The Roles of Typology and L2 Status in the Acquisition of L3 Phonology: The Influence of Previously Learnt Languages on L3 Speech Production

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1. Introduction

The influence of the mother tongue in the acquisition of a second language (L2) is a widely discussed topic in the field of Applied Linguistics. However, learning a third language is becoming more common, and it is not clear the extent to which current models of bilingualism and Second Language Acquisition (SLA) in general can account for trilingualism. The field of Third Language Acquisition (TLA) has therefore become a "distinct area of research" (Hoffman, 2001:1). To date, there is a dearth of research in this new field but the studies that have been conducted so far on the influence of previously learnt languages on the acquisition of the third seem to indicate that both the native and non-native languages, as well as the typological relationship between the known languages and the one that is being learnt, play a role in L3 acquisition (Chumbow, 1981; De Angelis, 2005; Dewaele, 1998; Möhle, 1989; Sikogukira, 1993; Williams & Hammarberg, 1998).

The effect that previously learnt languages can have on the learning of a new language can be referred to as cross-linguistic influence (CLI). The present study is intended to investigate the effect that the L1 and the L2 may have on the acquisition of an L3 phonological system. Specifically, this study focuses on how two factors, typology and L2 status, may compete in determining the main source language on the acquisition of voice onset time (VOT) patterns involving the voiceless stops /p/, /t/, and /k/ in stressed onset positions in an L3 (e.g., /p/ as in *pato* ['pa.to] 'duck').

Typology relates to the relative distance among languages, while L2 status refers to any languages the speaker knows other than the mother tongue. Of the variables that have been found to trigger CLI in previous TLA studies, typology and L2 status appear to be among the most determinant. On the one hand, typological closeness has proven to be the most influential factor in some studies on the acquisition of lexis in a third language (Möhle, 1989; Rossi, 2006). On the other hand, it has also been reported that at the early stages of L3 acquisition, the L2 may exert a strong influence on the pronunciation of the target language (e.g., Marx, 2002; Williams & Hammarberg, 1998). However, such studies have based their reports on impressionistic judgements by native speakers rather than on the analysis of learner speech. The contribution of this study is that it presents a more objective means of measuring such influence.

The aim of our investigation was to provide answers to the following question: Which is a stronger predictor in the selection of a source language for phonological influence in L3 acquisition: L2 status or typology? Data were collected from 18 adult learners of Spanish as an L3. Participants were divided into two groups: nine native speakers of English with an advanced knowledge of French, and nine native speakers of French with an advanced knwoledge of English. They were asked to read two word lists, one in their L2 (English or French), and one in their L3. The results of the analysis seem to point to L2 status as a stronger predictor of CLI with respect to VOT patterns for /p t k/ production in an L3.

This paper is organized in the following way. In Section 2, we introduce the concepts of typology and L2 status, as well as the feature under investigation, VOT. This is followed by a review of the findings reported in previous studies involving VOT in SLA and TLA.

Section 3 presents the study, describes the participants, the instruments, and the tasks, and provides a discussion of the results. Finally, in Section 4, we summarize the limitations of the study, provide suggestions for future research, and present our concluding remarks.

2. Background
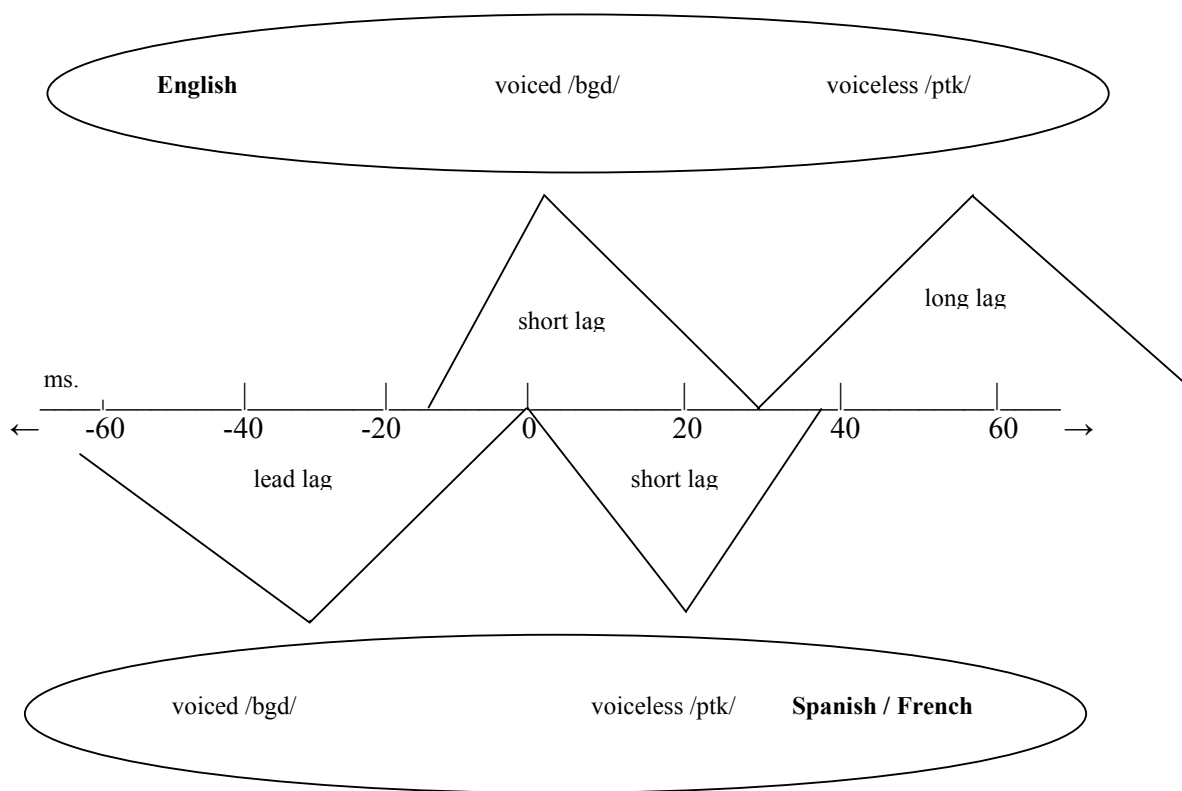
2.1 Acquisition of third language phonology

It is generally believed that the L1 is the prevalent source of influence on L3 pronunciation (Ringbom, 1987), as can be confirmed by the findings from a study by Llisterri & Poch (1987), in which the researchers provide an acoustic analysis of L3 vowels produced by Catalan (L1) – Spanish (L2) bilinguals, showing a clear influence from the L1 exclusively. However, some studies that have dealt with L3 speech production (e. g. Marx, 2002; Williams & Hammarberg, 1998) have reported that, at the early stages of L3 acquisition, the L2 exerts a strong influence on the pronunciation of the target language. It is important to note that these case studies do not offer an analysis of speech tokens to back up their claims but rather report on the impressions of the speaker, or on the judgments of a group of listeners who perceived the participants' overall accent as being influenced by their second language and not by their first.

The effect of the second language, or foreign language effect (De Angelis, 2005), has often been reported in lexical studies as one of the prominent factors in determining CLI in TLA (Dewaele, 1998; De Angelis & Selinker, 2001; Williams & Hammarberg, 1998). According to De Angelis (2005), the non-native languages will fall under the category "foreign languages" in the mind of the learner, which creates a cognitive association between them. Since the mother tongue does not sound foreign, it is excluded from this association, and it becomes easier for the speaker to block it. This cognitive process, labeled by De Angelis as "association of foreignness" (2005:11) would favor non-native lexical transfer, giving the L2 a privileged status. Thus the name of the variable: L2 status. The fact that L2 status is a salient factor in lexical studies in TLA, and that an L2 effect has been observed in the acquisition of L3 pronunciation, make this variable a good candidate for further investigation.

Phonology does remain the least explored area of language in TLA and more research is needed in order to shed light on how the three languages may interact and how L3 pronunciation is affected by the L1 and/or the L2. Due to the lack of studies on L3 speech acquisition, it makes sense to set up an experiment that would take the variables found to cause an influence in TLA studies for other areas of language and apply them to a feature that has already been investigated in SLA phonology. In the TLA literature, the most referred to factor that contributes to CLI is the typological relationship between the known languages and the one that is being learnt. Typology is the degree of similarity or distance among a given set of languages. Although a common approach to understanding typology is to group languages by families, for the purposes of this study the typological relationship will be established for the feature under investigation rather than for the languages as a whole. The linguistic feature chosen for this experiment was aspiration, measured by the means of voice onset time (VOT), as it meets two decisive requirements: it has been widely investigated in SLA studies (Caramazza et. al, 1973; Diaz Campos, 2004; Fellbaum, 1996; Flege & Eefting, 1987; Zampini & Green, 2001) and it allows for the establishment of a straightforward typological relationship for the three languages involved (see forthcoming Section 2.2).

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2.2 English, French and Spanish VOT patterns from a typological point of view

English, French and Spanish fall under the same category of languages if we look at the number of groups of stops that characterize their sound inventories. The stop phonemes in all three languages are distinguished phonologically by voicing, where the voiceless group is made up of the stops /p t k/ and the voiced group consists of the stops /b d g/. Despite this phonological similarity, the stop phonemes are produced differently in the three languages. More precisely, they differ in the voice onset time (VOT) or the lag patterns they display. VOT is the term that Lisker and Abramson (1964) coined in their pioneering study that looked at voicing in onset stops across eleven languages. It is used to refer to the time interval from the release of a stop until voicing for vowel production begins (Yavas, 2006). This is a widely reported measure as it correlates with the voiced-voiceless distinction established across the world's languages. For all three languages involved in this study, the distinction between voiced and voiceless stops is a two-way one. However, in French and Spanish, voiced stops are implemented with VOT values of less than 0 ms. (lead VOT), while typical VOT values for voiceless stops (/p t k/) range from 0 to 30 ms. (short-lag, unaspirated stops). On the other hand, English voiced stops are usually produced with short lag, whereas /p t k/ are produced with VOT values that typically range between 60 and 100 ms. (long-lag, aspirated stops; Lisker & Abramson, 1964). Besides the length of the lag, another characteristic sets English voiceless stops apart from those of French and Spanish: aspiration. A burst of air is noticeable on the release of /p t k/ in English when they occur in stressed onset position (Avery & Ehrlich, 1995; e.g., [pʰɪt] 'pit', [ə.kʰjuz] 'accuse', where a superscripted "h" represents aspiration and a period "." syllable boundaries), except when the relevant segment is preceded by an /s/ (e.g., [stɑp] 'stop'), or in word-internal stressed onset position. For the purposes of establishing a typological relationship between English, French and Spanish, a look at aspiration and VOT patterns (see Figure 1) allows for the conclusion that French and Spanish are typologically close to each other and distant from English.

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Figure 1. Schematic representation of the VOT continuum showing the relationship between English, French and Spanish stops (adapted from Zampini & Green, 2001).

2.3 Second and third language acquisition studies

To our knowledge, the only study to explore VOT to determine CLI in TLA is that of Tremblay (2007). She analyzed acoustic samples from four native speakers of English, with French as an L2, who were at the early stages of learning Japanese as an L3. Her findings indicate an effect of the L2 on the acquisition of an L3 phonological system. For one out of her four participants, the L2 influenced not only the L3 but also the L1. However, the acquisition of VOT is a well investigated segment of speech in SLA, and a review of some of the findings could provide TLA researchers with some helpful insights from which to carry on.

Most L2 VOT studies seem to highlight the fact that learners are hardly ever able to attain native-like VOT values in their second language (Diaz Campos, 2004; Fellbaum, 1996, Caramazza et al., 1973). This does not imply that learners produce the L2 and L1 stops with the same values, but rather that their L2 values differ from those of monolingual native speakers of that L2.

In his study of the acquisition of Spanish second language phonology in two different contexts of learning, Díaz Campos (2004) pointed to the aspiration of voiceless stops as one potential area of difficulty for native speakers of English. Based on Eckman´s (1977) Markedness Differential Hypothesis (MDH), learning to suppress aspiration to produce target-like voiceless stops in Spanish would pose no problem for native English speakers since the presence of aspirated stops presupposes the presence of non-aspirated ones in a language. However, the results from Campos' work told a different story: The English speakers that took part in the study (*n*=8) failed to produce native-like unaspirated Spanish stops. Similar findings were reported by Fellbaum (1996) after conducting a preliminary

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study on the acquisition of voiceless stops by both learners of Spanish and English. Her eight anglophone learners of Spanish, as those in Campos' study, fell outside the accepted VOT range for /p/ and /t/ in Spanish. Her seven hispanophone learners of English, on the other hand, were able to achieve a closer VOT mean to the target sound in the L2, but still differed from native-like values in their second language.

The impossibility to aspirate as a native speaker of English when coming from a Romance language, or vice versa, is not only an obstacle that can be attributed to adult learners. Caramazza et al. (1973) found that even in the case of compound and coordinate bilinguals in French Canada who had began to acquire English at no later than seven years of age, there was a difference in the perception and production of stop consonants when these participants were compared to a group of English unilinguals and another one of French unilinguals. With regards to perception, bilinguals seemed to be applying the same criteria to judge both sets of stimuli (one in French and one in English), producing values that would occupy intermediate positions when compared to the unilingual groups. With regards to production, the participants did show a clear separation for each phonemic contrast but their values were closer to the unilingual French group (in French) than they were to the unilingual English group (in English), which means that, although bilinguals, their L2 was at a disadvantage.

Findings regarding the acquisition of VOT in the second language show that, for the most part, L2 learners are able to create a new category for the L2 sound, but that this category differs from that of native speakers. It is not uncommon to find L2 proficient speakers who produce stops in their L2 with VOT values that are intermediate between those of monolinguals of their L1 and monolingual speakers of their L2.

3. The present study

The analysis of the data presented in this paper aims to answer the following question: Which is a stronger predictor in the selection of a source language for phonetic influence in L3 acquisition: L2 status or typology?

3.1 Method

3.1.1 Participants

Eighteen informants (range in age= 17-27) in two groups took part in the study. Nine participants were native speakers of Canadian English (CE) and had a high command of their L2, Canadian French (CF). The other nine participants spoke Canadian French as their mother tongue and had an advanced knowledge or their L2, Canadian English. The level in Spanish for all participants was intermediate, as illustrated in Table 1 (En = English; Fr = French; Sp = Spanish).

Table 1. Classification of participants according to mother tongue and subsequent languages.

Group	*n*	L1	L2	L3
A	9	En	Fr	Sp
F	9	Fr	En	Sp

In the selection of participants, three criteria were of critical importance: First, their level of proficiency in the L2 (English or French) needed not be native-like but advanced; second, they were more proficient in their second language than in their third (Spanish); and

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third, their VOT values for [p t k] in their second language differed from those expected for [p t k] for monolinguals of their L1. The participants' proficiency in their L2 and L3 was assessed via yes/no vocabulary tests as well as self-ratings, a measure that was provided by the informants as part of a detailed language background questionnaire.

3.1.2 Stimuli

The elicitation materials for the data reported in this paper consisted of three word lists, one for each of the languages involved in the study. Participants in both groups were recorded reading the L3 list. It contained 60 target words and four training items to be produced in isolation. All 60 target tokens were bisyllabic, real words in Spanish (20 /p/-, 20 /t/ -, 20 /k/- initial words). Participants were also asked to read aloud a list in their L2. The L2 lists were slightly shorter than the L3 list, and were included in the study as a mean to assess the degree to which the informants had learnt to aspirate or deaspirate in their non-native language. The L2 English list contained 42 target words and four training items. As it was the case with the Spanish list, all 42 English real words were bisyllabic (14 /p/-, 14 /t/-, 14 /k/- initial words). The L2 French list contained 42 target words and four training items. Due to the stress pattern of French (i.e., iambic, with word-level stress falling on the rightmost syllable), most target words were monosyllabic instead of bisyllabic in order to ensure that each voiceless stop would be produced in word initial, stressed position.

3.1.3 Excluded tokens

Although all lists were designed to contain the same number of tokens for each stop, some /t/- word initial items were removed. This is due to the fact that, in Canadian French, /t/ affricates when followed by a high front vowel, which causes the lengthening of VOT. A higher VOT value due to affrication would confound the results. Despite the fact that not all participants affricated the sequence /t+i/, it was decided to disregard any token starting with that sequence from all the lists (and not only from the French one). Thus, a total of 12 tokens (four per list) were excluded from the final analysis.

Besides those 12 items, a number of tokens needed to be excluded on an individual bases due to mispronunciation. Mispronounced tokens included: a) words whose stress was shifted by a given participant from the first to the last syllable (therefore such tokens no longer met the word-initial stop in stressed position criterion); b) words starting with the sequence /t+u/, as this sound was affricated in some cases by two of the participants in Group A and one participant in Group F; and, c) the word chemist (in the English word list), that was produced as /tʃeməst/ by two of the participants in Group F.

3.1.4 Procedure

It was important to ensure that all three languages were activated so they would all have an equal chance of becoming a potential source of CLI. Although participants were not to be tested in their L1, they were greeted by the interviewer and asked to fill out a consent form in their mother tongue. The different tasks were then grouped and administered according to language. After filling out the consent form, participants were asked to read a word list in their L2 and then complete an L2 vocabulary test. The score from the vocabulary test was used to assess the participants' overall proficiency in their second language. All instructions for the L2 tasks were provided in the participants' L2. After the L2 tasks were completed, the interviewer switched to the participants' L3, Spanish. Then, they were asked to read a word list in their L3, take an L3 vocabulary test and describe a set of pictures in Spanish. The data

collected via the picture description task will be used to determine CLI in L3 lexical production and therefore its analysis will not be reported here.

As for the reading of the lists, all tokens were produced in isolation and after a pause. The participants saw the stimuli appear on a computer screen, one word at a time, as part of a PowerPoint presentation. Both lists and the picture description task were audio recorded using an Edirol R-1 24-bit digital recorder and an Audio-Technica AT831b lavaliere microphone.

3.1.5 Data analysis

A total of 1676 were analyzed: 996 in Spanish, 340 in English and 340 in French. Of the 996 Spanish tokens, 494 were produced by Group A, while 502 were produced by Group F. The data were analyzed using PRAAT 4.3.33 (Boersma & Weenink, 2008). VOT measurements were obtained for every token to determine whether the values indicated the presence of absence of aspiration, and to determine CLI in both a gradient and a non-gradient way. On the one hand, the VOT measurements were used to code each token as aspirated or non-aspirated. The aim of this coding was to be able to calculate and report the percentages of aspiration found in the participants' L3 production, where a high percentage of aspiration is to be interpreted as English influence, and a low percentage of aspiration is to be interpreted as influence from French. Cut-off values, based on VOT means reported for monolingual speakers of each language in the literature (see Table 2), were established in order to code each token as aspirated or non-aspirated. The cut-off value for /p/- and /t/- initial words was 30 ms. (i.e., any token with a VOT of 30 ms. or higher was considered to show traces of aspiration). The cut-off value for /k/ was established at 40 ms, as has been reported in the literature. Note that it is common for SLA studies to report the mean VOT in milliseconds, which is a gradient way of addressing the same issue. The mean VOT for each stop, for each group, was calculated and is reported in the following Section.

Table 2. Mean VOT in milliseconds for voiceless stops in native Castilian Spanish, Canadian French, and Canadian English

	Spanish	**French**	**English**
/p/	13.10	18	62
/t/	14	23	70
/k/	26.50	32	90
reference	Rosner et al. (2000)	Caramazza et al. (1973)	Caramazza et al. (1973)

3.2 Results and discussion

For the sake of completion and in order to provide a more comprehensive view of the results, findings will be presented in both percentages of aspiration and VOT means. For illustrative purposes and to aid our discussions, percentages of aspiration (computed based on VOT means) for each group's L2 and L3 are presented in Figure 2, where they are compared to the percentages of aspiration expected from monolinguals of each group's L1. This way, we are able to establish that, as a group, participants may produce voiceless stops in their second and third languages in a different manner than they do in their mother tongue (or at least, in a different manner in comparison with monolingual L1 speakers). With regards to the percentages of aspiration, it was assumed that all the native speakers of English (Group A) would aspirate voiceless stops in English 100 % of the time. It was also assumed that all the participants in Group F (native speakers of Canadian French) would never aspirate their voiceless stops in French (0 % aspiration), in compliance with the native phonology of the

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language. The overall percentage of aspiration for Group A in French (L2) was 61.4 % (range 36.8 – 84.2), and in Spanish (L3) 63.2% (range 23.2 – 87.5). Similar percentages were found for Group F, especially for the L2 (English), 67.8 % (range 30.7 – 94.8). The overall percentage of aspiration for Group F in Spanish (L3) was 49.4 (range 28.5 – 72.7).
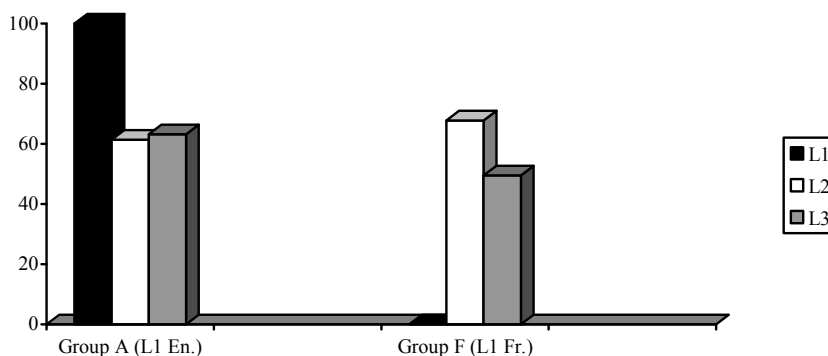
Figure 2. Percentages of aspiration across the three languages for both groups.

Figure 2 illustrates that native speakers of English aspirated in their L2 over 50% of the time (61.4 %); if they had conformed to the norms of French, they would not have aspirated at all. However, they did not aspirate a 100 % of the time, as would be the case if they transferred their L1 values for the production of L2 voiceless stops. Turning to their L3, their percentage of aspiration (63.2 %) was remarkably similar to that of their L2. This percentage was considerably high for a target language (Spanish) characterized by unaspirated voiceless stops.

A look at the results from the native speakers of French in Figure 2 reveals a somewhat similar picture. The percentage of aspiration in their L2 was 67.8 %; if they had conformed to the norms of L2 English, they would have aspirated the set of stops 100 % of the time. Their percentage of aspiration in the L3 is quite interesting. Participants in Group F aspirated approximately 50% of the time (49.4 %), which suggests that there was some English-influenced production. However, they aspirated less than they did in their L2, almost as if there was some positive effect from their L1, French. Nevertheless, it has to be noted that, had they transferred from their L1, they would have produced Spanish /p t k/ with 100% accuracy, i.e., as unaspirated stops. What seems to emerge from Figure 2 is a pattern of CLI where participants draw on their L2 for their L3 production, and not on their L1. This is particularly surprising for Group F, as one could predict reliance on their L1 based on the fact that French is typologically closer to Spanish and the two languages share the same category of voiceless stops.

Figures 3, 4 and 5 also highlight the similarities between the values that participants produced in the L2 and the L3. The mean VOT values for L1 English and L1 French /p t k/ have been taken from Caramazza et al. (1973), and correspond to monolingual values for speakers of CE and CF (as was reported earlier in Table 2). As for the L2 French voiceless stops, the mean VOT in milliseconds as produced by Group A were: /p/ = 29.7, /t/ = 37.8, and /k/ = 56.9 (Figure 3), for an overall mean VOT of 41.4 ms., as indicated in Figure 5. For the L2 English voiceless stops, the mean VOT in milliseconds produced by Group F were: /p/ = 36.8, /t/ = 44.9, and /k/ = 64.3 (Figure 4), for an overall mean VOT of 67.8 ms., as illustrated in Figure 5. Mean VOT in the Spanish for both groups A and F are represented graphically in Figures 3 and 4. Group A (Figure 3) produced the following means: /p/ = 31.9, /t/ = 35, and /k/ = 55.4, for an overall mean of 40.8 ms. (Figure 5). As it can be noted, very similar means were produced by Group F (Figure 4): /p/ = 31.6, /t/ = 31, and /k/ = 56, for an overall group

mean of 39.5 ms. (Figure 5). As was the case in Figure 2, the pattern that emerges from Figures 3, 4 and 5 points to the L2 as the main source language of CLI. These results indicate that, for the production of voiceless stops in the L3, both groups resorted to their L2.

It can be argued that resorting to the L2 for L3 production resulted in positive transfer for Group A, and in negative transfer for Group F. Although they had not achieved native-like values in their L2, participants in Group A were able to reduce the length of VOT and apply this reduction to their L3. In this Group, the two variables under the investigation were confounded in the same language, i. e. French was not only typologically closer to the target language, but it was also the speakers' L2. Therefore, for the purposes of answering our research question, it is crucial to examine Group F's results to decide which of the two factors outweighs the other. If typology were the most determinant factor, Group F would have transferred their French-L1 values to their L3. Both the graphical representations of their VOT lengths (Figure 4) and of their aspiration levels (Figure 2) paint a different picture, as they highlight the similarity between their production in the L2 and the L3, rather than between the L3 and the L1. Based on results for Group F, for which L2 status was a stronger predictor in the selection of a source language for the production of L3 voiceless stops, it is reasonable to consider that, Group A also resorted to the L2 as a result of an L2 status effect and not because of the typological relationship between the L2 and the L3.
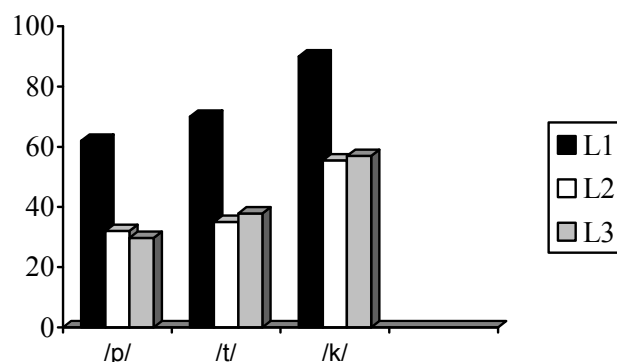
Figure 3. Mean VOT in milliseconds for /p t k/ in the French L2 and Spanish L3 of Group A, as compared to monolingual L1 values (from Caramazza et al., 1973).
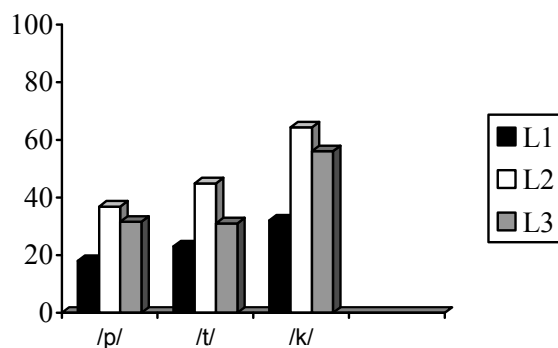
Figure 4. Mean VOT in milliseconds for /p t k/ in the English L2 and Spanish L3 of Group F, as compared to L1 monolingual values (from Caramazza et al., 1973).
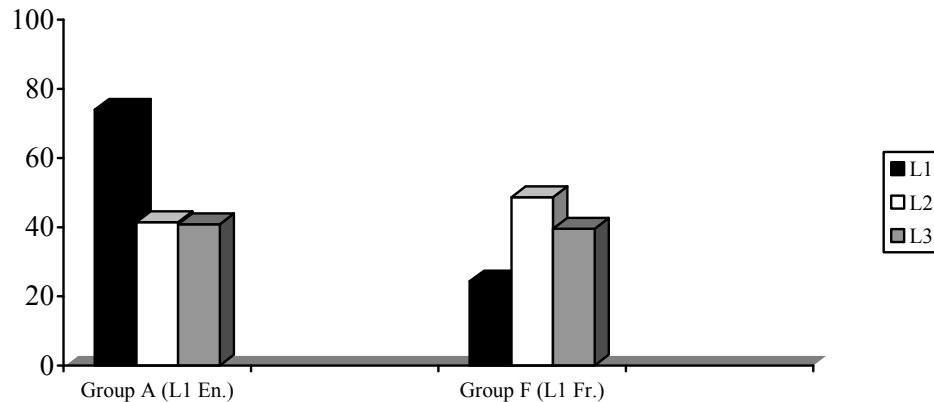
Figure 5. Mean VOT in milliseconds for /p t k/ (combined) in the three languages for both groups (L1 means calculated from the values reported by Caramazza et al., 1973).

4. Limitations, future directions and concluding remarks

Although this study contributes to the field of TLA by backing previous claims that a second language can have an impact on the acquisition of an L3 phonological system (Williams & Hammarberg, 1998), the results found for voiceless stop aspiration and their VOT means may not be generalizable to other phonological features.

It has been reported in previous studies that some bilinguals and very proficient L2 speakers produce a similar mean VOT in both languages (Flege, 1987a). This similar VOT consists of an intermediate value between monolingual native-like means reported for the L2 speaker's two languages. Due to these results, Flege (1987a) suggested that CLI could be bidirectional. In our case, this would mean that, not only can the L2 be a source of influence for the L3, but it could have also had an impact on the L1. It is strongly recommended that in future studies dealing with the acquisition of an L3 sound system, baseline data be collected in the L1 and the L2.

As mentioned at the outset of this paper, the results presented represent some early findings of an ongoing project. For instance, data from more participants in the two groups investigated are still being analyzed. In addition, there are tokens elicited through a semi-guided picture description task, which still needs to be analyzed and compared to the results from the word lists, presented in this study. As indicated in the literature, (e.g., Williams and Hammerberg, 1998), different tasks seem to have a different effect on the source of cross-linguistic influence. The picture description task was also used to collect samples of lexical inventions in order to investigate the relative effects of typology and L2 status in a different area of language, lexis. Results from both areas, lexis and phonology, will be compared in future research.

In this study, we set out to investigate which of these two factors, L2 status and typology, would become a stronger predictor in the selection of a source language for the production of voiceless stops in an L3. While previous research have found a more determinant role for typology in L3 lexical production (Möhle, 1989; Rossi, 2006), some studies that looked at L3 phonology (Marx, 2002; Williams & Hammarberg, 1998) had reported an L2 effect on the pronunciation of the third language. Our study has shown that both groups display similar patterns for aspiration and VOT for their second and third languages. Based on our results, and in agreement with previous claims regarding CLI in L3 phonology, we argue that L2 status is a stronger predictor in the selection of a source language for phonological influence in L3 acquisition.

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References

Avery, P., & Ehrlich, S. (1995). *Teaching American English pronunciation*. Oxford: Oxford University Press.

Boersma, P., & Weenink, D. (2008). *Praat, a system for doing phonetics by computer*. URL: http://www. praat.org

Caramazza, A., Yeni-Komshian, G. H., Zurif, E. B., & Carbone, E. (1973). The acquisition of a new phonological contrast: The case of stop consonants in French-English bilinguals. *The Journal of the Acoustical Society of America*, *54,* 421-428.

Chumbow, B. S. (1981). The mother tongue hypothesis in a multilingual setting. In J. G. Savard, & L. Laforge (Eds.), *Proceedings of the 5th Congress of l'Association Internationale de Linguistique Appliquée,* Montréal (pp. 41-55). Québec: Les presses de l'Université de Laval.

De Angelis, G. (2005). Interlanguage transfer of function words. *Language Learning, 55*, 379-414.

De Angelis, G., & Selinker, L. (2001). Interlanguage transfer and competing linguistic systems in the multilingual mind. In J. Cenoz, B. Hufeisen, & U. Jessner (Eds.), *Cross-linguistic influence in third language acquisition: Psycholinguistic perspectives* (pp. 42-58). Clevedon: Multilingual Matters.

Dewaele, J. (1998). Lexical inventions: French interlanguage as L2 versus L3. *Applied Linguistics, 19,* 471-490.

Díaz-Campos, M. (2004). Context of learning in the acquisition of Spanish second language phonology. *Studies in Second Language Acquisition, 26*, 249-273.

Eckman, F. R. (1977). Markedness and the Contrastive Analysis Hypothesis. *Language Learning, 27*, 315-330.

Fellbaum, M. L. (1996). The acquisition of voiceless stops in the interlanguage of second language learners of English and Spanish. Retrieved 18 March 2006, from http://www.asel.udel.edu/icslp/cdrom/vol3/663/a663.pdf.

Flege, J. E., & Eefting, W. (1987). Cross-language switching in stop consonant production and perception by Dutch speakers of English. *Speech Communication, 6,* 185-202.

Hoffmann, C. (2001). Towards a description of trilingual competence. *The International Journal of Bilingualism, 5,* 1-17.

Lisker, L., & Abramson, A. S. (1964). A cross-language study of voicing in initial stops: Acoustical measurements. *Word, 20*, 384-422.

Llisterri, J., & Poch, D. (1987). Phonetic interference in bilingual`s learning of a third language. In *Proceedings of the XIth International Congress of Phonetic Sciences*. Tallinn: Academy of Sciences of the Estonian SRR (pp. 134-137). Retrieved 14 November 2004, from http://liceu.uab.es/~joaquim/publicacions/Llisterri_Poch_87/Llisterri_Poch_87.pdf

Marx, N. (2002). Never quite a "native speaker": Accent and identity in the L2 and the L1. *The Canadian Modern Language Review, 59,* 264-281.

Möhle, D. (1989). Multilingual interaction in foreign language production. In H. W. Dechert, & M. Raupach (Eds.), *Interlingual processes* (pp. 179-194). Tübingen: Gunter Narr Verlag.

Ringbom, H. (1987). *The role of the first language in foreign language learning*. Clevedon: Multilingual Matters.

Rosner, B. S, López-Bascuas, L. E., García-Albea, J. E., & Fahey, R. P. (2000). Voice-onset times for Castilian Spanish initial stops. *Journal of Phonetics, 28,* 217-224.

Rossi, S. L. (2006). *L' interference lexicale dans l'acquisition d'une troisième langue : Effet langue seconde ou distance typologique ?* Unpublished Master's Thesis, University of Calgary, AB. Retrieved 2 March 2007, from http://acpi.scedu.umontreal.ca/fr/acpi_depot/consulter.php?PHPSESSID=111e9e15c0e3c7ed6dbb 7fcb22cd48c8

Sigokukira, M. (1993). Influence of languages other than the L1 on a foreign language: A case of transfer from L2 to L3. *Edinburgh Working Papers in Applied Linguistics, 4,* 110-132.

Tremblay, M. C. (2007). *L2 influence on L3 pronunciation: Native-like VOT in the L3 Japanese of English-French bilinguals*. Paper presented at the Satellite Workshop of ICPhS, Freiburg, Germany.

Williams, S., & Hammarberg, B. (1998). Language switches in L3 production: Implications for a polyglot speaking model. *Applied Linguistics, 19,* 295-333.

Yavas, M. (2006). *Applied English phonology*. Malden, MA: Blackwell Publishing.

Zampini, M. L., & Green, K. P. (2001). The voicing contrast in English and Spanish: The relationship between perception and production. In J. Nicol (Ed.), *One mind, two languages* (pp. 23-48). Oxford: Blackwell.