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A Linguistic Comparison: Stress-timed and syllable-timed languages and their impact on second language acquisition

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Background

Acquisition of a second language can be a challenging task for a multitude of different reasons because no two languages are alike in their structure, syllabification, pronunciation, rhythm, etc. Also, after speaking one language for any amount of time, the speaker becomes accustomed to the specific qualities of that language; therefore, learning to speak another language takes extra effort because it is essentially rewiring the brain to think differently in many ways. One important element of language is prosody, or the patterns of stress and intonation in language (Dilley et al 237). The subsector of prosody that is to be studied is rhythm, explicitly isochrony and stress timing. Isochrony can be defined as the postulate that morphological stresses occur at nearly equal intervals in language (Dilley et al 237). Though there is not clear evidence to support this concept, there is evidence that languages have individual natural rhythms. A close comparison of multiple languages will show that some rhythms are based on syllable timing, while others are timed around stress, and still others do not consistently fit either of these models. Lloyd James was the first to develop the idea that languages have different rhythms when he described that the rhythm of Spanish was similar to that of a machine gun, while that of English was more similar to Morse code (Nespor et al 1148-1149). In Spanish, each syllable lasts the same amount of time whether it is stressed or not; however, in English, syllables are audibly lengthened or shortened based on stress which can be compared to the inconsistent tapping of Morse code.

In order to make these comparisons among languages, it is necessary to have an understanding of the different rhythms or timing of languages.

Stress-timing is an important element of many languages, such as English, Russian, and Arabic (Nespor et al 1149). Stress-timing refers to the perceived notion that there are equal amounts of time between two consecutive stressed-syllables (Pamies Bertrán 103). This is true, on average, for native speakers of English, who subconsciously extend or shorten syllables so that the stresses will be spread out as consistently as possible. The English language is based around vowel stress; stressed syllables are given a longer duration. For example, in the word "America," pronounced [ə-ˈmɛr-ə -kə], the second syllable is the stressed syllable and thus is given a longer duration in pronunciation. The other three vowels 'e,' 'i,' and the final 'a' are all pronounced as a schwa sound and since they are unstressed, their duration is significantly shortened. In this example, the stressed vowel is in the syllable 'mer.' In the other three syllables, there is an almost complete loss of vowel quality due to significant shortening of the syllables. They are shortened and unstressed so speakers naturally brush over them without significant emphasis.

In a stress-timed language, the stressed syllable in a certain word can move or change depending on how the word is used in a sentence or what other stressed syllables may be near it. For example, when one counts, "fourteen, fifteen, sixteen," the stress is always on the first syllable of each word so in " 'six-teen," the "'six-" is stressed; however, in the sentence "She's 'only six'teen," the second syllable of the word "sixteen" receives the stress because the first syllable of " 'on-ly" is stressed and the speaker naturally spreads the stresses out as evenly as possible (Ladefoged

98). This phenomenon is common to most English sentences as native speakers move the stressed syllable without even realizing it.

The basis of stress-timing in English is found in two different processes that function to maintain the rhythm and timing. As previously stated, stresses can be moved within a word depending on their location in a sentence and their location relative to other stressed words (or syllables). In addition to moving stresses within a word, stresses can also be dropped if two stressed words are pronounced too close together. For example, in isolation, the words, "The, big, brown, bear, ate, ten, white, mice" all receive individual stresses since they are monosyllabic words; however, in the sentence, "The 'big brown 'bear ate 'ten white 'mice" stresses are dropped on every other word so that the stresses are as indicated above—evenly spread out (Ladefoged 98). The way native speakers move stresses or delete stresses on certain words is innate: stresses tend to be placed at equal intervals. It is important to note that that is not always the case, but the tendency is to space out stresses as evenly as possible. The other process by which stresses are spread out instinctively is through vowel pronunciation:

> We saw that the vowel in "speed" is longer than that in "speedy," and in turn is longer than that in "speedily." This can be interpreted as a tendency to minimize the variation in the length of words containing only a single stress, so that adjacent stresses remain much the same distance apart (Ladefoged 99).

Naturally, native speakers try to pronounce single stress words with a constant duration, no matter how many syllables they contain. In this example, the vowel in

"speed" is the same sound and intensity as "speedy" and "speedily," but its duration

is obviously longer. Together, the extension and shortening of vowels by these two

methods makes stress timing extremely consistent.

The other common language rhythm is called syllable timing and refers to a

language in which the duration of each syllable is roughly equivalent ("Prosodic

Features"). Languages with this rhythm often seem more monotone because

syllables are always given the same duration no matter the placement or the

stresses. Every syllable in every word is pronounced over the same duration

whether it is tonic or atonic. Spanish is one example of a syllable-timed language;

other examples include Italian, French, and Telugu (Nespor et al 1149). To continue

with the example above, the Spanish word "América," the phonetic transcription of

which is [a-'me-ri-ka]. In this example, all four syllables have the same duration and

the vowel quality of each is unreduced. Even though there is only one stressed

syllable, all four vowels are pronounced for similar intervals; in fact, there is no loss

of vowel quality in Spanish as there are only ever five vowel sounds compared to ten

in English that differ based on quality and duration.

Relevance

Within the scope of this study, a comparison will be made between syllable-

timed languages and stress-timed languages, using Spanish and English as examples

of each. To study the impact of rhythm, or timing, on second language acquisition a

comparison will be made between the speaking rhythm of native speakers as well as

non-native speakers. I hypothesize that second language acquisition is greatly

impacted by the differences in rhythm between two languages. Therefore, in

comparing the stresses used by native speakers and non-native speakers, I expect to see that native Spanish speakers have a more consistent, even displacement while native English speakers will show more variation in their displacement, as they account for the many stresses in their rhythm. The changes in displacement represent the intensity of the sound. A greater, more changed displacement is indicative of a high degree of loudness. Since second language learners are not typically taught about the differences in stress-timing versus syllable-timing, I expect that speakers will not demonstrate a knowledge of the differences when speaking their second language.

Research Design

This study uses human research subjects and their natural speaking capabilities to measure and study the nature of the stresses they use in language. There were four participants, two native Spanish speakers and two native English speakers. This was a single-blind experiment because the subjects knew that the study had to do with their use of language, but were uninformed as to what was specifically being analyzed.

Subjects were asked to sit in a quiet room and wear headphones to avoid distractions or outside noise. Subjects were first asked a few questions about their learning styles and how they had learned to speak their second language. Each, at separate times, was then provided with the story, "Little Red Cap" (The text is included in Appendix A) and asked to read it when instructed to do so. The story was kept covered until the recording was started. The researcher asked the subject if he or she was ready and when he or she affirmed that he or she was, each was

asked to begin reading. The subject read a portion of the story. Then the recording was stopped and the researcher gave the subject a copy of "Caperucita roja," the same story in Spanish (The text is included in Appendix B). The story was kept covered until the recording was started, at which time the subject was instructed to uncover the story and began reading. The subject read a portion of the story. After he or she finished, the recording was stopped and the study was finished. After recording all four subjects, the researcher used the phonetics software Praat to analyze the recordings. The recordings were compared syllable to syllable within each subject's data in order to compare the intensity of the waveform between stressed and unstressed syllables. This analysis was documented and then used to compare the average intensities between the two languages. The spectrogram and results are recorded below.

Results

Of the four subjects that were used in this research study, data from two of them is included below. Data from the other two speakers was consistent with what is shown below so for clarity, the excess data was omitted from this project. The recording of the native Spanish speaker reading in English was not included because it was outside the scope of this paper and because it was abnormally accurate as the subject had a very high level of education in both English and Spanish language. The figures shown below were selected as they were the clearest representation of the data that is significant to the hypothesis, some additional data was not included as it was insignificant to the study.

A sound spectrogram is a visual representation of an acoustic signal (Ladefoged). The spectrograms should be read in the following way:

1. The intensity of the sound is represented by the displacement of the line from the origin.

2. The greater the displacement, the greater the intensity of the sound and therefore, the louder the sound.

3. A consistent displacement indicates a consistent amplitude or loudness profile.

4. In the smaller section spectrums, the amplitude patterns are represented by the yellow line on the spectrum that is intended to highlight the dark bands in which the spacing represents the rhythm and the darkness represents intensity.

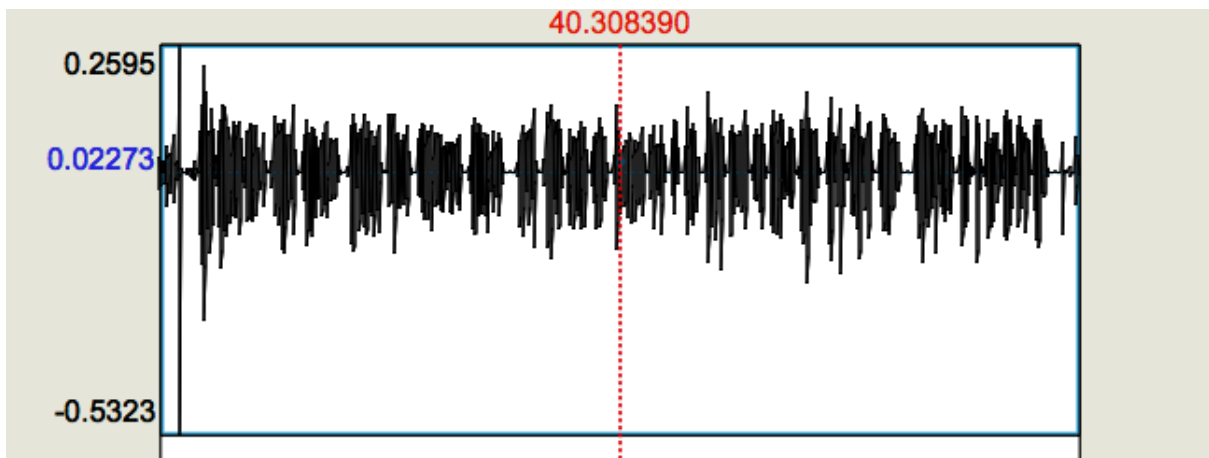**Figure 1. Native Spanish Speaker 1 reading in Spanish**

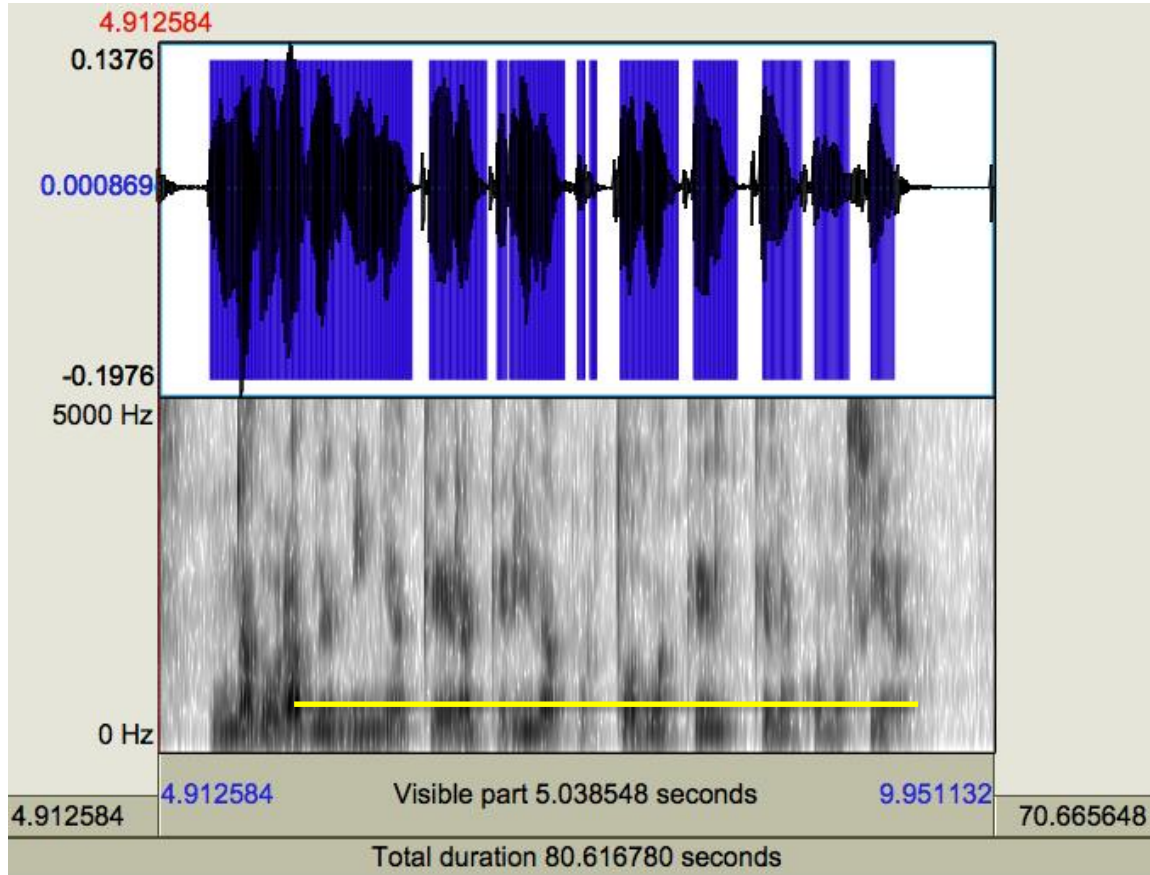**Figure 2. Section of Native Spanish Speaker 1 reading in Spanish**

Figure 1 details the speech of a native Spanish speaker; the intensity between syllables is pretty consistent and shows that there is a natural rhythm present in the subject's speech. Figure 2 represents a smaller section of the speech of the native Spanish speaker. As is shown by the yellow line, there are consistent bands of intensity that appear to be evenly spaced in the speech of the subject. The dark bands appear almost like many plateaus of equal height. There is some inconsistency near the beginning of the spectrum, but this can be explained as the opening words of the recording, before the subject got comfortable reading; therefore, these are not significant to the study.

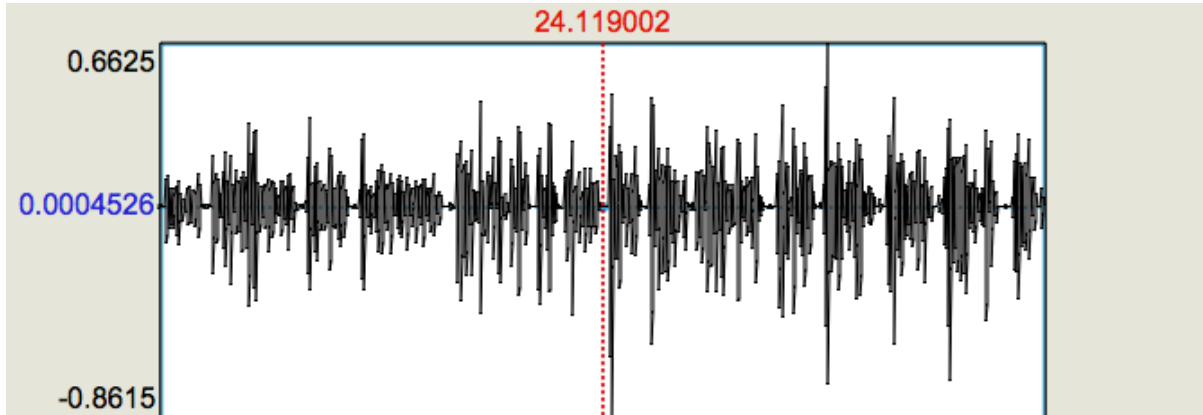**Figure 3. Native English Speaker 1 reading in English**

Figure 4. Section of Native English Speaker 1 reading in English
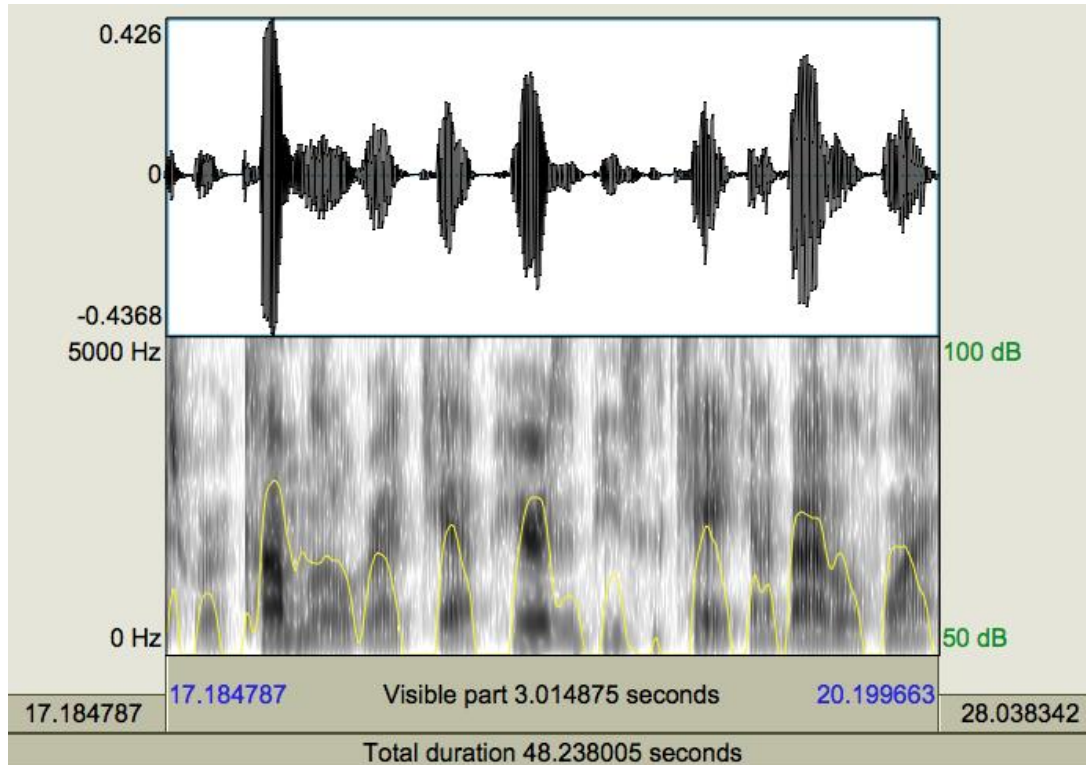

Figure 3 shows the spectrogram for a native English speaker reading in English. The wide scope view of the entire spectrum shows that there are significant changes in intensity throughout the reading. Figure 4 shows a smaller section of the subject's waveform. The bottom section of the graph demonstrates

that the intensity is peaking at regular intervals, as there are three main peaks and

smaller ones in between.

Figure 5. Native English Speaker 1 reading in Spanish
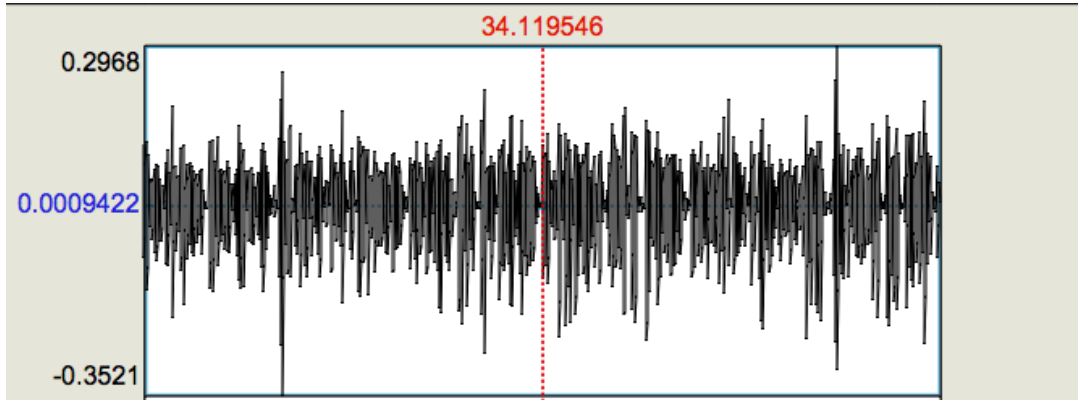

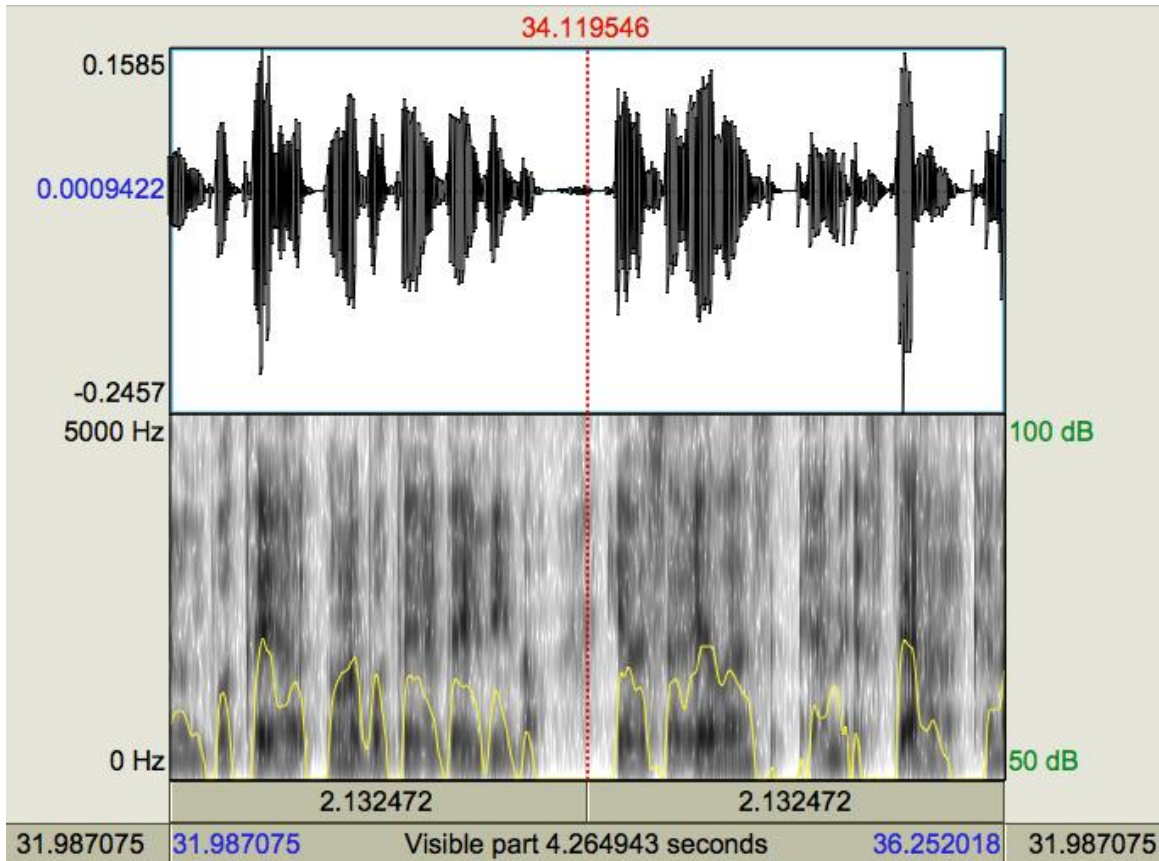**Figure 6. Section of Native English Speaker 1 reading in Spanish**

Figure 5 is the spectrum on a native English speaker reading in Spanish. This spectrum is extremely choppy and demonstrates extreme changes in intensity from syllable to syllable. In comparing Figure 5 to Figure 1 (that of the native Spanish speaker) and Figure 3 (that of the native English speaker), it is obvious that the spectrum of the native English speaker reading in Spanish is more similar to the native English speaker reading in English. This demonstrates that the native English speaker does not account for prosodic difference between Spanish and English, but rather just pronounces them in the same way. The following waveform, Figure 6, is a smaller representation of the same spectrum taken from the native English speaker reading in Spanish. This waveform shows peaks and valleys that are unevenly spaced.

Analysis

In comparing the spectrums from all subjects, those shown above represent the average spectrums for the different categories of the speakers. From the first four spectrograms, the evidence supports the idea that there is an obvious difference in intensity depending on the rhythm of the language. For the syllable-timed language, Spanish (shown in Figures 1 and 2), there is an even distribution of stress, basically on each syllable. This provides for an even, smooth waveform and a more or less consistent intensity. On the other hand, for the stress-timed language, English, the evidence in Figure 3 and 4 shows that the intensity is much more varied and peaks at almost regular intervals which represent the attempt to space out stresses as much as possible in a sentence.

If it is assumed that Figure 1 is a good representation of the average spectrogram for native Spanish speakers and the same is true for Figure 3 as a representation of native English speakers, then Figure 5 supports the idea that there is an almost complete absence of the consciousness of timing differences between languages. The subject behind this spectrogram was a native English speaker reading in Spanish and his rhythm is very much one of an English speaker. This means that the speaker does not realize there is a significant difference in rhythm between Spanish and English and he does not account for this when changing between languages. In order to sound natural when speaking a language, one must understand the rhythm and timing of said language so that his speech will appear natural and fluid. Without this consciousness, the second language learner will never sound like a native speaker.

Implications

There are many methods by which a person acquires a second language which differ significantly depending on their age, location, and first language. But no matter the situation, language acquisition takes place in approximately the same way. There is a specific set of steps or benchmarks that a person reaches as he is learning a language. To understand second language acquisition, one must first understand the way in which a child acquires his primary language.

First language acquisition is a natural process in which toddlers begin to learn to use verbal communication. There are debates as to whether language acquisition is based more on nature or nurture; most arguments, however, support some combination of the two. The nature theory is supported by the idea that

children are not 'taught' their primary language, but rather they acquire it naturally through exposure (Ingram). One example of this is that children cannot use grammar that they have not yet attained. Even if parents attempt to force their children to learn language and grammar at a rate that is faster than what the children are naturally prepared for, the children will still move at their own pace. Secondly, children are not predisposed to learn the language of their ancestors. A child will learn whichever language they hear spoken.   Also, language acquisition is not just repetition of what is heard, because children will often say phrases or use grammar that is nonstandard or that they have never heard spoken. For example, once a child has learned that a regular verb is conjugated in the past tense by adding the suffix '-ed,' he or she may say something like "I goed to the store." Even though this is not standard grammar, during language acquisition a child learns a certain grammatical rule and then applies it across the board without realizing or accounting for the irregularities in language.

First language acquisition occurs in a typical fashion that contains about four benchmark stages of speaking. The first stage is referred to as pre-linguistic development and is a time of learning to produce sounds and control the sounds produced as well as beginning to string sounds together (Ingram 2). The next stage is called single-word utterances, which occurs in infants around twelve to eighteen months old and involves identification of objects through single words and imitation of other speakers. The third phase of language acquisition, the first word combinations stage, lasts about another six months in which infants do not quite understand the grammar of the language, but begin to relate words and string two

or three together (Ingram 2). The final stage in acquiring language begins at a young age and continues through adulthood. Ingram refers to this phase as simple and complex sentences. To begin to communicate, toddlers start by using short sentences such as "Me want," or "Momma go," but they very quickly add words and come to control different grammatical structures so that by the time they start school, most children are able to make themselves understood.

Second language acquisition is believed to occur in a manner different from first language acquisition. According to Stephen Krashen, there two ways in which an adult can master a second language—acquisition or conscious learning. Similar to the stages explained above, second language acquisition is done subconsciously through informal, implicit learning (Krashen 17). This process often takes place in an immersion situation in which an adult is living or working in an area where the only method of communication is different from his or her primary language. This process is said to take place more naturally and acquisition is noted to take place without the speaker even realizing it. The second way an adult learns to speak a second language is by conscious learning. This refers to "explicit, formal linguistic knowledge of the language" (Krashen 17).   The main difference between these two ways of learning a second language is represented by the formality and forcefulness by which a person attempts to learn the language.

Also, many linguists have studied the implications of the Critical Period Hypothesis—the idea that there is "a biologically determined period of life when language can be acquired more easily and beyond which time language is increasingly difficult to acquire." (Ipek).   This hypothesis was originally only

thought to be related to first language acquisition, as language learning was shown to occur at a fixed rate that depends on the anatomical, physiological, motor, and cognitive development of the child. This critical period was determined to take place between the ages of two and twelve. More recent studies have shown that this hypothesis is also true in relation to second language acquisition. In application to second language acquisition, the critical period is said to last until puberty, after which acquiring a second language becomes significantly more challenging.

In many cases, when learning a second language, whether by conscious learning or acquisition, the first steps include learning vocabulary and grammar. As these topics are important initial steps that need to be taken to allow communication, it is necessary that language learning begin here. However, prosodic features of language are also very important because without them, a second language learner will never have the ability to speak naturally or have native pronunciation. Prosodic features include intonation, stress, and rhythm. For the scope of this study, stress and rhythm of second language learners is the focus. The collected data supports the hypothesis that there is a lack of emphasis on the difference between syllable-timed language and stress-times language during second language acquisition. Without learning important prosodic features, a non-native speaker lacks the ability to ever speak in a fluid way that is similar to a native speaker.

In order to combat this, there are teaching methods that can be used in the instruction of second language learners that will greatly contribute to a better understanding of the prosodic feature of timing. In learning a second language,

there are many important aspects, but one that is often missed or not explained well enough is that many languages have different rhythms. One method to help students understand this is explained by the British Council on Teaching English. It suggests, "One way to focus learners on various aspects of prosody is to select a text suitable to be read aloud - for example a famous speech - and ask learners to mark where they think pauses, main stress, linking, and intonation changes occur. They can then practise reading this aloud" ("Prosodic Features"). Allowing students to discover the prosodic features in a common text will help them internalize these differences and better use them in their daily language. This teaching method would be useful to the subjects in this study as they had all learned Spanish in a formal classroom, but it appears they did not receive instruction on the difference in language timing or rhythm. To this end, making prosodic features an important part of a second language curriculum forces students to focus on them and learn how to properly use a foreign language in a more natural way; however, language acquisition does not necessary allow for this method, but in this case learning language rhythm may come more naturally—similar to that first language in children.

There are other methods that can be used to ensure second language learners are taught these more subtle features of language. One research study, for example, analyzed the use of Praat in aiding students to acquire prosodic features of the English language. The subjects for this study were all Iranian EFL (English as a Foreign Language) learners (Gorjian et al). The data collected demonstrated that there is a positive correlation between using computerized instruction for prosodic

features of language and the subject's understanding of prosody and practice of its features. This study explains that prosody is necessary to the naturalness and intelligibility of speech (Gorjian et al). Without this, a speaker will not be able to communicate naturally. Overall, understanding the difference between syllable-timed and stress-timed languages, and being able to implement the correct rhythm depending on the language being spoken, is essential in being able to communicate effectively in a second language.

Further Studies

The data collected in this study has been useful in forming the conclusions made above, but the scope was rather limited. Repeating the same process with a larger number of speakers of both languages would allow for more statistically significant results as well as a wider subject pool providing more well-rounded results. Additionally, this study was limited to only native speakers of English and Spanish as examples of syllable-timed and stress-timed language, but there is an abundance of examples of each. To better understand the relations among syllable-timed or stress-timed languages throughout the world, the study could be repeated with native and non-native speakers of other languages that fit these categories.

This study relied heavily on phonetic transcription software, known as Praat, in order to obtain results. In order to test the relevance and accuracy of this software, the study could be repeated, but instead the researcher could phonetically transcribe the recordings of each subject and note the stresses in order to make a comparison. In this way, the researcher could test the software and see if the results differ significantly depending on the research design.

Finally, it is important to note that many individuals speak differently depending on the situation they are in. When asked to read aloud, the subjects may become nervous or overwhelmed and add stresses or change their natural rhythm. This may have skewed the results especially near the beginning of the recording. Additionally, conversational language is often different than professional or formal language. Since subjects knew data was being collected to be used for a research study, they may have been less comfortable or free in their use of language. If this study were to be repeated, it may be informative to record a natural conversation rather than the artificial reading of a text. Studies that account for these factors may provide more accurate results.

Appendix A

Once upon a time there was a sweet little girl. Everyone who saw her liked her, but most of all her grandmother, who did not know what to give the child next. Once she gave her a little cap made of red velvet. Because it suited her so well, and she wanted to wear in all the time, she came to be known as Little Red Cap.

One day her mother said to her, "Come Little Red Cap. Here is a piece of cake and a bottle of wine. Take them to your grandmother. She is sick and weak, and they will do her well. Mind your manners and give her my greetings. Behave yourself on the way, and do not leave the path, or you might fall down and break the glass, and then there will be nothing for your sick grandmother."

Little Red Cap promised to obey her mother. The grandmother lived out in the woods, a half hour from the village. When Little Red Cap entered the woods a wolf came up to her. She did not know what a wicked animal he was, and was not afraid of him.

"Good day to you, Little Red Cap."

"Thank you, wolf."

"Where are you going so early, Little Red Cap?"

"To grandmother's."

"And what are you carrying under your apron?"

"Grandmother is sick and weak, and I am taking her some cake and wine. We baked yesterday, and they should give her strength."

"Little Red Cap, just where does your grandmother live?"

"Her house is a good quarter hour from here in the woods, under the three large oak trees. There's a hedge of hazel bushes there. You must know the place," said Little Red Cap.

The wolf thought to himself, "Now there is a tasty bite for me. Just how are you going to catch her?" Then he said, "Listen, Little Red Cap, haven't you seen the beautiful flowers that are blossoming in the woods? Why don't you go and take a look? And I don't believe you can hear how beautifully the birds are singing. You are walking along as though you were on your way to school in the village. It is very beautiful in the woods."

Appendix B

Había una vez una adorable niña que era querida por todo aquél que la conociera,

pero sobre todo por su abuelita, y no quedaba nada que no le hubiera dado a la niña.

Una vez le regaló una pequeña caperuza o gorrito de un color rojo, que le quedaba

tan bien que ella nunca quería usar otra cosa, así que la empezaron a llamar

Caperucita Roja. Un día su madre le dijo: "Ven, Caperucita Roja, aquí tengo un pastel

y una botella de vino, llévaselas en esta canasta a tu abuelita que esta enfermita y

débil y esto le ayudará. Vete ahora temprano, antes de que caliente el día, y en el

camino, camina tranquila y con cuidado, no te apartes de la ruta, no vayas a caerte y

se quiebre la botella y no quede nada para tu abuelita. Y cuando entres a su

dormitorio no olvides decirle, "Buenos días", ah, y no andes curioseando por todo el

aposento."

"No te preocupes, haré bien todo", dijo Caperucita Roja, y tomó las cosas y se

despidió cariñosamente. La abuelita vivía en el bosque, como a un kilómetro de su

casa. Y no más había entrado Caperucita Roja en el bosque, siempre dentro del

sendero, cuando se encontró con un lobo. Caperucita Roja no sabía que esa criatura

pudiera hacer algún daño, y no tuvo ningún temor hacia él.

"Buenos días, Caperucita Roja," dijo el lobo. "Buenos días, amable lobo."

– "¿Adonde vas tan temprano, Caperucita Roja?"

– "A casa de mi abuelita."

– "¿Y qué llevas en esa canasta?"

– "Pastel y vino. Ayer fue día de hornear, así que mi pobre abuelita enferma va a

tener algo bueno para fortalecerse."

– "¿Y adonde vive tu abuelita, Caperucita Roja?"

– "Como a medio kilómetro más adentro en el bosque. Su casa está bajo tres grandes robles, al lado de unos avellanos. Seguramente ya los habrás visto," contestó inocentemente Caperucita Roja. El lobo se dijo en silencio a sí mismo: "¡Qué criatura tan tierna! qué buen bocadito – y será más sabroso que esa viejita. Así que debo actuar con delicadeza para obtener a ambas fácilmente." Entonces acompañó a Caperucita Roja un pequeño tramo del camino y luego le dijo: "Mira Caperucita Roja, que lindas flores se ven por allá, ¿por qué no vas y recoges algunas? Y yo creo también que no te has dado cuenta de lo dulce que cantan los pajaritos. Es que vas tan apurada en el camino como si fueras para la escuela, mientras que todo el bosque está lleno de maravillas."

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