The acquisition of L2 phonetic categories: Perceptual development in Dutch learners of Spanish

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Abstract

We show that the acquisition of phonetic categories crucially involves perceptual development. We present evidence to confirm the following three hypotheses:

A. Listeners treat L1 and L2 sounds differently: under L2 priming, L1 vowel classification becomes more appropriate for the second language.

B. Some differences between L1-primed and L2-primed vowel classification are due to language-specific perception rather than to high-level strategies.

C. With experience in the second language, differences between L1 and L2 perception increase and L2 categorization improves.

Our case is the acquisition of vowels by **Dutch learners of Spanish.**

EXPERIMENT: L1 AND L2 VOWEL CLASSIFICATION WITH LANGUAGE-SPECIFIC PRIMING

A female Spanish speaker read a Spanish text, from which we cut 25 CVC chunks for each of the five Spanish vowels /a/, /e/, /i/, /o/, /u/. The chunks were embedded into a Dutch or Spanish carrier phrase spoken by the same speaker. Dutch learners of Spanish were asked to classify the 125 tokens in three conditions.

	Condition 1: L1-primed	Condition 2: L2-primed	Condition 3: L2-only
Target stimuli:	125 Spanish CVC	125 Spanish CVC	125 Spanish CVC
Primed perception mode:	L1	L2	L2
The subjects were told that the stimuli were...	'Dutch'	'Spanish'	'Spanish'
Carrier phrase:	Dutch	Spanish	Spanish
Filler stimuli:	Dutch	Spanish	Spanish
Requested report:	L1	L1	L2
Explicit task:	'listen with your...'	'listen with your...'	'listen with your...'
	-	'Dutch ears'	'Spanish ears'
Response categories:	12 Dutch vowels	12 Dutch vowels	5 Spanish vowels

Subjects:

- 38 Dutch learners of Spanish (11 beginners, 18 intermediate, 9 advanced)
- 11 Dutch-only listeners (not for Condition 3)
- 44 Spanish-only listeners (only for Condition 3)

References

Escudero, P. & Boersma, P. (2002). The subset problem in L2 perceptual development: Multiple-category assimilation by Dutch learners of Spanish. To appear in *Proceedings of the 26th Boston University Conference on Language Development.* Downloadable from our web sites.

All production and perception data and simulation scripts are available at:
http://www.fon.hum.uva.nl/paul/p2b/

A. L2 PRIMING INFLUENCES CLASSIFICATION

The 38 learners heard the 125 tokens twice: once under L1-, once under L2-priming. The following table summarizes the 4750 responses (all three learner groups pooled):
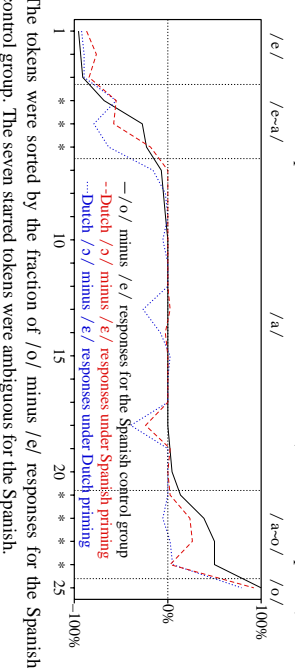
		i	eː	ɪ	ɛ	ʏ	øː	ʏ	aː	u	oː	ɔ	a	
L1–primed	i	646	0	27	1	0	0	0	0	2	0	0	0	676
	eː	0	2	3	6	0	0	0	0	0	0	0	0	11
	ɪ	120	3	599	101	0	0	0	17	2	1	0	1	844
	ɛ	0	4	57	373	1	0	24	2	2	0	9	44	516
	øː	2	0	1	0	5	0	3	0	4	0	0	0	15
	ʏ	1	0	8	17	5	1	118	0	0	0	0	0	298
	aː	0	0	2	0	0	0	7	0	0	1	35	0	45
	ɑ	0	0	0	3	0	0	15	0	891	4	16	1	932
	ɔ	0	0	4	17	1	0	13	0	0	122	617	4	768
	oː	0	0	0	0	0	0	9	5	8	0			22
	u	0	0	1	0	3	0	10	3	2	29	532	0	617
	a	769	10	700	518	14	1	210	19	1116	24	738	629	4750

1. Observation:

1. In both conditions, the listeners avoid the Dutch long vowels /eː, øː, aː, oː/.
2. Under L2 priming, learners respond more with the categories /ɑ, ɛ, ɪ, ɔ, u/, which they associate with the Spanish /a, e, i, o, u/, and less with the categories /ɪ, ʏ /, which occur in Dutch only. The following table shows the reliable shifts:

shift	size	p (raw 1-tailed)	explanation
ɔ → u	122−16 = 106	< 10⁻²⁰	(complicated)
ɪ → i	120−27 = 93	< 10⁻¹⁴	avoid /ɪ/
ʏ → u	79−15 = 64	< 10⁻¹¹	avoid /ʏ/
ɪ → ɛ	101−57 = 44	< 10⁻¹¹	avoid /ɪ/
ʏ → ɔ	56−13 = 43	< 10⁻⁶	avoid /ʏ/
ɛ → ɑ	44−17 = 27	< 0.001	Spanish /a/ is more front than Dutch /ɑ/
ɑ → ɑ	29−4 = 25	< 10⁻⁴	Spanish /a/ is more front than Dutch /ɑ/
ɑ → ɑ	35−10 = 25	< 0.001	Spanish /a/ is more front than Dutch /ɑ/
ɛ → ɔ	9−0 = 9	< 0.005	(not very significant because of multiple tests)

2. Interpretation:

there are separate perception modes for L1 and L2. Under Spanish priming, the learners switch on their L2 perception mode. They cannot completely follow the explicit task of listening 'with Dutch ears'.

L1–primed: "[æ]-like tokens belong to my L1 /ɛ/ category, and [ɒ]-like tokens belong to my L1 /ɑ/ category."

	intended TL category	perceived	reported L1 category

L2–primed: "[æ]-like tokens belong to my L2 /a/ category, and [ɒ]-like tokens belong to my L2 /o/ category."

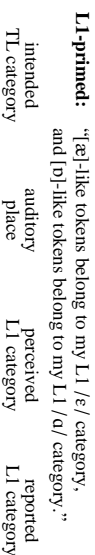|	intended TL category	auditory place	perceived	reported L1 category

B. SOME L2 PRIMING EFFECTS ARE PERCEPTUAL

Could the results above be due to a conscious decision to avoid categories that the listeners know do not exist in Spanish? Unlikely, since the ɛ → ɑ → ɔ shift occurs only for those tokens whose auditory properties were ambiguous for the Spanish control group. This picture shows the fraction of /o/ responses minus the fraction of /e/ responses on each of the 25 /a/ tokens (all 38 learners pooled):
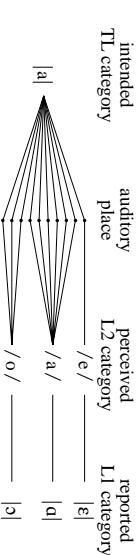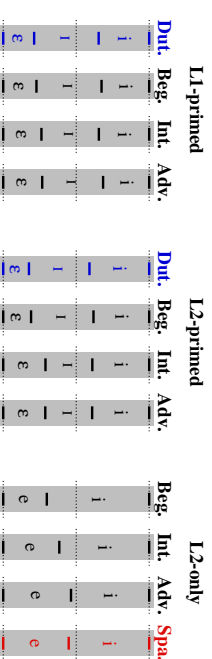

The tokens were sorted by the fraction of /o/ minus /e/ responses for the Spanish control group. The seven starred tokens were ambiguous for the Spanish.

C. L2 PERCEPTUAL DEVELOPMENT

The behaviour of the learners on the front vowels changes with experience level. The following picture shows the relative numbers of responses on the front vowels:

L1-primed: there is little change with experience level → L1 perception stays good.
L2-primed: the difference between L1-primed and L2-primed conditions changes with experience level (boundary shift, loss of /ɪ/) → L2 perception develops.
(learners use /ɪ/ less under L2- than under L1-priming; paired-samples t = 5.90; N=38; p < 10⁻⁶)
L2-only: performance on L2 classification improves.
(reduction in /ɪ/ use between L1- and L2-priming correlates with exp. level: t = 0.30; M=49; p<0.002)

Interpretation: effect of language-specific priming predicts L2 performance.
(L1-to-L2 /ɪ/ reduction correlates with height of /i/-/ɛ/ boundary: t = 0.40; N = 38; p < 0.0003)

CONCLUSIONS

1. Listeners listen to L1 and L2 sounds with two separate perception modes.
2. The L2 perception mode develops: category boundaries become more appropriate for the target language; category boundaries become more accurate.