Sonority across Languages: A Contrastive Perspective on the Mutual Learnability of Spanish and English Front Pure Vowels

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Abstract

This paper presents a contrastive perspective on the front monophthongs in Spanish and English. Applying the quantitative-contrastive method designed and used in the researchers' earlier works of 2015 and 2019, we highlight the contrast between Spanish and English front monophthongs from a zonal frame of reference in the oral tact, and proceed to offer insight about the comparative levels of learner stress and difficulty that English speaking learners of Spanish and Spanish speaking learners of English as a foreign language will probably experience while attaining accuracy in the acquisition of their target vowel systems. The facts that English and Spanish front monophthongs are more different than similar (71.43: 28.57) and the acquisition workload is greater (80:50) for Spanish speaking learners of English have been established in this study. In addition, English speaking learners of Spanish will need to generate a greater degree (80:50) of substratum counter-influence than Spanish speaking learners of English for the accurate acquisition of their target vowels. Although both types of learners can transfer an equal number of vowel sounds from their L1 inventories, the ratio is not the same (20:50) and the study indicates that English speaking learners of Spanish in general will probably experience a slightly greater degree of articulatory stress in attaining perfection in the pronunciation of the target system.

Keywords: Spanish, front monophthong, contrast, substratum counter-influence, interference, acquisition workload

Despite having the same glossogenetic origin of the Proto-Indo-European language, English and Spanish developed and matured uniquely. The languages have obvious differences alongside similarities in their phonologies. Salcedo (2010) argues that present-day Spanish and English have similarities in syntax and lexis. However, when it comes to phonetics and phonology, the languages display noticeable dissimilarities, such as the presence and absence of long monophthongs in English and Spanish. On the other hand, occlusion and nasalization are the areas of phonology where the two languages display similarities. As many differences are revealed when studying the phonologies of these two languages, the information and insight obtained can help the learners and their facilitators use the right approach because, if they are aware of the contrast between the two sound systems,

they can predict the potential areas of problem and come up with viable solutions to ease the learners' journey to the correct acquisition. Such an area of contrast is the front monophthong systems or the pure vowels in the two languages.

In the present study, we use the same method we used for English and Bengali (2015) in which we look at the differences between the two systems of English and Spanish in mathematical terms by calculating the total number of phonemes in each category as well as the interfacing identical phonemes to figure out the differences between the two systems. The calculations allow us to quantitatively discover the degree to which English and Spanish front monophthong systems are different or *away* from each other from a zonal frame of reference in the oral tract. This helps us to obtain an idea about the probable degrees of learner stress and workload as well as substratum counter-influence that is likely to be essential if English speaking learners of Spanish as well as Spanish speaking learners of English as a foreign language ever want to achieve accuracy in their acquisition of the front monophthongs of Spanish and English, respectively. Although one hundred and forty-seven undergraduate students of various disciplines at North South University in Bangladesh took part in a recent survey about the desire for learning a European language from a set of six languages (French, Spanish, German, Italian, Dutch and Russian) to indicate that Spanish is the most preferred language after French, the preference for the scope of the present study is in fact a matter of curiosity and research.

The Vowel Sound

Gimson (1975) points out that a vowel phoneme is the tiniest, irreducible yet discrete conceptual unit of sound in any language that eventually comes into existence through little or no physical or articulatory obstruction to the outgoing lung air. This unit is considered as some sort of consciousness or a concept that is later neurolinguistically transformed into a "sound" with certain physical properties that can be corroborated and studied by a sound-scientist. As an audible entity, a phone has determinable features, i.e., it has an initiation, a continuation, and a termination. Therefore, the phoneme is a concept which is the cause and the phone is the physical entity which is the effect or the logical consequence of the phoneme. In other words, the relationship between the phoneme and the phone is that of a cause and its effect. The cause or the phoneme is realized, when we work on it by using our vocal organs. In English, in order to realize the /i:/ in "feel" the speaker first needs to have the concept of the sound or the phoneme before he can give voice to the actual sound [i:], which is the phone. In order to produce the phone [i:] in English, the tongue has to be moved forward and upward in the oral tract. The lung air will pass through the oral tract, and the vowel sound wave will be formed with the vibrating air molecules.

The vowels and the consonants are the two types of speech sounds that generate the phonology of a language. The sound types are consequences of the dynamics of the articulators or actants. All speech sounds are products of the static and the dynamic actants interacting with one another and, through a process called "articulation," they generate sounds of a language. The various forms of the displacement and movement of the tongue – a dynamic actant – give birth to "vowel sounds," such as, /e/ and /u:/ in languages like English.

Ball and Rahilly (1999) argue that speech sounds are a form of mechanical energy released by vibrating air particles. Vowel sounds, just as any other types of sound, travel as sound waves comprising vibrating particles. A form of energy may be perceived as the capacity that can bring about a change in an environment. Since sound breaks "silence" in the environment, it is a form of energy. Realizing a vowel sound, such as /æ/, results in the release of sound energy. To produce the energy, the vocal cords and the actants experience vibration and displacement, and as the vocal folds strike each other, they also strike the air particles, causing them to oscillate systematically. This turbulence of air particles through sound waves results in speech sounds, such as those of the vowels and consonants.

Haque (2015) notices that among all the actants in the oral tract, the tongue is the most dynamic and versatile vocal organ, and through its three-dimensional movements, the tongue plays the most important role in generating the sound waves that produce vowel phones. The boneless tongue comprises *intrinsic* and *extrinsic* muscles that enable the organ to change its shape and position.and that is crucial for the correct pronunciation of speech sounds (Fiore & Eroschenko, 2000).

In writing, a vowel refers to either a grapheme or a visual graph – a sign meant for retinal experience. In phonetics and phonology, however, a vowel, or more appropriately, a vowel sound wave appears as a form of energy that, once generated, can travel through the air and enter the human sound receptors in order to eventually produce an auricular effect or experience. Language learners often fail to see the difference between the vowel graph and the vowel phone, and take one concept for the other (Haque, 2015). From articulatory frames of reference, vowels are the sounds or segments of speech continuum for which the pulmonic airstream is allowed to pass through the oral tract with little or no articulatory obstructions.

As there are five graphemes in Spanish (a, e, i, o, u), and five (a, e, i, o, u) in English, learners often tend to believe that Spanish as well as English phonology has the same number of five vowel sounds only. As a matter of fact, the Spanish language has twenty-three vowel sounds against twenty-five in English (Salcedo, 2010).

The spoken forms of natural languages do not exist without phonemes. Phonologically, each language of the world is composed of a definite, well-defined set of phonemes that all L1 and L2 learners must learn as part of their attempt at developing competence in that language. This is essential because speech sounds or phones, which are the discrete, indivisible, units of real sounds, cannot be generated without the help of phonemes that function as the conceptual basis of speech sounds. A language learner can articulate a well-formed phone of their target language if the underlying phoneme is internalized correctly since correct pronunciation primarily depends on correct concept of a speech sound. On the other hand, as Haque (2015) observes, mispronunciation occurs when there is an error at the phonemic or conceptual level, although other reasons, such as those involving the vocal organs, may also play a role. Therefore, it is very important that learners of a foreign language such as English learn about the phonemes of English as part of their effort to develop speaking skills. It is also equally important for the learner to be able to recognize

the traces and characteristics of mother tongue phonemes so that they can learn to avoid substratum influence in speech.

Vowel Realization

Vowels can be classified in terms of their position in the vocal tract. This tract is drawn as a quadrilateral chart, where all the vowels are arranged in different positions. From this positioning, it is found that the horizontal categories are *front*, *central*, and *back*, along with the vertical categories of *high*, *mid*, and *low*. While producing the front vowels, the tongue moves close to the opening of the oral tract, and for the back vowels, it moves back in the tract. Moreover, vowels can also be categorized as monophthongs or pure vowels, and diphthongs or compound vowels. Both English and Spanish possess these vowels.

As indicated above, vowel sounds are a consequence of the open interaction between the actants in the oral tract. The stream of air leaving the lungs through the trachea and the oral tract is the egressive pulmonic airstream (EPA), while the air entering the lungs, by inhalation or inspiration, is referred to as the ingressive pulmonic airstream. The articulators interact with one another in such a way that they allow the egressive pulmonic air to pass freely. The EPA does not face any obstacles and can pass through the oral tract more or less in an undisturbed manner. This happens because when the articulators interact, they do not touch each other. Vowels are produced in this way. For instance, for /i:/ the tongue goes forward and upward but does not touch the alveolar ridge. It is possible to exhaust all of the EPA while making a single /i:/ in English. Vowels in any natural language can be seen to have two broad categories: pure and non-pure or compound.

A pure vowel or monophthong is by nature a basic vowel sound in the sense that it is indivisible. It cannot be analyzed in terms of any other sounds. For instance, /e/ in the English word "egg" cannot be analyzed in terms of any other sound, while /ai/ – a compound vowel – can be, in terms of /a/ and /i/, so it represents the category of diphthong. McMahon (2002) states that, to describe vowels, three parameters such as the *height*, *frontness*, and *roundness* are to be taken into consideration. Inside the oral tract, there are front-back and high-low dimensions where different vowel sounds are articulated. However, this article exclusively spotlights the front monophthongs which can be categorized into three types: high front (such as /i:/ in the English word "reach," and /i/ in the Spanish word "tipo"), mid front (such as /e/ in the English word "excellent," as well as the /e/ in the Spanish word "elefante"), and low front (such as /æ/ in the English word "flag").

Interference and Mispronunciation

Lekova (2010) defined possible phonetic interferences as "the improper pronunciation of phonetic sounds in the second language caused by the existence of different phonetic structures from the point of view of the mother tongue" (p. 321). Therefore, if necessary, as Brown (2000), James (1994), and Hai and Ball (1961) acknowledge, the learner has to neutralize L1 interference or generate substratum counter-influence to fight back the mother tongue interference to ensure correct pronunciation of the words in the foreign language. An attempt at this process involves the learner's conscious effort to overcome L1 habits and influences that can disturb the correct realization of a phoneme in L2.

Brown suggests that such substratum counter-influence facilitates *cognitive pruning* which is equivalent to "the elimination of unnecessary clutter and a clearing of the way for more material to enter the cognitive field" (p. 87). To illustrate the point, we can consider the existence of long /i:/ and short /i/ in English and Spanish respectively. Unless an L2 learner of English speaking in Spanish as L1 is aware that /i/ in the two languages is not the same in terms of phonetic duration and longevity, s/he will not be able to make the difference when pronouncing words like lead and will inevitably pronounce it as lid or something close to it. The correct pronunciation in such cases comes from awareness of contrast as well as ability to suppress the habit and influence. This makes it necessary for us to opt for contrastive analyses of the English and Spanish phonological properties to provide learning as well as teaching with additional phonemic insight necessary for both the learner and the teacher.

An important element playing a vital role in the production of a vowel sound is the airstream that leaves the vocal tract. Vowels and consonants in most languages, including English as well as Spanish, are produced by the aerodynamics of the egressive pulmonic airstream. Compared to the "consonant sounds," some vowel sounds require less energy, and depending on the duration there are non-tense, e.g., short or lax and mid-long, and long or tense vowel sounds. The short pure vowels require relatively small amounts of energy and duration than mid-long and long vowels. For example, the English /ə/ is about one third of the duration and acoustic length of /ɑ:/.

Postman and Underwood (1973), Anderson (2003), Lakova (2010) and Haque and Uddin (2019) believe that in foreign language acquisition scenarios in general, learning new sounds as against unlearning or neutralizing L1 habit receives more focus and attention of the learners as well as their facilitators. This is why the issue of substratum counter-influence is often grossly ignored and the L1 habit perpetually interferes with the learners' attainment of accuracy in pronunciation of the foreign language sounds.

Contrast and Implications

According to MacMahon (2002), Idahosa (2017), and Quintero (2019), English vowel inventory has twenty-five phonemes (including triphthongs) while Spanish has twenty-three. Among the twenty-five monophthongs in English, there are five front monophthongs. In contrast, Spanish has only two front pure vowels, where one is in the high section, and the other in the middle section of the oral tract. According to IPA, the orthographic and phonological vowels can be represented in the following way:

/a/ a	**/e/** e	**/i/** i	**/o/** o	**/u/** u
Central	Front	Front	Back	Back
Unrounded	Unrounded	Unrounded	Rounded	Rounded

Table 1: Spanish monophthongs

/e/ E	/i/ i
Front	Front
Unrounded	Unrounded
Mid	High
Short	Short
Relatively Tense	Relatively Tense

Table 2: Spanish front monophthongs

	Spanish	English
Monophthong	5	12
Diphthong	14	08
Triphthong	4	5
Vowels shown in the alphabet	5	5
Total number of vowels	23	25

Table 3: Contrast between English and Spanish vowels (MacMahon, 2002, Idahosa, 2017 and Quintero, 2019)

In contrast, we know that the monophthongs in the English language are twelve in number:

/e/	/ɪ/	/i:/	/ʊ/	/u:/	/ə/	/æ/	/ʌ/	/ɑ:/	/ɜ:/	/ɒ/	/ɔ:/
e	I		u		a					o	
Front	Front	Front	Back	Back	Central	Front	Front	Back	Central	Back	Back
Unrounded	Unrounded	Unrounded	Rounded	Rounded	Rounded	Unrounded	Unrounded	Unrounded	Rounded	Rounded	Rounded

Table 4: English monophthongs

The front monophthongs in English are as follows:

/e/	/ɪ/	/i:/	/æ/	/ʌ/
e	i		a	
Front	Front	Front	Front	Front
Unrounded	Unrounded	Unrounded	Unrounded	Unrounded
Mid	High	High	Low	Low
Short	Short	Long	Short	Short
Lax	Lax	Tense	Lax	Lax

Table 5: English front monophthongs

A schematic diagram of the inside of the oral tract may be used to present a view of the points of origin of the monophthongs of English (Collins & Mees, 2003, p. 89):

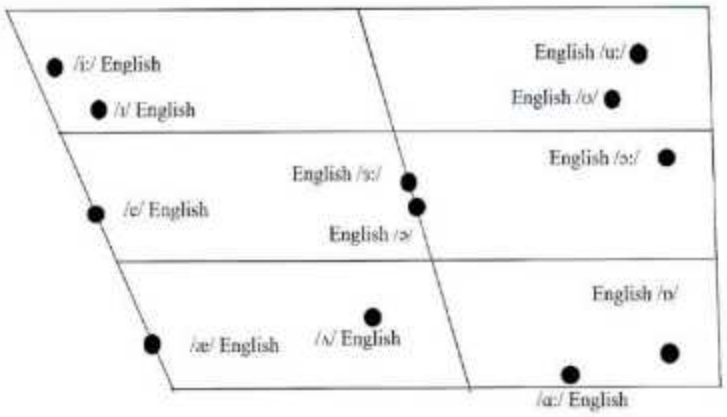

Fig. 1: Points of origin of the English monophthongs

The schematic diagram of the inside of the oral tract may be used to present a view of the points of origin of the monophthongs of Spanish (Ladefoged & Johnson, 2010, p. 44):

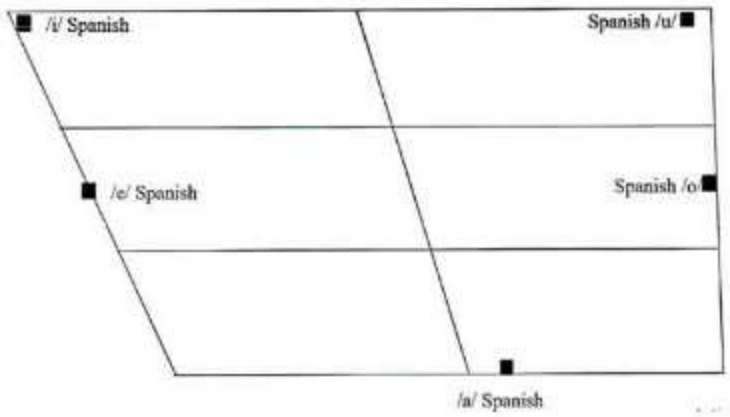

Fig. 2: Points of origin of the Spanish monophthongs

The following schematic diagram of the oral tract shows a zonal contrast between the English and Spanish front monophthongs:

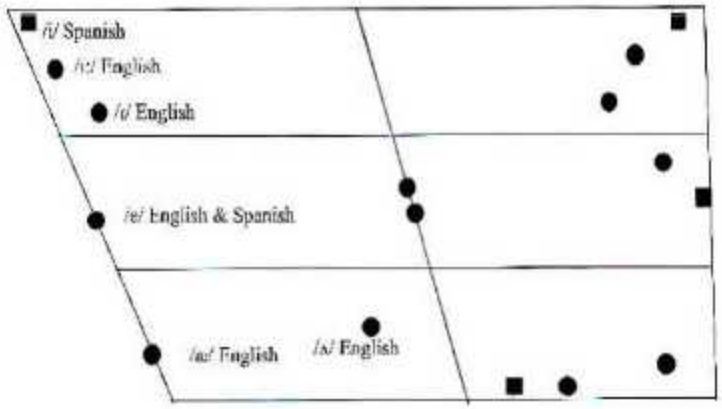

Fig. 3: Points of origin of the Spanish and English front monophthongs

From the information presented above, following MacMohan (2002), Idahosa (2017) and Quintero (2019), the identity features of the front pure vowels in English and Spanish can be delineated, mathematically contrasted, and summarized in the same manner as they appear in Haque (2015) and Haque and Uddin (2019):

Front monophthong	Spanish [2]	English [5]
/ɪ/ e.g. in English *fit*	Absent	High, front, lax, weak, short, moderately loud pure vowel
/e/ e.g. in English *ten*	Mid, front, relatively tense, strong, short, moderately loud pure vowel	Mid, front, lax, weak, short, moderately loud pure vowel
/i:/ e.g. in English *sheep*	Absent	High, front, tense, strong, long, moderately loud pure vowel
/æ/ e.g. in English *bat*	Absent	Low, front, lax, weak, short, moderately loud pure vowel
/ʌ/ e.g. in English *cut*	Absent	Low, front, lax, weak, short, moderately loud pure vowel
/i/ e.g. in Spanish *pino* (pine)	High, front, relatively tense, weak, short, moderately loud pure vowel	Absent

Table 6: Features of Spanish and English front monophthongs

Front pure vowel in the two languages with considerable interface are two:

Vowel Sound	Features
English & Spanish /e/	Mid, front, weak and semi-tense, short, moderately loud pure vowel

Table 7: Features of English and Spanish front pure vowel

For high front monophthong, the contrast is demonstrated below:

Spanish	English	Interfacing Phonemes	HFM Interface
01	02	00	00%

Therefore,
Interface = 00%
HFM Divergence = 100%

Hence, for high front monophthongs, we observe that there are front long and front short monophthongs in both languages but no identical phonemes between the languages. For that matter, in terms of high monophthongs, these languages are 100% different from each other.

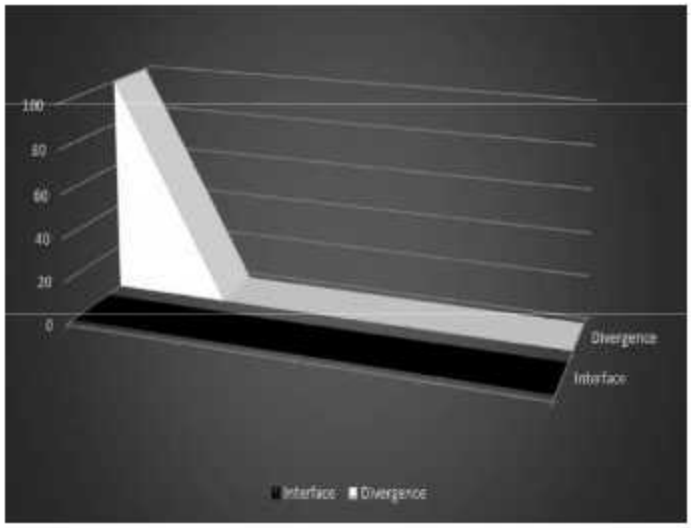

Fig. 4: There is no interface between English and Spanish high front systems

The indication of this disparity for the learners of English and Spanish are shown as follows:

Learner	Acquisition L2 HFM	Transfer L1 HFM
Spanish speaking learner of English	2 /i:/ /ɪ/	0
English speaking learner of Spanish	1 /i/	0

Table 8: Acquisition and transfer of high-front monophthongs

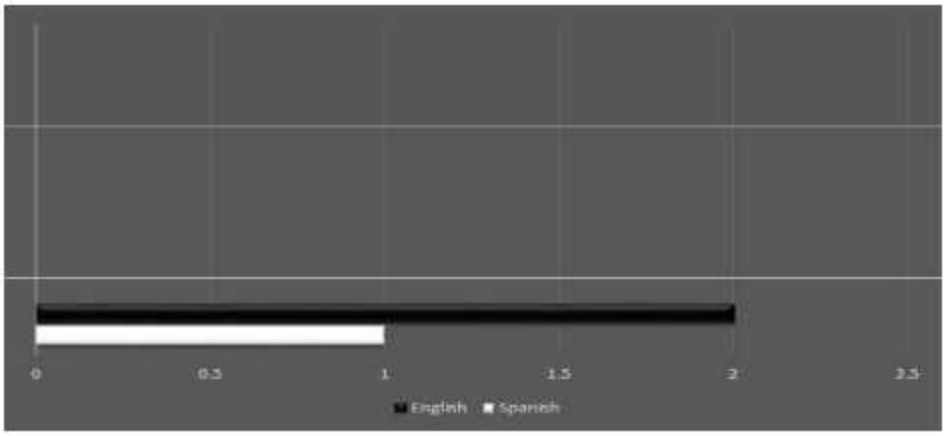

Fig. 5: English is 200% richer than Spanish where high front systems are concerned

Therefore, the Spanish speaking learner of English has to learn two sounds from English phonology, while the English speaking learner of Spanish has to learn one sound from this category. In addition, both BLE and ELB have no sounds in their target language to tranfer and use.

There is only one mid front monophthong in Spanish as well as English, and this mid front monophthong is in complete interface:

Monophthong	Features
Spanish and English /e/	Mid, front, weak and semi-tense, short, moderately loud pure vowel

Table 9: Features of Spanish and English mid-front monophthong

For mid front monophthong, the situation is as follows:

Spanish	English	Interfacing Phonemes	MFM Interface
01	01	02	100%

Therefore,
Interface= 100%
MFM Divergence= 00%

Therefore, for mid front monophthong, our observation is that there is only one monophthong in both languages. Also, their position and features are identical, which make them strikingly similar.

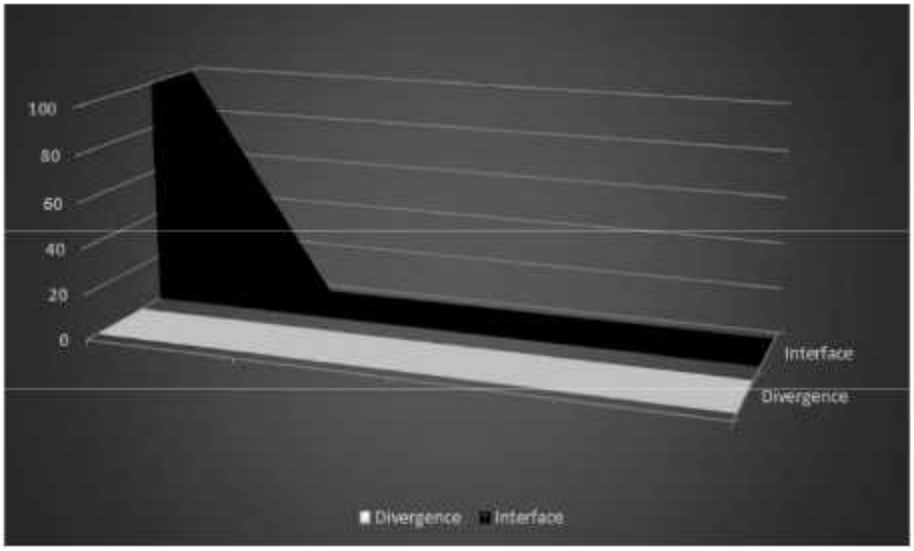

Fig. 6: The mid fronts vowels underscore the resemblance between English and Spanish

The implications of this difference for the learners of Spanish and English can be summarized as follows:

Learner	Acquisition L2 MFM	Transfer L1 MFM
English speaking learner of Spanish	0	1 /e/
Spanish speaking learner of English	0	1 /e/

Table 10: Acquisition and transfer of mid-front monophthong

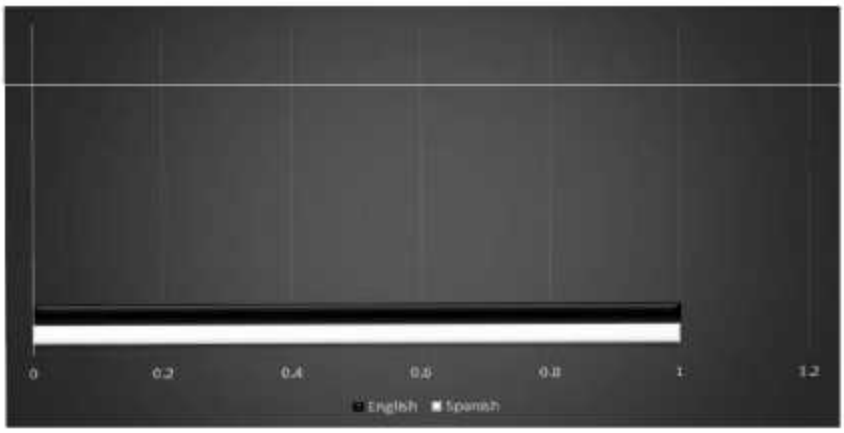

Fig. 7: The mid front monophthongs make English and Spanish resemble each other

Therefore, in terms of the mid-front monophthongs, /e/ is the common sound in both the languages which is why ELS and SLE will have this sound automatically transferred and employed in their target language.

There are two low front vowels in English while there are none in Spanish. Therefore, there are no interfacing low phonemes between these languages.

For the low front vowels, the following is the contrast:

Spanish	English	Interfacing Phonemes	LFM Interface
00	02	00	00%

Therefore,
Interface= 00%
LFM Divergence= 100%

Therefore, our observation is that there are two low front monophthongs in English as opposed to zero in Spanish. This confirms the fact that English depends more on low front vowels than Spanish does.

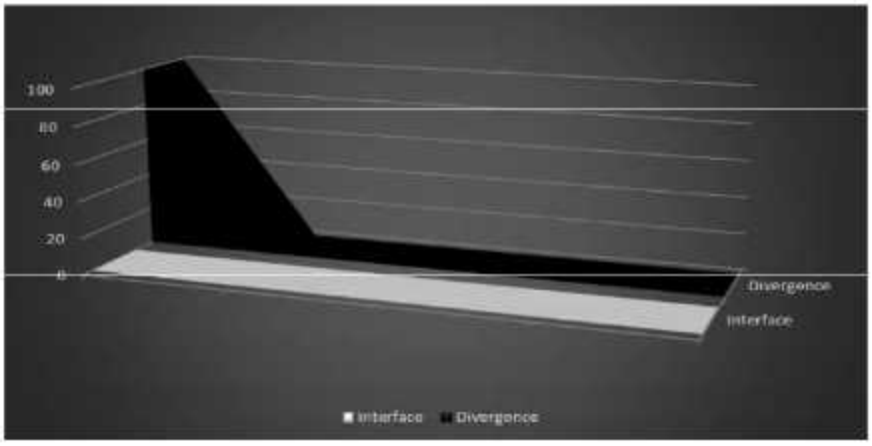

Fig. 8: Low front vowels give English a uniqueness that Spanish does not possess

The implications are as follows:

Learner	Acquisition L2 LFM	Transfer L1 LFM
English speaking learner of Spanish	00	00
Spanish speaking learner of English	2 /æ/ /ʌ/	00

Table 11: Acquisition and transfer of low-front monophthongs

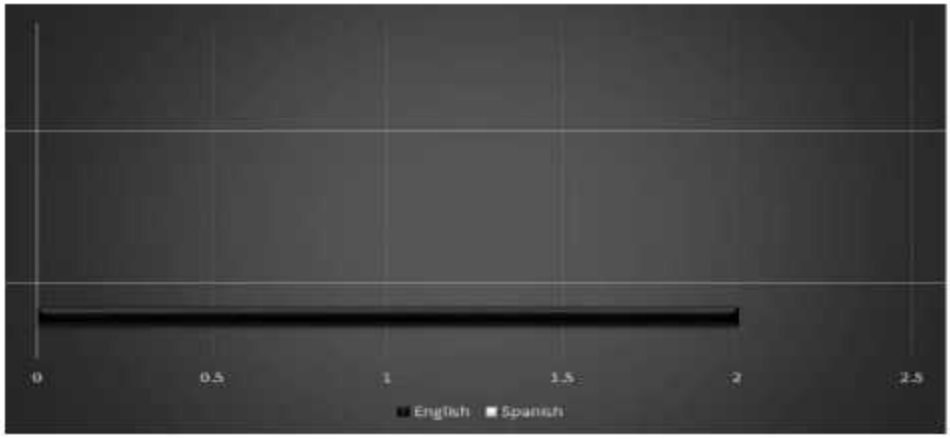

Fig. 9: English is 200% richer than Spanish in respect of Low Front Monopthongs

Therefore, ELS does not have to acquire any sound from the Spanish phonology when it comes to the low front vowels and, naturally, there is no sound to transfer. However, since there are no interfacing phonemes, SLE has to acquire two new sounds from the target phonology, and there will be no transfer from L1.

Therefore, in the final analysis, we can confirm that total number of interfacing front monophthongs between English and Spanish as once mentioned above are two in number, and are as follows:

Monophthong	Features
English & Spanish /e/	Mid, front, weak and semi-tense, short, moderately loud pure vowel

Table 12: Total interfacing front monophthongs between English and Spanish

For the complete set of front monophthongs in Spanish and English, the following is the contrast:

Spanish	English	Interfacing Phonemes	FPV Interface
02	05	02	28.57%

Therefore,
Interface= 28.57%
FPV Divergence= 71.43

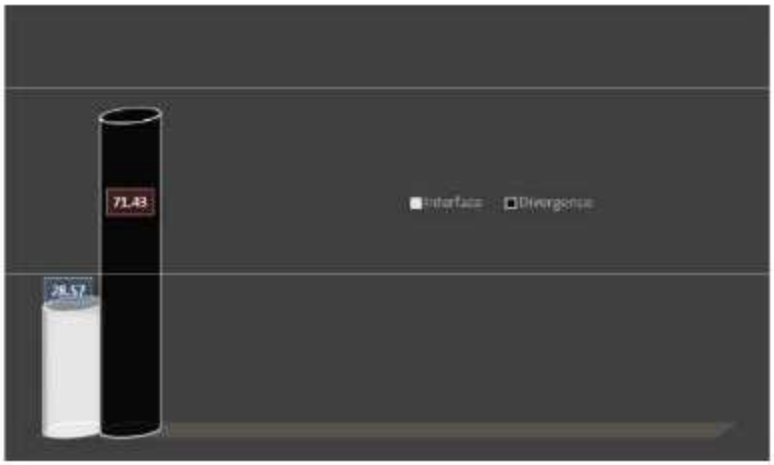

Fig. 10: English and Spanish front monophthongs are more different than similar

Accordingly, as far as the pure front vowels are concerned, Spanish and English are almost poles apart. This makes learning Spanish and English more challenging for the ELS and SLE, respectively. The implications of the phonetic differences for the learners of Spanish and English can be summarized as follows:

Sound type	Learner	Retention/ Transfer (L1)	Acquisition/ Learning (L2)	Substratum counter-influence (L1)
Front monophthong	English speaking learner of Spanish as a foreign language	1 /e/ **20%**	1 /i/ **50%**	4 /æ/ /ʌ/ /iː/ /ɪ/ **80%**
	Spanish speaking learner of English as a foreign language	1 /e/ **50%**	4 /æ/ /ʌ/ /iː/ /ɪ/ **80%**	1 /i/ **50%**

Table 13: Implications of the phonetic differences for the learners of Spanish and English

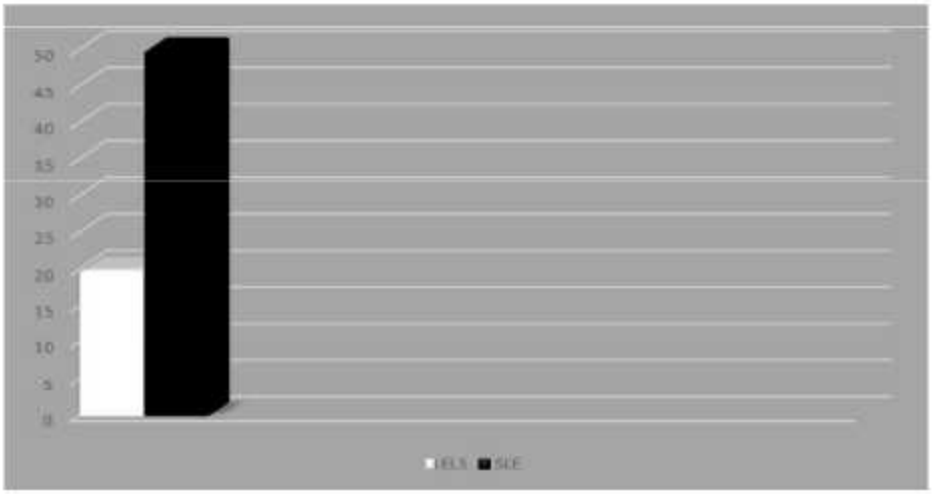

Fig. 11: Retention and transfer of L1 sounds make learning seemingly more stressful for ELS (20:50)

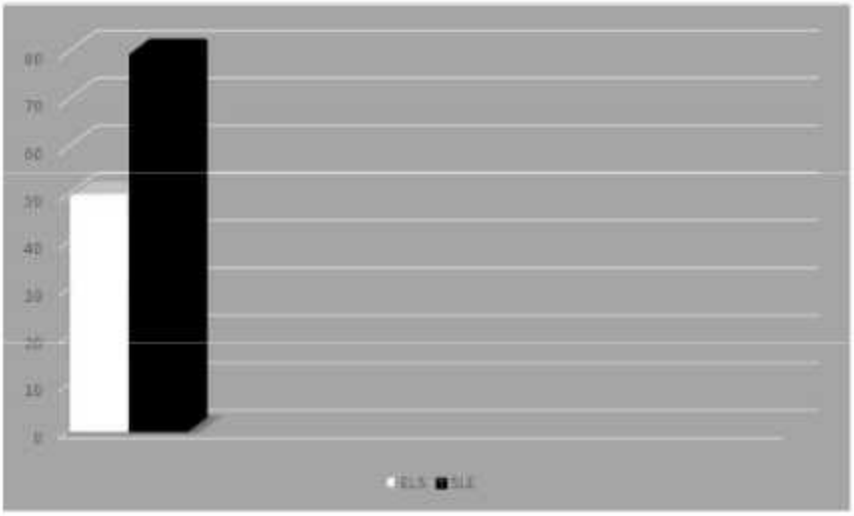

Fig. 12: The SLE encounters a greater workload in learning (80:50)

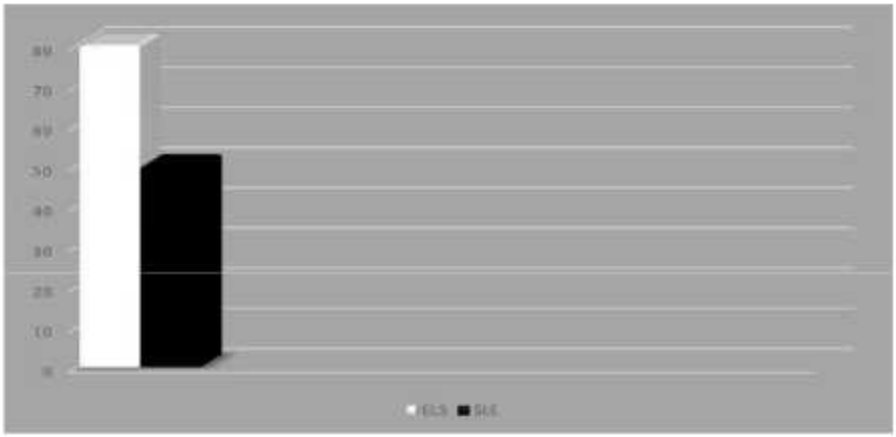

Fig. 13: The ELS will contemplate a greater degree of substratum counter-influence to ensure phonological accuracy (80:50)

The Final Observations

From the zonal frames of reference, it appears that English and Spanish front monophthong systems are considerably different (71.43%) from each other, and that Spanish speaking learners of English have a greater acquisition workload (80:50) to deal with compared to English speaking learners of Spanish. On the other hand, while it is true that both groups of learners are at ease with the retention and transfer of just one mid-front pure vowel sound /e/, the ratio is not equally favorable for the English speaking learners of Spanish (20:50) and it, in fact, makes Spanish speaking learners of English experience comparatively low stress (50:80) due to the relative needlessness of the language substratum counter-influence. This, however, is not the case with English speaking learners of Spanish, and for that matter, the present researchers believe that English speaking learners of Spanish, in general, will probably experience a slightly greater degree of articulatory stress, and challenge compared to the Spanish speaking learners of English as they endeavor toward attaining the phonological perfection in their target system since the observations of

Postman and Underwood (1973), Anderson (2003), Lakova (2010) and Haque and Uddin (2019) suggest that acquisition of foreign sounds is often less stressful than completely neutralizing the substratum influence and interference.

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