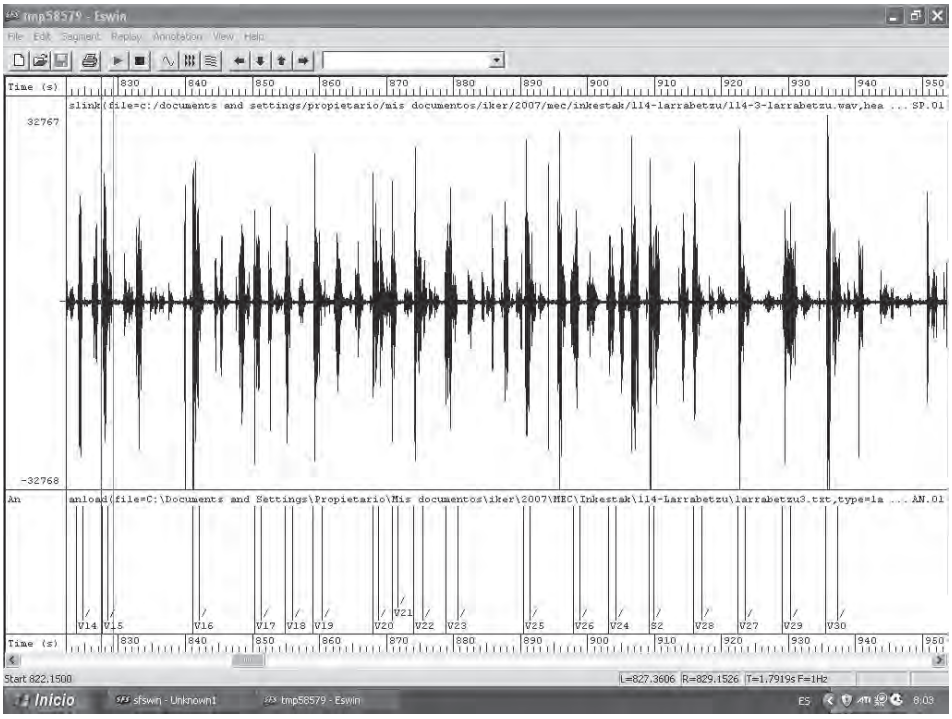


Fig. 1

Image of the annotation of EDAK data using the SFSWin program

2.3. Sound labelling

The output of the SFSWin program is a .txt file which links the annotations of each question (V14, V15…) with the sound location in the recording. Figure 2 shows the annotations of the questions analysed in this paper only.

Once the sound had been annotated, the labelling task was carried out by using the "txertatu_etiketak" Active perl script.[6] This script has been adapted by Aholab,

[6] *http://www.activestate.com/.*

823.60378	V14
824.67929	/
827.55588	V15
828.40101	/
840.99302	V16
842.06804	/
850.21459	V17
851.27490	/
854.78713	V18
855.86241	/
859.00270	V19
860.30397	/
867.96080	V20
868.69909	/
870.85901	V21
871.57844	/
874.02069	V22
875.34611	/

Fig. 2

The output of the SFSWin program

the Signal Processing laboratory *(http://aholab.ehu.es)* of the University of the Basque Country (UPV-EHU), with which we are working.

97192-114-3-1-13:43.603-13:44.679
97193-114-3-1-13:47.555-13:48.401
97194-114-3-1-14:00.993-14:02.068
97195-114-3-1-14:10.214-14:11.274
97196-114-3-1-14:14.787-14:15.862
97197-114-3-1-14:19.002-14:20.303
97198-114-3-1-14:27.960-14:28.699
97199-114-3-1-14:30.859-14:31.578
97200-114-3-1-14:34.020-14:35.346
97201-114-3-1-14:38.763-14:40.635

Fig.3

Image of the labelling of EDAK data

The fig. 3 has different columns separated by hyphens:

— the first column refers to the question
— the second to the locality
— the third to the informant
— the fourth to the answer

— the fifth to the position of the beginning of the sound of the answer obtained by the SFSWin program and measured in minutes, seconds and hundredths of a second
— the last column refers to the end of the sound of the answer

Once these tasks had been carried out, the data were ready to be used in the acoustic analysis or in the audible atlas.

2.4. Data storage

The recorded data and their transcriptions were stored in two formats: MySQL and TEI (Text Encoding Initiative).

The first one was used to enter the data into the computer system and to exploit the data geolinguistically. The second one was used to facilitate transfer to the different systems. The updating between these two systems was automated and the data were entered only once.

2.5. Acoustic analysis

The following step is the acoustic analysis of the data. The Praat program[7] was used for this task. This program is one of the most widespread free programs for acoustic analysis, in addition to the "Segment Data" Script.[8]

2.6. Graphics

For the graphics, Microsoft Office Excel was used for the purposes of this paper, but we are starting to use the OpenOffice Cal program.

3. Background of the field

As in other latitudes, prosodic variation has not been considered in Basque dialectology when comparing dialects and making dialect maps. Only a few pieces of research have studied geo-prosodic variation. It was K. Mitxelena (1972) who first distinguished different accent types and divided the geography of the Basque language into four main types, namely type I (Western and Middle part), type II (Eastern part), type III (Southern part of Navarre) and type IV (accent of Bidasoa). Txillardegi distinguished only two types: the Western accent and the Eastern accent. Subsequently, J. I. Hualde (1990), I. Gaminde (1995) and others have studied different kinds of accents. In all of them, however, the basic materials used for distinguishing the different kinds of accents were not gathered by means of the same methodology and an identical questionnaire.

The studies of intonation are more recent in the Basque language. There are very few people who have studied the features of intonation in Basque. The most impor-

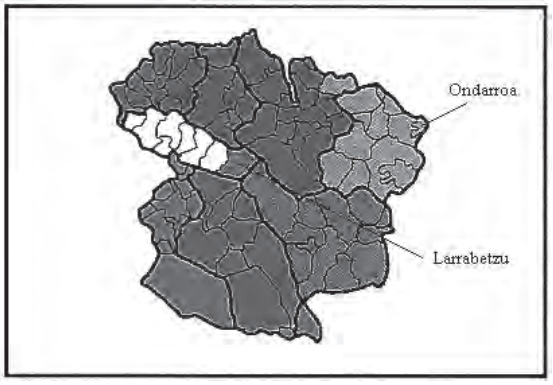
[7] *http://www.fon.hum.uva.nl/praat/.*
[8] *http://www.helsinki.fi/~lennes/praat-scripts/.*

tant researchers in this field are I. Gaminde (1995, 2002, 2004, 2006, etc.), G. Elordieta (1997, 2000, 2007, etc.) and J. I. Hualde (1997, 2002, 2003a, 2003b, etc.).

The EDAK corpus provides us with an opportunity to compare, for the first time, prosodic variation in Basque by using the same questionnaire and gathering information by means of an identical methodology, and not only geo-prosodic variation, but also socio-prosodic variation.

If we compare the utterances of adults with those of young people from the two localities, we can obtain two figures for the differences between the two localities, differences between adults and differences between young people.

The utterances we have selected are questions. We have chosen two kinds of questions: five Yes/No questions and four Wh- questions.



Map 1

Location of Ondarroa and Larrabetzu in the Biscayan accent distribution (Gaminde 2007: 66)

4. The data

For this paper, we have selected data from two localities: Larrabetzu and Ondarroa, each of which is located in a different accent area (as we can see in Map 1). They allow us to research two types of variation: geolinguistic (comparing data from two generations in the same locality) and sociolinguistic (comparing data from the two localities).

We wanted to select two localities with different accent systems in order to analyse the role played by the accent in the intonation system.

The EDAK project questionnaire has 22 items for analysing intonation: 12 are affirmative sentences and 10 are interrogative sentences. We have selected 9 interrogative sentences. All of them have a question structure, although the first five are yes/no questions and the last four are Wh-questions.

These interrogative sentences were asked three times: at the beginning of the data gathering, halfway through it, and at the end. Some of the answers have been

excluded for different reasons; in these cases there will be two, instead of three (see Fig. 5, for example).

5. Intonation patterns in Larrabetzu and Ondarroa

The data gathered enables us to study socio-prosodic and geo-prosodic variation. First of all, data taken from two generations in both localities is compared. By comparing these data it is possible to confirm whether there is socio-prosodic variation or not in both localities.

After that, data from the two localities is compared, but data gathered from the two generations is analysed separately. Furthermore, we will be showing whether the geo-prosodic variation between the two localities is the same in the two generations or not.

5.1. Intonation in Larrabetzu

First of all, the intonation pattern in the two localities, Larrabetzu and Ondarroa, is analysed. This task is carried out separately: firstly, the intonation pattern of adults and secondly, the pattern of young people.

5.1.1. Intonation pattern of adults

We have analysed two kinds of patterns: patterns in y/n questions and patterns in wh-questions. For the first type we have 5 questions with the verb at the end and with the verb at the beginning. For the wh- ones we have 4 questions: three of them begin with a question mark and the last one has an introductory noun.

Y/N questions

Each question is analysed separately because they have a different number of syllables and different patterns.

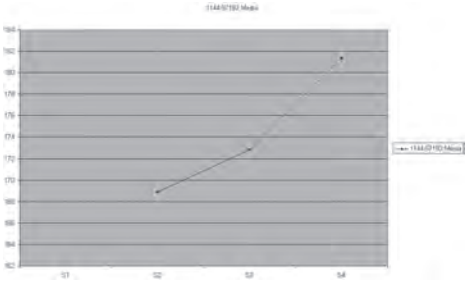


Fig. 4

Etorri da? [Has he come?]

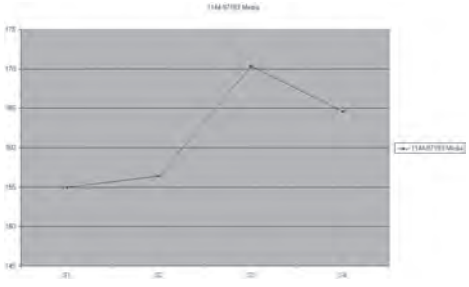


Fig. 5

Erosi du? [Has he bought it?]

The intonation of y/n questions among adults in Larrabetzu has more than one pattern:

— First pattern: the intonation curve is upward as far as the last accentuated syllable and downward on the last syllable (Figs. 5 and 6).
— Second pattern: the intonation curve is only upward (Fig. 4).
— Third pattern: the curve is upward from the beginning as far as the last accentuated syllable; then, there is a downward syllable and on the last syllable there is an upward curve (Fig. 7).

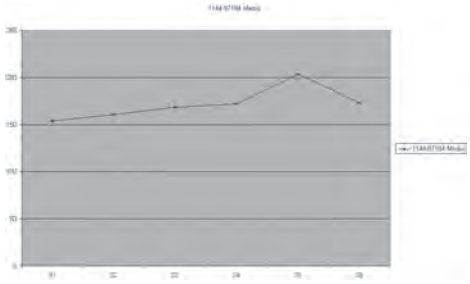


Fig. 6

Laguna sartu da?
[Has the friend come in?]

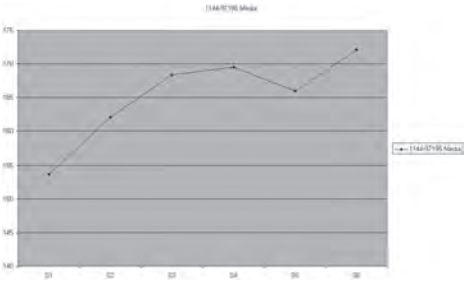


Fig. 7

Laguna, etorri da?
[The friend, has he come in?]

Different patterns emerge in the three sentences used to show the intonation of Wh-questions:

— First pattern: the intonation curve is falling from the first syllable as far as the last one (Figs. 8 and 10).
— Second pattern: the curve is falling as far as the last accentuated syllable and after that it is rising (Fig. 9).

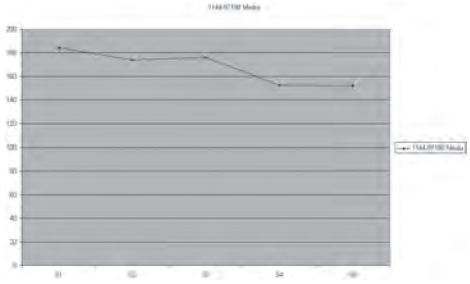


Fig. 8

Zer ikusi du? [What has he seen?]

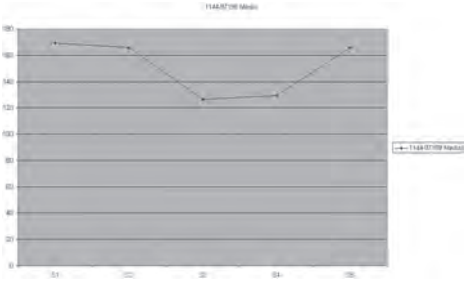


Fig. 9

Non ikusi du? [Where has he seen it?]

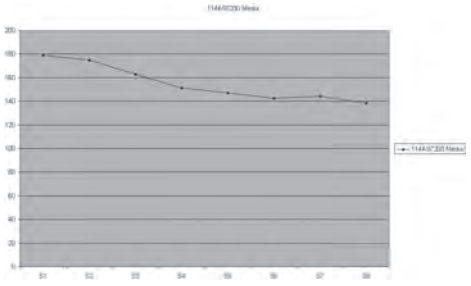


Fig. 10

Zer ikusi du alabak? [What has the daughter seen?]

5.1.2. Intonation pattern of young people

Y/ N questions

We can say that there are two patterns:

— First pattern: the curve is upward (Figs. 11 and 12).

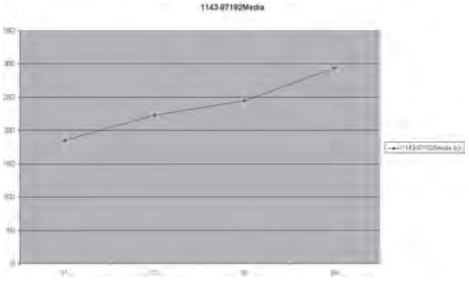


Fig. 11

Etorri da? [Has he come?]

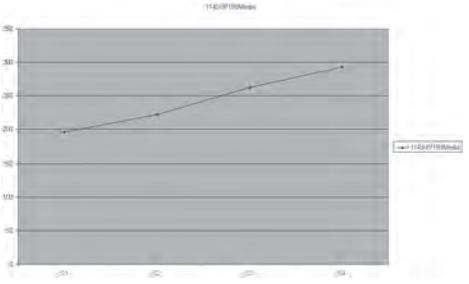


Fig. 12

Erosi du? [Has he bought it?]

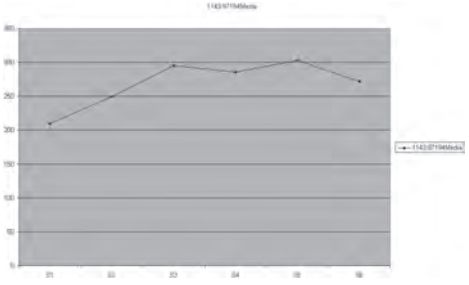


Fig. 13

Laguna sartu da?
[Has the friend come in?]

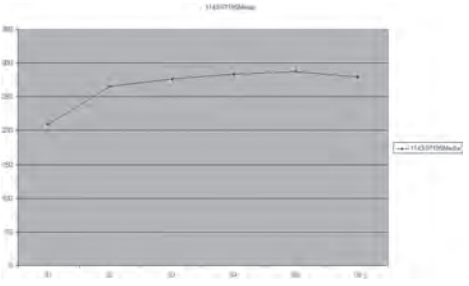


Fig. 14

Laguna, etorri da?
[The friend, has he come in?]

— Second pattern: the curve is upward, but downward on the last syllable (Figs. 13 and 14).

Wh-questions

We have the same pattern in the three utterances: the utterances begin with %H mark, falls as far as the accentuated syllable and rises on the last syllable (Figs. 15 and 16). Fig. 17 shows a similar pattern with little difference, owing to the fact that it ends on a noun after the verb.

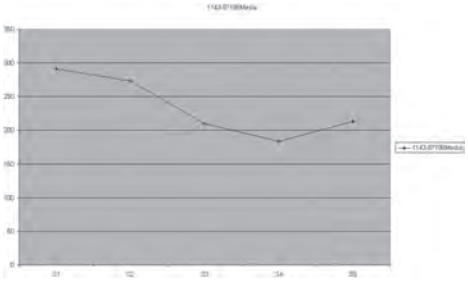


Fig. 15

Zer ikusi du? [What has he seen?]

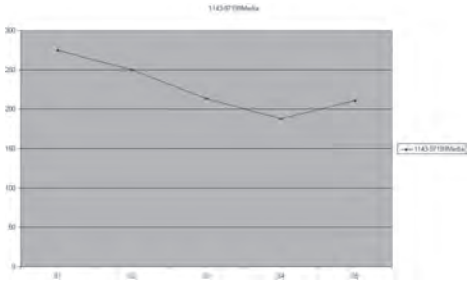


Fig. 16

Non ikusi du? [Where has he seen it?]

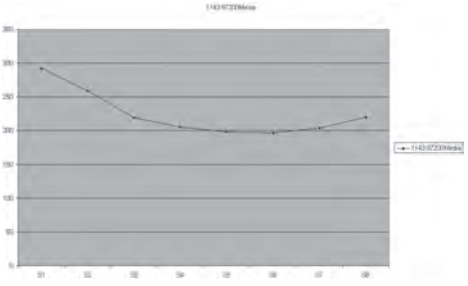


Fig. 17

Zer ikusi du alabak? [What has the daughter seen?]

5.2. Intonation in Ondarroa

5.2.1. Intonation pattern of adults

Y/ N questions

The same pattern appears in all of the utterances: the utterances begin at the lowest position and the F0 gradually increases as far as the end of the utterance (Figs. 18, 20 and 21). But Fig. 19 shows a particular pattern that displays a very marked curve in the first part corresponding to the noun.

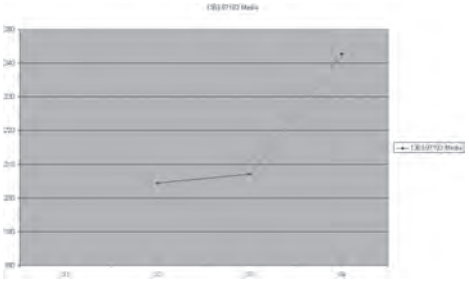


Fig. 18

Etorri da? [Has he come?]

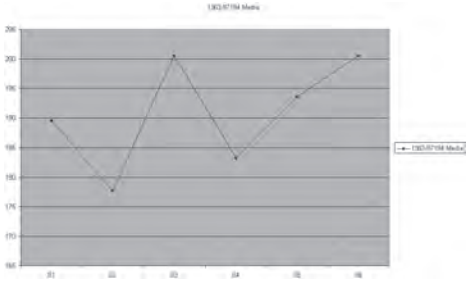


Fig. 19

Laguna sartu da? [Has the friend come in?]

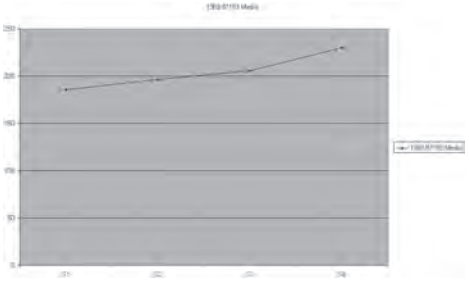


Fig. 20

Erosi du?
[Has he bought it?]

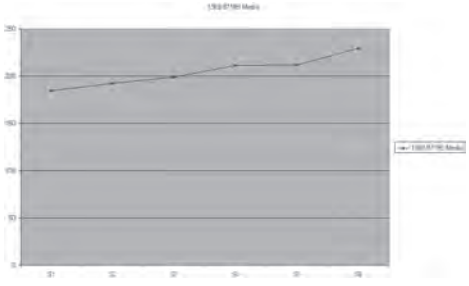


Fig. 21

Laguna, etorri da?
[The friend, has he come in?]

Wh-questions

The pattern of the three Wh-questions is similar (Figs. 22, 23 and 24). If we consider Fig. 23, it displays a slight difference compared with the others owing to the including of a noun at the end of the sentence: the pattern begins with %H and rises on the last syllable.

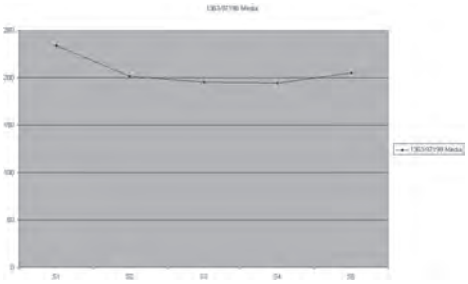


Fig. 22

Zer ikusi du?
[What has he seen?]

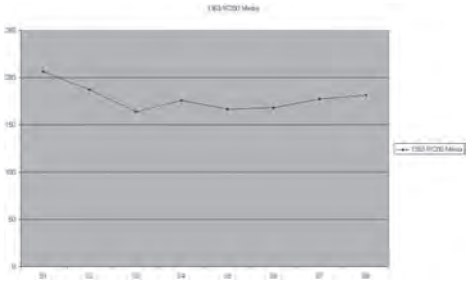


Fig. 23

Zer ikusi du alabak?
[What has the daughter seen?]

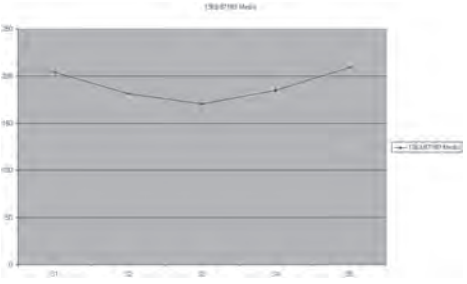


Fig. 24

Non ikusi du? [Where has he seen it?]

5.2.2. Intonation pattern of young people

Y/ N questions

The four utterances show the same intonation pattern: the sentence begins with %L mark and rises right up to the end (Figs. 25-28).

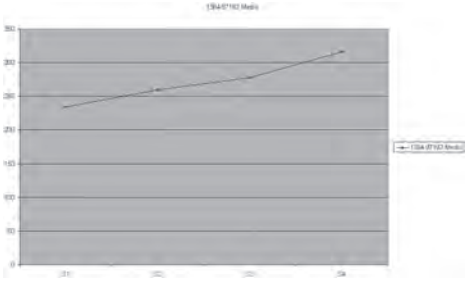


Fig. 25

Etorri da? [Has he come?]

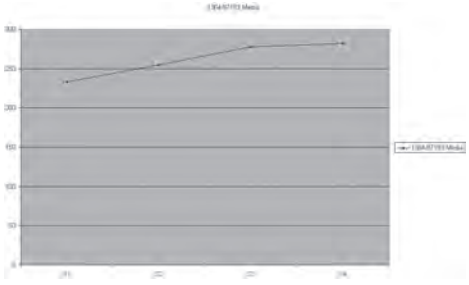


Fig. 26

Erosi du? [Has he bought it?]

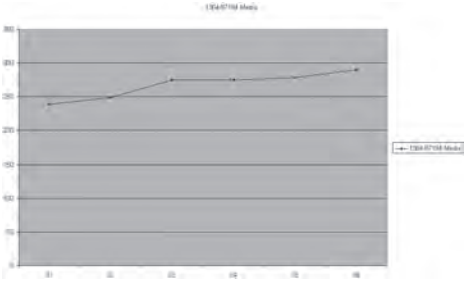


Fig. 27

Laguna sartu da??
[Has the friend come in?]

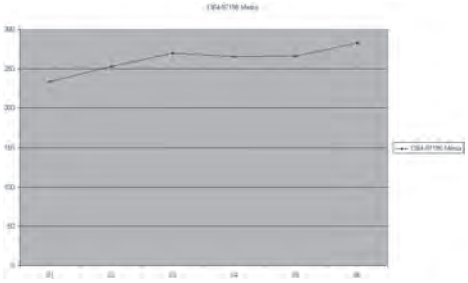


Fig. 28

Laguna, etorri da?
[The friend, has he come in?]

Wh-questions

But in Wh-questions there are two patterns:

— First pattern: the utterance is %H at the beginning and falls as far as the end (Figs. 29 and 30).

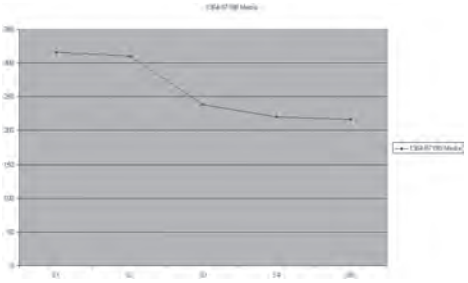


Fig. 29

Zer ikusi du? [What has he seen?]

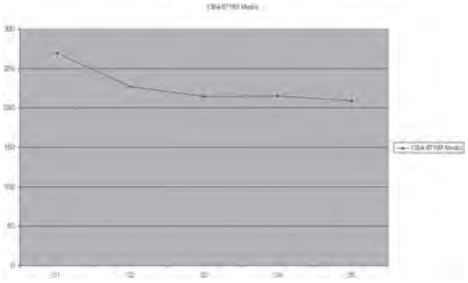


Fig. 30

Non ikusi du [Where has he seen it?]

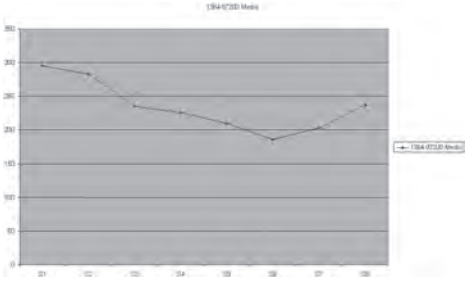


Fig. 31

Zer ikusi du alabak? [What has the daughter seen?]

— Second pattern: the inclusion of the noun after the verb changes the pattern of the intonation, which is upward from the beginning of the noun as far as the end (Fig. 31).

6. Socio-prosodic variation

6.1. Socio-prosodic variation in Larrabetzu

To measure the socio-prosodic variation, data taken from adults and young people will be compared (see Figs. 4 and 11 for the first utterance, Figs. 5 and 12 for the second ; Figs. 6 and 13 for the third ; Figs. 7 and 14 for the fourth ; Figs. 8 and 15 for the fifth ; Figs. 10 and 16 for the sixth ; Figs. 9 and 17 for the seventh).

In y/n questions there are different systems:

— The first utterance shows the same pattern (Fig. 32): the utterance begins with %L mark and rises as far as the end. Young people produce this sentence with one syllable less, because they do not pronounce the first syllable of "etorri".
— In the second utterance (Fig. 33), while the adults' curve rises as far as the end of the sentence, the young people's curve rises and falls slightly on the last syllable, thus indicating variation.

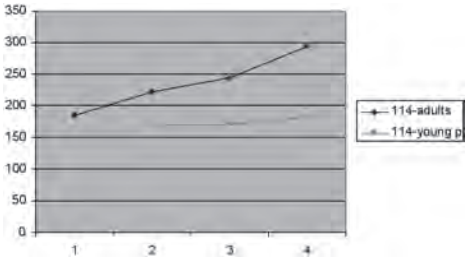


Fig. 32

Etorri da? [Has he come?]

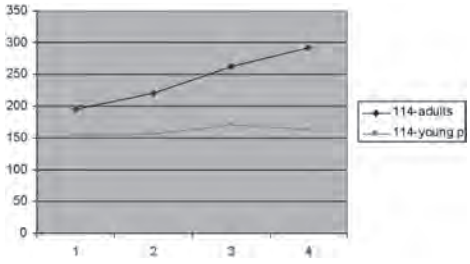


Fig. 33

Erosi du? (Has he bought it?]

— In the third utterance (Fig. 34), the adults' curve rises from the first syllable onwards and maintains its level more or less at the same height and falls on the last syllable, whereas the young people's curve rises at first, and then falls on the last syllable, indicating an absence of variation.
— In the fourth utterance (Fig. 35), there is no prosodic variation except on the last syllable.
— In the fifth utterance (Fig. 36), the adults' curve rises on the last syllable, whereas the young people's curve falls slightly, which indicates variation.
— In the sixth utterance (Fig. 37), there is no variation between the patterns produced by adults and young people.
— In the seventh utterance (Figs. 38a and 38b), the two graphics differ considerably: the pattern produced by adults rises slightly on the last syllable, but in young people the pattern shows a slight fall; thus, there is linguistic variation.

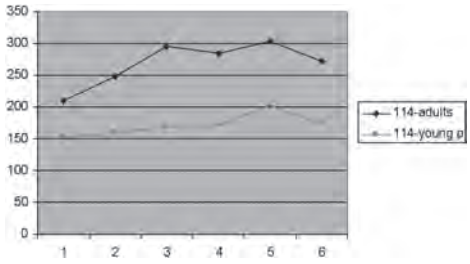


Fig. 34

Laguna sartu da
[Has the friend come in?]

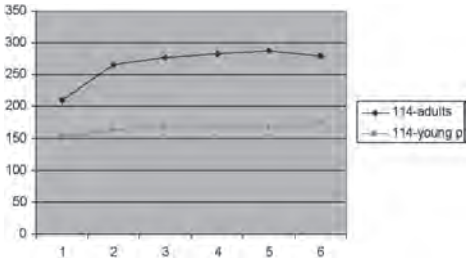


Fig. 35

Laguna, etorri da?
[The friend, has he come in?]

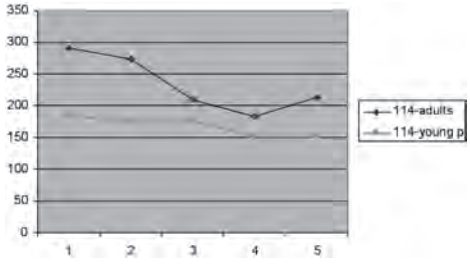


Fig. 36

Zer ikusi du? [What has he seen?]

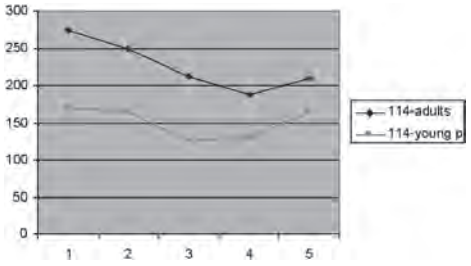


Fig. 37

Non ikusi du? [Where has he seen it?]

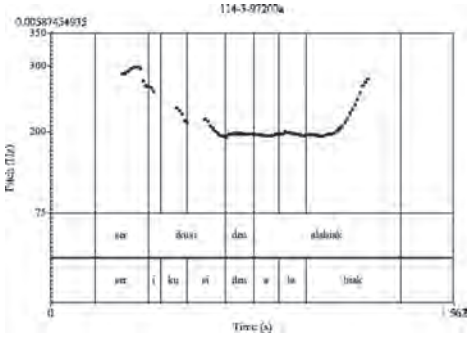


Fig. 38a

Zer ikusi du alabak?
[What has the daughter seen?]

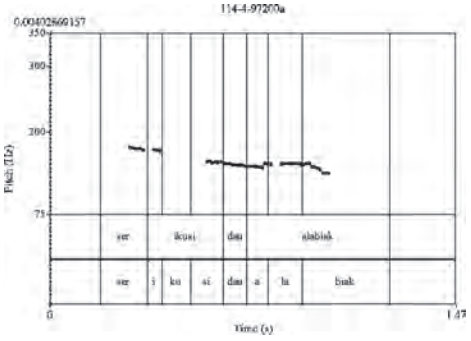


Fig. 38b

Zer ikusi du alabak?
[What has the daughter seen?]

Therefore, three out of the seven utterances display different curves indicating different prosodic structure between data collected from adults and young people (43%).

Consequently, we can affirm from these data in Larrabetzu that socio-prosodic variation between adults and young people can be found.

6.2. Socio-prosodic variation in Ondarroa

To measure the socio-prosodic variation, data taken from adults and young people are compared (see Fig. 39).

Y/N questions. The results are as follows:

— in the first utterance (Fig. 39), the intonation pattern is similar in adults and young people; so there is no variation;
— in the second utterance (Fig. 40), there is a rising curve in adults and young people; so there is no variation.

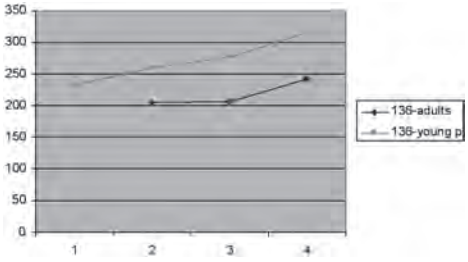


Fig. 39

Etorri da? [Has he come?]

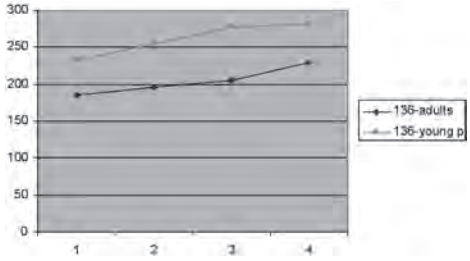


Fig. 40

Erosi du? [Has he bought it?]

— in the third utterance (Fig. 41), even if the curve is not the same in the utterances of the two generations, the main features are identical, so there is no variation.

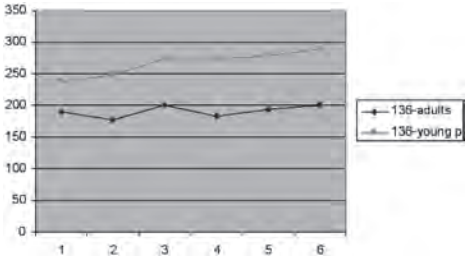


Fig. 41

Laguna sartu da?
[Has the friend come in?]

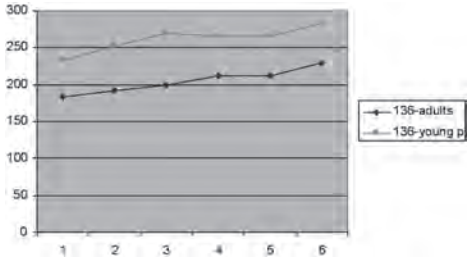


Fig. 42

Laguna, etorri da?
[The friend, has he come in?]

— in the ninth utterance (Fig. 42), the curves in the patterns produced by adults and young people are very similar; so we do not consider socio-prosodic variation.

Wh-question sentences.

— in the first utterance (Fig. 43), the patterns differ at the end of the curve: in adults it rises, whereas in young people it falls; so there is variation.

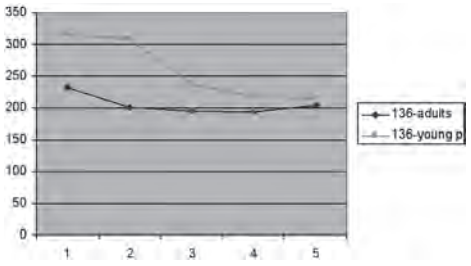


Fig. 43

Zer ikusi du? [What has he seen?]

— in the second utterance (Figs. 44a and 44b), there is socio-prosodic variation because the pattern produced by adults shows a falling curve right from the beginning of the utterance, whereas the curve of young people ends on an upward curve. So, there is variation.

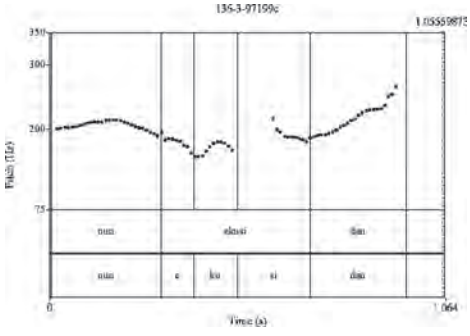


Fig. 44a

Non ikusi du? [Where has he seen it?]

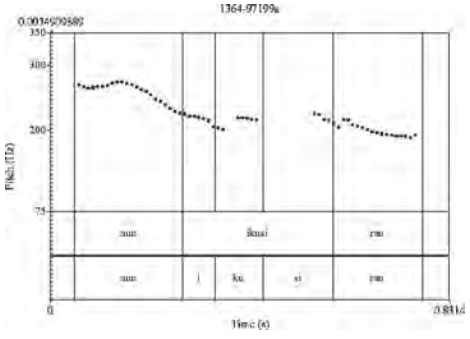


Fig. 44b

Non ikusi du? [Where has he seen it?]

— In the third utterance (Fig. 45), the main features of the intonation curves are similar, some differences notwithstanding. So there is no variation.

In five utterances in the seven cases analysed, the curve of the utterance is similar between adults and young people, while in two of them it differs. Consequently, we have to say that in Ondarroa there is evidence of incipient socio-prosodic variation (28%).

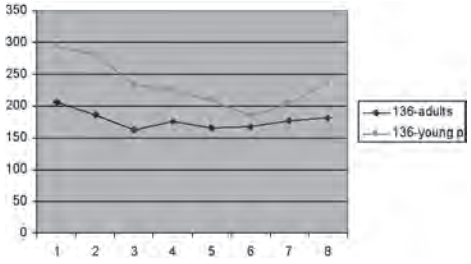


Fig. 45

Zer ikusi du alabak? [What has the daughter seen?]

7. Geo-prosodic variation

Once the phonological pattern occurring in the intonation in both localities and in both generations had been determined, it was then possible to compare the intonational patterns between them. The comparison between different patterns must be made taking into account phonological aspects alone. For that we have got the average of the data.

This kind of comparison is one of the most widespread ways of comparing two intonational patterns, as in studies related to the AMPER project (M. A. Pradilla & P. Prieto 2002; Fernández et al. 2004; Carrera et al. 2004: for Catalan: López et al. 2005; for Asturian, etc.).

As we have gathered data from two generations, we can compare these localities twice: the patterns of adults and the patterns of young people.

7.1. Geo-prosodic variation in adults

The intonation of adults from Larrabetzu and Ondarroa can now be compared. We have two groups of utterances:

a) utterances with a similar or equal intonational pattern (Fig. 4 —Larrabetzu— and Fig. 18 —Ondarroa—), and
b) utterances with a different intonational pattern: in Larrabetzu the last syllable is downward and in Ondarroa upward (Fig. 46).

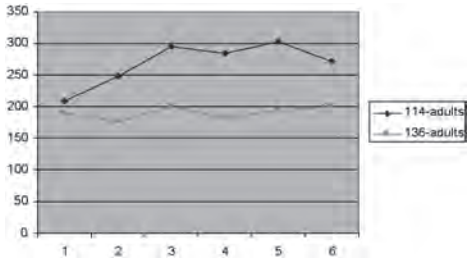


Fig. 46

Laguna sartu da? [Has the friend come in?]

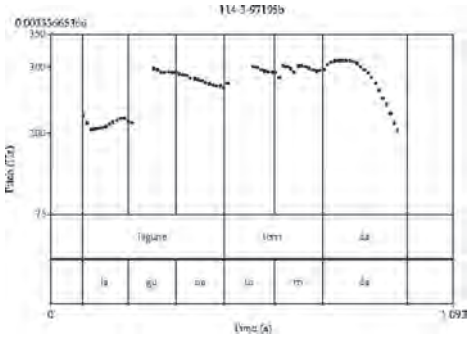


Fig. 47a

Laguna, etorri da?
[The friend, has he come?]

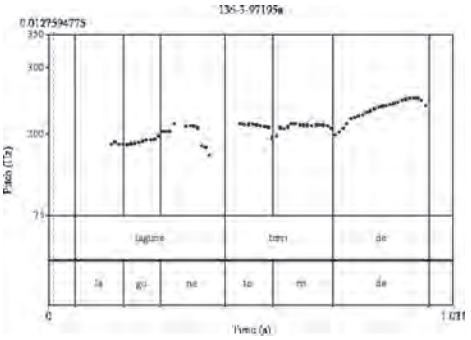


Fig. 47b

Laguna, etorri da?
[The friend, has he come?]

We have used 7 utterances: in five of them there is no geo-prosodic variation between Larrabetzu and Ondarroa, and in two of them variation was found. So, it has to be pointed out that there is 28% geo-prosodic variation between adults from Larrabetzu and Ondarroa, according to these data.

7.2. Geo-prosodic variation of young people

If we take data from young people and compare them, the following emerges:

a) In some questions there is a similar intonational pattern: utterances 97192, 97195 and 97198.

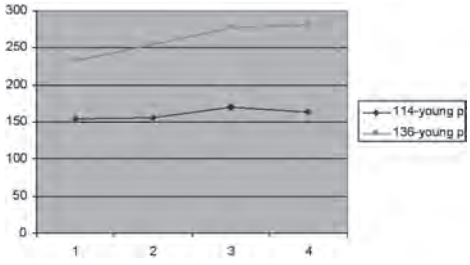


Fig. 48

Erosi du?
[Has he brought?]

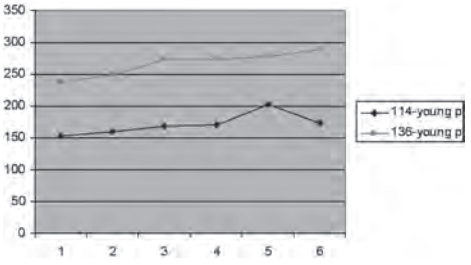


Fig. 49

Laguna sartu da? [
Has the friend come in?]

b) In others it is different: fig. 48, fig. 49, fig. 50 and fig. 51.

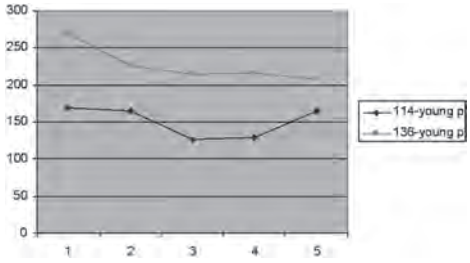


Fig. 50

Non ikusi du?
[Where has he seen it)?]

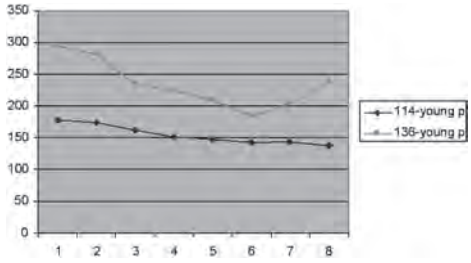


Fig. 51

Zer ikusi du alabak?
[What has the daughter seen?]

Out of the 7 sentences used, three of them exhibited no geo-prosodic variation between Larrabetzu and Ondarroa, and in the other four variation was found. So, it is possible to say that there is 57% geo-prosodic variation between young people from Larrabetzu and Ondarroa, according to these data.

Consequently, it can be said that, according to the data used in this research (bearing in mind the reduced number of sentences), when comparing Larrabetzu and Ondarroa, there is more geo-prosodic variation between young people (57%) than between adults (28%).

8. Conclusions

The technological means used in the EDAK research project in data gathering, sound annotation and labelling, and data analysing have been described.

The use of means of this type is crucial when the objective of the research is the prosodic analysis of the data.

Using this technology we have been able to compare and display the socio-prosodic variation that exists in one locality, and to compare and determine the geo-prosodic variation between two localities.

We have found socio-prosodic variation in both localities, Larrabetzu and Ondarroa. The difference between adults and young people is 43% in Larrabetzu whereas in Ondarroa it is 28%.

With regard to geo-prosodic variation between these two localities, in adults the difference is 28%, whereas in young people it is 57%; in other words, the number of differences among young people is higher than among adults.

This is the first analysis of EDAK data, the first study to approach socio- and geo-prosodic variation in the Basque language. It will require considerable additional work and that is why it cannot be regarded as the definitive study.

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