Laboratory Approaches to Romance Phonology: Contributions and Challenges to the Study of Sound Variation and Change

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1. The point of departure

As a point of departure for evaluating the contributions and challenges that are inherent to our own field of study, I would like to start with a an observation from a relatively distant discipline:

Since the seventeenth century, physical intuition has served as a vital source for mathematical problems and methods. Recent trends and fashions have, however, weakened the connection between mathematics and physics; mathematicians, turning away from the roots of mathematics in intuition, have concentrated on refinement and emphasized the postulational side of mathematics and at times have overlooked the unity of their science with physics and other fields […]. This rift is unquestionably a serious threat to science as a whole; the broad stream of scientific development may split into smaller and smaller rivulets and dry out […]. (Courant & Hilbert, 1953: Preface)

Any discipline, as Courant & Hilbert remind us, should pause once in a while to reflect on its own practices and to decide whether the path being followed is the one that leads to answering the questions that originated the discipline itself. Thus, the quote reminds us of the need of having an epistemological and a vocational discussion. It also reminds us of the consequences of not having such a discussion; namely distraction and sterility.

Why do we need to have a similar discussion in Laboratory Phonology and in Romance Laboratory Phonology, in particular? I will argue here that there are several reasons to get involved in such a practice. First, there is the test of time. In his 2002 article, Dresher asked himself whether Laboratory Phonology was a “new way of doing phonology” (Dresher 2002:3) or simply a case of phoneticians showing interest in phonology and phonologists being interested in phonetics. Ten years later, it is important to try to answer this question sincerely, reflecting on what linguistics has gained from this new approach. Second, there is an even more important reason, namely the shift of the focus of our attention from observation and questions to methodology and data modeling. In other words, there are subtle signs indicating that the path that should start with noticing interesting issues in our observation of the linguistic facts, which, in turn, should trigger specific research questions, which motivate a methodology, has been broken and the emphasis now is in designing better methodologies and better techniques to model the data gathered. In itself, this is a good attempt; the only problem is when it is done at the expense of the observation and the raising of research questions.

Thus, in this article I will start by briefly discussing the Laboratory Phonology goals (§2). I will then focus on some of the Romance Laboratory Phonology contributions to phonetics and phonology (§3), before addressing what I believe are some of the challenges that we have ahead (§4). The last section will discuss a possible path to avoid falling into methodological traps, by focusing on two metaphors that are pervasive in the discipline; namely, “variation is a disease” and “speech is visible”. I will present the consequences that the use of these metaphors had to the study of intonation and

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analyze an attempt to address the problem. Finally, I will conclude by analyzing whether Laboratory Phonology should be part of the humanities, the sciences or both.

2. Laboratory Phonology

Laboratory Phonology has been defined as a “community” of practice rather than as a theoretical framework (Cohn, Fougeron & Huffman, 2012; Pierrehumbert, Beckman & Ladd, 2000). As a community, it gathers researchers working in a variety of disciplines with a common interest, namely furthering the understanding of speech production and perception. As a consequence, Laboratory Phonology tends to be interdisciplinary, and experimentally driven, as phonetics. Although some of the theoretical questions and frameworks are adopted from phonological theory, such as articulatory phonology (Browman & Goldstein 1989; 1990), there are two important theoretical departures when Laboratory Phonology is compared to phonology. First, according to its followers, Laboratory Phonology does not assume the traditional dichotomy in linguistics between *langue* and *parole* or competence vs. performance. Second, the point of departure, instead of the invariable system, is the variation observed in speech. Thus, the most important theoretical issue is how categorization over a variable input occurs. The challenge, then, is not strictly to search for invariance but rather to develop a theory of categorization, such as exemplar (e.g. Pierrehumbert, 2001) or prototype theory (e.g. Bybee, 2001).

From an epistemological point of view, laboratory phonologists distance themselves from either relativistic or positivistic approaches to science, opting for treating science as “an adaptive human activity” (Pierrehumbert et al., 2000:3). They consider themselves scientists who believe in the progress of science, and argue that the use of mathematical modeling is crucial for the development of Laboratory Phonology as a predictive science. Although it is recognized that formal linguistics also makes use of mathematical formalization, laboratory phonologists argue for the importance of incorporating (or maybe giving priority) to non-discrete mathematics over discrete formalizations.

This brief summary intends to highlight the theoretical stands of Laboratory Phonology, which are crucial to interpret the contributions of the discipline, as well as to understand the paths that the discipline has followed during the last ten years. In the next section, I will highlight the empirical and methodological contributions of Romance laboratory phonology and I will show how this framework has triggered more empirical findings within Romance in the last ten years than ever before.

3. Contributions

In this section I will focus on two types of contributions. First, I will highlight the empirical contributions that have arisen in Romance laboratory phonology, focusing in particular on the findings published in the Proceedings of this conference. Second, I will briefly discuss examples from my previous research and from research on speech perception to argue for the importance of experimentation in hypothesis testing.

3.1. Summary of empirical contributions

Research conducted over the past ten years has greatly expanded our understanding of a variety of segmental and suprasegmental phenomena as well as of the varieties described.¹ As for the former, although most of the attention has been devoted to consonants, there is an increasing interest in vowels. There have been studies on vowel voicing (Delforge, 2008) and comparative studies on the vowel space (O’Rourke, 2010) for Spanish in contact with Quechua; comparative studies on the realization of vocalic sequences in Sicilian and Spanish (Limanni, 2008) and work on vowel nasalization in Brazilian Portuguese (Raposo de Medeiros, 2011). Different types of consonants have been investigated as well, with a particular emphasis on liquids, and within liquids, on rhotics. Different aspects involving variation in coda and onset rhotics have been covered, such as coda

¹ Given space restrictions, I am only summarizing here research on segmental phenomena.
weakening (Bradley 2006), partial-neutralizations of the opposition between laterals and rhotics (Simonet, Roiena Madrazo & Paz, 2008), assimilation (Colantoni, 2006), aspiration of onset trills (Willis and Bradley, 2008), and variability between trills and fricative realizations (Henriksen and Willis, 2010). The study of liquids also involves obstruent-liquid clusters in onset position (Bradley, 2006; Ramirez, 2006) and codas in Spanish (Romero, 2008) and Majorcan Catalan (Amengual & Blanco, 2010). As in other languages, stops have also been the focus of some attention; in particular the Spanish voiced stop-approximant alternation (Kingston, 2008; Ortega-Llebaria, 2004) and the weakening of voiced and voiceless stops across dialects (Colantoni & Marinescu, 2010). Studies have not been restricted to Spanish. In recent years, there has been also interest in stop weakening in Italian (Stevens, 2011). Studies on fricatives have also considered a variety of structures, such as the well-known phenomenon of /s/ aspiration (Brown, 2011) and voicing (Schmidt & Willis 2011), the devoicing of voiced post-alveolar sibilants (Gradoville, 2011), cross-dialectal differences in the realization of post-alveolar sibilants and deaffrication of palatals (Colantoni & Kochetov, 2011) and alternations between velar and labial fricatives among illiterate speakers (Mazzaro, 2010). Finally, nasals have also received some attention, and this includes de-occlusivization in nasals (Shosted & Willgoths, 2006) and cross-linguistic perception of coarticulatory effects of nasalization (Goodin Mayeda, 2011).

3.2. Examples of some experimental techniques used

In this subsection, I will provide some examples from my previous collaborative research as well as from work on speech perception that speak to the importance of using a variety of experimental techniques in order to answer specific theoretical questions.

3.2.1. The obstruent-liquid cluster project (Colantoni & Steele 2011)

An observation that came out repeatedly in our research on French and Spanish first and second language obstruent-liquid clusters (Colantoni & Steele, 2006; 2007) was that there were consistent durational asymmetries in the realization of voiced vs. voiceless clusters. In voiced stop-lateral clusters, the lateral was longer than in voiceless clusters in both languages (see O’Shaughnessy, 1981; 1982 for French). In voiced stop-rhotic clusters, an epenthetic vowel was found between C1 and C2 in both languages, whereas either no vowel (French) or a shorter vowel (Spanish) was observed in voiceless stop-rhotic clusters. These synchronic asymmetries matched asymmetries in the diachronic evolution from Latin to Romance (e.g., Hall, 1976; Jensen, 1999; Mendeloff, 1969), such as the maintenance of voiced-stop liquid clusters as opposed to the palatalization of affrication in voiceless-stop liquids clusters.

Thus, we set out to explore a specific research question: was it possible that the durational asymmetries observed for the lateral and the asymmetries that we had found in the duration of the epenthetic vowel were at the source of the diachronic asymmetry reported? In order to answer that question, we analyzed the relative duration and the voicing patterns of the stop, the liquid and the epenthetic vowel (when relevant) in the production of 10 native speakers of each language.

Figure 1 below illustrates the relative difference in duration for the stop and the lateral in French in word initial and medial position, whereas Figure 2 displays the same data for Spanish word initial stops in initial position and approximants and voiceless stops for word-medial position. Figures 1 & 2 show that, albeit the proportions are different, in both languages voiceless stops are longer than voiced stops and laterals are shorter after the former than after the latter.
In stop-rhotic clusters we also observe durational asymmetries but the situation is slightly more complex because the two languages differ in the way they treat voiceless and voiced clusters. In French (Figure 3), there is an epenthetic vowel breaking the voiced but not the voiceless clusters. Voiceless clusters do not show vowel epenthesis but the duration of the rhotic seems to compensate for the absence of the vowel; indeed the rhotic is longer in these latter clusters.
In Spanish (Figure 4), the epenthetic vowel breaks up both clusters; the rhotic, which is indeed very short, does not vary in duration but the epenthetic vowel shows the same asymmetries observed with the lateral, i.e. it is longer after a voiced stop.

Why did we need to conduct an acoustic analysis in this case? First, an acoustic analysis allowed us to capture systematic durational differences in both languages across cluster types that we would have never been able to capture using auditory transcription. Second, the acoustic analysis documented the existence of the epenthetic vowel in both languages (there were previous reports of the existence of the vowel only for Spanish – Blecua, 2001; Malmberg, 1965), which does not seem to be perceived by native speakers of either language. The verification of the existence of these durational asymmetries makes it then possible to return to the diachronic accounts and to extrapolate that the asymmetries that we observe in the present should also have been there in the past. In particular, the fact that the lateral is longer in voiced than in voiceless clusters, may explain why these clusters were preserved in the evolution from Latin to either Spanish or French, while this was not the case in voiceless clusters. In such clusters, diachronic affrication was sometimes attested, which is consistent with the fact that synchronically we have either a shorter lateral or a shorter vowel.

3.2.2. Weakening and assimilation: An electropalatographic (EPG) study of coda /s/ in Argentine Spanish (Colantoni & Kochetov, 2011; Kochetov & Colantoni, 2011)

The second example illustrates the use of a different experimental technique -electropalatography (EPG) – in the study of a well-documented variation in Spanish, i.e. the weakening of coda /s/ to [h]. In Buenos Aires Spanish, this weakening is restricted to pre-consonantal position, regardless of the position in the word (e.g., Bybee, 2001; Terrell, 1978). We were intrigued by the results of studies that looked at the effect of place, which systematically reported that weakening was less prevalent before a following coronal consonant than before either labials or velars (see File-Muriel, 2007 for a review). Thus, we wanted to verify whether this asymmetry was also present in Buenos Aires Spanish, as well as to determine whether this was a categorical or gradient phenomenon. In order to explore these issues, we analyzed the EPG recordings collected from 5 native speakers of Buenos Aires Spanish. We performed a qualitative analysis of the mean contact profiles and the temporal displays and a quantitative analysis of the contact degree over the whole palate (quotient of activation Q; see Fontdevila, Pallarès & Recasens, 1994).

Figure 5 illustrates the contact pattern for two speakers for /s/ in onset position, a context where no weakening is expected to occur.
Figure 5: Mean linguopalatal contact for /s/ in onset position for two speakers (average over six tokens). Data collected at mid point and at the point of maximum contact (PMC). Colantoni & Kochetov (2011)

Figure 6 displays the mean contact profiles for the first set of clusters: [sp]. Although slightly different contact patterns are observed for both speakers (more back contact for A4 than for A1), these patterns clearly differ from those found in word-initial position (see Figure 5).

Figure 6: Mean linguopalatal contact of /s/ in [sp] coda clusters for two speakers (averages over six tokens). Data collected at mid point and at the point of maximum contact (PMC). Adapted from Kochetov & Colantoni (2011: 278)

The acoustic and temporal display in Figure 7 basically illustrates that the degree of contact in the [sp] cluster does not significantly change for the whole duration of the cluster.

Figure 7: Acoustic display (top) and EPG temporal display (bottom) of the [sp] cluster as produced by speaker A1. Note: displays are not aligned.
Figure 8 illustrates two patterns in the realization of /st/ clusters. A1 shows very little contact in these clusters, which suggest a [h] realization. A4, instead, represents the most frequent realization in our sample (4 out of 5 speakers). In her case, there is an increasing constriction towards C2, which is evidenced in the different degree of contact between the mid point and the point of maximum contact. This increasing degree of contact, which results in an [s] percept, is further illustrated in the acoustic and temporal displays (Figure 9).

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Figure 8: Mean linguopalatal contact profiles for [st] coda clusters for two representative speakers (average over six tokens). Data collected at mid point and at the point of maximum contact (PMC). Adapted from Kochetov & Colantoni (2011:278).

Veolar clusters [sk] behaved similarly to coronal clusters (Figure 10), in the sense that a greater constraint in the fricative is observed when approaching the following veolar consonant. Once again,

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2 The point of maximum contact was defined looking at the acoustic signal; i.e. the period of fricative noise, regardless of its acoustic realization (i.e. [s] or [h]), was identified and the point of maximum contact within that interval was labeled.
speaker A1 shows no difference in the degree of contact closer to C2 but A4 and the other three
speakers displayed an increasing degree of contact when approaching the following consonant, as
further illustrated by the temporal display (Figure 11). Thus, the asymmetry in the degree of contact is
not between coronal and non-coronal consonants, as previously reported, but between lingual (coronal
and velar) and non-lingual consonants.

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Figure 10: Mean linguopalatal contact profiles for [sk] coda clusters for two speakers (average over six
tokens). Data collected at mid point and at the point of maximum contact (PMC). Adapted from

Figure 11: Acoustic display (top) and EPG temporal display (bottom) of the [sk] cluster as produced
by speaker A4. Note: displays are not aligned.

The values obtained for the overall degree of contact (Q) further confirmed the results reported;
I.e. although there is no significant difference in the degree of contact when values are taken at mid
point (Figure 12, left), when measurements are taken at the point of maximum contact differences
become significant: /s/ shows the highest degree of contact before /t/ and the lowest before /p/ (Figure
12, right).
What are then the benefits of using EPG to explore our questions? Results obtained using this technique document the gradual overlap between two articulatory gestures, which is missed by either an auditory transcription or acoustic analysis. These results suggest that what was previously transcribed as /s/ in coronal clusters is indeed the result of gestural overlap. Thus, our results have implications for accounting for contextual effects in /s/ weakening patterns. Additionally, these findings allow us to explain how pre-aspirated consonants may have emerged diachronically from the sequence of [h] plus a following stop (Silverman, 1997).

3.2.3. Perception studies

The research gathered in the Proceedings of this series of conferences also demonstrates how many of the fundamental issues in speech perception can only be answered through careful experimentation. This is demonstrated by the research on cue weighting and the perception of Spanish and Catalan stress (Ortega-Llebaria, 2006; 2008) and the distinction between coda sibilants and rhotics (Romero, 2008). The role of co-articulation in speech perception has also been explored by Goodin Mayeda (2011) in her study of L1 English L2 Portuguese and Spanish speakers. Finally, unimodal vs. multimodal speech perception has been explored for the perception of intonation (Oliveira Peres, Raposo de Medeiros, Ferreira Nietto & de Almeida Baia, 2011), and in Mazzaro’s (2010) study on the role of orthographic input in sound change.

4. Challenges

The previous section has briefly illustrated how much Laboratory Phonology, and Romance laboratory phonology, in particular, has contributed to expanding our empirical knowledge and our methodological refinement (see also Cohn et al. 2012 for a similar argument). From this section on, I want to highlight what I foresee as some future risks and their potential sources. Of the potential risks, I want to focus on two: losing our capacity to observe reality and believing that our metaphors are real.

4.1. Observation

The risk of losing our capacity to observe reality and to be fascinated by new methodological or technical developments is obviously a problem that goes beyond Laboratory Phonology and that was also foreseen by the mathematicians quoted at the beginning of this article. In Laboratory Phonology, it has a particular flavor; namely the increasing need of depending on instrumentation to propose...
hypothese$\text{s}$, to verify our observation and the mere reliance on statistics to make strong claims about the linguistic meaning of a given trend. In acoustic studies, for example, it is frequent to find reports on durational differences that are statistically significant but below the perception threshold. In articulatory studies, statistical differences in the contact indices used are reported, without always being certain of whether these differences can be perceived by native listeners. Although statistically significant differences are important to make inferences about gradient processes, it is important to be careful about their interpretation.$^3$

4.2. Metaphors

The second risk is subtler, and, thus more interesting, and involves the possibility of treating our metaphors as a reality. Of all the possible metaphors, I want to focus here on two: variation is a disease and speech is visible.

4.2.1. Variation is a disease

Although the term ‘disease’ may not be the most appropriate, not only theoretical linguistics can be blamed for traditionally problematizing variation. Even disciplines that focus on the study of speech, as sociolinguistics or phonetics, seem to conceive variation at least as a problem. For example, in a recent book, Labov (2010:369) asks himself “what useful purpose is served by language change?”, maybe implying that a language that does not change would serve the speech community better. In phonetic theory, the quest for invariance has been a recurrent topic, and researchers have argued that invariance is either found in the acoustics (e.g. Stevens, 1972; 1999) or in the mental representation of articulatory gestures (e.g. Fowler, 1986).

In the Hispanic linguistic tradition, this metaphor is recurrent and explicit. In earlier works, references to “defectos de pronunciación”, “formas anómalas” (Navarro Tomás, 1918: §121) or “peculiaridad lingüística” (Castro, 1941) to refer to non-Peninsular pronunciations are abundant. Nowadays, the language has changed but the spirit has not. In the recent phonology textbook published by the Real Academia (RAE, 2011), we find again the same conception: when the inventory of Spanish phonemes is discussed, only the Peninsular realizations are present and all the other forms are relegated to the category of variation (see for example RAE, 2011: 301). This again is symptomatic of a conception of language as having a core and a periphery, although it is not clear how the core and the periphery are linguistically defined.

4.2.2. Speech is visible

This second metaphor is also pervasive and may have its roots in our alphabetic writing system (McLuhan & Powers, 1989; McLuhan, 1994; Ong, 1982). As McLuhan reminds us, writing has had an enormous impact on our Western society, changing the way we even conceive time and space. There is plenty of evidence that this visualization of speech through orthography changes the way we perceive speech (Port & Leary, 2005; Port, 2007). L1 perception changes when children are first exposed to orthography (e.g. Nittrouer, 2002); literate and illiterate speakers behave differently in sound change (e.g. Mazzaro, 2011); and L2 learners evidence different developmental patterns when exposed to orthography (e.g., Rafat, 2011; Steele, 2001).

Our phonetically-based writing system, in its turn, has paved the way to phonetic transcription, solidifying this idea that the acoustic code can be transposed into a visual code (McLuhan & Powers 1989). As a consequence, vowels and consonants are conceived as discrete$^4$, successive units in the speech chain, and, in order to explain how these units are modified in the speech chain theories about co-articulation emerged. The acoustic theory of speech production and the current availability of software that gives access to conduct acoustic analysis to a larger number of researchers only

$^3$ See also Labov (2006) for similar observations about the use of acoustic measurements and statistical techniques to make inferences about potential sound changes.

$^4$ Feature theory and articulatory phonology contest, in part, this idea that there are discrete units in speech.
emphasizes this conception that speech can be made visible. Thus, a spectrogram (visible speech) can be conceived as a direct representation of our audible speech, reinforcing once again McLuhan’s observation that Western societies were moving from acoustic to visual modes of communication. As mentioned in 3.2.1, acoustic analysis is an invaluable research tool, and we need to make an effort in educating ourselves in understanding the science that is behind the techniques we use, so we can make better-informed inferences from what we see on the screen. Perception research constantly reminds us that acoustic-perceptual relations are not linear; that when perceiving speech sounds we may integrate visual and auditory information or we may simply ignore information that it is present in the signal (see Hawkins, 2009 for a review).

4.3. Consequences of our metaphors

These metaphors have direct consequences for our study of segmentals and indirect consequences for the study of intonation. As mentioned, the conception that vowels and consonants can be represented via written symbols had implications for the study of running speech. If speech is a concatenation of discrete units, then it is necessary to have a theory that explains how these units are modified in speech, and coarticulatory theory emerged as a partial response. I am more interested, though, in briefly addressing the indirect consequence that these metaphors had for the study of intonation, because, paradoxically, the study of intonation was pivotal in the development of Laboratory Phonology. Intonation, however, still remains as an (un)tamed savage (Bolinger, 1978). Why are the consequences of these metaphors more visible in the study of intonation? Because, by its nature, intonation (and prosody more generally) is not discrete, traditionally it has not been transcribed (beyond some basic correlates in punctuation), and it is debatable whether what we perceive as a melody of speech can be reduced to the visible F0 contour (e.g., Kochanski; 2006; Kohler 2006).

The autosegmental metrical approach to intonation (e.g., Pierrehumbert, 1980; Pierrehumbert & Beckman, 1986; Ladd, 2008) has made significant contributions to the cross-linguistic study of intonation, but may have overemphasized the parallel between the study of segmentals and suprasegmentals, by attempting to come up with an inventory of contrastive tonal units for each language, in the same way that we have an inventory of vowels and consonants. This, paired up with the methodological decision, especially in earlier studies, to focus on read speech, has left the communicative use of intonation (and prosody) aside (Kohler, 2006; 2007). Many attempts have been made in recent years, to further our understanding of the communicative (linguistic) uses of intonation (see, for example, Breen, Watson & Gibson, 2010; Kohler, 2007).

In our own research (see Ortega-Llebaria & Colantoni, to appear) we have proposed to turn to the study of L2, focusing in particular on how a specific form-meaning mapping in the L2 (the tonal marking of sentential stress) is acquired. When acquiring a second language, learners have to perform a meaning-form mapping and determine which mappings in the L2 are also present in the L1. In this way, the study of L2 prosody, beyond furthering our understanding on L2 speech acquisition, may act as window into the L1, allowing us to infer how prosody is used to convey meaning in the learners’ native language. In this research, we test the general hypothesis that auditory perception of prosody is rather similar across languages (see Grabe, Rosner, García-Albea & Zhou, 2003) but speakers differ when they have to perceive and produce intonation in context.

In order to test this hypothesis we designed two experiments, each one with a perception and a production component. Experiment 1 was designed to test the auditory (de-contextualized) perception and the capacity to imitate contours of isolated sentences. Experiment 2 was based on a story and tested the participants’ ability to choose the response appropriate to a story and to answer with the expected intonational contour. In both cases, the target prosodic structure was sentential stress, which could fall either on the subject, the verb or the verb complement (either an Object or a PP). Participants were 13 English controls, 13 L1 Mandarin and 14 L1 Spanish English L2 speakers. For the purpose of illustration, I report here the perception results of both experiments. As shown in Figure 13, controls and Mandarin Chinese speakers performed almost at ceiling in Experiment 1. Spanish speakers lagged behind, especially in the perception of focalized subjects. In Experiment 2, both groups of learners differed from controls, but Mandarin learners resembled controls more closely overall. Spanish speakers display a very interesting asymmetric behavior in both tasks. Indeed, more than a task-effect
these participants reveal a contextual effect; namely they are more accurate in the perception of sentential stress in object position, where we usually find the most prominent prosodic element in the native language (Nava & Zubizarreta, 2009; Zubizarreta & Nava, 2011).

Figure 13: Perception results (mean correct responses) organized by task and focus position. Note: HLPT (left) = high level processing task; Experiment 2, context vs. LLPT (right) = results of the low level processing task; Experiment 1, no context (from Ortega-Llebaria & Colantoni, 2014:344)

In summary, on the one hand, our results show that higher levels of processing are affected more than auditory processing for Mandarin speakers. This may be motivated by the fact that Mandarin and English, in spite of being typologically different languages, are prosodically more similar than English and Spanish, in the marking of sentential prominence. On the other hand, the results obtained for Spanish learners of English suggest that the form-meaning mapping in the L1 affects both the auditory and the non-auditory processing in the L2. If it is truly the case that Spanish speakers only use pitch productively to mark prominence in sentence-final position, it may be necessary to revise some of the existing literature that claims that pitch is a correlate of focus marking in Spanish more generally.

5. Concluding remarks

As we recalled in section 2, the Laboratory Phonology community proposed an epistemological shift, aligning the discipline with predictive sciences and arguing for the importance of using continuous mathematics to model the data. Phonology, on the other hand, pushes for a different epistemological model, a deductive paradigm where data but not necessarily experimentation are used to support the proposed hypothesis, and ultimately, to test a theory. Thus, as Dresher (2002) suggests, experimentation does not play a role in Phonology. It is not news for those interested in the analysis of speech sounds to find themselves at an epistemological crossroads. If we want to make an epistemological decision though, we need to reflect on our own practice, and this, starts, as I argued, by understanding the implications of the metaphors we use. If we want to go a step further, we need to reflect on our epistemological choices. Laboratory Phonology makes a clear choice (Pierrehumbert et al., 2000: 2-3) based on a desire to follow the model of “mature sciences”. This is always an available option: after all our empirical knowledge has considerably grown thanks to experimentation in linguistics. There is another option, though, that it is not mutually exclusive and it does not require that we leave our origins aside, as Courant & Hilbert remind us. Phonology was born and had benefitted from being part of the Humanities. Cutting that dialogue with Humanities has implications for our conception of language, and ultimately, for our conception of the role played by language in defining us as humans. We may then want to seek for epistemological models that allow us to encompass the changes that have taken place without denying where we come from. In that sense, it may be useful to reflect on the work of philosophers of science, such as Feyerabend, who cannot easily be categorized
as either relativists or neo-positivists (but see Pierrehumbert et al. 2000: 3). Feyerabend specifically proposes a path to progress of knowledge that encompasses diversity of paradigms, as reflected in the following quote:

Variety of opinion is necessary for objective knowledge. And a method that encourages variety is also the only method that is compatible with a humanitarian outlook. (Feyerabend 1975: 32)\(^5\)

If interested in the progress of our discipline, we may need to put more effort in two complementary areas: (a) in defining a mechanism of external assessment of our own progress (Feyerabend 1975) so the discipline does not close on itself; (b) paying more close attention to the way we educate our students. The latter may include fostering the capacity of observation and reflection, through the use of problems settings and data analysis (as done in Fieldwork courses) without the aid of technology. Above all, attention should be paid in promoting thematic and theoretical freedom in our students; i.e. in not equating scientific rigor with homogeneity. In this sense, once again, Feyerabend (1975: 11) reminds us of an always latent risk: “Scientific education as we know it today has precisely this aim. It simplifies science by simplifying its participants.”

Finally, and in order to engage in true interdisciplinary research, we need to turn to the vocational aspect and think of the value of linguistics research. And this brings us back to our initial quote. Laboratory Phonology is not different from mathematical physics in the theoretical challenges and the risks but laboratory phonologists may be different from mathematicians and physicists in a crucial aspect: the latter are certain of the values of their own disciplines.

References


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\(^5\) See also Hawkins (2009) for strong arguments in favor of abandoning dogmatism in perception research.
conference on laboratory approaches to Spanish phonetics and phonology (pp.48-61). Somerville, MA: Cascadilla Press.


