

# Transfer in L2 Sound Production

Susana Cortés Pomacóndor  
 The University of Edinburgh  
 E-mail: susana@ling.ed.ac.uk

## ABSTRACT

This study aims to determine whether production of second language sounds is influenced by the native language (L1) phonology through a) only the phonemic inventory of the L1, b) both the phonemic inventory and the allophonic rules, c) only the phones in the L1 or d) the surface well-formedness conditions on L1 output. Predictions drawn from these hypotheses were tested against Catalan speakers' production of the English phonemes /d/ and /ð/ in initial and intervocalic position. The results of the production experiment were consistent with two hypotheses: 1) that both the L1 phonemic inventory and the allophonic rules transfer or 2) the surface L1 output conditions are transferred onto L2.

## 1. INTRODUCTION

Research on the acquisition of second language sounds has largely focused on the perception of L2 sounds or L2 contrasts. Two of the most influential proposals working in the field of foreign speech perception are Best [1] and Flege [2]. Best's Perceptual Assimilation Model (PAM) and Flege's Speech Learning Model (SLM) make predictions of how L1 speakers will perceive L2 sounds depending on their L1's sound systems and the configuration of the L2 system. These models of L2 sound perception assume that L2 sounds are mapped onto categories of the L1 system. PAM relates sounds in L1 and L2 without taking the context in which those sounds occur in both languages into account. On the other hand, Flege [2] assumes that "L2 sounds may at first be identified in terms of a positionally defined allophone of the L1 but, as L2 learners gain experience in the L2, they may gradually discern the phonetic difference between certain L2 sounds and the closest L1 sound(s)." (p. 263). At this point, L2 learners might create a new category for the L2 sound.

We can apply these same hypotheses to L2 sound production. In order to examine whether it is L1 phonemes (i.e. not position-sensitive phones) or L1 allophones (i.e. position-sensitive phones) that are transferred onto L2 sounds in production, we have tested four competing hypotheses that cover all the different mapping possibilities between L1 and L2 phones.

The four hypotheses we tested in this experiment are that L2 speakers 1) transfer their L1 phonemic inventory onto L2, and assume a one-to-one mapping from L2 phones to allophones; 2) transfer their L1 phonemic inventories and

the mapping from phones to allophones from L1; 3) transfer their L1 allophonic inventory onto the L2 phonemic inventory; or 4) transfer the surface well-formedness conditions on L1 output.

In order to test these hypotheses, we used Catalan speakers of English because their L1 and L2 have different phonemes and different realizations of the same phones in the same contexts. This will allow us to discern whether it is allophones or phonemes that are transferred onto L2 phones. In Catalan, stops are spirantised in intervocalic position [3] and, therefore, in absolute initial position, voiced dental stops occur but in intervocalic position they surface as fricatives. On the other hand, in English both the voiced alveolar stop and the voiced dental fricative occur in absolute initial and intervocalic position. The present study aims to find what the mapping between speaker's L1 and L2 phones is like when they pronounce these L2 phones. The following section describes each of our four hypotheses and the predictions about Catalan speakers' pronunciation of English /d/ and /ð/.

In this study we assume that Catalan speakers' perception of these sounds is native-like (as was actually confirmed in a previous perception study with the subjects who took part in this production test). We are not expecting categorical but relative results due to the advanced level in English proficiency of the subjects.

The first hypothesis assumes that the L1 inventory transfers and a mapping to a default realization follows.

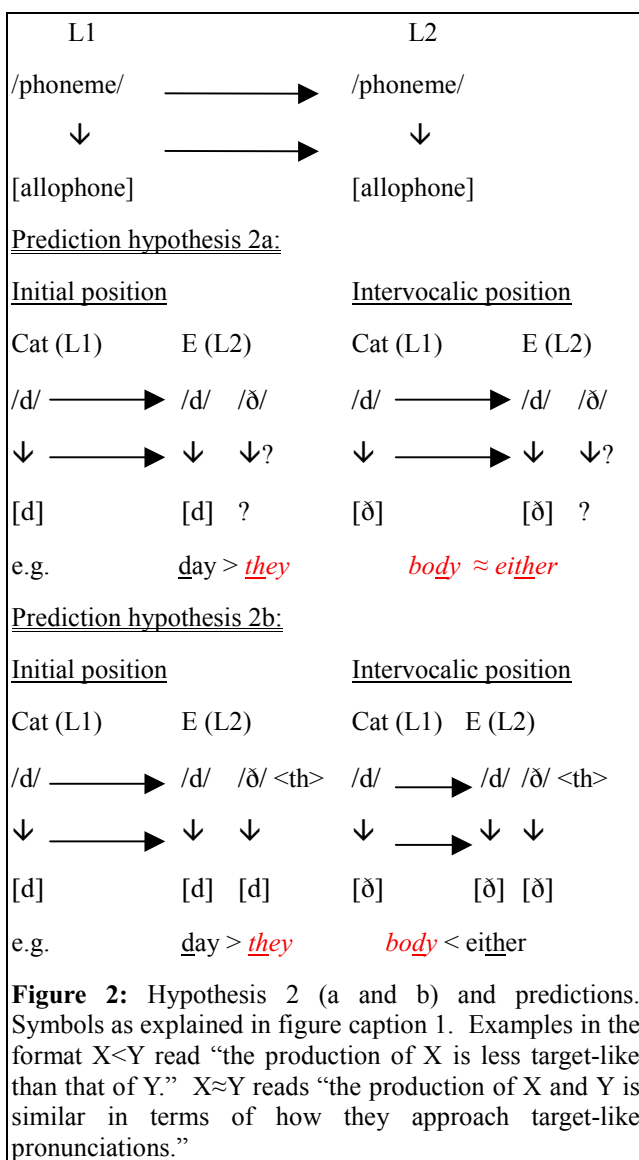
L1		L2	
/phoneme/	→	/phoneme/	
↓		↓	
[allophone]		[allophone] in any position	
<u>Prediction hypothesis 1:</u>			
<u>Initial position</u>		<u>Intervocalic position</u>	
Cat (L1)	E (L2)	Cat (L1)	E (L2)
/d/ →	/d/ /ð/	/d/ →	/d/ /ð/
↓	↓ ↓?	↓	↓ ↓?
[d]	[d] ?	[d]	[d] ?
e.g.	day > <i>they</i>	body > <i>either</i>	

Figure 1: Hypothesis 1 and predictions. Horizontal

arrows stand for the transfer, vertical arrows stand for the mapping from phonemes to allophones and question marks indicate problematic cases because of lack of category in L1 to be transferred to L2. Examples in the format X>Y read “the production of X is more target-like than that of Y.” Examples are in italics if their production is not very target-like.

Hypothesis 1 predicts that /d/ will be correctly produced in any position because it exists as a phoneme in Catalan and will, consequently, be transferred to the English phonemic inventory and a mapping to a default realization will follow. On the other hand, the voiced dental fricative will be less accurately produced in any position because, as it does not have the phonemic status in Catalan, it cannot be transferred to the English phonemic inventory.

The second hypothesis states that both the L1 phonemic inventory and the L1 mapping transfer. This is indicated by the horizontal arrows in fig.2.

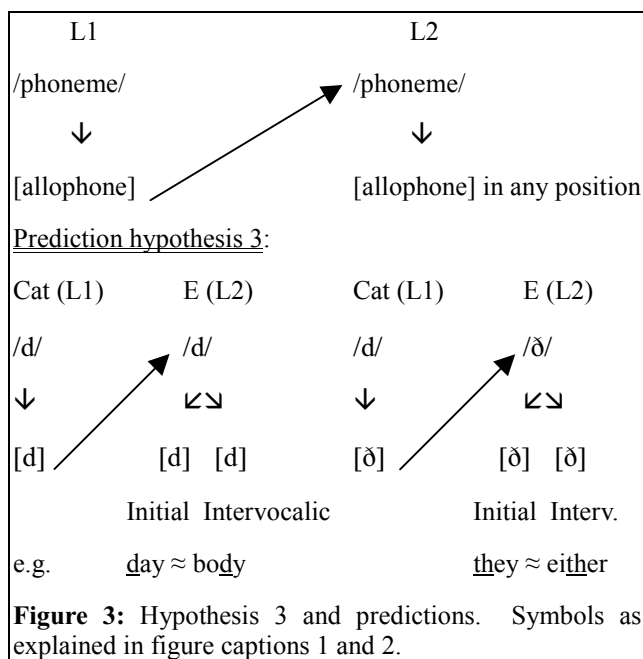


We have two different versions of hypothesis 2: 2a and 2b.

They share the same mapping processes but the difference between hypotheses 2a and 2b is that the former only takes into account the phonemic-phonetic status of sounds in L1 and L2, whereas the latter assumes a relationship between spelling and phonetic implementation.

For hypothesis 2b, we are considering the possibility that Catalan speakers associate the graphemes <th> and <d> with the phoneme /d/ because this is the Catalan phoneme that is phonetically closer to English /ð/. This is just like English speakers associate the graphemes <ph> and <f> with phoneme /f/. In this way, this hypothesis predicts that whenever Catalan speakers find the grapheme <th>, they will interpret it as /d/ and will consequently produce it as a stop in initial position but as a fricative in intervocalic position, following the L1 mapping that is transferred onto the L2 sound system.

The third hypothesis states that the L1 allophonic inventory transfers onto the L2 phonemic inventory and a mapping to a default phonetic realization follows.



This third hypothesis predicts that the production of /d/ and /ð/ in any position will be good because both phones are allophones in L1 and, as such, will be transferred onto the phonemic inventory. This transfer will be followed by a mapping to a default realization.

The fourth hypothesis predicts that the surface well-formedness output conditions of L1 transfer onto L2.

L1		L2	
[allophone] in context a		→ [allophone] in context a	
*[allophone] in context b		→ *[allophone] in context b	
<u>Prediction hypothesis 4</u>			
<u>Initial position</u>		<u>Intervocalic position</u>	
Cat (L1)	E (L2)	Cat (L1)	E(L2)
# [d]	→ # [d]	V [ð] V	→ V [ð] V
e.g. <u>day</u> > <u>they</u>		e.g. <u>body</u> < <u>either</u>	

**Figure 4:** Hypothesis 4 and predictions. Symbols as explained in figure captions 1 and 2.

The last hypothesis predicts that the output conditions of Catalan will be transferred onto the surface forms of Catalan speakers of English, namely only the forms that surface in L1 will also surface as such in L2. This means that /d/ will be better produced in absolute initial position than in intervocalic position, whereas /ð/ will be better produced in intervocalic than in initial position.

## 2. METHOD

### 2.1. STIMULI

Two sets of stimuli were used in this production experiment: a list of words and a list of minimal pairs.

A list of 22 words containing the target phones in initial and intervocalic position was designed. Examples of the words included are ‘dance’, ‘than’, ‘odor’ and ‘brother’.

The second set of stimuli consisted of minimal pairs (or near minimal pairs when complete minimal pairs did not exist), containing /d/ and /ð/ in initial and intervocalic position, such as ‘day-they’ and ‘blather-bladder’.

### 2.2. SUBJECTS

Twenty native Catalan speakers (18 females, 2 males) served as subjects in this experiment. At the time they took part in the experiment, these speakers (age mean= 30, range 18 to 58 years) were about to finish their Certificate of Advanced English (CAE) courses in a language school. All were adults and they were paid for their participation. The requirements for eligibility were that they should have not lived in an English speaking country for more than 8 weeks and they should have never taken a course on phonetics. The reason behind the last two criteria was for the analysis to describe the speech of average Catalan students who generally learn all their English in language schools and have no specific training in phonetics.

### 2.3. PROCEDURE

Subjects’ production was tested in single sessions. Subjects were recorded while they read the two lists: first

the word list, and then the minimal pairs.

## 2.4. MATERIALS

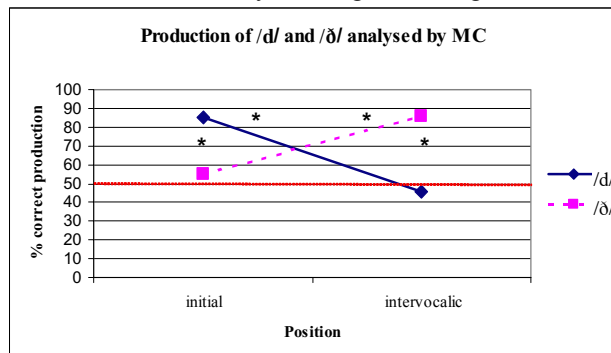
The data was recorded using a Sony TCD-D8 DAT recorder and a Shure 16A microphone on a tripod stand.

## 3. RESULTS

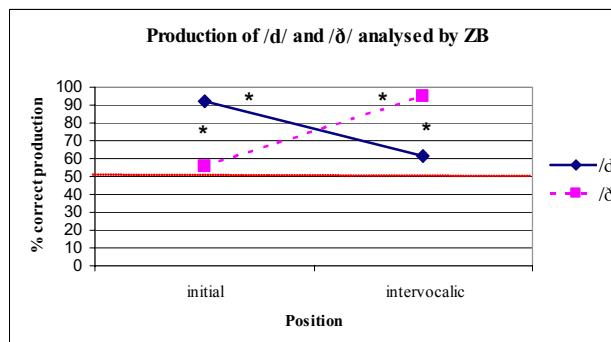
The data elicited in this production test was divided in two blocks and each one was auditorily analyzed by two phonetically trained native English speakers (MC and ZB). They were asked to identify the segment they heard in initial or intervocalic position (depending on the token) as either /d/ or /ð/, or provide their own transcription if they thought the sound corresponded to none of them.

The output of the transcribers’ work was filtered in a way such that for target /d/ items, any transcription giving us [d], [ɖ] and intervocalic [ɾ] was considered a good production of /d/. Intervocalic [ɾ] was considered to be a good production of target /d/ because taps involve a complete, although brief, closure. For target /ð/ items, tokens considered to be produced as [θ] were discarded.

The results of the analysis are given in figures 5 and 6.



**Figure 5:** Production of /d/ and /ð/ by Catalan speakers analyzed by MC.



**Figure 6:** Production of /d/ and /ð/ by Catalan speakers analyzed by ZB.

The stars in the figure captions above indicate the comparisons that reached significance. Both figures 5 and

6 show that Catalan speakers have problems with the production of intervocalic /d/ and initial /ð/ in support of hypotheses 2b and 4.

Two separate two-way repeated measures ANOVAs were run on the data analyzed by both transcribers. The ANOVAs revealed a significant Phoneme x Position interaction (MC: [F (1, 19) = 45.236; p < .001]; ZB: [F (1, 19) = 83.262; p < .001].) This means that a difference in production depends on the phoneme's position. Such an interaction is consistent with both hypotheses 2b and 4. The two main effects did not reach significance: Phoneme (MC: [F (1, 19) = .562; p = n.s.]; ZB: [F (1, 19) = .047; p = n.s.]) and Position (MC: [F (1, 19) = .792; p = n.s.]; ZB: [F (1, 19) = .591; p = n.s.].)

Planned comparisons were carried out to test the specific predictions of each of our four hypotheses, i.e. comparisons between initial and intervocalic /d/, initial and intervocalic /ð/, initial /d/ and initial /ð/, and intervocalic /d/ and intervocalic /ð/. All proved to be significant which supports hypotheses 2b and 4.

	MC	ZB
Initial vs. interv. /d/	F (1, 19) = 46.321; p < .001*	F (1, 19) = 37.787; p < .001*
Initial vs. interv. /ð/	F (1, 19) = 14.547; p = .001*	F (1, 19) = 29.445; p < .001*
Initial /d/ vs. initial /ð/	F (1, 19) = 12.587; p = .002*	F (1, 19) = 18.006; p < .001*
Interv. /d/ vs. interv. /ð/	F (1, 19) = 26.386; p < .001*	F (1, 19) = 29.635; p < .001*

**Table 1:** Results of the one-way ANOVAs run on the planned comparisons in MC's and ZB's analyses.

#### 4. DISCUSSION AND CONCLUSIONS

The findings of this production experiment support hypotheses 2b and 4 because these hypotheses predict that /d/ is significantly better pronounced in initial position than in intervocalic position, and /ð/ is better pronounced in initial than in intervocalic position. However, production of intervocalic /d/ and initial /ð/ is not always bad. These L2 speakers seem to be learning to pronounce these phones correctly in any position.

Our results are consistent with the view that both the L1 phonemic inventory and the L1 mapping may transfer onto L2 phones, and Catalan speakers associate the graphemes <d> and <th> with phoneme /d/, as described in hypothesis 2b. If L1 phonemic inventory transfers, PAM's assumption that L1 categories are transferred onto L2 is supported for production too. Since the mapping from phoneme to allophones in L1 is also transferred onto

the L2, SLM's claim that sounds in L1 and L2 are related in a position sensitive way is also supported here. As far as the <th> spelling is concerned, we assumed that it was associated with /d/ when the target phoneme was /ð/. Our data showed that some items were pronounced [θ] because <th> can stand for both the voiced and the voiceless fricative. It would be interesting to study this spelling interference in target /θ/ words.

The results are also consistent with hypothesis 4 because the surface pronunciation of L1 segments is carried onto L2 production. This suggests that L1 surface level phonic patterns transfer onto L2 pronunciation, even in students who are at an advanced stage of their L2 acquisition. This supports the SLM claim about the importance of taking the context in which L1 and L2 phones occur into account.

As mentioned above, these Catalan speakers' perception of /d/ and /ð/ was not significantly different from native English speakers' perception of /d/ and /ð/. Maybe they have reached the stage at which they create an L2 sound category according to SLM. This precedence of perception over production might be due to the motor skills involved in pronunciation and the difficulty in getting rid of L1 articulatory habits.

Further research could focus on checking whether the same production patterns are found in the pronunciation of /d/ and /ð/ by Catalan students with different levels of English proficiency. Our hypotheses could also be tested on different phones or languages in L2 acquisition scenarios which are similar to the one we examined.

#### ACKNOWLEDGMENTS

This research has partly benefited from the support of a grant awarded by Caixa de Balears "SA NOSTRA".

I would like to thank Dr. Alice Turk and Dr. Mitsuhiro Ota for their help in the development of this project.

#### REFERENCES

- [1] C.T. Best, "A Direct Realist View on Cross-Language Speech Perception," in *Speech Perception and Linguistic Experience: Issues in Cross-Language Research*, W. Strange, Ed., pp. 171-204. Timonium MD: York Press, 1995.
- [2] J.E. Flege, "Second-Language Speech Learning: Theory, Findings and Problems," in *Speech Perception and Linguistic Experience: Issues in Cross-Language Research*, W. Strange, Ed., pp. 233-277. Timonium MD: York Press, 1995.
- [3] D. Recasens, *Fonètica Descriptiva del Català (Assaig de Caracterització de la Pronúncia del Vocalisme i Consonantisme del Català al Segle XX)*. Barcelona: Institut d'Estudis Catalans, 1991.