Purdue University

NOMINATION FORM FOR

HELPING STUDENTS LEARN AWARD

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Name of Nominee

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Title of Innovation

Visual feedback for pronunciation instruction

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(if other than self)

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Nominations must be received electronically to cie@purdue.edu, no later than 5 pm, Friday, February 26, 2016.

Outstanding Innovation in Helping Students Learn
Nominee: Dr. Daniel J. Olson
Title: Visual feedback for pronunciation instruction

In the field of language learning and teaching, many researchers have noted that teaching pronunciation has taken a back seat to the more prominent aspects of syntax and morphology (i.e. grammar) (e.g. Deng et al., 2009). The relatively "marginalized" role of pronunciation can be seen in a general lack of pedagogical materials for, and the limited amount of time dedicated to, pronunciation in the classroom (Foote et al., 2004). Yet, both students (Elliot, 2007) and instructors (Olson, 2014a) recognize the importance of second language pronunciation. Even when grammatically correct, poor pronunciation has been shown to cause misunderstandings, slow comprehension, and lead to negative judgments about the speaker (Munro et al., 2006).

Addressing the general lack of pedagogical materials for pronunciation instruction, I created a novel series of empirically tested materials for pronunciation instruction. Grounded within the theoretical frameworks of noticing (Schmidt, 1990) and inductive learning (Shulman & Keisler, 1966), these activities make use of emerging speech technology to foster student self-assessment and correction. Specifically, these activities take the innovative approach of incorporating visual analysis into what has traditionally been an auditory phenomenon. Results from a series of analyses demonstrate significant, long lasting gains in pronunciation (e.g., Olson, 2014b), and surveys show that students respond positively to this type of activity (Olson, 2014a).

1. How does the improvement facilitate learning? Discuss the pedagogical method and the theories driving the innovation as well as the innovation itself.

The Pedagogical Method. Broadly, the new approach described here, termed a *visual feedback activity,* uses speech analysis software to create a "visual picture" of the student's speech, and allows the student to compare her production with that of a native speaker. Each visual feedback activity (VFA) consists of: (a) initial self-recording; (b) guided visual analysis; and (c) practice with self-assessment. The visual feedback activity (VFA) employs the speech analysis program PRAAT (Boersma & Weenink, 2011), which is free, downloadable software designed for linguistic analysis. Generally, PRAAT allows for the recording of speech sounds and

provides a visual representation of the acoustic signal through waveforms and spectrograms that detail the acoustic signal (Figure 1). Following an at-home recording, students participate in an in-class session to: (a) visually examine their own productions, (b) visually analyze native speaker productions, and (c) compare their own productions with those of a native Spanish speaker. Following this in-class activity, students are asked to practice and re-record, using their new skills and speech technology to self-assess and modify their pronunciation.

As an example, consider the case of an American English speaker learning Spanish. In English, /p/ is followed by a burst of air, known as aspiration (70-120ms).[1] In Spanish, the burst of air is much shorter (0-30ms). This difference can lead to both potential confusion and a "notable foreign accent" (Lord, 2005, p. 559).[2] Figure 1 shows a sample visualization of the word *pito* 'whistle' produced by a native Spanish speaker (left) and a native English speaker (right).

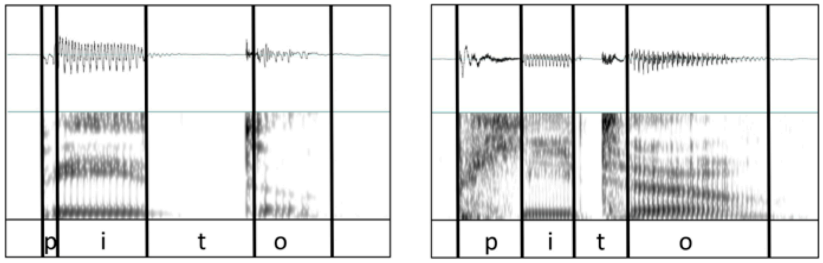

Figure 1. Sample spectrograms by a native speaker (left) and a language learners (right).

Through a series of guiding questions (Example 1 for sample) the student must analyze her own production and compare it to that of a native speaker. These questions are designed to draw focus to the pronunciation of the target sound, and encourage students to correlate the visual difference with a potential auditory difference.

(1) a. How do you differentiate your vowel "i" from the consonant "p"?
b. Is your "p" longer or shorter than your "i"?
c. Is the Spanish speakers "p" longer or shorter than the "i"?
d. Describe the visual difference between your "p" and the "p" of the native speaker.
e. What is the *auditory* difference is between your "p" and the "p" of a native speaker?

Following this in-class, self-guided analysis, students re-recorded the set of target words and sentences, using the visual image as a guide to assess their own pronunciation.

[1] This can be seen in the emphatic spelling of the word *please* as "puh-lease".
[2] A variety of sounds have been addressed using this method, including /b,d,g,p,t,k,h, pr, tr, kr/.

Theoretical Grounding. This innovative paradigm has been designed following notions of *guided inductive learning* and *noticing*, both of which have been shown to be crucial for language acquisition. Within the (guided) inductive approach to language learning, it has been said that students learn best by formulating a hypothesis and receiving immediate feedback on that hypothesis (Herron & Tomasello, 1992). Visual feedback represents a key way for students to test their hypotheses. However, as noted by Derwing and Munro (2005), just as in grammar, learners often need help "noticing what they are doing" (p. 387). Noticing is an important step in processing the relevant input, applicable at all levels of language learning (e.g., Schmidt, 1990). For pronunciation, learners may not notice the differences between native and non-native speech, unless explicitly directed by the instructor (Miller, 2012). Moreover, auditory perception is limited by the phonotactics of the first language (e.g., Flege & Wang, 1989), such that distinctions not relevant to the first language may not be perceptible. Overcoming these obstacles, visual perception provides a second modality to facilitate noticing and lead to self-correction, particularly relevant when auditory perception is difficult. This process also ensures that the student is an active participant in the learning process and provides them with the skills to continue critical self-analysis outside the classroom context.

2. How is this work creative and/or innovative? Discuss the novelty and practicality of the current advancement.

First, this project is novel as it represents a systematic, empirically tested, approach to pronunciation instruction, which has been largely lacking in second language instruction. Specifically, a number of studies have demonstrated that while both students and instructors would like pronunciation instruction, there is a clear lack of pedagogical materials (e.g. Levis & Grant, 2003) and pronunciation is generally included via an ad-hoc approach (e.g., Foote et al., 2013). When pronunciation is included in texts, it is often inaccurate, inconsistent, and rarely empirically tested (for Spanish, Arteaga, 2000).

Second, while visual feedback has been a minor area of research for intonation instruction, previous approaches have differed in two significant ways. First, early approaches

relied on complex laboratory settings (e.g. de Bot, 1983), making a classroom approach and further independent self-study impossible. Second, early approaches looked solely at intonation, ignoring the more crucial component of segmental (i.e. consonant) production. This project represents the first (to my knowledge) that has incorporated visual feedback into a lower-level language classroom, and one of the first to use this method to teach individual sounds.

With respect to practicality, I designed the VFA specifically to be accessible to students, both in-class and at-home, and practical to implement. To that end, no equipment is needed beyond a computer (at-home), the activity can be conducted in a normal classroom without computer-lab accommodations, and use of technical jargon was limited.[3] As some have claimed that speech analysis software may be too technical for students (Setter & Jenkins, 2005), I conducted a survey to evaluate the "ease of use" of the activity (Olson, 2014a). Students reported positive experiences across every stage of the activity, as shown in Table 1 (1 = strongly agree; 9 = strongly disagree). Moreover, students reported that they thought the VFA improved their pronunciation and recommend this activity in the future (Table 2).

Table 1. Learner Perceived Ease of Use of Praat

	M	SD
Downloading the program was easy.	1.22	0.7
Using the program to record my voice was easy.	1.18	0.5
Creating a visual picture was easy.	1.73	1.5
Visually differentiating between my own pronunciation and native speaker productions was easy.	2.32	1.8
Overall using this program was easy.	1.64	1.2
I had NO major difficulties using this program.	1.14	0.4

Table 2. Learner Perceived Benefits of Praat

	M	SD
The Praat activity was a good way for me to think about my own pronunciation.	2.18	1.5
I think that visualizing pronunciation will help me improve my pronunciation in Spanish.	2.40	1.8
I liked the activity using Praat.	2.40	1.5
I would recommend that the instructor use Praat again.	2.30	1.4

3. What are the broad impacts? Make sure to discuss the number of students affected as well as the applicability of the method to other domains and universities.

To date, I have implemented this project with several groups of Spanish learners at the 200- and 300-levels. Specifically, over the last 3 years, 13 sections of SPAN201 and SPAN202 have used this VFA (approx. 300 students). In addition, since re-designing SPAN361 in 2015 to incorporate this type of activity, another 50 students have participated in the VFA.

[3] As an example, *spectrograms* are referred to as "pictures" and formants referred to as "dark lines."

Reaching beyond language courses at Purdue, I have published a series of research-based papers about this approach (Offerman & Olson, under revision; Olson 2014a, 2014b), which have been well received and cited. In addition, this approach has been used as an example in a graduate-level course on *Technology in Foreign Language Educations* at a peer institution (Lu, p.c.). These examples speak to both the broader impact of the project, as well as the care with which the approach has been designed, implemented, and evaluated.

Given both the success and practicality of the VFA, it can be easily adapted for a variety of contexts, including language classrooms, ELS training, and accent reduction programs.

4. What is the evidence of student learning?

The approach described above has been, and continues to be, thoroughly vetted to understand both the type and scope of acquisition. As an example, when implemented to teach the intervocalic sounds /b, d, g/ in Spanish, results demonstrated statistically more native-like productions following the VFA (Figure 2), as evidenced by a greater, acoustically measured, intensity ratio. In addition, students exposed to the VFA have shown significantly greater improvement than a control group who received "traditional" instruction (Olson, 2014b). Similar results have been shown for training /p,t,k/, with consonant durations decreasing by an average of 35ms (Offerman & Olson, under revision), and are currently being analyzed with respect to complex consonant clusters (e.g, /pr/). Furthermore, as evidenced by the delayed post-test in Figure 2, the VFA had a long-lasting effect. With respect to the scope, Offerman and Olson (under revision) demonstrated that training in limited contexts, specifically individual words and short read-aloud sentences, leads to significant improvement even in more spontaneous speech. In short, the VFA detailed here has been empirically proven to result in more native-like pronunciation for a variety of sounds in the target language.

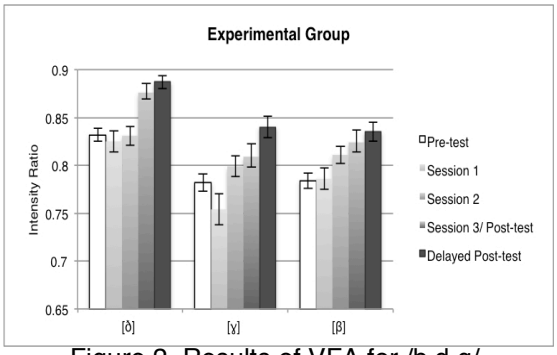

Figure 2. Results of VFA for /b,d,g/,