Perceptual L2 vowel categories in L1 Spanish speakers: what late L2 speakers (do not) learn

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Intro

✓ Sound categories: the phonology perspective

  ✓ The phoneme as a categorical phenomenon

   ✓ Phonemes are seen as abstract representations of speech sounds.

   ✓ Behaviour → categorical

   ✓ Production: actual features are defined by rules

   ✓ Perpeption: also works categorically (e.g. categorical perception, Liberman et al. 1957, etc).

   ✓ Gradient phenomena pose a problem for phonological theory.

  ✓ But what about the nature of L2 perceptual categories?

✓ Can they show categorical behaviour?

Background

✓ Creation of new categories

    ✓ Flege (1995):

        ✓ Phonetic category

        ✓ Diaphone

        ✓ Equivalence Classification

        ✓ AOL correlates with nonnative pronunciation and perception

    ✓ Best (1995):

        ✓ Perceptual assimilation in naïve speakers: single-category assimilation (SC). Poor discrimination.

✓ Does this actually change at some point? How much?

Background

✓ The role of acoustic cues in L2 speech perpeption

   ✓ Escudero (2004): L2 learners learn to use the same perceptual cues as target language speakers' community

      ✓ Two L2 categories mapped onto the same L1 perceptual category

      ✓ Extra cue available for the speakers to learn (duration)

         ✓ L2 contrasts within the same cue system

         ✓ Bootstrapping problem: no auxiliary cue available for splitting the L1 category

         ✓ If learning takes place, will input be enough to form native-like categories?

            ✓ Boundaries

            ✓ Robustness

Vowel systems

✓ The /ʌ-ɑ/ contrast

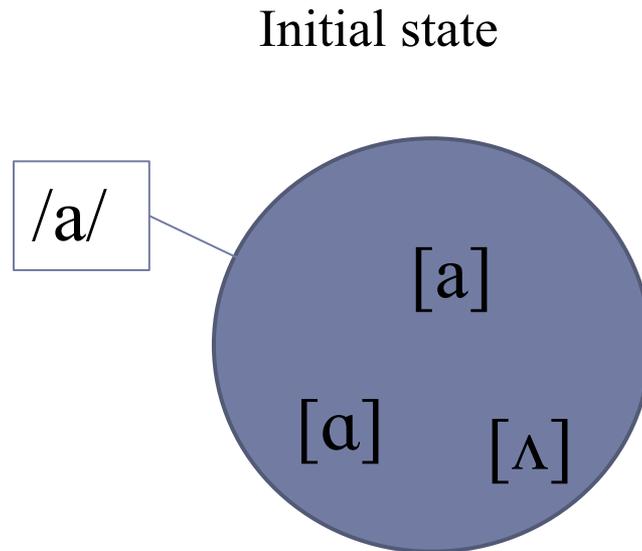**Formant values of endpoints**
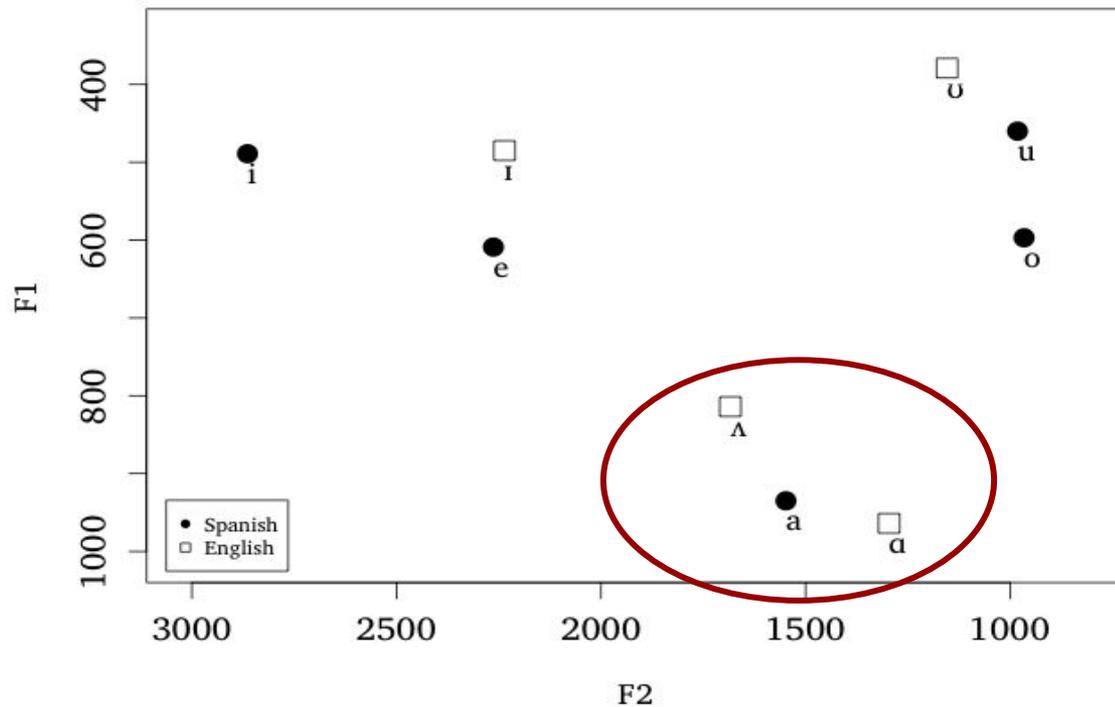
✓ Closeness in ED
✓ Both /ɑ/ and /ʌ/ mapped onto /a/

Vowel systems

✓ The L1-splitting problem
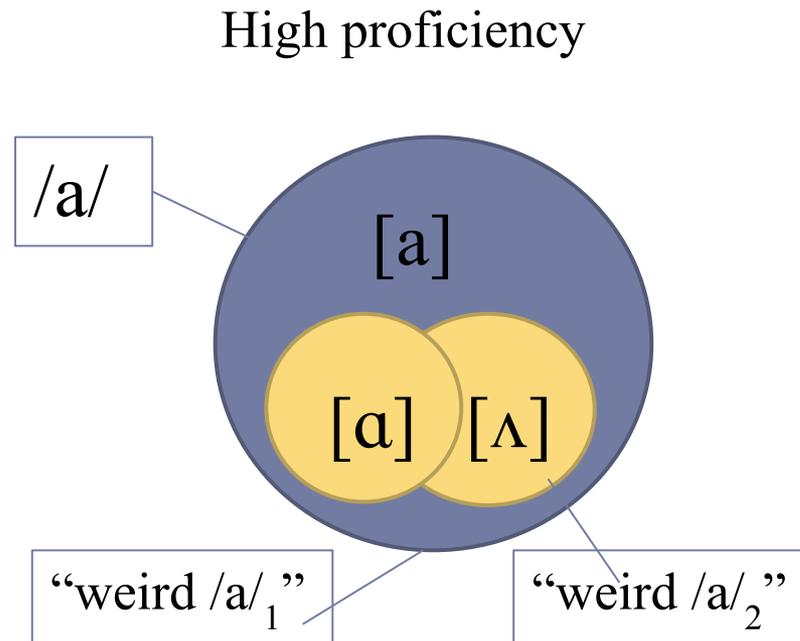
Initial state

/a/

[a]

[ɑ]   [ʌ]

Vowel systems

✓ The L1-splitting problem

High proficiency

/a/

[a]

[ɑ] [ʌ]

"weird /a/$_1$"   "weird /a/$_2$"

Vowel systems

✓ The L1-splitting problem

Ultimate attainment?

/a/ —— [a]

/ɑ/ —— [ɑ] [ʌ] —— /ʌ/
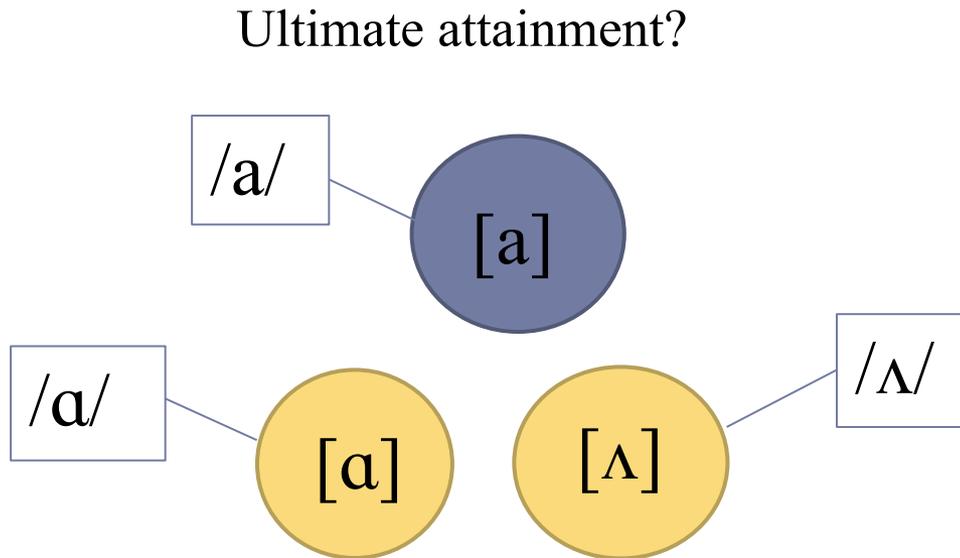
Perception of vowel categories: the experimental point of view

✓ Some tasks are designed to show the presence and behaviour of certain perceptual categories

    ✓ **Labelling**: A stimulus x from an /A-B/ continuum is presented in isolation and the Subject decides which sound it is, from a list of options. (e.g. "is this a vowel as in *cat* or one as in *bed*?")

        ✓ Downside: How do we make labels for L2 speakers? -bias in task

    ✓ **Discrimination**: two adjacent stimuli from a 7-step /A-B/ continuum (e.g. /A-B/$_3$ and /A-B/$_4$) are presented one after another, with a fixed inter stimuli Interval (ISI). Subject responds whether stimuli are the same or not

        ✓ Downside: would this work for vowels?

    ✓ **Categorical perception**: Labelling predicts discrimination along a continuum between ***two adjacent*** sounds. However, effect is <u>not consistent for vowels</u> (Schouten et al, 2003).

        ✓ Effect has been tested on stops, with VOT continuum.

This study

- ✓ Questions:
  - ✓ Where are non-native categories being mapped onto?
  - ✓ Do L2 speakers set a native-like boundary along the continuum?
  - ✓ Does endpoint-to-endpoint perception behave categorically?
- ✓ Subjects:
  - ✓ 21 native speakers of Spanish
    - ✓ 9 of them with advanced knowledge of English (Postgraduates with over 6.5 IELTS scores studying in Manchester)
    - ✓ 13 of them with beginner-low intermediate knowledge (taking short-term English courses in Manchester).
  - ✓ A third group of 8 native speakers of American English.

This study

✓ **Task**

   ✓ Software used: E-prime

   ✓ Participants were asked to discriminate as either "same" or "different" between two stimuli along the synthesized 7-step continua /ɑ–a/, /ʌ-a/, and /ɑ–ʌ/.

Continuum	Euc Dist	Diff F1 (Hz)	Diff F2 (Hz)
/ɑ – a/	253	29	252
/ʌ - a/	182	121	136
/ɑ – ʌ/	415	150	388

   ✓ Each continuum token was compared against an endpoint of the continuum.

   ✓ Reaction times were measured. Participants were told that they would have about 4 s per trial.

This study

✓ Stimuli
  ✓ Each stimulus consisted of a CVC nonce word in which V was one token of the /ɑ-ʌ/ continuum, followed by a 1s ISI and then either one of the endpoints of the continuum.
  ✓ Stimuli were presented in random order.

✓ The second set of stimuli has the arrows reversed (all the continuum tokens against the other end).

/ɑ-ʌ/$_1$ /ɑ-ʌ/$_2$ /ɑ-ʌ/$_3$ /ɑ-ʌ/$_4$ /ɑ-ʌ/$_5$ /ɑ-ʌ/$_6$ /ɑ-ʌ/$_7$
(/ɑ/)   (/ʌ/)

/ɑ - a/ results - NNS-Beginners

Discrimination along /ɑ - a/ continuum vs. /ɑ/ - NNS-B

Discrimination along /ɑ - a/ continuum vs. /a/ - NNS-B
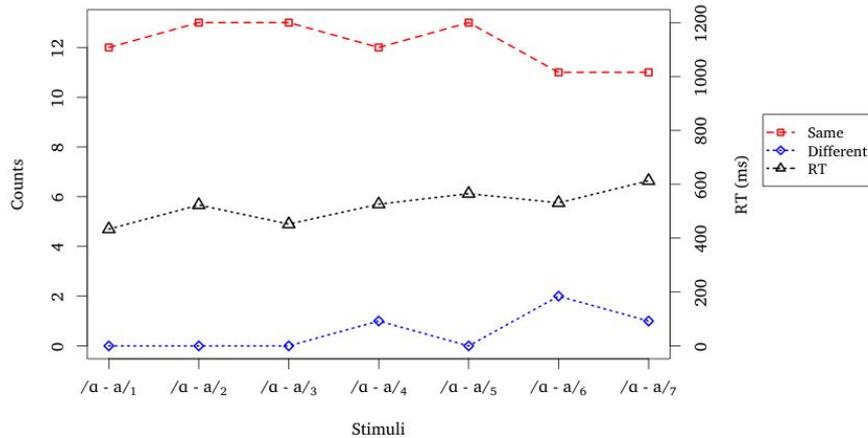
✓ No significant discrimination
✓ Flat RT lines

/ʌ - a/ results - NNS-Beginners

Discrimination along /ʌ - a/ continuum vs. /a/ - NNS-B

Discrimination along /ʌ - a/ continuum vs. /ʌ/ - NNS-B
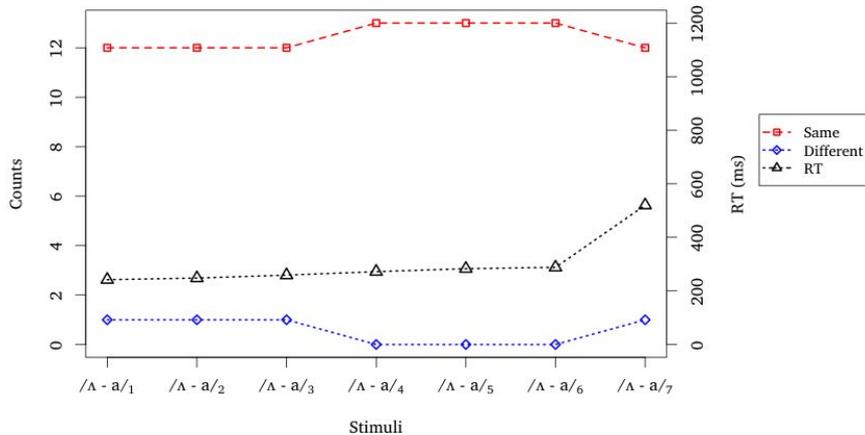
✔ No significant discrimination
✔ No significant variation in RT
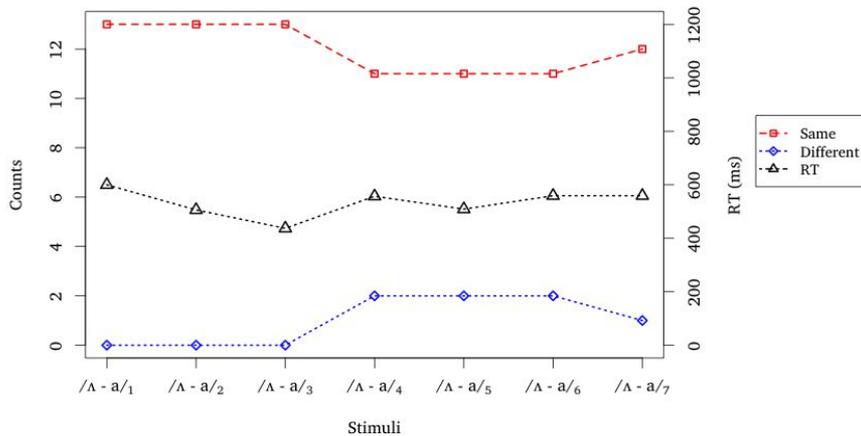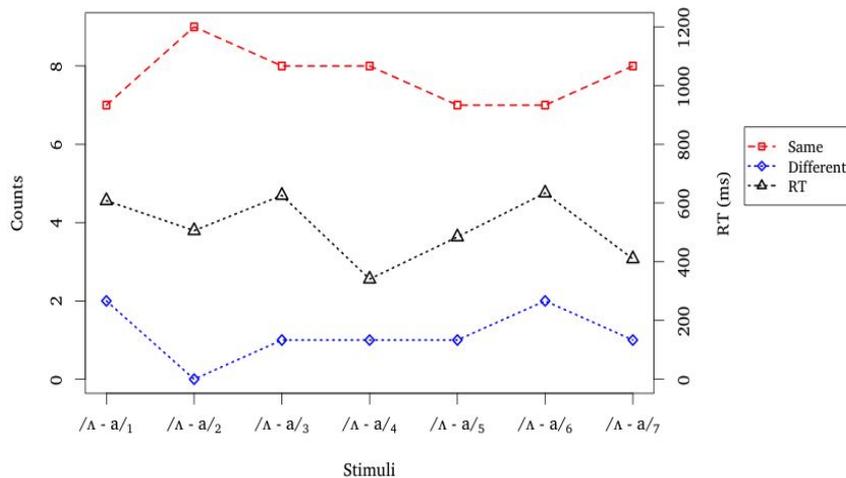
/ɑ - ʌ/ results - NNS-Beginners

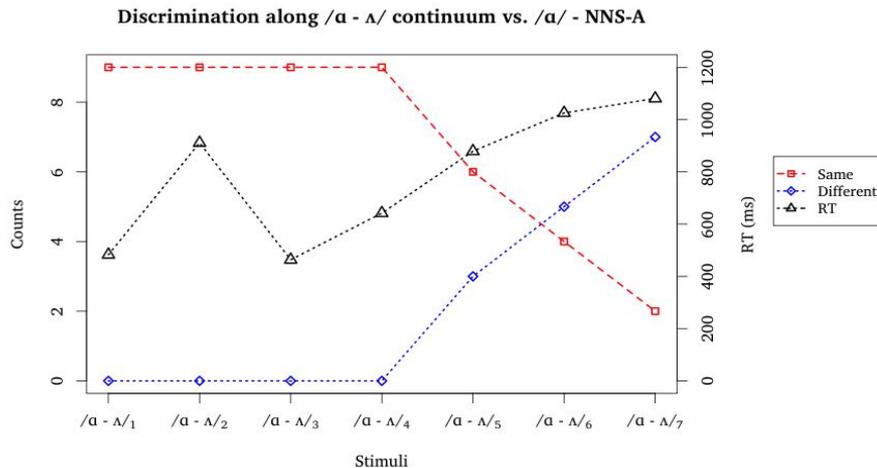Discrimination along /ɑ - ʌ/ continuum vs. /ɑ/ - NNS-B

Discrimination along /ɑ - ʌ/ continuum vs. /ʌ/ - NNS-B
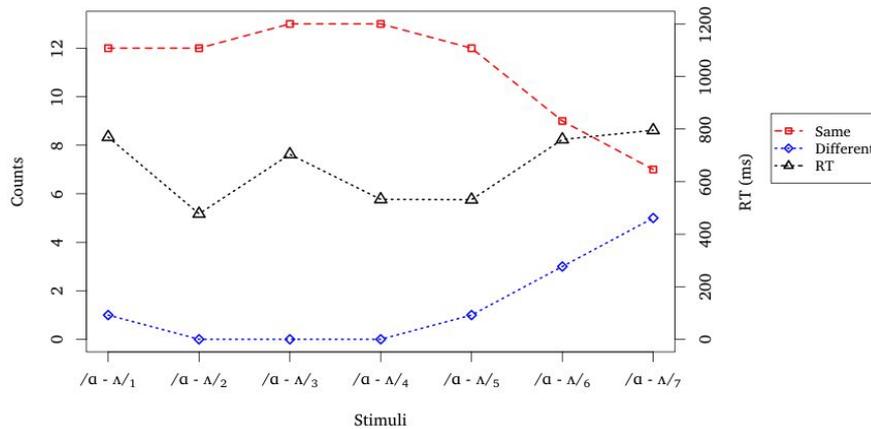
✓ Increase in discrimination at the point of maximum difference between stimuli
✓ No categorical discrimination
✓ No significant increase in RT
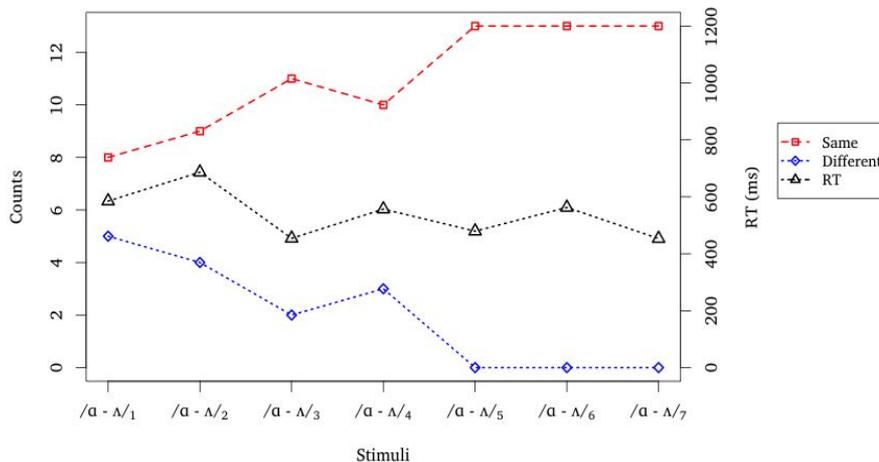
/ɑ - a/ results - NNS-Advanced
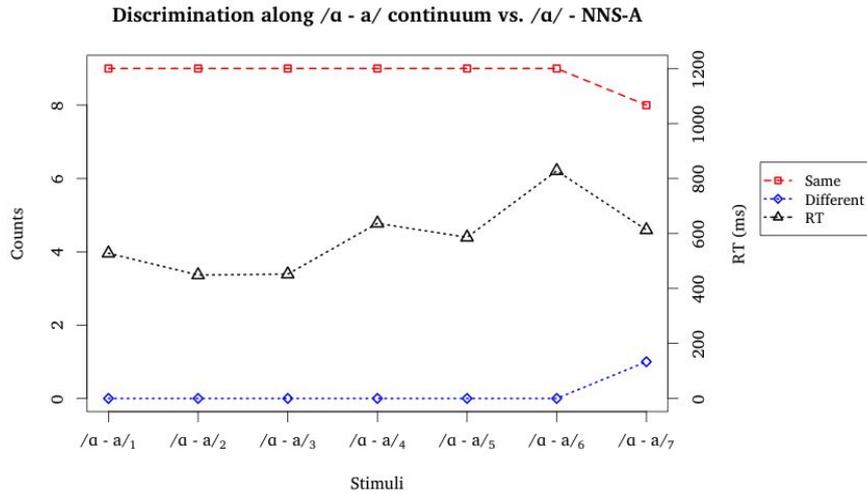
✓ Flat discrimination lines
✓ No significant increase in RT, only a mildly significant when comparing stimuli against /ɑ/

/ʌ - a/ results - NNS-Advanced

Discrimination along /ʌ - a/ continuum vs. /a/ - NNS-A
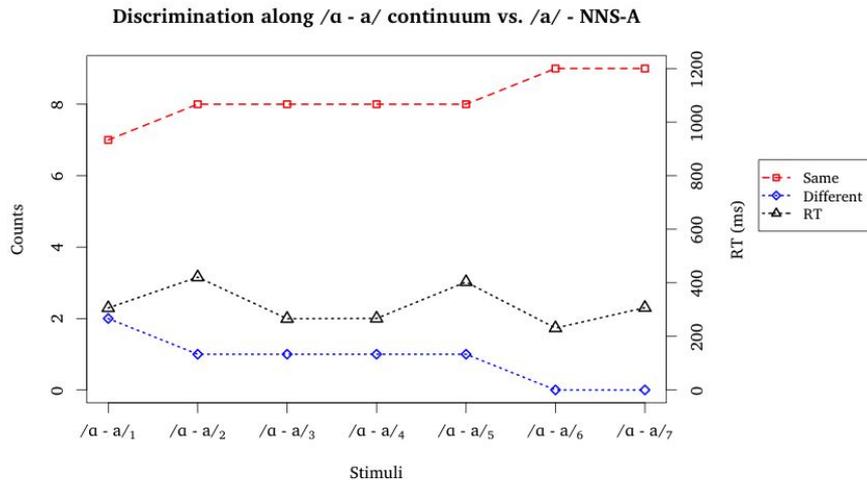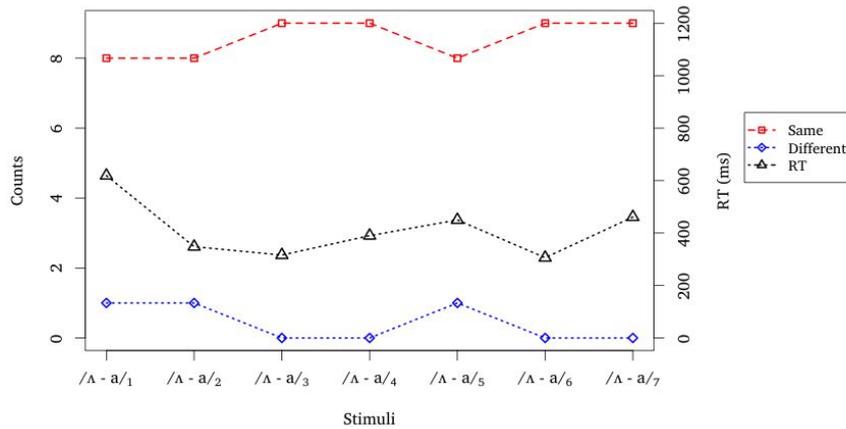
Discrimination along /ʌ - a/ continuum vs. /ʌ/ - NNS-A

✓ Mild increase in discrimination at the point of maximum difference between stimuli
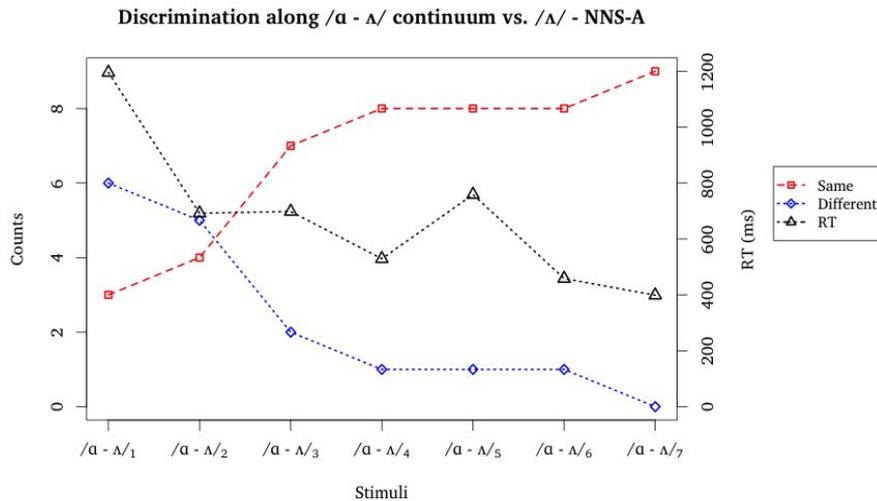✓ No categorical discrimination
✓ Random RT peaks

/ɑ-ʌ/ results - NNS-Advanced

Discrimination along /ɑ - ʌ/ continuum vs. /ɑ/ - NNS-A

Discrimination along /ɑ - ʌ/ continuum vs. /ʌ/ - NNS-A

- ✓ Crossing lines!
- ✓ Over 50% chance for discrimination on the /ʌ/ side of the continuum (2 last tokens)
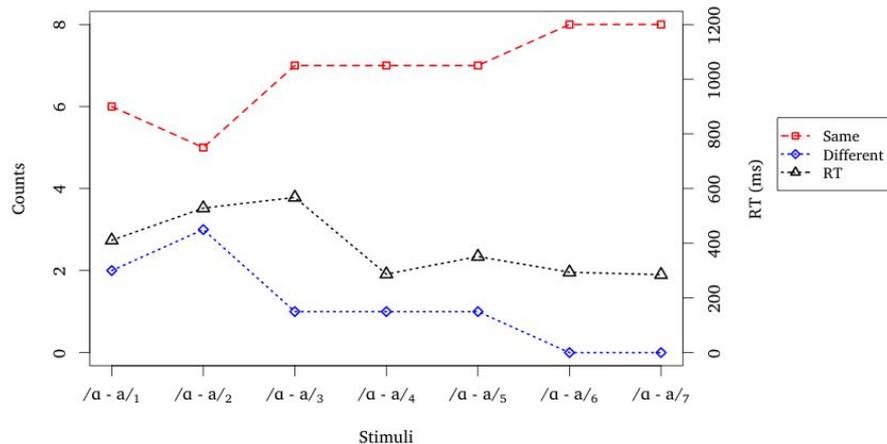- ✓ Highly significant RT increase at the point of maximum acoustic distance

/ɑ - a/ results - NS
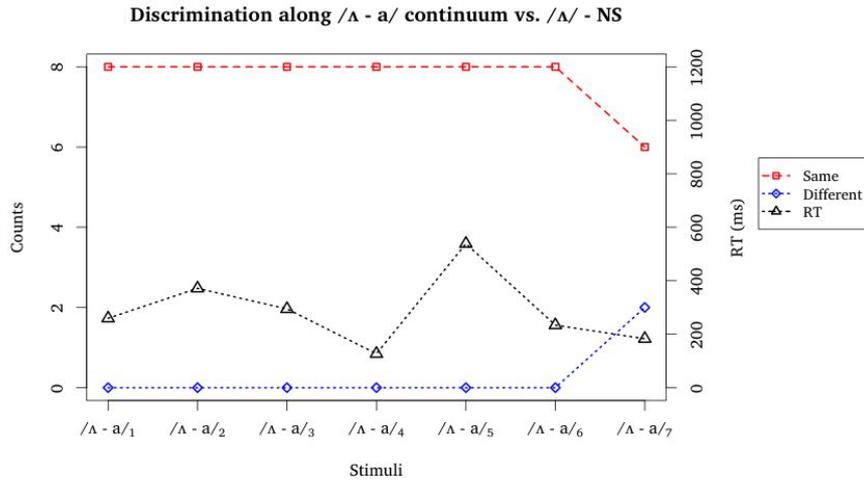

Discrimination along /ɑ - a/ continuum vs. /ɑ/ - NS
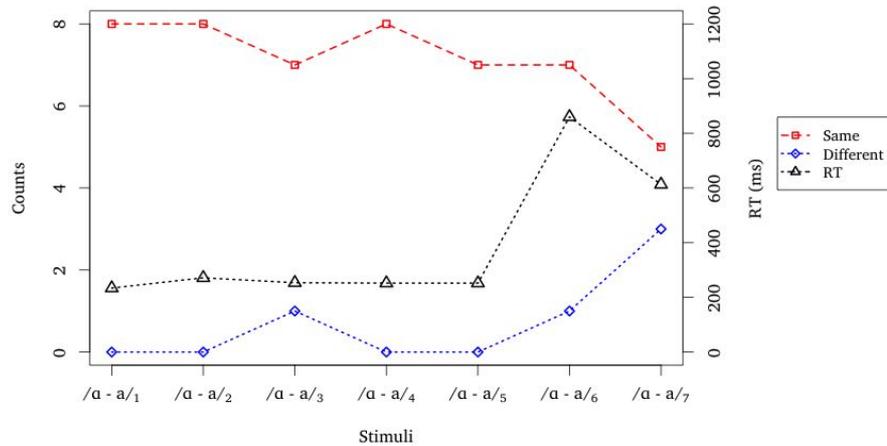
✓ Mild increase in discrimination at the point of maximum (still not reaching chance level) difference between stimuli

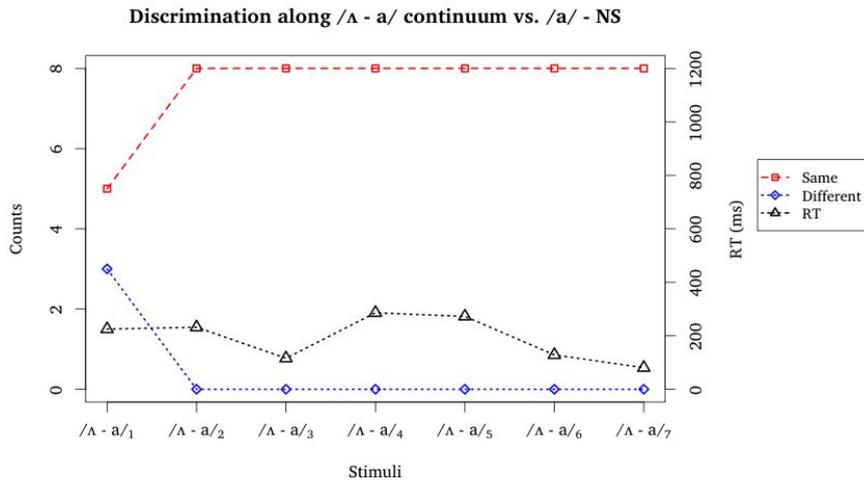✓ No categorical discrimination

✓ RT increase at end of continuum

Discrimination along /ɑ - a/ continuum vs. /a/ - NS

/ʌ - a/ results - NS

Discrimination along /ʌ - a/ continuum vs. /ʌ/ - NS
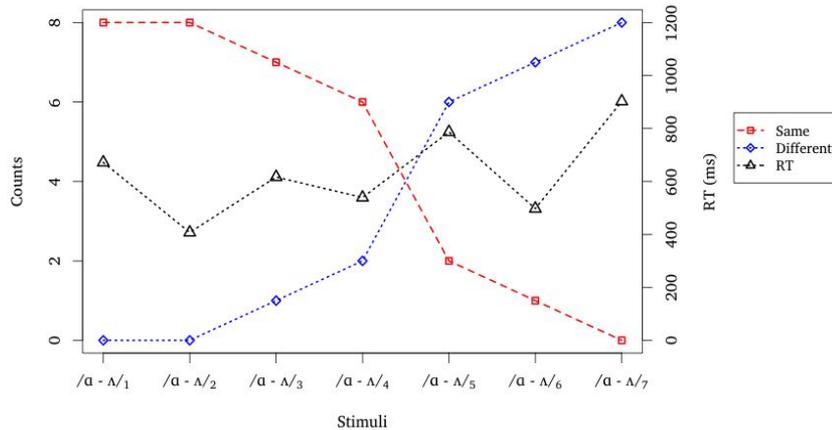

Discrimination along /ʌ - a/ continuum vs. /a/ - NS

✓ Mild increase in discrimination at the point of maximum difference between stimuli (25%)
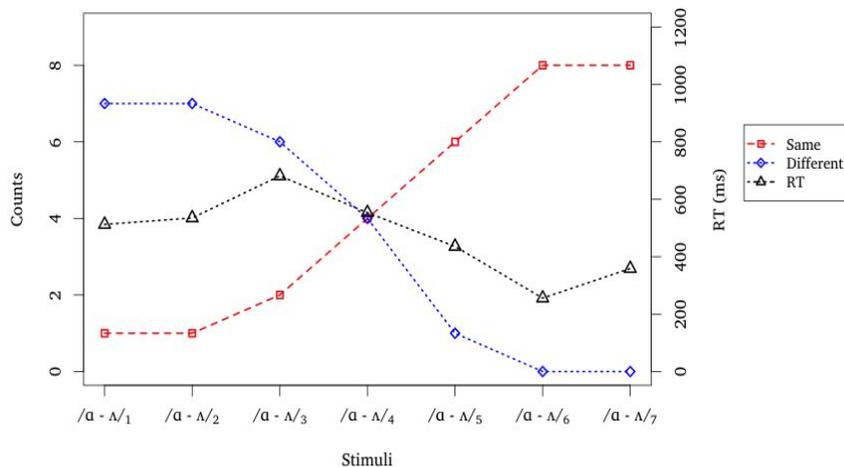
✓ No categorical discrimination

✓ No significant RT trend

/ɑ-ʌ/ results - NS
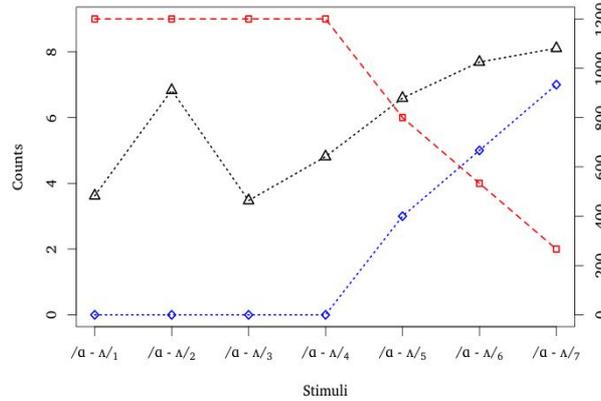

Discrimination along /ɑ - ʌ/ continuum vs. /ɑ/ - NS

Discrimination along /ɑ - ʌ/ continuum vs. /ʌ/ - NS

✓ Perfect categorical discrimination pattern

✓ Crossing lines at the middle of continuum

✓ RT increase around boundary zone

/ɑ-ʌ/ results

NS　　　　　　　　NNS-A　　　　　　　NNS-B

✓ Discussion

✓ Identification results

- ✓ Advanced NNS cannot discriminate nonnative sounds with the same accuracy as NS (but almost)
    - ✓ Intersecting lines show the presence of two category areas and a boundary (i.e. a zone with 50/50 chance of identification as either /ɑ/ or /ʌ/).
    - ✓ Crossing lines by the end of the continuum show that
        - ✓ Creation of a /ʌ/ category is in progress
        - ✓ Some learning is taking place --in the NS direction.
- ✓ Beginner NNS did not reach the 50/50 stage of sensitivity.
- ✓ NS showed clear categorical discrimination pattern.
- ✓ Perception of categories on the /ʌ/ endpoint is weaker than the /ɑ/ endpoint for all categories.

Discussion

✓ About RTs

  ✓ Both mean and median values show that NS were overall much faster than NNS-A, but not much faster than NNS-B.

  ✓ Pisoni's experiment (1974) measured perception of consonants, with VOT as variable

    ✓ A one-dimensional cue with less dispersion in prototypical values might explain the difference in RT patterns

    ✓ 300 ms ISI make comparisons much easier! (due to short-term auditory memory)

Conclusions

✓ Phonetic representations

- ✓ NS show the expected kind of identification behaviour, but RTs do not give any particular insights; the task itself is more informative than both combined.

  - ✓ Pisoni & Tash's results were explained by the short ISI, which triggers short-term auditory memory as a decision mechanism. The task is not linguistic but auditory.

- ✓ NNS-B's invariance in responses show that there are no different categories across the /ɑ-ʌ/ perceptual space.

Conclusions

✓ But…
  - ✓ NNS-A show a notorious change in RT as they reach the second category area, which shows the struggle of /ʌ/ to stand out as a category.
  - ✓ NNS-A do not store phonemic representations in their grammar in a native-like manner
    - ✓ No deterministic behaviour, but **probabilistic** (over chance, below ceiling, less robust than NSs)
    - ✓ Yet it corresponds with the target values that NSs recognise.
  - ✓ The responses are not merely aided by short-term auditory memory; they are long-term *gradient categories* that store prototypical values of an L2 category.
    - ✓ The phonetics-phonology interface is also present in perception.

Th/a/nk you

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