Learning a Second Language Influences Perception of L1 sounds

Lucrecia Rallo Fabra
Universitat Ramon Llull, Barcelona, Spain
E-mail: lucreciarf@blanquerna.url.es

ABSTRACT

This study explores interferences of L2 learning in the perception of L1 sounds. We examined perception of Catalan vowels by Catalan monolinguals (CMs) and Catalan speakers of English (CSEs) with limited exposure to the L2. In a perceptual identification task both groups of listeners were instructed to identify Catalan and English vowels in terms of the seven native Catalan categories [i e ɛ a ɔ o u]. As expected, CMs perceived all native categories as intended. However, CSsE perceived Catalan [e] as [i] and Catalan [o] as [ɔ]. These results suggest that CsEs probably heard Catalan [e] as instances of English [ɪ] and also that they could not discriminate the Catalan [o] – [ɔ] contrast. These findings have important implications for the Speech Learning Model (Flege 1995). Apparently, the perceptual systems of CSEs may eventually adapt to accomodate new sounds at the cost of losing perceptual sensitivity to some of the native phonetic contrasts.

1. INTRODUCTION

Infant speech perception has been explored extensively by Khul and cols. [5] who introduced a model known as the "perceptual magnet effect". This model posits that speech perception is strongly influenced by language experience so the contact with a particular language early in life "produces a change in perceived distances in the acoustic space underlying phonetic distinctions". According to Khul, this hypothesis can be also extended to adults learning a second language. Thus, the learner's L1 categories "interfere with the ability to perceive the phonetic distinctions in the new language". Kuhl further predicts that L2 categories that are to close to the L1 magnets will be easily assimilated by the native-language category.

Many studies on L2 acquisition have investigated perception of L2 sounds and its relation to production accuracy. It has been found that some experienced L2 learners may establish perceptual phonetic categories for the L2 sounds that differ from the closest L1 sounds.
Interference has only been applied to the influence of the L1 on the production of L2. According to Flege's *SLM* [3] cross-language phonetic interference is bidirectional in nature and, as we will show, it does not only affect production but also perception. However, researchers have not paid much attention on how learning a second language may influence perception of the learners's L1 sound system. In this study, we explore how the L2 learner's perceptual system reorganizes to accomodate both the L1 and L2 sounds.
Limits on behavioral plasticity in speech perception have been explored for early Spanish-Catalan bilinguals using AXB and gating tasks by Sebastián-Galles and her cols. [2, 6, 7]. The authors concluded that subjects did not show to possess "two independent phonetic spaces between which they could easily switch" . This could be taken as evidence that L1 and L2 categories exist in a common perceptual space, and thus may influence one another, modifying pre-existing phonetic categories to serve both languages.

2. METHOD

Stimuli collection

We recorded the productions of four native Catalan talkers and four native American English talkers. They elicited a word written on a card which was showed to them through the window of a sound booth. This procedure guaranteed no list-reading effects on intonation. The words consisted on s_t syllables containing one of the following Catalan vowels [i e ɛ a ɔ o u] and English vowels [i ɪ ɛ æ ʌ u ʊ ɔ ɑ]. The productions were digitized using a waveform editor at 22000 kHz samplig rate and 16 bit accuracy. The s_t words were then edited to eliminate the final [t] sound. This was done to prevent listeners from basing their perceptual judgements on the differences of VOT between the Catalan short-lag [t] and the English long-lag [t] or glotal stop. This way, we ensured that listeners relied on the vowel sound only.

Participants

Thirty-eight Catalan speakers of English (CSE) and fifteen Catalan monolinguals (CM) were tested by the same experimenter. The CSEs were third/fourth-year English Philology students. The CMs were Catalan Philology students. None of the CMs reported to speak fluently any foreign language. Both groups of listeners were phonetically-trained.

ISBN 1-876346-48-5 © 2003 UAB

Procedure

The English and Catalan speech stimuli were presented to listeners individually for auditory judgement in a single session which lasted about ten minutes. They heard the stimuli over headphones. The computer screen had eight pushbutton boxes. Seven of these buttons represented the seven Catalan vowel categories in IPA symbols. The other button had the label nc, which stood for "non Catalan". Listeners were told they would hear syllables of the type CV. They were instructed to identify each stimulus they heard using ony one of the eight buttons which represented the seven Catalan vowel categories. The "nc" button could only be clicked if the vowel they heard did not sound like any of the above seven vowel categories. Clicking this option implied that the sound in question was probably perceived by listeners as a "new" L2 sound with no direct equivalent in the L1.

2. RESULTS

Tables I and II show identification of Catalan vowels in terms of the seven Catalan vowel categories [i e ɛ a ɔ o u] by fifteen Catalan monolinguals (table I) and thirty seven Catalan speakers of English (table II). The stimulus label column represents the words the listeners heard in the test. The response category columns represent the number of times the listeners clicked each of the seven pushbuttons that appeared on the screen.

Comparison of tables I and II and suggests that CMs' and the CSEs' responses vary across vowels. Both groups of listeners show almost identical trends in identifying three Catalan vowels, [a], [u] and [i]. Almost 80% of the listeners in both broups clicked the response category button labeled [a] to identify this vowel sound. The other 20% used the "NC" label meaning that they interpreted this vowel as non-Catalan. Almost all listeners identified vowel [u] correctly. And finally [i] was perceived as intended in almost 100% of the CM's trials. CSEs heard Catalan [i] as a non-Catalan vowel only in 10% of the trials.

Stimuli labels	RESPONSE CATEGORY								
	a	e	ɛ	i	o	ɔ	u	nc	Total
sɛt		18	**42**						60
sat	**49**	1	1			2		7	60
set		**38**	7	14				1	60
sit				**60**					60
sot	1				**43**	13	3		60
sɔt	9		1		7	**34**		9	60
sut					1		**44**		45

Table I: Identification of Catalan vowels by 15 Catalan Monolinguals (CMs).

Stimuli labels	RESPONSE CATEGORY								
	a	e	ɛ	i	o	ɔ	u	nc	Total
sɛt		26	**117**					5	148
sat	**119**	2	1			1	2	23	148
set	1	14	23	**69**				**41**	148
sit	1			**132**				15	148
sot					37	**86**	9	16	148
sɔt	9	1			15	**111**	1	11	148
sut					1		104	6	111

Table II: Identification of Catalan vowels by 37 Catalan speakers of English (CSEs).

[ɛ] CMs and CSEs identified this vowel as intended in 80% and 70% of the trials. In the remaining trials listeners perceived it as instances of [e]. There is no significant effect of group as showed by the χ^2 values calculated for a 2x2 table:

$$\chi^2 = 3.477, \text{ d.f.} = 1, p<.01$$

[ɔ] Only 55% of the CMs perceived this vowel correctly, which makes us think that maybe the samples used in the test were not good instances of this vowel category. CSEs identified [ɔ] as intended in 75 % of the judgements. Both groups also clicked the symbols [a] [o] and "nc" to label this vowel. Again there is a non-significant effect of group:

$$\chi^2 = .722, \text{ d.f.} = 1, p<.01$$

[e]. The CM group identified this vowel as intended in more than 60% of the cases. Less than 10% of the CSE identified C /e/ as intended. Almost 50% of them perceived this vowel as C [i] ; another 30% heard it as a non-Catalan sound. Significance test using χ^2 analysis calculated for a 2x2 table, gives us an interaction between the dependent variable "response category" and the independent variable "second language".

$$\chi^2 = 42.653, \text{ d.f.} = 1, p<.01$$

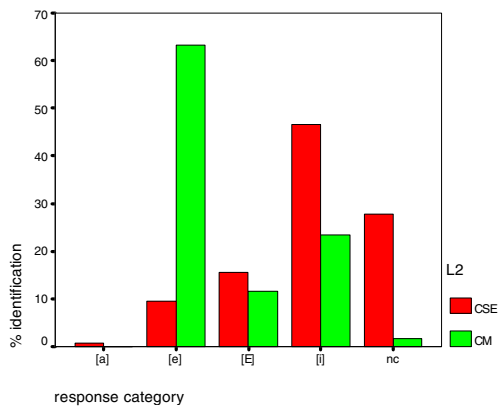

Fig. 1: Identification of Catalan vowel [e] by a group of Catalan monolinguals (CM) and a group of Catalan speakers of English (the symbol [E] stands forIPA [ɛ]).

/o/. The response category used by listeners to identify this sound varied as a function of group. Over 70% of CMs used the /o/ label, thus identifying this vowel sound as intended. CSEs however used the /ɔ/ label more often (nearly 60%) than /o/ (only 20%). As it can be observed in the table below, the interaction "response category" x "second language" is significant.

$\chi^2 = 3.477$, d.f. = 1, p<.01

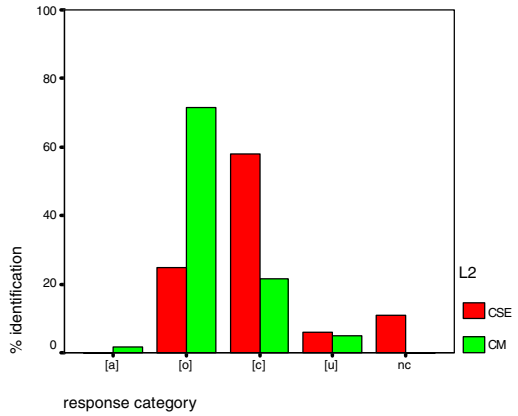

Fig. 1: Identification of Catalan vowel [ɔ] by a group of Catalan monolinguals (CM) and a group of Catalan speakers of English.(the symbol [c] stands forIPA [ɔ])

2. DISCUSSION

In a perceptual task in which both, English and Catalan vowel stimuli were presented simultaneously, CMs and CSEs show different trends in identifying some of the native vowel categories. The diffences apply to two Catalan vowel categories, namely [e] and [ɔ]. CSE identified Catalan [e] using the button labelled [i], which suggests that these listeners probably heard this vowel as instances of English [ɪ]. However CMs identified Catalan [e] as intended in almost 70% of the trials. As for [ɔ], CSEs used the response category [o] more often than [ɔ], whereas CMs identified Catalan [ɔ] as intended in almost 80% of the trials.

Our interpretation of these results confirms tha basic tenet of Khul's perceptual magnet effect, i.e., language experience definitely influences speech perception. However, this influence does not only affect L2 categories which assimilate to pre-existing native categories. Apparently, perceptual interference could be bidirectional in nature and experience with new L2 sounds could alter long-established perceptual patterns for the L1.

Implications for models of L2 Learning

One of the questions that arises in theories of second language acquisition is whether the vowel systems of L1 remain adaptable over the life span. The data obtained in the present study prove that the L1 perceptual system does not fossilize after a critical period. Perception results of native vowels by CSEs suggest that L2 learners are unable to mantain contrast between sounds from two different systems. For this reason, the learners' vowel system reorganizes to include new L2 vowels at the cost of losing sensitivity to some of the L1 contrasts, namely /e/-/ɛ/ and /o/-/ɔ/.

REFERENCES

[1] Best, C. T. (1994) "The Emergence of Native-Language Phonological Influences in Infants: A Perceptual Assimilation Model" . C. Goodman y H. C. Nusbaum (eds.) The Development of Speech Perception, Cambridge (Mas.): The MIT Press, pp. 167-224.

[2] Bosch, L.; Costa, A.; Sebastián-Gallés, N., "First and second language vowel perception in early bilinguals". *European Journal of Cognitive Psychology,* 12

[3] Flege, J.E. (1995) "Second language speech learning: Theory, findings and problems" in W. Strange (ed.) Speech Perception and Linguistic Experience, Baltimore: York Press: (233-277).

[4] Guion, S. G.; Flege, J. E. And Loftin, J. D., "The effect of L1 use on foreign accent ratings in Quichua-Spanish Bilinguals", *Proceedings of the 14th International Congress of Phonetic Sciences*, San Francisco, CA, 1471-1474., 1999.

[5] Kuhl, P. And Iverson, P. Linguistic Experience and the Perceptual Magnet Effect"

[6] Pallier, C.; Bosch, L. & Sebastián-Galles, N. (1997) "A limit on behavioral plasticity in speech perception", Cognition, 64, B9-B17.

[7] Sebastian-Gallés, N.; Soto-Faraco, S. (1999) "Online processing of native and non-native phonemic contrasts in early bilinguals", Cognition 72, pp. 111-123.

ACKNOWLEDGEMENTS

This research was supported by a grant FP95 from the Spanish Ministerio de Educación y Cultura awarded to the author. I am grateful to Joaquín Romero and Pilar Prieto for their useful comments on this paper.

ISBN 1-876346-48-5 © 2003 UAB