Is L1 category splitting possible? On representations of L2 sounds and their role in lexical activation

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Intro

- Learning perceptual representations of L2 vowel sounds is usually understood as the ability to perceive <u>differences</u> between sounds.
  - This could depend on the task being carried out (discrimination vs. labelling).
    - These are the only indicators that we have.
    - Would discrimination be more accurate than labelling, or vice versa?
- Perception of new contrasts by late L2 speakers is possible and it has been attested.
  - Though this doesn't necessarily mean that a <u>phonemic distinction</u> has been created.
- What is the nature of this newly created representation?
  - Something phonemic, equivalent to a phoneme?
    - Deterministic behaviour is expected: ceiling effect.
 - A phonetic category (Flege 1995)?

Intro

- Learning an L2 phonological system: different scenarios with different learnability issues (2-to-2, 2(+)-to-1,or1-to-2(+)).
  - A particular scenario: 2-to-1, which entails splitting an L1perceptual category
    - Neither L2 category keeps the prototypical values of the L1 category
    - /ɑ-ʌ/ contrast is mapped onto the same L1 category /a/
    - Unlike the /i - ɪ/ case, the /ɑ-ʌ/ contrast is based on perception of F1/F2 values, and not duration.
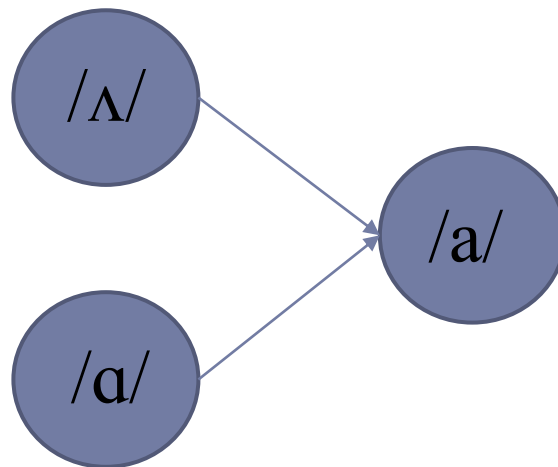
Alternative scenarios

- Scenario 1 – Deflection: Instead of splitting, one L2 category is attracted by another L1 category
  - Sub-scenario 1: The L2 category closest to prototypical L1 values wins, and the other is deflected to a less ideal L1 category.
  - Sub-scenario II: Warping effects from L1 categories are subject to language-specific cue-weighting, and not necessarily overall F1/F2 values.

[ʌ] → /a/

[ɑ] → /a/

/a/ → /o/
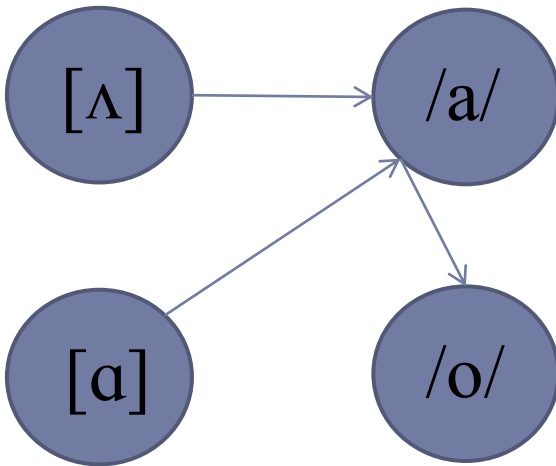
- Implications
  - Nothing is being created.
  - A labelling task with L1 labels will be consistent.
  - A discrimination task will yield zero different counts along a continuum between 2 nonnative categories mapped onto the same L1 category.

Alternative scenarios

‣ Scenario 2 - Subsetting: Instead of a full split, two subsets of a same phonemic category are created.

  ‣ Implications:

    ‣ The distinction is made only in L2 language mode (Grosjean 2001).

    ‣ Categories will always show an amount of overlap, as prototypical values will still be within an L1 category and will not undergo warping (Kuhl 1995)
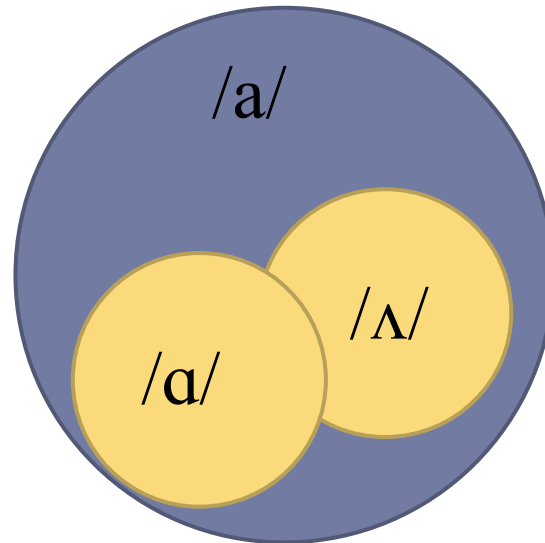
Alternative scenarios

▸ Scenario 3 - Homophony: The two L2 sounds are mapped onto the same perceptual L1 category and are perceived as the same sound.

    ▸ Implications:

        ▸ Again, nothing is being created.

        ▸ The distinction is never made and lexical access in cases of minimal pairs are made by context, assuming homophony.

    ▸ Note that this is only a perceptual account –L2 speakers may have different categories in production.

/a/

[a]

[ɑ]

[ʌ]
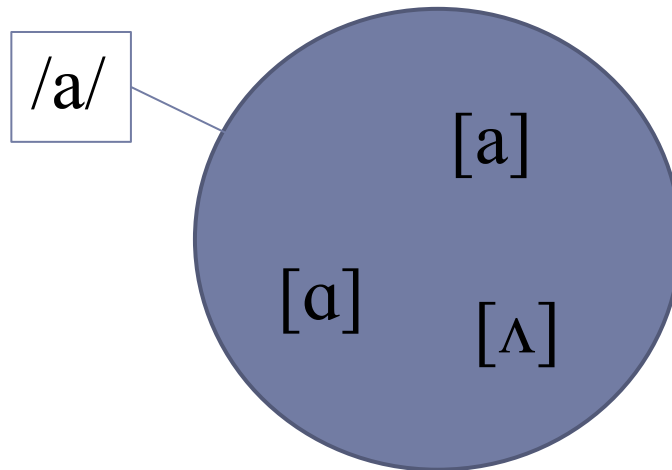
Experiment 1: nonce word minimal pairs - labelling

▸ Question:
  ▸ What is being perceptually mapped onto what?
    ▸ Perception of /ɑ-ʌ/ tokens by native speakers of Spanish
    ▸ Does that mapping change over time?

▸ Subjects:
  ▸ 42 native speakers of Spanish, with different proficiency levels in English.

▸ Stimuli:
  ▸ A set of 8 English-like CVC nonce word minimal pairs with vowels ɑ - ʌ was recorded by a trained bilingual speaker (Native speaker of English).
  ▸ Mean values:
    ▸ /ɑ/: F1 = 613, F2 = 1268
    ▸ /ʌ/: F1 = 551, F2 = 1279
    ▸ /a/ (as recorded by a native speaker of Spanish in the same contexts): F1 = 717, F2 = 1343).

▸ Procedure:
  ▸ Subjects listened to each one of the stimuli and had to categorize the vowel as either one of the Spanish vowels /i-e-a-o-u/.

▸

Experiment 1: nonce word minimal pairs - labelling

▸ Results: overall

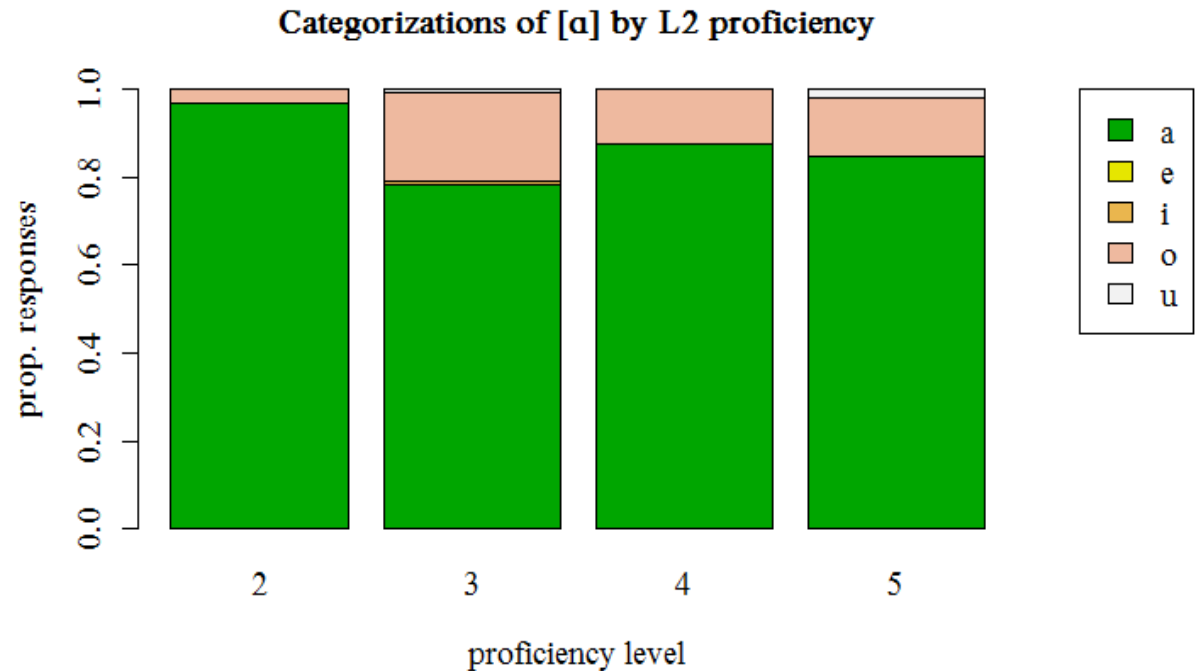Categorizations of [ɑ] and [ʌ] in nonce word minimal pairs
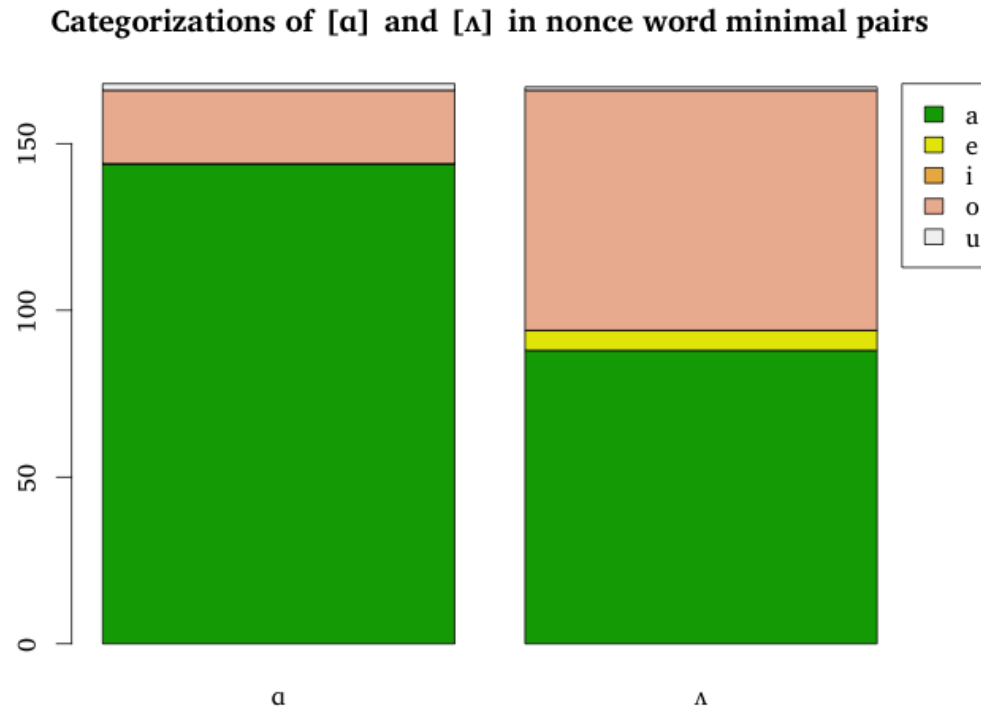
- Tokens of /ɑ/ were categorized as /a/ 84% of the time, and as /o/ 14% of the time.
- Tokens of /ʌ/ were categorized as /a/ 58% of the time (followed by /o/, 39%).

Experiment 1: nonce word minimal pairs - labelling
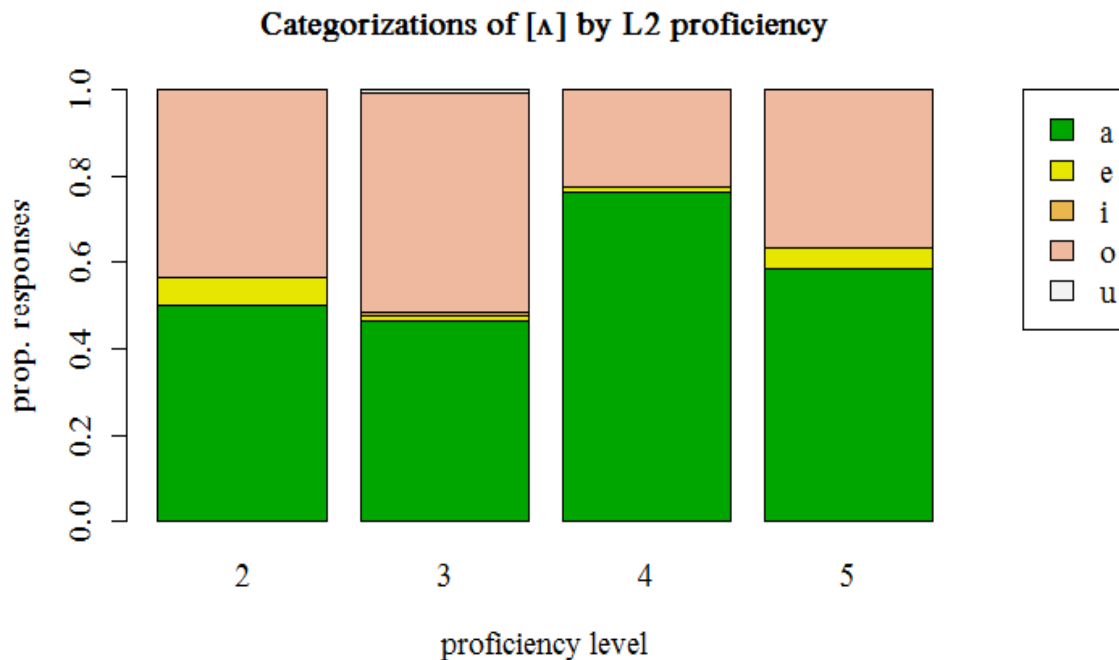
▸ Results by proficiency: /ɑ/

- A Chi-square test showed no significant correlation between preferences in categorization and proficiency. ($\chi^2 = 6.77$, p-value $= 0.079$).

Categorizations of [ɑ] by L2 proficiency

Experiment 1: nonce word minimal pairs - labelling

▸ Results by proficiency: /ʌ/

Categorizations of [ʌ] by L2 proficiency

- A Chi-square test showed a strong correlation between proficiency and categorization ($\chi^2 = 17.48$, p-value $= 0.0005$).
- Increased proficiency is related to more categorizations of /ʌ/ as /a/, rather than as /o/.

Experiment 1: nonce word minimal pairs - labelling

‣ Summary

  ‣ Categorization of /ɑ/ does not change with L2 proficiency, and it keeps being mapped onto /a/.

  ‣ On the other hand, /ʌ/ does go through a remapping process with the increase of L2 proficiency, but in a counterintuitive way –instead of remapping in order to leave only one L2 vowel per L1 category, it merges two.

    ‣ In this respect, scenario 1 (deflection) is only valid for initial stages of language learning.

    ‣ Scenarios 2 (subsetting) and 3 (homophony) remain possible.

Experiment 2: discrimination along continuum

▸ Questions:
  ▸ Will a nonnative-to-nonnative discrimination task show native-like ability to perceive the contrasts along a continuum?
  ▸ Will these results be consistent with the past experiment?
  ▸ Will discrimination change over time?

▸ Subjects
  ▸ 10 native speakers of Spanish with low proficiency in English, 10 native speakers of Spanish with high proficiency in English, and 10 native speakers of American English.

▸ Stimuli:
  ▸ Five 7-step continua: /ɑ-ʌ/, /ɑ-a/, /ɑ-o/, /ʌ-a/, /ʌ-o/. Each resulting token was embedded into a C_C context, followed by a 1sec ISI, and either one of the endpoints of the continuum.
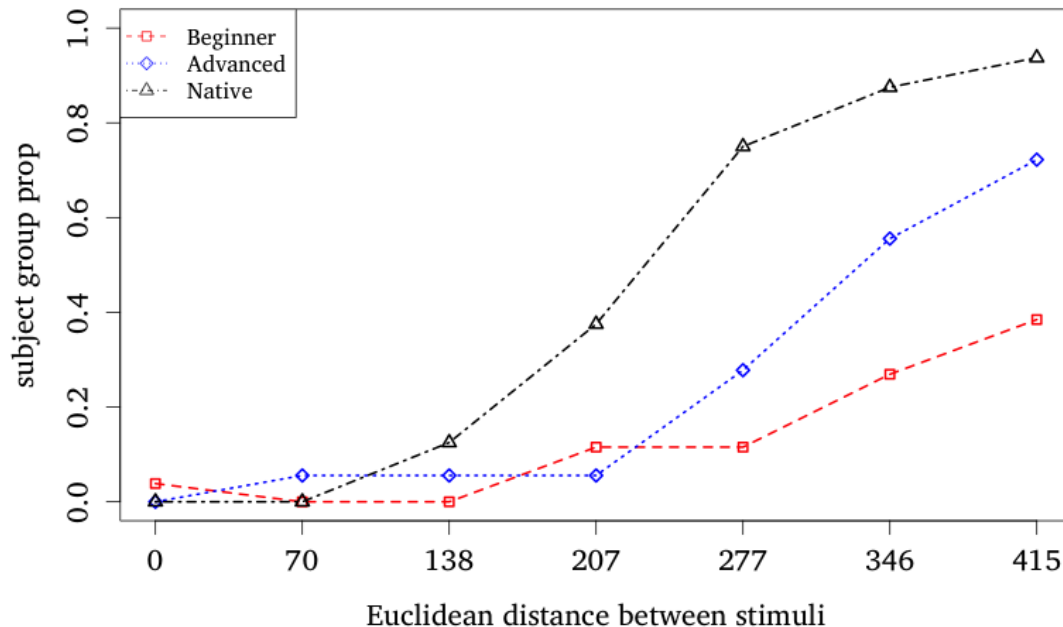
▸ Procedure:
  ▸ Subjects were asked to discriminate as either "same" or "different" the embedded vowel and the one after the ISI.

▸

Experiment 2: discrimination along continuum

▸ Results: /ɑ-ʌ/

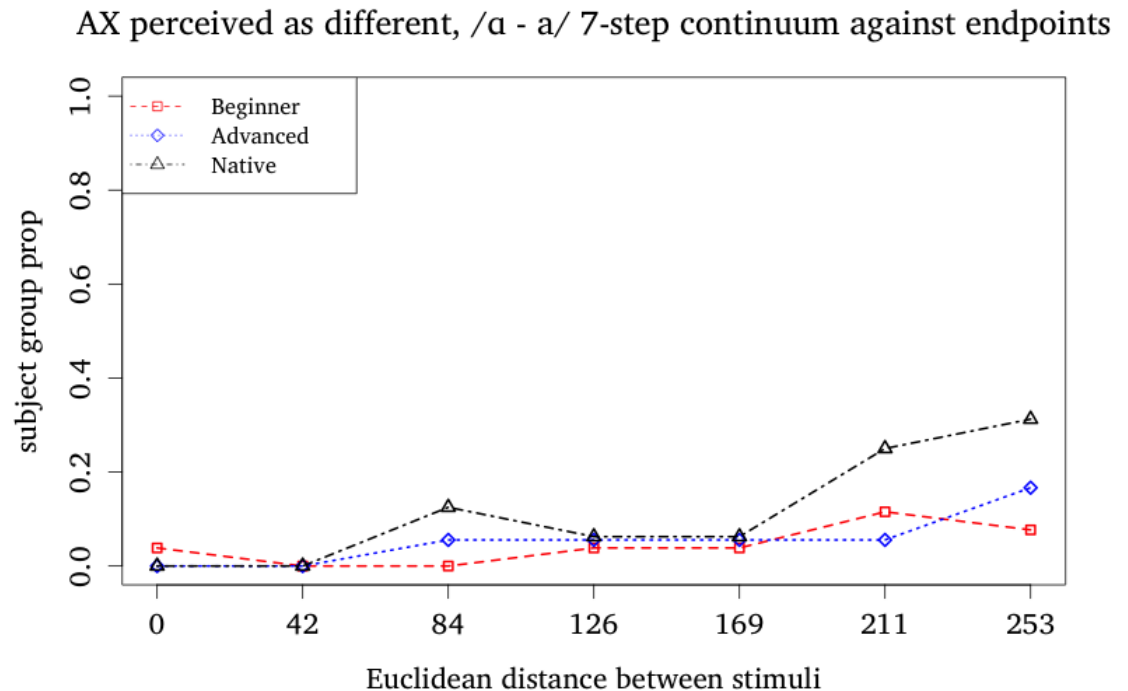AX perceived as different, /ʌ - a/ 7-step continuum against endpoints

- Native English speakers showed an S-curve with clear boundaries between tokens 3 and 5, with token 4 performing at chance.
- Native Spanish speakers with low proficiency in English showed below-chance discrimination.
- Native Spanish speakers with high proficiency showed a raising trend in discrimination after token 4, without reaching ceiling.

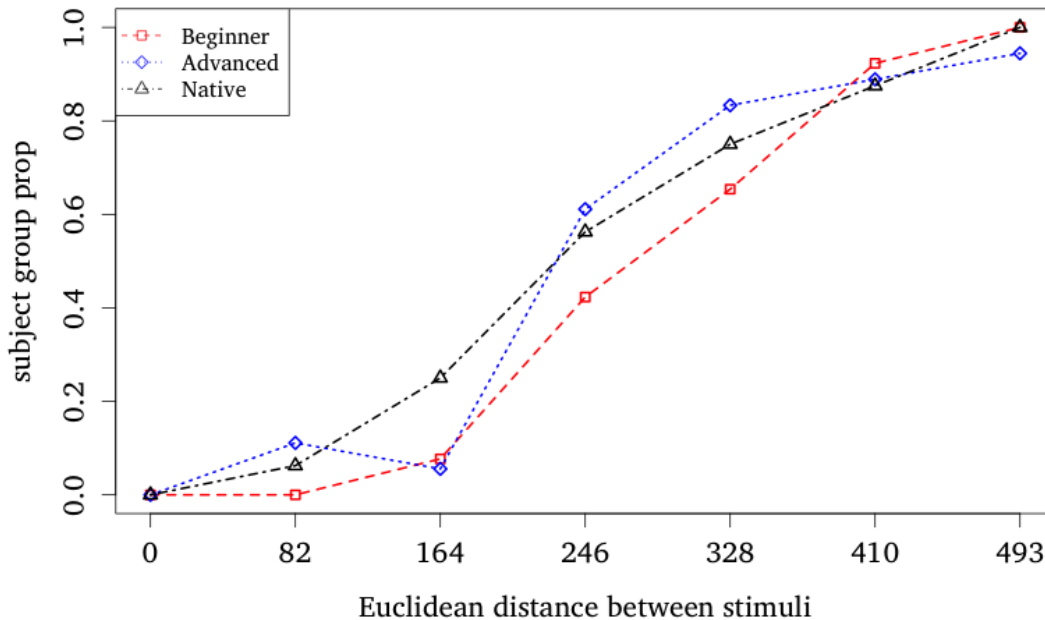# Experiment 2: discrimination along continuum

▸ Results /a-ɑ/

- Discrimination shows that [a] tokens are mapped consistently onto /a/.
- Only native speakers showed a subtle ability to perceive a different at the endpoint, although non significant.

AX perceived as different, /ɑ - a/ 7-step continuum against endpoints

Legend:
- Beginner
- Advanced
- Native

subject group prop (y-axis: 0.0 to 1.0)

Euclidean distance between stimuli (x-axis: 0, 42, 84, 126, 169, 211, 253)

Experiment 2: discrimination along continuum

▸ Results /ɑ-o/

AX perceived as different, /ɑ - o/ 7-step continuum against endpoints

- Tokens closer to /ɑ/ are perceived as increasingly different when compared to endpoint /o/.
- Tokens of / ɑ/ are not being mapped onto /o/, which is consistent with the results of Experiment 1.

Experiment 2: discrimination along continuum

▸ Results /a-ʌ/

- Discrimination shows that [ʌ] tokens are mapped consistently onto /a/.
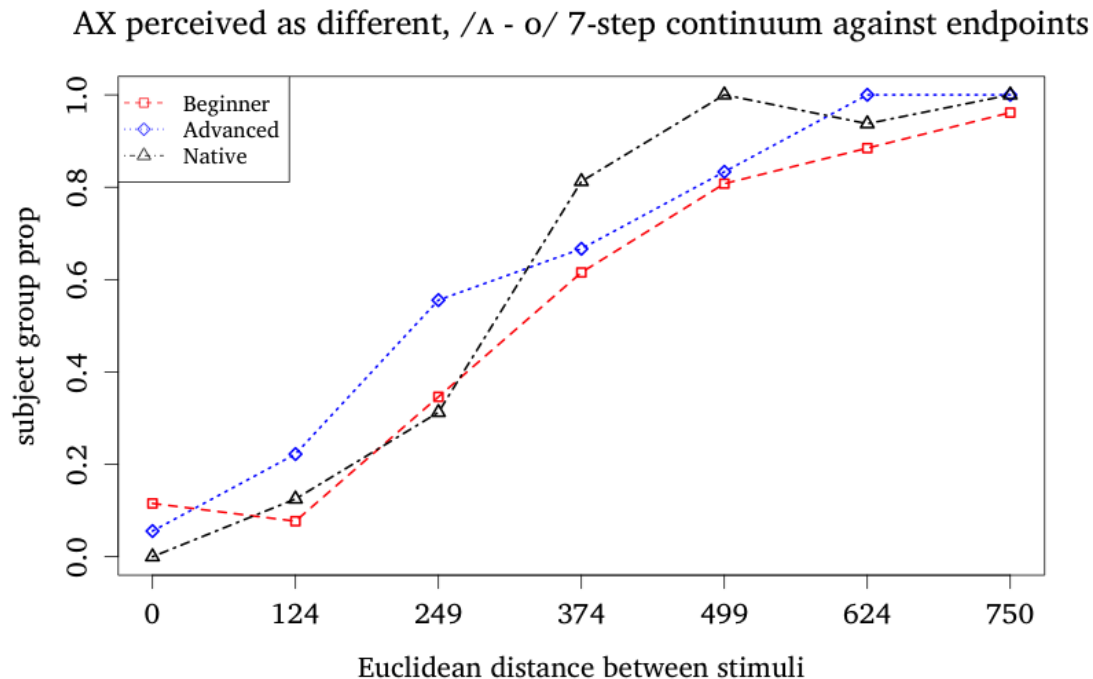- No significant difference in discrimination among groups were noted.

AX perceived as different, /ʌ - a/ 7-step continuum against endpoints
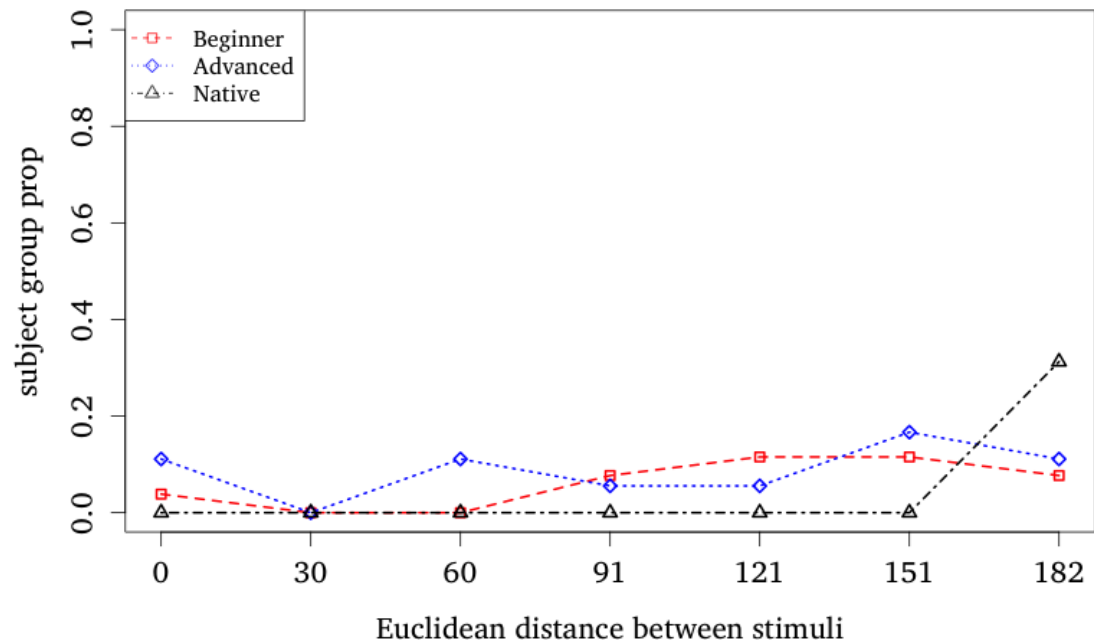
Experiment 2: discrimination along continuum

▶ Results /o-ʌ/

AX perceived as different, /ʌ - o/ 7-step continuum against endpoints

- Discrimination shows that [ʌ] tokens are not mapped consistently onto /o/ by neither of the groups, as discrimination increases when reaching endpoints.
- Different boundary zones are shown for different groups, but discrimination at endpoints is very similar.

Experiment 2: discrimination along continuum

‣ Summary

  ‣ Discrimination shows that /o/ is not an L1 category to which L2 categories are being mapped onto, which is consistent with Experiment 1 results.

  ‣ Both L2 categories, /ʌ-ɑ/, are being mapped onto /a/.

  ‣ Discrimination shows that /ʌ-ɑ/ reaches an above chance, but below ceiling performance.

Conclusions

‣ Experiment 1 shows that scenario 1 (remapping) is not a strategy that holds over time when learning an L2. Hence, phonetic similarity is stronger than the need to enforce contrast perception.

‣ Experiment 2 confirms the results of Experiment 1 in terms of mapping, but also shows that the presence of native-like boundaries that can be attributed to a Native Language Magnet effect is not available for L2 speakers, even in stages of high proficiency.

‣ Both experiments show that:

  ‣ Either the /a/ category is assumed to be a supercategory with two subsets formed by values of L2 vowels (scenario 2)

  ‣ Or that no splitting or creation takes place, (scenario 3) and only homophony is assumed.

Conclusions

▸ Lexical activation in minimal pairs is mostly triggered by contextual cues, and not by bottom-up processing of the speech signal, at least for the case of late L2 speakers.

▸ Both possible scenarios do not leave room for a phonemic distinction. The nature of this "in between" kind of L2 sound representation is then closer to a unique type of phonetic phenomenon, where perception works in a non-deterministic way and is bound to an L1 perceptual category.

▸ Further work will consider both tasks (discrimination and labelling) and prototipicality ratings performed on the exact same set of stimuli.

▸