



# Analysis of EFL speech production corpora according to the Speech Learning Model

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To my Grandpa, who  
wasn't able to see  
me finish my  
bachelor.

## ABSTRACT

Nowadays learning a language other than one's own mother tongue is seen as a must in our society. The reasons for considering this are various: possibilities of moving from one place to another (travelling), immigrating to start a better life in a foreign country, bigger chances to achieve a better career and the like. In this context, it is important to speak the language of the place of destination accurately to be understood by the native population. This means that grammar is not the only important aspect to be acquired in a new language but also its speech patterns and pronunciation. One of the main researchers investigating the phenomenon of pronunciation is J. E. Flege. He has conducted numerous experiments and pieces of research regarding second language (L2) speech acquisition and developed the *Speech Learning Model* (SLM) (1995) to explain and predict the pronunciation mistakes L2 learners make.

A similar phenomenon to L2 learning is foreign language (FL) learning. Nevertheless, it has to be stressed that, although similar, they are not the same event. One of the main differences between these two learning processes is that L2 learners are in a linguistic immersion setting whereas FL students are not; and also that the latter ones receive formal classroom instruction mostly oriented to grammar skills rather than to oral skills. Thus, from this first impression, it can be deduced that L2 and FL learning do not occur in the same circumstances. As a consequence, a need to verify whether an L2 learning oriented theory was sufficient to explain all phenomena occurring in FL learning was detected.

Therefore, the aim of this study is on the one hand, to analyse FL speech production and see whether the SLM can explain all pronunciation errors of a FL speaker; and on the other, to shed some light on FL speech teaching methodologies so that it becomes more effective and efficient. The confirmation of the existence of unexplained or unpredicted mistakes might mean that a FL speech learning theory would be needed; and a big amount of predicted mistakes might suggest that the teaching practices should be remodelled. The methodology followed in the analysis of errors was listening to the data with Praat and classifying the mistakes according to the SLM (as new, same or similar sound categories). The results showed that some of the participant's mistakes were not explained by the model (such as orthographically motivated mistakes). Taking into account that, as demonstrated by many studies -such as the one by Gómez Lacabex & García Lecumberri (2010)-, perception and production

training do help improving those abilities, it would be interesting to incorporate such training sessions into the classrooms. Finally, this dissertation also aims to encourage more research within the field of FL speech learning in order to firstly, understand better this phenomenon and secondly, improve the teaching system.

(Key words: FL/ L2 speech learning, speech learning theories, SLM).

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# 1. INTRODUCTION

When learning another language we not only have to learn the rules of its grammar but also the rules of its pronunciation and speech patterns among other things. Fluency is an important part of speech to be seen as a native speaker. Nevertheless, there are other factors that contribute to retaining the non-native accent that foreign language (FL/L2<sup>1</sup>) speakers have. For instance, factors such as misplacement of stress in words, erroneous rhythm and wrong intonation of the sentence (suprasegmental<sup>2</sup> elements) demonstrate the retention of a foreign accent (FA). The correct pronunciation of the speech-sounds of that particular language is also crucial in order to be taken as a native speaker. However, learners seem to find particular difficulty in attaining native-like pronunciation in their foreign language ([Stockwell & Bowen, 1965](#)) and, particularly, those who learn a language in a formal classroom setting. As it seems that there has been less research done on FL learners than on L2 learners, and the general knowledge about FL learners' difficulties to attain an accent free speech may not be very broad, it might be interesting to focus on these formally instructed students' pronunciation in order to shed some light on this phenomenon and on the development of a more efficient and effective teaching methodology of FL speech.

Consequently, I will firstly mention very early second language acquisition theories which try to explain the reason why FL learners retain a FA -the Critical Period Hypothesis and the Contrastive Analysis Theory- and secondly, I will summarize the four main L2 speech acquisition theories with the same concern as the previous ones - the Ontogeny and Phylogeny Model, the Native Language Magnet, the Perceptual Assimilation Model and the Speech Learning Model. Thirdly, some of the main L2 speech acquisition influential factors will be explained to understand some of the variables affecting this learning process. In the second part of this dissertation, the study's methodology and results will be presented finally discussing them and drawing some conclusions.

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<sup>1</sup> Foreign Language /Second Language.

<sup>2</sup> "a vocal effect which extends over more than one sound segment in an utterance, such as a pitch, stress or juncture pattern." ([Crystal, 2008:466](#)).

## 2. LITERATURE REVIEW

### 2.1. VERY EARLY SECOND LANGUAGE ACQUISITION (SLA) THEORIES

One of the early explanations to the retention of foreign accent in second language acquisition was given by the Critical Period Hypothesis ([Lenneberg 1967](#), [Scovel, 1969, 1988](#), in [Piske, 2007](#); [Penfield & Roberts 1959](#); [Stockwell & Bowen, 1965](#)). This hypothesis holds that, due to a biological change of the brain occurred between childhood and puberty ("the loss of neural plasticity" [[Piske, 2007:303](#)]), it is impossible to achieve a native-like speech after the age of 12-15. This loss of plasticity means that the brain and, in this case, the rules of the mother tongue are fixed and inflexible to change. Thus, it makes the speaker unable to master the non-native language.

Another theory which tried to explain this accent (or continuum of pronunciation errors) on L2 learners is Contrastive Analysis (CA). This theory holds that the main reason for (pronunciation and other) errors is direct transfer<sup>3</sup> from the mother tongue (L1) ([Lado, 1957](#); [Stockwell & Bowen, 1965](#)). It is noteworthy that this transfer occurs specially in the phonemic system. CA holds that comparing the phonemic system of L1 and L2/FL, errors can be predicted and explained. Nevertheless, it was seen that not all predicted errors appear; also that there are different tendencies for errors ([Eckman, 1977](#)); that transfer can be positive<sup>4</sup> too ([Archibald, 1998](#)); and that there are errors which are not due to transfer, but rather due to universal developmental reasons, and thus, they are dependent on the learners' level of L2 ([Major, 1987, 2001](#)). According to Archibald ([1998:4](#)), this means that learners will make use of what they know.

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<sup>3</sup>Substitution of a sound of L2 which shares some features with the L1 sound / "Sound substitutions in L2 speech may occur when the L1 does not contain the L2 target phone, or when the L2 target appears in a position prohibited by the L1" ([Zampini, 2008:232](#)).

<sup>4</sup>"Those NL-based uses that do not lead to linguistic errors are labeled as positive transfer" ([Liu, 2001:1](#))

## **2.2. MORE RECENT L2 SPEECH ACQUISITION THEORIES**

### **2.2.1. The Ontogeny and Phylogeny Model (Major 1987, 2001)**

Following CAH, Major developed the Ontogeny Model ([1987](#); later on modified to the Ontogeny and Phylogeny Model in [2001](#)), which is one of the four main theories that tries to explain and predict L2 phonetic errors. As stated above, Major claimed that the kind of errors made by a second language speaker are two: errors of transfer and universal errors such as developmental processes and "overgeneralisations" ([Archibald, 1998:4](#)). The model predicts that the first type of mistake will be highly frequent at the early stages of L2 acquisition, but that they will decrease as the mastery of L2 increases. Meanwhile, the other prediction made is that, even though developmental factors will be low and after high during acquisition, they will decrease at the final stage of the learning process up to the point of their disappearance ([Major, 1987](#)).

### **2.2.2. Native Language Magnet (Kuhl, 1993)**

Kuhl ([1993](#)) made a further step in the importance and influence of L1 when learning another language. She concluded that pronunciation/production inaccuracies are a consequence of imperfect perception of the L2's phonetic system. She claimed that infants are born with an innate ability to perceive any sound ([Streeter, 1976](#); [Werker & Lolande, 1988](#); in [Kuhl, 1993:125](#)) but that this ability starts disappearing when they arrive at the age of six months ([Werker & Tees, 1984](#), in [Kuhl, 1993](#)). This is caused by the development of a language-specific perception due to exposure to the mother tongue. Kuhl ([1993](#)), thus, stated that with linguistic experience or exposure to L1, infants create ideal sounds categories -called "prototypes"- representing each sound of their L1 and that this early organisation of the sound system prevents learners from perceiving FL sounds later in life. This theory is explained through the Native Language Magnet (NLM). The model sustains that once this L1 prototypes have been established, they behave as magnets pulling similar (FL) sounds towards them and, as a consequence, the person is not able to discriminate those new sounds from the native category. Therefore, foreign language sound units that are similar to the native ones are predicted to be more difficult to perceive whereas dissimilar ones are thought to be easier to discriminate ([Best, McRoberts, & Sithole, 1988](#), in [Kuhl, 1993:131](#)).



### **2.2.3. Perceptual Assimilation Model (Best, 1995)**

A third theory related to the degree of difficulty of perceiving FL sounds depending on their proximity to the native sounds is Best's Perceptual Assimilation Model (PAM) ([1995](#)). The model predicts that depending on the proximity between the mother tongue's and the target language's (TL) sound, the degree of acquisition difficulty will vary. In other words, the more different a TL phone is from an L1's, the easier it will be to distinguish and acquire it. PAM is based on articulatory phonology. That is, the model claims that the learner perceives speech sounds through the "articulatory gestures"<sup>5</sup> ([Best & Tyler, 2007:25](#)). In addition, it predicts that the listener will interpret TL sounds as 1) prototypes of an L1 category being considered as a better or worse instance of the prototype; as 2) different categories to L1; or as 3) non-linguistic sounds (i.e. sounds that are not recognised as an instance of speech). Putting it all together, the first group corresponds to the "Assimilated" sounds and are predicted to be the most difficult ones to perceive and acquire; the second one corresponds to the "Uncategorised" sounds being thought to be the easiest phones to distinguish; and the prediction for the third group, the "Non-assimilated" sounds, is that they will not be taken into account by the learner.

### **2.2.4. Speech Learning Model (Flege, 1995)**

Following with the influence L1 has in L2 speech production, a fourth model was developed by J. E. Flege ([1995](#)). Similar to Best's PAM theory, Flege's Speech Learning Model (SLM) theory claims that sounds will be classified and produced in a certain way depending on how they are perceived: as 1) totally new/different sounds, 2) similar or 3) identical to an L1 sound. This last classification, the identical sounds, might be directly (and correctly) transferred from L1 to L2/FL. Phones perceived as new or totally different are likely to be perceived and produced accurately (the learner would create a new phonemic category for them) due to the impossibility to pair them with any of the L1 phones. Thus, these two categories would not be problematic. However, the third group would be of higher difficulty to acquire since L2 sounds would be assimilated to an already existing L1 category and thus, learners would not be likely to distinguish the TL phoneme from the L1 one. Summarizing, the SLM, as well as PAM and NLM, also predicts that the more similar TL and L1 sounds are, the more

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<sup>5</sup>Learners compare L1's articulatory system to the target language's one.

difficult their discrimination and acquisition will be; and by contrast, the more different TL and L1 sounds are, the easier their discrimination and acquisition will be.

### **2.3. FACTORS THAT INFLUENCE L2 ACQUISITION AND PRODUCTION**

It can be seen in these four models that all of them agree with the important role the mother tongue plays when acquiring a foreign language. Specially at the time of perceiving and producing the target language's phones in adulthood since, as Kuhl (1993) puts forward, once the native system is established its influence is enormous. Therefore, it could be said that, on the one hand, there seems to be a "selective 'loss' of the ability to differentiate those contrasts that were not functional in the learner's native language" (Strange, 1995:22) and, on the other, that those perception patterns are apparently very difficult to redefine in adulthood (Mochizuki, 1981; Gottfried, 1984, in Strange, 1995). Perception starts being modified when exposure to L1 starts. In other words, experience with the mother tongue causes a language specific perception from the very beginning of our lives (Strange, 1995; Kuhl, 1993). This means that before exposure, humans are able to perceive and distinguish any sound and hence, it seems that age matters at the time of learning an L2/FL.

One of the main researchers with this concern is J. E. Flege. His investigations are related to the retention of the foreign accent and the influence of the linguistic environment on the learner. More specifically, his studies have shown that there are factors other than biological ones which make it difficult to achieve a complete mastery of an L2. The main force is considered to be L1's influence. Nonetheless, this force is accompanied by some other factors such as the age of first intensive exposure, age of learning (AOL), language use, quantity and quality of L2 input, length of residence (LOR), motivation and aptitudes (Flege, Munro, & MacKay, 1995a; Munro, Flege, & MacKay, 1996; MacKay, Flege, Piske, & Schirru, 2001; Piske, Flege, MacKay, & Meador, 2002; Flege & MacKay, 2004, in Piske, 2007:301). I will refer to AOL, language use and input as they are likely to be present in a different manner in foreign language learners.

Regarding the importance of age, it has been widely supported that early L2 learners have a better level and accent than those who start learning a foreign language later in life (Rochet, 1995; Flege, Bohn, & Jang, 1997; Thronburgh & Ryalls, 1998, in Ioup, 2008; Flege, 1988b; Flege & Fletcher, 1992; Flege Munro, & MacKay, 1995b, in

[Piske, 2007](#)). This would be the so-called "earlier is better" ([Flege, 1995:233](#)) which is the cause of the already mentioned perceptual structure modification. In addition, the influence of the amount of use of a particular language can result in different ways: the more the target language is used (and, therefore, the less L1 is used) the less foreign accent the speaker will have; and the more L1 is used, the more foreign accent the speaker will retain ([Atkey, 2002](#); [Flege, Schirru, & MacKay, 2003](#); [Flege & MacKay, 2004](#); [Guion, Flege, & Loftin, 2000](#); [Moyer, 2004](#); [Piske, MacKay, & Flege 2001](#), in [Major, 2008](#)). Finally, the weight input has must be highlighted. When the learner is in an immersion setting the amount of speech and its quality are one of natives. The target sounds are native productions and therefore, the perception of the learner may be adjusted correctly. Studies proving this hypothesis are numerous, many of them carried out by Flege and his colleagues (e.g. see [Flege & Liu, 2001](#), [Flege & Fletcher, 1992](#); [Flege, Birdsong, Bialystok, Mack, Sung, & Tsukada, 2006](#)).

By contrast, it is worth mentioning that the presence of a single factor is not the only reason for having bad pronunciation. For instance, the fact that a learner has a greater AOL does not bind her/him to have a bad pronunciation for the rest of their life. It is usually the combination of different factors which provoke heavy accent ([Piske, 2007](#)). Following with the example of age, there are many studies supporting the role of age when learning a foreign language ([DeCasper & Spencer, 1986](#); [Mehler, Jusczyk, Lambertz, Halsted, Bertoni, & Amiel-Tison, 1988](#); [Trehub, 1976](#); [Werker & Tees, 1984](#), [Strange, 1995](#), in [Ohala, 2008:22-27](#)). One of them is the one carried out by Werker & Tees ([1984](#)). They saw that babies between six and eight months were able to discriminate sounds from a language other than L1 whereas those babies who were between ten and twelve month-old were not. Therefore, it was concluded that children adjust the auditory mechanism towards L1 sounds, leaving out phonetic contrasts that are not of relevance in their mother tongue. Fortunately, many studies on L2 speech acquisition showed that, adults are in fact "able to change their phonological systems" with enough training ([Archibald, 1998:50](#); see also [Logan, Lively, & Pisoni, 1991](#); [MacKain, Best, & Strange, 1981](#); [Maye, 2000](#); [Tees & Werker, 1984](#), in [Ohala, 2008](#); [Strange, 1992, 1995](#), [Gómez Lacabex & García Lecumberri, 2010](#)). That is to say, the language specific patterns are not fixed in the brain and, even though a language-specific perception is developed in the first months of life, it has been claimed that it can be modified later on in life. Consequently, it could be stated that the simple fact of starting to learn an L2 later in life does not necessarily mean that the learner will have

poor pronunciation. Nevertheless, it has to be stressed that complete modification is very unlikely and thus, native-like perception and pronunciation are not likely to be acquired ([Flege, 1995](#)).

Unfortunately, it is improvable for foreign language learners in a classroom setting to be surrounded by the same linguistic context as L2 learners. These listeners do not have as much input quantity as those who are in a linguistic immersion setting and neither are they hearing native-like sounds. This occurs because most of the formal language teachers are also FL speakers of the target language and because students also hear the non-native pronunciation of their mates. As FL learners do not live in a TL speaking country, the amount of use of the FL and output produced by the learners is restricted to the formal teaching hours. Therefore, these learners might need a larger amount of years in order to achieve a high proficiency level. That is, a FL speaker will have worse perception and production of the TL compared to someone who has spent the same length of time learning the TL in a linguistic immersion setting. As a consequence, due to the dissimilar linguistic conditions FL learners and L2 learners have, a question one ought to consider is if the theories of L2 speech acquisition are applicable to FL learning.

## **2.4. THE MODEL FOLLOWED IN THIS PAPER**

It seems clear that even though many of the FL phonology learning aspects can actually be explained through the theories developed in the last decades, there might be other aspects that neither the OPM, the NLM, the PAM nor the SLM clarify since, as they are concerned with L2's phonetic system acquisition, they do not take into account the special circumstances where FL learning occurs. As a result, one of the aims of this study is to use one of these theories to analyse the data I have, and see whether there are unexplained phenomena which have not been predicted by the selected model. If there are unexplained phenomena, it might mean that a FL speech perception and production model is needed.

Taking everything into account, it seems that Flege's model would be the most appropriate one to follow in my analysis of the data. Firstly, because as my data is not a longitudinal one, Major's Ontogeny and Phylogeny Model (OPM) would not be of much help at the time of predicting the speaker's errors. In addition, I would not be able to track the speakers' development and see if they evolve as Major predicts they would do. Secondly, since, even though Kuhl's Native Language Model (NLM) describes

accurately why perceptual inaccuracies exist in L2 learners, it does not help to classify the mistakes into different types of misperceptions. Therefore, it will not be used in the analysis of errors. Thirdly, although Best's Perceptual Assimilation Model (PAM) provides a detailed classification of the assimilated sounds, it will not be applied in my analysis since I consider that I would need a goodness rating experiment of the participants to define the exact kind of assimilation they make. Finally, despite the Speech Learning Model (SLM) being concerned with the last attainment level of the L2 (and not FL, as the speakers in whom we would be interested), its relation between the perception/production explanation and the classification of mistakes seem to be the most appropriate one. Moreover, Flege's theory about the contribution of environmental factors (age of first intensive exposure, quality and quantity of input, language use...) seems to be very helpful at the time of predicting the mistakes and the reason for making them.

### **3. EXPERIMENTAL STUDY**

#### **3.1. SPEECH LEARNING MODEL**

As stated above, I will follow Flege's SLM classification of errors to explain the reasons why the mistakes are made. The SLM distinguishes three possible groups depending on how the L2 sounds are perceived: 1) Similar sounds: L2 sounds that are treated as realisations of L1 sounds (diaphones). 2) Identical sounds: L2 sounds which are perceived to be the same as L1 (transfer). 3) New sounds: phones that are not paired with the phones of the mother tongue and thus for which a new phonetic category is created. The model claims that without an accurate perception, the production of L2 speech will not be accurate. That is, native-like production is directly linked to native-like perception ability. Nonetheless, the SLM does not assign all production mistakes to an inaccurate perception.

**1. Table Postulates and hypotheses forming a speech learning model (SLM) of second language sound acquisition (Flege, 1995:239).**

<b>Postulates</b>	
<b>P1</b>	The mechanisms and processes used in learning the L1 sound system, including category formation, remain intact over the life span, and can be applied to L2 learning.
<b>P2</b>	Language-specific aspects of speech sounds are specified in long-term memory representations called phonetic categories
<b>P3</b>	Phonetic categories established in childhood for L1 sounds evolve over the life span to reflect the properties of all L1 or L2 phones identified as a realization of each category.
<b>P4</b>	Bilinguals strive to maintain contrast between L1 and L2 phonetic categories, which exist in a common phonological space.
<b>Hypotheses</b>	
<b>H1</b>	Sounds in the L1 and L2 are related perceptually to one another at a position-sensitive allophonic level, rather than at a more abstract phonemic level.
<b>H2</b>	A new phonetic category can be established for an L2 sound that differs phonetically from the closest L1 sound if bilinguals discern at least some of the phonetic differences between the L1 and L2 sounds.
<b>H3</b>	The greater the perceived phonetic dissimilarity between an L2 sound and the closest L1 sound, the more likely it is that phonetic differences between the sounds will be discerned.
<b>H4</b>	The likelihood of phonetic differences between L1 and L2 sounds, and between L2 sounds that are noncontrastive in the L1, being discerned decreases as AOL increases.
<b>H5</b>	Category formation for an L2 sound may be blocked by the mechanism of equivalence classification. When this happens, a single phonetic category will be used to process perceptually linked L1 and L2 sounds (diaphones). Eventually, the diaphones will resemble one another in production.
<b>H6</b>	The phonetic category established for L2 sounds by a bilingual may differ from a monolingual's if: 1) the bilingual's category is "deflected" away from an L1 category to maintain phonetic contrast between categories in a common L1-L2 phonological space; or 2) the bilingual's representation is based on different features, or feature weights, than a monolingual's.
<b>H7</b>	The production of a sound eventually corresponds to the properties represented in its phonetic category representation.

The model is based in seven hypotheses which derive from four postulates and they are introduced in Table 1. The first hypothesis (H1) states that L1 and L2 sounds are related at an "allophonic level". This would mean that a native Spanish speaker would relate English L2 [ð] in word-final position to [θ] but [ð] in word-initial position to [d]. H2 says that a new category can be created for an L2 sound if and only if the bilingual is capable of noticing significant differences between both L1 and L2 sounds. In other words, if the English phoneme /ð/ is thought to be a realisation of any of the Spanish allophones of /d/, or as another new allophone of the L1's /d/ phoneme, the learner will not create a new phonemic category for the foreign language. Thus, as the

third hypothesis says, the greater the perceived differences are between the sounds, the easier it will be to notice their contrast. The next hypothesis (H4) states that this capacity to discriminate the phonetic differences will be more difficult as age of learning (AOL) increases. Therefore, those who started learning the L2 later in life will have poorer discrimination rates/abilities. The equivalence classification mechanism can block L2 category formation (H5). This means that the different realisations will be classified within the same phonetic category. Linked to this idea is H6 because if the realisations are similar in pronunciation, that would cause a deflection in the bilingual's phonetic system to "maintain phonetic contrast" (between the native and non-native phones). Thus, Flege predicts a bidirectional interference in the learner. For instance, it might be that native Spanish speakers with English as L2 use greater VOT values for typical L1 stops than the values a Spanish monolingual would use. Consequently, native-like pronunciation is no longer predicted to be possible at the time of producing certain sounds. Last but not least, H7 concludes that a sound will be articulated with the properties of its phonetic category.

Arising the issue of not taking into account some of the statements by the model, H6 will not be considered for the following reasons: 1) I am interested in the errors Spanish native speakers make when speaking English (their FL) and not in how their bilingualism affect their L1 production. Consequently, I will not do any acoustic analysis to compare L1 sound production with L2 sound production. 2) The speakers of the data I obtained are English FL learners, not L2 learners. Therefore, their linguistic environment is not the same as the one of L2 learners' and thus, the foreign language does not affect speakers' L1 production in the same way as the SLM predicts for L2 speakers.

## **3.2. METHODOLOGY**

### **3.2.1. Data**

The analysed data (which can be found in <http://dx.doi.org/10.7488/ds/139>) was provided by the supervisor of this paper Dr. García Lecumberri. The data was created by Professor Martin Cooke, Dr. Maria Luisa Garcia Lecumberri, and Dr. Mirjam Wester and was made in consortium with (i) Language and Speech Laboratory, Universidad del Pais Vasco, Spain and Ikerbasque, Spain; (ii) Centre for Speech Technology Research, University of Edinburgh, UK.

The participants were asked to solve a "spot-the-difference" task in pairs both in their first and foreign language (which for native Spanish speakers is English, and for native English speakers is Spanish). Half of the recordings were made at the Centre of Speech Technology at the University of Edinburgh ([www.cstr.ed.ac.uk](http://www.cstr.ed.ac.uk)) and the other half at the Language and Speech Laboratory at the University of the Basque Country ([www.laslab.org](http://www.laslab.org)). I analysed the sound files containing the Spanish native speakers talking in their FL (English) on the grounds that the paper's focus is on the production of English as a Foreign Language. In order to isolate the relevant utterances in an easier manner, the sound files were processed with Praat ([Boersma & Weenink, 2015](#)). On the whole, I analysed one participant taking as focus her overall pronunciation in English. Thus, I will comment upon the production errors the participant has.

### **3.2.2. Participant**

All the speakers' identity has been conserved anonymous. Consequently, I have put a pseudonym to the participant I have selected for the analysis: Rebecca. Although I have no more information about the speaker than that she is a university student raised and living in the Basque Country, it could be deduced that -taking into account the educational system in the territory- she started learning English as a FL in primary (around the age of 4-8). There were six pairs of participants who took part in the experiment. Even though their amount of learning time is the same or considerably similar, I have no information about why their proficiency differs. There could be various reasons: motivation, quantity of exposure to native input, use of the language, differences in personal ability and such variables. The reason for choosing this speaker (Rebecca) and not another one, is that she has the best pronunciation proficiency and she is the most fluent compared to the rest of participants. That is, she is closer to the last stage of attainment the SML focuses on and thus, the application of the model will be more accurate than if it was applied to a speaker with a lower level.

### **3.2.3. Predictions**

Taking into account Flege's SLM theory, there are some predictions that can be made. I will analyse the production patterns of a specific participant. Taking into account Rebecca's (the participant's) L1 one could predict that she will mostly struggle with vowels since the Spanish vowel inventory is smaller than the English's one, being /ʊ/, /ɪ/, /ɑ:/, /ʌ/, /æ/ the most problematic vowels and being the central vowels easier to



acquire (according to the model). Focussing on consonants, as the SLM suggests, L2 consonants will be linked to positionally-sensitive allophones. In other words, the same L2 phoneme will be perceived as a different sound depending on where it appears in the word. However, I would suggest that if the learner finally discerns some minimal phonetic differences between those phones, it does not necessarily mean that the speaker will be able to produce the L2 phone accurately.

## 4. RESULTS

### 4.1. CONSONANTS

#### 4.1.1. Same/Identical Sounds

The voiced, velar, plosive /g/ has been positively transferred from the L1 to the L2. Rebecca produces this sound accurately. However, there is an instance that shows her mother tongue's phonotactic's influence in the way this phone is produced. In Spanish when a voiced, velar, plosive is between vowels it is spirantised<sup>6</sup> (/g/→[ɣ]/V\_V). Therefore, the plosive sound becomes an approximant: "I guess" /aiges/→[ar'yes]. This suggests that Rebecca is still learning her FL and that her proficiency is not of a native's one. In consequence, we would not say that she perceives the English consonant wrong but rather that her L1 habits make her produce /g/ (a plosive) as [ɣ] (an approximant) when it is found between two vowels.

The voiced, bilabial, plosive is positively transferred from Spanish when it is in initial position, and negatively transferred when it is between vowels or word-final position. English and Spanish /b/ are almost identical sounds. Nevertheless, the sounds behave differently in each language. In English, although it can be found in word-initial, -medial and -final position, it is pronounced in the same way in either of the positions. By contrast, in Spanish, the /b/ phoneme is realised as a voiced, bilabial, plosive [b] in word-initial position ("birds" [bɜ:ds]); in word-medial position it is spirantised producing a voiced, bilabial approximant [β] ("a bikini" [aβi'kini]); and finally, as it is

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<sup>6</sup> "Spirantization is a historical process by which a stop consonant becomes a fricative [or approximant]." ([Matthews, 2014](#)).

not allowed in word-final position, it is sometimes assimilated to a voiceless, labio-dental, fricative [f] ("pub" [pʌf])<sup>7</sup> and other times to [β].

#### 4.1.2. New Category

Rebecca seems to have established a new phonetic category for the English voiced, labio-dental, fricative /v/ in word-initial and medial position. This suggests that H1 might be correct, that phones are related "at a position-sensitive allophonic level" since the word-final position /v/ is not accurately produced. This error will be further explained in the next section of "similar sounds".

Rebecca does produce the voiceless, velar, plosive /k/ as her FL defines in all positions. She does not transfer her native pronunciation rules for this sound and thus, it can be stated that she has eventually created a new category for this phone. According to the SLM this is because she perceives enough phonetic differences to establish a new category for the L2 phoneme (H2). Therefore, it can be said that her voice onset time (VOT) is closer to the English monolingual's VOT of /k/ than to her L1's one. "Colours" [k<sup>h</sup>oləɪs], "drinking" [driŋkin], "pink" [p<sup>h</sup>iŋk].

Rebecca seems to have established a new phonetic category for the voiceless, bilabial, plosive /p/ too. She aspirates specially when the sound comes in word-initial position and might have more difficulties at the time of producing a word-final /p/ as it is not usual in her language. Overall, she produces the phone accurately. "Pink" [p<sup>h</sup>iŋk], "pillows" [p<sup>h</sup>iləʊs].

#### 4.1.3. Similar Sounds/ Category Assimilation

Although Rebecca has learnt to produce some English sounds quite accurately, there are still some other specific phones that she strives to produce when they are in some particular positions. Rebecca has not established a new category for the English voiced, dental, fricative phoneme /ð/. Her pronunciation of this consonant varies depending on where it appears in speech. At word-initial position, she tends to stop it (although she sometimes articulates it accurately) realising both the Spanish dental [d̪] allophone and the English alveolar [d] one ("the" [de], [d̪e], [ðe]). This suggests that she still has not well established two phonetic boundaries: on the one hand, the category boundary between /d/ and /ð/, and on the other hand, the one between L1 /d/ and L2 /d/

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<sup>7</sup> This is not a word uttered by Rebecca. It has been used to illustrate how a word-final /b/ is spirantised/weakened and devoiced.

as she uses them interchangeably. In word final position, she produces a voiceless, dental, fricative [θ]<sup>8</sup> ("with" [wiθ]). In word-medial position (between vowels), however, she uses her L1 allophone [ð] ("that's" [ðats]); that is, the voiced, dental, approximant due to the transfer of L1 phonotactics and phonological processes. According to the model, this could be because of the process of "equivalence classification" (Flege, 1987, 1988a, 1995). As Rochet (1995:385) explains, this is to

classify separate L2 phonemes as acoustically different realizations of the same L1 category, even if they [learners] perceive the acoustic differences in question. Once assigned to that category, the intended target speech sound is actualized accordingly to the phonetic realization rules of L1.

This means that Rebecca classified the English /ð/ as a realisation of the Spanish /d/ phoneme. So, as the H2 and H5 state, as the speaker does not find functional contrast between the native and non-native sounds, new category formation is blocked. This means that even if she notices some difference between /ð/ and [d̪] (since she sometimes articulates the fricative phone and other times the dental or alveolar plosives), and (although not much) between /ð/ and [ð] and [θ]; she still does not perceive enough distinctive phonetic features to create a new category. Thus, the non-native sound is classified as an allophone of the native category. Nonetheless, it has to be highlighted that the fact that she sometimes produces a /ð/ in word-initial position is an indicator of her learning stage and acquisition process towards the eventual establishment of the L2 category. Another reason for articulating a voiceless, dental, fricative [θ] instead of the voiced one [ð], is the Spanish phonological process of devoicing. Even if Rebecca might have established a new category for word-final /ð/, her L1 realisation rules or phonotactics might prevent her from producing the phone she has in mind. Also, it is worth mentioning that this devoicing process also is used by English native speakers and that, as a consequence, Rebecca might perceive the devoiced phone as an L1 voiceless sound. Similarly with the other two realisations.

Rebecca is incapable of producing a voiced, labio-dental, fricative /v/ in word-final position: "dive" [darf]. The reason for this could be that she perceives the word-final /v/ as voiceless (H1) and thus, produces it the way she has assimilated the phone (H5 and H7). Nevertheless, there may be other reasons that explain the phenomenon. For example, Rebecca, as I already explained above, has already established a new

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<sup>8</sup> Although /θ/ is itself a phoneme in Spanish, it is sometimes present as an allophone of the voiced, dental, plosive /d/ when this appears in word-final position as in the word "Madrid", where the last "d" can be spirantised to [ð] and devoiced and fricated to [θ].

category for /v/ which is linked to the orthographic letter "v". As she knows that whenever "v" is in a word the /v/ phoneme is present too, the reason that she does not articulate it is the Spanish phonetic realisation rules. Her L1 phonotactics do not allow such phone in word-final position (particularly because it does not exist), and therefore, she pronounces it voiceless. Taking this into account, I would give more consideration to the second explanation due to her knowledge about English orthographic rules since she would know that whenever "v" is present, the /v/ phoneme will be too. In addition, it is noteworthy that Rebecca might be perceiving this sound in such place as voiceless because of the devoicing processes native speakers have in word-final position.

According to the SLM and its hypotheses, second language learners perceive FL sounds through their L1 phonetic system. As the voiced, alveolar, affricate /dʒ/ is not a phone occurring in Spanish in word-final position, it is assimilated to the closest L1 phoneme: the voiceless, alveolar, affricate /tʃ/. It is, as a consequence, produced with the L1 properties (H7). It is interesting to mention that [dʒ] is actually part of the Spanish phonetic inventory. It is a free variance allophone of the dʒ > j > j sequence. However, Rebecca does separate L2 [dʒ] and [j] from each other. The problem comes when the affricate is in word-final position since it is realised voiceless. Again, the reasons for the mispronunciation are various. On the one hand, there is the role L1 phonotactics and phonological processes; and on the other, the speaker's devoicing of the phone does not let her perceive the voicing accurately: "garbage" ['gɑ:ɪbɪʃ], "orange" ['ɒrɪndʒ]. Taking into consideration these three errors, it could be generalised that Rebecca has a tendency to devoice all voiced obstruents in word-final position.

Even though there are no instances of word-initial and -medial /z/, a similar thing happens to this phone: it is realised voiceless /s/. Spanish does not contain a voiced, alveolar, fricative phoneme /z/ (it rather is an allophone). Although she might have acquired it, her L1 phonotactics and English orthography do not help her in predicting and distinguishing when to produce the voiced sound and when the voiceless one. Due to the large amount of written language FL learners receive in the formal instruction (since it is more focused on doing grammatical exercises than oriented to speaking practices or listening-answering exercises), orthography is very present in their mind. This is clearly reflected in Rebecca's production as she would have been transferring L1 orthographic pronunciation rules to her L2 orthographic production rules. This hypothesis is supported by the occasional accurate production of /z/. This shows that she might actually be on her way to creating a new category for this

phoneme and in consequence, we would say (once more), that she is still in the learning process. This is evidenced with her double utterances of some words: "pillows" [p<sup>h</sup>iləʊs] and [p<sup>h</sup>iləʊz] or "those" [dəʊz] and [dəʊs].

#### **4.1.4. Unexplained Phenomena**

Rebecca inserts [b] or [β] before the [wʊ] sequence to make the pronunciation easier. This sequence does not exist in her L1 and due to the similarity of both sounds, she needs an extra phone to articulate it. In words like "wood" and "wooden", [bud] and [βuden], the use of this help is prominent. I could not find a way to explain this insertion through the SLM since there is not a mistake perceptually motivated. However, it is interesting to remark that in Spanish a [g] or [ɣ] is introduced in sequences such as [we] ("cacahuete" /kakawete/ → [kakaywete]) and that this phenomenon might be linked to the insertion of [b] or [β].

The second phenomenon that the SLM could not explain is the insertion of [w] in a word like "etiquette" ['etikwet]. This has been thought to be an overgeneralisation of L2 orthographic rules. As in words like "question" and "acquisition" the "u" after the "q" letter is pronounced, Rebecca might have overgeneralised this rule to every word containing such sequence. From this example we can see that she is in a developmental stage between L1 and L2 orthographic rules: she does not know how to pronounce "etiquette" correctly but she does know that the last vowel letter "e" is silent.

## **4.2. VOWELS**

### **4.2.1. Same/Identical Sounds**

There are two vowels which Rebecca considers to be the same as her L1 vowels: /i/ and /u/. Both of them are produced with her native features; that is, she does not show any length. This might be because, as there is only one "i"-like and "u"-like vowel in Spanish and length is not a meaningful feature, Rebecca does not process them correctly in her L2 (where length does matter and where are two different unrounded, front and high vowels and another two rounded, back and high vowels).

### **4.2.2. New Category**

Rebecca usually pronounces the tense, mid central /ɜ:/ the way L1 orthographical rules define; that is, /ɜ:/ has not been assimilated to a specific L1

phoneme. It is rather realised according to L1 orthography. The only instance where this phoneme is pronounced accurately is in the word "birds" [bɜ:ds]. Rebecca might be aware that she is in front of a new phonetic category. What is more, according to the SLM, she should be able to perceive and create a new category for this sound as Spanish vowels do not occupy the mid central space of the vowel inventory. Nevertheless, she still finds it difficult to articulate the phone: "learn" [leɪn], "turquoise" [tuˈrkweɪs], "curly" [ˈkɜ:li], "circle" [ˈsɜ:kl]. Similarly, she sometimes struggles to produce the schwa or lax, mid central vowel /ə/ as in words such as "bottom" [ˈbɒtəm]. However, the second substitution has not been found very frequently.

According to Flege (1989) and the SLM, Rebecca is likely to establish a new category for these mid central vowels since Spanish does not contain sounds with such features and thus, she would perceive and articulate both phones accurately. In other words, as Rebecca's central vowel articulatory space is not used or determined for any phoneme, this would allow her establish that space for the new sounds. The explanation for Rebecca's inaccurate pronunciation would be based in two factors: 1) Rebecca is still learning the L2 and as a consequence, her low proficiency does not allow her produce the vowels in a native-like manner; 2) Orthography still influences her speech. The production of /ɜ:/ and /ə/ are usually linked with their graphemes. Therefore, if the one to one correlation of sounds and orthographic letters in Spanish are taken into account, it is not a surprise if Rebecca substitutes /ɜ:/ by [u] in a word like "curly" and /ə/ by [o] in a word like "bottom". Nonetheless, the fact that she sometimes produces the phones accurately and other times according to her L1 orthography might mean that she has not assimilated them to an L1 phoneme and that, therefore, she is aware that the central vowels belong to new categories.

#### **4.2.3. Similar Sounds/Category Assimilation**

Rebecca strives to maintain the phonetic differences between the L2 and L1 vowels. Although she sometimes pronounces /ʌ/ accurately (like in "club" [klʌb]) and /ɑ:/ quite well (like in monosyllabic words as "bar" [bɑ:] and "car" [kɑ:]), she still uses a Spanish /a/ most of the time. This is due to the fact that the space the three English vowels occupy in the vowel phonetic inventory is also shared with the Spanish phoneme's. In other words, in Rebecca's L1, the /a/ category can be realised throughout the low-front, -mid and -back areas and this means that its place of articulation coincides with the place of articulation of the L2 sounds. In consequence, they are not

accurately distinguished. As predicted by the model, Rebecca produces these three phones inaccurately because she does not discriminate the L2 vowels from each other and from her native sound. Therefore, Rebecca's pronunciation of these L2 phonemes is the same/ similar as the category they have been linked with (H7).

Rebecca has assimilated the L2 /ʊ/ or the lax, rounded, high, back vowel to her L1 /u/ phoneme: "Full" [ful], "wood" [bud]. Both vowels are rounded, high and back and as in her L1 there is only one vowel corresponding to such features, she is not able to discern them (H2 and H7). In consequence, new category formation is blocked (H5). All in all, the assimilation of the lax vowels /ɪ/ and /ʊ/ to the native language and the perception of the tense /i/ and /u/ as identical to L1 supposes that Rebecca will generally articulate the lax vowels longer than monolinguals do and the tense vowels shorter than monolinguals do. In the same way, the L2 lax, unrounded, high, front /ɪ/ vowel has also been assimilated to the Spanish /i/ ("fish" in plural ['fiʃəs], "bikini" [bi'kini]).

#### **4.2.4. Unexplained phenomena**

Rebecca not only substitutes /əʊ/ by [oʊ] -which is perfectly understandable taking into account her L1 vowel inventory-, but she also reduces the diphthong into the monophthong [o]. This substitution might be due to 1) her stage of orthography acquisition; that is, she still is learning the L2 orthographic rules and as a result, she transfers L1 reading rules into her FL; and 2) because of the similarity both words have in both languages: "tone" and "tono". Once more, it is worth mentioning the fact that even if the diphthong is mispronounced, she does not articulate the "silent" vowel in "tone".

By contrast, Rebecca diphthongises the /ɪ/ in the word "signal" ['sainəl] due to another overgeneralisation. The lexical influence comes from the non-suffixed word "sign" /saɪn/. Rebecca uses the same pattern to utter the derived word "signal" /'sɪgnl/ which she pronounces as ['sainəl]. These either kind of influence are not taken into account by the SLM.

Finally, as in the previous case of cognate words, the word "turquoise" /'tɜːkwɔɪs/ is realised [tur'kwes]. The already explained substitution of /ɜː/ by /u/ is appreciated and the insertion of [w] after "q" too. However, here we might hypothesise that Rebecca has directly transferred the Spanish "turquesa" [tur'kesa] into the English inventory as there is not other explanation for the pronunciation of [ɔɪ] as [e].

## 5. DISCUSSION AND CONCLUSION

This paper investigated the production errors of a EFL speaker with a high proficiency level. One of the aims was to provide evidence that not all phenomena were explained by the selected model and to suggest that there might be a need to develop a specific speech acquisition model for FL. The SLM mostly limits production errors to faulty perception caused by L1, as the other models do. Nevertheless, some errors are not necessarily perceptually motivated but they rather are motivated by L1 habits. It is not the case that, for example, Rebecca perceives a [ɣ] sound instead of [g] when it goes between vowels since she has demonstrated that she articulates the L2 sounds always (except for the instance of "I guess"). As it has been already mentioned above, L1 habits are difficult to change ([Strange, 1995](#)) but can actually be modified with enough training ([Archibald, 1998](#); [Gómez Lacabex & García Lecumberri, 2010](#)). Similarly, the case of mispronunciation of /ð/, /v/, /z/ and /dʒ/ might have been influenced by L1 habits as it is clear that Rebecca sometimes articulates the phones accurately. This suggests that some specific training on production tasks would help her utter the L2 phonemes correctly. Clear cases of assimilation are both L2 lax and high vowels. Both /ʊ/ and /ɪ/ (together with the L2 tense and high vowels) are perceived and pronounced in terms of her L1 /i/ and /u/. The reason for classifying this as an assimilation and not another thing is because Rebecca does not even make any difference between the lax and tense vowels, not even in terms of length. Therefore, I coincide with the explanation the SLM gives. Similar, although not the same, is the case of the three "a"-like vowels. Rebecca does have a different category for the unrounded, low and back /ɑ:/ sound but she does not make any differentiation for the other two.

There have been some other phenomena that could not be explained through Flege's model such as the influence of L1 and L2 orthography. All orthographically motivated mistakes were difficult to classify within the "same", "new" or "similar" categories. We have seen that even some of the classified errors had an orthographic influence (like for e.g. with the /v/ sound in initial position). Overgeneralisation of lexis pronunciation as in "etiquette" [ˈetikwɛt] and "signal" [ˈsɪnəl] could not have been explained through the SLM. However, that developmental factor of orthographic-pronunciation rules is taken into account by Major's OPM (although it would be necessary to verify whether Rebecca continued making those kind of mistakes to see if they are developmental errors or not). This means that Flege's model does not explain



all of the errors. It is worth mentioning that as Rochet (1995) mentioned, it is hard to foresee which phone will be interpreted as similar (or same) and which one as new since almost all FL sounds will be occupying the space L1 sounds have. What is more, it could be suggested that those sounds that were expected to be easier to acquire (the mid, central vowels which occupy an unoccupied area of the vowel inventory) have not been completely established as new categories due to the low amount of instances of accurate articulation. Thus, it is difficult to know what one should expect.

There are many limitations in this paper for several reasons and thus, the results must be interpreted carefully. Firstly, I have to admit that the sample used for the analysis is not very significant since it was a twenty minutes talk maintained with another participant about the same/limited topic. Thus, it does not provide enough instances to determine if an error is occasional or systematic. Secondly, I did not obtain much information about the educational background of the speaker; that is, I did not know whether she was uniquely instructed formally or whether she also had exposure to the TL by means of the media (TV, radio, films, Internet and the like) or a linguistic immersion among other possibilities. Therefore, predicting the kind of mistakes she was expected to make was not easy. Thirdly, an important drawback was that the author is not a native English speaker but rather is an English FL speaker -as the participant. This was specially relevant in the data analysis when it had to be decided which specific sound was articulated by Rebecca. In consequence, and fourthly, an acoustic analysis might have helped with this task since the articulated sound would have been analysed through physical features or by empiric means, instead of through the perceptual abilities of a non-native. Fifthly, having a perceptual experiment of this participant would have helped determine whether her mistakes are perceptually motivated (as the SLM mostly predicts). Finally, the space constraints limit in a great manner the quality of this study since there have been errors which could have been added to the paper and other mistakes which could have been explained more deeply and better.

Another aim was to shed some light on the teaching methodologies. It has been commented that training does help in improving production, thus I would suggest that teachers of formal instruction should prepare more oral oriented classes. It is clear that the amount of years (around 10) Rebecca spent learning the language did not provide her with the level an L2 speaker would attain during the same life-span. Therefore, further research is necessary in this field to understand the issue of FL learning and to improve the efficiency and effectiveness of FL teaching methodologies.

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