

The role of the L1 phonemic inventory in L2 category creation: effects of L2-to-L1 mapping in perception of nonnative contrasts

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Background

- ▶ Naive L2 speakers perceptually assimilate L2 categories to L1 categories [1]
- ▶ Two-category assimilation (TC type): two non-native segments fall into two different L1 categories. Predicted discrimination: excellent.
- ▶ Single-category assimilation (SC type) and Category-goodness difference (CG type): two L2 segments fall into one L1 category. Predicted discrimination is poorer than in TC type.
- ▶ Perceptual magnet effect/Native Language Magnet [2]: does experience in L2 override it?
- ▶ Equivalence classification mechanism: one phonetic category processes similar L1 and L2 sounds (diaphones) and may impede category creation. [3]

Research questions

- ▶ What nonnative vowel segments are perceived better when the native vowel inventory has fewer elements than the target inventory, therefore adding a new set of distinctive features?
- ▶ Will the different types of perceptual assimilation yield the predicted results?
- ▶ Can nonnative speakers learn new contrasts only from the perceptual cues that the native language offers?
- ▶ Will more experience with the L2 affect perception of nonnative contrasts?

Methodology

- ▶ Subjects:
 - ▶ 6 Native speakers of English (control group)
 - ▶ 10 native speakers of Spanish with advanced knowledge of English
 - ▶ 6 native speakers of Spanish with limited knowledge of English
- ▶ Task: modified version of AX, 2FC task. Subjects were asked to discriminate between a vowel embedded in a C_C context and an isolated one.
- ▶ Stimuli: CVC followed by a silence of 1 sec and a vowel in isolation, such as

$$\text{Stim} = \text{C}(\text{V}_1\text{V}_2)_i\text{C} + \text{S} + \text{V}_1$$

- ▶ Where C = consonant, S = 1 sec silence, and i = any value between 1 and 7, corresponding to the step in the continuum. The embedded vowel (V_1V_2)_i was a token of a 7-step continuum built between two vowels (V_1 and V_2): one native and one nonnative (Table 1), or between two nonnative vowels (Table 2).
- ▶ the target vowel was either one of the continuum endpoints.
- ▶ The stimuli consisted of resynthesized vowels using Praat, from native speakers' recorded vowels.
- ▶ Total stimuli: 196 (98 with V_1 as target vowel and 98 with V_2).

Continuum	ΔF1	ΔF2	EucD
/a- a/	29	252	253
/a- o/	367	330	493
/Λ- a/	121	136	182
/Λ- o/	217	718	750
/i- e/	124	27	126
/i- i/	4	628	628
/u- o/	218	188	287
/u- u/	81	172	190

Table 1: Differences in Hz between endpoints of nonnative-to-native continua

Continuum	ΔF1	ΔF2	EucD
/a- Λ/	150	388	415
/u- i/	106	1082	1087
/u- a/	585	142	601
/i- a/	479	940	1055
/i- Λ/	329	552	642
/Λ- u/	435	530	685
/u- u/	81	172	190
/i- i/	4	628	628

Table 2: Differences in Hz between endpoints of nonnative-to-nonnative continua

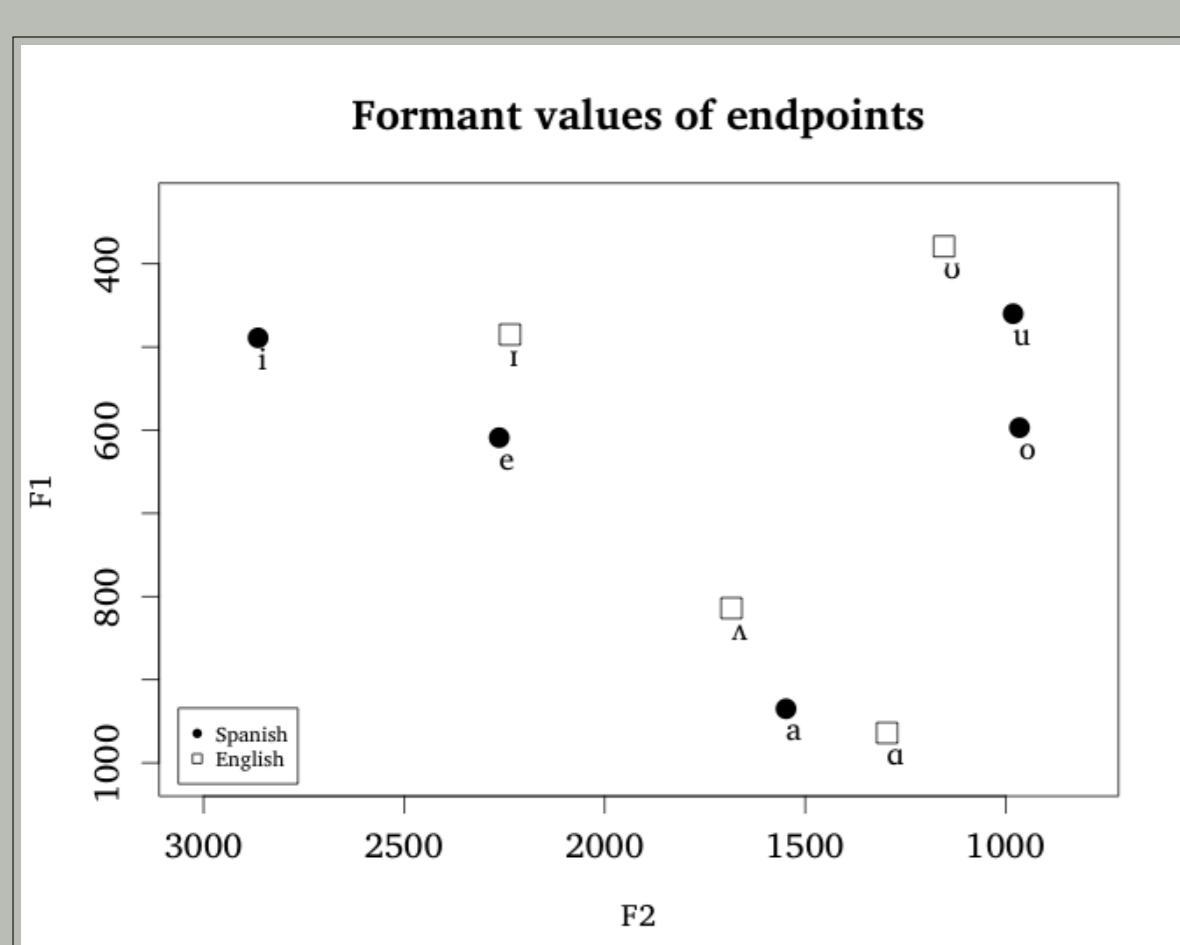


Figure 1: Formant values of endpoints, from tokens recorded by native speakers.

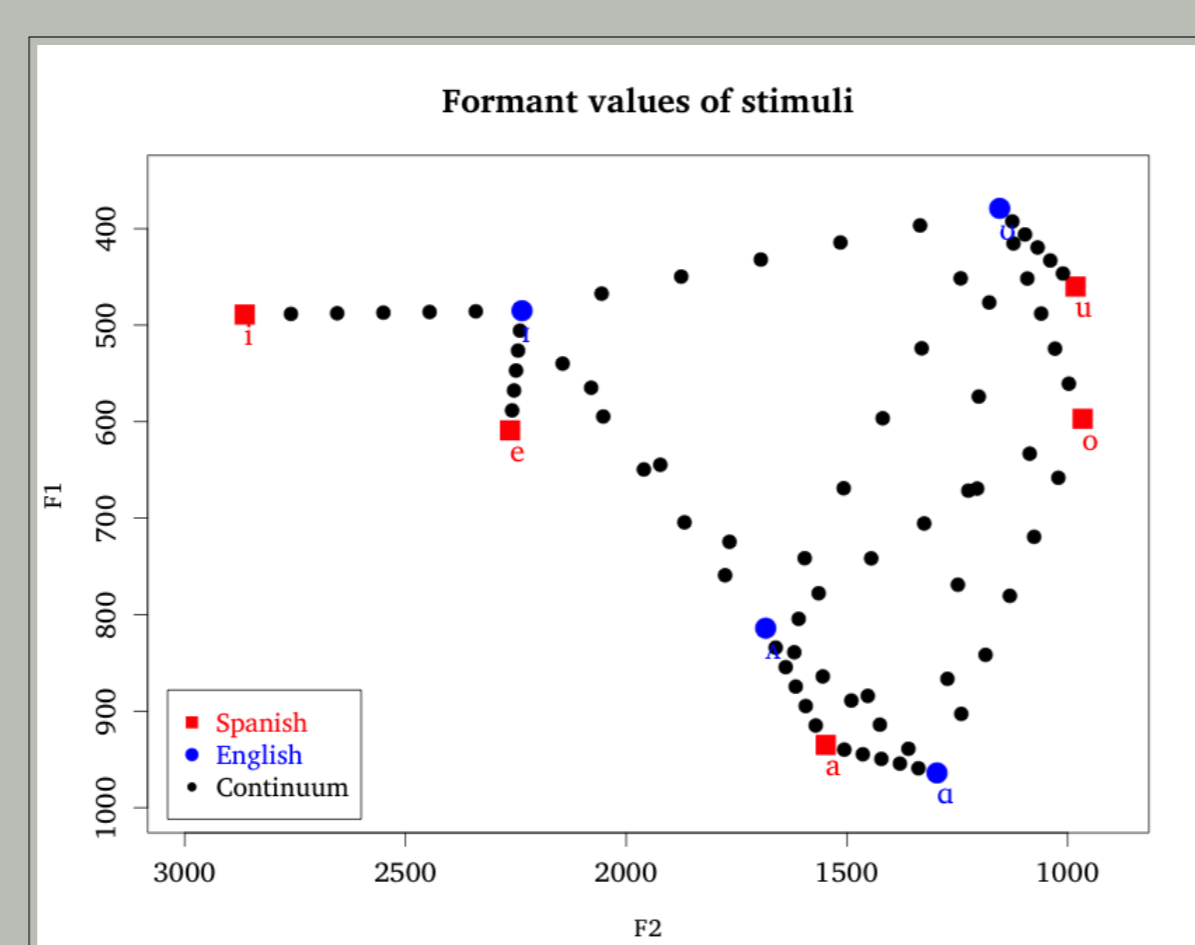


Figure 2: All the vowel stimuli, resynthesized.

Perceptual Assimilation (PA) of nonnative vowels

NNV	NV1	NV2	Perc Assim	beginners	advanced
/a/	/a/	/o/	NV1	NV1	
/Λ/	/a/	/o/	NV1	NV1	
/i/	/e/	/i/	both	both	
/u/	/u/	/o/	NV1	NV1	

Table 3: PA of nonnative vowels (NNV) onto the closest native vowels (NV1 and NV2)

- ▶ Back NNVs prefer the closest NV in the acoustic space.
- ▶ The near-front NNV perceptually assimilates to either one of the closest options.
- ▶ But its NV2 is farther away than the NV1 of /a/ and /u/.

Perception of nonnative contrasts

NNCont	Perc. Assim	Discrimination	beg	adv
/a- Λ/	/a/	/a/	poor	moderate
/u- i/	/u/	/i/	good	good
/u- a/	/u/	/a/	good	good
/i- a/	/i/	/a/	good	good
/i- Λ/	/i/	/a/	good	good
/Λ- u/	/a/	/o/	good	good
/u- u/	/u/	/u/	poor	poor
/i- i/	/i/	/i/	poor	poor

Table 4: Discrimination of Nonnative vowels according to their respective L2-to-L1 mapping

- ▶ Perception of the open v. open-mid contrast increases with L2 experience, resembling native-like behaviour (Fig. 1)
- ▶ Perception of NN contrasts when features are not present in L1 are aided by TC type (Fig. 2)
- ▶ Perception of the close v. near-close contrast is equally poor for all groups, even in native speakers (Fig. 3 and 4)

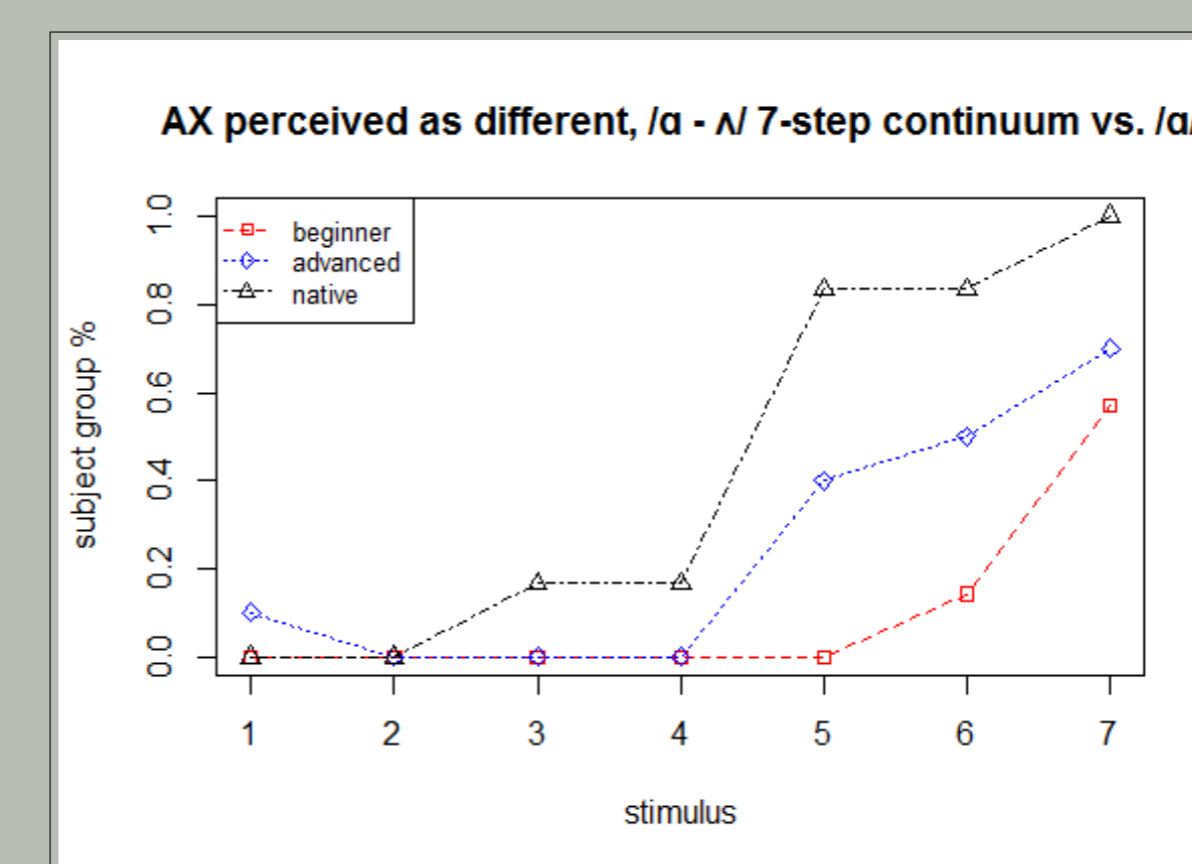


Figure 3: SC assimilation type, with increasing discrimination for advanced L2 speakers

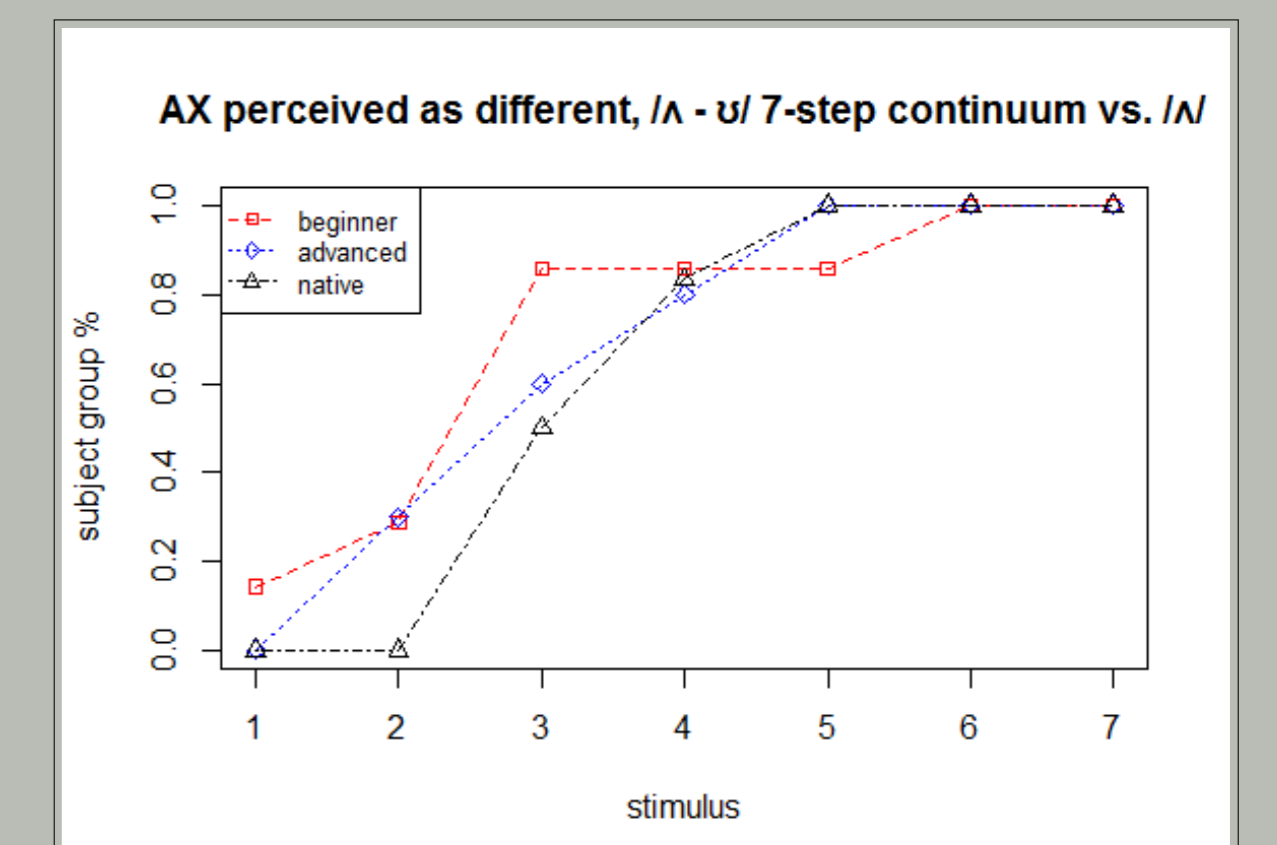


Figure 4: TC assimilation type, with excellent discrimination at the endpoints.

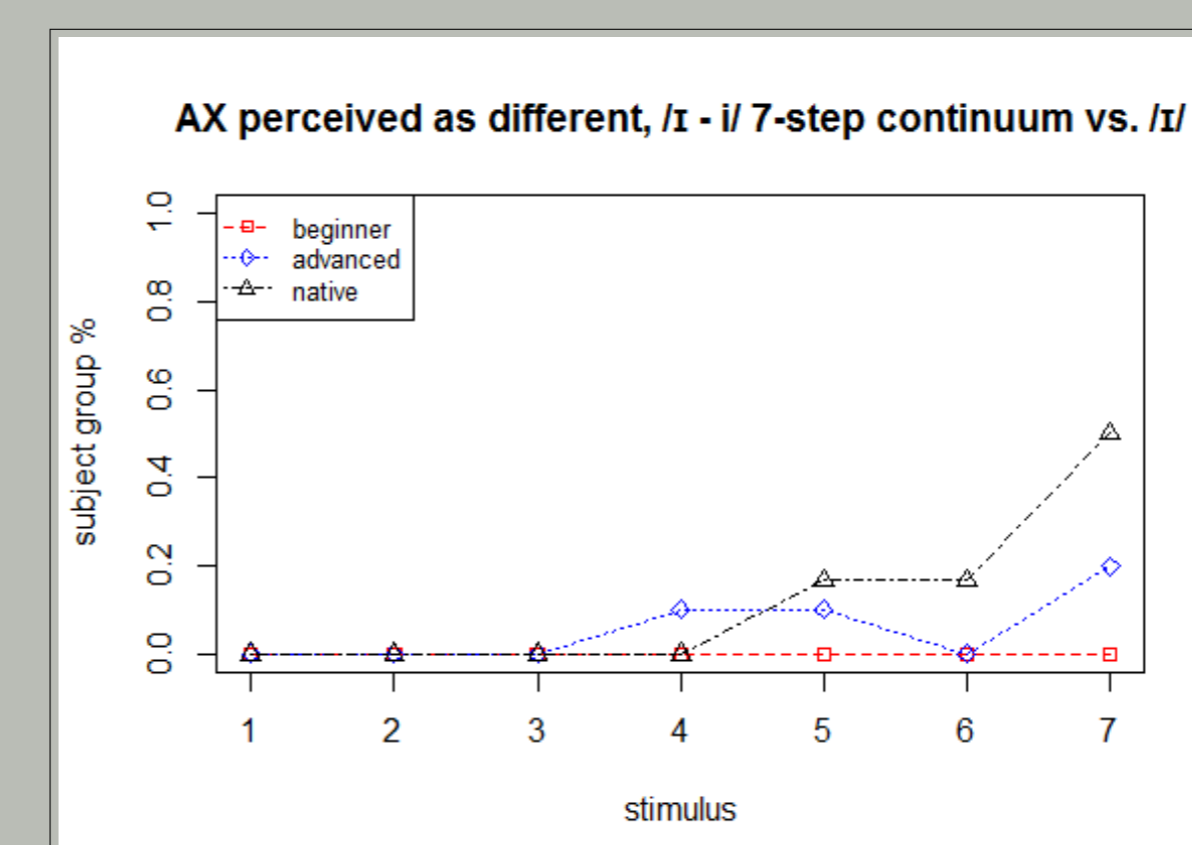


Figure 5: SC assimilation type, with no discrimination along the continuum.

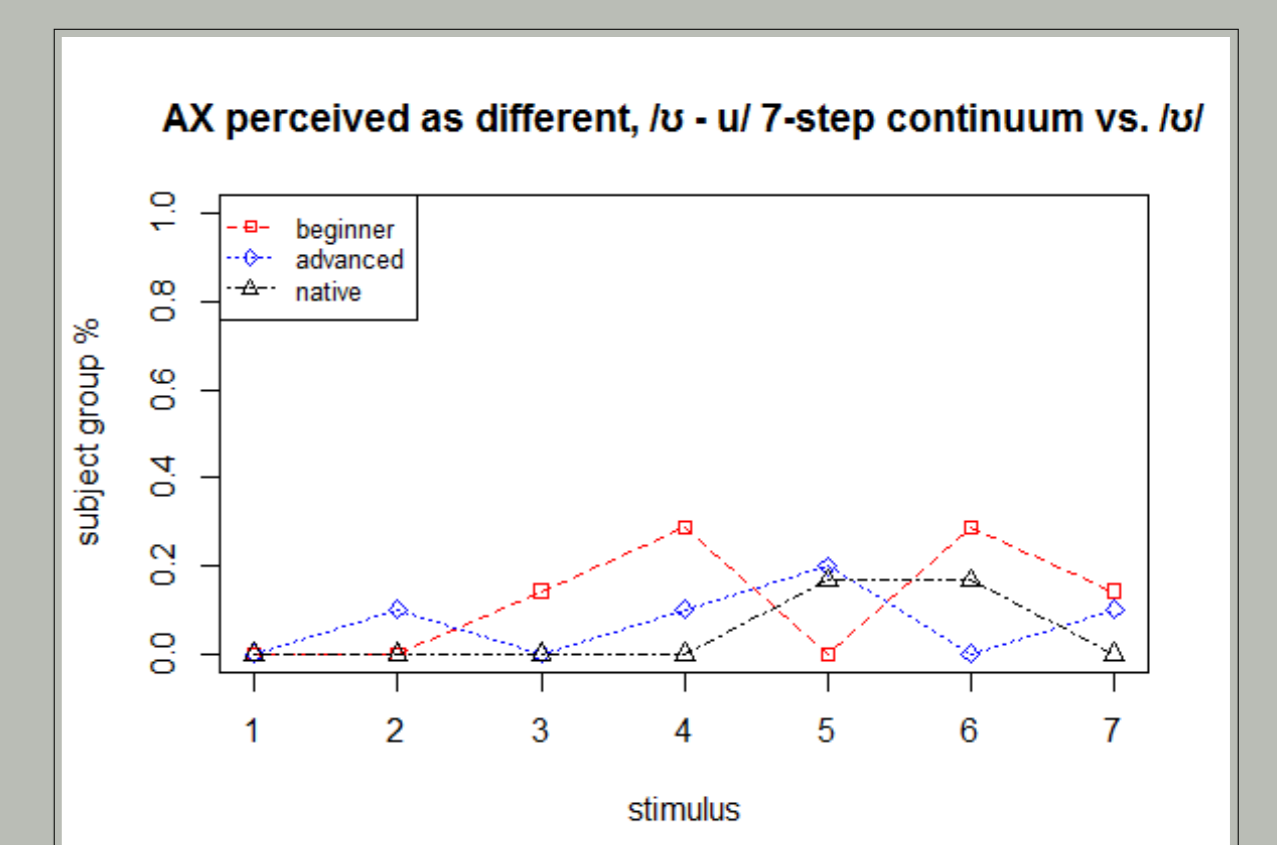


Figure 6: SC assimilation type, with poor discrimination along the continuum.

Conclusions

- ▶ The results confirm the predictions regarding TC and SC types of perceptual assimilation.
 - ▶ Given their formant values, the close v. near-close contrast between /i/ and /i/ could be considered as a case of CG assimilation type with /i/ as a poor exemplar of /i/, but discrimination results were among the poorest.
 - ▶ Only the open v. open-mid contrast in /Λ- a/ seems to show a learning pattern, where advanced L2 speakers emulate native-like discrimination.
- ▶ L1 categories warp the perceptual space, thus not letting Euclidean distance be enough to predict discrimination.
- ▶ The incomplete emulation of the native-like pattern in the /Λ- a/ case may suggest the creation of a new category, though it is not known if these categories have the same strength than those of the L1.

References

- [1] Best, C. (1995) Chapter 6: A Direct Realist View of Cross-Language Speech Perception. In Speech perception and linguistic experience: Issues in cross-language research, 171-204.
- [2] Kuhl, P., & Iverson, P. (1995). Chapter 4: Linguistic Experience and the Perceptual Magnet Effect. In Speech perception and linguistic experience: Issues in cross-language research, 121-154.
- [3] Flege, J.E. (1995) Second-language Speech Learning: Theory, Findings, and Problems. In W. Strange (Ed) Speech Perception and Linguistic Experience: Issues in Cross-language research. 229-273.