



# Phonetic Shift /ɔr/ Phonemic Change?

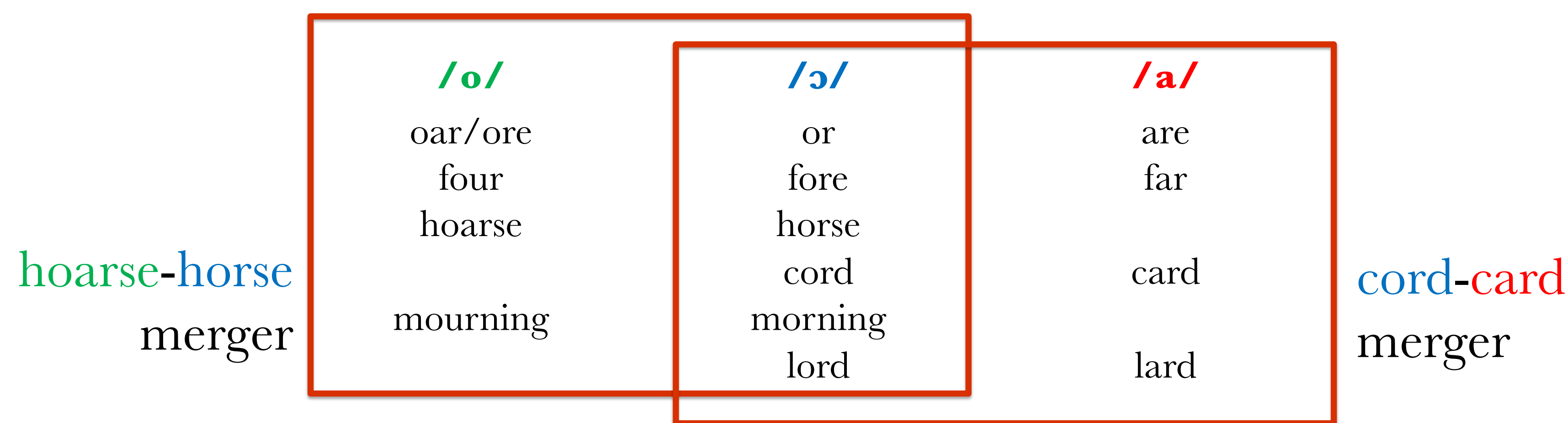
## American English mergers over 40 years

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### 1. Back vowel mergers in English<sup>[10]</sup>

- Middle English: /o/ ≠ /ɔ/ ≠ /a/ before rhotics
- Modern American English: /ɔr/ has merged into /or/ or /ar/



### In Northern Utah

- The cord-card merger was widespread in 1930s Salt Lake City.<sup>[3]</sup>
- But it was quickly replaced by the more common hoarse-horse merger.

### Research Questions

- Can a speaker shift from one merger to another in the course of their lifetime?
- Does this suggest a phonological change instead of just phonetic changes?<sup>[7][8]</sup>

### Hypotheses

- Because of the ongoing changes in the Salt Lake community, we predict that individuals can shift over time from a cord-card merger to a hoarse-horse merger.

### 2. Data Source\*

- Tom Perry (1922–2015), a notable Mormon leader
  - Born, raised, and majority of life spent in northern Utah
  - Expected to have the cord-card merger.
- Recordings of sermons Perry gave in Utah and Idaho<sup>[2]</sup>
  - 42 hours of recordings: 115 sermons over 43 years
  - Dates: 1973 (age 50) – 2015 (age 92)
  - Sermons were 9–44 min, avg. = 22 min
  - Each year represented by 16–117 min, avg. = 58 min



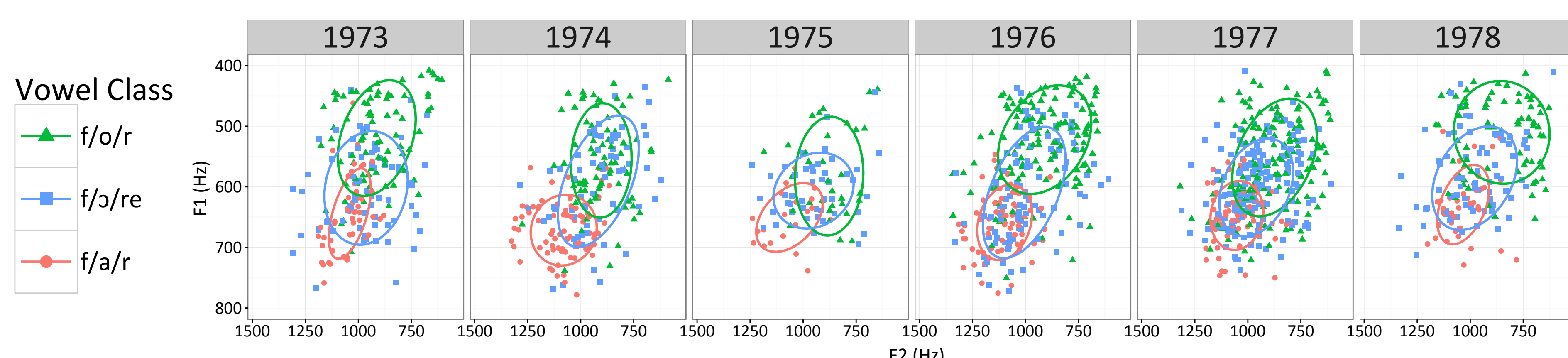
### 3. Methods

- Forced Alignment by Prosodylab-Aligner,<sup>[5]</sup> using the DARLA<sup>[11]</sup> web interface.
  - Extracted all stressed, pre-rhotic [o] and [a] (n=8,116)
  - F1 and F2 measured at point of max intensity
  - Transcription and formants hand-checked for accuracy
- Words grouped into three historically based classifications: /o, ɔ, a/<sup>[12]</sup>
- Euclidean distances between vowels
  - For each observation, the Euclidean distance was measured between it and the corresponding yearly F1, F2 centroids of the other two vowels.
- Overlap measures (see Johnson 2015<sup>[9]</sup> for comparison)
  - Pillai scores,<sup>[6]</sup> frequently used to evaluate vowel mergers, with p-values
  - Bhattacharyya's Affinity,<sup>[11][4]</sup> which might be better suited for vowel overlap
    - Values range from 0 (complete overlap) to 1 (total separation). Confidence intervals are not possible for this summary statistic, so smoothers are applied instead.

### 4. Results: Vowel mergers over time

#### 1970s: Three-way distinction

- In the 1970s, the /ɔr/ class is no closer to /a/ than it is to /o/.
- Each class has a different distribution with approximately equal overlap between them.

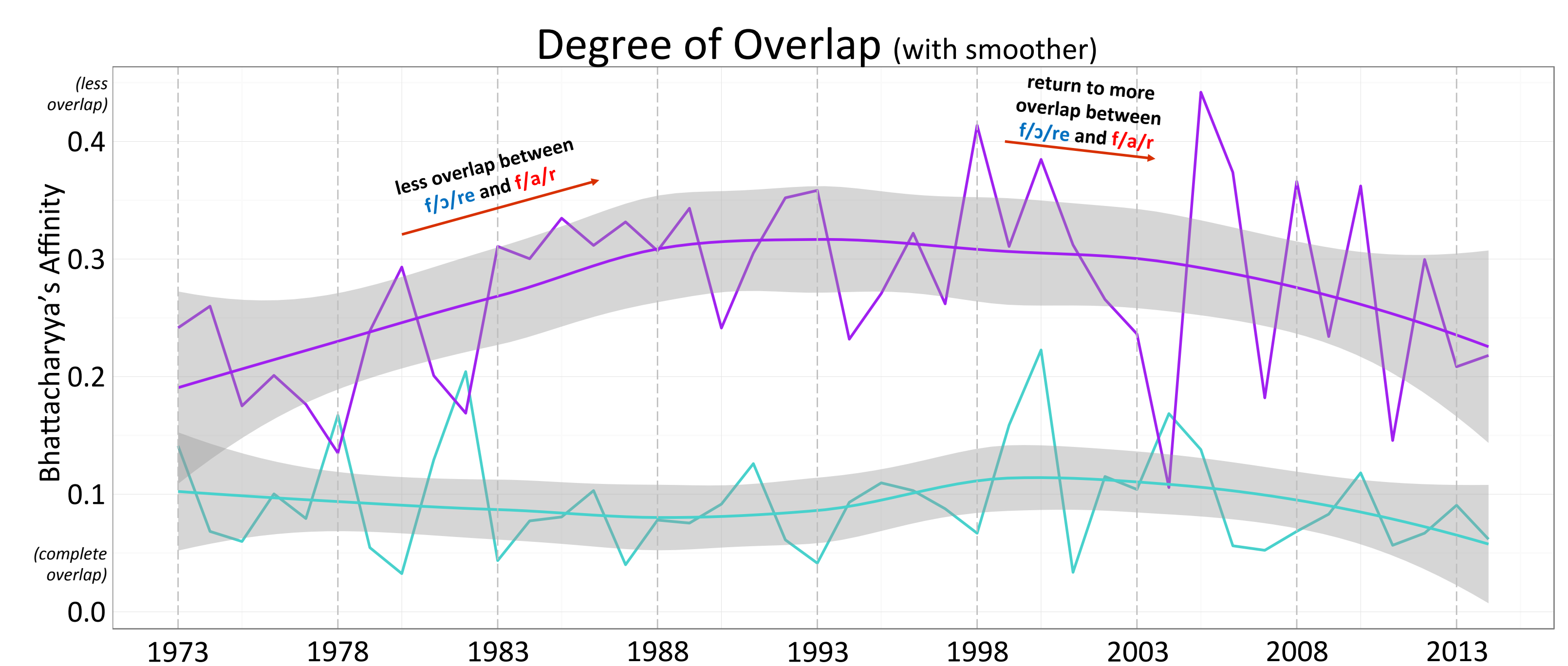
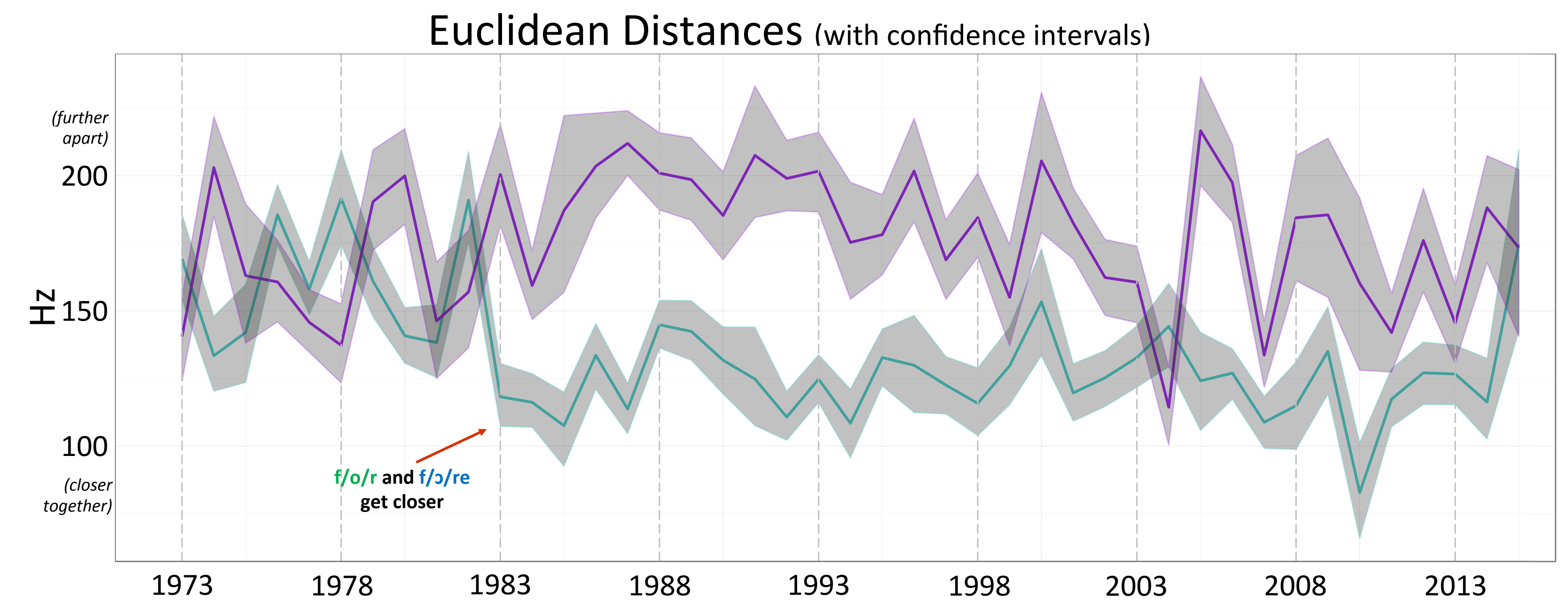
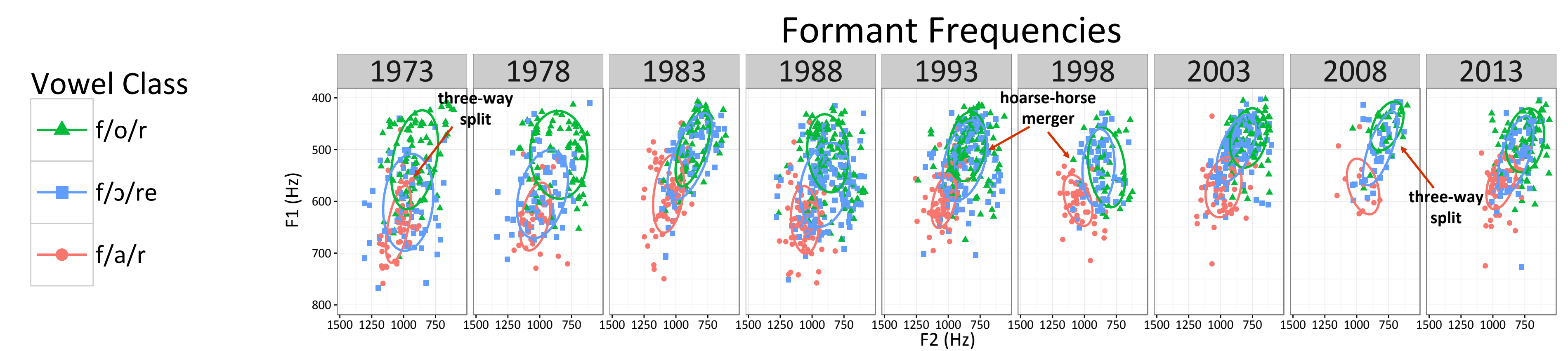


Pillai scores	f/o/r ~ f/ɔ/re	f/o/r ~ f/a/r	f/ɔ/re ~ f/a/r
1973	0.27 ***	0.47 ***	0.12 ***
1974	0.06 ***	0.57 ***	0.35 ***
1975	0.08 *	0.45 ***	0.25 **
1976	0.20 ***	0.53 ***	0.19 ***
1977	0.13 ***	0.39 ***	0.18 ***
1978	0.28 ***	0.54 ***	0.12 **

Vowels in 1973–1978, with Pillai scores for each vowel pair. \*\*\*  $p < 0.001$ ; \*\*  $p < 0.01$ ; \*  $p < 0.05$ ; .  $p < 0.1$ , NS = not significant.

### 1980s–1990s: Shift toward hoarse-horse

- The /ɔr/ class gradually raises and backs to overlap significantly with /o/r.
- Euclidean distance from /o/r to /ɔr/ decreases in 1983, remaining low for 15 years.
- Overlap of /ɔr/ and /a/ decreases from 1970s to 1990s (higher B.'s Affinity).
- F1 and F2 of /ɔr/ and /a/ decreased significantly from the 1970s to the end of the 1980s, consistent with the greatest raising and backing of /ɔr/ in the 1980s.



Vowel	df	F	p	70s/80s	80s/90s	90s/00s	00s/10s
F1	f/o/r	4	2.18	.	NS	NS	NS
	f/ɔ/re	4	4.0678	**	**	NS	NS
	f/a/r	4	6.8803	***	**	NS	*
F2	f/o/r	4	1.1984	NS	NS	NS	*
	f/ɔ/re	4	6.1405	***	**	NS	***
	f/a/r	4	11.224	***	***	NS	*

Left: the results of ANOVA tests for each vowel's formant measurements grouped by decade, e.g. aov(Formant ~ Decade), run in R. Right: post hoc t-tests tested for significant changes across decades (no Bonferroni correction). Normalized measurements (z-scored by year) were used to account for the physiological effects of aging.<sup>[13]</sup>

### 2000s: Return to a three-way distinction?

- The /ɔr/ cluster returns to the vowel space between /o/r and /a/ by 2008.
- Greater overlap between /ɔr/ and /a/ after 1993 (lower B.'s Affinity).
- However, few significant changes to F1, F2 occur in 1990s – 2010s: thus the reversal towards a split is of a smaller magnitude than the original merger.

### 5. Conclusion

**Hypothesis:** Perry changes from cord-card merger to hoarse-horse merger.

- ✗ If he started life with a cord-card merger, he had lost it by age 50.
- ✓ However, he did shift towards the hoarse-horse merger.
- ? Data suggest that late in life, Perry reversed back towards a three-way split.

### Findings

- Despite its rarity,<sup>[10]</sup> Perry had a three-way distinction in the 1970s.
- Phonetic changes are consistent with phonological recategorization.
- This is possibly another case where a speaker's vowels return to an earlier pattern.<sup>[8]</sup>

### References

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