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An Acoustic Analysis of Spanish Learners' English Prosody: L1 Transfer Effects

Un análisis acústico de la prosodia inglesa de estudiantes españoles: efectos de transferencia de la L1

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Abstract

This study examines the acoustic realization of quantitative rhythm, intonation, and nuclear stress in Spanish-speaking learners of English as a second language. It also considers speech rate as a relevant factor in L2 prosodic processing. Fifteen university students from the University of Valencia completed a controlled reading task based on a short poem containing 23 rhyming words. Acoustic analyses were conducted using Praat, focusing on rhythm (%V, nPVI-V, and articulation rate), intonation (pitch range, mean F0, and boundary tones), and nuclear stress (prominence cues). Results indicated that participants produced a higher %V, less durational variability, and reduced vowel reduction, all of which illustrate the persistence of a syllable-timed transfer from Spanish. Patterns of intonation revealed a limited pitch range and a prevalence of falling contours, making them less adaptable to context. In addition, Nuclear stress was accurately placed in only 50% of contexts, with errors involving both reliance on penultimate-stress tendencies in Spanish and problems with contrastive stress. Overall, the results suggest that prosodic transfer remains active even at advanced proficiency levels and highlight the pedagogical importance of explicit training in rhythm, pitch modulation, and stress placement in English language teaching.

Keywords: Intonation, L1 transfer, Praat analysis, prosody, rhythm.

Resumen

Este estudio examina la realización acústica del ritmo cuantitativo, la entonación y el acento nuclear en estudiantes hispanohablantes de inglés como segunda lengua. También considera la velocidad del habla como un factor relevante en el procesamiento prosódico de la L2. Quince estudiantes universitarios de la Universidad de Valencia completaron una tarea de lectura controlada basada en un poema corto de 23 palabras que riman. Se realizaron análisis acústicos con Praat, centrándose en el ritmo (%V, nPVI-V y velocidad de articulación), la entonación (rango tonal, F0 media y tonos límite) y el acento nuclear (indicadores de prominencia). Los resultados indicaron que los participantes produjeron un %V más alto, menor variabilidad de duración y menor reducción vocálica, lo que ilustra la persistencia de una transferencia rítmica silábica del español. Los patrones de entonación revelaron un rango tonal limitado y una prevalencia de contornos descendentes, lo que los hace menos adaptables al contexto. Además, el acento nuclear se colocó correctamente solo en el 50% de los contextos, con errores que involucraban tanto la dependencia de las tendencias de acento penúltimo en español como problemas con el acento contrastivo. En general, los resultados sugieren que la transferencia prosódica se mantiene activa incluso

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en niveles avanzados de competencia y resaltan la importancia pedagógica del entrenamiento explícito en ritmo, modulación de tono y acentuación en la enseñanza del idioma inglés.

Palabras clave: Entonación, transferencia de L1, análisis de Praat, prosodia, ritmo.

Introduction.

Prosody, the rhythm, stress, and intonation of spoken language, is very important for how well people understand the clarity, fluency, and meaning of communication in a second language (Derwing & Munro, 2015; Jenkins, 2000). Traditionally, teaching pronunciation has focused on how to say consonants and vowels correctly. There is a growing body of evidence showing that suprasegmental characteristics influence how people perceive and produce spoken foreign languages (White & Mattys, 2007). The disruption of prosodic features (e.g., the rhythm of speech, intonation, etc.) can decrease an individual's perception of fluency and naturalness, even if the segments are produced accurately. Although learners can produce speech sounds clearly with correct pronunciation, they are sometimes considered either non-natives or unable to express what they mean; this is dependent on how well their rhythm and intonation match those of the target language. Therefore, the structural role of patterning is evident in the above examples for both phonetic theory and current second language teaching methodologies.

The differences between English and Spanish prosody are considerable. English is generally classified as a stress-timed language, in which vowels in unstressed syllables tend to be reduced, syllable durations vary, and stressed syllables occur at roughly regular intervals (Roach, 1982; Ling *et al.,* 2000). Conversely, Spanish is generally regarded as a syllable-timed language, with approximately equal syllable durations and little vowel reduction (Gómez González & Sánchez Roura, 2016). Rhythmic differences can be measured using acoustic measures like the percentage of vocalic intervals (%V) and the normalized Pairwise Variability Index for vowels (nPVI-V), both of which are useful for distinguishing stress-timed from syllable-timed languages (Ramus *et al.,* 1999; White & Mattys, 2007).

With respect to intonation, English generally utilizes a wide pitch range and pitch movements, in addition to more flexible placement of nuclear stress to convey different discourse and pragmatic meanings (Brazil, 1997; Mennen, 2007). Spanish, on the other hand, tends to display a narrower pitch range and a more predictable pattern of stress placement that tends to favor falling contours

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and penultimate stress (Ortega-Llebaria *et al.,* 2019). When Spanish speakers bring these patterns to English, while their speech may remain understandable, it can also sound more monotonous or pragmatically limited, in that the speakers may not convey the proposed meaning or the information structure (Trouvain & Braun, 2020).

This linguistic tendency aligns with ideas of second language learning. Flege (1995) posits that learners categorize new L2 phonemes in relation to L1 phonemes, resulting in consistent pronunciation discrepancies. In this vein, Mennen (2007) expands the concept of *prosodic transfer*, indicating that even intonation is affected by L1. A significant amount of empirical research has explored segmental transfer. There may be good reasons for segmental to be more studied than prosodic transfer, although the little prosodic transfer previously discussed, particularly involving rhythm and intonation, has been studied considerably less, despite significant evidence showing the apparently greater resistance to change in rhythm and intonation, particularly in the fact that prosodic patterns exist in both perception and articulatory systems. In fact, Munro *et al.,* (2006) expressed that despite apparent high levels of proficiency, many speakers still reproduce L1 prosody patterns.

In the past few years, researchers have focused specifically on these prosodic properties among Spanish-speaking learners of English. In one study, Valenzuela, (2013) found that Spanish-speaking learners of English frequently use intonational contours from their native language (Spanish) when learning English. In addition, their pitch ranges are consistently lower than those of native English speakers, and they prefer falling tones rather than high tones and/or fall–rise tones. White and Mattys (2007) and Ramus *et al.,* (1999) have also observed that Spanish speakers exhibit heavy Spanish accents when speaking English. Their data showed that Spanish-accented speakers produce longer vocalization intervals (i.e., a larger percentage of time spent producing vowels during a one-syllable interval) than their native English counterparts, and that there is less variation in syllable vocalization duration than in English. From their data, they concluded that Spanish-accented English speakers have transferred prosodic patterns from their L1 (Spanish) to their L2 (English) in accordance with the rhythm classes they were speaking. However, suprasegmental transfer has, thus far, also been viewed as a source of communication problems rather than as a contributor to the fluency and intelligibility of the speaker being

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evaluated. Gordon and Darcy (2022) have clearly demonstrated that prosodic differences in language can affect fluency and intelligibility; however, most current studies use either subjective assessments of non-native versus native or a simple or poorly designed methodology to evaluate the learners' prosody, so learners' prosody is not currently treated as a separate area of research.

This issue can be examined from an educational standpoint. It may not only affect the ability of students to produce individual sounds accurately; however, if there are differences in the way that students' prosodic models structure differs from what listeners expect, then students' speech may not only lack intelligibility, but also come across as less fluent as well. Jenkins (2000) contends that international intelligibility is enhanced to a greater degree through the use of rhythm, stress, and/or intonation as opposed to segmental accuracy when considering that suprasegmental features contribute greatly to English being viewed as a Lingua Franca. Therefore, teachers can utilize learners' awareness of prosodic habit(s) in order to develop pronunciation instruction that promotes rhythm, pitch variation, and/or placement of stress during instruction.

Despite the useful findings from earlier research, detailed acoustic studies of English prosody produced by Spanish speakers remain largely unexplored, especially in constrained reading tasks that allow systematic comparison across speakers. Many existing studies focus on bilinguals, highly advanced learners, or very extreme L1-L2 differences. As a result, while we have important findings on Spanish learners' pronunciation, we still lack descriptive accounts of how these learners typically use prosody in English. A thorough description of acoustic properties can reveal which timing or intonation characteristics transfer from Spanish and how learners adapt to a stress-timed system.

The present study aims to address this gap by providing an exploratory acoustic description of English prosody produced by Spanish learners in a controlled reading context. The primary objectives are (i) to describe patterns of rhythm, intonation, and nuclear stress placement, (ii) to identify systematic indications of L1 prosodic transfer; and (iii) to consider the pedagogical implications for pronunciation instruction. In particular, we explore whether rhythm metrics such as the percentage of vocalic intervals (%V), the normalized Pairwise Variability Index for vowels

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(nPVI-V), and the articulation rate (i.e. the number of syllables per second, excluding pauses) reflect transfer from syllable-timed rhythm, how learners implement intonation by means of pitch range and boundary tones, and to what extent they assign nuclear stress correctly. The study does not aim to test or extend theoretical models. Instead, it offers a preliminary descriptive account that can inform future empirical and pedagogical work on L2 prosody among Spanish learners.

The organization of the rest of the paper is shown below. Section 2 details how the participants were recruited, how the recordings were done, and how the acoustic measures were performed. Section 3 discusses the result of this analysis and finds that learners of Spanish exhibit problems with producing nuclear stress appropriately, particularly in contrastive (or focal) contexts; have little variability of pitch; and prefer a syllable-timed rhythm pattern. Finally, the last section provides a summary of these findings, limitations to this study, and directions for future research studies.

Materials and methods

The current research included 15 Spanish L1 adult learners of English. All participants were undergraduate students enrolled in an English Studies degree programme at a public university located in Valencia, Spain. All were L1 speakers of a Peninsular Spanish dialect. Since none of the participants had moved to an English-speaking country like England, the United States, or others, the chance of having their prosodic patterns altered due to immersion was regarded as minimal. The ages of the participants were between 19 and 23 years (M = 20.8; SD = 1.4). Placement scores identified the participants to be B2 to C1 CEFR in their proficiency level. This profile was considered to be an advantage since students at these levels usually show segmental accuracy that makes it possible to focus on an analysis of suprasegmental features, in which L1 influence continues to be more durable.

Participants read a 93-word English poem and a list of 23 rhythm words, derived from standard pronunciation materials. Having a controlled reading passage ensured systematic comparisons between speakers and yet elicited connected speech. Poetry is often used as a source of data in research into prosody because it displays natural variation between lines of verse, or stanzas, with regard to rhythm, stress placement, and phrasing within relatively short utterances. The poem

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selected fell into an optimal range of comparability and naturalness and hence did not contain the uncontrolled spread of variance often seen in spontaneous speech or the singularity observed from lists of isolated words.

Recordings were done serially in a quiet room at the laboratory with a Zoom H6 digital recorder and a head-mounted microphone. Speech was sampled at 44.1 kHz and 16 bits per sample to preserve high-quality acoustics. Before the recording started, all of them read the poem once for practice and chatted informally with the researcher for a while. This period of familiarization was designed to minimize performance anxiety and foster a more naturalistic reading pace. The participants were asked to read at a normal pace and not to force their speech in order to get as close as possible to a native accent. Rhythmically relevant words were presented in capital letters to signal target items for analysis and equalize participants' attention to these segments. Subsequently, these tokens were analyzed for context to ascertain whether learners' productions more closely resembled English stress timing or were influenced by transfer from syllable timing in Spanish. This was done in an attempt to obtain learner production of a phonological form that was less likely to result in imitation or hypercorrection.

The analysis focused on three major prosodic dimensions: rhythm, intonation, and nuclear stress placement. All acoustic measures were collected with the software Praat, which is a digital laboratory for speech, offering a comprehensive suite of tools for acoustic analysis, phonetic annotation, and speech synthesis (Boersma & Weenink, 2024). These dimensions were chosen because they are highly associated with intelligibility and communicative effectiveness in L2 speech and have regularly demonstrated robust L1 transfer mechanisms.

Rhythm was analyzed using three traditional quantitative measures: articulation rate, percentage of vocalic intervals (%V), and the normalized Pairwise Variability Index for vowels (nPVI-V). These measures, heavily confirmed in typological investigations at the level of languages (Ramus *et al.,* 1999; White & Mattys, 2007), faithfully distinguish stress-timed from syllable-timed rhythmic patterns. Intonation analysis was based on the fundamental frequency (F0) information, pitch range (Hz), and mean F0, using boundary tone classification at major phrase-final positions. These measures represented both global melodic contours as well as local discourse-

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marking functions such as final rises and falls. The prominence of nuclear stress was determined through the use of acoustic correlates: F0 peak, intensity maximum, and duration of syllable.

In order to maintain the methodological integrity of the current study and restrict extraneous variables that would require separate experimental designs, other prosodic features, such as phrasing, speech rate variability, or tonal alignment, were not included to maintain methodological coherence and avoid introducing additional variables requiring separate experimental designs. The study aims to provide a focused, evidence-based account of L1 prosodic transfer in L2 English within three core areas.

Descriptive statistics (means, standard deviations, and percentages) were used initially to summarize the data and identify speaker-level tendencies. To enhance interpretive richness, there was a non-parametric inferential analysis in the form of Wilcoxon Signed Rank testing for small samples and non-normally distributed data. This test assessed the reliability and direction of mean differences between prosodic variable pairs within speakers. This method of analysis facilitated discovering the statistically significant tendencies that would not have been exposed had generalizations taken place. Through the combination of descriptive and non-parametric inferential analyses, this research provides a strong exploratory description of Spanish learners' prosodic patterns in L2 English, integrating quantitative precision with qualitative interpretation and laying the groundwork for future large-scale research.

Results

This section reports on the acoustic analysis of learners' English prosody. Figures and statistical descriptions summarize the pattern of rhythm, intonation, and nuclear stress with emphasis on those particular areas where Spanish-speaking learners of English typically have difficulty. Each measure is interpreted in relation to the known prosodic differences between the Spanish (syllable-timed) and the English (stress-timed) prosodic systems. The combination of visual and numerical information indicates consistent evidence of L1 transfer effects as well as difficulty adjusting to and producing the stress-timed rhythm and intonation patterns of English.

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Rhythm pattern

Participants in this study exhibited a distinctive production pattern that correlates with their temporal regime. They frequently produced full, non-reduced vowels in rhythmically susceptible monosyllables like TOUGH, BOUGH, COUGH, and DOUGH, where a native English speaker tends to centralize or reduce such vowel sounds. For instance, participants tended to produce forms like [ˈtʌf], [boʊ], or [doʊ] with full vowel quality rather than reduced or weakened realizations. Likewise, speakers did not systematically mark stress prominence in polysyllabic words (i.e., HICCOUGH and THOROUGH), showing that the rhythm of spoken English varies but follows a syllable-timed rhythmic pattern. This pattern suggests that learners adapt to a more isochronous syllable timing system, similar to their L1, which would lead to a lack of reduction and consistent vowel quality across syllables.

As Figure 1 shows, Spanish participants' speech contained a relatively large proportion of vocalic intervals (52.3% V, ± 3.1). This pattern reflects a syllable-timed rhythmic system in which the durations of vowels are relatively equidistant and where vowel reduction is minimal. These findings align with earlier research on the use of vocalic material (%V) as a reliable indicator of rhythmic differences between languages.

In their landmark work, Ramus *et al.,* (1999) demonstrated that %V is a good predictor when comparing stress-timed and syllable-timed languages. Regarding the %V, English (as a representative stress-timed language) showed lower values of the percentage of vowels per utterance (40.1 ± 5.4), indicating shorter and less regular vowel durations. By contrast, Spanish showed a higher percentage of vowels (43.8 ± 4.0), indicating longer and more evenly spaced vowel durations, as is typical of syllable-timed rhythm. The greater amount of vocalic material in Spanish is indicative of a more fixed temporal structure of syllables. At the same time, the lesser proportion in English is associated with that language's higher degree of temporal variability and vowel reduction.

In accordance with these results, White and Mattys (2007) also observed that %V was significantly higher in Spanish (48 ± 0.8) than English (38 ± 0.5), indicating again that speech material in Spanish has a longer duration of the vowel and a more regular timing between the

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syllables compared to English. Similarly, Wiget *et al.,* (2010) reported a significant but variable inter-speaker spread in %V among Spanish speakers (1.6–3.0), accounting for only 16–30% of the rhythmic difference between Castilian Spanish and Southern British English that is commonly observed. This small range of variation demonstrates the consistency and dependability of %V as a rhythm measure, differentiating syllable-timed languages from stress-timed ones.

Carter (2005) used the Pairwise Variability Index (PVI) to measure rhythmic contrast between language groups. He found a clear contrast in his data with respect to rhythm: the benchmark American English speakers from North Carolina had higher PVI scores, 0.5515 for African American English and 0.5304 for European American English, which reflected larger variability in vowel duration, similar to that reported for stress-timed languages. On the other hand, Spanish speakers as a group (combined) exhibited much reduced PVI values (mean = 0.2798), which are typical of syllable timing where vowel duration is more evenly distributed between stressed and unstressed vowels. The bilingual Hispanic English speakers' PVI score was intermediate (M = 0.426, SD = 0.106), indicating a moderate degree of rhythmic assimilation to English, while also maintaining L1 Spanish rhythm patterns. Carter's (2005) results quantify a connection along the rhythmic continuum for monolingual and bilingual speakers, evidencing the gradual impact of Spanish rhythm on English productivity.

In the current study, participants had an average of 34.5 ± 5.7 for their normalized Pairwise Variability Index of Vowels (nPVI-V), which indicates that there is not much variability between pairs of vowel durations. This suggests that the timing of the syllables was consistent and therefore more similar to the syllable-based rhythm of the Spanish language than the English language, based on stress-timing. This pattern, along with the high percentage of vocalic intervals (% V), indicates the presence of Spanish-like temporal organization within the English speech of these learners and that this influence continues even now in their learning of the English language through exposure to their native language's rhythm structures.

Previous studies of rhythm across languages have led to these same results, and they provide additional support for the position that bilinguals' and L2 learners' speech is positioned closer to

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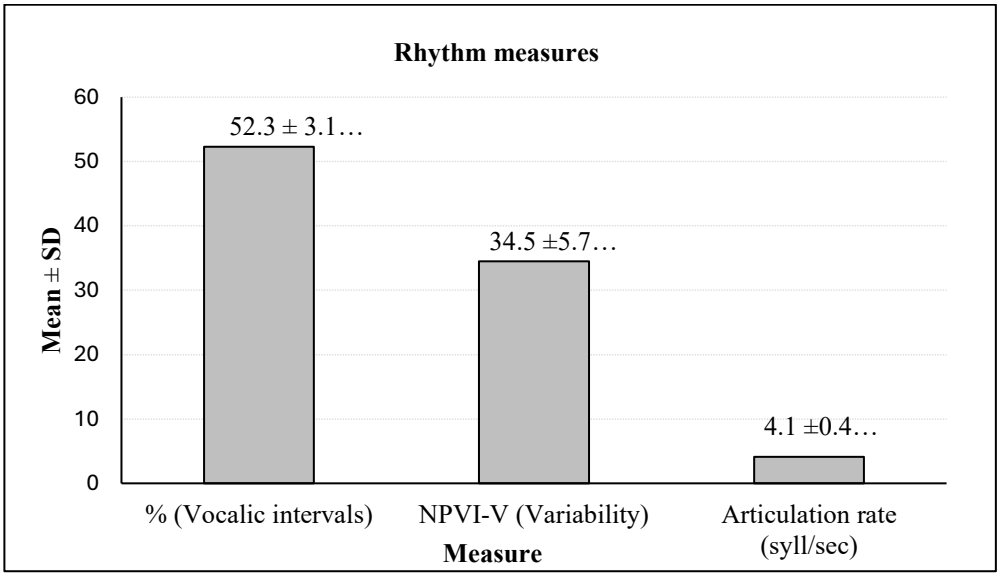
the center of rhythmic space. These results may be interpreted as potential manifestations of rhythm transfer effects, that is, an influence of the temporal organization in L1 on that in L2, and its effect on the resulting speech timing control, which is based on both stress-timed and syllable-timed systems.

Figure 1

Rhythm measures for Spanish learners (n = 15).



The mean articulation rate was 4.1 ± 0.4 syllables per second, somewhat slower than normatively 'normal' English tempo, often cited as approximately 4–5.3 syllables per second (Goldman-Eisler, 1968, as summarized in Stepańtsova, 2013; see also Laver, 1994). The slower pace might indicate a compensatory strategy to deal with orthographic irregularities in items like *dead, meat*, and *threat*. Whereas native speakers often reduce vowels in rapid speech, learners produced nearly full vowel realizations. In several cases, the presence of clear onset consonants and unreduced vowels further supported the interpretation that learners followed a syllable-timed pattern rather than adopting English-like reduced timing.

The group variation in rhythm measures was low. % V (± 3.1), nPVI-V (± 5.7), and articulation rate (±0.4) also displayed a narrow distribution, which suggests that learners acted uniformly independent of subjects. %V and articulation rate, specifically, were significantly invariant, which implies that there were the same amounts of vowel materials and a similar rate of speech

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among subjects. Although nPVI-V showed slightly more individual variation, the overall values remained low, reflecting small differences in timing from one syllable to the next.

Altogether, these findings reveal an overall homogeneous rhythmic profile across participants, consistent with L1 Spanish influence. Learners, as a group, produced more vowel material overall, less durational variance, and slower articulation rates than expected for native English speech, patterns that collectively reflect transfer from syllable-timed Spanish to their L2 English prosody.

Intonation patterns

This section examines learners' pitch range, mean pitch level, and boundary tone distribution in order to characterize their English intonation patterns. These measures provide insight into how learners used pitch variation to signal prominence and structure the discourse while reading the poem.

Figure 2

Intonation measures for Spanish learners (n = 15).

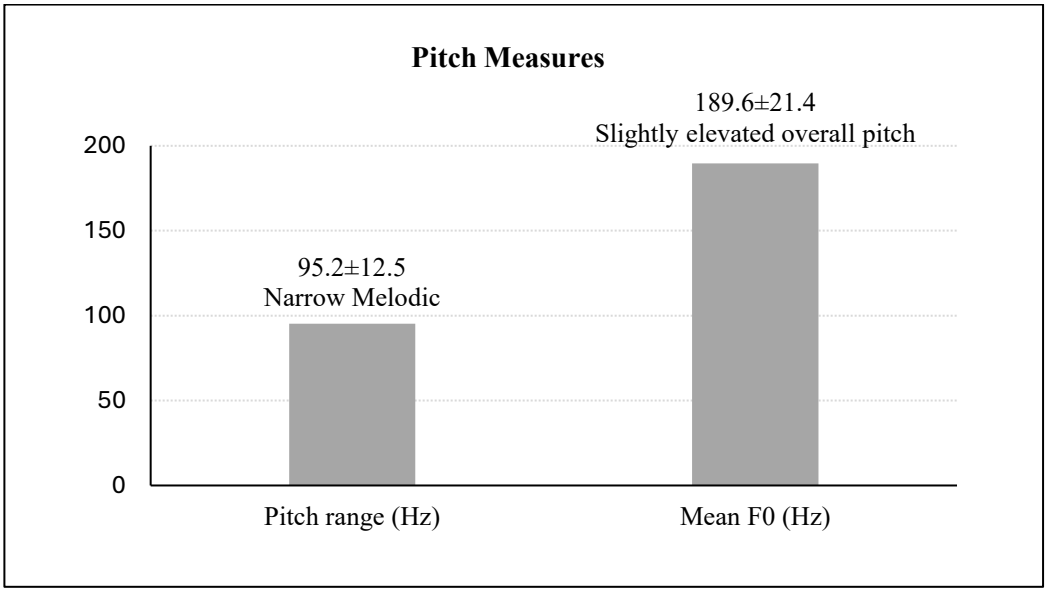

Figure 2 shows that participants produced a rather narrow range of pitch (M = 95.2 ± 12.5 Hz), which means that the variation in pitch between stressed and unstressed syllables was not very different. No sudden or wide excursions of pitch occur in the rhyming strings; indeed, the curves

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have a very flat aspect, as seen in words such as HICCOUGH, THOROUGH, LOUGH, and THROUGH. Less pitch range is usually an indication of less expressiveness and a more "flat" or insipid melodic profile. While the overall mean pitch level of the learners was relatively high (M = 189.6 Hz, s = 21.4 Hz), this seemed to merely result from an overall upward register shift rather than a functional adjustment. In other words, learners maintained a mid-to-high pitch plateau across phrases rather than producing localized peaks to mark contrastive or emotive meaning, even in lines such as "*Beware of HEARD, a DREADFUL word*". As a result, differences in prominence between stressed and unstressed syllables were weakened.

In contrast, native English speakers typically use a larger pitch range and more pitch variation than the learners in this research. Intonational phonetics research shows that English relies heavily on pitch movements, particularly rises, falls, and expanded pitch excursions, to signal stress, focus, information structure, and discourse prominence (Xu, 2005; Mennen, 2007). These studies emphasize that English speakers generally employ a flexible pitch range and systematically enlarge pitch excursions when marking contrast or highlighting new information. Similarly, in English as a Lingua Franca communication, dynamic pitch range is also found to be helpful for intelligibility and attention (Jenkins *et al.,* 2018). By comparison, the learners in the present study produced a mean pitch span of only 95 Hz, indicating a considerably more compressed melodic profile. Such a reduced span is consistent with prosodic transfer from Spanish, a language characterized by a narrower pitch range and fewer pragmatically motivated pitch modulations (Frota & Prieto, 2015).

The absence of gender information in the data set means that the intonation analysis can only be generalized to a limited degree. Many previous studies show that biological (e.g., laryngeal physiology) and sociophonetic conventions both affect F0 level and pitch span (Laver, 1994). Without separating male and female speakers, it is not possible to determine whether the narrow pitch ranges observed here reflect physiological baselines or L2-learning effects. Future research should therefore analyze male and female learners independently to clarify whether reduced prosodic contrast in Spanish-accented English is consistent across genders or shaped by gender-specific pitch strategies.

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Figure 3

Distribution of boundary tones in learners' English speech (n = 15).

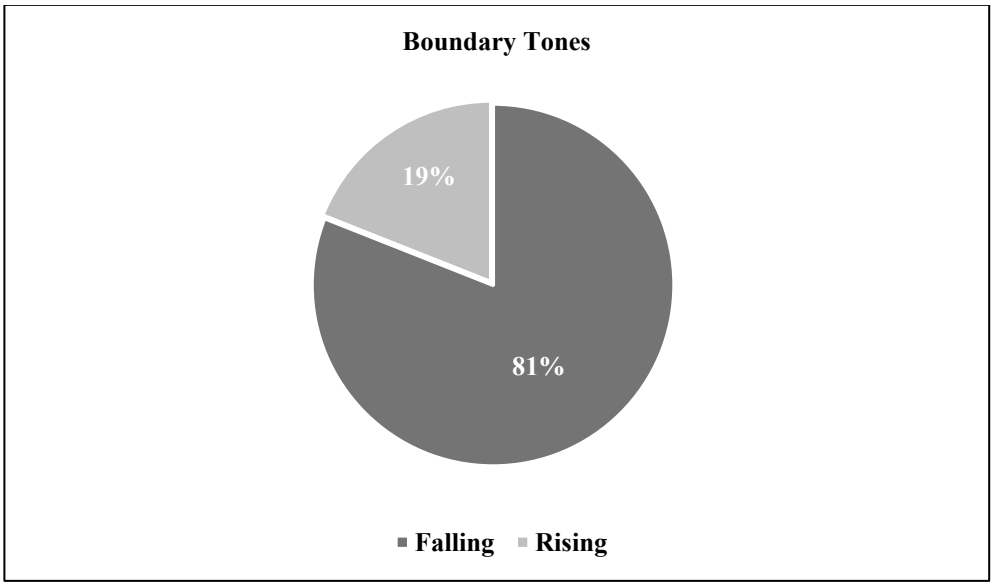

Figure 3 further illustrates the restricted intonational patterns by showing the distribution of boundary tones. The general tendency is for phrase-final boundaries to be produced with falling contours, which was the case in 81% of our examples; only 19% had rising or level tones. Even in contexts where a rising boundary would have been expected, such as in *"For goodness' SAKE, do not call it DEED"*, learners produced falling tones. Similarly, in sequences such as *"Watch out for MEAT and GREAT and THREAT",* where rising-falling patterns might signal listing or contrast, learners read the entire series with gradual falling.

These findings indicate that learners made extensive use of a default falling contour and had minimal control over pitch range for pragmatic or discourse-structuring reasons. In general, their intonation was quite flat, with smaller pitch excursions, higher mean F0, and predictable boundary tone patterns. Preference for falling contours also indicates less use of rising or level tones that in English are commonly used to signal continuation, uncertainty, politeness, engagement, and discourse cohesion (Face, 2003; Valenzuela, 2013). In contrast, these functions are not expressed prosodically to the same degree as they are in Spanish. As a result, an insufficient stock of boundary tone could have constrained the learners' capacity to encode

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pragmatic distinctions, and their utterances might easily have been perceived as flat or overly declarative.

From a communicative viewpoint, limited pitch variation affects both expressiveness and listeners' ability to interpret informational structure and speaker attitude. Studies of L2 speech perception have demonstrated that prosodic features such as stress, rhythm, and overall pitch range make a significant contribution to listeners' perceptions of comprehensibility and accentedness (Saito *et al.,* 2017). Given that prosody plays a critical role in both comprehensibility and listener engagement, numerous scholars have claimed that inadequate modulation of prosody can lead to negative assessments of fluency and communicative efficacy (Derwing & Munro, 2015). That is, the relatively flattened melodic contours that were exhibited in the learners' utterances could limit their potential to distinguish focus, discourse boundaries, and emotional or pragmatic nuance.

These findings support previous investigations of Spanish–English interlanguage intonation that show a relatively small pitch range as well as a predominant tendency toward final falling contours Valenzuela, 2013; Trouvain & Braun, 2020). Research on Spanish intonation more generally also shows that Spanish employs fewer rising and pragmatic boundary tones than English, limiting speakers' repertoire of intonational contrasts (Ortega-Llebaria *et al.,* 2019). As the pitch range in Spanish is usually narrower and there are fewer pragmatically motivated pitch movements (Mennen, 2007), falling contours can be seen as an L1-driven strategy that allows for a simpler model at production but with a loss of communicative nuance when producing this variable in their L2 English.

Nuclear stress placement

This part of the analysis explores learners' accuracy in assigning nuclear stress to the appropriate syllable, with emphasis on producing the pragmatically most salient syllable of each phrase. Accuracy was assessed in three contexts: polysyllabic lexical items, sentence-final phrases, and structures requiring contrastive focus.

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Figure 4

Nuclear stress accuracy in Spanish learners (n = 15).

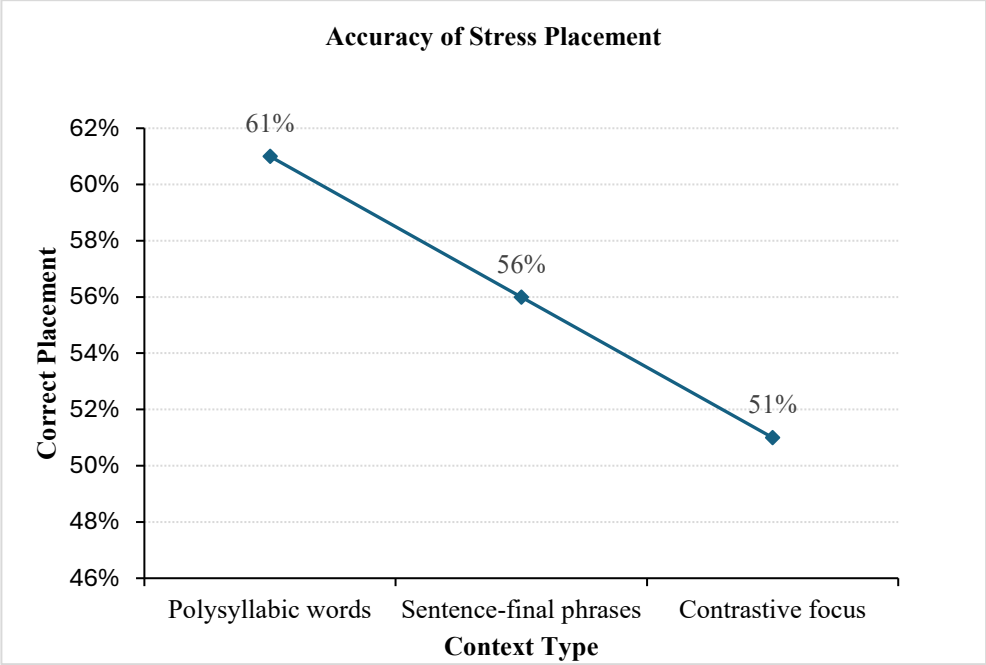

Figure 4 indicates that the average score for accuracy was 56%. The major reason for this was the influence of Spanish penultimate stress on the movement towards the penultimate position of prominent, non-weighted syllables in the Spanish language, such as *THOROUGH* or *HICCOUGH*. Productions like *tho-ROUGH* instead of *THO-rough* changed not only lexical prominence but also disrupted the expected phrasal rhythm of English.

Studies on English stress variation show that nuclear stress in English is a flexible cue for encoding discourse-level meanings such as information focus and contrast (Ladd, 2008; Cruttenden, 1997). In Spanish, however, stress patterns are not as erratic and are used less for pragmatic marking (Face, 2002; Zubizarreta, 1998). This helps explain why some learners in the present study relied on default lexical stress rather than shifting the nucleus to reflect information structure. Such a transfer affects communicative clarity because nuclear stress cues the listener to the most informative element in a sentence (Derwing & Munro, 2015).

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Sentence-final phrases posed similar challenges. Learners often placed prominence on "GOODNESS" rather than on "SAKE" in *"For goodness' SAKE, do not call it DEED"*. This reduced the expected final lengthening and pitch prominence associated with English phrase-final stress and weakened the intended corrective force of the utterance.

Contrastive focus was by far the most challenging context to produce. A classic example is the sentence "*Watch out for MEAT and GREAT and THREAT*," where learners produced the nucleus of the stress pattern where they thought it should go, but did not shift the nuclear stress to reflect the lexical contrast. Research has shown that this is a common phenomenon amongst Spanish-speaking learners of L2 English, as there is a low degree of use of nuclear-stress shifts and a preference for the use of the default stress in L2 English (Face, 2002; Mennen, 2007). Because English frequently employs nuclear stress to mark new or contrastive information, misplacement can obscure the speaker's intention and reduce pragmatic informativeness (Ladd, 2008).

On the whole, our learners' global accuracy of 56% reveals sustained L1-to-L2 prosodic transfer, particularly with respect to predictable Spanish stress patterns and reduced use of prominence for pragmatic meaning. The results have pedagogical implications for the necessity of explicit instruction of nuclear stress and focus marking. Controlled listening and production tasks with a focus on stress movement may be useful for learners in developing a more target-like ability to control prosody and greater intelligibility in spoken English.

Discussion

This study examined the production of prosody by Spanish-speaking learners of English in three domains (e.g., rhythm, intonation, and nuclear pitch accent) and highlighted the systematic influence of the L1, consistent with current models of L2 prosodic acquisition. Learners produced higher %V values and lower nPVI-V scores than those reported for native English speakers, whose %V values typically fall around 40–45% and whose nPVI-V values generally range between .3 and .4 (Ramus *et al.,* 1999; White & Mattys, 2007). These findings indicate that learners maintained a syllable-timed rhythmic pattern more characteristic of Spanish than the stress-timed rhythm of English.

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This pattern is in line with the predictions of the Speech Learning Model - Revised (SLM-r; Flege *et al.,* 2021): that new L2 temporal categories, which are not perceptually distinct enough from L1, will likely be assimilated to L1 categories. The Prosodic Transfer Hypothesis (Gut, 2009) also predicts the retention of L1-based prosodic organization by learners until they acquire new L2 prosodic representations. The lack of vowel reduction, as illustrated by L2 items like *THOROUGH* or *HICCOUGH,* is an example of this transfer. Although clear vowel articulation may enhance segmental intelligibility, insufficient durational contrast weakens perceived fluency, especially in terms of temporal efficiency and rhythmic alternation (Derwing & Munro, 2015).

Regarding intonation, learners displayed a limited use of pitch contours and were highly biased toward falling tones. In contrast, native English speakers typically exhibit wider pitch spans and employ pitch movements for pragmatic and discourse-level functions (Cruttenden, 1997; Ladd, 2008). While specific semitone ranges vary across studies, the consensus is that English uses a broader and more flexible tonal space than Spanish. According to the L2 Intonation Learning Theory (LILt; Mennen, 2015), learners must first gain phonological control over basic contours before they can develop pragmatic control of intonation. Learners' limited use of rising or falling–rising contours, therefore, reduces their ability to signal focus, contrast, stance, or interpersonal meaning (Field, 2005). Reduced pitch variability may also influence listener perceptions of comprehensibility and engagement, factors known to affect judgments of fluency and naturalness (Derwing & Munro, 2015; Saito *et al.,* 2017). The extensive use of falling tones is consistent with transfer from Spanish, where pragmatic meanings are less frequently expressed through intonation and more commonly encoded through syntactic means (Valenzuela, 2013; Ortega-Llebaria *et al.,* 2019; Trouvain & Braun, 2020).

Aspects of prosodic transfer were examined using nuclear stress placement, where many learners were still relying on Spanish default stress patterns when producing polysyllabic words, and also frequently did not shift their nuclear stress for the purpose of contrastive focus on *MEAT, GREAT,* or *THREAT*. Stress is an essential marker of how information is organized and conveys pragmatic intent when speaking English (Lee, 2013), and misplaced prominence can cause miscommunication. According to the Speech Learning Model-Revised, learners do not have to

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completely restructure their perceptual systems so as to be able to use English prominence clues, particularly in terms of those needed to interpret meaning based upon pragmatic use. The persistent reliance on L1 prosodic templates supports the view that suprasegmental acquisition progresses more slowly than segmental accuracy for many learners.

Overall, the evidence suggests a multifaceted and gradual path of suprasegmental development. Rhythmic patterns reflect L1 category assimilation (Flege *et al.,* 2021). Intonation patterns suggest the lack of functional learning skills (Mennen, 2015). Stress placement mistakes are evidence of the use of L1 prominence templates to create stress patterns in L2 (Gut, 2009). The development of these two aspects of prosody may not occur at the same time, reinforcing the importance of providing instruction that emphasizes both perception and pragmatic control rather than just articulation.

From a pedagogical point of view, the findings in this study indicate that explicit and evidence-based work on suprasegmental properties should be included. Perception-production training has proved to enhance the ability of vowel reduction and rhythmic control (Saito & Lyster, 2012), and focused instruction can promote pitch-range flexibility (Gordon & Darcy, 2006). Activity fostering schwa reduction, durational contrast, and affective intonation in natural language contexts could have a beneficial effect on learners' prosodic flexibility, intelligibility, and communicative success.

Finally, this study had some limitations related to its methodology. Data collected during a controlled reading task were collected under planned conditions, unlike spontaneous speech. Future research should incorporate both styles of speaking into understanding the manifestation of prosody across the various stages of real-time communication. Additionally, longitudinal studies should be conducted with larger groups to determine if there is any change in timing, pitch, and stress over time, and whether or not explicit prosody instruction speeds up these changes.

Conclusion

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This research examined the prosodic features relating to Spanish-speaking students' English pronunciation through an experimental poem designed to elicit rhythm and stress-timing forms. Results showed that the way learners produced English as an L2 was significantly influenced by their Spanish (L1) prosodic system. As such, they produced a primarily syllable-timed rhythm of speech (as evident in High %V, low nPVI-V scores, and no reduced vowels in multi-syllable words) and demonstrated limited expressive variability in intonation (characterized by a reduced pitch range, prioritizing Spanish-English L1 English falling contours). Additionally, their English intonation was less effective due to limited expressive variability, consequently reducing the pragmatic effectiveness of their speech. The learners demonstrated a long-standing difficulty with the placement of nuclear stress; they regularly used penultimate stress rules from Spanish and had difficulty shifting prominence when numerous ideas were presented in a single conception (for contrastive emphasis and informational focus).

The findings indicate that learner challenges can be more than just segmental accuracy or orthographic confusion; they include subtler prosodic elements to some degree or another, which directly influence their ability to understand something (intelligibility), interpret the structure of a discourse (the way the information is grouped), and engage with the listener. Explicit instruction in using rhythm, timing, and vowel reduction; activities designed to help learners improve their pitch range; and structured practice for the purpose of marking the place of greatest emphasis (nuclear stress) for information structure and contrastive meaning are essential pedagogical interventions.

In the future, spontaneous, interactive, or conversational speech should be used to investigate how prosodic control develops in real-time communication. Longitudinal studies and pedagogical investigations could also reveal how exposure, feedback, and focused L2 training contribute to the development of the L2 prosody and reduce the influence of L1 transfer over time.

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