Perceptual boundaries and features in Chilean Spanish

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Summary

i. The Spanish vowel system: a 5-vowel system with peripheral vowels and one low central vowel.

ii. How do speakers respond to 'intermediate' vowels? Do they map them onto multiple categories with similar probabilities?

iii. Pure acoustic distance isn't a good measure of actual behaviour.

The Spanish five-vowel system

- Descriptive literature: the low vowel is centralised, from Navarro Tomás (1991) to Hualde (2005)
- /a/ specification: [+low] and either [-back] (Núñez Cedeño & Morales-Font, 1999) or [-front], [-back] (Barrutia & Schwagler, 1982).
- Underlyingly: tense, peripheral vowels: /i, e, a, o, u/; lax realisations have allophonic status.

The Chilean Spanish vowel system

- Production across dialects of Spanish varies.
- Sadowsky (2012): of all varieties for which acoustic analysis exists, Chilean Spanish has the most centralised vowel system; lax realisations in *stressed* syllables; the low central vowel realised as [ɐ].
- How do production values relate to perceptual values? What do speakers do with 'non-native' vowels whose acoustic values lie at boundaries of native categories, or well outside the expected production distribution?
- What do we predict?
  - One possibility: speakers' categorisations of unfamiliar vowels (in our study English /ɛ/ - /ʌ/ - /ɑ/) are mapped onto the Spanish category closest in acoustic space.
  - Another possibility: speakers' categorisations don't correspond to acoustic distance but to some assessment of featural distance instead; unfamiliar vowels are mapped onto the category judged to match best in feature specification.

Experiment

- Subjects: all native speakers of Chilean Spanish (N=7), little to no proficiency in a second language, no experience of living outside Chile.
- Stimuli: three 5-step continua: /ɑ - ɛ/, /ɑ - ʌ/, and /ɛ - ʌ/.
  - Synthesis was made using the Praat Klatt synthesizer (Boersma & Weenink, 2017).
  - Formant values for the continuum endpoints: reference vowels elicited by a female native speaker of American English. Fig. 1 shows the resulting continua with reference Spanish vowels.
- Task: Forced categorization task: label continuum token using Spanish-like labels.
  - Labels: pictures corresponding to Spanish /a/ /e/ /o/: 'pan', 'red' and 'ron'.
  - Tokens were presented in random order, and each was repeated five times.
  - Online, closed-access; individual participants were given unique user keys.
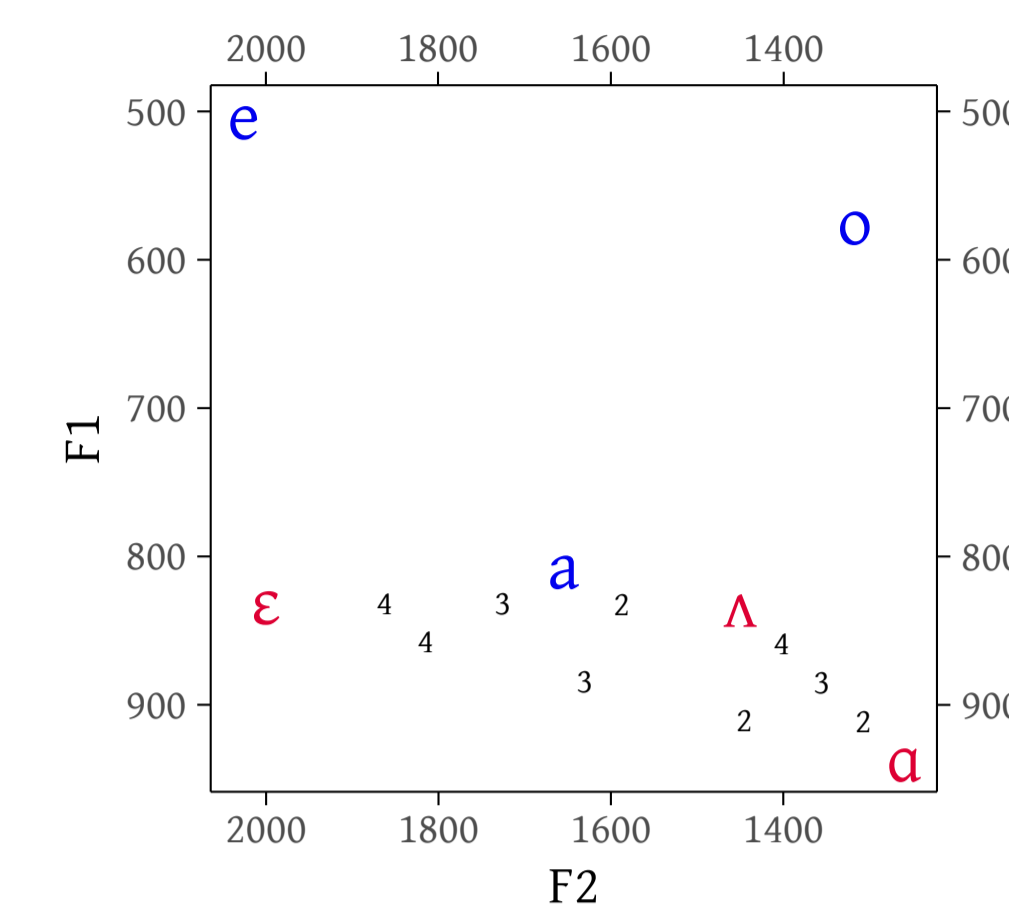 - Subjects filled out a short questionnaire on their linguistic background beforehand.

Figure 1: Continuum stimuli (endpoints), with mean values for Chilean vowels (Sadowsky, 2012)

Vowel continua

- Continuum results: figure 2.
- Along the /ʌ - ɛ/ continuum: the first three tokens (towards /ʌ/) were labelled almost equally /a/ and /o/. Listeners labelled token 3 with either /a/, /o/, and /e/ fairly equally.
  - in F1-F2 space: these tokens are very close to Spanish /a/, and fairly distant from /o/ – but are optionally categorisable as /o/ anyway.
- Along the /ɑ - ɛ/ continuum: very few /o/ responses. The boundary appears to be located between tokens 3 and 4.
  - Lower than the /ʌ - ɛ/ continuum, but otherwise fairly similar – but admit no /o/-responses.
- Along the /ɑ - ʌ/ continuum: no /e/ responses. Mostly /a/, with a declining response rate after token 2 that reached 60% by the [ʌ] endpoint.
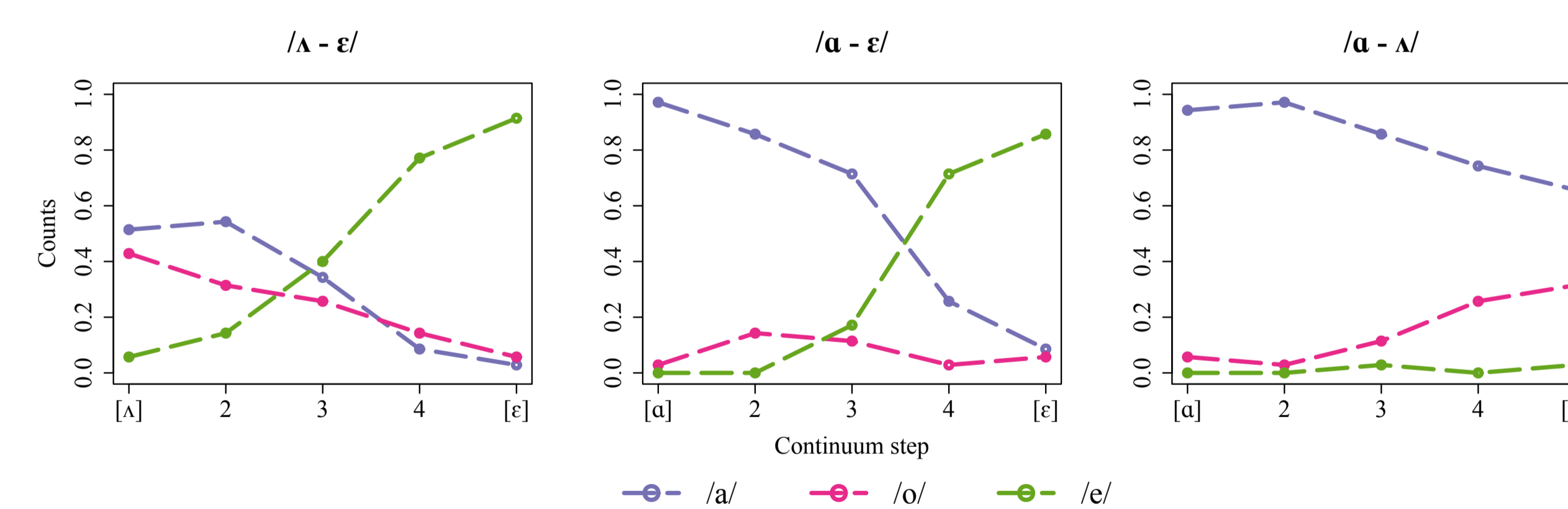

Figure 2: Categorisation results: curves represent speakers' responses along the continuum.

Endpoints

- Endpoint categorisations: figure 4.
- /ɛ/: mostly /e/. Spanish has allophonic [ɛ] in closed syllables, but F1 values are still very high: Spanish /e/ is as distant from /ɛ/ as Spanish /a/.
- /ɑ/: categorized as /a/, very confidently.
- /ʌ/: both /a/ and /o/, in a 3:2 ratio. Distance in F1-F2 space: larger between /ʌ/ and /o/ than between /ʌ/ and /a/, but apparently not large enough.
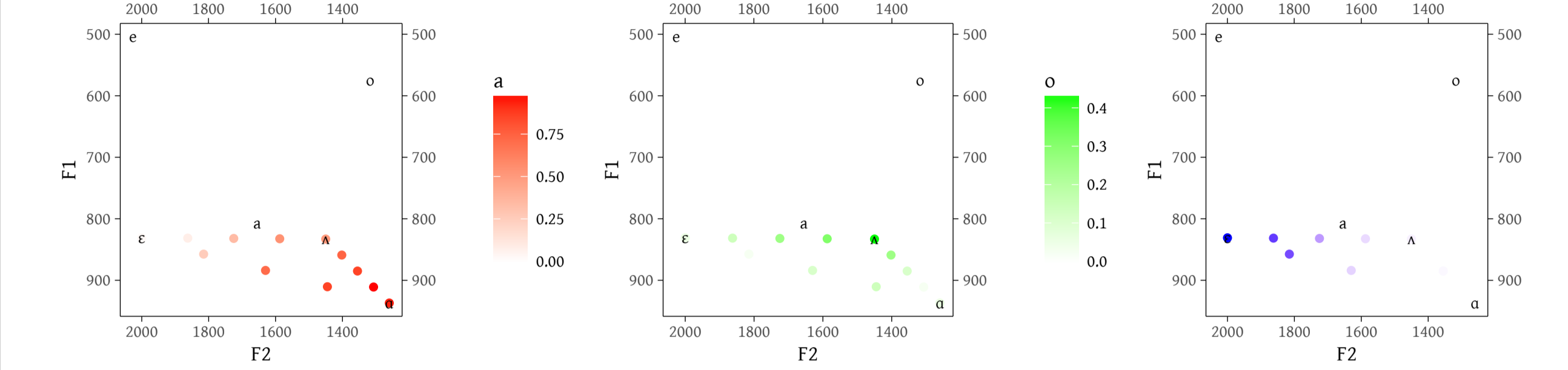

Figure 3: Categorisation probabilities plotted in F1-F2 space: a, o, e.

Boundaries

- Preference for /e/ over /a/ in /ɛ - ɑ/: speakers are sensitive to [front].
- /o/-categorization is quite variable! All the stimuli presented to listeners are unrounded; there seems to be variation in how salient rounding is in categorisation as /o/ or non-/o/ (we can attribute the overall lower rate of identification as /o/ – never approaching 100% – to speakers' sensitivity to rounding).
- The lowest and backest portion of the /ɑ - ʌ/ continuum strongly favours /a/, even though these realisations are quite distant from expected Chilean Spanish.
- Even though we don't expect Chilean Spanish /a/-productions to be very low and back, speakers strongly prefer the lowest stimuli in perception – these are the most invariably categorised as /a/. They slightly disprefer the most front stimuli for /a/, but fairly central stimuli are still acceptable: they're less sensitive to [back].
- Further evidence for dialect-specific perceptual mappings can be found in loanwords from English: /ʌ/ is variably adapted as either /a/ or /o/ in different varieties of Spanish (Barrientos & Gopal, in prep), and this corresponds to the degree of 'central'-ness of their production-spaces.
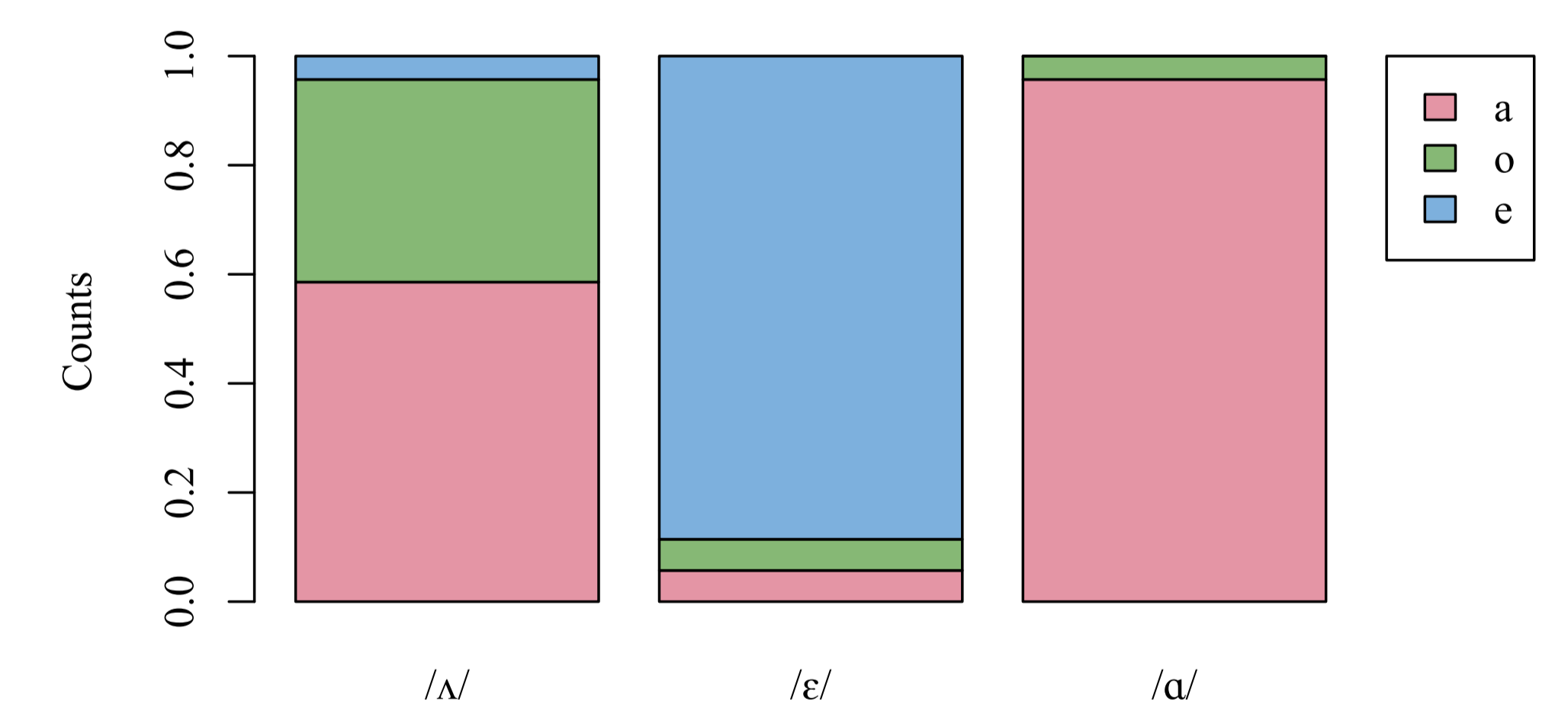

Figure 4: Results of the categorisation task at endpoints (i.e. English reference vowels only)

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