

Native vs. Non-Native Spanish Language Comparison

University of Illinois at Urbana-Champaign

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Table of Contents

Introduction and Motivation.....

Method.....

Process.....

Analysis.....

Figures

Conclusion.....

Acknowledgements.....

References.....

Introduction and Motivation

With the Spanish language becoming as predominant as it is in the United States, the initial motivation for this project was to ultimately create a software package that could better teach this language. When thinking about non-native Spanish speakers, there is often a lack of accent in their speech. They may have learned the language and can speak it at a proficient level, yet they sound incredibly novice just by the strength of their accent. Originally, the motivation for our project came from these accent issues. We wondered if it could be possible to record and bucket native Spanish speakers in such a way, that a software could analyze volume, pitch and speed of speech to determine how the speaker could alter their own speech in order to sound more native to whatever region they might be interested in.

While one might confuse the objective of our idea with a software package like Rosetta Stone, it's important to note that the distinctive difference is that we are proposing teaching proper pronunciation to enhance an individual's accent. We foresee this taking place in the form of tips that are given by the software after comparing what an individual is trying to sound like versus what a native actually sounds like. The software can give these tips in the form of helping make commentary on mouth shape, syllable makeup of a word and slowing or speeding up of speech to name a few things.

There are numerous factors that influence how an individual utilizing this software may be compared to a native speaker within the system. Due to this realization, we've recognized that we will need to narrow our project scope in order to draw meaningful analysis during the duration of this course. Throughout this report, we will detail how we went about this.

Method

There are several words within the Spanish language that are commonly mispronounced by non-native speakers. The mispronunciation of these words comes from several factors. A majority of these factors are what we are looking at in this study such as volume, pitch and the speed at which words are pronounced. Due to this, we have decided to take a look at four key words that are most commonly mispronounced. They are favorito, llamar, mucho and nombre, which translate in English to favorite, to call, much and name respectively. We use these four words and look at them in a few different ways that help show us the differences and similarities within accents and what they can be attributed to.

For each of the four words, we created two Spanish sentences where one sentence had the word in the middle of the sentence and one where it was used at the end of the sentence. We did this because we wanted to make sure the behavior of the words we are looking at are not influenced by being at the end of the sentence. Verifying that there are similar patterns when the word is placed at the middle or end of a sentence helps us do this.

For each Spanish sentence, we also had its English equivalent. We did this because it would allow for us to compare similarities and differences between each test subject's Spanish and English equivalent recordings.

To have the most controlled study, we limited our focus to look at females in their early 20's where we could have representation by two native and two non-native speakers. Therefore, we had four total test subjects. We categorized a native speaker as someone whose first language is Spanish or it has been spoken since childhood. Similarly, we categorized a non-native speaker as someone, whose primary language is not Spanish, but has some prior

knowledge in speaking the language. Test candidates Melisa and Lily make up our native speakers while Hannah and Sara make up our non-native speakers.

Process

The sentences we created are very basic and are commonly used in one way or another by both native and non-native speakers. They are categorized as follows:

Favorito

- 1.1 Mi equipo favorito es de Mexico
- 1.2 My favorite team is from Mexico
- 2.1 El color rosa es mi color favorito
- 2.2 The color pink is my favorite color

Llamar

- 3.1 Ella se llama Hannah
- 3.2 Her name is Hannah
- 4.1 Como se llama?
- 4.2 What is her name?

Mucho

- 5.1 Estoy nerviosa para mi examen aunque estudiado mucho
- 5.2 I am nervous for my exam even though I studied hard
- 6.1 Mi examen tuvo muchos problemas dificiles
- 6.2 My exam had a lot of difficult problems

Nombre

- 7.1 Mi nombre es Hannah

7.2 My name is Hannah

8.1 ¿Cual es tu nombre?

8.2 What is your name?

As you can see, there are 16 sentences when counting all of the Spanish sentences that the four words make up and their English counterparts. We then proceeded to have all four test candidates speak these sentences into a 64 bit digital audio recorder. This left us with 64 audio files. We ran each audio file through MATLAB sound analysis software to retrieve graphs such as signal vs. time, magnitude of amplitude vs. frequency and frequency vs. time vs. volume. Ultimately, we ended up focusing on the frequency vs. time vs. volume graphs as they provided the most information for us. The frequency acted as pitch and amplitude as volume. Consequently, these are the graphs you will see throughout our report.

These graphs can be understood by recognizing that frequency is on the y-axis, time is on the x-axis and amplitude is represented by color where darker shades, like red, represent the higher amplitudes and lighter shades represent lower amplitudes.

Analysis

For purposes of clarity, consistency and ease of comparison, we have grouped all 4 of the test subject's audio file graphs into a square like structure. In this structure, you can notice that both non-native speakers will be on the left side and both native speakers on the right hand side. Melisa will always be found in the first quadrant, Hannah in the second, Sara in the third and Lily in the fourth quadrant.

We noticed a lot of both similarities and differences when we analyzed our graphs, but we were careful to make sure we accounted for different people naturally speaking louder or

softer and at higher or lower pitches, for the different levels of fluency in the two non-native speakers, and the fact that one of our native speakers is Cuban and the other is Mexican so there will naturally be some differences in accent and pronunciation. In this section we will point out where there are visible accents, how speaking speed increases with fluency, the similarities between the two native speakers and between the two non-native speakers, and explain our approach that we took in our analysis that helped us reach these realizations.

Our approach was fairly simple. We first analyzed each speaker alone so as to avoid making assumptions without taking natural tendencies into account. We found that Lily naturally speaks the loudest and Hannah the softest, and Melisa and Sara have a higher pitch. Having this information up front allowed us to realize that we only needed to look at where the changes in each graph occurred, instead of the exact increase or decrease in pitch and volume at each peak. We then lined up the graphs with the sound files to figure out where in the sentence each peak occurred so that we could begin to analyze which words are more similar between the four and which are different. We found that the frequency peaked at words that had harsher sounds such as an “s” or a “t”, and the lower peaks are the softer letters such as vowels that don’t require a lot of effort to say. With this information, we then looked for similarities and differences that we could legitimately attribute to differences in fluency and region.

The most obvious thing that we noticed, and one of the things we expected to see, is that Sara is the least fluent Spanish speaker and she took significantly longer to speak her Spanish phrases than the other three, with Hannah still being slightly slower than Melisa and Lily. When learning a language it is important to be able to speak and understand at the rate that native speakers are speaking, but speed naturally increases as you get more comfortable speaking, as is shown by the increase in speed from Sara to Hannah to Melisa and Lily.

Another major thing that we noticed in general across all of the Spanish graphs is that Lily and Melisa have a very fluid look to their graphs because their words are more connected in a “sing-song” way than Hannah and Sara, who have very defined points where the word changes. The fluidity that comes with being a fluent speaker is another aspect of learning a language that is very important. It’s very obvious to native speakers who is and isn’t native because of the choppy sentence structure and frequent pauses when speaking.

For the rest of the analysis section we will be referencing individual figures, which are all labeled below.

First, in Figure 1 and Figure 3 we found that “favorito” was pronounced differently by the native and non-native speakers. The non-native speakers essentially cut out a syllable in the middle of the word but put a lot of accent on the “t”, whereas the native speakers said it very fluently, all four syllables are present, and the “t” is much softer. This shows a fundamental difference between English and Spanish, which is that English has harsher sounds on those letters that require a tongue-teeth connection where Spanish is more fluid and has softer sounds on those letters.

Accents are also very visible in the graphs, which is helpful for the eventual creation of a program that would be able to detect those differences and give tips on how to roll r’s, etc. Figures 13 and 15 especially illustrate this point, because “nombre” is a word with mostly soft sounds, but because of the r roll, the native speakers have a much more defined peak at that point than the non-native speakers. This point is also visible in other graphs where the Spanish phrase had an r roll, but it is easiest to see on Figures 13 and 15.

There are so many other similarities and differences between the graphs, but these are the biggest ones that we found. Given an infinite amount of time and more speakers and phrases the

possibilities of this research would be endless, but in a sixteen week semester and without fancy software and equipment to be able to normalize the graphs and help us analyze them, these big points are the most reliable takeaways we could find.

Figures

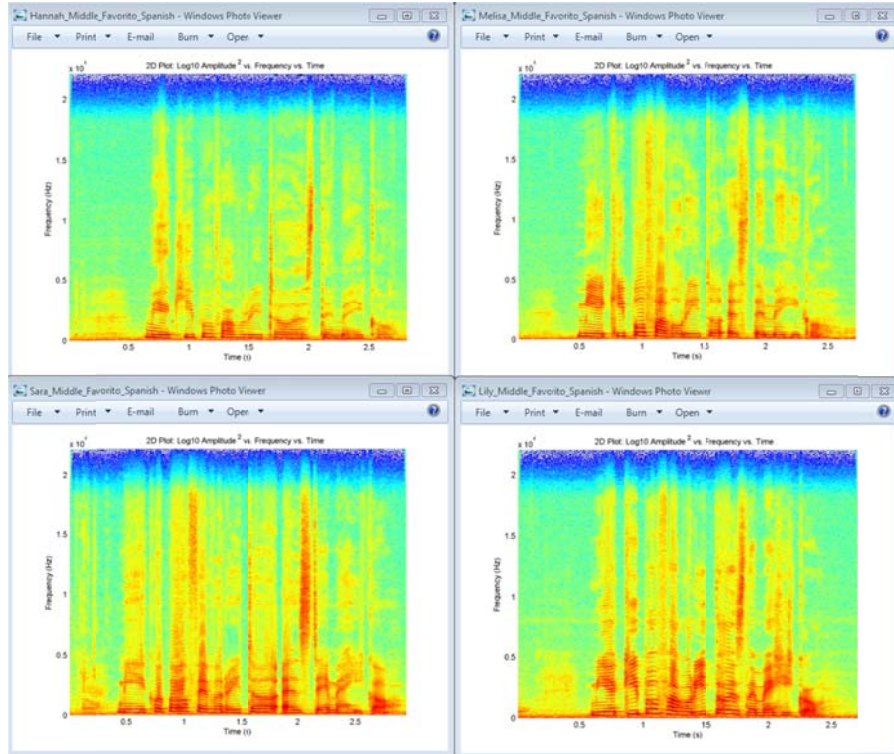


Figure 1. The spoken phrase, “Mi equipo favorito es de Mexico.”

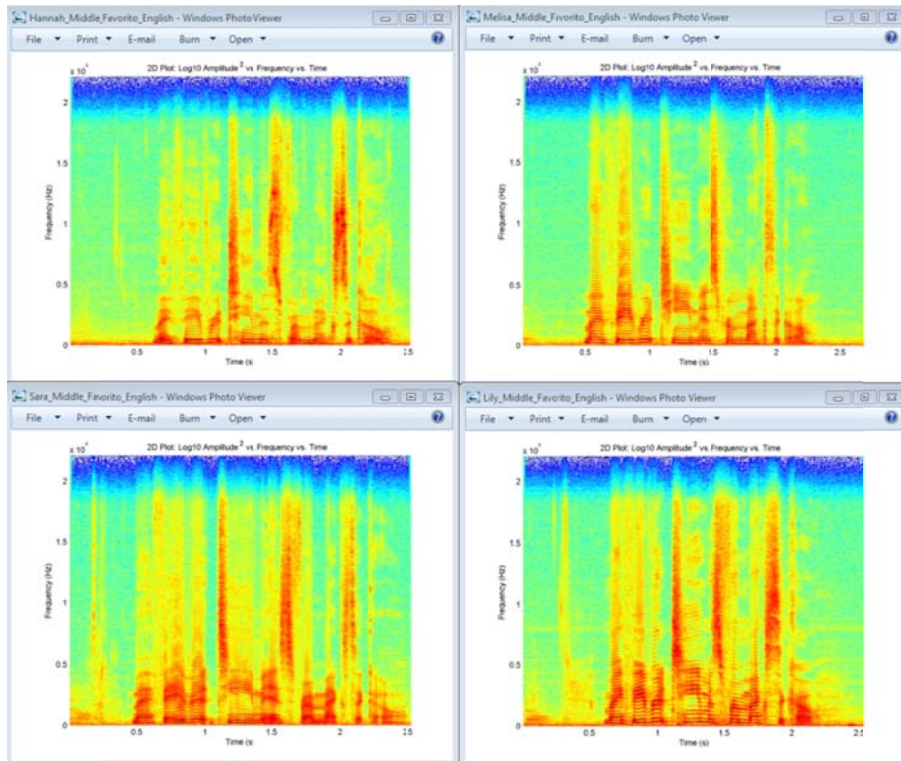


Figure 2. The spoken phrase, “My favorite team is from Mexico.”

Native vs. Non-Native Spanish Language Comparison

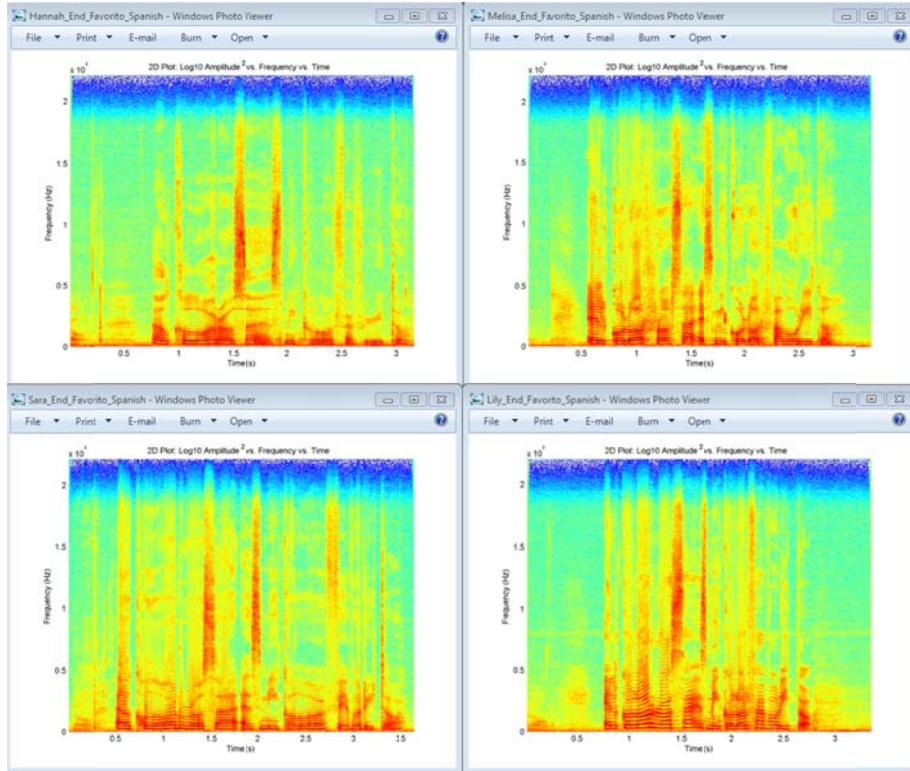


Figure 3. The spoken phrase, “El color rosa es mi color favorito.”

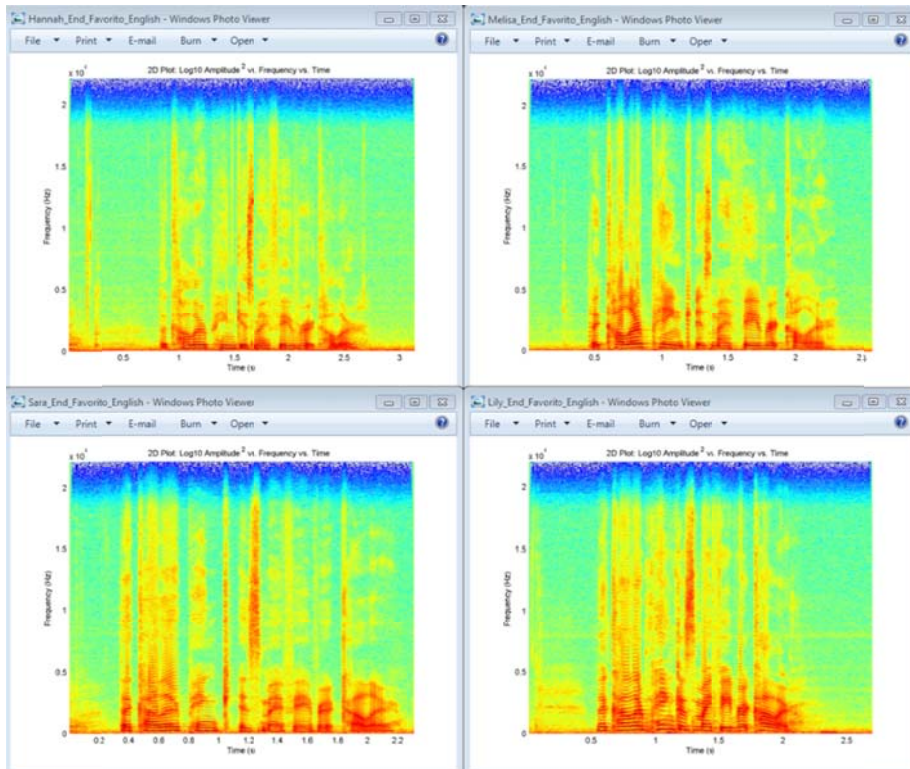


Figure 4. The spoken phrase, “The color pink is my favorite color.”

Native vs. Non-Native Spanish Language Comparison

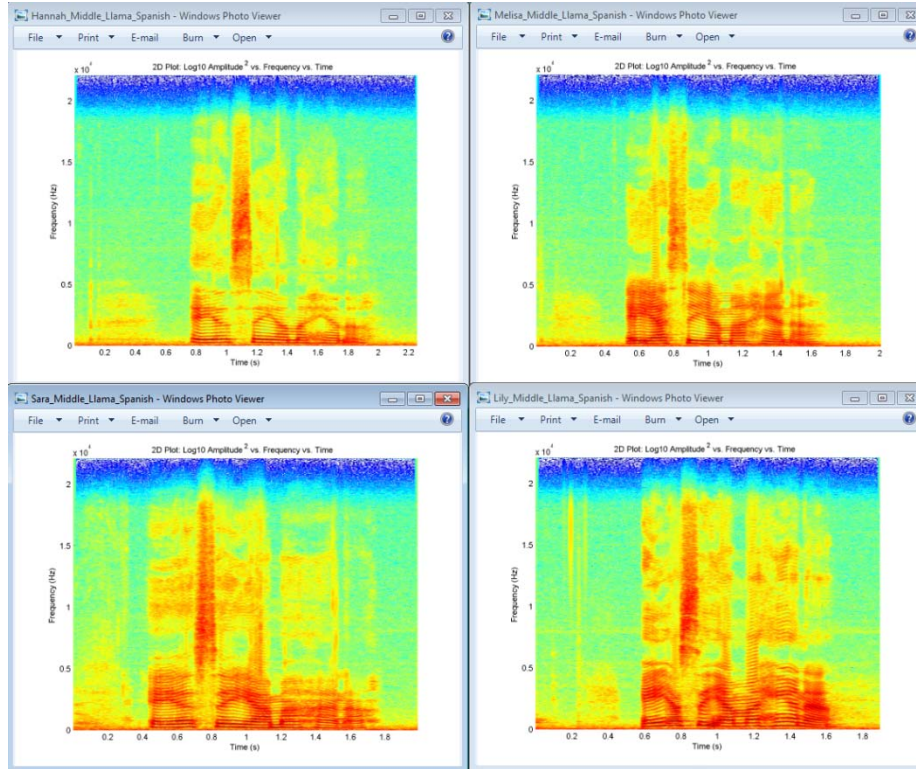


Figure 5. The spoken phrase, “Ella se llama Hannah.”

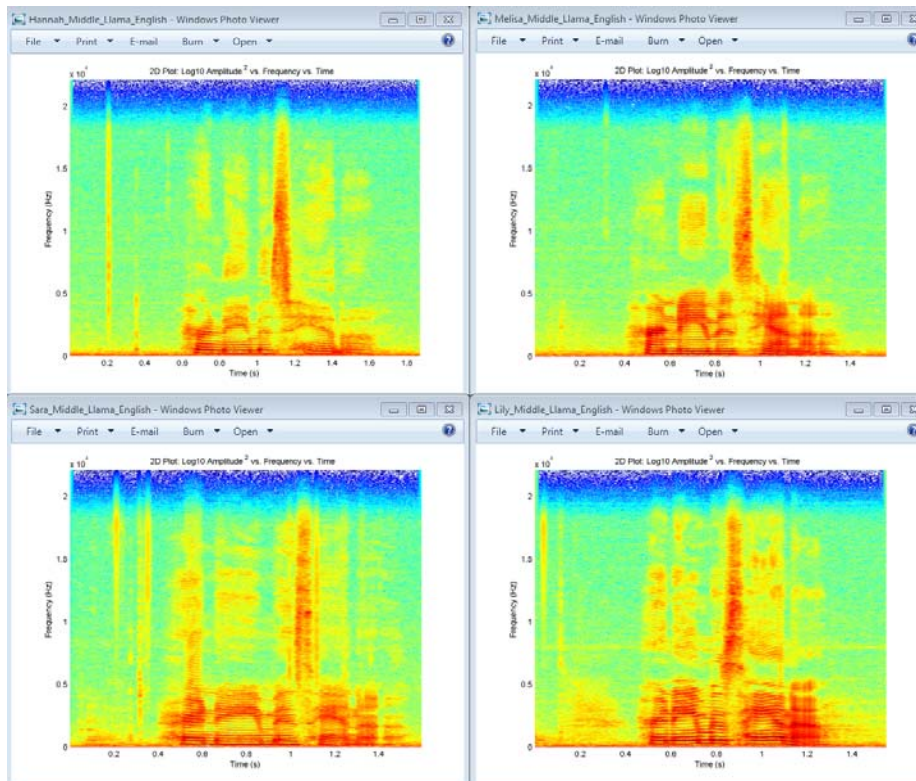


Figure 6. The spoken phrase, “Her name is Hannah.”

Native vs. Non-Native Spanish Language Comparison

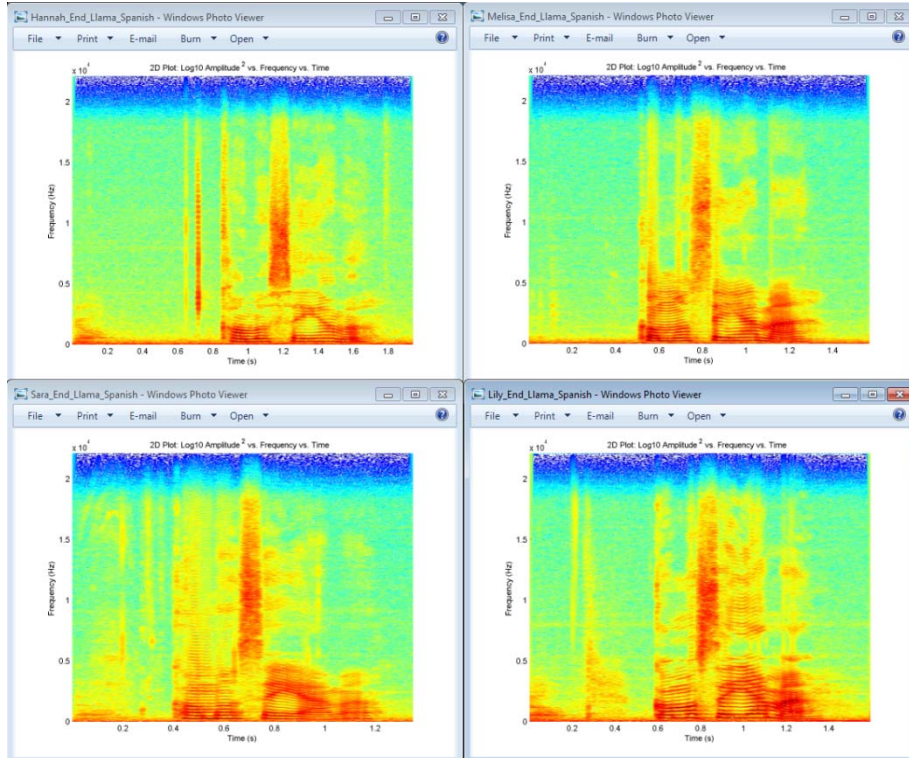


Figure 7. The spoken phrase, "¿Como se llama?"

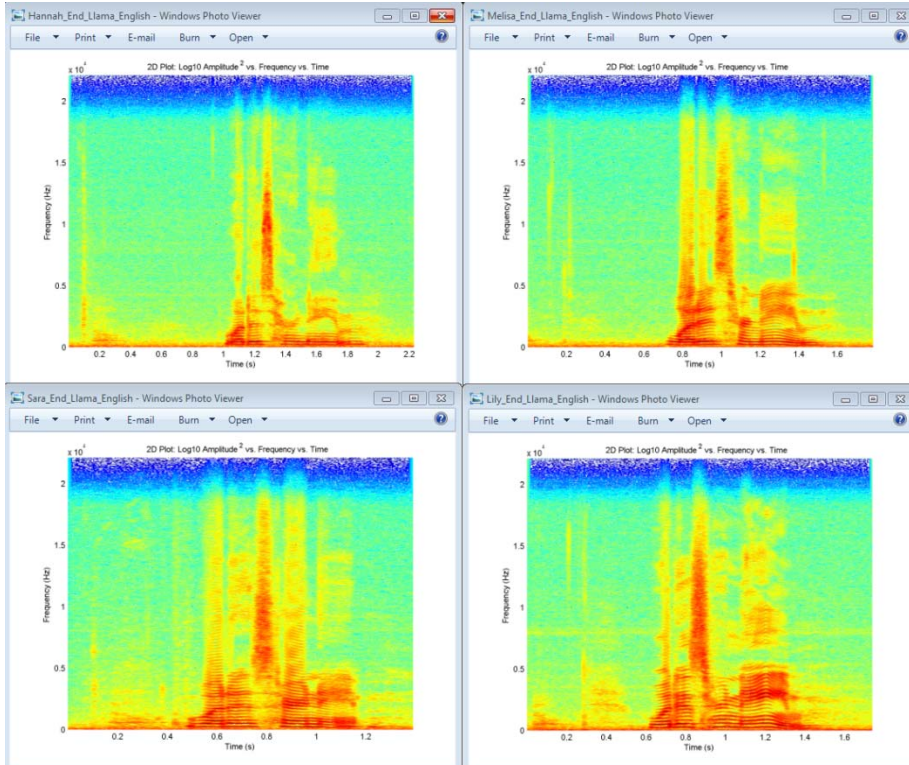


Figure 8. The spoken phrase, "What is her name?"

Native vs. Non-Native Spanish Language Comparison

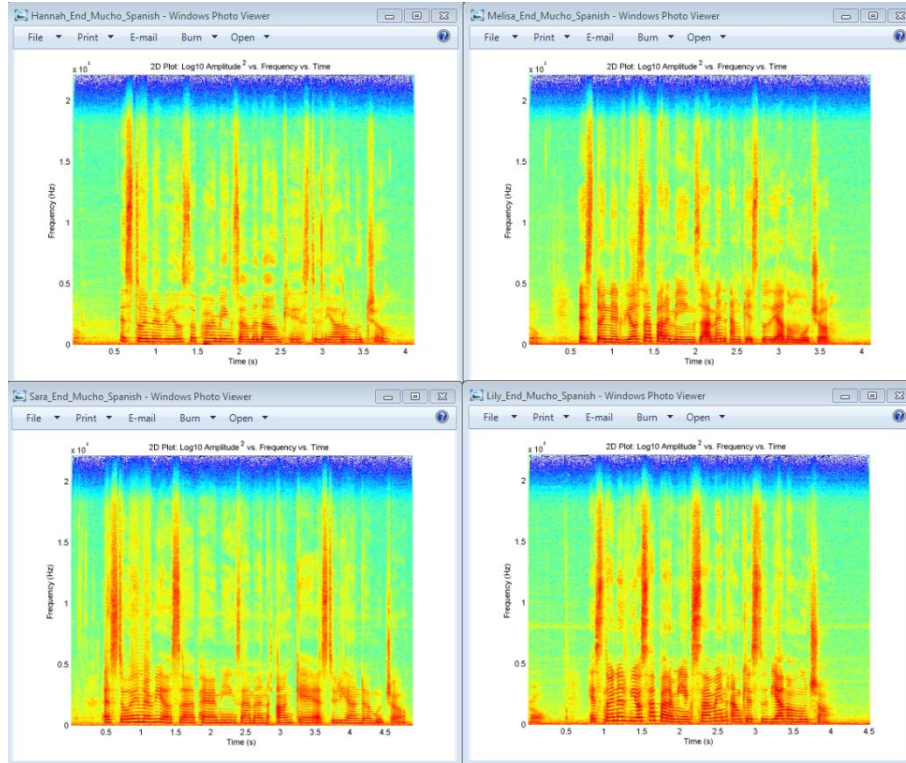


Figure 9. The spoken phrase, "Estoy nerviosa para mi examen aunque estudiado mucho."

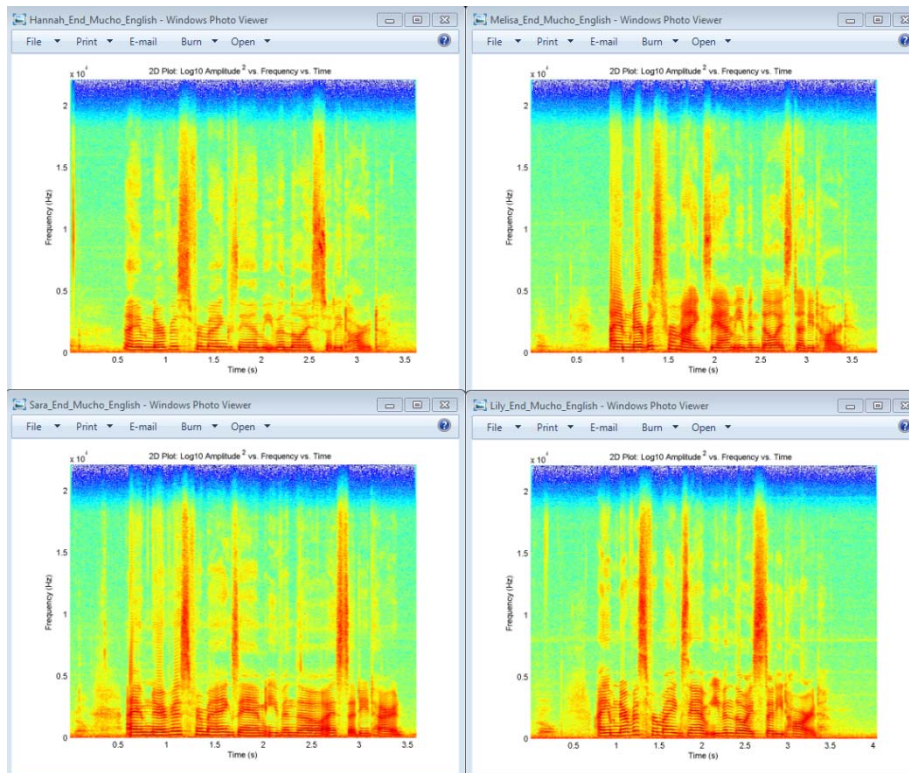


Figure 10. The spoken phrase, "I am nervous for my exam even though I studied hard."

Native vs. Non-Native Spanish Language Comparison

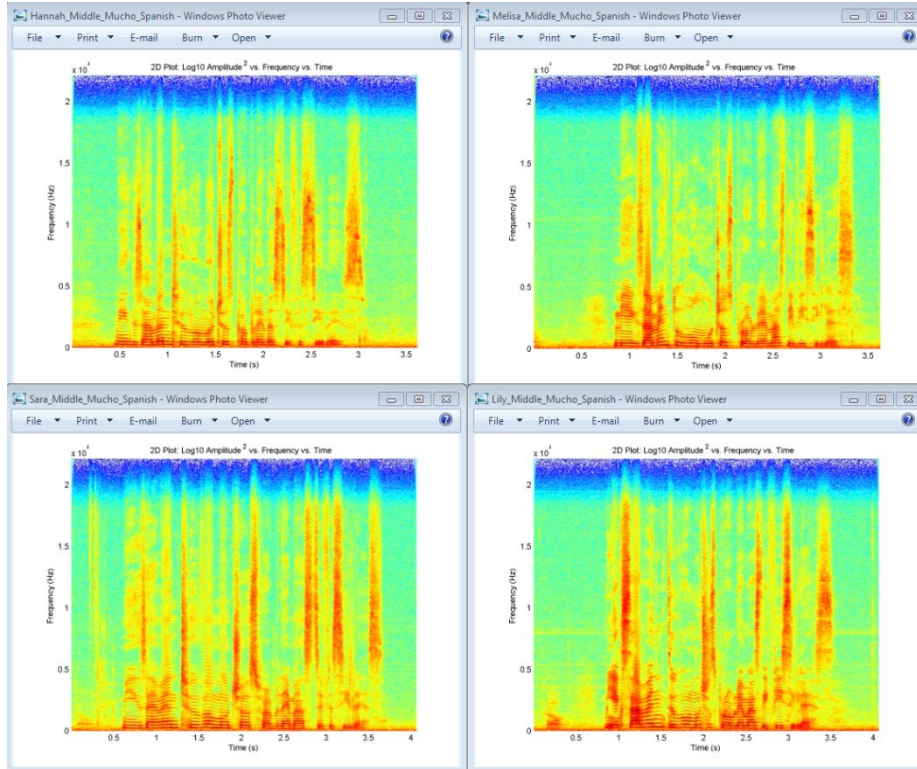


Figure 11. The spoken phrase, "Mi examen tuvo muchos problemas difíciles."

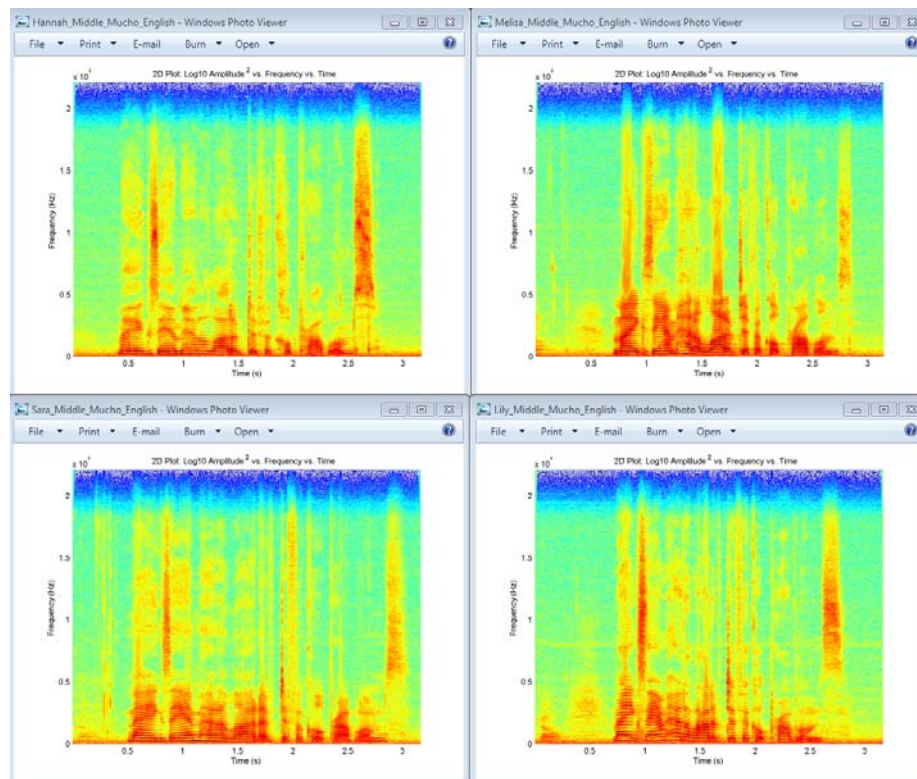


Figure 12. The spoken phrase, "My exam had a lot of difficult problems."

Native vs. Non-Native Spanish Language Comparison

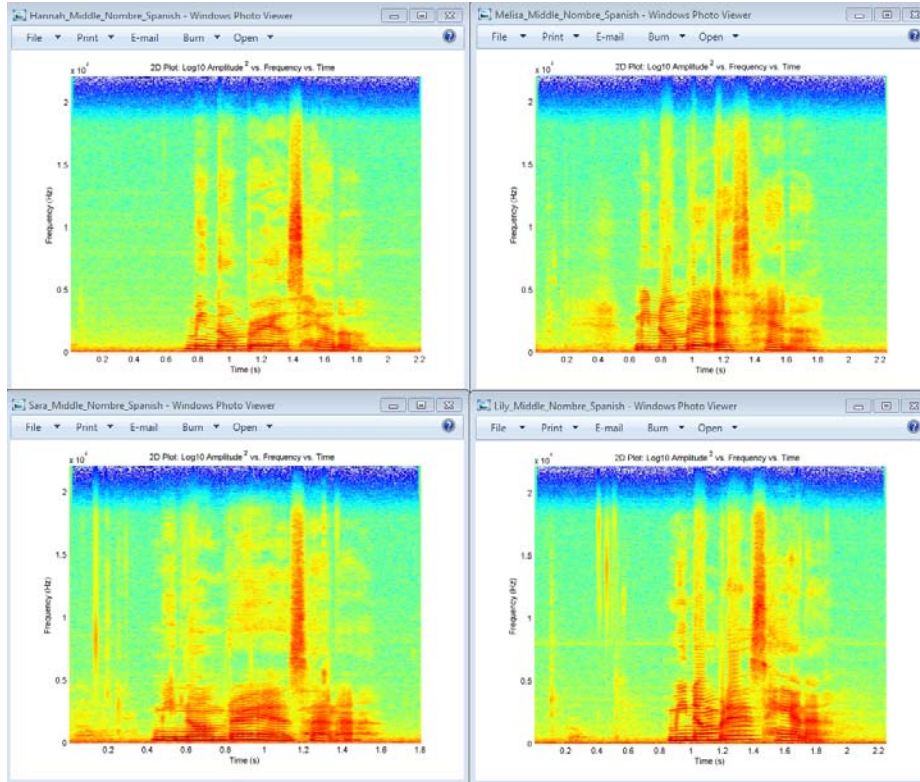


Figure 13. The spoken phrase, “Mi nombre es Hannah.”

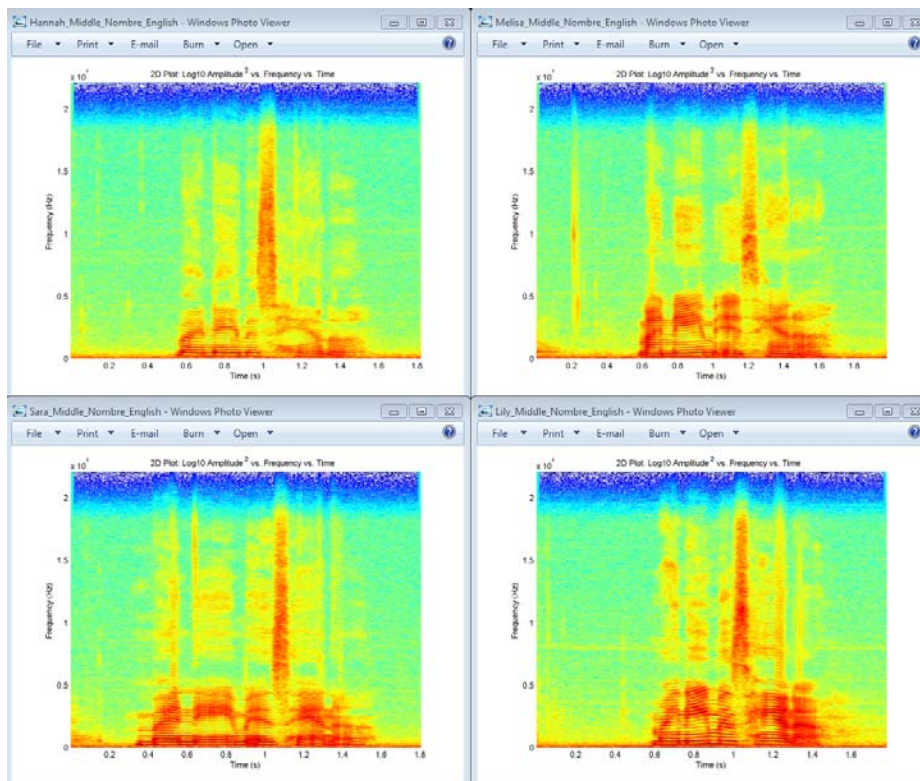


Figure 14. The spoken phrase, “My name is Hannah.”

Native vs. Non-Native Spanish Language Comparison

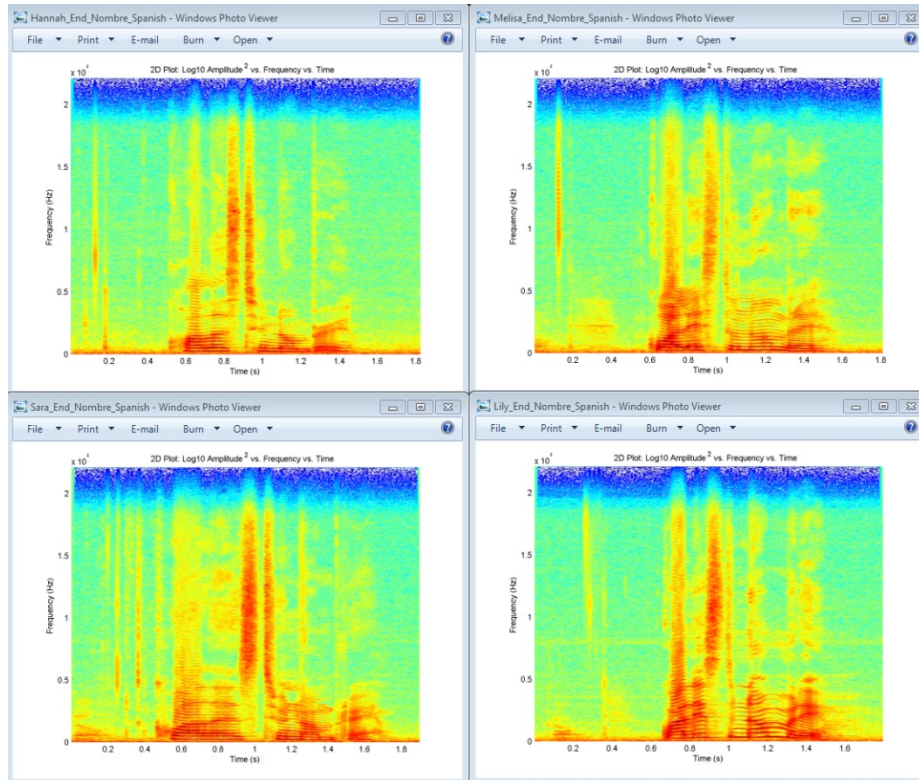


Figure 15. The spoken phrase, "¿Cual es tu nombre?"

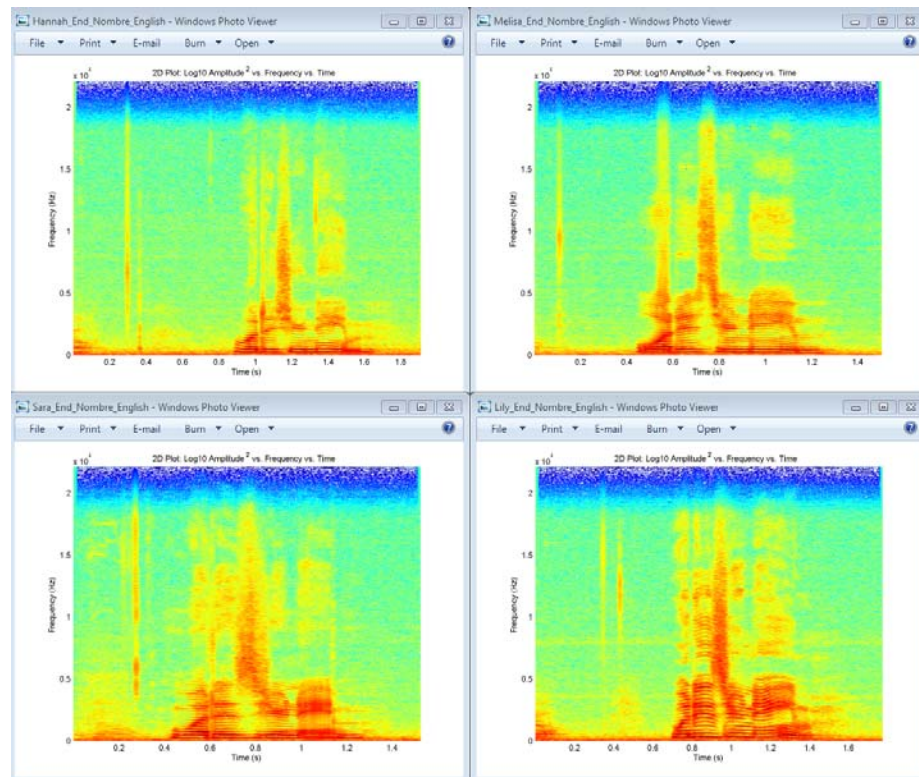


Figure 16. The spoken phrase, "What is your name?"

Conclusion

With more time and further investigation, there is much more we would have liked to pursue. Although, through the last 16 weeks we feel we have learned a vast amount regarding the physics of language patterns. We originally underestimated how complex this field would be, but now having become familiar with the process of coming up with an original project scope and other research that is ongoing, we realize we have only touched the surface of this field. Even so, we are now able to attribute certain frequency, pitch and overall speech patterns to native and non-native speakers of the Spanish language.

Further work could include the creation of a software that lines up the audio file against their respective graphs. This would allow someone to pause the audio file and very easily be able to see where that pause is occurring on the graph. This means someone could critically look at the syllable break down of words in a sentence structure among many other things.

Additionally, the creation of a different kind of software that takes the quantitative differences between amplitude and frequency and time delay between each test candidate could yield important information. A software of this caliber could compare audio files against each other and yield a much larger amount of information than the more qualitative analysis we have done throughout the duration of this project. A software of this magnitude would greatly reduce human error in comparing graphs against each other.

To add onto the scope of this project, we would have also liked to record and track the speaking patterns of many more test subjects that are represented by different Spanish speaking countries, regions and ages. This could be used to create an even smarter system to recognize language patterns if we were to proceed this way.

Acknowledgements

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