Article:

Training and Research in Phonetics for Spanish as a Second Language with Technological Support

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Abstract

Foreign language acquisition must inevitably start with phonetics, an aspect of language whose importance is matched only by its neglect. Different research has shown how the systematic teaching of pronunciation is beneficial not only because it aids the comprehension of messages and their expression, but also because it diminishes the anxiety students feel when communicating orally. Furthermore, pronunciation is the first indication of social identity, with all that means for one's integration in or exclusion from a speech community. But nevertheless, phonetics practice takes a back seat in foreign language teaching programmes, in teacher training, in teaching material and, above all, in research work, and this is particularly true in the case of teaching Spanish as a second language. In order to redress this situation, researchers from nine universities have put together an oral corpus and developed a series of resources, tools and applications which can all be accessed at a website for cooperative and interactive work called Fono.ele. The corpus is the first to gather together a significant and representative number of oral recordings of learners of Spanish. It also breaks new ground in embarking on a general study of the pronunciation of Spanish/L2 in relation to social, cultural and educational factors. In addition, it makes available data regarding oral production and auditory perception. As for its applications, they enable those who may be interested (researchers and/or teachers) to handle and manage the speech extracts from the oral corpus, to carry out searches in the phonological errors data base, to obtain quantitative and statistical data, to interconnect text, sound and data, and to devise training exercises. All the foregoing can be done using our materials (that is, in collaboration with the *AACFELE* Project) or the user's own materials (for the preparation of new projects). Our article describes these resources, explains their features and functions, and indicates the options they offer different kinds of users.

Keywords: Phonological component, Spanish/L2, training, investigation, technological resources.

1. Phonological competence

Phonological competence is vital to language acquisition and development since it is the outward manifestation of the complex web of linguistic knowledge, skills and abilities stored in the human brain. It is the capacity an individual may have to produce and recognise the elements proper to a given language, as well as to identify others which are not (Iruela, 2004: 35). According to the *Common European Framework of Reference*

for Languages: learning, teaching, assessment (2002: section 5.2.1.4) it may be defined as the skill to perceive and produce: a) the sound-units of a language (phonemes) and their realisation in particular contexts (allophones); b) the phonetic features which distinguish phonemes (e.g. voicing, nasality, occlusion, labiality); c) the phonetic composition of words (syllable structure, the stress pattern of words); d) the phenomena of coarticulation (assimilation at the point of articulation, shortening of atonic vowels, articulatory relaxation, elision of consonantal sounds); e) sentence stress and rhythm; f) intonation. Phonological competence plays a key role in carrying out oral language skills, namely, oral expression, auditory comprehension, and oral interaction. On the one hand, pronunciation is the means whereby information is transmitted as a result of which the listener's understanding or otherwise of the message will depend on the quality of that transmission. It is also freighted with highly important communicative values, transmitting as it does attitudes, intentions, sociocultural information, expressive contents, and so forth. On the other hand, perception is one of the basic processes which compose auditory comprehension. If an individual fails to recognise correctly the segments forming part of an oral text, he or she will find it difficult to understand and interpret. The implication of this is that there is a direct relation between the capacity to perceive and discriminate L2 phonological elements (phonological contrasts, the sounds that represent each phoneme, rhythm, intonation, word and sentence stress, and so on) and greater facility to comprehend the message. We may therefore say that inadequate phonological competence hampers or makes impossible oral expression and comprehension.

This is why foreign language acquisition should necessarily start with phonetics. Nowadays there are no doubts surrounding the importance of pronunciation teaching to foreign language learning, or of the advantages for communication of appropriate, clear and correct pronunciation. All involved -students, teachers, programme designers, writers of material- are well aware of that, as numerous articles have pointed out. But a quick look at the teaching material currently in use reveals that it is an issue which is most often ignored or at best occupies a back seat.

There are various reasons for this contradictory state of affairs. On the one hand, there are the methodological approaches themselves, above all the communicative approach which currently holds the field: they do not attach the same importance to phonetic and phonological contents as the rest. The attention paid to this aspect of the language is limited to the amount of time the student needs before being able to communicate (Poch, 2004). In other words, any interest in pronunciation evaporates once the latter ceases to hamper comprehension of utterances. However, various pieces of research have proven that the systematic teaching of pronunciation is beneficial to language acquisition not only because it enhances comprehension of messages and aids expression, but also because it diminishes students' anxiety when faced with oral communication (Elliot, 1997).

The widespread belief that imitation is sufficient if one wishes to master the phonetic aspects of a language also leads to a lack of emphasis on teaching pronunciation. A further reason for its neglect is the lack of specific training for teachers, who have normally received some theoretical instruction in Spanish phonetics and phonology, but never any practical training, at least in relation to language teaching. In content areas such as grammar, vocabulary, functions and culture, the teacher learns as a result of his or her teaching experiences; but this sort of self-training is very difficult given the nature of phonetics and phonology and the lack of tools with which to train oneself effectively. At the same time, training courses for Spanish teachers devote little time if any to pronunciation, while it is easy to see that there is less related research and fewer

researchers in this aspect of Spanish teaching than in others. In a word, it is a furrow that receives little ploughing.

If this state of affairs is to be redressed, oral materials and analytical tools are required which will facilitate the development of studies of different kinds regarding the acquisition and learning of the phonological component. The results of these studies will be applicable or transferable to teaching, to the design of teaching material, to curricular planning and course design, and to teacher training. At present no oral corpora of recordings of non-native speakers are available, much less computer tools and analytical instruments (transcriptions, error types, tests) which might enable the layman to obtain information and data for immediate use and application. It is this void which Fono.ele hopes to fill.

2. Fono.ele: an interactive training and research website

The Fono.ele website (http://www3.uah.es/fonoele/index.php) is the outcome of the AACFELE *(Adquisición y aprendizaje del componente fónico del español como lengua extranjera)* research project, financed by the Spanish Ministry of Science and Innovation as part of the National R+D+i Plan (Ref. FFI2010-21034). Under the leadership of the University of Alcalá, it gathers together researchers from another eight universities: La Laguna (Tenerife), Kapodistriaka (Athens), Fu Jen Catholic University, Tamkang University, University of Paderborn, University of El Cairo, University of Silesia and the University of Braganza. It makes available training and research tools to anyone with an interest in the phonological component of Spanish/L2. Our main goals for it are:

- To develop highly practical lines of research into the acquisition and learning of Spanish as a foreign language.
- To analyse and identify the basic errors in the Spanish of non-native speakers in relation to linguistic factors (mother tongue, level of knowledge, register) and sociocultural ones (nationality, age, sex, educational level, relationship with foreign country).
- To study the psycholinguistic and physiological factors behind the most significant cases of error (reception/phonation), as well as the social impact of those errors (sociolinguistic attitudes of natives towards non-natives, rates of acceptance/rejection as a function of phonological correctness, and so on).
- To provide language samples (corpus) and the tools required to handle, search and quantify data with a view to facilitating the development of various kinds of research (theoretical or applied, didactic or methodological).
- To demonstrate to companies dedicated to the production and publication of teaching materials students' learning requirements in terms of phonology and phonetics.
- To make available to teachers and the designers of teaching material information, data and examples related to the areas that need to be worked on in the classroom in accordance with the characteristics of the group and the educational situation.
- To provide Spanish teachers with an opportunity to benefit from practical and useful (self-)training in this area (by means of their own experience of phonetic analysis) so that they may grow accustomed to phonetic diagnosis and assessment.
- To provide teacher-trainers with an interactive learning space where they can work with their students.

The website offers four main working tools: **Fono.data**, **Corpus Fono.ele**, **Fono.Elearning** and **Fono.ele+** all of which have been designed to have a two-fold function. On the one hand they are training and research tools for the *AACFELE* project. On the other, they are resources intended for use by teachers and researchers with an interest in developing their own projects along similar lines to ours. The hope is to build a research and study community around the *AACFELE* project given that the material it

contains will enable many works of scientific research to be carried out. But we will also make available to other professionals the resources required to pursue their own projects, design their own courses, and so on, as well as offering scope to adapt those resources to diverse circumstances, purposes and variables. These initial goals account for the chief characteristics of the Fono.ele tools, namely: flexibility, versatility and multifunctionality.
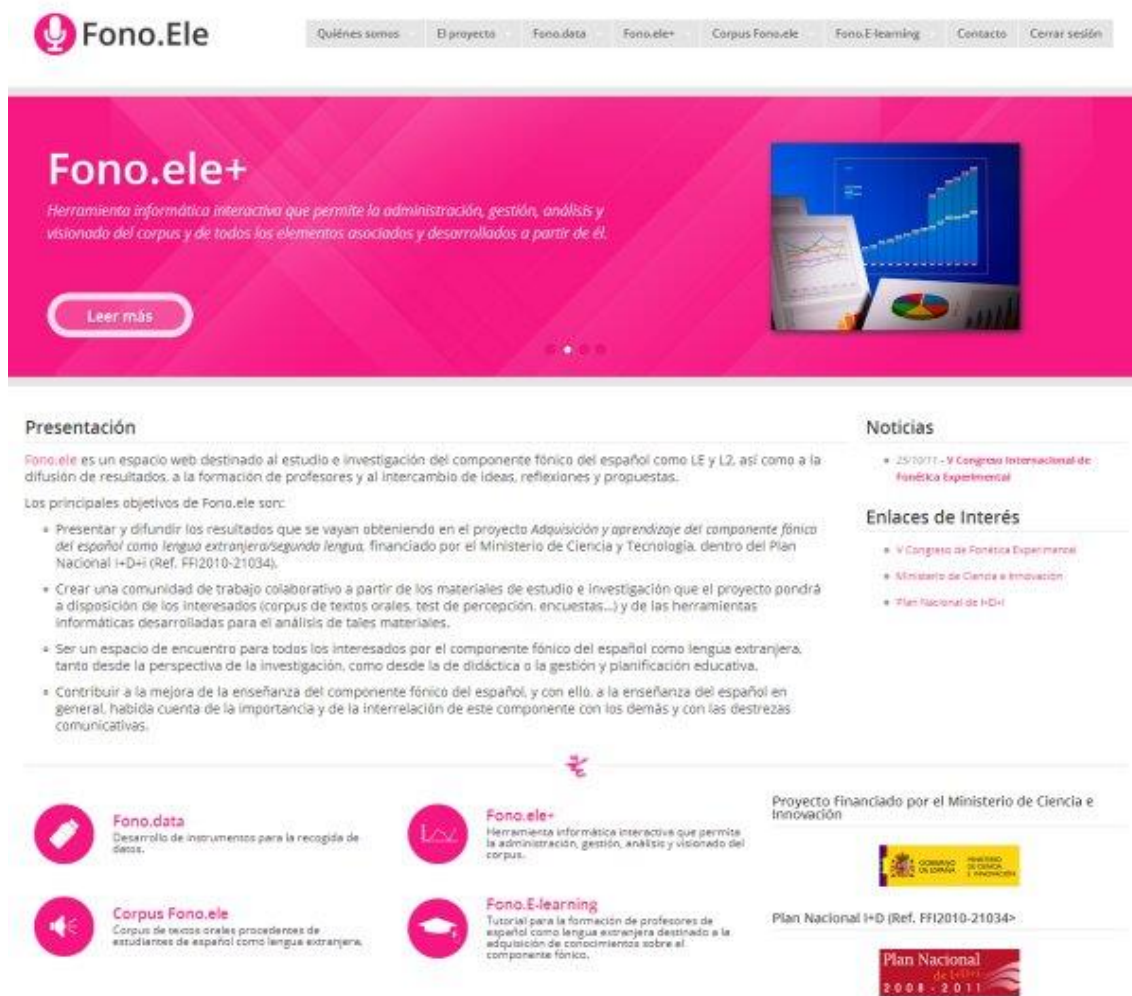

Figure 1. Fono.ele website.

2.1. Fono.data

2.1.1. Phonetic production and perception. Data collection tools

The study of foreign language acquisition and learning must not solely concern itself with matters of production, however fundamental they may be. It must also take stock of perception, for the phonetic acquisition of a language is conditioned by the way students perceive new sounds. For some (Flege 1980, 1991; Wode 1994, 1996), similarities or differences between L1 and L2 as perceived by the learner play a key role in how he or she configures the new system as well as enabling difficulties and transfer processes to be predicted. To state matters in very general terms, as far as similar sounds are concerned, the learner will assimilate the new element to some L1 phonological category instead of going to the trouble of creating a new category for such a small phonological difference. However, when the sound is markedly different, the learner will not associate it with any L1 sound but will construct for it a new

category, with varying success. The conclusion is that a different sound is comparatively easier to acquire than a similar one.

The *Fono.ele* corpus is chiefly composed of samples of speech (production), although it houses perception data too. Naturally, the **instruments** used in either case are very different. In order to gather **production data** we made use of recordings with varying degrees of formality and of attention to what was being said. This allowed us to incorporate speaking style as an analytical tool for assessing the real extent of phonetic difficulties and the inter-relationship between L2 pronunciation and the production of fluent oral discourse (that is to say, the extent to which pronunciation is neglected when efforts are concentrated on the message). We devised four different assessment procedures:

- A short, structured conversation in which both speakers talked about a prescribed topic with the aid of a list of questions to prompt conversation.
- Reading texts: each speaker recorded two different texts, one dialogical, the other narrative.
- Reading phrases: 36 phrases geared particularly to the analysis of suprasegmental phenomena (phonological groups and intonation).
- Reading words: 297 words covering all the selected segmental units in their different phonological contexts. Volume was also noted.

Figure 2. Instruments to gather production data.

Each speaker took part in two types of session: a recorded session with a partner (for the structured conversation) and a recorded individual session (for reading). The conversation was recorded first to ensure that the result was as natural as possible. No explanation regarding the specific focus of the research ("study of pronunciation") was given to the speakers; instead, they were simply informed that it was part of research into learning Spanish. In the course of the conversation the speakers were more attentive to matters of grammar and vocabulary than to phonetics. Afterwards, and on

an individual basis, each was recorded as they read, starting with the texts and ending with the word lists. As the session proceeded, they began to notice that the focus of the research was their pronunciation and accordingly made an effort to improve their pronunciation. By the time they came to the reading of the words, their care and attention were at their peak. Thus we were able to obtain speech samples from **two quite distinct registers** ([+ formal] / [- formal]).

The **perception data** were gathered by means of a multiple choice test geared oriented equally to segmental and suprasegmental features. Unlike the materials designed to gather the production data, which were generic and undiscriminating in so far as, with the exception of the word lists, they all enabled the sounds, intensity, phonetic groups and intonation of all respondents to be analysed irrespective of their mother tongue, the analysis of perception required a tailor-made test for each nationality comprising matters of particular complexity. The structure and length of the test was the same in all cases and consisted of:

- 14 questions aimed at detecting problems with vowels and consonants;
- 5 questions targeting volume;
- 4 questions targeting intonation;
- 5 questions about the respondents' attitudes and appraisals of the two linguistic norms reproduced in the recordings (central-peninsular Spanish and Caribbean Spanish).

The perception tests were conducted in six large national groups of 60 respondents, giving a total of 360 tests in this first phase. The objective was to ensure that all the selected social and linguistic parameters (sex, age, linguistic level, and so on) were represented in proportions similar to the production samples.

Figure 3. Instruments to gather perception data.

The data collection was complemented with a test of beliefs, attitudes and motivation regarding Spanish phonetics and the systematic learning of this aspect of the language. As with the perception test, 360 students responded in 6 national groups of sixty.

2.1.2. Data collection tools on the Fono.ele website

The Fono.data section makes available the tools required for a full collection of phonetic competence data, namely:

- Guides about how to conduct the structured conversations.
- Repertoire of texts, phrases and words for reading and recording.
- Listening material, transcriptions and answer sheets for perception data collection.
- Perception tests adapted to students with six different mother tongues (Polish, Portuguese, Greek, Arabic, German and Mandarin Chinese).
- Attitudes and motivation test.

There are three different conversation guides, one for each language level, A, B or C. In each case the difficulty of the questions and the subjects to be covered are tailored to the knowledge the students are assumed to have at each of those levels. Accordingly, guide A is chiefly concerned with personal data, likes and dislikes, habitual activities, family, leisure and sports. B focuses on appraisals and knowledge of Spanish language and culture, learning experiences and preferences. C tackles the subjects of travel undertaken or planned, and work (professional experience, looking for work, most likely sectors).

The repertoire of texts, phrases and words is the result of painstaking work with the aim of covering the greatest possible number of significant and important Spanish phonetic elements. In this regard, much effort was taken to reduce the infinity of elements that composes the Spanish phonetic universe to a manageable number. One consequence was that we discarded all dialectal, sociolectal and stylistic realizations in order not to go beyond the more abstract plane of allophonic variants.

The phenomena gathered belong to both the segmental level (sounds and sound groups, the latter including sounds generated phonotactically) and the suprasegmental level (volume, phonetic groups and intonation). In the repertory these are put into groups according to the focus of their interest (vowels, diphthongs, hiatus, unvoiced occlusives, palatals, and so on and so forth).

Since sounds do not occur in isolation when pronouncing a language but are in contact with one another and permanently influenced and modified by their neighbours, each one must be studied with an eye to its most frequent or most significant combinations. It is often the case that articulatory problems are not due so much to emitting the sound in a "pure" state as to pronouncing it in a context (coarticulation). This point is of particular importance when learning a language because it enables practice, correction and teaching to be properly focused. Our project's data collection and analysis tools were designed in such a way that the incidence of different phonetic features (preceding and succeeding sounds, volume, syllabic structure, position…) in the emission of a particular element could be studied. In this connection we attempted to ensure that the phonetic units that interested us cropped up in the recorded material in different contexts.

With a view to maximising sound quality, the audios for the perception data collection were recorded in wav format by four professional voice-over artists in a multimedia dubbing studio. The whole process was supervised by a telecommunications engineer with ample experience in voice treatment. Two of the voice-over artists were male, two were female; of these, one pair (male and female) spoke a central-peninsular linguistic standard, the other a Caribbean standard.

The attitudes and beliefs tests was divided into three parts. The first aimed to find out the value students attached to correct pronunciation and their interest in improving it. The second was concerned with the students' motivation regarding the systematic learning of pronunciation. The third addressed affective issues such as difficulty, anxiety, embarrassment or error.

2.2. The Fono.ele corpus

2.2.1. Corpus description

At time of writing the *Fono.ele* corpus comprises speech samples from German, Greek, Taiwanese, Polish, Portuguese and Egyptian students with Spanish *ECFR* (2000) levels ranging from A2 to C1. In the future we hope to increase the number of nationalities represented and the language levels of the respondents.

When compiling the samples we adopted the intentional quota sampling technique. This consists in dividing the population into groups and finding respondents for each group so that all groups are represented. The respondents are chosen by the researcher on the basis of their compliance with some pre-established criteria. In our case, we actually created six sub-samples, one for each nationality. Each of these sub-samples was represented by 16 respondents, 8 male and 8 female. Thus our initial corpus consisted of 96 speakers.

In view of the corpus's nature (Spanish students with different levels and from different countries), we attempted to homogenise the characteristics of the speakers in order to minimise differences between some countries and others and enable comparisons to be made. Nevertheless, as we wanted to study the processes of acquiring, learning and teaching the phonological component in the light of some of the parameters which, according to the literature on the subject, are relevant or play some part or other, we attempted to cater for the variables which might turn out to be significant, discarding other features which would only make the implicit variety more complicated still without contributing any results of interest to our project. Finally, when creating the simple we took into account social factors (age, sex and contact with Spanish) and external linguistic factors (language level, second foreign language and learning experiences).

As far as **sex** was concerned, we used the same number of males as females even though there were actually considerably more female students than males. We adopted this parameter as it would allow us to check whether females are more sensitive to the relevant rules and to correction, as is the case with mother tongues (García Moutón, 2000); if so, it would indicate that the females had greater interlinguistic awareness in their interlanguage.

The **age** factor was differentiated between two groups: Group 1, from 18 to 25 years of age; and Group 2, from 26 to 35 years of age. Any systematic changes, however slight, in the phonetic behaviour of both groups would enable the theory of the critical period— after which period it is impossible to acquire a new phonological system—to be questioned since they would demonstrate the existence of a process of evolution, albeit negative (that is, the greater the age, the lower the capacity). Should no significant differences be detected between the two groups, it would be reasonable to think that, indeed, once a certain age is reached the process comes to an end and phonological competence cannot be developed further.

The **contact with Spanish** variable attempts to gauge the importance of travel, social networks, Spanish culture and so on in the acquisition of phonetic skills. Four different degrees of contact were established: high, medium, low and very low. The placement of a given speaker at a given level was decided on the basis of the average score achieved

in two dimensions: travel and daily life. Both these variables were in turn determined by three factors, as shown in Table 1:

TRAVEL	DAILY LIFE
Number of visits to Spanish-speaking countries in last five years One 1 point Two 2 points Three 3 points Four or more 4 points	Spanish-speakers in speaker's social network None 0 points 1 to 3 1 points 4 to 6 2 points 7 or more 7 3 points
Length of each visit 1 week or less 1 point Fortnight 2 points 1 month 3 points More than 1 month 4 points	Use of Spanish outside classroom Never 0 point Rarely 1 points Sometimes 2 points Often 3 points
Use of Spanish during visits None or very little 1 point Sometimes 2 points Frequent 3 points Always or almost always 4 points	Culture in Spanish (music and films) Never 0 point Very rarely 1 points Sometimes 2 points Often 3 points
If there has been **no** visit to a Spanish-speaking country, the score for Travel is 0.	

Table I: Factors defining the *contact with Spanish* variable.

Speakers scoring between 19 and 24 points obtained a *high* degree of contact with Spanish; those between 13 and 18 points, a *medium* degree; between 7 and 12 and between 0 and 6, *low* and *very low* respectively.

As for the speakers' **linguistic characteristics** , we tried to ensure that in each of the sub-samples (German students, Polish students, and so on) the speakers only had one mother tongue and that it was the same for all (either the particular country's official language or the most-spoken variety). In the same way, our aim was for all respondents to possess the same dialectal variant since geographical diversity might give rise to erroneous interpretations of many phenomena. As for possible sociolectal varieties, we also felt it advisable to eliminate differences as far as possible in order to minimise the effects of each community's natural social diversity.
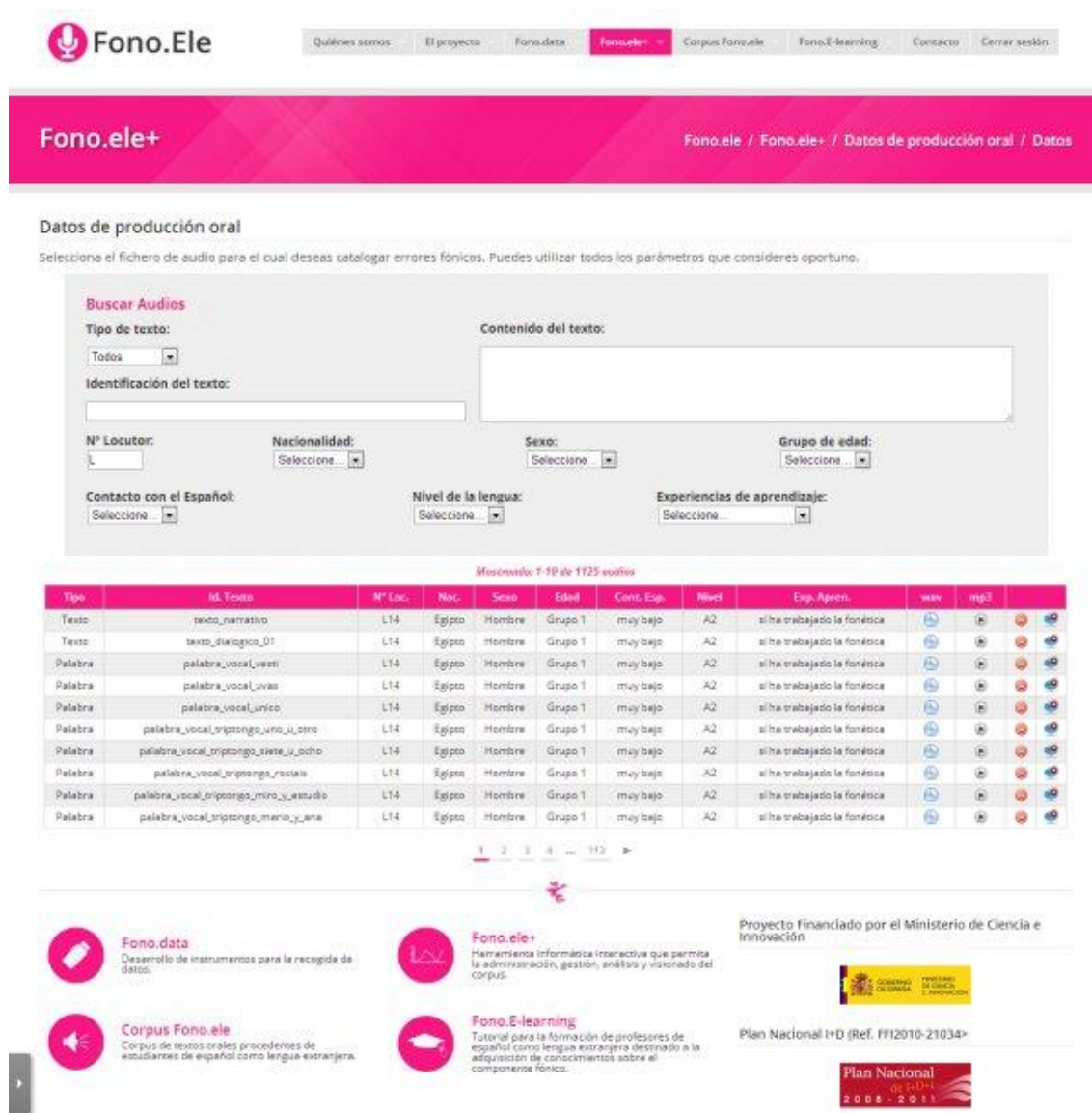
On the other hand, we did seek heterogeneity with respect to **second foreign language** (the first had necessarily to be English), **level of Spanish** (A2, B1, B2 and C1) and **previous learning experiences**. The aim of this last parameter was to assess the impact of systematic work on phonetics on pronunciation quality. Three levels were established:

- Has worked/works habitually on phonetics in the classroom.
- Has worked/works sometimes on phonetics in the classroom.
- Never or almost never has worked/works on phonetics in the classroom.

2.2.2. The website corpus

There are two ways of accessing the corpus: as a general user of the Fono.ele website or as a registered user of the *AACFELE* project. The former may consult 25% of the total production corpus, amounting to around 7,000 files. We have tried to ensure that this material is a balanced and faithful representation of the whole, in other words, is an "abridged corpus" with identical social and linguistic characteristics. To help with

searching we have created a simple tool for selecting audios on the basis of the different social variables taken into account (nationality, age, sex, contact with Spanish and language level). Access to the whole corpus is open to those who work or collaborate with the *AACFELE* project on one of the many tasks related to error analysis or perception studies. In this case access is gained from the Fono.ele+ tool.

Figure 4. Search of audios in Fono.ele+.

2.3. Fono.Elearning

Our website also houses a space for teacher training which offers two quite different tools:

- A self-learning tutorial enabling basic knowledge to be acquired about the phonological component and particularly the development of phonological assessment and analysis skills. This tool is intended for teachers with little experience who wish to deepen or improve their knowledge on the basis of their own praxis.
- An open-source e-learning platform which allows teachers to create dedicated courses incorporating all available theoretical contents as well as other material and resources (texts, audios, instruments, worksheets, and so on). Teachers can work with their students by using the assessment and monitoring tools (projects, tasks, self-assessment, reports, and tables) and the communication tools (forums,

chats, wikis) provided on the platform, thus enabling an interactive learning environment to be established.

The tutorial deals with the main issues concerning the phonological component of Spanish/L2 and its teaching-learning. The contents are organised into five blocks, each of which is divided into learning sessions in which theoretical matter is always liberally illustrated from our own materials. Each session also has a series of activities to reinforce the contents, check comprehension of them and apply what has been learnt.
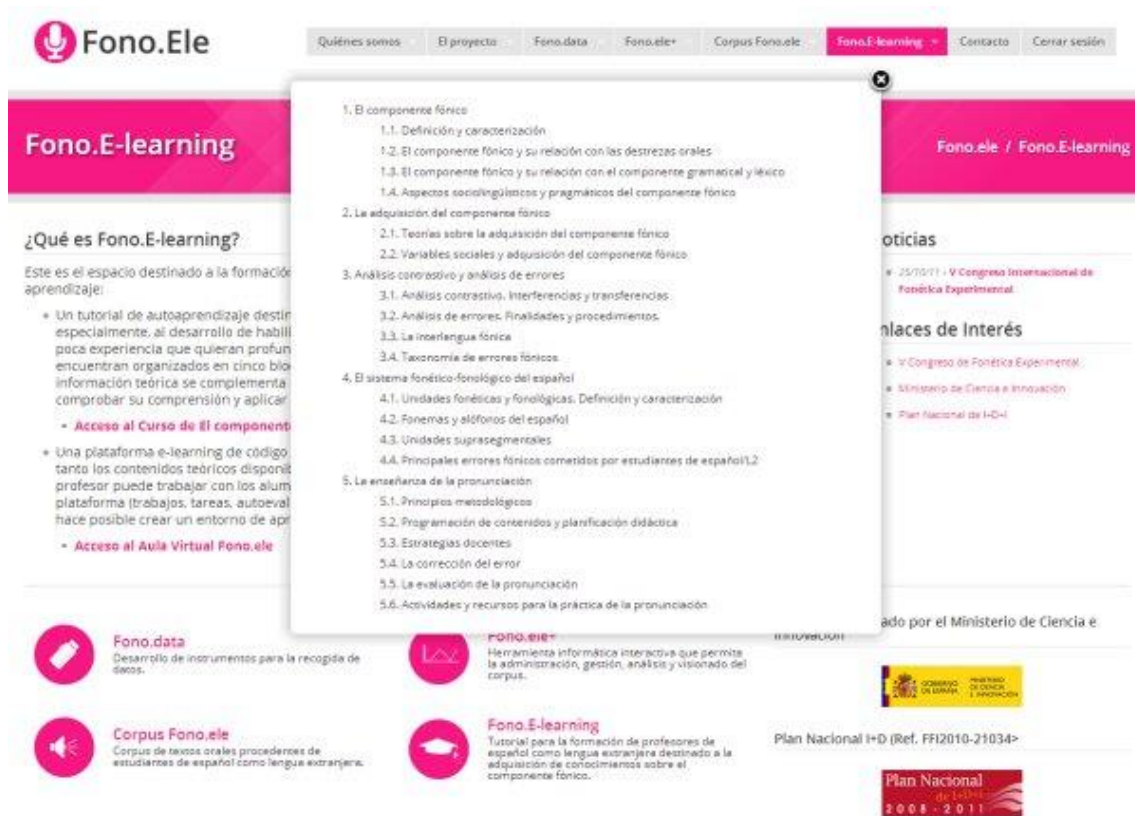
Figure 5. Fono.Elearning. Contents of the training course.

2.4. Fono.ele+

Fono.ele+ is an interactive information system which allows the corpus and all elements associated with it or developed from it to be analysed and viewed. Basically a database, it not only administers all audio, text, error and response content, but is also responsible for interrelating the different materials and information (linguistic and extralinguistic) held by the system. It is a MySQL-type relational database of the kind employed widely in the development of web applications on account of its versatility and ease of use.
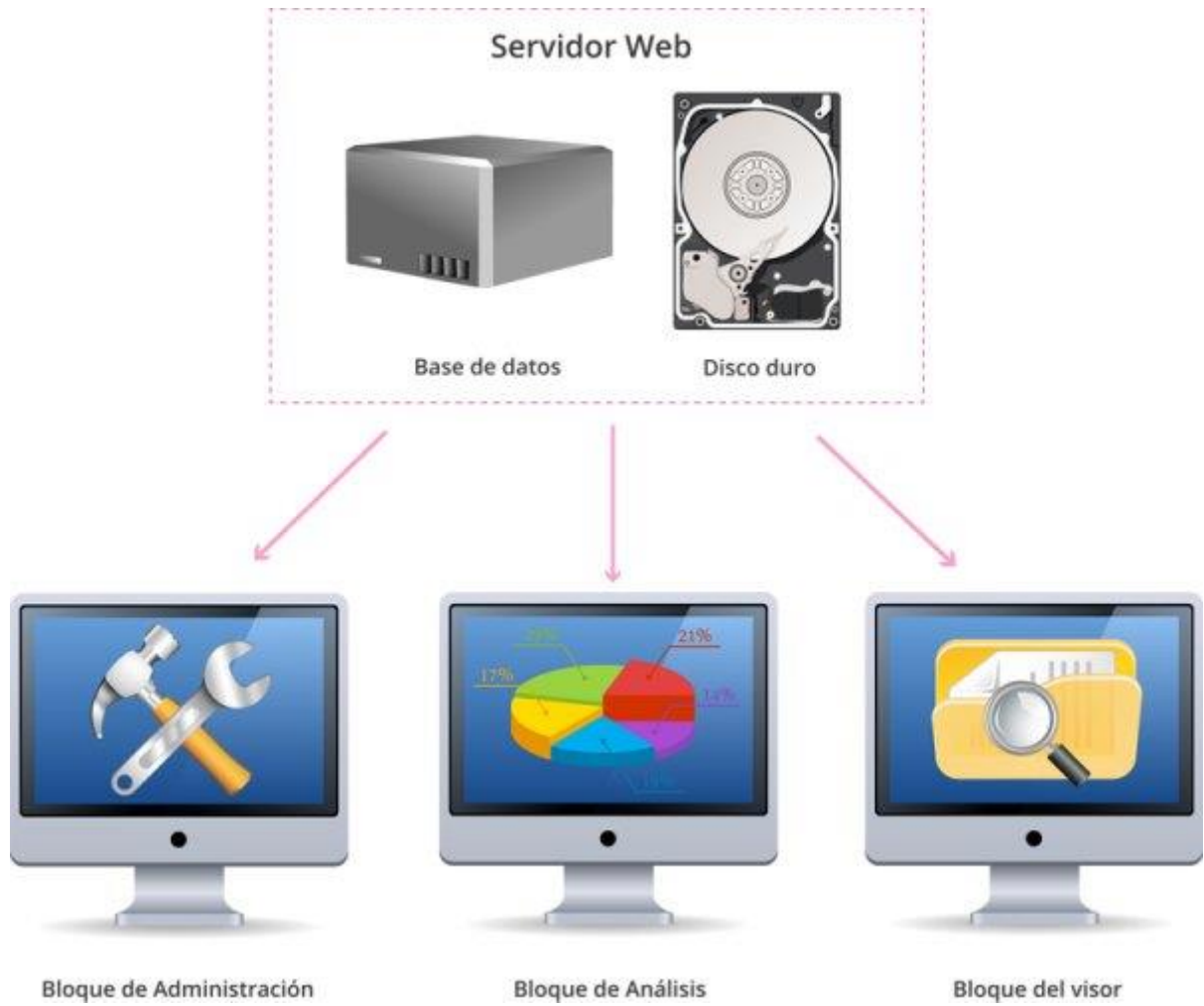
Figure 6. Fono.ele+ structure.

Fono.ele+ has three main sections:

- The administration panel.
- The oral production zone.
- The auditory perception zone.
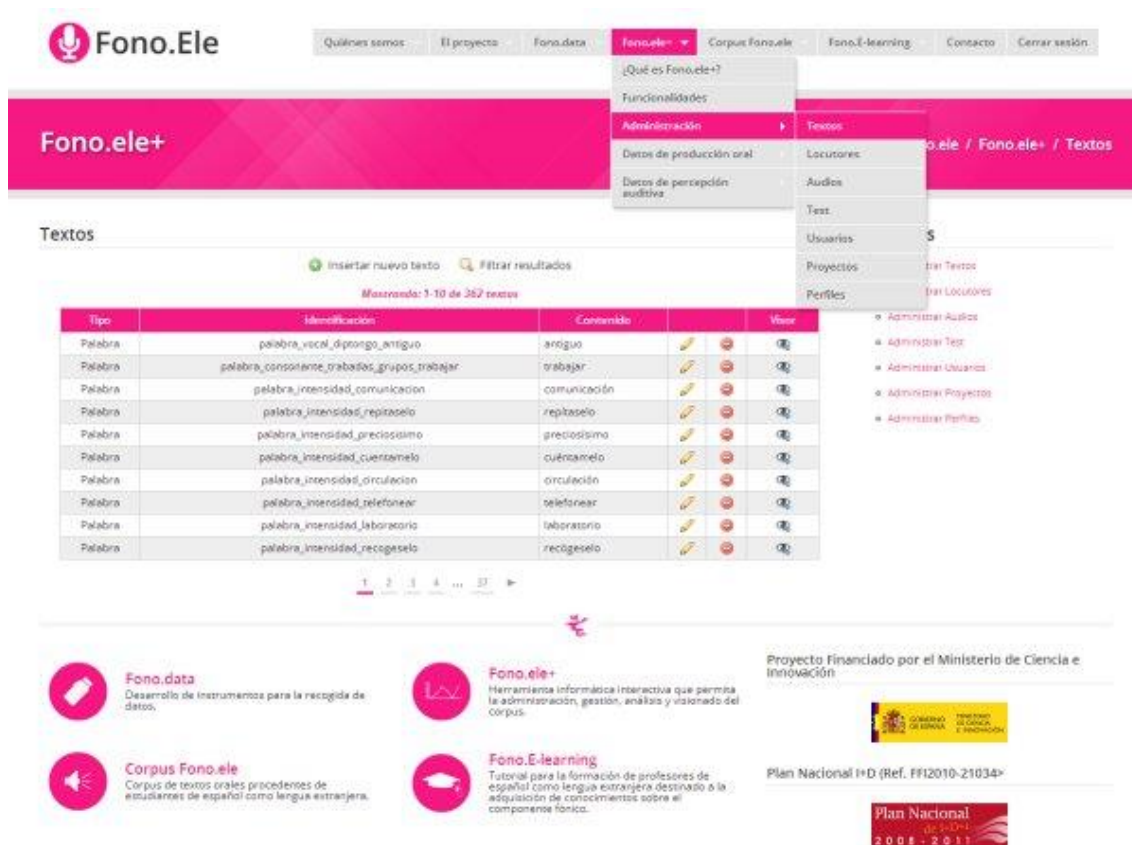
Figure 7. Fono.ele+ administration.

2.4.1. The administration panel

This tool enables the easy introduction, handling and relation of information within the corpus with no need for any special technical knowledge.

It has five main sections permitting management of Users, Respondents, Texts, Audios and Tests. Access, user authorisations and cancellations, and profile assignment is managed from the **Users** section. Since it includes an access system protected by User ID and password, different levels of user with different rights can be set up. The current profiles are:

- **Administrator:** a person who can add, edit, delete and view users, respondents, texts, audios and tests; also to add errors to the database, carry out analysis and use the viewer; finally, to fill out tests and perform analysis of them.
- **Researcher:** a person who can see and consult respondents, texts and audios; can add errors and use analysis and viewer; can fill out perception tests and perform statistical analysis.
- **General user:** a person who can use the statistical analysis applications for production and perception, and the viewer.

Figure 8. User administration.

At the same time, on registration all users will be assigned a research project permitting them to view or manage the data of that project without it being interrelated with data from other different projects. The main project is *AACFELE* (our own), and its are the only administrators who can create users for other projects. Let's imagine that a user creates *Project 2* with its audios, user, texts and so on. That project's administrator will be able to create researchers and general users for that project, but not for others, while *AACFELE* 's administrator can create users for any project.

Figure 9. Project administration.

This means that the tool has great scope for use ranging from research, through teacher-training and obtaining information, to results analysis. Thus, a researcher could be a collaborator in the AACFELE project and use the tool to perform new error analysis on the basis of the available audios and tests. Some researchers may wish to create their own projects on the basis of our methodological principles, procedures and resources. A teacher, meanwhile, could use it for practical training with his or her students and be able to see the analysis carried out, their results and so on. Anybody with an interest could simply enter in order to listen to audios or obtain information on the basis of the data already available.

The **Respondents** section allows information to be entered regarding the sociocultural and linguistic characteristics of the students of Spanish participating in the project.

Figure 10. Respondent administration.

From the **Texts** section new texts can be added and existing ones edited or deleted. The data base stores each text with three attributes: text type (conversation, text, phrase, word); a tag related to the category, such as *palabra_vocal_hola* (= word_vowel_*hola*) or *frase_entonación_interrogativa_1* *(=* phrase_intonation_interrogative_1), (each project can decide which tags to use); and the content of the transcribed text.

Figure 11. Text administration.

Audio files are added, edited or deleted from the **Audios** section. In order to facilitate the introduction of material into the data bases, we have devised a very strict naming system for audios so that on the basis of the information contained in the audio's name we can extract, on the one hand, the speaker's parameters (sex, nationality, age, contact with Spanish or pronunciation learning experiences) and, on the other, the tags of the text with which the audio is associated. Internally, the platform creates the respondent automatically if it does not already exist; if it does already exist, the platform associates the audio with it whenever the sociocultural parameters obtained from the audio file name coincide with those already known; otherwise, an error message is generated and the audio is not catalogued. In short, this section permits an audio to be uploaded and catalogued by inheriting the parameters of the associated respondent and text.

Figure 12. Audio file administration.

Figure 13. Audio file administration. Selection and playlist.

The **Test** section enables multiple tests to be created and assigned to the countries for which they are valid. A test is created by inserting in the model question groups, each with their corresponding questions and possible answers, only one of which is valid in each case. Once the test has been created, it is configured as visible and may be completed from the Perception zone. Here is an example.

- We create a test called *Test 1.*
- We add a group of questions: *Mark the tonic syllable.*
- We add a question, for which "a title" is required (for example *pájaro),* as well as the options (for example: 1. pá - 2. ja - 3. ro) and the correct answer (2). We then add another question (for example, *papeles)* with its options (1. *pa* – 2. *pe* – 3. *les)* and the correct answer (2).

On the basis of this information the corresponding test is set up in the Perception zone where it may be completed with the answers of each respondent.
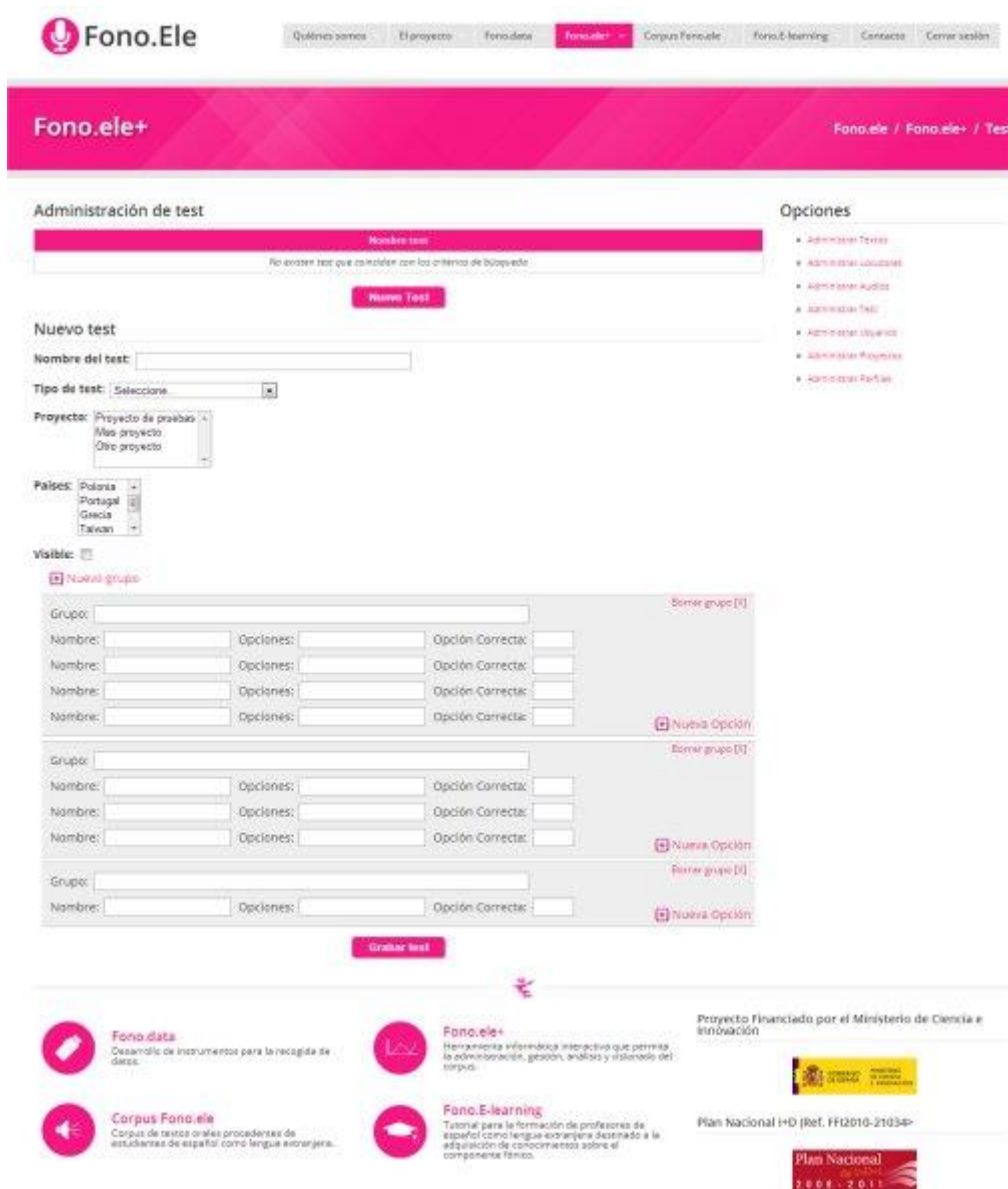
Figure 14. Test administration.

2.4.2. The oral production zone

This section is intended for the introduction and analysis of phonological errors identified in the corpus. It is divided into three sections: Data, Analysis and Viewer.

The **Data** section allows us to record and describe every one of the errors. As with previous sections, this is carried out by means of a form including both identification parameters (linguistic nature —phonetic or phonological— and element type —segmental or suprasegmental) and error classification parameters (underlying processes —addition, elimination, substitution, modification or displacement— and effect on communication —prevents, hampers or no effect). On the basis of these parameters a code is generated which allocates this error type a unique identity which will be used later in the analysis and the viewer in order to group and view errors. Drawing up the table and its parameters called for a great deal of reflection and research since there are no generally valid error taxonomies which also offer descriptive precision (Blanco and Nogueroles, 2012a, 2012b). The underlying classification is the result of analysing the most frequent pronunciation errors in students of Spanish of twelve different

nationalities. The table is also the most complex and time-consuming to fill in since thousands of errors have to be identified and coded.
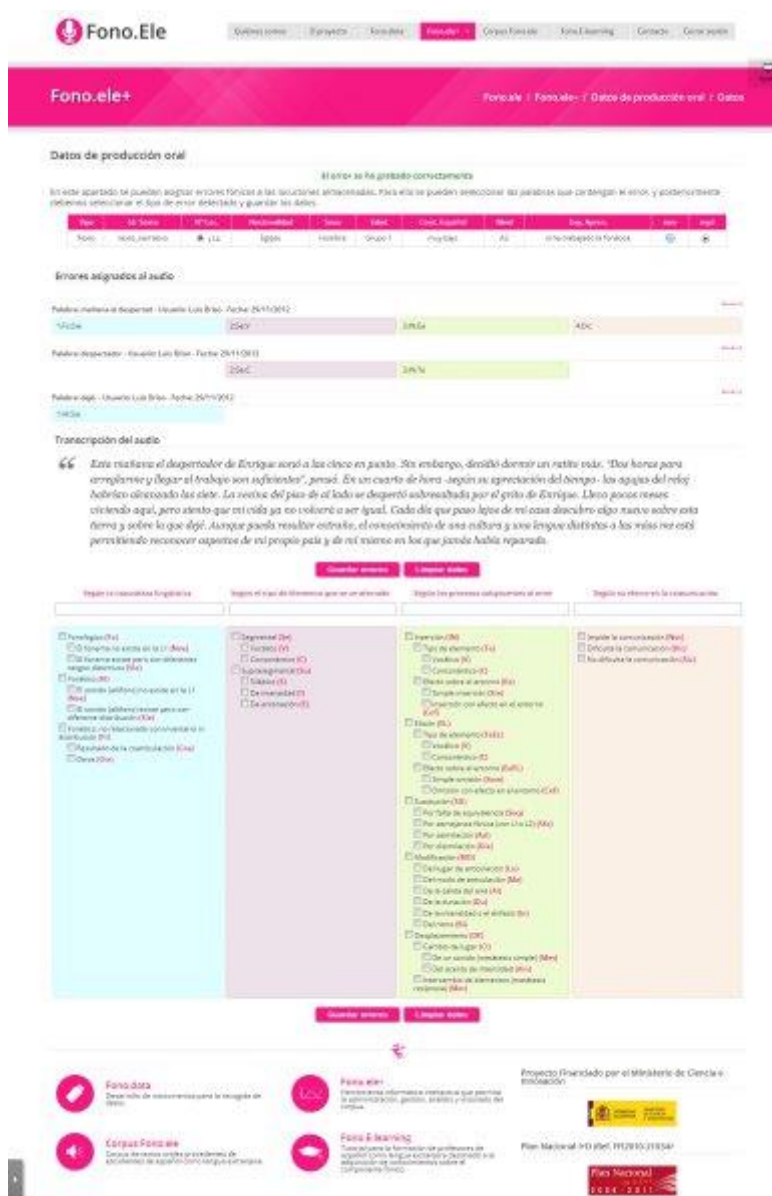

Figure 15. Introduction of phonetic or phonological phonic errors.

Different kinds of quantitative studies (absolute figures, percentages, averages, comparisons, and so on) can be performed from the **Analysis** section. The results can be obtained in written form or graphically.

There are countless options when searching for data since the variables we would like to be taken into account can be selected as well as the source of those data, in other words the profile from which they have been introduced (think, for example, of the case of teachers and students, or of collaborators). We can search for the total occurrences of the same error (or error type) in speakers (male and/or female) of the same nationality; compare the same error across nationalities among all respondents from the same age group; quantify the errors of emphatic intonation according to whether instruction in pronunciation has been received or not; and so on. In short, the data that can be obtained are so many and varied that there is scope for a whole range of studies into the nature of pronunciation learning, its teaching, and so on.

The application permits the results to be stored in external devices in the format of choice (PDF, Word, Excel); it also gives the option of saving in the platform itself the data search preferences corresponding to the analysis carried out; that is to say, labels can be given to the analyses carried out so that they can be visualised again in future without having to select all the parameters from scratch.

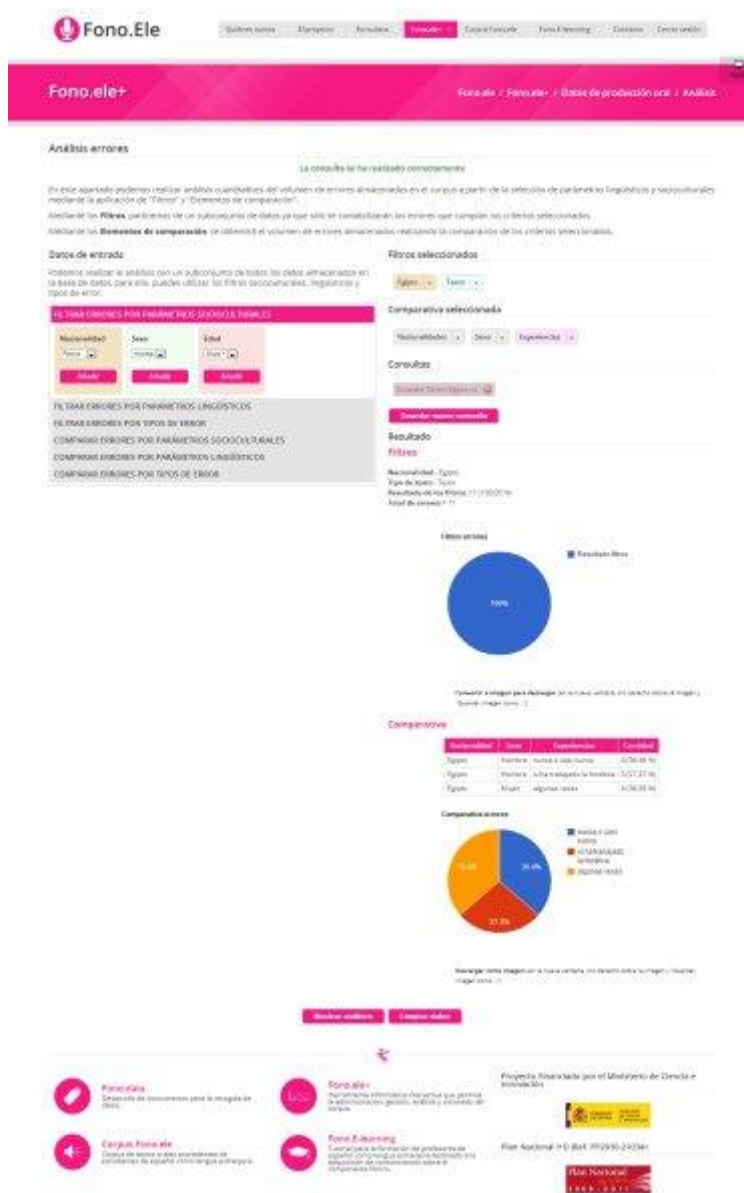Figure 16. Analysis of data. Selection of filters and comparative.

Figure 17. Analysis of data. Graphs.

The contents **Viewer** is a totally flexible tool which permits us to focus exclusively on what we want to see or hear. As before, its possibilities are extremely varied, depending as they do on the variables selected. It is also very easy to use. A text (conversation, text, phrase or word) is selected and the parameters of interest are set, both sociocultural ones (respondent, age, sex, nationality, etc.) and linguistic (vowel, consonant, addition, modification, aspiration, etc.). The errors of interest appear highlighted in the selected text. At the same the audios coinciding with the specified criteria can be listened to, thus providing sound evidence of the errors. When we are over one of the highlighted segments, a pop-up layer appears with a description of the error type together with its and its audio's specific data. In addition, if we click on the highlighted segment we can hear the audio clip containing the error. The tool has been specially designed for teacher training since it offers the most eloquent description imaginable of the errors as described in specialist literature.

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Figure 18. The contents viewer.

2.4.3. The perception zone

The perception zone contains everything related to the results obtained in the tests performed by the respondents, perception tests and attitudes and motivation tests alike. From this zone data can be introduced and analysed; accordingly it is divided into two sections:

The **Data** section corresponds to the registry of responses. This is subdivided in turn into perception data and beliefs data. As far as perception data are concerned, it is necessary to select the nationality first as the tests differ in accordance with the respondent's mother tongue. As mentioned earlier, the questions that make up the test are directly related to the learners' main difficulties. There is no point searching for perception errors in elements which we know for sure present no difficulties to certain students. That is why we ruled out the use of a general, across-the-board test. Consequently those tests are shown which were previously created by a user-administrator and which allow us to see the questions organised into groups according to the set arrangement, together with their answers. It is a simple matter of moving to the answer template and assigning a respondent to each test.

The **Analysis** section allows the results to be quantified in accordance with the variables selected. As with production, we can carry out answer searches in accordance with one or several of the parameters taken into account by the project, and establish as many contrasts and comparisons we deem appropriate. But unlike the production errors, these data are grouped by nationality, although a mixed quantification is also possible (thereby permitting results to be compared in terms of mother tongue) when the test is valid for more than one country, as established when creating the test. The results are grouped by series of questions (each series corresponds to a content type, as is also established when creating the test) so that we are shown, for each series, the percentage of correct answers obtained from among all the respondents who comply with the selected filter of sociocultural and linguistic parameters.

3. By way of conclusion

The versatility, manageability and multifunctionality of the Fono.ele website make it an extremely useful technological resource for research and teacher training. On the one hand it will facilitate the work of those wishing to carry out relevant and significant —both quantitatively and qualitatively— research into the interlanguage of learners of Spanish, into the way phonological elements are learnt, the variables involved in that process, descriptions and classifications of phonological and phonetic errors, and so on. On the other hand, it will equip trainers and teachers with resources and means to acquire on the basis of their own praxis the knowledge and skills required to work successfully with pronunciation in the Spanish classroom. There is no doubt that the traditional neglect of this area of study and knowledge can be palliated thanks to technological development which enables the type of tools and resources required by phonetics research to be designed, along with the spaces best suited to the sort of collaborative work by numerous research teams which the phonological component calls for.

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