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The Effects of Phonetics Training on the Intelligibility and Comprehensibility of Native Spanish Speech by Second Language Learners

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Traditionally, second language (L2) phonetics training has been used primarily as an aid to pronunciation improvement for L2 learners. The impact that such training has on L2 listening comprehension, on the other hand, has not received systematic attention in the literature. This paper addresses this issue by presenting a study that examined the impact of phonetics training on the intelligibility and comprehensibility of native Spanish speech as perceived by L2 learners. Two learner groups (control, experimental) participated. For the pre-test, both groups listened to sentences produced by native Spanish speakers and wrote down what they said (a measure of *intelligibility*). In addition, they rated how easy they thought the speaker was to understand (a measure of *comprehensibility*). The experimental group then received six weeks of instruction on specific phonetic characteristics of the Spanish dialect spoken by the native speakers and engaged in focused listening and pronunciation practice. Both groups then took the post-test, which was identical to the pre-test. The results demonstrated that the experimental group showed significant improvement with respect to the intelligibility of some of the phonetic aspects trained. This research thus illustrates the benefits of phonetics training for helping L2 learners improve listening comprehension skills.

INTRODUCTION

Listening comprehension is a central component of second language (L2) acquisition, yet, as Omaggio Hadley (2001,p. 184) notes, research on the development of L2 listening comprehension skills is "still in its infancy" (see also Rubin, 1994, for an overview of research in this area). The listening process involves numerous skills (Richards, 1983; Omaggio Hadley, 2001), one of which is the ability to discriminate individual speech sounds. An understanding of the L2 sound system is therefore critical for the development of L2 listening comprehension. Indeed, Arteaga (2000) argues that phonetics teaching in the L2 classroom is "an essential ingredient in improving students' comprehension" (p. 342). The impact that phonetics training has on L2 listening comprehension skills, however, has not received systematic attention in the literature. In addition, and perhaps because of this, textbooks and instructional techniques largely

ignore the relationship between phonetics and L2 listening comprehension. For example, Arteaga (2000) examined the phonetics content of ten first-year Spanish textbooks and found that the trend was to provide "minimal coverage" of phonetics and pronunciation. In addition, an examination of more advanced textbooks in L2 Spanish phonetics reveals that the written content and practice exercises focus primarily on the *articulation* of L2 speech sounds, with little or no practice on the *perception* (comprehension) of L2 speech (e.g., Torrejón, 2000; Schwegler & Kempff, 2007; Piñeros, 2008). Thus, L2 phonetics training, when used, is typically employed as an aid to pronunciation improvement, or foreign accent reduction, rather than the development of listening comprehension skills.

Previous research has nevertheless shown that listening comprehension and L2 pronunciation are related (e.g., Postovsky, 1974; Oyama, 1982). In addition, several researchers have examined the kinds of training techniques that are most effective in helping L2 learners perceive or produce particular L2 contrasts accurately (see Bradlow, 2008, for an overview). Much of this research, however, has focused on L2 listeners' ability to perceive a particular contrast in individual L2 words, rather than global listening comprehension of native L2 speech. There has also been a great deal of research on the intelligibility and comprehensibility of spoken speech, but most of it has focused on L2 speech as perceived by L1 listeners, rather than native speaker speech as perceived by L2 learners (e.g., Munro & Derwing, 1995; Derwing & Munro, 1997; see Munro, 2008, for an overview).

In one related area, Bent and Bradlow (2003) found that L2 learners comprehend the L2 speech of other learners of the same L1 more easily than that of a native speaker of the L2, a phenomenon known as the interlanguage speech intelligibility benefit (ISIB). Moreover, they also found evidence for a "mismatched interlanguage speech intelligibility benefit," whereby speakers from different L1 backgrounds who speak the same L2 also found each other more intelligible than native speakers of the L2 (but see Hongyan & van Heuven, 2007, for different results).

RESEARCH QUESTIONS

This paper contributes to the existing literature and attempts to fill a gap by examining the impact of phonetics training on the intelligibility and comprehensibility of native Andalusian Spanish speech as perceived by L2 learners. Andalusian Spanish is spoken in southern Spain, in the region of Andalusia, of which Seville is the capital city. For the purposes of this study, we employ the definition of intelligibility given by Smith and Rafiqzad (1979), who define it as the "capacity for understanding a word or words when spoken/read in the context of a sentence being spoken/read at natural speed" (p. 371). Second, we use Derwing and Munro's (1997) definition of comprehensibility, which they consider to be the listener's "*perception* of intelligibility" (p. 2). Given previous research findings, the following hypotheses guided this study:

1. L2 listeners with phonetics training will show greater improvement in the intelligibility of native Spanish speech than L2 listeners without training.

2. L2 listeners with phonetics training will show greater improvement in the comprehensibility of native Spanish speech than L2 listeners without training.

RESEARCH DESIGN

Subjects

The subjects were two groups of native English-speaking learners enrolled in third and fourth year Spanish courses at Le Moyne College. Because of the small student population at the College, we were unable to restrict our subject pool to one course. Thus, the subjects were enrolled in either SPN-201 (Intermediate Conversation and Composition), which is a third year bridge course between the lower and upper levels of instruction, or SPN-301 (Advanced Conversation). Twenty students initially participated in the study, and they were assigned randomly to one of two groups: experimental or control. The groups were balanced with respect to course enrollment and gender; however, four of the control group subjects failed to complete the post-test and therefore had to be eliminated from the analysis. None of the subjects had studied abroad, nor spent extended periods of time in a foreign country. In addition, none of the subjects reported having had an instructor from Spain.[1]

Materials and Procedure

The procedure involved a pre- and post-test for both L2 listener groups, with a six-week training session in between for the experimental group. The materials were the same for both the pre- and post-tests and consisted of 35 sentences--3 practice sentences and 32 test sentences--produced by four native Andalusian speakers from Seville, 2 male and 2 female. The sentences contained only common vocabulary items and grammar that most second-year students of Spanish would be expected to know. In addition, the sentences were created so as to elicit certain characteristics of the Andalusian dialect (see the Appendix A for the list of sentences used). The 32 test sentences were balanced so that the subjects heard eight different sentences produced by each of the four native speakers. In addition, the sentences were randomized so that the same speaker's voice did not appear twice in a row.

[1] Beyond this basic information provided by the subjects in a background questionnaire, we do not know the extent to which they may have been exposed to the Andalusian dialect, either inside or outside the classroom. The training was provided by the first author, who had spent a year in Seville, Spain, and thus provided the experimental group with additional exposure to characteristics of this dialect.

A response sheet was created, in which the first sixteen sentences of the test were in the form of fill-in-the-blank, similar to a cloze test, with blanks that targeted words featuring the phonetic aspects in question (see Appendix B for a sample portion of the response sheet). For the last sixteen sentences, no part of the sentence was given, and the listeners were asked to write out the sentences in standard orthography. In addition, the subjects were asked to rate each of the 32 sentences on a Likert scale of 1 to 7 based on how difficult the speaker was to understand (1=very difficult to understand, 7=very easy to understand).

For the pre-test, the experimental and control group subjects came together to a quiet room and were asked to listen carefully to each sentence and write down to the best of their ability either the missing words in standard orthography or the entire sentence, and then to rate the comprehensibility of each sentence according to the scale provided. The subjects were first given three practice sentences to transcribe and rate, and were then given an opportunity to ask any questions they had about the procedure. The experimenter then presented each of the 32 test sentences once and paused the recording until she saw that all subjects had finished writing. The session lasted approximately 25 minutes.

One week after the pre-test, the ten subjects in the experimental group returned to begin phonetics training. The training consisted of one thirty-minute session per week for six weeks. Most of the training occurred in Spanish, although English was used occasionally to clarify specific points. During week 1, the subjects were given an overview of Spanish articulatory phonetics and syllable division. In weeks 2- 6, they studied four salient pronunciation characteristics of the Andalusian dialect, as follows:

- Aspiration or deletion of syllable-final /s/: In many Spanish dialects, including Andalusian, an /s/ at the end of the syllable may be pronounced like an aspirated [h] or deleted altogether (e.g., *estás* (‘*you are*’): [ehtáh] or [etá]).

- Synalepha: Spanish exhibits linking or elision of vowels across word boundaries. This study focuses only on the linking of identical vowels across word boundaries, as in *la amiga* (‘*the friend’*) [lamiɣa]. This feature is found in all dialects of Spanish, but is one that native speakers of English struggle to acquire and was therefore included here.

- The presence of the interdental voiceless fricative phoneme, /θ/: In many dialects of Spain, orthographic ‘c’ (before /e, i/) and ‘z’ are pronounced as an interdental voiceless fricative (e.g., *cena, cita, zapato* [*dinner, date, shoe*, respectively]). In most Spanish dialects of the Americas, on the other hand, there is no /θ/, and these graphemes correspond to the alveolar voiceless fricative /s/. Thus, L2 learners are unaccustomed to hearing the /θ/ in Spanish unless exposed to dialects from Spain.

- Deletion of intervocalic or word-final /d/: (e.g., *tomado* (‘*taken’*): [tomáo], and *usted* (‘*you’*): [uhté]).

These characteristics were presented in Weeks 2 – 5 of training based on their average scores on the pre-test. That is, the aspect on which the subjects performed most poorly, synalepha, was taught first, followed by /s/ aspiration, words containing /θ/, and finally, /d/ deletion. At the beginning of each session a short review was given of the previous session. Next, the new phonetic characteristic was introduced and explained. Subjects listened to recordings of the characteristic in isolated words or phrases, and where applicable, the Andalusian pronunciation was contrasted with standard general American Spanish pronunciation. This was followed by both listening and pronunciation practice. The listening exercises progressed from isolated phrases and sentences to longer discourse chunks, often dialogues or interviews found on YouTube. All materials used during the training sessions were different from the sentences of the pre- and post-tests. Week six, the final week of training, was a review session covering all four phonetic aspects, and the post-test was administered one week after the last phonetics training session. As mentioned, the post-test was identical to the pre-test.

RESULTS

Intelligibility

The results presented here include only the first 16 sentences on the pre- and post-test, in which the subjects were asked to fill in blanks. Each target word was categorized by the target phonetic features it contained, and the subjects were given a point each time they correctly transcribed the word for the target feature. A Chi-square analysis was then performed for each phonetic feature to see if significant changes emerged over time for each subject group.[2]

Synalepha. As shown in Table 1 and Figure 1, the control group transcribed 3% (n=1) of synalepha occurrences correctly during the pre-test and 11% (n=4) correctly in the post-test. This difference is not statistically significant ($\chi^2_{(1)}$= .166, $p>.05$). The experimental group did not transcribe any instance of synalepha correctly during the pre-test and 20% (n=12) correctly during the post-test. This difference proved statistically significant ($\chi^2_{(1)}$= 10.191, $p<.01$). Thus, these results confirm the first hypothesis, which predicted that the experimental group would show greater improvements in intelligibility than the control group as a result of training.

[2]Intervocalic /d/ deletion was eliminated from the analysis, because it was not produced enough by the native speakers to provide useful data. /d/ deletion is variable and appears more frequently in informal speech. For the present experiment, however, the native speakers were asked to read sentences, and despite attempts to get them to produce them as naturally as possible, they did not produce all target features in every context in which they could potentially appear. The remaining discussion, therefore, does not include this feature.

Table 1. Pre- and post-test synalepha scores.

	Total Possible	**Pre-test** Scores	Percent Correct	**Post-test** Scores	Percent Correct	p-value
Control	36	1	3%	4	11%	.166
Experimental	60	0	0%	12	20%	.001*

*p<.05

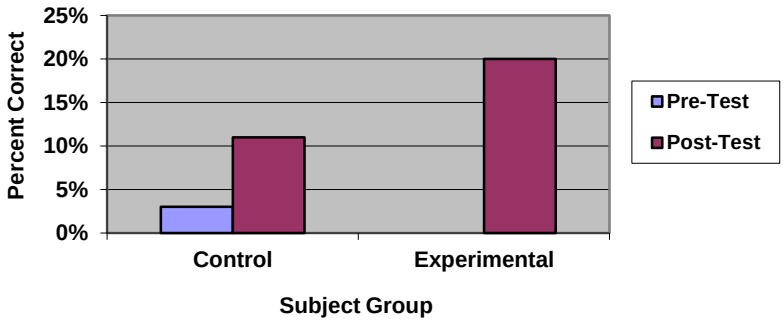

Figure 1: Pre- and post-test synalepha scores for control and experimental groups

***/s/ aspiration*.** As shown in Table 2 and Figure 2, the control group transcribed 15% of /s/ aspiration correctly during the pre-test and 25% correctly in the post-test. This difference is statistically significant ($\chi^2_{(1)}$= .449, $p<.05$). The experimental group transcribed 14% of /s/ aspiration correctly during the pre-test and 41% correctly during the post-test. This difference is also statistically significant ($\chi^2_{(1)}$= 30.749, $p<.001$). Thus, both groups showed improvement in the comprehension of words containing aspirated /s/, and therefore, seem to contradict the first hypothesis. The gains made by the experimental group do appear to show a trend toward greater improvement than the control group, however. A between-group analysis was therefore conducted to see if the observed differences between the two groups proved significant, but they did not, so the first hypothesis could not be confirmed on the basis of this data.

Table 2. Pre- and post-test /s/ aspiration scores.

	Total Possible	Pre-test Scores	% Correct	Post-test Scores	% Correct	p-value
Control	102	15	15%	26	25%	.015*
Experimental	170	23	14%	70	41%	.000*

*p<.05

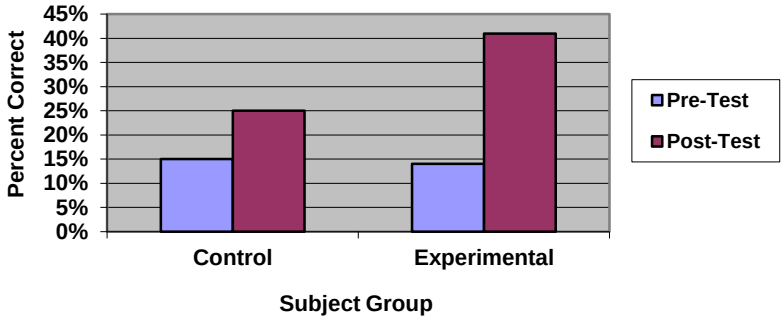

Figure 2. Pre- and post-test /s/ aspiration scores for control and experimental groups.

Words containing /θ/. As shown in Table 3 and Figure 3, the control group transcribed 44% of words containing /θ/ correctly during the pre-test and 39% correctly in the post-test. This difference is not statistically significant ($\chi^2_{(1)}$= .608, *p*>*.05*). The experimental group transcribed 47% of the words containing /θ/ correctly during the pre-test and 57% correctly during the post-test. This difference was not statistically significant ($\chi^2_{(1)}$= .666, *p*>.05) for the experimental group either, nor did the between-group analysis prove significant. Thus, these results also fail to confirm the first hypothesis. There appears to be a slight upward, positive, trend on the part of the experimental subjects, but no strong conclusions can be made on the basis of these results.[3]

[3] An anonymous reviewer wondered whether the trend indicating improvement in the comprehension of words containing /θ/ may have been due to the fact that this sound also appears in English. This may indeed be a contributing factor for the experimental group, who had been explicitly taught that the Spanish /θ/ is comparable to English, albeit with a different orthographic representation. It is important to note, however, that the mere presence of /θ/ in English does not appear to facilitate acquisition of this sound in L2 Spanish. After all, the control subjects did not show improvement, and overall comprehension by both groups is still somewhat low. The differing

Table 3. Pre- and post-test scores for words containing /θ/

	Total Possible	Pre-test Scores	% Correct	Post-test Scores	% Correct	p-value
Control	18	8	44%	7	39%	.435
Experimental	30	14	47%	17	57%	.414

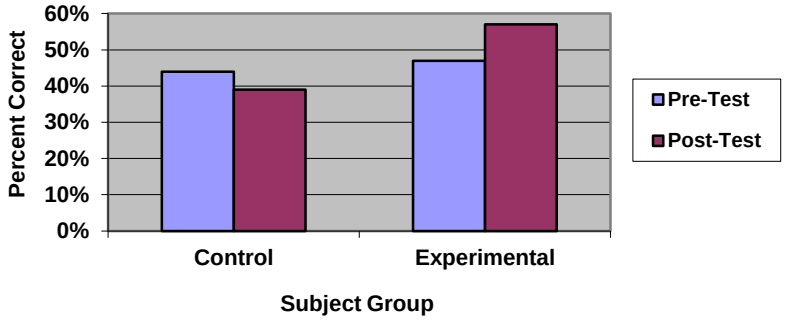

Figure 3. Pre- and post-test **/θ/** scores for control and experimental groups.

Comprehensibility

Recall that the comprehensibility ratings were based on a Likert scale of 1 to 7, where 1 was "very difficult to understand" and 7 was "very easy to understand." The subjects' ratings were analyzed for the interaction between the pre- and post-test vs. the control and experimental groups in a 2x2 Mixed Design Factorial Analysis of Variance (ANOVA). As shown in Table 4, the mean comprehensibility rating for the control group in the pre-test was 3.63 (*SD*=.44) and in the post-test was 4.03 (*SD*=.62). The mean rating for the experimental group in the pre-test was 3.23 (*SD*=.83) and in the post-test was 4.03 (*SD*=.58). The ANOVA thus showed no significant interaction between the pre and post-test and the control and experimental group. Moreover, the mean differences between the control and experimental groups were not significant. However, there was a significant difference in the average comprehensibility ratings between the pre-test and the post-test ($F(1,14)=13.60$, $p<.01$) when all subjects were grouped together. Overall, the mean comprehensibility rating for the pre-test was 3.38 (*SD*=.72) and for the post-test was 4.03 (*SD*=.57). In other words, although there was no significant difference between the control and

orthographic representations for /θ/ in the two languages seems to have an inhibitory effect for many English-speaking learners of Spanish.

experimental groups, both groups gave significantly higher comprehensibility ratings during the post-test than in the pre-test. These results, therefore, fail to support the second hypothesis, which predicted that the experimental group would show greater improvements over time in their comprehensibility ratings than the control group.

Table 4. Mean comprehensibility ratings based on a scale of 1 ("very difficult to understand") – 7 ("very easy to understand")

	Pre-test	Post-test
Control	3.63	4.03
Experimental	3.23	4.03
Both groups combined	**3.38**	**4.03**

DISCUSSION

To summarize, the results of this study reveal some support for the hypothesis that phonetics training improves the intelligibility of native Spanish speech for L2 learners. The synalepha results provide clear support for the hypothesis, in that the experimental group showed significantly better comprehension of sequences containing synalepha in the post-test than in the pre-test, whereas the control group did not. The results for /s/ aspiration and words containing /θ/ failed to support the first hypothesis, since both subject groups performed significantly better in the post-test with regard to /s/ aspiration, but neither group showed significant improvements with regard to words containing /θ/. In both cases, however, the results suggest a positive trend by the experimental group vis-à-vis the control group, but additional testing with larger subject groups would be needed to confirm this trend.

The results for /s/ aspiration were unexpected, in that the control group showed improved comprehension during the post-test. A surface overview of the transcription of the target words, however, indicates that the control group may have accurately transcribed more function words (such as the definite articles *los*, *las*) in the post-test than the pre-test. Thus, an interesting follow-up would to see whether or not significant differences emerge with respect to content words, as opposed to function words. In addition, since all subjects were enrolled in relatively advanced Spanish classes throughout the course of the experiment, it is possible that they all received some exposure to speakers that exhibit /s/ aspiration in their interactions with instructors, classmates, and other native speakers.

With regard to words containing /θ/, the lack of significantly improved comprehension over time by the experimental group may have been due to the fact that this was one of the last features taught and practiced; as a result, the subjects had less time to assimilate this characteristic. It is also interesting to note that the /θ/ was not produced consistently by the native speakers who read the sentences used in the tests; thus, there were fewer /θ/ tokens in the speech sample than expected. Many Andalusian dialects do not distinguish between /θ/ and /s/, unlike northern Spain; they have either just /s/ (the standard Andalusian variety) or just /θ/. However, because Seville is the capital of Andalusia and a larger city with greater contact with Madrid (where /θ/~/s/ distinction is the norm), many speakers from Seville also make the same distinction. Our informants reveal, however, that the distinction may not be a categorical phonemic one, but rather an instance of allophonic free variation, whereby either /θ/ or /s/ may appear in words that contain orthographic 'c' or 'z'.

As for the comprehensibility of native Spanish speech, the results here fail to confirm the hypothesis that the experimental group would show significantly higher comprehensibility ratings than the control group as a result of training. In fact, when grouped together, both groups as a whole gave significantly higher ratings in the post-test. As already mentioned, both subject groups were enrolled in Spanish courses throughout the time of the experiment; thus, it may be that all subjects simply became more comfortable over time with listening to Spanish speech as a result of their classes and coursework. It may also be that six half-hour training sessions is not enough to significantly impact listeners' confidence with respect to their ability to comprehend native speech. This topic therefore merits further investigation.

The inconsistency in the findings points to two primary limitations of this study. the small number of subjects and the variability of the phonetic features examined. Future research in this area, therefore, needs to recruit a larger number of subjects. In addition, more natural, less formal, speech samples may increase the appearance of certain phonetic features. Pre-determined sentences were used instead of unscripted speech in an attempt to ensure that numerous instances of the target features appeared in the test materials. However, that did not turn out to always be the case. An alternative might be to provide native speakers with pictures and ask them to narrate a story (Munro, 2008). Pictures would contain items or actions that would likely solicit the use of a word containing a particular phonetic feature.

CONCLUSION

To conclude, in spite of some inconsistent findings, the results of the current study do suggest that phonetics training can improve the intelligibility of native Spanish speech for English-speaking learners. Such findings have implications for the L2 classroom with regard to how listening skills are taught and lend support to those who argue that phonetics instruction should be integrated more effectively into the L2 curriculum. In addition, the knowledge gained from studies such as this one can be used to improve short-term training programs and orientations for study abroad students, as well as for organizations that send representatives abroad. Phonetics

training on the dialect to which individuals will be exposed may help them to integrate more quickly into the immersion environment and may lessen their overall anxiety. More systematic experimental research, however, is clearly needed.

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