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Daniel Olson

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Head of the Department Graduate Program   Date

THE EFFECT OF VISUAL FEEDBACK ON VOICE ONSET TIME

PRODUCTIONS BY L2 LEARNERS OF SPANISH

A Thesis

Submitted to the Faculty

of

Purdue University

by

Heather Michelle Offerman

In Partial Fulfillment of the

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of

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West Lafayette, Indiana

For my mother, who although is no longer with us, is with me spirit.

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ABSTRACT

Offerman, Heather Michelle. M.A., Purdue University, May 2014. The Effects of Visual Feedback on Voice Onset Time Productions by L2 Learners of Spanish. Major Professor: Daniel Olson.

Research suggests that pronunciation instruction should be developed and taught in the second language classroom (Derwing & Munro, 2005; Elliott, 1997; Simões, 1996) in order to facilitate intelligible and comprehensible utterances in the L2 (Derwing & Munro, 1997). Although accentedness does not always create intelligibility issues, it can be the catalyst to negative native speaker perceptions of second language learners' speech (Derwing & Munro, 2009). One distinctive marker of accent among native speakers of English and Spanish is the duration of aspiration values for the voiceless plosives /p/ /t/ /k/ (Lord, 2005). The present study proposes the use of visual feedback treatments to aid native speakers of American English in producing more target-like realizations of /p/ /t/ /k/ in Spanish. Generalizability between treatments was also measured in order to observe whether or not second language learners can apply their knowledge to non-focus phonemes, as well as from words in a carrier phrase to various, longer types of speech. Results conclude that the Experimental group improved significantly in each elicitation task from the Pre-test to the Post-test. Responses to an attitudes survey also determine that participants favor a combination of explicit instruction and visual feedback. This

study concludes that learners are able to generalize pronunciation knowledge of tokens in a carrier phrase to longer discourse, as well as from focus to non-focus phonemes.

CHAPTER 1. INTRODUCTION

1.1   Introduction & Goals of the Present Study

The role of pronunciation in the second language classroom has varied throughout the last century. Beginning with the Audio-lingual Method, an emphasis on pronunciation, memorization, and drills composed the majority of instruction (Saville-Troike, 1973). Due to the difficulty experienced by second language (L2) learners from this type of controlled, explicit learning method (Oxford, Lavine, & Crookall, 1989; (Saville-Troike, 1973), researchers then turned to focus exclusively on implicit teaching methods of a second language in many areas, including pronunciation (Isaacs, 2009).

As various forms of the Communicative Method began to surface, emphasizing meaning-focused communication activities (Oxford, Lavine, & Crookall, 1989), pronunciation teaching continued to receive very little attention in L2 instruction in many pedagogical implementations. In transition, Simões (1996) suggested that pronunciation be explicitly taught to adult L2 learners in order to facilitate successful learning and target-like acquisition of the L2. Derwing & Munro (2005) also proposed that not only is there a need for explicit pronunciation teaching to be developed, but also the development of research based approaches to teaching should be established for L2 pronunciation.

Although some aspects of pronunciation do not necessarily impede intelligibility and comprehensibility, an aspect such as accentedness, can cause the native listener to have certain perceptions of the non-native speaker (NNS) (Derwing & Munro, 2009). A feature that is often an obstacle for L2 learners of Spanish is the class of voiceless plosives, /p/ /t/ /k/ (Lord, 2005). While non-target like productions of these sounds do not necessarily cause intelligibility or comprehensibility issues, they are indicators of foreign accentedness to the native speaker (NS) (Lord, 2005). Aspiration duration values for voice-onset time (VOT) in English are substantially longer than in Spanish (Lisker & Abramson, 1964), and L1 transfer results in noticeably longer Spanish VOT values for English learners.

As researchers continue to investigate new methods of instruction for pronunciation, one method of particular interest is placed at the forefront, combining pronunciation instruction with technology. Visual feedback activities have begun to be integrated into the classroom in the last 30 years in efforts to aid learners in not only hearing their errors, but also helping students to visualize these errors, as well as NS productions, in order to produce more target-like pronunciation (Chun, 1989; deBot, 1983; Olson & Offerman, 2013; Saito, 2007). However, no studies have looked specifically at the voiceless plosives while implementing a visual feedback paradigm. Furthermore, many of the existing studies focusing on segmental features have typically only tested the target features in isolation (e.g. Saito, 2007), or isolated tokens and tokens within novel sentences (Olson & Offerman, 2013), somewhat ignoring the relevant issue of generalizability of target-like pronunciation into continuous and spontaneous speech.

First, the current study investigated the use of visual feedback in aiding L2 learners of Spanish to reduce their aspiration duration values in productions of /p/ /t/ /k/ in the L2. Visual feedback treatments were used in order to illustrate to participants differences in voice onset time (VOT) values in English as opposed to Spanish, through comparisons of spectrograms and sound waves. Second, the present study also sought to determine whether or not L2 learners were able to not only produce the target-like productions of /p/ /t/ /k/ in a carrier phrase and within novel sentences, but also in continuous controlled speech and spontaneous speech. As previous research has focused mainly on observing improvement of segmental features in isolated tokens (Olson & Offerman, 2013; Saito, 2007) and also contained within novel sentences (Olson & Offerman, 2013), it is of particular interest to determine whether or not L2 learners are able to generalize to continuous and spontaneous speech contexts. And finally, as Olson & Offerman (2013) found that L2 learners were able to generalize about related features of pronunciation after providing visual feedback in instruction, this study also investigated whether or not L2 learners will be able to generalize VOT values for /t/ and /k/ in Spanish after receiving visual feedback treatment of the closely related phoneme /p/.

It was also of interest to investigate whether or not L2 learners find visual feedback useful for their pronunciation learning. Following completion of the visual feedback tasks, that participants were given an attitudes survey in order to determine whether or not visual feedback treatments are seen as beneficial and useful to their pronunciation learning environment.

1.2   Outline of the Study

In Chapter 2, a detailed review of previous literature is provided concerning how pronunciation instruction has developed, how current methods approach pronunciation instruction, as well as visual feedback methods that have been studied in order to teach L2 pronunciation. This chapter will conclude with a discussion of the differences between Spanish and English VOT values in order to demonstrate the difficulties that L2 learners face in reducing aspiration values for the voiceless plosives. Chapter 2 will summarize the specific research questions and hypotheses concerning the treatments and their effects on the participants, generalizability of treatments, as well as attitudes toward visual feedback. Chapter 3 discusses the methodology used for the treatments carried out in the Experimental group and the Control group, how data was elicited, along with examples of tokens used in the treatments. Chapter 4 will then present the results of the collected data for both groups. Chapter 5 explains the methods and results found for the attitudes survey, which was executed after the study was completed.

In Chapter 6, the research questions and hypotheses will be revisited, along with a discussion of the results. This chapter will also provide the pedagogical implications of the study. In Chapter 7, conclusions and limitations of the study, as well as future directions for a possible further study will be discussed.

CHAPTER 2. REVIEW OF THE LITERATURE

This chapter details the various views on the issue of teaching pronunciation in the L2 classroom, and provides pertinent information concerning the research that has been carried out in order to advocate the integration of pronunciation activities in today's L2 classroom. This chapter also considers examples of current research that propose the use of technology, more specifically visual feedback, as a valuable component of teaching pronunciation.

Overall, the review of the literature exhibits the potential benefits of including L2 pronunciation in the L2 classroom, due to the importance of intelligibility, comprehensibility, and accentedness (Section 2.1). The lack of teacher training and materials (Section 2.2) call attention to the desired development of new materials and methods that are fundamental for pronunciation instruction. Current approaches to pronunciation instruction are then discussed (Section 2.3), as well as innovative and developing research which suggests that using technology as a means to teach pronunciation, such as visual feedback, may be beneficial to L2 learners in a classroom environment (Section 2.4). The proposal of visual feedback involving voice onset time (VOT) is then described (Section 2.5), along with the conclusion (Section 2.6) and the research questions (RQs) and hypotheses that are proposed (Section 2.7).

2.1 *Pronunciation: Intelligibility, Comprehensibility, & Accentedness*

As second language (L2) learners continue in their pronunciation development, they are faced with different issues of intelligibility, comprehensibility, and accented speech. The perceived foreign accents of second language learners (L2 learners) by native speakers (NSs) (Flege & Bohn, 1989; Flege, 2001; Piske, McKay,) has led to an argument that pronunciation is a viable part of intelligibility (Derwing & Munro, 1997; Derwing, Munro, & Wiebe, 1998; Munro & Derwing, 1999; Derwing & Munro, 2005; Derwing & Munro, 2009; Levis 2005; Levis & Grant, 2003; Derwing & Munro, 2009; Simões, 1996; Sturm, 2013; Strum, 2013b). Intelligibility is broadly defined as how understandable a non-native (NNS) utterance is to a native speaker (NS) listener (Derwing & Munro, 2005); in other words, an utterance that is produced by a NNS in which a NS listener is able to understand the whole of the message being communicated by the NNS is considered intelligible communication (Derwing & Munro, 1997; Derwing, Munro, & Wiebe, 1998; Munro & Derwing, 1999).

For example, in some cases, confusion can occur in situations such as the interchanging of sounds (found within minimal pairs), which can cause misinterpretation by the NS upon hearing the message that the NNS is attempting to convey. As an example, taken from Simões (1996), is if an NNS were to produce the word mesa ([me.sa]) 'table' with the intentions of actually producing misa ([mi.sa]) 'Catholic mass', confusion could arise between the interpretation of the NS and the NNS within the conversation. Zampini (1994) offers another example with the Spanish word todo 'all'([to.Do]), as pronounced by a NS of English, being heard as toro 'bull' ([to.ro]) by a NS of Spanish. Although context can be taken into consideration by the NS in order to

interpret what the L2 learner is trying to convey, if this mix up of sounds happens frequently, more confusion could arise within the interpretations of the NS.

As NNSs work toward the goal of producing intelligible utterances, they are challenged with producing utterances that are also easily comprehended by the NS listener. As defined by Derwing, Munro, Wiebe (1998), comprehensibility is the degree of ease or difficulty with which the NS listener can understand the utterances being produced by the NNS. Although there are different factors that go in to this concept of comprehensibility, such as the familiarization of different accents that are being produced by the NNS in the target language (Derwing & Munro, 1997), this does not discount the comprehensibility issues that can occur when NS listeners are familiar with the NNS accent. Researchers have often had NS listeners rate comprehensibility on a scale in order to demonstrate how easy or difficult it is for the NS to understand the L2 learner or NNS (Derwing, Munro, Wiebe; 1998).

This concept and definition of comprehensibility can also be applied to Simões's (1996) research on L2 learner fluency: conveying a message the NNS wishes to communicate in not only a syntactically sound and vocabulary rich manner, but with "fluency" containing target, or native-like, pronunciation. In other words, both intelligible and comprehensible pronunciation are key in communicating with the NS in order to express a clear thought or idea (intelligibility) in the L2 that is not overly difficult for the NS to understand (comprehensibility).

Morley (1996) claims that pronunciation is essential in providing "communicative competence" among L2 leaners in order to accurately and efficiently convey their thoughts and ideas to a NS (as cited in Gonzalez-Bueno, 2001, p. 135). Furthermore,

Agostinelli (2012) argues as well that errors made by L2 learners in pronunciation can at times create more communicative difficulties than morphosyntactic errors. Derwing and Munro (1999) found that the more accented NSs thought the NNS speech was, the lower the score for comprehensibility was given by the NS listener. Wong (1985) also argues that improper production of suprasegmentals, such as intonation, pitch, and stress, produced by L2 learners of English can create significant difficulty for the NS listener who is interpreting the utterance.

As the importance of maintaining intelligible and comprehensible communication throughout speech has been discussed as the primary goal, the aspect of accentedness should also be taken into account when looking at NNS speech. As defined by Derwing & Munro (2009), accentedness can be described as "how different a pattern of speech sounds to a local variety" (p. 478). Although accentedness does not always indicate degree of intelligibility or comprehensibility for a NS listener (Derwing & Munro, 1997; Derwing & Munro, 2009), it can bring with it different NS perceptions about the NNS, such as discrimination and other judgments (Derwing & Munro, 2009).

Other recent research has also suggested that accented speech can be related to NSs' perceived, negative thoughts about NNSs (Gluszek & Dovidio, 2010; Kim, Wang, Deng, Alvarez, & Li, 2011; Munro, Derwing & Sato, 2006; Purkiss, Perrewé, Gillespie, Mayes, & Ferris, 2006). Munro, Derwing and Sato (2006) elaborate on this topic stating that often an NNS accent causes an NS to determine that that the NNS is ignorant in their L2. Gluszek & Dovidio (2010) expand on this concept explaining that NSs will determine that an NNS is not to be considered fluent in the target language, despite NNSs' use of correct syntax or grammar, if a foreign accent is detected.

Therefore, the topic of accentedness is indispensable when examining aspects of pronunciation, specifically in that an accent can incur negative thoughts or certain assumptions about the NNS and should not be overlooked. In addition to negative attitudes that form due to NNS accented speech, misinterpretations and miscommunication can also occur simply within foreign-accented speech (Derwing & Munro, 2009). Therefore, it is crucial to take accentedness into consideration for not only discrimination and negative attitudes of NSs, but also the possibility of miscommunication that can arise. In sum, while the literature has shown that intelligibility and comprehensibility are key throughout NS and NNS dialogue, and the degree of accentedness that a NNS holds is also pertinent to interlocutors due to negative and discriminatory perceptions that may be held by NSs.

While it is deemed important that NNS speech should be intelligible and comprehensible to the NS listener, this does not always indicate that the accented speech is easily comprehensible to the NS. In reviewing these factors, it can then be stated that pronunciation instruction is essential in aiding NNS to achieve not only intelligible, but also comprehensible speech. As the recognized importance of intelligible, comprehensible, and even less accented speech has been discussed, the views on pronunciation instruction held by L2 learners will be investigated in the following subsection:

2.1.1   L2 Learner Desire for Pronunciation Instruction

While some researchers have shown that is it possible to achieve native-like pronunciation in adult L2 speech (Abrahammson & Hyltenstam, 2008; Birdsong & Molis,

2001; Birdsong, 2007; Diaz-Campos, 2004), it is has been stated in past research that after the age of puberty, or after the critical period, many L2 learners will more than likely never achieve native-like speech (Castino, 1996; Elliott, 2003; Flege, 1981; Flege, 1991; Hurtado & Estrada, 2010; Levis 2005). Despite this common belief that native-like pronunciation acquisition of the L2 during adulthood is not likely, there is a growing desire among students to learn pronunciation techniques (Elliott, 2007) and to obtain more target-like pronunciation (Derwing & Munro, 2009) to improve intelligibility, comprehensibility, and also accentedness.

Levis and Grant (2003) also state that many L2 learners feel that pronunciation is crucial to their speaking skills and are eager to receive pronunciation instruction. Therefore, even if it remains the case that native-like speech and pronunciation may ultimately be unattainable for L2 learners, this should not discount the fact that L2 learners have a desire to improve their pronunciation.

One major component of this motivation to improve pronunciation is that NNSs often feel less comfortable speaking with NSs, fearing that their speech may be unintelligible to the NS (Zielinski, 2012). This may sometimes cause NNSs to shy away from speaking with NSs, especially at their earlier stages of L2 development (Zielinski, 2012), resulting in a lack of language use. There are several elements that can be attributed to the lack of confidence L2 learners have in regards to their pronunciation skills. First, many L2 learners do not want to be identified as being foreign due to their accent (Levis, 2005). Second, these learners also sometimes feel that they may be categorized and judged according to their foreign accent (Kissling, 2013). Finally, L2 learners are at times discriminated against due to their accented speech (Derwing &

Munro, 2009). These factors combined influence the L2 learner's ability and willingness to speak the L2 in the presence of an NS, and subsequently serves to increase motivation to learn target-like pronunciation.

For many years, it has been expected that L2 leaners would implicitly learn and acquire the necessary pronunciation skills in order to produce intelligible speech, especially in methods such as Krashen's Monitor Theory (VanPatten & Williams, 2007). As Arteaga (2000) and Isaacs (2009) note in regards to this type of implicit learning, it is assumed that the more input that is received, typically students will become more willing to produce an increased amount output. However, if the student never actually reaches a point at which they feel comfortable producing output, or if the student only produces very little output, it could be argued that acquisition of pronunciation may never occur in this learning situation.

As accentedness does not only affect intelligibility and comprehensibility to some degree, it also accounts for NNSs' thoughts about their own production and NSs perceptions of NNS speech. Therefore, pronunciation instruction can be claimed as necessary for the L2 learner. Several components to pronunciation instruction may prove to be potentially useful, which will be discussed in the following section.

2.2   Lack of Pronunciation Instruction

The current section reviews literature pertaining to the role of pronunciation in the L2 classroom. The first topic of discussion is the evolution of pronunciation implementations over the last several decades within different teaching methodologies. Second, lack of teacher training as a result of some current methods is investigated, as

well as the lack of appropriate materials for L2 pronunciation teaching. Finally, a review of how current pronunciation methods and materials are integrated into some L2 classrooms is presented. It is then concluded from these findings that there is a need for research-based teaching methodologies for pronunciation.

2.2.1   Broad Approaches to L2 Instruction

From the early 1940s through the late 1960s, a very popular method of instruction called the Audio-lingual Method was prevalent among most L2 classrooms, and also thought to be most effective by many teachers at the time (Isaacs, 2009). This method primarily focused on listening and speaking skills (Saville-Troike, 1973)   and   ignoring reading and writing practices, drawing on the notion that language was a completely mental phenomenon (Saville-Troike, 1973). This form-oriented, oral communication-heavy theory, specifically focused on sounding native-like rather than focusing on meaning, resulted in little success in providing L2 learners with actual language knowledge (Oxford, Lavine, & Crookall, 1989; Saville-Troike, 1973). In reaction, many theorists and teachers have now considered aspects such as pronunciation to be a much less important construct in L2 learning; therefore, they spent little time teaching it or have completely disregarded it in current teaching practices (Isaacs, 2009).

Following the Audio-lingual method, the Communicative Approach has slowly gained a place of preference in the L2 classroom (Oxford, Lavine, & Crookall, 1989). As stated by Oxford, Lavine, & Crookall (1989), "The Communicative Approach implicitly encourages learners to take responsibility of their own learning and to use a wide range of language learning strategies" (p. 29). They explain that this approach has learners use the

language in a way in which they experiment communicatively with the language and involve themselves in activities in which active communication is the main objective of the exercises. Oxford, Lavien, & Crookall (1989) also explain that the Communicative Approach focuses on "meaning, context and authentic language" (p. 34), while also implementing the "four skill areas" (p. 30) of speaking, listening, reading and writing.

When speaking of meaning, context, and authentic language, this means that students are to focus on relaying and interpreting communication in either "authentic contexts" or "nearly authentic contexts (Oxford, Lavine, & Crookall, 1989)". In sum, the main goal of the Communicative Approach is to create an environment in which the L2 learner is primarily focused on relaying information to the NS listener in a manner in which the NS is able to understand the information being spoken by the L2 learner.

Although the Communicative Approach has become the favored method of instruction throughout L2 classrooms today, research suggests that the majority of pedagogical interpretations of the Communicative Approach give little attention to pronunciation teaching (Arteaga, 2000; Derwing & Munro, 2005; Elliott, 1995; Elliott, 1997; Isaacs, 2009; Lord, 2005; Saalfeld, 2011; Saito, 2011; Saito, 2013; Simões, 1996). Elliott (1997), for example, explains how pronunciation has been set aside as mere "linguistic competence" rather than "communicative competence" in more recent methods of instruction. In other words, learning about pronunciation is too detailed and may be too advanced for L2 learners, and they are taught mainly to focus on communicating an idea by using as much implicitly acquired knowledge as possible. However, he maintains that pronunciation is vital to L2 speech and should not be set aside. As mentioned previously, avoiding pronunciation instruction can impact not only

intelligible, but also comprehensible communication, as well as potentially negative judgments that are associated with accentedness.

With pronunciation being somewhat disregarded in recent teaching methods, teachers are then faced with attempting to teach pronunciation with limited or no training.

2.2.2   *Lack of Teacher Training*

Many teachers receive little to no pronunciation training and are therefore looking for more ways to implement this kind of training into the classroom (Levis, 2007). Isaacs (2009) also agrees that there is a lack of teacher training, stating that teachers lack the skills necessary to fuse pronunciation techniques with current teaching practices that result in inconsistent pronunciation teaching and guidance for the students.

As Derwing & Munro (2005) make the case for the importance of a research-based approach to pronunciation instruction, they acknowledge the fact that many teachers today are not well equipped with the skills to implement a fortified and structured method. They, as well as Levis (2005), add that many teachers often times rely on their own intuitions when it is required of them to actually explain pronunciation techniques. Mere reliance on intuitions is not sufficient enough to provide quality pronunciation instruction to L2 learners (Derwing, Munro, & Wiebe, 1998).

Levis and Grant (2003) also state that even the teachers who desire to implement pronunciation activities into their curriculum feel that they are unprepared for finding ways to incorporate pronunciation into their daily listening and oral activities. They go on to state that these teachers either may devote too much time to pronunciation without

incorporating other features of the language, or they tend to only rely on listening and oral activities that do not involve pronunciation learning.

Another issue that arises for teachers is found in the textbooks provided for the classes they teach, which teachers often rely on to guide them through class activities.

2.2.3 Textbook Approaches to Pronunciation

As textbooks are often the focal point for teaching practices and activities done in class (Thomson & Derwing, 2004), research suggests that the design of textbooks should be carefully examined and re-evaluated, as they have not been found to provide sufficient pronunciation materials (Arteaga, 2000; Derwing, Diepenbroek, & Foote, 2012; Ellis, 1997; Thomson & Derwing, 2004). More specifically, recent research has called attention to the lack of pronunciation activities within textbooks used in different second and foreign language contexts (Arteaga, 2000; Derwing, Diepenbroek, Foote, 2012; Levis, 1999; Rossiter, Derwing, Manimtim, & Thomson, 2010). Levis and Grant (2003), for example, state that textbooks that are communication focused often tend to exclude any type of explicit instruction of pronunciation.

In the extant textbooks that do contain some degree of focus on pronunciation, the information and activities presented are often lacking in accuracy and complexity (e.g. for intonation see Levis, 1999). With respect to Spanish, Arteaga (2000) in her review of ten popular textbooks, finds that there are many inconsistencies and inaccuracies regarding various phonemes and dialectal differences. These findings have been repeated in a number of different languages, such as French and English (Arteaga, 2000), and these inaccuracies in pronunciation materials are especially problematic given that not

only is the textbook a source for the student, but it also provides teachers with an instructional guide.

In summary, there is a call for concrete ways for teachers to implement pronunciation practices and activities into the classroom. These types of pronunciation practices ought to be research-based, in order to have clear and goal-oriented principles which can be easily followed by the teachers. The next section addresses the current methods for pronunciation that have been carried out in efforts to create more structured approaches, helping L2 learners acquire more target-like pronunciation.

2.3   Current Pronunciation Instruction Practices and Methods

The current section discusses different methods in which recent researchers have incorporated or suggested the incorporation of pronunciation instruction into the L2 classroom. Explicit-only instruction methods are presented first, concluding this section with a proposal for the use of a visual feedback paradigm to be integrated into pronunciation teaching techniques. This paradigm is suggested in efforts to aid learners in not only perceiving, but also being able to visualize pronunciation errors.

2.3.1   Current Pronunciation Practices in the L2 Classroom

As mentioned in the previous section, many teachers that use the Communicative Method as a basis for instruction are often not adequately prepared to teach pronunciation explicitly or implicitly, and tend to implement pronunciation in a somewhat random and disorganized manner (Levis, 1999; Levis & Grant, 2003). Gonzalez-Bueno (2001; 1997)

recognizes the fact that there is a necessity for pronunciation instruction within the classroom, focusing on aiding students in their productions. Saito (2012) advocates for pronunciation instruction as well, finding that L2 learners' speech was rated as more comprehensible after receiving training and taking part in pronunciation activities. Therefore, there is still a need for an effective and organized implementation of pronunciation instruction in the L2 classroom. Despite either the minimal emphasis put on pronunciation or the complete lack of pronunciation instruction, recent research has been conducted in efforts to implement pronunciation into the classroom

Within this framework, one of the well-studied areas has been the use of articulatory pronunciation instruction, focused on learning parts and shapes of the vocal apparatus (Derwing, Munro, & Wiebe, 1997; Elliott, 1997; Lord, 2005; Saito, 2012; Saito, 2013; Sturm, 2013). As a recent example, Saito (2013) examined the effect of native speaker modeling coupled with instruction on points of articulation and how to produce phonemes more native-like, by way of instruction on shaping of the mouth. Elliott (1997), Lord (2005), and Sturm (2013) also implement similar types of explicit pronunciation instruction. Elliott (1997) provides L2 learners with explicit instruction for accent reduction in Spanish, primarily in focusing on allophones of various phonemes. He did so by explaining to students the phonemic descriptions (i.e. place & manner of articulation) of Spanish phonemes as opposed to their English allophones. Lord (2005) carried out similar instructional methods for differences between English and Spanish by providing her students with explanations of features, like place, manner, and articulation, through different textbooks dealing with phonetics.

Sturm (2013) also carried out procedures such as Elliott (1997) and Lord (2005) by utilizing activities that focused on place, manner, and articulation, while also focusing on learning the different parts of the vocal apparatus in order to become more familiar with how to produce specific sounds in French. In sum, these particular studies focused on teaching students the various ways to identify how to articulate different phonemes that contrast between their native language and their L2. In each study, the researchers found that their students had improved significantly after receiving pronunciation instruction.

With respect to educational context, which many authors have hypothesized may impact pronunciation acquisition, research has demonstrated that students can significantly improve their pronunciation skills during a study abroad (SA) experience (Diaz-Campos, 2004; Diaz-Campos and Lazar, 2003; Lord, 2010; Simões, 1996). For example, Simões (1996) concluded that SA was overall helpful to the acquisition of more native-like pronunciation. In the study done by Diaz-Campos (2004), he concluded that both SA and at home (AH) programs were beneficial to pronunciation improvement, but that neither program was superior to the other. Lord (2010) concludes that there are immense gains and benefits to students who participate in an SA program, as well as an AH course prior to SA. What can also be concluded from this is the fact that the students who had received specific pronunciation instruction in turn outperformed those who had not received phonetic instruction before even having participated in the SA program (Lord, 2010). It can be determined that SA programs are indeed beneficial, but AH programs can have the potential to be equally beneficial. As SA may be highly beneficial to L2 learners' acquisition of more native-like pronunciation, not all students are able to

participate in SA programs, as emphasized by Simões (1996); there needs to be an alternative for those students. As such, pronunciation instruction techniques are beneficial to L2 learners who are not able to study abroad, as well as greatly benefiting L2 learners prior to participation in an SA program.

While the pronunciation-focused activities aforementioned prove to be beneficial, there could arise the question of whether or not this type of instruction works for all L2 learners. The ability to provide a type of immediate visual aid, displaying learner errors and target productions, to L2 learners poses to be a sufficient and efficient type of feedback for pronunciation.

2.4   Technology in the L2 Classroom

It has been suggested in research findings throughout the last 30 years that there are practical ways in which technology can be integrated into the classroom as means through which L2 learners can improve their pronunciation (Chun, 1989; Chun, 1998; Chun, 2002; Chun, 2007; Dalby & Kewley-Port, 1999; deBot & Mailfert, 1982; deBot, 1983; Hardison, 2004; Levis, 2007; Lord, 2008; Motohashi-Saigo & Hardison, 2009; Olson & Offerman, 2013; Olson, In press; Saito, 2007; Wang & Munro, 2004; Weltens & deBot, 1984), although there have been several others that have claimed that the use of technology in today's L2 learning context is overcomplicated for L2 learners (Derwing & Munro, 2005; Eskenazi, 2009). In the following subsections, several studies will be reviewed describing the ways in which these researchers have implemented technology into L2 pronunciation research and into the classroom setting. These studies in the

following subsection will be focusing predominately on visual feedback. In addition, concerns about the usability of such technology are addressed.

2.4.1   *Visual Feedback*

Some of the first studies that included visual feedback focused primarily on suprasegmental features (Chun, 1989; Chun, 1998; deBot & Mailfert, 1982; deBot, 1983; Hardison, 2004; Weltens & deBot, 1984). In one of the earliest visual feedback studies, deBot & Mailfert (1982) found the L2 learners were able to significantly improve intonation after receiving visual feedback involving different pitch ranges of NSs being displayed on a screen for NNSs.

deBot (1983) further investigated this type of visual feedback by utilizing a type of software to detect L2 learner intonation and demonstrated that visual feedback is beneficial to L2 learners' learning of pronunciation. L2 learners were shown their own intonation contours and as well as intonation contours of a NS. This visual feedback provided them also with the ability to attempt to match their productions to that of a NS, after comparing their own contours to NS productions. This is significant for pronunciation instruction in that it creates a way in which leaners can see their degree of accuracy in their productions, as opposed to subjectively and solely relying on what they hear. Hardison (2004) also maintains that L2 learners of French using pitch contour displays are able to not only improve prosodic features, but that they are also able to generalize novel stimuli to novel sentences. In other words, students are able to apply these learned pronunciation techniques from shorter utterances to long ones.

Chun (1989) compiled a review of different methods of providing visual feedback in the classroom, in which she found that the use of computers was most efficient in aiding L2 learners' pronunciation with visual feedback, much like deBot (1983), focusing more specifically on intensity and pitch. It is also later argued that the ability to visualize pitch not only aids L2 learners in being able to produce more target like utterances, but that also in terms of discourse when producing correct stress for question and answer utterances (Chun, 1998).

However, it would seem beneficial to also use a type of program that provides multi-faceted visual feedback, addressing both segmental and suprasegmental features, for classroom implementation of pronunciation. As students do struggle with suprasegmental features (Levis, 1999), it seems helpful to also provide visual instructional methods for segmental features in efforts to create a balance of different pronunciation features being covered. Chun (2002) proposes visual feedback through observing the different features contained on a spectrogram concerning minimal pairs for vowel differentiation. For distinguishing between segments, this type of visual feedback could be most beneficial.

A very small number of studies continue this use of visual feedback in the classroom by instructing students on various segmental features (Motohashi-Saigo & Hardison, 2009; Olson & Offerman, 2013; Saito, 2007; Wang & Munro, 2004). Motohashi-Saigo & Hardison (2009) found that students were able to significantly improve their productions of Japanese geminates after having visual feedback involving the use of sound waves to distinguish between the geminates and singleton productions. They state that "visual cues are a valuable source of input in L2 learning" (p.42), after

finding that visual feedback was beneficial to their L2 learners (Motohashi-Saigo & Hardison, 2009).

Praat (Boersma & Weenink, 2006) has been suggested as the favored tool for visual feedback instruction of segmentals, due to its display capabilities of features for vowels and consonants (Olson & Offerman, 2013; Saito, 2007). Saito (2007) found that his students made great improvement after visual feedback treatment that was provided by Praat for distinguishing between English and Japanese vowels, after looking at spectrograms of NS productions for the treatment.

Olson & Offerman (2013) provide an expansion on the work done by Saito (2007), by creating a type of visual feedback, having L2 learners focusing on different Spanish allophones to avoid accentedness. Students were able to examine spectrograms of their own productions as well as those produced by NSs. As students were able to visualize both their and the NSs' productions, they were able to make comparisons about differences that existed between target-like and non-target-like pronunciation (Olson & Offerman, 2013; Saito, 2007).

In both of the previously mentioned studies, students were shown spectrograms of NS productions containing productions of the target phonemes in order to aid learners to better grasp certain errors made in their L2. Overall, the experimental groups outperformed the control groups significantly in both instances (Olson & Offerman, 2013; Saito, 2007), further supporting that the use of visual feedback is beneficial to L2 pronunciation learning. This also supports the idea that visual feedback is accessible not only on the suprasegmental level, but also the segmental level.

In conclusion, it can be proposed that visual feedback is an exemplary tool and aid in the instruction of L2 pronunciation. If learners are not able to hear or perceive their own mispronunciations on their own (see Dlaska & Krekler, 2008), then a paradigm such as visual feedback would present itself as a way in which L2 learners can now visually identify their errors and possibly make more efforts to correct themselves.

2.4.2   *Student Attitudes towards Technology Use in the L2 Classroom*

As visual feedback has been shown to be a beneficial means through which to teach L2 learners pronunciation, the attitudes of these L2 learners towards visual feedback should be taken into consideration. The investigation of this topic is worthwhile, as it has been claimed that the use of technology can be overly complicated or overwhelming for learners (Derwing & Munro, 2005; Eskenazi, 2009). While this type of pronunciation instruction has been found to help L2 learners improve significantly (e.g. Olson & Offerman, 2013; Saito, 2007), it is important to recognize whether or not the L2 learners find visual feedback to be beneficial to their own learning as well as an optimal tool to learn L2 pronunciation.

Several authors have also looked at using technology in the classroom finding that it is not overly complicated, such as the use of technology in a general sense (Thorne & Payne, 2005), through Podcasting (Lord, 2008), through audio-visual aid (Sundquist, 2010), and also through the use of Praat for visual feedback (Olson, In press). It is also proposed that technology is not only beneficial in the classroom, but that students tend to have positive thoughts about the use of technology for different classroom learning activities (Lord, 2008).

Thorne & Payne (2005) mention that technology being used within the everyday life of many L2 learners may cause them to be more inclined to want to use technology in the classroom. Sundquist (2010) also states that students who are increasingly exposed to and familiar with using various types of technology will more than likely have little to no issue in using technology in an L2 learning situation.

Therefore, these studies promote the use of technology among the younger generations entering into the current L2 classroom. This supports the case that because of their exposure to technology earlier in life, they are not intimidated or overwhelmed by the possibility of using technology in a learning environment. It can then be assumed that technology will generally be well accepted among students in the L2 classroom; however, this is something that still needs to be quantified.

In the current section, overviews of various technological instruction methods that have been used, as well as the attitudes of the students regarding ease of usability in current technology usage in the classroom have been summarized. As minimal studies have focused on implementing a visual feedback paradigm for teaching segmentals (Motohashi-Saigo & Hardison, 2009; Olson & Offerman, 2013; Saito, 2007), instruction of voice onset time (segmental feature) using visual feedback for L2 learners of Spanish has yet to be investigated.

2.5   *Voice Onset Time (VOT)*

As the current study focuses on the feature of voice onset time (VOT), it is relevant to discuss VOT norms in English and Spanish, and the issues that L2 English learners of Spanish experience. As Lord (2005) points out, there is an obvious and

remarkable difference between Spanish and English when looking at VOT. Lord (2005) adds, "While these pronunciations [VOT] are unlikely to cause confusion in meaning, they can result in a notable foreign accent" (p. 559). With recognizing the negative attitudes that can be attributed to NNSs when a foreign accent is identified (Gluszek & Dovidio, 2010; Kim, Wang, Deng, Alvarez, & Li, 2011; Munro, Derwing & Sato, 2006; Purkiss, Perrewé, Gillespie, Mayes, & Ferris, 2006), VOT has been selected as the focus of the study in order to reduce accentedness in producing the target L2 (Spanish).

Diaz-Campos and Lazar (2003) defines voice onset time (VOT) as "the beginning of vocal cord vibration following the release of closure." In other words, once a closure of the mouth is released after producing a consonantal sound, the vocal cords begin vibrating, typically in producing a vowel, in which the time of voicing begins. Whalen, Levitt, and Goldstein (2007) describes this phenomena as being a releasing of the plosive before the actual onset of the voicing, or vowel, to be considered as "positive" VOT, which then indicates aspiration prior to the onset of voicing.

2.5.1   *VOT in NSs of English & Spanish, and L2 Learners of Spanish*

VOT values, or durations, are considered to be short-lag in Spanish (Hualde, 2011; Diaz-Campos, 2003; Gonzalez Lopez & Counselman, In press), and there is very little aspiration that precedes the onset of a vowel. The phonemes /p/ /t/ /k/ are produced with minimal or no aspiration, whereas allophones of these phonemes produced by NS of American English are typically produced with a greater amount of aspiration in the onset position (Lisker & Abramson, 1964; Flege, 1991; Gonzalez-Bueno, 1997) and are represented as $[p^h]$ $[t^h]$ $[k^h]$ (Hualde, 2011). Lisker & Abramson's seminal (1964) study

states that averages for aspiration duration in the onset posisiton in Spanish are as follows: /p/ = 4ms; /t/ = 9ms; /k/ = 29ms. Values for aspiration duration in American English, according to Lisker & Abramson (1964), were reported as: /p/ = 58ms; /t/ = 70ms; /k/ = 80ms. Therefore, it can be concluded that values for /p/ /t/ /k/ among NSs of English have noticeably different pre-aspiration time values than those produced among NSs of Spanish. For the current study, the previous measurements for aspiration time in Spanish (Lisker & Abramson, 1964) were used as a basis for comparison to the Spanish productions of NSs of American English.

The following table (Yavas, 2007) serves as a visual example for the differences between VOT for /p/ in Spanish as opposed to English.

Table 1

Spanish and English VOT Differences

Plosive Type	Stop	Vowel	Language
Voiceless Unaspirated	_____/	vvvvvvvvvv	/pa/ Spanish
Voiceless Asipirated	_____	____/vvvvv	/pa/ English
	/p/	/a/	

It must also be noted that little research that has been done on the effect of explicit pronunciation on the Spanish voiceless plosives among L2 learners in the intermediate stages (Gonzalez Lopez & Counselman, In press). This production of Spanish voiceless plosives can prove to be difficult for L2 learners whose native language is English, because these L2 learners contain similar phones or variants of the Spanish phones, which are not always as easily distinguished by adult, NSs of English learning Spanish (Diaz-Capmos & Lazar, 2003).

2.6   Conclusion

As has been reviewed in the previous literature, the case has been made that pronunciation is valuable in looking at intelligibility and comprehensibility among NNSs, as well as accentedness due NSs' perceptions and judgments of foreign accents. It has also been shown that while the Communicative Approach has benefited students in creating a classroom atmosphere in which communication and meaning are the main goal of learning an L2, many implementations of this approach may be somewhat lacking in the area of pronunciation.

One method of instruction that has been of particular interest has been that of visual feedback, which is used so that students are able to not only hear, but also see their errors in pronunciation and are able to compare their productions to NS productions. A newer type of visual feedback consists of the use of the program Praat, which contains multiple features in which students can visualize their productions in the form of sound waves, spectrograms, voicing, fundamental frequency, and formants.

Finally, a noticeable marker of foreign accent among English L2 learners of Spanish is the production of [pʰ] [tʰ] [kʰ] vs. the Spanish productions /p/ /t/ /k/ in regards to VOT. While there has been a considerable amount of research done on VOT and how it relates to learners, not much research has been provided on the instruction of the differences in VOT values in Spanish vs. English for intermediate English L2 learners of Spanish. Therefore, the research being proposed is the use of Praat in the classroom as a form of providing visual feedback to intermediate L2 learners of Spanish in looking at the voiceless plosives /p/ /t/ /k/ and their VOT values in English versus Spanish.

2.7 Research Questions & Hypotheses

Drawing on the previous research, this study investigates the use of visual feedback as a method of L2 pronunciation instruction for the segmental feature of VOT. Broadly, this work examines the effectiveness of the proposed pedagogical activity, the generalizability of such instruction, both from tokens within a carrier phrase to longer strings of speech and from focus phonemes to non-focus phonemes, and student attitudes towards this activity.

As visual feedback has been shown as beneficial when looking at suprasegmental features (e.g., deBot, 1983) and somewhat for segmental features (e.g. Saito, 2007), the current study seeks expand on the previous research in looking at another segmental feature, VOT. The VOT feature has been selected in due to the noticeable differences that exist between the voiceless plosives produced by NSs of English and NSs of Spanish. This is a feature that L2 learners of Spanish tend to have difficulty with, which is also an identifier of accentedness in Spanish (Lord, 2005). Specifically, this study seeks to investigate the following research question: (RQ1) Can this use of visual feedback in the classroom be used in looking at VOT, specifically in looking at voiceless plosives to help participants achieve a more native-like productions, in decreasing the aspiration of their productions of /p/ /t/ /k/ in tokens embedded in a carrier phrase?

Hypothesis 1: Participants will benefit from having visual feedback in improving their productions of /p/ /t/ /k/ in a more native-like, demonstrating significantly shorter asipiration durations following the implementation of the visual feedback paradigm.

While several studies have looked at pronunciation gains for words in isolation (Olson & Offerman, 2013; Saito, 2007) or embedded in novel sentences (Olson & Offerman, 2013), it is proposed that additional pronunciation environments, such as a short reading (i.e. Lord's (2008) podcasting study), could have been used as another measure of generalizability for student. Therefore, the following research question addresses this gap: (RQ2) Will this knowledge be transferred from token elicitations into sentence, continuous speech (i.e. short story/ paragraph), and spontaneous speech environments?

Hypothesis 2: Participants will improve in all sections; however, it is likely that participants will improve most in the token elicitations, somewhat in the novel sentences, and that they will improve little in the continuous speech and spontaneous speech environments.

While Olson and Offerman (2013) showed some effects of generalizability of training on related phonemes (i.e. gains on /b/ when training /d/), their findings were somewhat inconclusive. Specifically, given the more intuitive nature of the duration contrast (i.e. more obvious to students), it is possible that the VOT context could reap better gains in generalizability. The third research question is then proposed: RQ3) Will participants be able to generalize their knowledge of aspiration reduction of /p/ in Phase 1 after the first treatment to /t/ and /k/, before /t/ and /k/ become the focus of treatment in Phase 2 and Phase 3?

Hypothesis 3: Participants will be able to generalize aspiration reduction by decreasing aspiration values for not only /p/, but also /t/ and /k/ after the first treatment carried out for /p/ in Phase 1.

Finally, in recent research (Olson, in press) the use of visual feedback was seen to be useful and not overly complicated for students to use in the classroom. However, it was not determined whether or not students found the visual feedback treatments useful to their own learning. The final research question then asks: (RQ4) Will this practice, the use of visual feedback in the classroom to improve pronunciation, be seen as useful and beneficial by the participants?

Hypothesis 4: Participants will find that Praat is easy for them to use and that it is a beneficial and useful tool in helping them to learn. This will be identified through a language attitudes survey.

The following chapter will discuss the methods carried out to investigate RQs 1-3 and their respective Hypotheses, with results to be shown in Chapter 4. Chapter 5 will describe the methods used concerning RQ4, along with presenting results in regards to RQ4 as well.

CHAPTER 3. METHODS

The following chapter provides a detailed account of the background of the participants, how the data were collected, and the tasks carried out in order to collect the data.

3.1   Participants

The participants in this study consist of two groups of undergraduate participants at a midwestern university[1]. Participants were recruited through two courses taught by the researcher in the fall of 2013. Following the exclusionary criteria described below, the Control group consisted of 7 participants, and the Experimental group is comprised of 17 participants. Participants were between the ages of 18 and 23, with a mean age of 20 (SD = 1.54 years). Both groups were in their fourth semester of Spanish, which is equal to the 202 level (highest intermediate level). Their level was also determined by a proficiency test given by the university to place participants in the appropriate level.

Participants were given a Language Background Questionnaire, based on topics included in the Bilingual Language Profile (Birdsong, D., Gertken, L.M., & Amengual, M., 2012), asking how long the participants had been studying Spanish, if they had ever

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[1] Each group could not be equal in number due to the fact that the researcher could not control class size for enrolled participants in each course.

traveled to a Spanish speaking country (where, how long, at what age), if they had any family members who spoke Spanish fluently, at what age they began taking Spanish courses, etc. This was done in efforts to eliminate any data collected from participants who had more experience with the language and create a homogeneous group of L2 learners.

Participants who had grown up speaking Spanish at home (heritage speakers), had more than 6 weeks of consecutive exposure to Spanish in a Spanish speaking country, had taken a phonetics course previously, had begun taking Spanish before middle school, or who had more than one native language were not included in the study[2]. All included participants were native English speakers, with minimal to no exposure to Spanish outside of the classroom. The participants were required to complete the following tasks, detailed below, as part of the required coursework. The tasks were graded as a whole, in which the participants received full credit for simply having completed the task, not for how well any particular token was pronounced. Participants received no credit if they did not complete the task[3], and no extra credit was offered or given in exchange for completing the research tasks (with the exception of Phase 5, detailed in Section 3.3.5).

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[2] Five participants in total from the experimental group were eliminated according to these criteria; one was a heritage speaker of Spanish, one was a native speaker of an African language, two had begun Spanish in elementary school, and one had studied abroad longer than 6 weeks.
[3] Three participants from the experimental group and two from the control group were eliminated for not having completed each task.

3.2   Materials

The experiment focused on the voiceless plosives /p/ /t/ /k/ in the onset position of each token. Native speakers (NSs) of American English tend to aspirate their voiceless plosives [pʰ] [tʰ] [kʰ] as opposed to the productions of NSs of Spanish (Hammond, 2001; Hualde, 2011). The current study was comprised of four separate elicitation tasks, ranging from the most controlled (i.e. carrier phrase) to the most spontaneous (i.e. picture naming task). These four tasks, detailed below, consisted of four different but related sets of materials, and were included to address the question of generalization of pronunciation gains. The materials for each task are detailed in sections 3.2.1-3.2.4. Procedures are detailed in 3.3

3.2.1   Carrier Phrase: Task 1

Task 1 was comprised list of 30 tokens within the carrier phrase Di _____ de nuevo, similar to that of Fox, Flege, & Munro's (1995) elicitation task (Digo ahora_____). For the 30 tokens contained within the carrier phrase Di _____ de nuevo, each voiceless plosive was paired with each of the 5 Spanish vowels /a/ /e/ /i/ /o/ and /u/ to create words containing an equal number of plosive and vowel pairings (3 plosives [/p, t, k/] x 5 vowels [/a, e, i, o, u/] x 2 = 30 tokens). The reason for this was to control for any possible variance between the different vowel environments. Possible VOT variances could arise in the production due to the following vowel of each voiceless plosive (Port & Rotunno, 1979). Table 2 provides an example of the list for Task 1 (for an extensive list of the tokens embedded in the carrier phrase, see Appendix A).

Table 2

Tokens Embedded in Carrier Phrase Di _____ de Nuevo

Plosive	Example 1	Example 2
/p/	Di *pesa* de Nuevo	Di *poco* de nuevo
/t/	Di *testigo* de Nuevo	Di *toca* de nuevo
/k/	Di *quepo* de Nuevo	Di *copa* de nuevo

3.2.2   Tokens within Novel Sentences: Task 2

For Task 2, participants were to record 15 different novel sentences in order to provide a context in which short speech segments contained the tokens (Elliott, 1997). Each novel sentence contains one token, taken from the list of 30 tokens embedded in the utterance Di ____ de nuevo for that particular Phase, as seen in Table 3. Each plosive was again paired with vowels /a/ /e/ /i/ /o/ /u/, but only one time. The goal was to evaluate whether or not participants began to improve not only on the focus phonemes in a carrier phrase, but also to see if participants were able to generalize these isolated productions into novel sentences (For an extensive list of the tokens embedded in novel sentences, see Appendix B).

Table 3

Tokens within Novel Sentences

Plosive	Example 1	Example 2
/p/	Quiero un *poco* de agua.	No sé por qué *Paco* quiere irse.
/t/	Hay un *testigo* con el juez.	*Toca* la guitarra para mí.
/k/	Esa *cosa* no sirve para nada.	Llévame a *casa* por favor.

3.2.3 Short Story: Task 3

Participants recorded a short story reading for Task 3. The short story contains 30 tokens for /p/ /t/ /k/, and tokens were chosen from Phase 1, Phase 2, and Phase 3 lists. This was done in order to provide a controlled atmosphere for measuring tokens in continuous speech, which provides a total of 30 tokens in continuous speech (3 phonemes x 10 tokens per phoneme = 30 tokens). It could be argued that the short story creates a scenario in which participants may rely too heavily upon orthography to produce continuous speech; however, it does provide a control for the number of times each token is produced and distributed throughout the continuous speech (Elliott, 1997; Diaz-Campos, 2004; Lord, 2008). The purpose of the short story in the Pre-test and Post-test was to observe how participants initially produced the target plosives within controlled, continuous speech, as well as to look at how well the participants transferred their gained knowledge of plosives within a larger, continuous speech context at the end of the study, as seen in Example 1 below (Olson & Offerman, 2013) (for the full, short story text, see Appendix C).

(1) *Me llamo* Paco *y quiero contarte sobre mi primera experiencia* con *mi compañero, Pedro*. *Había acabado de* cumplir *18 años, y tuve que mudarme a Indiana para mi primer año de la Universidad*. *Llegué a la* casa *de Pedro con mi* padre *el 12 de octubre*.

3.2.4 Picture Task: Task 4

In efforts to create an environment in which participants could have the opportunity to produce free speech, the picture task (Task 4) was created. Although this

method of eliciting free speech is guided, it still does not provide the learner with the orthography of the desired production of the token on the actual slide in which the participants were asked to produce a sentence. The picture task (Elliott, 1997; Willis, 2004; Bigelow, Delmas, Hansen, & Tarone, 2006; Miller, 2013; Munro, 2013) was carried out in attempt to analyze the productions of the voiced plosives in a spontaneous speech environment. The current picture task was based most closely off of that created by Munro (2013).

For the design of the picture task, a power point presentation was created, which consisted of 30 pairs of slides. For each pair of slides, an instruction slide (Figure 1) preceded the spontaneous speech slide (Figure 2). First, directions were given to the participants having them study the picture associated with the token in the power point slide in order to remember it for the second power point slide. The first slide either contained the name Juan or Mariana written within the sentence. The second slide displayed either a picture of a boy or a girl with the names Diego and Ana; however, the names in the second slide were not written in the sentence.

Participants were required to insert the new name into the sentence, along with remembering the target token associated with the picture. The purpose of having the students change the name of the person in the second slide was to serve as a distraction device, which did not permit participants to exclusively focus on the target token (Munro, 2013). Tokens were taken from the lists of tokens within the carrier phrase. The task was carried out at the end and the beginning of the semester in order to serve as a comparison when looking at the Pre-test and Post-test (Elliott, 1997).

Figure 1. Picture Task Instructional Slide *Figure 2*. Picture Task Elicitation Task

3.3   Procedures

The following procedures consist of various phases containing tasks that were carried out over 8 weeks during the last half of the fall semester, every two weeks. Each phase was comprised of an activity in which the participants were to record themselves. For the Experimental group, visual feedback was implemented into the second session of the first three phases for its respective focus-phoneme (see Table 5 below). The Control group did not receive any visual feedback for pronunciation; class instruction was deemed "normal class instruction".

Phase 1-3 consisted of two Sessions, and Phases 4 and 5 consisted of only one Session. During Session 1 of each phase, both groups were required to record several Tasks. For Session 2 of Phase 1-3, both groups were required to re-record Tasks 1-2. For the Experimental group only, an additional visual feedback component (treatment) was implemented in Session 2 for that phase's respective focus-phoneme. Each task was

carried out in the following order for the Experimental and Control groups as displayed in

Table 4 (Experimental) and Table 5 (Control):

Table 4

Phases, Sessions, and Tasks for Experimental Group

	Session 1	Session 2
Phase 1	Tasks 1-4 (Pre-test)	Treatment 1 (Visual feedback for /p/ & re-recording) & Tasks 1-2
Phase 2	Tasks 1-2	Treatment 2 (Visual feedback for /t/ & re-recording) & Tasks 1-2
Phase 3	Tasks 1-2	Treatment 3 (Visual feedback for /k/ & re-recording) & Tasks 1-2
Phase 4	Tasks 1-4 (Post-test)	None
Phase 5	Task 4 (Delayed Post-test)	None

Table 5

Phases, Sessions, and Tasks for Control Group

	Session 1	Session 2
Phase 1	Tasks 1-4 (Pre-test)	Tasks 1-2
Phase 2	Tasks 1-2	Tasks 1-2
Phase 3	Tasks 1-2	Tasks 1-2
Phase 4	Tasks 1-4 (Post-test)	None
Phase 5	Task 4 (Delayed Post-test)	None

3.3.1   Phase 1

Phase 1, Session 1 was comprised of a Pre-test, in which both the Control and

Experimental groups were sent home with a list of recordings for Tasks 1-4. All

recordings were done via Praat (Boersma & Weenink, 2006), which was free for the

participants to download, to be completed at the participant's home, and participants were

given an instruction sheet plus an in-class demonstration of how to operate Praat. These

recordings consisted of 4 different sections: Task 1 - tokens contained within a carrier

phrase (Flege & Munro, 1994); Task 2 - tokens contained within novel sentences (Elliott, 1997; Olson & Offerman, 2013); Task 3 - tokens contained within a short story (continuous speech) (Diaz-Campos, 2004; Elliott, 1997; Lord, 2008); and Task 4 – tokens contained within a picture task to elicit free speech (Biegelow, 2006; Elliott, 1997; Munro, 2013 [unpublished]; Willis, 2007). Participants were also provided with a short, in-class demonstration on how to complete the picture task (Task 4) by using an example from the task (participants completed Task 4 at home).

Session 2 of Phase 1 consisted of an in-class handout in which only the Experimental group participated (Treatment 1). In order to participate in the in-class analysis, participants were required to print out the first 4 tokens off of their list of tokens which were contained in the carrier phrase from the Session 1 recording list (Olson & Offerman, 2013). The handout was comprised of a series of questions (examples in Table 6; for complete in-class handout example, see Appendix D) leading the participants to conclusions about how their productions of /p/ differed from the productions of /p/ produced by a native speaker of Spanish (see Figure 3). The participants were also shown the spectrogram of a native speaker's (NS's) production of *Paco*, in which the participants were given the segmentation below as a guide in making their own segmentations.

Table 6

Sample Questions from In-Class Worksheet

Sample	English Translation
¿Cómo puedes identificar tu vocal (vowel) 'a' del consonante 'p'?	How do you identify your vowel 'a' from the consonant 'p'?
¿Es la 'a' más oscura o clara que el 'p'?	Is the 'a' darker or lighter than the 'p'?
¿Cómo es la 'p' del hablante nativo en el ejemplo?	What is the 'p' of the native speaker like in the picture?
Ahora marca los límites de tu 'p' y tu 'a.'	Now, mark the boundaries for your 'p' and your 'a.'
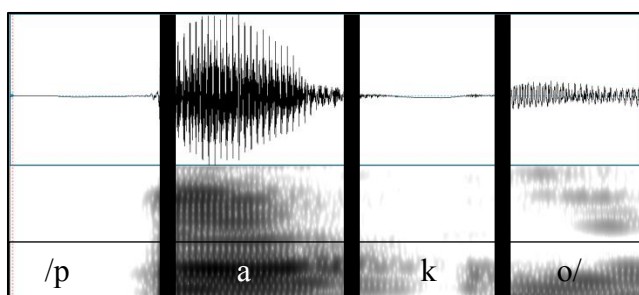
Figure 3. Paco Produced by a NS of Spanish & Segmented

The participants were then asked to segment their 4 tokens that they had printed out from Session 1, using the already segmented spectrogram of the native speaker as a model. After segmenting their own tokens, participants were provided with guided instruction in which they were asked to compare their productions with that of the production of the NS. This guided instruction consisted of asking participants to look at differences in the sound waves and features within the spectrogram (using contrasts such as darker or lighter, or bigger or smaller). The questions were asked in such a way that would not make the understanding of the sound waves and spectrogram overly difficult.

Once the participants had completed the first several questions which called for a visual analysis, the researcher then provided audio of the word *Paco* produced by both an

NS of Spanish and an NS of American English. This was provided along with the spectrograms of both speakers. Once the participants in the Experimental group had completed the handout, the researcher had the participants take part in a discussion of the handout. Participants were able to ask questions for clarification if confusion arose. The researcher primarily served as a mediator if questions arose, and guided the participants' attention towards certain features of the particular focus phonemes.

The participants, both the Experimental and Control groups, were then assigned to re-record only the list of tokens within the carrier phrase and sentence environment from Session 1, as a part of Session 2, to be sent to the researcher. The Control group received no in-class instruction or guidance before submitting Session 2's tokens within the carrier phrase and novel sentences; they received normal, daily instruction.

3.3.2   Phase 2

Phase 2 very closely resembled Phase 1, omitting only Tasks 3 and 4 in Session 1. For Phase 2, Session 1, this again consisted of a sheet that the participants took home with a list of tokens embedded in a carrier phrase and novel sentences to record for both Control group and the Experimental group, recording and submitting Task 1 and Task 2 for Phase 2. The tokens for Phase 2 contained new tokens not previously seen in Phase 1, beginning with /p/ /t/ /k/ and equal distribution of /a/ /e/ /i/ /o/ /u/.

On the following day, for Session 2 of Phase 2, the Experimental group then focused on the phoneme /t/ in class, bringing 4 print-outs with them to class. A set of guiding questions, parallel to those used for the visual feedback paradigm, focused on /p/ in Phase 1, were provided for Treatment 2 (/t/) during Phase 2. There appeared again a

spectrogram of a word produced by an NS, *tapa*, in which the participants then had to segment the word on their own. Then the participants were again provided with the production of the word todo produced by an NS of Spanish and an NS of American English to serve as a comparison between the 2 different productions of the word. Participants were asked to go home and re-record Task 1 and Task 2 for the completion of Session 2 (Task 1 and Task 2 equivalent to structure of Session 1 tasks, differing only in tokens).

Participants from the Control group were also given a list of token in a carrier phrase and in novel sentences, the same list from Session 1 of Phase 2, to re-record and send to the researcher, without having received guidance or instruction during class.

3.3.3   Phase 3

For Phase 3, Session 1, participants from both groups were required a third time to record a list of tokens, Task 1 and Task 2, within a carrier phrase and in novel sentences for /p/ /t/ and /k/ in the onset position. For Phase 3, participants received a list of new tokens not previously seen in Phase 1 or Phase 2.

In Session 2 of Phase 3, participants in the Experimental group were again required to bring print-outs of their first 4 words to class in order to be able to participate in the in-class activity. The in-class activity focused particularly on /k/ and how /k/ is produced by NSs of Spanish in comparison to NSs of American English (Treatment 3). This activity again consisted of similar questions to the activities done in Session 2 of Phase 1 and Phase 2. Participants segmented their spectrograms according to where they

believed their /k/ began and stopped, and where their vowel began. The researcher guided participants through the handout, again providing guidance and clarification.

Participants were then played a recording of a native speaker producing the word *capo*, as well as the token produced by a native speaker of American English in order to serve as an auditory comparison. This activity also included a self-evaluation portion in which the participants were asked whether or not they thought they had improved in their production of /p/ /t/ /k/ in the last several weeks. Participants were then asked why they thought they had or had not improved in order to facilitate critical thinking when focusing on their own pronunciation of the plosives. After completing the worksheet, participants were asked to submit their handouts. After completing the in-class handout, participants were required re-record their tokens within a carrier phrase and in novel sentences for completion of Session 2.

Participants in the Control group were also assigned to re-record their tokens within a carrier phrase and in novel sentences from Session 1 of Phase 3 (Session 2 of Phase 3), but again without any in-class instruction or guidance.

3.3.4   Phase 4

During Phase 4, both groups of participants were provided with a Post-test, which was comprised of the same tokens contained in the carrier phrase, in novel sentences, the short story, and picture task (Tasks 1-4) as the Pre-test (Phase 1, Session 1). This Post-test was done for purposes of comparing results to the Pre-test:

3.3.5   Phase 5

After the semester in which the participants completed all of the required tasks, participants from the Control and Experimental groups were contacted to become volunteers to participate in the continuation of the study for Phase 5, a Delayed Post-test. Participants were recruited via a gift card drawing; all participants from both the Experimental and the Control Groups were contacted by the researcher.

Three participants from the Experimental group and no participants from the Control group participated in the Delayed Post-test. The Delayed Post-test, was completed 12 weeks after the last recording for Phase 4 and consisted of the same picture task (Task 4) that was completed by both groups in the Pre-test (Phase 1 Session 1) and the Post-test (Phase 4). The purpose of this Delayed Post-test was to see if participants maintained the learned knowledge about their pronunciation of the voiceless plosives /p/ /t/ /k/ from the previous semester in a free speech environment. Participants were given one week to complete the task at home at their convenience.

CHAPTER 4. RESULTS

The current chapter discusses the results from the tokens embedded in a carrier phrase (4.1), tokens within novel sentences (4.2), tokens within continuous speech (4.3), and tokens within spontaneous speech (4.4). Generalizability of focus phonemes compared to non-focused phonemes is also discussed for the tokens within a carrier phrase (4.1.1) and within the novel sentences (4.2.1). This chapter concludes with a short discussion of the Delayed Post-test (4.5), which did not include a statistical analysis.

Aspiration durations for each target token produced by the participants throughout the course of the study were measured and analyzed manually via Praat (Boersma & Weenink, 2006) by the researcher. The boundaries of the aspirations were marked by hand, from the release of the preceding stop consonant to the onset of voicing. Duration measurements were extracted using an automated script.

Recordings from the following phases and sessions were used for data analyses as seen in Table 7. Session 1 of Phases 2 and 3 was not used due to already having a Pre-test (Session 1 of Phase 1) for a basis of comparison.

Table 7

Phases and Sessions for Data Analyses

	Sessions Used for Analyses
Phase 1	Session 1 & 2
Phase 2	Session 2
Phase 3	Session 2
Phase 4	Session 1
Phase 5	Session 1

Statistical analysis was carried out in order to find differences within an individual group, between the Experimental and Control groups, as well as to note any generalizability in the Experimental group. Statistical analysis was carried out with R v.2.6.2. using the LME4 package. For all linear mixed models, the significance criterion was set at $|t| > 2.00$. As there is no accepted method of calculating F statistics for linear mixed models, they are not reported here.

The following subsections address the findings of the Experimental and Control groups for each task within each phase. Along with each finding are detailed descriptions on the statistical analyses carried out in order demonstrate significant findings. For the purposes of easily identifying and comparing results, Session 1 of Phase 1 will be referred to as the Pre-test; Session 2 of Phase 1, 2, and 3 will simply be referred to as Phase 1, Phase 2, and Phase 3; and Session 1 of Phase 4 will be referred to as the Post-test.

4.1 Tokens in Carrier Phrase

A total of 3584 of a possible 3600 tokens (24 Participants×30 Items × 5 Phases [Pre-test, Phase 1, Phase 2, Phase 3, Post-test] = 3600 tokens) were included in the analysis of tokens in a carrier phrase. As can be seen in the Figure 4 below, participants in the Experimental group demonstrated general improvement over time with respect to the aspiration of /p/ /t/ /k/, from an overall average of 68.65ms (SD=27.70ms) in the Pre-test to an average of 35.62ms (SD= 24.9ms) in the Post-test.

To determine if such improvement was significant, the data were submitted to an LME model with Group (Experimental vs. Control) and Time (Pre-test, Phase 1, Phase 2, Phase 3, Post-test) as fixed factors, and Participant and Item as random factors with both random slopes and intercepts, following recommendations by Barr et al. (2013)[4]. Of initial importance, results of the mixed model indicated no significant difference between the intercept (Experimental group: Pre-test) and the Control group performance on the Pre-test (β = -11.52, t = -.463), illustrating that both groups performed similarly prior to training.

To better understand the data, subsequent mixed model analyses were conducted separately for the Experimental and Control groups, with fixed factor of Time and random factors of Participant and Item with both random slopes and intercepts. Results for the Experimental group demonstrate a significant difference between aspiration durations at the intercept (Pre-test) and each of the following sessions: Phase 1 (β = -23.62, t = -5.633), Phase 2 (β = -30.85, t = -5.037), Phase 3 (β = -28.28, t = -4.596), and

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[4] Although /p, t, k/ have different aspiration durations (Lisker & Abramson, 1964), the inclusion of *Item* as a fixed factor effectively accounts for the inter-phoneme variation.

the Post-test (β = -33.03, t = -5.416). Subsequent multiple comparison post-hoc analyses (TukeyHSD) demonstrated that while there was significant improvement between the Pre-test and each of the other Phases and Sessions, there were no other significant differences between any of the following phases (e.g. Phase 1 vs. Phase 2) (p > .1, for all subsequent comparisons). As such, the major gains are seen following the Treatment 1, as seen in Figure 4, and are maintained during all subsequent phases.
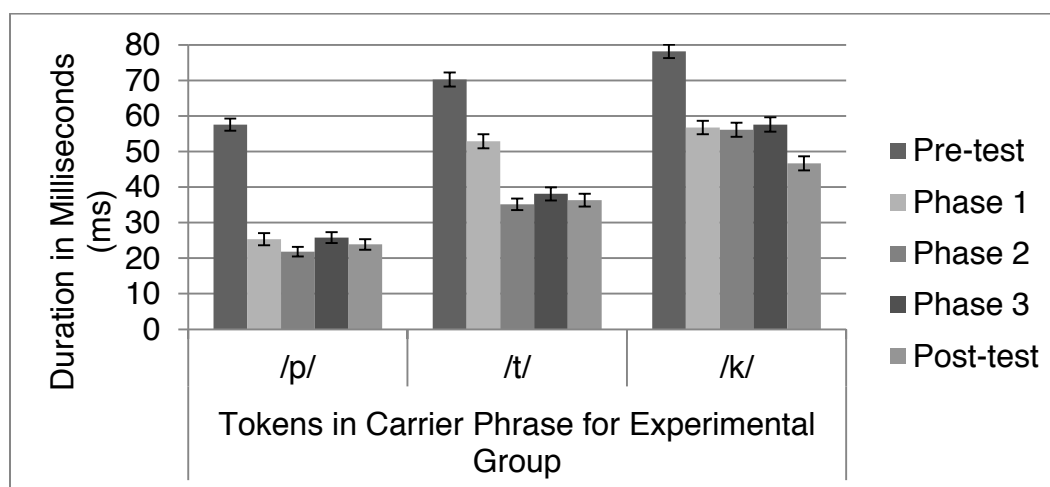
Figure 4. Tokens in Carrier Phrase for Experimental Group

Performance of the Control group stands out in contrast. Results of the mixed model analysis for the Control group yielded no statistically significant differences for the tokens produced during the Pre-test and any of the subsequent recordings (|t| < .4 in all cases). Visual analysis of Figure 5 illustrates this finding, with similar aspiration durations maintained during each of the recording sessions.

Performance of the Control group stands out in contrast. Results of the mixed model analysis for the Control group yielded no statistically significant differences for the tokens produced during the Pre-test and any of the subsequent recordings (|t| < .4 in all

cases). Visual analysis of Figure 5 illustrates this finding, with similar aspiration durations maintained during each of the recording sessions.
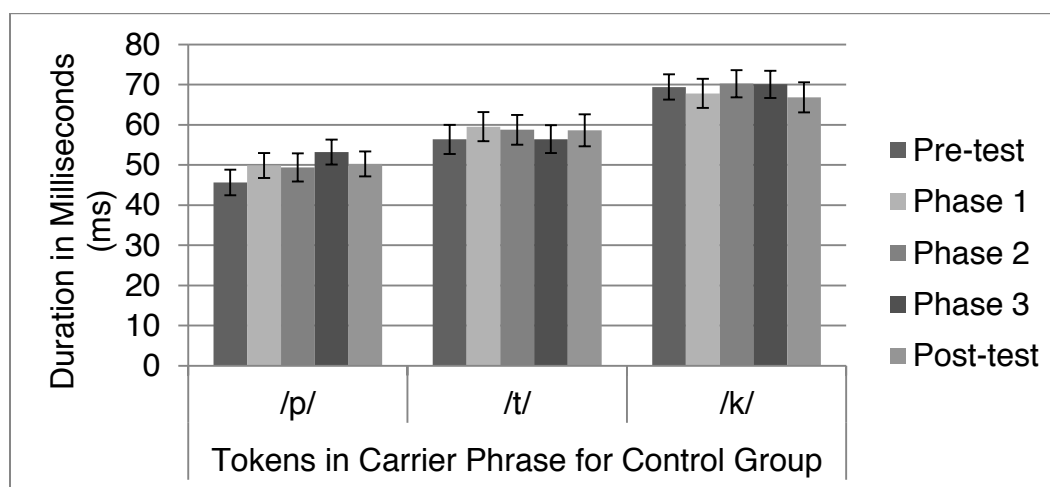
Figure 5. Tokens in Carrier Phrase for Control Group

4.1.1 Carrier Phrase Results by Phoneme

Although the initial mixed model analysis showed significant improvement as a whole, in order to better understand the performance on each phoneme, the effect of each visual training session (treatment), and the potential role of generalizability, subsequent models and TukeyHSD multiple comparison post-hocs were run for each of the individual phonemes for the Experimental group. It bears repeating that the phoneme /p/ was the subject of the Treatment 1, /t/ was the focus of Treatment 2, and /k/ was the focus of Treatment 3.

With respect to the performance on /p/, the initial average for aspiration of /p/ in the Pre-test was 57.75ms (SD=27.83ms) and was reduced to an average of 23.88ms (SD=19.49ms) in the Post-test. Averages for /t/ and /k/ for the Pre-test came to 70.23ms

(SD=26.59ms) and 78.15ms (SD=23.72ms) respectively, and an average of 36.33ms (SD=23.72ms) for /t/ and 46.65ms (SD=25.65ms) for /k/ in the Post-test. Statistical analysis confirms the significance of these trends with significant differences for each phoneme between the Pre-test and Post-test: /p/ (β = -34.21, t = -2.543), /t/ (β = -34.76, t = -2.903) and /k/ (β = -31.36, t = -5.051). That is, over the course of the treatments, performance improved significantly for each of the phonemes.

Also of importance is an analysis of each phoneme with respect to each phase. As visual analysis of Figure 4 reveals, there is a general trend towards improvement in Phase 1, following Treatment 1 which focused on /p/, for all three studied phonemes. The mixed model analysis confirms this finding, with significant differences for each phoneme between the performance on the Pre-test and Phase 1: /p/ (β = -32.53, t = -4.848), /t/ (β = -18.01, t = -3.926) and /k/ (β = -21.26, t = -5.172). Subsequent multiple comparisons (TukeyHSD) revealed no significant differences between any other comparisons for the phoneme /p/ (e.g. phase 1 vs. phase 2, etc.) (p > .1). As such, for /p/, while there was a significant decrease in aspiration duration following Treatment 1, there were no subsequent significant changes (increases or decreases).

For /t/, the focus of Treatment 2, post-hoc comparisons revealed that in addition to the significant decrease in aspiration between the Pre-test and Phase 1, a significant decrease in aspiration duration was found between Phase 1 and Phase 2 (diff. = -15.5, p < .005, d = .748). Finally, for /k/, as was the case for /p/, there were no significant differences revealed in any of the subsequent multiple comparisons beyond that found between the Pre-test and Phase 1. In summary, while the first training focused solely on the phoneme /p/, significant improvements were found for the other two phonemes (i.e.

/t/ and /k) not considered in Treatment 1. The phoneme /t/ also showed improvement following the training focused on /t/ (i.e. Treatment 2).

In short, while the Control group showed no significant changes in the aspiration of tokens in a carrier utterance during the course of the study, the Experimental group showed significant reductions in the aspiration durations for each of the three phonemes under consideration. Of note, all three phonemes showed significant improvements following Treatment 1, and these differences are maintained through the Post-test.

4.2   Tokens within Novel Sentences

Below in Figures 6 and 7, when considering the performance of tokens within the carrier phrase, a pattern very similar to that found for the tokens in novel sentences emerges. A total of 1746 tokens were submitted to the statistical analysis (24 Participants×15 Items × 5 Phases = 1800 tokens). For the Experimental group, the average aspiration for the Pre-test was found to be 60.25ms (SD=31.1ms) and for the Pre-test to 39.37ms (SD=26.66ms) for the Post-test, as can also be seen in Figure 9. For the Control group, aspiration averages were found at 52.62ms (SD=30.39ms) for the Pre-test and at 49.6ms (SD=26.25ms) for the Post-test.

Statistical analysis, with a linear mixed model approach identical to that employed in the analysis of the tokens in carrier phrases, confirms the above observations. Again, both groups were shown to perform similarly with respect to aspiration duration in the Pre-test, as illustrated by the lack of a significant difference between the intercept (Experimental group: Pre-test) and the Control group performance during the Pre-test (β = -7.77, t = -0.590). With respect to the Experimental group, significant reductions in

aspiration were found between the Pre-test and: Phase 1 (β = -17.06.83, t = -4.795), Phase 2 (β = -22.96, t = -2.612), Phase 3 (β = -13.80, t = -2.188) and the Post-Test (β = -21.00, t = -3.426). That is, the Experimental group showed significant improvement following Treatment 1, and maintained such gains through the Post-test.
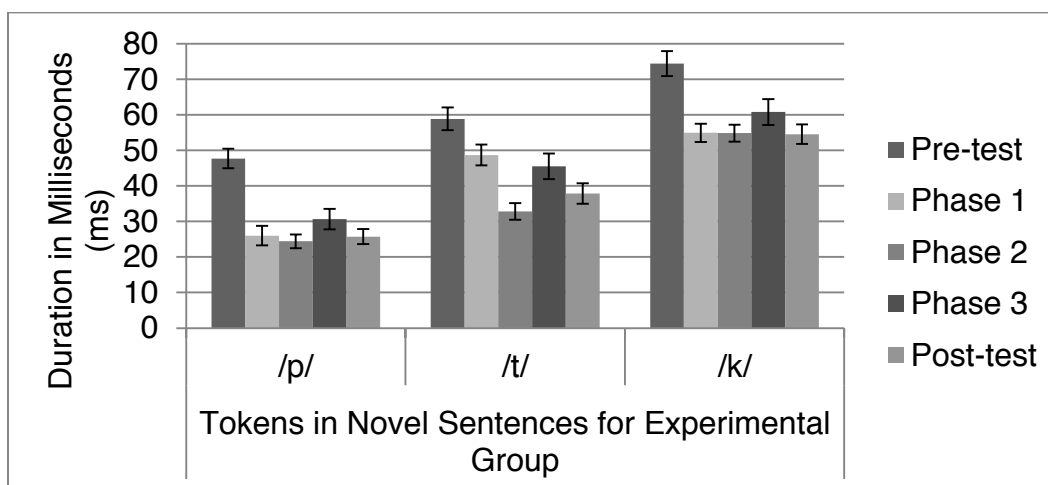

Figure 6. Tokens in Novel Sentences for Experimental Group

For the Control group, in contrast, there were no significant differences between the intercept (Pre-test) and any of the subsequent Phases (|t| < .5 for all comparisons), as shown in Figure 7.
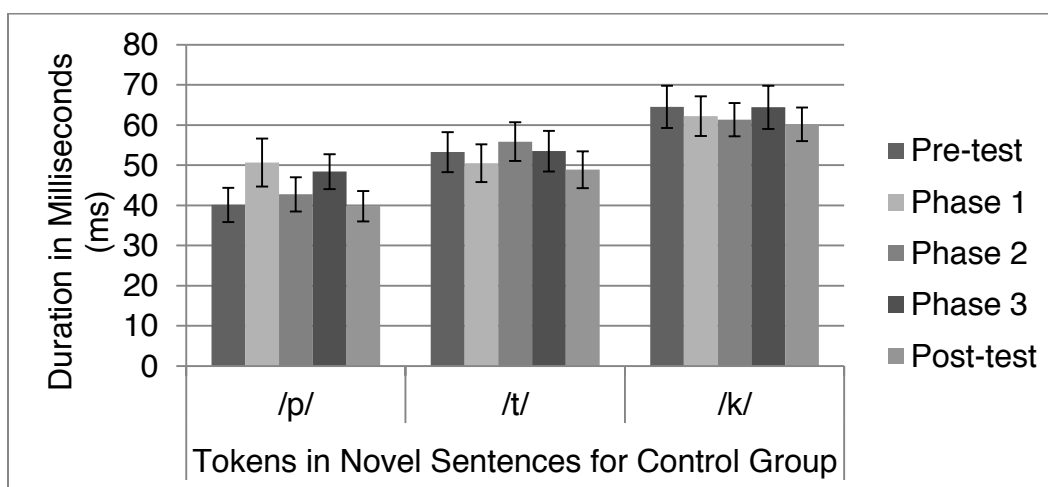

Figure 7. Tokens in Novel Sentences for Control Group

4.2.1   Tokens within Novel Sentences by Phoneme

Again, in parallel to the analysis conducted for words within a carrier phrase, to better understand the performance on each phoneme, subsequent models were run for each of the phonemes for the Experimental group. Again, as with the tokens in carrier phrase, the phoneme /p/ was the subject of the Treatment 1, /t/ was the focus of Treatment 2, and /k/ was the focus of Treatment 3.

An initial observation of the performance on each phoneme reveals that between the Pre-test to the Post-test, aspiration duration decreased for all phonemes: /p/ improved by approximately 22ms (Pre-test: M = 47.68ms, SD=25.24ms; Post-test: M = 25.73ms, SD=19.55ms), /t/ improved by approximately 21ms (Pre-test M = 58.83ms, SD=29.49; Post-test M = 37.86ms, SD = 26.53ms), and /k/ improved by about 20ms (Pre-test: M = 74.41ms, SD=32.21; Post-test: M = 54.53ms, SD=25.06ms). Statistical analysis confirms the significance of these trends with significant differences for each phoneme between the Pre-test and Post-test: /p/ (β = -21.98, t = -4.159), /t/ (β = -22.22, t = -2.903) and /k/ (β = -21.21, t = -2.905). That is, over the course of the treatments, performance for the tokens in novel sentences improved significantly for each of the phonemes.

Also of importance is an analysis of each phoneme with respect to each phase. As visual analysis of Figure 6 reveals, there is a general trend towards improvement in Phase 1, following Treatment 1 which focused on /p/, for all three studied phonemes. The mixed model analysis confirms this finding, with significant differences for each phoneme between the performance on the Pre-test and Phase 1: /p/ (β = -21.12, t = -4.483), /t/ (β = -11.23, t = -2.184) and /k/ (β = -19.83, t = -4.246).

Subsequent multiple comparisons (TukeyHSD) revealed no significant differences for any of the phonemes between performance in Phase 1 and any subsequent recording (p > .1), indicating that while significant improvement occurred during the Phase 1, there were no further significant improvements (or declines) with subsequent treatments and phases. In summary, while Treatment 1 focused solely on the phoneme /p/, significant improvements were found for the other two phonemes, not considered in Treatment 1, /t/ and /k/.

4.3 Tokens within the Story Task (Continuous Speech)

A total of 1417 tokens were included in the analysis for Task 3, the Story task (24 Participants×30 Items × 2 Sessions = 1440 tokens). For the story task, the participants in the Experimental group continued to show a different pattern with respect to the Control group, as illustrated in Figures 8 and 9. Specifically, while the Experimental group produced longer aspiration durations in the Pre-test (M = 60.33ms, SD=30.77ms) than the Post-test (M = 37.51ms, SD=26.6ms), the Control group showed little variation between the Pre-test (M=49.84ms; SD=26.26ms) and Post-test (M=49.73ms; SD=27.06ms).

Statistical analysis, again employing a linear mixed model with fixed factors of Time and Group and random factors of Participant and Item, confirms the above observation. Demonstrating the homogeneity of the two groups initially, there was no significant difference between the intercept (Experimental group: Pre-test) and the Control group (Pre-test) (β = -10.42, t = -0.783). However, there was as significant difference between the intercept and the Experimental group performance in the Post-test (β = -22.67, t = -3.967), and a significant difference between the intercept and the Control

group performance in the Post-test (β = 21.67, t = 3.032). These results indicate while both groups performed similarly initially, the Experimental group showed significant improvement during the course of the training, while the Control group showed no significant changes.

Figure 8. Tokens in Story Task for Experimental Group
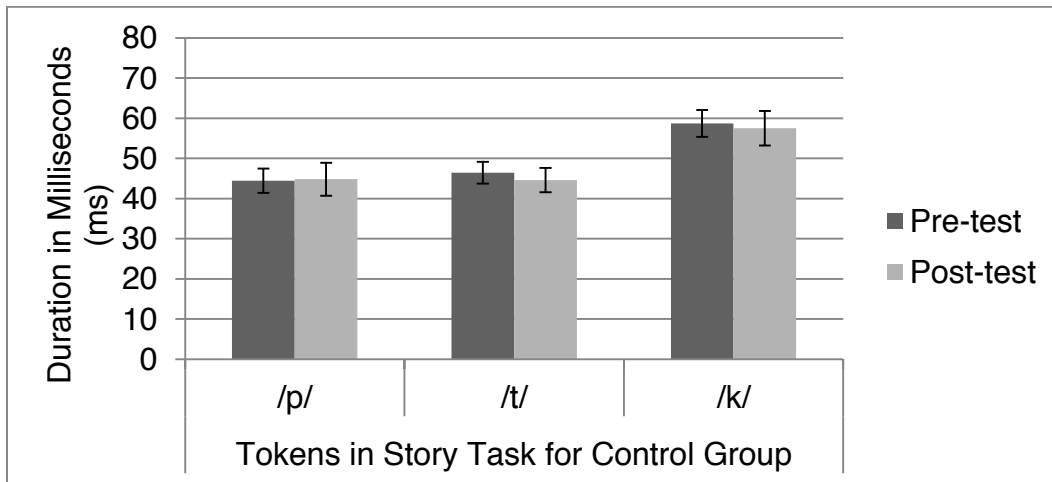
Figure 9. Tokens in Story Task for Control Group

4.4 Tokens within the Picture Task (Spontaneous Speech)

Results for Task 4, the picture task, paralleled those found for the continuous speech task (Task 3). A total of 1408 tokens were included in the analysis of Task 4 (24 Participants×30 Items × 2 Sessions = 1440 tokens). The participants in the Experimental group continued to show a different pattern with respect to the Control group, as illustrated in Figures 10 and 11. Again, the Experimental group produced longer aspiration durations in the Pre-test (M = 61.3ms, SD=30.22ms) than the Post-test (M = 40.81ms, SD=24.82ms), and the Control group showed little difference between the Pre-test (M=46.36ms; SD=22.02ms) and Post-test (M=44.44ms; SD=21.49ms).

Statistical analysis, again employing a linear mixed model with fixed factors of Time and Group and random factors of Participant and Item, confirms the above observation. Although there was no significant difference between the intercept (Experimental group: Pre-test) and the Control group (Pre-test) (β = -14.62, t = -0.824), there was a significant difference between the intercept and the Experimental group performance in the Post-test (β = -20.44, t = -5.169), and a significant difference between the intercept and the Control group performance in the Post-test (β = 18.15, t = 2.826). These results indicate while both groups performed similarly initially on Task 3, the Experimental group showed significant improvement during the course of the training, while the Control group showed no significant changes.
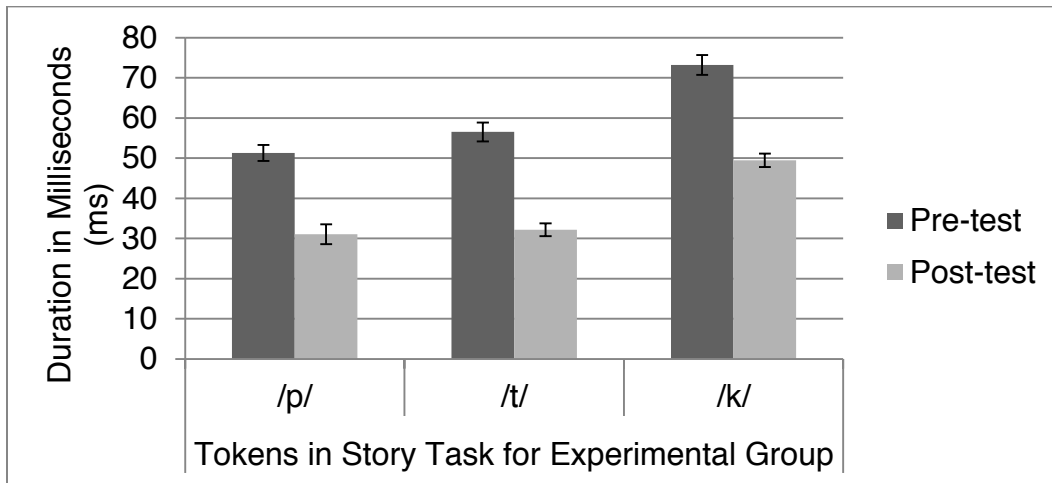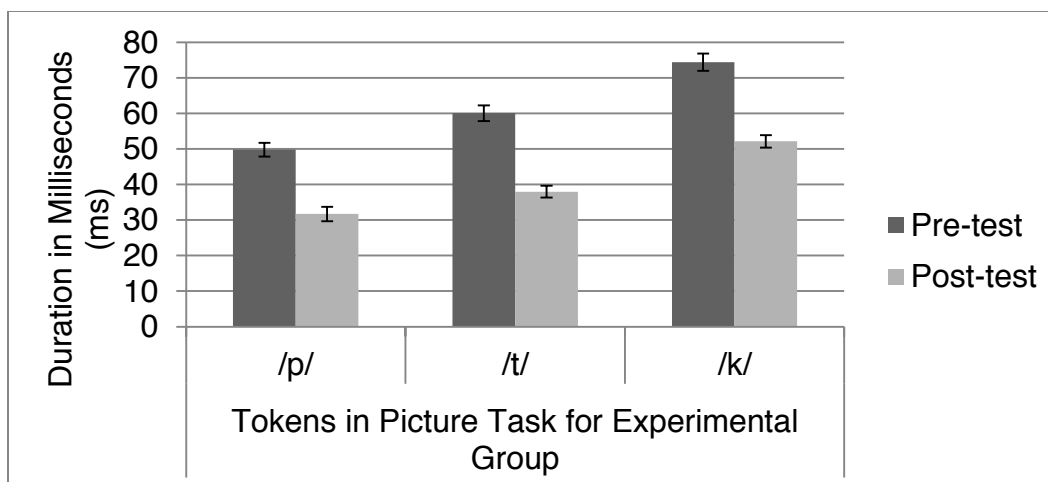
Figure 10. Tokens in Picture Task for Experimental Group
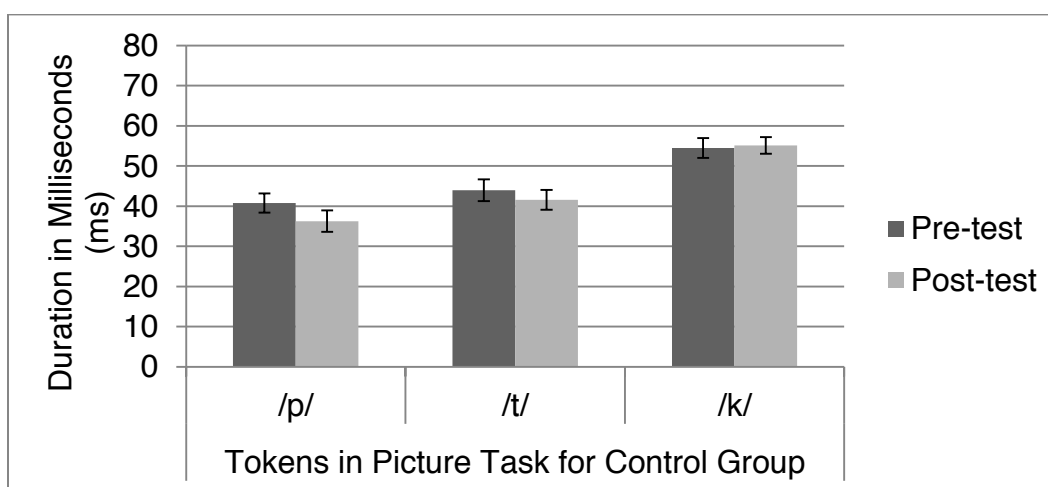
Figure 11. Tokens in Picture Task for Control Group

4.5 Delayed Post-test

In the Delayed Post-test (Phase 5), only three of the 19 participants in the Experimental group participated in the continuation of the study. The Delayed Post-test only consisted of the picture task in order to identify whether or not students had retained

the knowledge from the Treatments and were able to apply it to a spontaneous speech environment.

The total average duration for aspiration of three phonemes was 38.94ms (SD=22.64ms), with /p/ averaging at 23.2ms (SD=15.7ms), /t/ at 40.45ms (SD=19.5ms), and /k/ at 53.18ms (SD=21.39ms). Statistical analyses were not done for these participants, being that the number of participants was not considered large enough to represent the Experimental group well. Results are displayed below in Figure 12. It can be seen that, although there is a small group of participants, a trend towards improvement is found in the graphs for /p/ and /k/. Moreover, it can be determined for these participants that the decrease in aspiration was maintained.
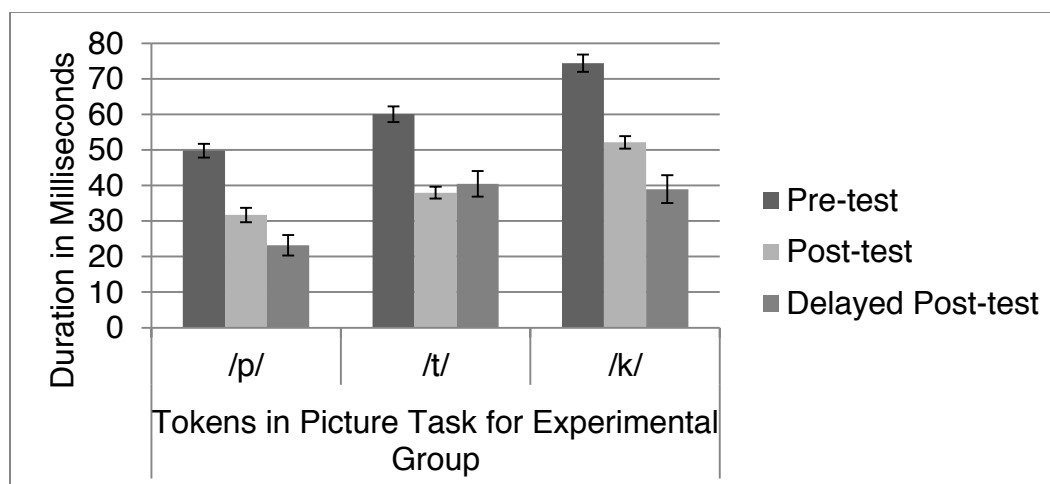
Figure 12. Tokens in Delayed Post-test

4.6   *Conclusion*

The results suggest that the participants from the Experimental group improved significantly with the tokens within the carrier phrase (4.1), novel sentences (4.2), the

story task (4.3), and the picture task (4.4). These results, indicating that significant improvement from the Pre-test to the Post-test in each task, means that not only were participants able to perform with more accuracy in short, controlled environments, but they also acquired more accurate productions within novel sentences, continuous speech (story), and spontaneous speech (picture task).

As for the Control group, the participants displayed no significant improvement in any of the tasks. Given results of the Experimental and Control groups, it can be concluded that visual feedback was the crucial component in the Experimental group's achievement of progressing toward native-like productions of /p/ /t/ /k/ in Spanish.

It was also shown that the participants in the Experimental group were able to generalize the knowledge gained from each treatment concerning the focus phoneme to the non-focus phonemes (i.e. /p/ = focus phoneme, /t/ and /k/ = non-focus phonemes). This generalizability between treatments can also be attributed to the visual feedback instruction that the Experimental group received; once participants were able to visually see the difference between NS and NNS productions, it is possible that they were able to make assumptions about VOT features for non-focus phonemes.

Therefore, based off of the data provided in this chapter, one can conclude that visual feedback is beneficial to L2 pronunciation learning. The following chapter will discuss the methods and results of the attitudes survey concerning the visual feedback treatments used in this study.

CHAPTER 5. ATTITUDES SURVEY

The current chapter discusses the methods and results of the attitudes survey carried out at the end of the study. Only the Experimental group participated in the attitudes survey, due to the fact that the survey concerned attitudes toward the visual feedback paradigm.

5.1 Methods of Attitudes Survey

At the end of the semester, all participants in the Experimental group were given a survey in order to discover different attitudes towards their pronunciation, as well as attitudes towards the software used for instruction. Questions were based off of previous research involving attitudes toward technology-use in the classroom for pronunciation instruction (Lord, 2008; Olson & Offerman, 2013).

Participants rated each statement or question in the form of a likert-scale evaluation (Elliott, 1995). Participants were to evaluate criteria such as their attitudes towards their pronunciation before and after the semester, how they felt about a native speaker (NS) listening to their pronunciation, if they felt the visual feedback Treatments to be useful, and whether or not they enjoyed the use of visual feedback in the classroom. Answers were given on a likert scale from 1-9 (1 = Agree, 9 = Disagree). It was of interest to find out what students thought about NSs listening to their pronunciation and

investigating how important their pronunciation in Spanish was to them, in order to know if visual feedback really was useful to their learning. For instance, if Spanish pronunciation was not considered important to the participants, then findings from the thoughts about the activity may be deemed as "less significant".

Examples of this survey are listed in Table 8 below (the complete survey, see Appendix E).

Table 8

Sample Statements from Attitudes Survey

Statement	
1	I think my pronunciation improved significantly. 1 2 3 4 5 6 7 8 9 Agree Neutral Disagree
7	I thought this activity was enjoyable. 1 2 3 4 5 6 7 8 9 Agree Neutral Disagree
9	I would be comfortable having a native speaker listen to my pronunciation and rate me. 1 2 3 4 5 6 7 8 9 Agree Neutral Disagree
14	Not having a strong American accent when speaking Spanish is important to me. 1 2 3 4 5 6 7 8 9 Agree Neutral Disagree
17	People who have a strong accent when they speak my native language (i.e. English) seem less intelligent. 1 2 3 4 5 6 7 8 9 Agree Neutral Disagree

All surveys were collected by the researcher following the completion of the study. The surveys served as an effective manner in which to gauge participants' attitudes toward their own pronunciation and the practice of using visual feedback in the classroom. The survey addressed thoughts about the usability of the computer program,

the views on the benefits the learners felt the gained after having used the computer program for visual feedback, as well as whether or not the participants felt more confident about their pronunciation at the end of the study.

For the survey, the participants in the Experimental group rated 17 different statements and questions about the usefulness of instruction, thoughts about the activity, attitudes toward their own pronunciation, importance of pronunciation, and attitudes toward foreign accent on a Likert-scale of 1-9 (1=Agree, 9=Disagree; 1=Native-like, 9=Not intelligible), and answered three open-ended questions. Statements 1-5 were grouped together in the category of Usefulness; 6-7 were grouped as Thoughts about the Activity; 8-12 were grouped under Attitudes toward My Pronunciation; 13-15 addressed Importance of Pronunciation; and 16-17 investigated Attitudes toward Foreign Accent. Questions 18-20 also addressed Attitudes toward Foreign Accent, but were not quantifiable (qualitative).

5.2   *Results of Attitudes Survey*

In Table 9, the means (M) and standard deviations (SD) for each of the 17 quantifiable questions on the survey can be seen. For the following categories, the means (M) and standard deviations (SD) were calculated: Usefulness, M=2.4 (SD=1.2); Thoughts about the Activity, M=3.2 (SD=3.3); Attitudes toward My Pronunciation, M=4.1 (SD =1.7); Importance of Pronunciation, M=3.2 (SD=1.8); and Attitudes toward Foreign Accent, 5.8 (SD=2.2).

Table 9

Attitudes Survey Results

Question/ Statement	M	SD
1. I think my pronunciation improved significantly.	2.6	1.1
2. This method is good for understanding ways in which to practice and improve my pronunciation.	2.1	1.3
3. This activity made me think consciously about my pronunciation.	1.9	1
4. The visual analysis software was useful for improving my pronunciation.	2.5	1.4
5. The teacher's guided instruction with this activity was useful for improving my pronunciation.	1.6	1.1
6. I put a lot of effort into accurately completing the pronunciation activities.	2.5	1.4
7. I thought this activity was enjoyable.	3.9	1.9
8. I feel very confident about my pronunciation in Spanish.	3.6	1.7
9. I would be comfortable having a native speaker listen to my pronunciation and rate me.	4.3	2.6
10. I am more confident now having a native speaker listen to my pronunciation than I was at the beginning at the semester.	2.9	1.3
11. Overall, how would you rate your accent in Spanish?	4.1	1.3
12. Overall, how do you think a native speaker would rate your Spanish accent?	5.5	1.8
13. My pronunciation in Spanish is very important to me.	2.8	1.8
14. Not having a strong American accent when speaking Spanish is important to me.	2.8	1.7
15. Knowing vocabulary and grammar is more important than having good pronunciation.	4.0	2.0
16. I struggle to understand people who have an accent in my native language (i.e. English), even if they have good grammar.	5.0	2.1
17. People who have a strong accent when they speak my native language (i.e. English) seem less intelligent.	6.6	2.3

Of particular interest, results suggest that the participants agreed that their pronunciation had improved significantly (M=2.6; SD=1.1). Participants also indicated that the visual analysis was useful for improving their pronunciation (M= 2.5; SD=1.4), and that they felt more confident about their accent in Spanish after having received the

visual feedback and instruction (M=2.9; SD=1.3). Participants reported as well that it was important for them to not have an accent when speaking Spanish (M=2.8; SD=1.7).

However, when asked an open-ended question about whether or not the guided teacher instruction or the self-guided nature of visual feedback was more beneficial to their learning environment, all participants but one relayed that the guided instruction provided by the teacher was the most useful. The one student that did not respond with the guided teacher instruction as being more useful described the guided teacher instruction and visual analysis as being equally useful to their pronunciation learning. They also reported to have only somewhat enjoyed the visual feedback activity (M=3.9; SD=1.9), although they did report the visual feedback as useful way to practice pronunciation (M=2.1; SD=1.3).

In response to the survey given to the Experimental group at the end of the study, participants indicated that they felt their pronunciation had improved significantly and visual feedback was in fact crucial to their pronunciation improvement. Although participants' responses also indicated that they believed the guided teacher instruction to be more beneficial to their learning, the results overwhelming point to visual feedback as being a central learning tool for the advances made in pronunciation.

The following chapter will discuss the significant findings in this study, as seen in Chapter 4 and 5, as well as future directions for the study and several limitations in Chapter 7.

CHAPTER 6. DISCUSSION

6.1   Summary of Significant Findings & Research Questions

The following subsections describe in detail four different contributions, accompanied by their respective research questions (RQs) and Hypothesis: (6.1.1) Visual feedback as a tool to teach aspiration reduction in productions of Spanish /p/ /t/ /k/; (6.2) generalization of tokens within a carrier phrase to connected speech; (6.3) participants' abilities to generalize their knowledge of treatment for one focus phoneme and applying it to non-focus phonemes before their subsequent treatments; and (6.4) the attitudes of the participants in the Experimental group about the visual feedback treatments carried out in class.

6.1.1   Visual Feedback & VOT

The following RQ was proposed to address whether or not participants in the Experimental group would improve productions after receiving visual feedback instruction, specifically for tokens within a carrier phrase:

RQ1: Can this use of visual feedback in the classroom be used in looking at VOT, specifically in looking at voiceless plosives to help participants achieve a more native-like productions, in decreasing the aspiration of their productions of /p/ /t/ /k/ in tokens embedded in a carrier phrase?

Hypothesis 1: Participants will benefit from having visual feedback in improving their productions of /p/ /t/ /k/ in a more native-like manner within a carrier phrase.

Previous studies have investigated the effects of visual feedback on L2 learner pronunciation for suprasegmental features, such as intonation (deBot, 1983; Chun, 1989), as well as segmental features, such as vowels (Saito, 2007) and consonants voiced plosives vs. fricative allophones) (Olson & Offerman, 2013). The present study investigated what effect visual feedback had on L2 learners of Spanish, specifically for the consonants /p/ /t/ /k/ regarding voice onset time (VOT) reduction, which has not been carried out previously in the field of pronunciation teaching in Spanish; the majority of studies looking at VOT values for /p/ /t/ /k/ previously have been conducted by means of explicit pronunciation teaching without visual feedback (Elliott, 1997; Díaz-Campos, 2004; Lord, 2008).

The Spanish voiceless plosives were chosen in efforts to inform second language (L2) learners about aspiration reduction in Spanish as opposed to increased aspiration values in English, which is considered a noticeable indicator of accented, foreign speech to NSs of Spanish (Lord, 2005). Although accented speech does not necessarily impede intelligibility (Derwing & Munro, 1997; Derwing & Munro, 2009), it can render negative attitudes held by native speakers (NSs) toward non-native speakers (NNSs) (Gluszek & Dovidio, 2010; Kim, Wang, Deng, Alvarez, & Li, 2011; Munro, Derwing & Sato, 2006; Purkiss, Perrewé, Gillespie, Mayes, & Ferris, 2006).

The visual aspect of the voiceless plosives also presents itself as being somewhat intuitive in nature, due to their aspiration duration values, thus furthering the motivation for the election of this particular feature. For example, after having learned how to

distinguish what the visual features of aspiration look like on a spectrogram (aperiodic waves, high frequency energy, no voicing, aspiration before a voiced feature), it could be stated that it becomes more easily identifiable by the participant. Therefore, once learned, the participant is then able to determine where the aspiration is on a spectrogram, the approximate length of aspiration, and if there is any aspiration at all. Based on these assumptions about aspiration duration, it is proposed that this feature is more intuitive for participants.

In response to RQ1, the Experimental group not only outperformed the Control group in their carrier phrase productions comparing Post-tests from both groups, but they also improved significantly from the Pre-test to the Post-test. This supports the claim of Hypothesis 1, that the Experimental group would improve their tokens of /p/ /t/ /k/ in a carrier phrase. Although participants were not able to produce exact, native-like aspiration duration values for /p/ (4ms), /t/ (7ms), and /k/ (29ms) on average (Lisker & Abramson, 1964), their improvement in reduction of aspiration from the original values in the Pre-test compared to the values in the Post-test were statistically significant. These gains were not, however, the case for the Control group, which made no significant strides toward more native-like production of /p/ /t/ /k/ in the carrier phrase from the Pre-test to the Post-test.

While other visual feedback studies focusing on segmental features, such as Olson & Offerman (2013), have found somewhat mixed results in their conclusions, the current study aimed to focus on a feature that that would fashion itself as being a more easily identifiable feature through visual feedback. For example, distinguishing between voiced plosives and their fricative allophones in Spanish may not always be something that is

easily distinguished, even after having been trained on how to identify the appropriate descriptions for each feature. In looking at the typical long-lag voiceless plosives produced by NSs of English, this not only involves a feature that is a marker of accentedness in Spanish (Lord, 2005), but it also provides an easily identifiable feature for participants.

6.1.2   *Visual Feedback & Connected Speech*

RQ2: Will this knowledge be transferred from token elicitations into novel sentences, continuous speech (i.e. short story/ paragraph), and spontaneous speech environments?

Hypothesis 2: Participants will improve in all sections; however, it is likely that participants will improve most in the token elicitations, somewhat in the sentence environment, and that they will improve little in the continuous speech and spontaneous speech environments.

Although previously mentioned experimental studies demonstrate significant improvement in L2 pronunciation owing to visual feedback (deBot, 1983; Olson & Offerman, 2013; Saito, 2007), studies looking at segmental features have reported significant results in solely observing and measuring tokens in isolation (Olson & Offerman, 2013; Saito, 2007) or tokens within novel sentences (that is, lists of numbered sentences that are simple in structure and do not pertain to one another) (Olson & Offerman, 2013).

The current study implemented two more categories to be tested, which included continuous speech (story task) and spontaneous speech (picture task). While other studies

have implemented such tasks to test L2 speech, visual feedback was not utilized as an instrument for instruction prior to testing L2 speech (Elliott, 1997; Díaz-Campos, 2004; Lord, 2008; Munro, 2013). These tasks were implemented to observe whether or not L2 learners were able to transfer knowledge from basic controlled speech tasks (tokens contained within a carrier phrase), after receiving visual feedback treatment, to novel sentences, a continuous speech task, and a spontaneous speech tasks in order to demonstrate that the L2 learners had acquired the knowledge.

While controlled speech tasks are beneficial practice for L2 learners, these tasks are not sufficient in arguing that learners have actually acquired the target feature and are able to produce these features in more native-like, connected speech. Significant findings from the current study suggest that, due to the Treatments of visual feedback in each Phase, participants were able to acquire knowledge about aspiration reduction of /p/ /t/ /k/ in connected speech (novel sentences, continuous speech, and spontaneous speech) in Spanish.

Hypothesis 2 assumed that the Experimental group would have the ability to transfer their newly attained knowledge for tokens in novel sentences, but not in the continuous or spontaneous speech environments. As predicted, participants in the Experimental group were able to transfer and implement their knowledge of aspiration reduction to novel sentences and significantly improved from the Pre-test to the Post-test. However, in contradiction to Hypothesis 2, the Experimental group out-performed the Control group significantly, as well as improving significantly from the Pre-test to the Post-test in both the continuous speech and spontaneous speech environments. Although this improvement was not predicted for the Experimental group, it has indeed further

confirmed that participants were able to transfer their knowledge acquired from the visual feedback activities into the novel sentences, continuous speech, and spontaneous speech environments.

Based off of these findings, one can surmise that visual feedback greatly aided the Experimental group in producing more native-like productions of these phonemes in not only short, controlled tasks (carrier phrase), but also in a longer, controlled tasks (novel sentences), a continuous speech task (story), and a spontaneous speech task (picture task). These findings conclude that participants in the Experimental group made significant gains toward more native-like pronunciation of /p/ /t/ /k/ due to receiving visual feedback instruction. Significant findings were again not found to be the case for the Control group for the novel sentences, story task, or picture task.

6.1.3   Generalizability of Pronunciation Features

RQ3: Will participants be able to generalize their knowledge of aspiration reduction of /p/ in Phase 1 after the first treatment to /t/ and /k/, before /t/ and /k/ become the focus of treatment in Phase 2 and Phase 3?

Hypothesis 3: Participants will be able to generalize aspiration reduction by decreasing aspiration values for not only /p/, but also /t/ and /k/ after the first treatment carried out for /p/ in Phase 1.

Multiple studies have investigated how L2 learners improved their productions of various suprasegmental and segemental features after receiving pronunciation instruction (Derwing, Munro, & Wiebe, 1998; Díaz-Campos, 2004; Elliott, 1997; González-Bueno, 1997; Lord, 2005; Lord, 2008; Lord, 2010; Olson & Offerman, 2013; Simões, 1996);

however, Olson & Offerman (2013) is one of few studies that has investigated whether or not L2 learners are able to generalize their knowledge about one feature (segmental) of pronunciation to similar features before other similar features are explicitly taught.

The present study sought to investigate whether or not L2 learners were able to make assumptions about /t/ (Phase 2) and /k/ (Phase 3) during Phase 1, in which /p/ was the focus of Treatment 1. In the first treatment carried out for /p/ during Phase 1, participants in the Experimental group were able to generalize for aspiration reduction based off of their gained knowledge about /p/, applying this to /t/ and /k/ before any treatments were implemented in which /t/ and /k/ were the primary focus. Along with aspiration values for /p/, values for /t/ and /k/ significantly decreased during Phase 1, indicating that in response to RQ3, Hypothesis 3 was supported. Therefore, participants not only improved significantly in decreasing aspiration values, but due to visual feedback treatment for /p/, they were also able to reduce values for /t/ and /k/ in concluding that values must be reduced for all three. Participants were also able to generalize their knowledge from producing more native-like tokens in a carrier phrase to also producing more native-like tokens within novel sentences, a continuous speech task, as well as a spontaneous speech task.

6.1.4   Attitudes toward Visual Feedback

Below RQ4 and Hypothesis 4 address the attitudes survey given to the participants in the Experimental group at the end of the study:

RQ4) Will this practice, the use of visual feedback in the classroom to improve pronunciation, be seen as useful and beneficial by the participants?

Hypothesis 4: Participants will find that Praat is easy for them to use and that it is a beneficial tool in helping them to learn. This will be identified through a language attitudes survey.

Hypothesis 4 predicted for RQ4 that participants in the experimental group would find the visual feedback activities useful through an attitudes' survey, which was carried out on a Likert-scale for 17 questions and through three open-ended questions. Participants reported that they believed the visual feedback activities to be helpful in their improvement of the three plosives in Spanish. It was also indicated that the treatments (in-class, visual analysis) helped them in thinking consciously about their pronunciation, that this particular method of instruction was helpful in finding ways to practice and improve pronunciation, and that they now feel more confident about their pronunciation in Spanish in comparison to the beginning of the semester.

It should be noted, however, that in response to the statement *The visual analysis software was useful for improving my pronunciation*, an average rating of 2.5 (SD=1.4) was reported, and for the statement *The teacher's guided instruction with this activity was useful for improving my pronunciation*, participants reported an average rating of 1.6 (SD=1.1). When asked in an open-ended question whether the self-guided visual feedback activities or guided instruction was more beneficial to the learning of aspiration reduction, 95% of participants (16 of 17) reported that the teacher guided instruction was the most useful. Only one participant reported that the combination of both the visual feedback and teacher instruction were equally beneficial.

Although these findings imply that participant thoughts toward visual feedback were not found to be as useful as the guided instruction, the results of the treatments

cannot be ignored. The statistics found for the data in the investigation of the treatments overwhelmingly support the benefits of visual feedback. In order to fully investigate the attitudes in correlation to whether or not visual feedback or merely explicit teacher instruction would be more useful, a second experimental group only receiving explicit, oral instruction would be necessary.

6.2   Pedagogical Implications

As previously described, it has been demonstrated that visual feedback was found to be significantly beneficial to the learning of reduced aspiration in the plosives /p/ /t/ /k/ by the Experimental group. Firstly, one can assume that due to pronunciation training, the participants were able to learn how to reduce aspiration in efforts to attain more native-like speech in Spanish. These results support previous arguments of the benefits of pronunciation focused activities in studies such as Arteaga (2000), Derwing & Munro (2005), Elliott (1997), Lord (2005), Olson & Offerman (2013), Saito (2007; 2011; 2012; 2013), and Simões (1996).

The second implication one can derive from this study is that not only was pronunciation training a vital component of the participants' learning, but more specifically the use of visual feedback via Praat (Boersma & Weenink, 2006), being the primary component of instruction, aided in the development of L2 learners' abilities to produce the plosives with a more native-like accent. Although it has been stated that the use of such technology in the classroom can be overly complicated (Derwing & Munro, 2005), participants reported that the use of this type of instruction (visual feedback) was useful to their learning, as well as it being a conducive form of pronunciation practice.

Therefore, the addition of visual feedback in the classroom did not only cause increased pronunciation improvement in the Experimental group's productions, it was also viewed by the participants as a useful tool in pronunciation practice and applicability.

Considering the positive effects that visual feedback had on the participants in the Experimental group, this type of pronunciation instruction should to be taken into account for the development of materials that aid in pronunciation improvement and teaching. As various types of visual feedback are demonstrated (Chun, 1989; Chun, 1998; Chun, 2002; deBot, 1983; deBot & Mailfert, 1982; Hardison, 2004; Motohashi-Saigo & Hardison, 2009; Olson & Offerman, 2013; Saito, 2007; Weltens & deBot, 1984), the present study re-emphasizes the growing development and success of visual feedback through technology in the classroom setting.

As younger generations become more exposed to technology at earlier ages (Thorne & Payne, 2005), it can be suggested that current L2 learners in are more willing to use different technology in a learning environment. This exposure to technology at a younger age among learners (who are now adult learners) also proposes that L2 learners are more apt to being capable of learning and navigating various forms of technology for learning.

In sum, visual feedback can be considered a practical means through which pronunciation can be taught in the classroom setting. Not only do the results from the different treatments carried out in the present study display the participants' improvement, but the responses to the attitudes survey also convey that learners are able to use the visual feedback technology in order to practice and improve pronunciation.

CHAPTER 7. CONCLUSION

7.1   Conclusions of the Study

It has been observed that participants in the Experimental group, relative to a matched Control group, significantly improved their productions of /p/ /t/ /k/ (i.e. shorter aspiration duration values) following a visual feedback treatment. Importantly, these results were found not only the carrier phrase and sentence environments, but also in continuous and spontaneous speech environments, further establishing the relevance and utility of the visual feedback paradigm, specifically in a classroom setting. Furthermore, the Experimental group was also able to make pronunciation gains on related, non-target phonemes (i.e. /t/ and /k/ after receiving Treatment 1 for /p/). This finding demonstrates that visual feedback, in some manner, was beneficial in helping participants to replicate learned knowledge from /p/ to /t/ and /k/.

Along with the participants' gains toward more native-like speech, it was also noted that participants' attitudes toward the use of visual feedback were substantially positive. Participants also expressed that the visual feedback was helpful and practical in guiding them to make comparisons and conclusions about their own pronunciation as well as native speakers' (NSs') pronunciation, in addition to feeling more confident about their pronunciation in Spanish at the end of the study. Therefore, results have indicated that visual feedback is a useful tool in teaching pronunciation in the second language (L2)

classroom setting. This method of instruction benefit learners in acquiring more native-like speech, but participants also viewed it as useful for learning L2 pronunciation.

7.2   *Limitations*

Although the results from the study are compelling in demonstrating the benefits to receiving visual feedback as part of pronunciation instruction, there are several limitations to the present study that should be noted.

First and foremost, an equal amount of participants in each group would suggest being most beneficial, providing an equal amount of data points for each group. This was unable to be remedied, due to the fact that the number of students placed in each class was out of the control of the researcher.

After reviewing the Experimental group's comments on the attitudes survey in the current study, it was noted that L2 learners felt that the guided teacher instruction provided was most helpful to their learning than the visual feedback. In the study by Muranoi (2000), there were three groups of participants, which were comprised of a Control group, and two Experimental groups receiving two different combinations of treatments, with only one treatment differing between the two Experimental groups. With this in mind, a second Experimental group receiving only pronunciation instruction could have been constructive in evaluating which form of instruction lead learners to produce more native-like productions of /p/ /t/ /k/.

Another aspect for development lies in the attitudes survey. Although the survey investigated participants' attitudes toward usability and practicality of the visual feedback treatments, the survey neglected to address the level of difficulty perceived by

participants. Had the level of difficulty been explored in the survey and found to be minimal, this could have created a more compelling argument to gauge how user-friendly the technology and activities were for the participants.

A final drawback lies in the picture task. Due to the intermediate level of the students' speaking abilities, it was not possible to create an authentic spontaneous speech task. While the picture task used provides an approximation of spontaneous speech, intermediate students may or may not have been able to produce free speech containing the target phonemes. For example, had the L2 learners been required to create half of a sentence in the picture task or been asked open ended questions to generate target features, participants may not have been able to produce target features or any spontaneous speech at all. Although a task such as an interview would have been ideal in eliciting target features in spontaneous speech, this would have been exceedingly difficult for participants, given their relatively low level of the target language proficiency.

7.3   Future Directions

In response to the limitations in the previous section, there are a number of directions that can be considered for future research. Among those, the most crucial addition is a second Experimental group, which would receive no visual feedback. The second Experimental group would exclusively receive oral, guided explicit instruction, while still using Praat (only as a means for the researcher to collect data) to record productions for the Pre-test, all of the phases, and the Post-test. The data from this non-visual feedback group would then be compared with the data collected for participants who received both aural instruction and visual feedback. This second set of data would

further examine which method was most beneficial in aiding participants to produce more native-like speech for /p/ /t/ /k/. As the field of pronunciation instruction is still in its relative infancy, there is a clear need for such studies to disambiguate the relative contributions of various pedagogical treatments, including that of visual feedback.

Concerning the attitudes survey, it would be worthwhile to investigate participant attitudes toward the amount of difficulty experienced in using Praat for completing the visual feedback activities. Responses to this inquiry would provide more insight into whether or not learners find this type of technology to be the most efficient and beneficial tool in guiding them toward more native-like productions.

Finally, it should be acknowledged that the paradigm implemented here is one of many possible iterations of visual feedback. As such, future research and technological development will only serve to enhance the current activities. For example, an expansion in the form of an audio-visual module could be an even more innovative method for teaching learners about pronunciation. Jokisch, Koloska, Hirschfeld, & Hoffmann (2005), for example, propose a type of visual feedback in which learners are able to record themselves speaking an utterance in their L2 and receive immediate visual feedback from the computer program. Once L2 learners have submitted their recording into the program, they are able to see their spectrogram as well as that of a NS in order to compare differences between the two. The visual feedback in this program also provides students with the ability to see pictures of the shaping of lips, mouth, and tongue in order to provide optimal guidance as to how one should produce an utterance most accurately.

Adapting this type of visual feedback would create a thorough explanation of different features that each individual L2 learner struggles with when practicing

pronunciation on their own, as well as alleviating the burden of the teacher to provide quality instruction to individual students (as time is limited in the classroom). A similar design to the current study, in addition to having a second Experimental group and more inquiry about usability of the software, would be utilized in order to investigate whether or not this more advanced type of visual feedback would be expedient and profitable in pronunciation improvement.

In conclusion, there is a call for a more innovative method of pronunciation instruction; one that is useable for L2 learners and that aids L2 learners in significantly improving pronunciation. As shown in this study, visual feedback is among one of the promising methods that can be used by L2 instructors, and it can be continually developed for optimal pronunciation acquisition.

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APPENDICES

Appendix A   Tokens in Carrier Phrase (Phase 1)

1.	Di *Paco* de nuevo		16.	Di *quita* de nuevo
2.	Di *poco* de nuevo		17.	Di *tuviera* de nuevo
3.	Di *pesa* de nuevo		18.	Di *pecado* de nuevo
4.	Di *puse* de nuevo		19.	Di *culo* de nuevo
5.	Di *pata* de nuevo		20.	Di *taza* de nuevo
6.	Di *testigo* de nuevo		21.	Di *quema* de nuevo
7.	Di *toca* de nuevo		22.	Di *tela* de nuevo
8.	Di *población* de nuevo		23.	Di *pica* de nuevo
9.	Di *pulga* de nuevo		24.	Di *quise* de nuevo
10.	Di *capa* de nuevo		25.	Di *cosa* de nuevo
11.	Di *tilde* de nuevo		26.	Di *toser* de nuevo
12.	Di *casa* de nuevo		27.	Di *piso* de nuevo
13.	Di *quepo* de nuevo		28.	Di *tiza* de nuevo
14.	Di *tacaño* de nuevo		29.	Di *tusar* de nuevo
15.	Di *copa* de nuevo		30.	Di *cupo* de Nuevo

Appendix B   Tokens in Novel Sentences (Phase 1)

1.   La *taza* está rota.

2.   Quiero un *poco* de agua.

3.   Hay un *testigo* con el juez.

4.   Yo *puse* mi ropa en la lavadora.

5.   Ese material me *pica* la piel.

6.   No te olvides la *tilde* cuando escribes.

7.   Esa *cosa* no sirve para nada.

8.   Yo esperaba que él *tuviera* el anillo para la boda.

9.   Siempre se *quema* con el fuego.

10.   No digas *culo* frente a tu madre.

11.   No sé por qué *Paco* quiere irse.

12.   *Toca* la guitarra para mí.

13.   Ahora ella *pesa* mucho.

14.   Llévame a *casa* por favor.

15.   Yo *quise* ir con ustedes, pero no pude.

Appendix C   Story Task

        Me llamo *Paco* y quiero contarte sobre mi primera experiencia *con* mi compañero, Pedro. Había acabado de *cumplir* 18 años, y tuve que mudarme a Indiana para mi primer año de la Universidad. Llegué a la *casa* de Pedro con mi *padre* el 12 de octubre. Era un día maravilloso afuera; hacía mucho sol, las hojas se cambiaban de color, y el aire olía de manzanas. *Todo* era perfecto, y en ese momento, no *quise* ir adentro de la casa. Pero por fin, *tocamos* la puerta. Estaba un *poco* nervioso, porque nunca había vivido con alguien a pesar[5] excepto mi padre. Cuando Pedro abrió la puerta, yo lo examiné cuidadosamente; era un *tipo* muy alto y delgado, y llevaba una *pulsera* de oro. Pero se veía como una persona normal con sus jeans, su camiseta gris y su bigote tan *tupido*. "Hola, ¿qué *tal* ustedes? Bienvenidos a mi casa," dijo él. "Tu cuarto está en el *quinto piso* – les muestro el cuarto y el resto de la casa." Era una casa enorme con un *techo* altísimo. No podía creer lo que mis ojos veían. Mi padre de repente empezó a hablarle, "Gracias a Usted por mostrarnos la casa, es hermosa." "De nada, de nada," dijo Pedro, "y ustedes me pueden *tutear*, ya somos familia. Yo *puse* una *cosa* en tu cuarto para que te sientas en casa, Paco." Cuando llegamos a mi cuarto, había una *taza* para tomar café en mi cama. "Oí que tomas *tinto*, o café como decimos en Colombia, entonces quería regalarte esta taza de Colombia." "¡Muchísimas gracias!" le dije. "Me siento como cometí un *pecado* porque no te traje nada, y esta taza es tan buenísima." "No te preocupes, como te dije, ya somos familia. Espero que me *pidas* para *cada* cosa que necesitas." Pedro bajó a la cocina para empezar a cocinar la cena, y mi padre fue al baño. Empecé a descargar mis cosas de las maletas. Había puesto la taza en mi escritorio, pero no me acordé de ponerla allí. Saqué mi *teclado* de una maleta, y sin ver, intentaba a ponerlo en mi escritorio cuando me di cuenta que pegué la taza sin querer y no tenía el *poder* de salvarla. Mi padre oyó el ruido e inmediatamente salió del baño. "Qué paso?!" me gritó. "Bueno…" le decía con mi cara hacia el piso, "acabo de…acabo de *quebrar* la taza. Es completamente mi *culpa*." De repente Pedro subió a mi cuarto y nos preguntó, "¿Ustedes están bien?! Oí un ruido abajo." Le explicaba lo que paso con la taza cuando olimos algo raro. Mi padre le dijo a Pedro, "Creo que algo se *quema* abajo…" Corrimos abajo y supuestamente, la cena se quemaba en el horno. ¡Que *pena*! Pedro nos aseguró que estas cosas pasan y nos dijo que no nos preocupáramos. Desde ese momento, yo sabía que seríamos buenos amigos.[6]

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[5] The story contains one typo; however, this typo did not affect results due to it not coming in contact with any of the tokens.

[6] The story was written by the researcher and reviewed by a native speaker of Puerto Rican Spanish.

Appendix D   In-class Worksheet for Visual Analysis (Phase 1)

QUIZ 2 Grabaciones: Trabajo en clase

PASO 1 - Instrucciones: Saca tus palabras que imprimiste y escoge un(a) compañero(a)

Contesta las siguientes preguntas con tu compañero(a).

1.   ¿Cómo es la producción de la 'p' en la
foto?_____

_____

2.   Marca donde piensas los límites deberían estar. Ejemplo:
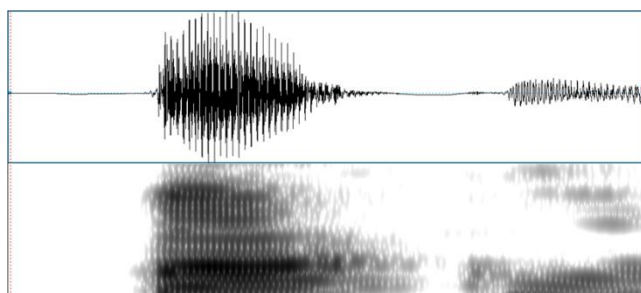
Figure 1: *Paco*

3.   "Figure 1" demuestra como pronuncia un hablante nativo la palabra 'Paco.' ¿Has notado algo de la duración (length) entre la 'p' de la foto y tu 'p'?

_____

_____

4.   ¿Son tus grabaciones similares o muy diferentes que "Figure 1"? ¿Cómo?

_____

_____

5.   Ahora, tu profesora va poner una grabación de la palabra 'Paco' producida por un hablante nativo de español, y también, por un hablante de inglés. ¿Cuáles diferencias notas?

_____

_____

6.   Ahora, mira las dos grabaciones de la palabra 'Paco' que tu profesora va a mostrar en la pantalla (on the screen). ¿Por qué son diferentes?

_____

_____

Appendix E   Attitudes Survey

Short survey about your experience with the PRAAT voice analysis activity

Instructions: Please rate the following statements on a scale of 1-9 by circling the number you feel is appropriate.

I. Usefulness:

(1) I think my pronunciation improved significantly.

$$1 \quad 2 \quad 3 \quad 4 \quad 5 \quad 6 \quad 7 \quad 8 \quad 9$$

Agree   Neutral   Disagree

(2) This method is good for understanding ways in which to practice and improve my pronunciation.

$$1 \quad 2 \quad 3 \quad 4 \quad 5 \quad 6 \quad 7 \quad 8 \quad 9$$

Agree   Neutral   Disagree

(3) This activity made me think consciously about my pronunciation.

$$1 \quad 2 \quad 3 \quad 4 \quad 5 \quad 6 \quad 7 \quad 8 \quad 9$$

Agree   Neutral   Disagree

(4) The visual analysis software was useful for improving my pronunciation.

$$1 \quad 2 \quad 3 \quad 4 \quad 5 \quad 6 \quad 7 \quad 8 \quad 9$$

Agree   Neutral   Disagree

(5) The teacher's guided instruction with this activity was useful for improving my pronunciation.

$$1 \quad 2 \quad 3 \quad 4 \quad 5 \quad 6 \quad 7 \quad 8 \quad 9$$

Agree   Neutral   Disagree

II. Thoughts about the activity

(6) I put a lot of effort into accurately completing the pronunciation activities.

1   2   3   4   5   6   7   8   9

Agree   Neutral   Disagree

(7) I thought this activity was enjoyable.

1   2   3   4   5   6   7   8   9

Agree   Neutral   Disagree

III. Attitudes towards my pronunciation

(8) I feel very confident about my pronunciation in Spanish.

1   2   3   4   5   6   7   8   9

Agree   Neutral   Disagree

(9) I would be comfortable having a native speaker listen to my pronunciation and rate me.

1   2   3   4   5   6   7   8   9

Agree   Neutral   Disagree

(10) I am more confident now having a native speaker listen to my pronunciation than I was at the beginning at the semester.

1   2   3   4   5   6   7   8   9

Agree   Neutral   Disagree

(11) Overall, how would you rate your accent in Spanish?

1   2   3   4   5   6   7   8   9

Native-like   Neutral   Not intelligible

(12) Overall, how do you think a native speaker would rate your Spanish accent?

1   2   3   4   5   6   7   8   9

Native-like   Neutral   Not intelligible

IV. Importance of pronunciation

(13) My pronunciation in Spanish is very important to me.

<div align="center">

1   2   3   4   5   6   7   8   9

Agree   Neutral   Disagree

</div>

(14) Not having a strong American accent when speaking Spanish is important to me.

<div align="center">

1   2   3   4   5   6   7   8   9

Agree   Neutral   Disagree

</div>

(15) Knowing vocabulary and grammar is more important than having good pronunciation.

<div align="center">

1   2   3   4   5   6   7   8   9

Agree   Neutral   Disagree

</div>

IV. Attitudes towards foreign accent

(16) I struggle to understand people who have an accent in my native language (i.e. English), even if they have good grammar.

<div align="center">

1   2   3   4   5   6   7   8   9

Agree   Neutral   Disagree

</div>

(17) People who have a strong accent when they speak my native language (i.e. English) seem less intelligent.

<div align="center">

1   2   3   4   5   6   7   8   9

Agree   Neutral   Disagree

</div>

(18) Do you feel like the computer program or the teacher instruction was most useful? Why?

(19) Do you think this was a good way to practice and improve your pronunciation? Why or why not?

(20) In what ways do you think this activity can be improved? (Be specific)