Mergers of CURE in the eastern United States

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Introduction

Introduction

- We investigate mergers of CURE, an understudied lexical set, in the eastern United States
- We find that CURE is undergoing several conditioned mergers at different stages of completion

Vowels of interest

Lexical set[1]	IPA[2]	Binary[3]
CURE	/ʊɹ/	/uhr/
NORTH/FORCE	/oɹ/	/ohr/
NURSE	/əɻ/	/ʌhr/
DOER	/u.əɻ/	/uw.ər/

[1]Wells 1982, except for DOER. DOER = GOOSE + letter
[2]Ladefoged & Johnson 2006
[3]Labov, Ash & Boberg 2006

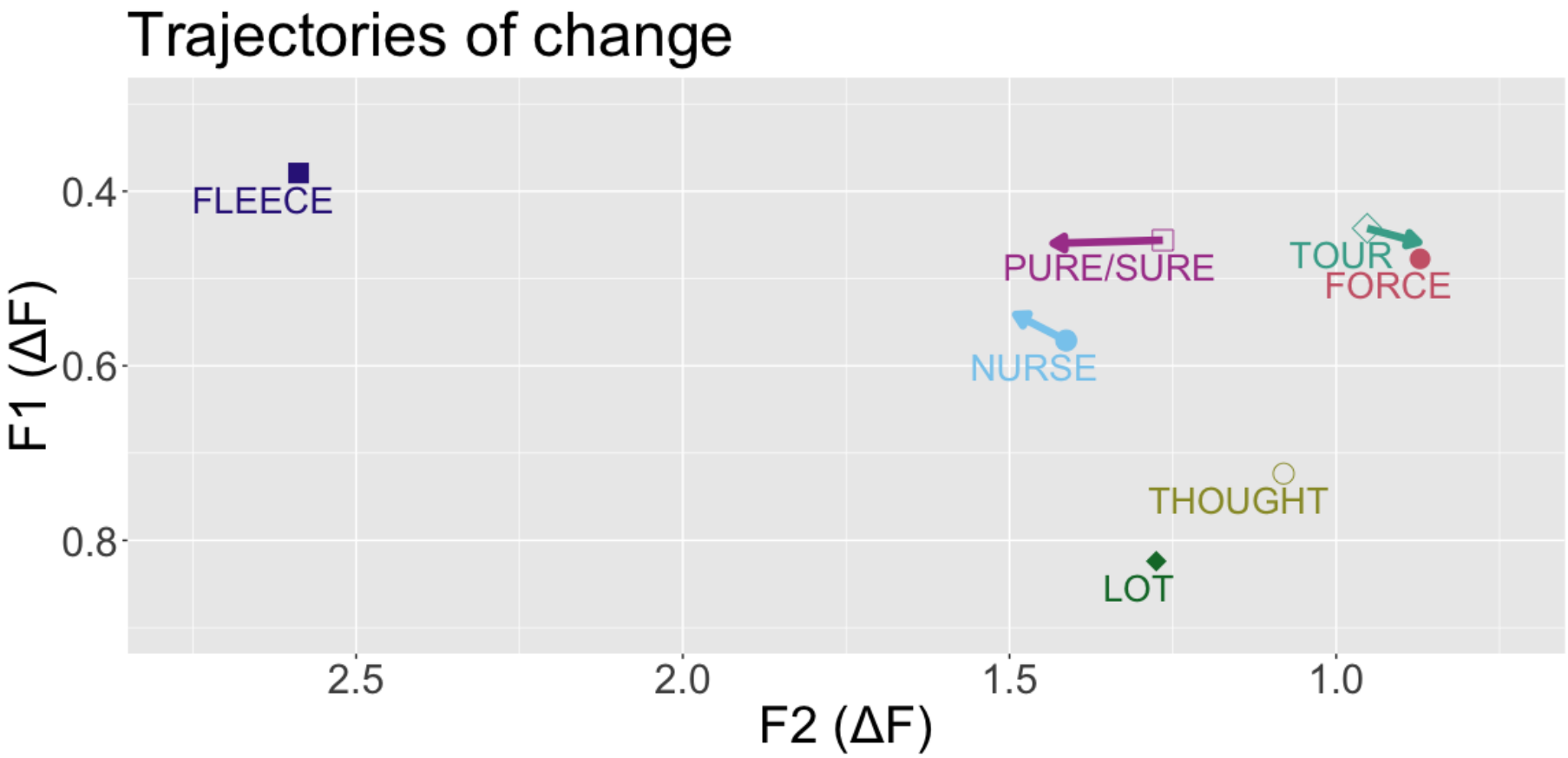
Subsets of CURE

Lexical set	Description	Examples
PURE	CURE following a non-coronal and yod	*cure, pure, demure*
SURE	CURE following a coronal and (historic) yod	*sure, endure, manure*
TOUR	CURE elsewhere	*tour, poor, moor*

Past reports of merger

CURE-FORCE merger	• historically in the South (Kurath & McDavid 1961; Thomas 2001, 2008) • New York City and the Mid-Atlantic (Labov, Ash & Boberg 2006) • Western Pennsylvania (Thomas 2001)
PURE/SURE-NURSE merger	• west of the Appalachians (Thomas 2001; see also Guenter 2000) • younger speakers in the South (Thomas 2008)
TOUR-FORCE merger	• west of the Appalachians (Thomas 2001; see also Guenter 2000)
TOUR-DOER merger	• west of the Appalachians (Thomas 2001)

Summary of changes



Outline

Methods

Overview

- Data collected in early 2024
- 737 participants recruited on Prolific
  - Self-reported native English speakers
  - From NY, NJ, PA, DE or MD
- 3-part survey hosted on phonic.ai
  - Word list
  - Rhyme judgment task (Johnson 2010)
  - Demographic survey

Word list

- CURE is too rare to use conversational data
  - Excluding *your/you're*, average of 2.59 tokens per speaker in the Corpus of New York City English (Tortora et al. in progress)
- Word list contained 50 words
  - PURE: *cure*, *impure*, *obscure*, *pure*, *secure*
  - SURE: *brochure*, *endure*, *entrepreneur*, *immature*, *lure*, *manure*, *sure*
  - TOUR: *contour*, *detour*, *gourmet*, *poor*, *tour*
- FLEECE, LOT and THOUGHT included as reference vowels

Rhyme judgment task

- A minimal pair task was not feasible due to the lack of minimal pairs
- 55 word pairs:
  - 5 pairs each from 8 target mergers
  - 10 distractor pairs
    - 5 rhymes (e.g., *beak-meek*)
    - 5 non-rhymes (e.g., *wet-lap*)
  - 5 /uw/-/yuw/ pairs (e.g., *boot-mute*)
- Presented in writing

Demographic questions

- Open response:
  - “Year of birth”
  - “Hometown (where you spent the most of your childhood)”
  - “Race/ethnicity”
  - “Gender”
  - “What language(s) did you speak at home as a child?"
  - "Highest level of education completed"

Rhyme sample

- 645 participants (92 exclusions)
  - 342 participants who accept /uw/-/yuw/ rhymes
- Birth years: 1944–2007 (median: 1992)
- Gender:
  - 362 women
  - 268 men
  - 15 other/unknown

Region	Count
Inland North	40
Mid-Atlantic	110
New York City	194
Western New England	10
Western Pennsylvania	42
Other/unknown	249

Production sample

- 253 participants
- Birth years: 1948–2007 (median: 1992)
- Gender:
  - 144 women
  - 93 men
  - 17 other/unknown

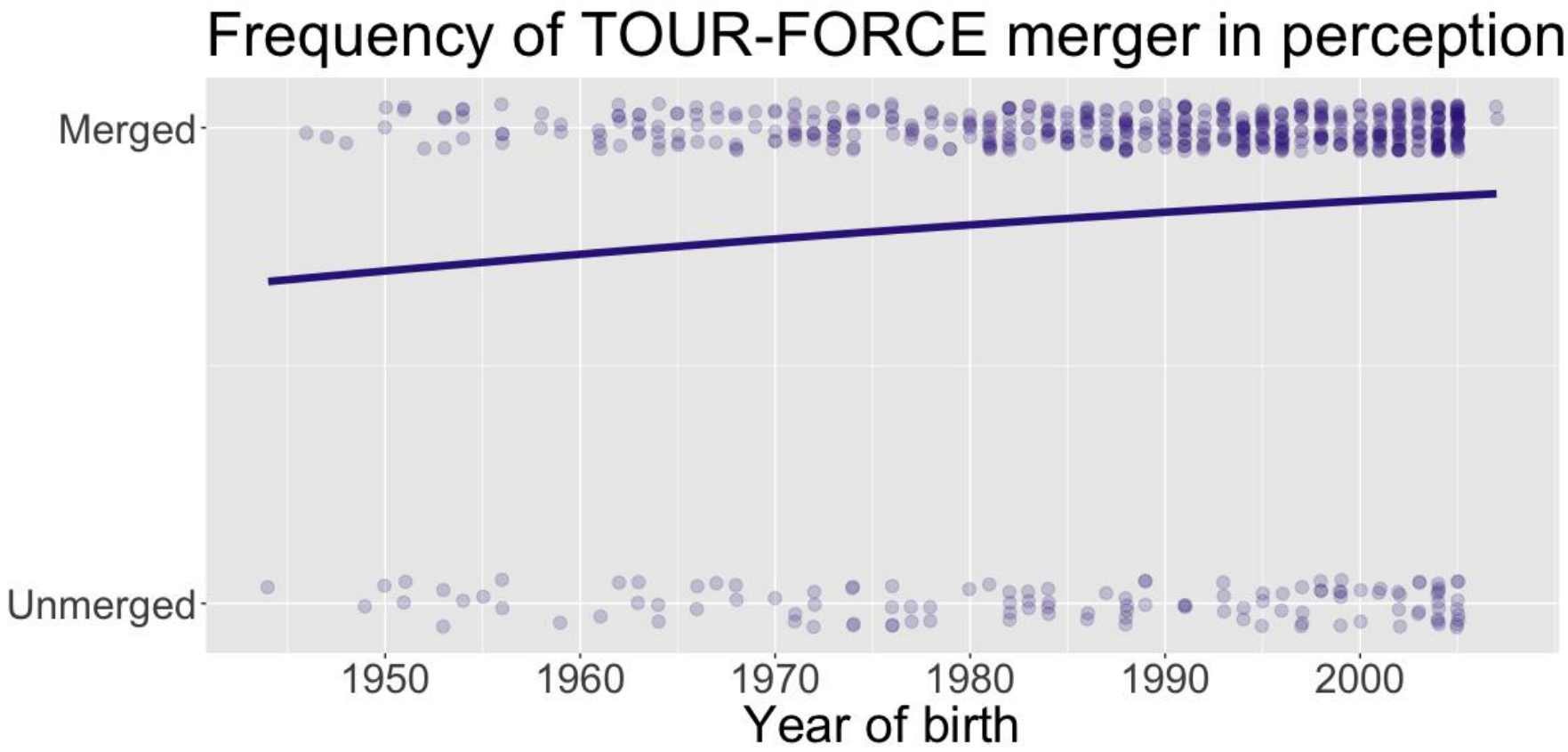
Region	Count
Inland North	12
Mid-Atlantic	45
New York City	66
Western New England	4
Western Pennsylvania	15
Other/unknown	112

Production data processing

- Formants extracted using DARLA's semiautomated pipeline (Reddy & Stanford 2015)
- Outliers removed using modified Mahalanobis distance (Stanley 2020)
- Formants normalized using ΔF (Johnson 2020, as implemented in Stanley 2023)

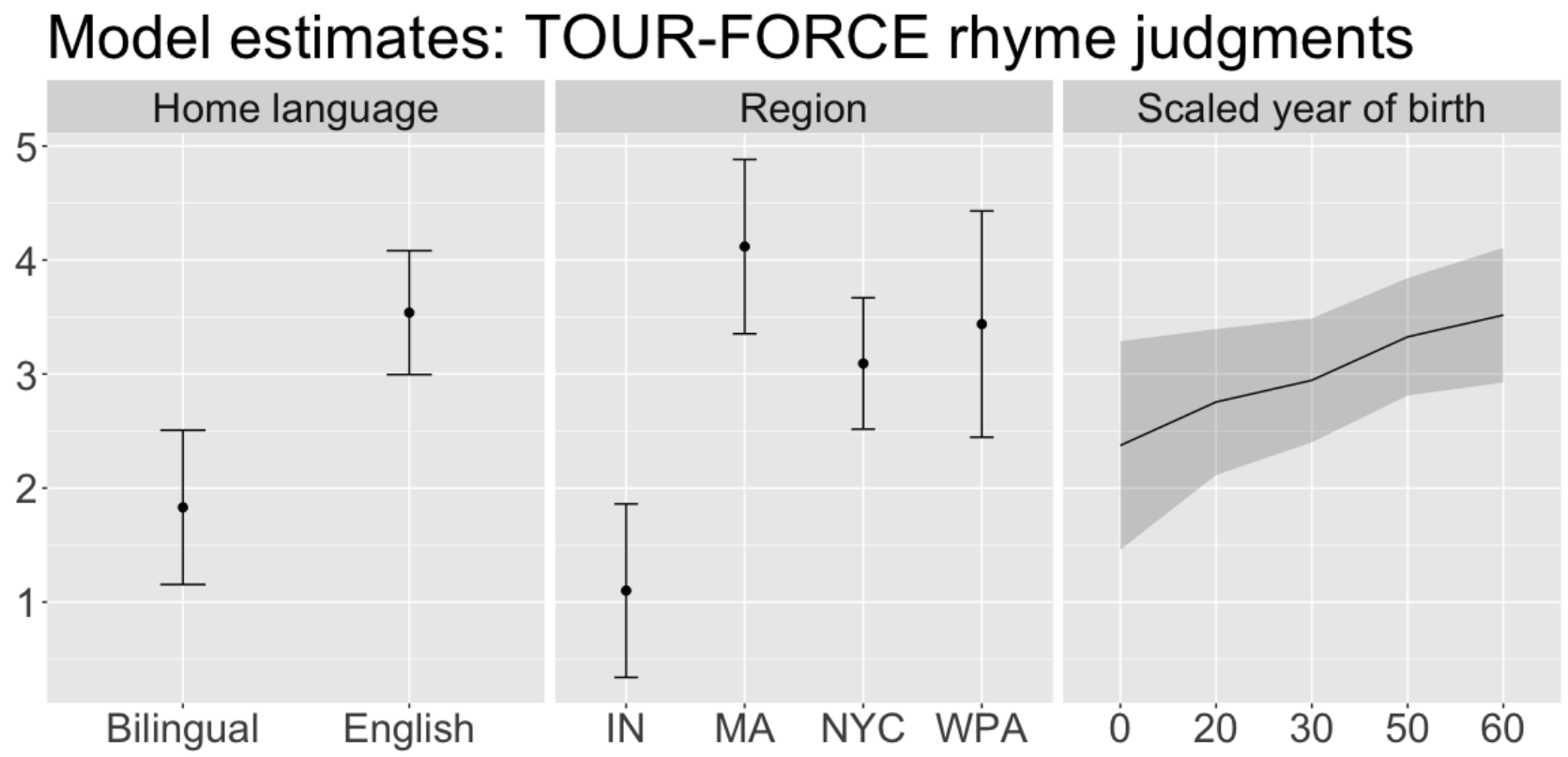
The TOUR-FORCE merger

TOUR is merging in perception with FORCE



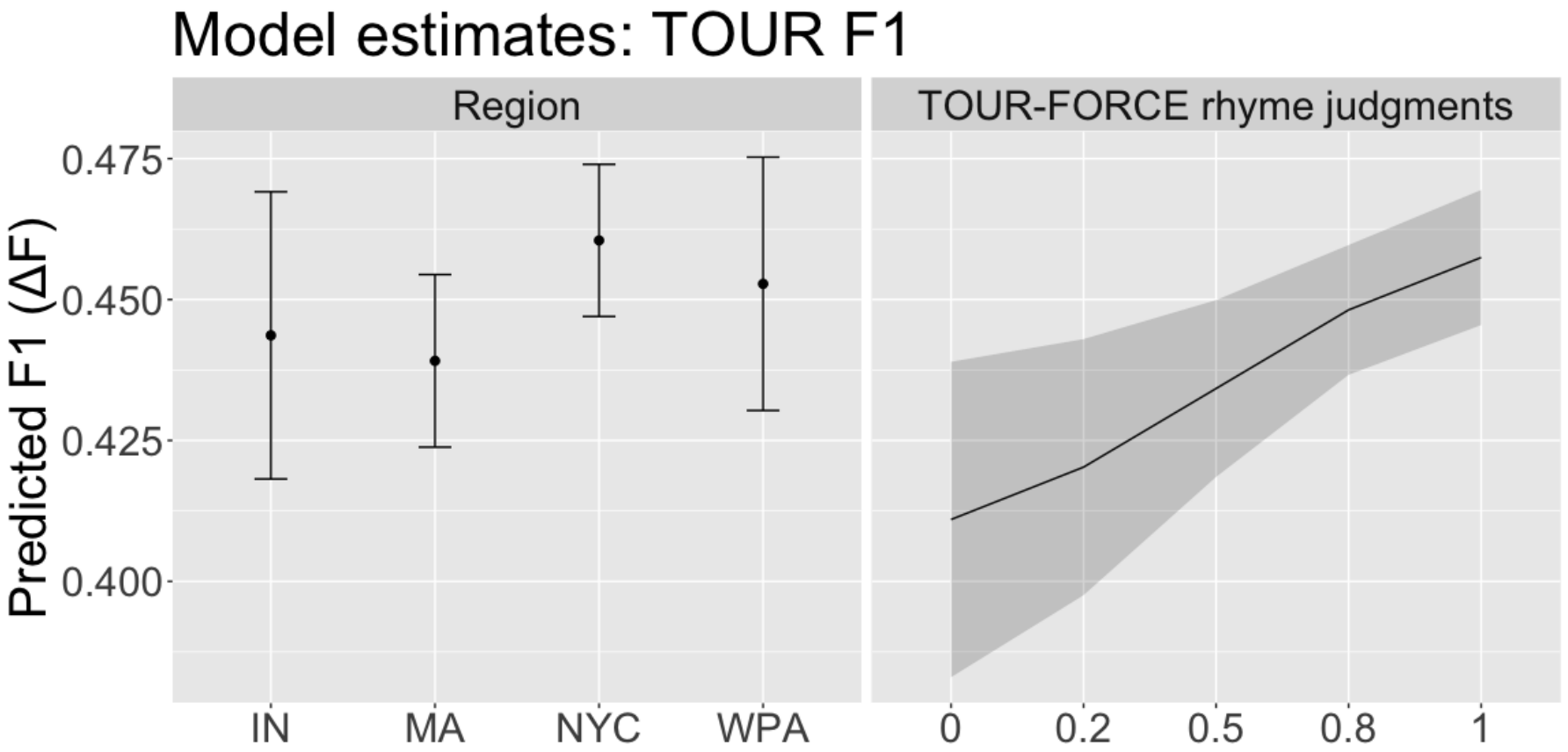
A speaker was considered merged if they said that at least 4/5 of the target pairs rhymed.

TOUR is merging in perception with FORCE



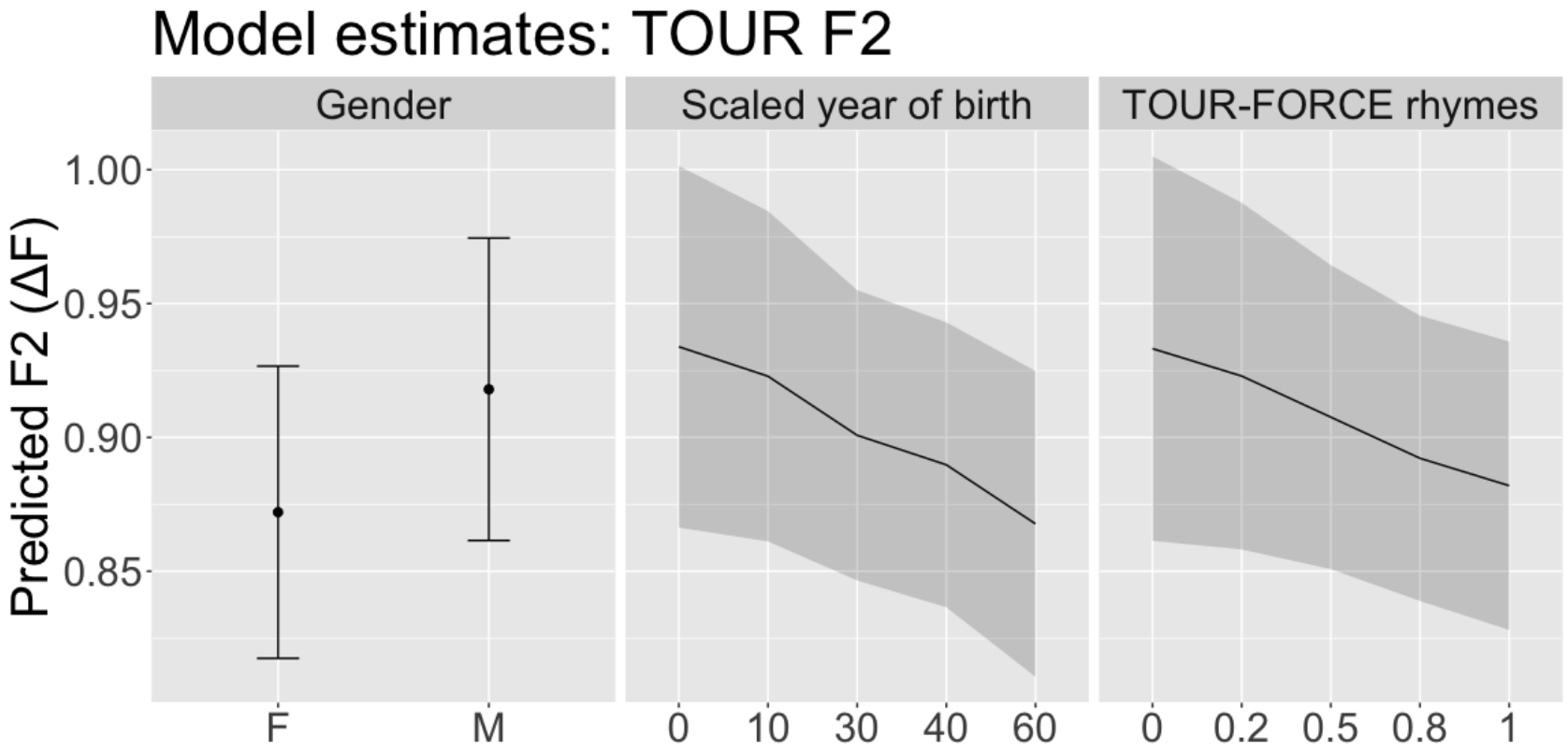
glmer(rhyme judgement ~ scaled year of birth + region + language + (1 | pair) + (1 | participant), family = "binomial"). N=386. Obs = 1928.

Due to TOUR lowering



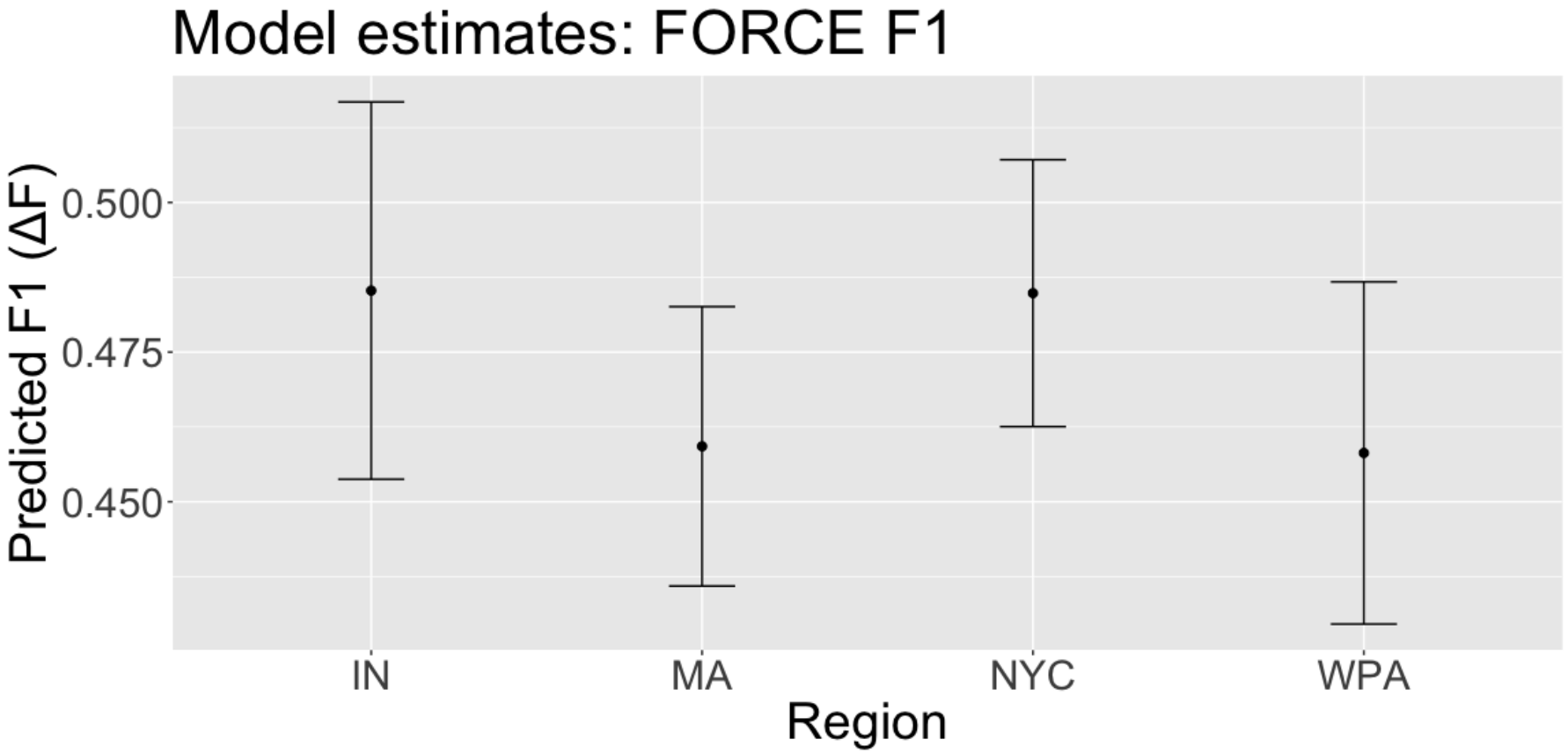
lmer(F1 (ΔF) ~ TOUR-FORCE rhyme judgments + region + (1 | word) + (1 + vowel | participant)). N=135. Obs=598.

And backing

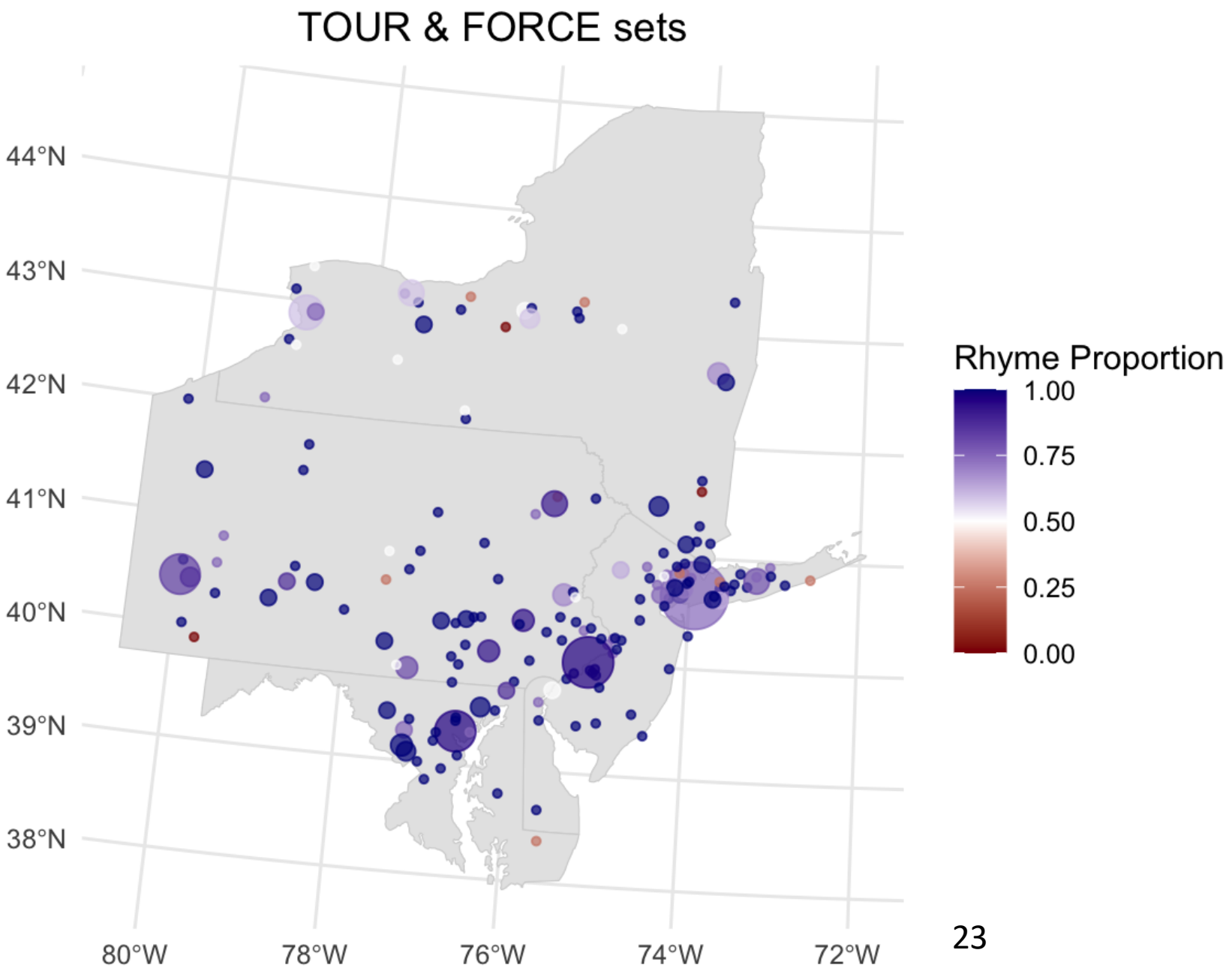


lmer(F2 (ΔF) ~ TOUR-FORCE rhyme judgments + scaled year of birth + gender + (1 | word) + (1 + vowel | participant)). N=235. Obs=1050.

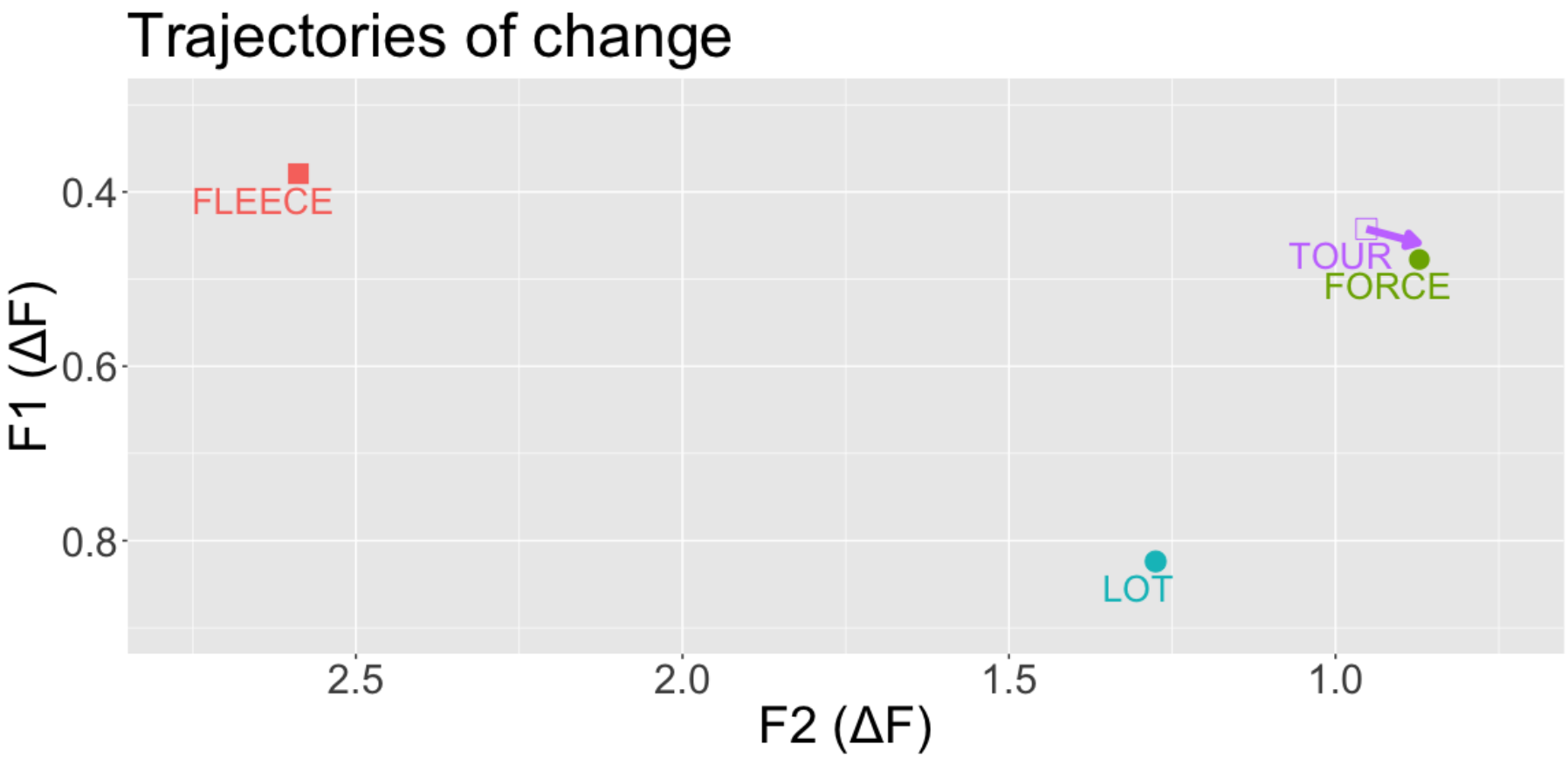
But in the Mid-Atlantic and Western PA, FORCE raises



`lmer(F1 (ΔF) ~ region + (1 | word) + (1 + vowel | participant)).`
`N=136. Obs=612.`

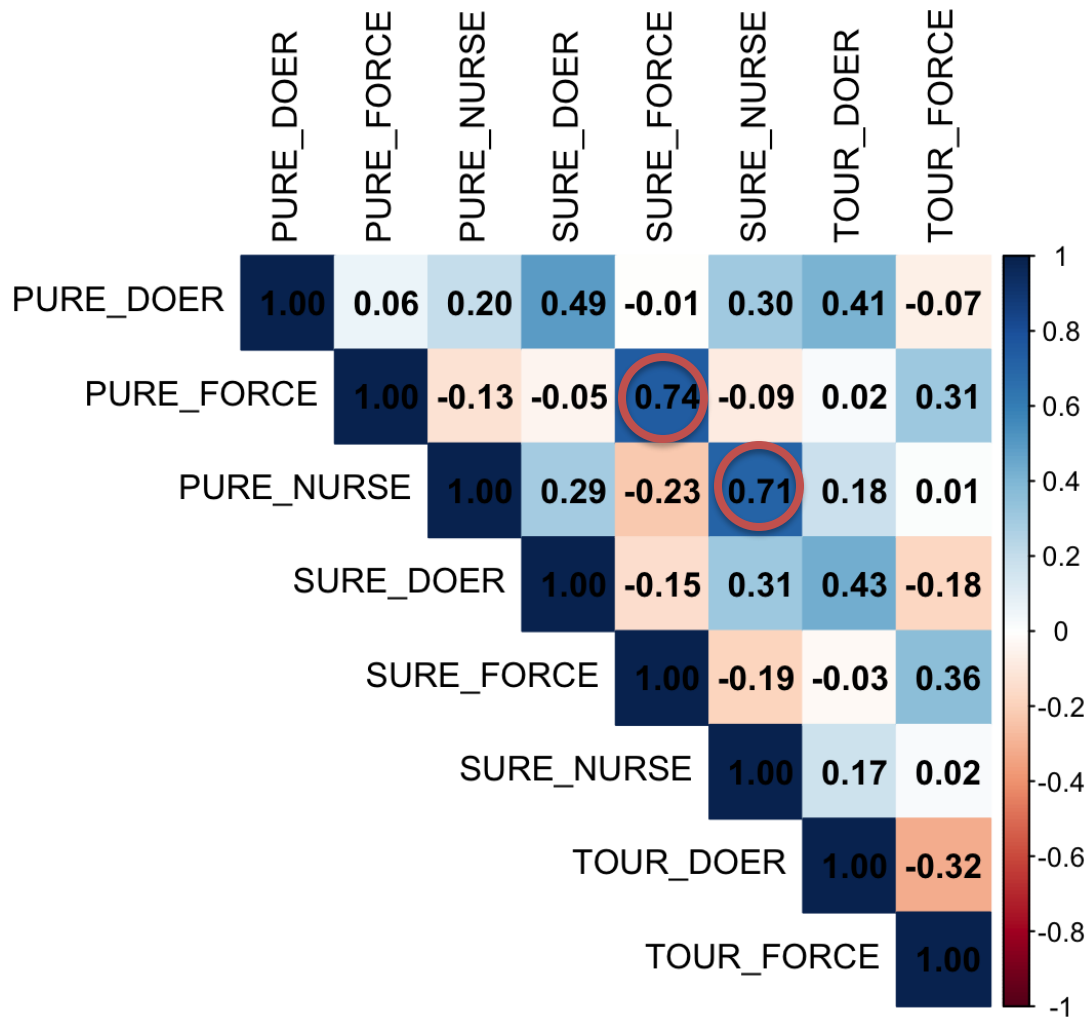

TOUR & FORCE sets
44°N
43°N
42°N
41°N
40°N
39°N
38°N
80°W
78°W
76°W
74°W
72°W
Rhyme Proportion
1.00
0.75
0.50
0.25
0.00

TOUR is merging to FORCE

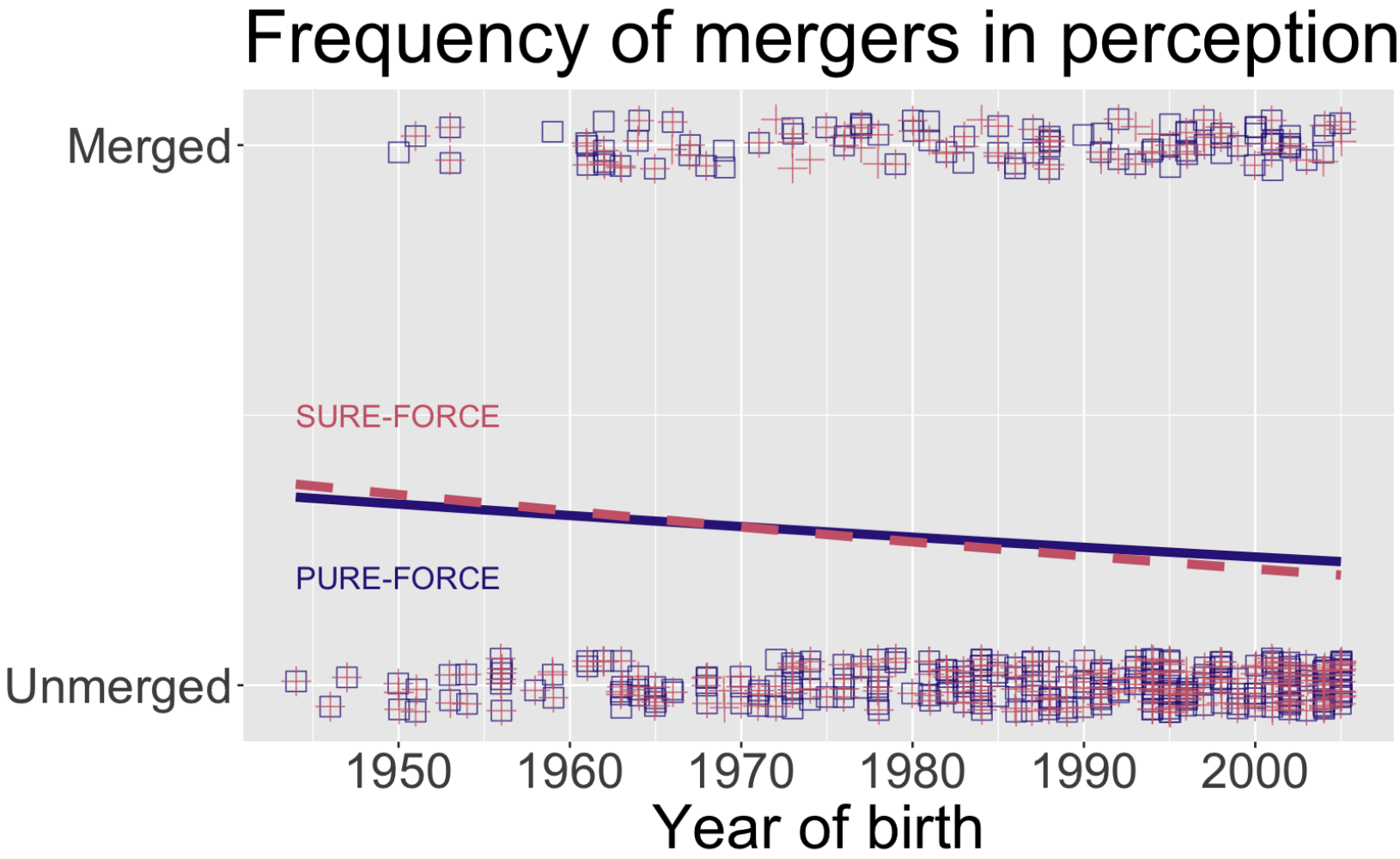


The PURE/SURE-FORCE merger

PURE and SURE pattern together



PURE/SURE mergers with FORCE in perception are waning in apparent time



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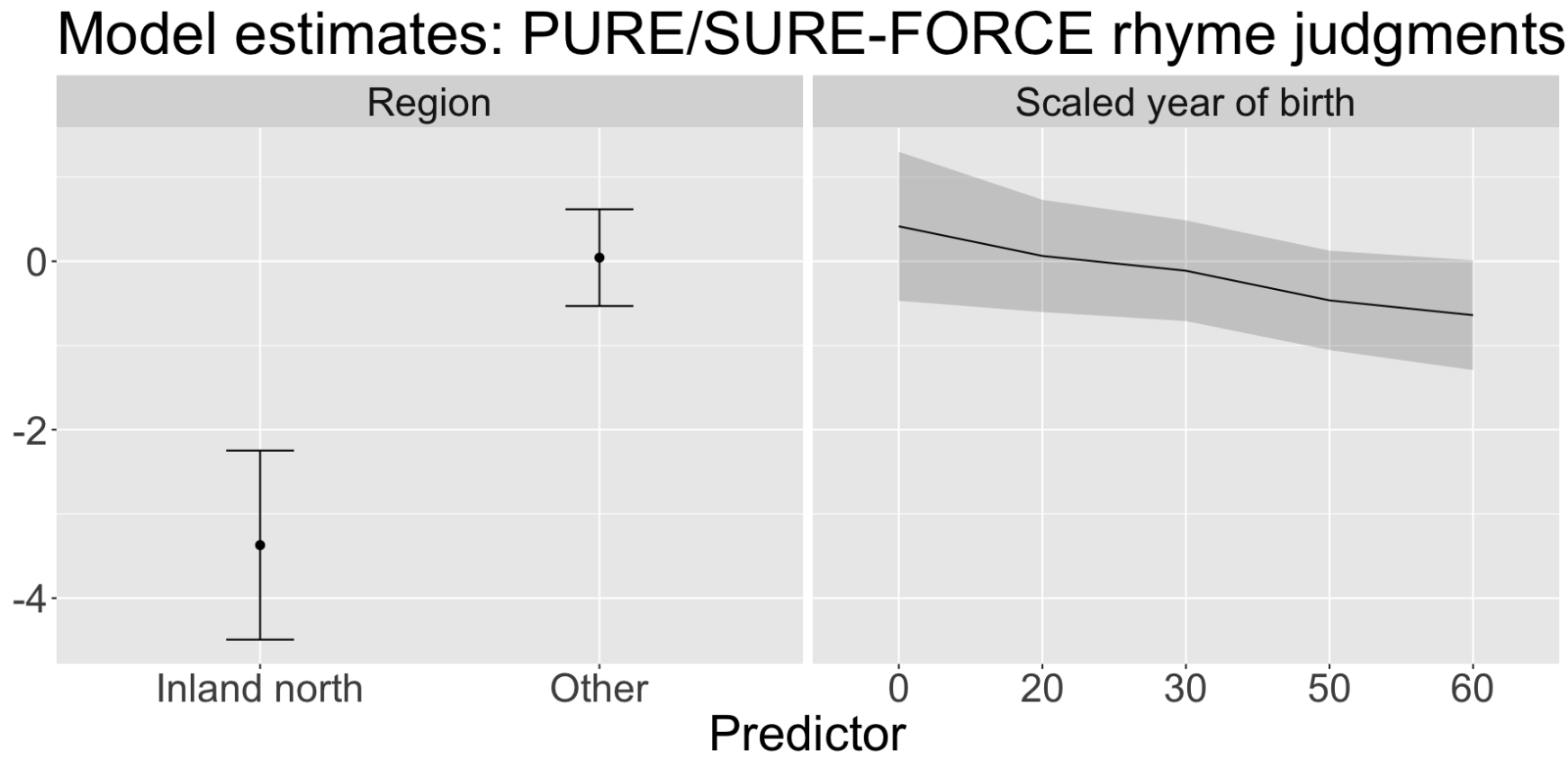
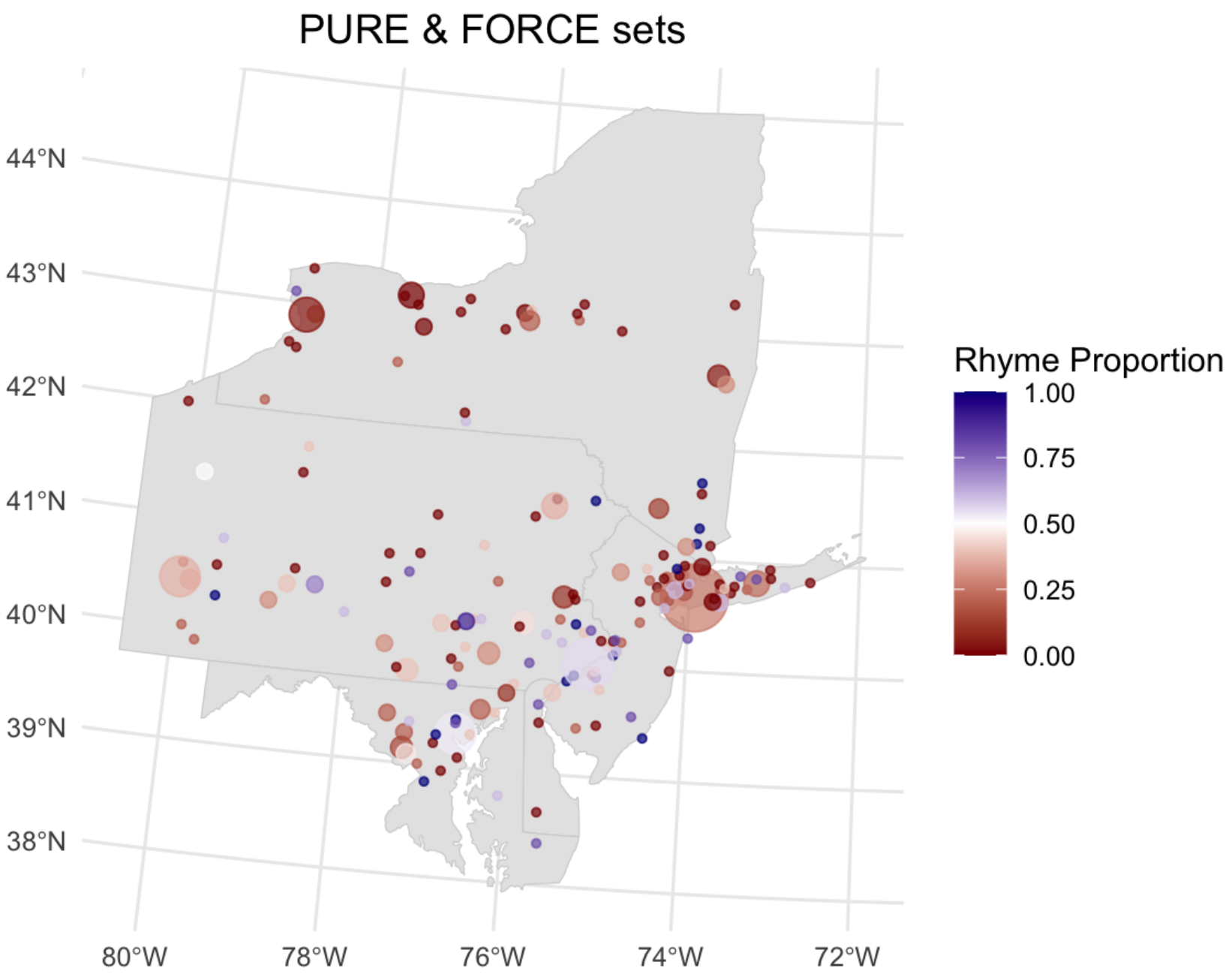


`glmer(rhyme judgement ~ region + scaled year of birth + (1 | pair) + (1 | participant), family = "binomial"). N=216. Obs=2160.`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0.75
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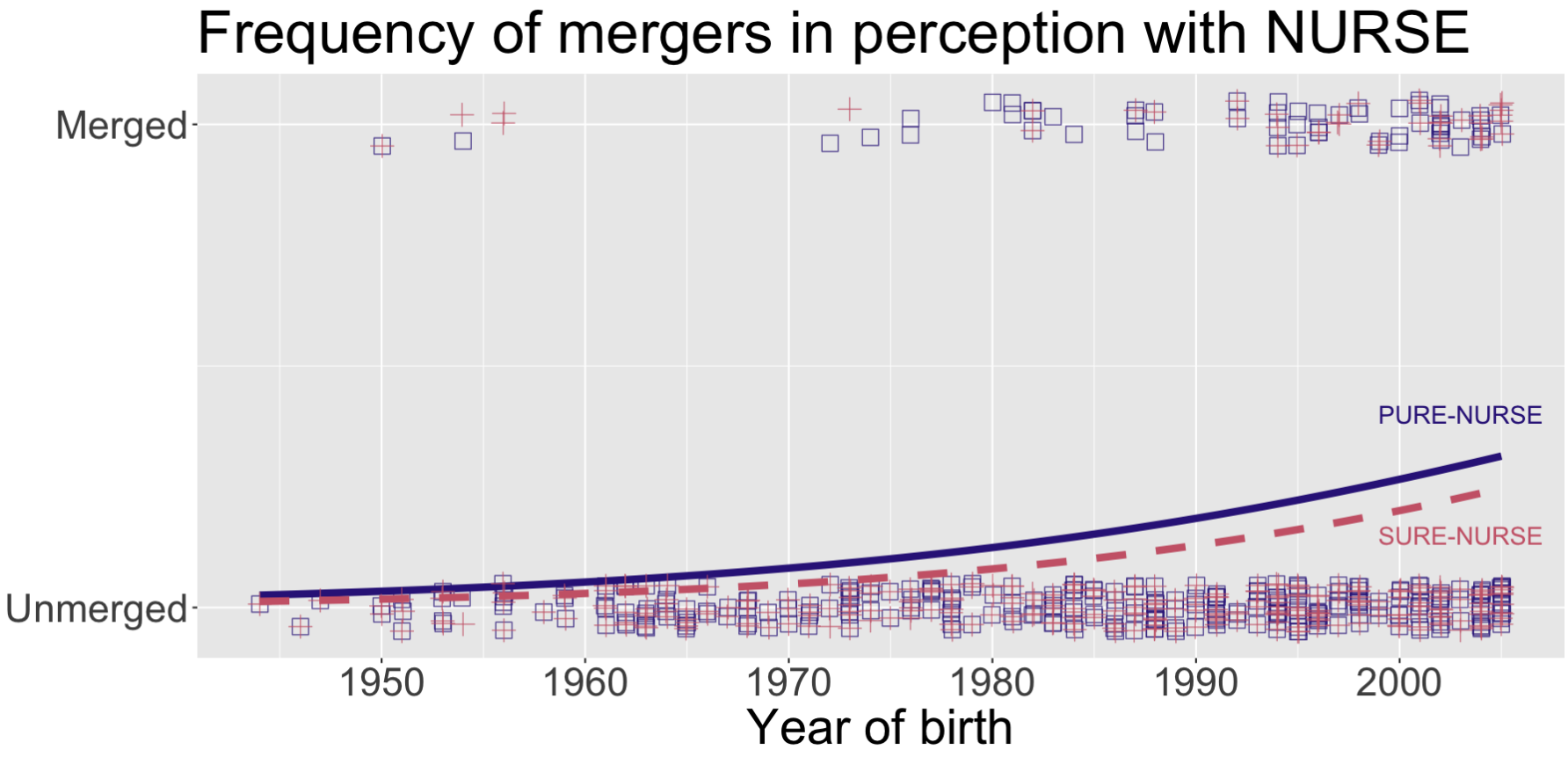
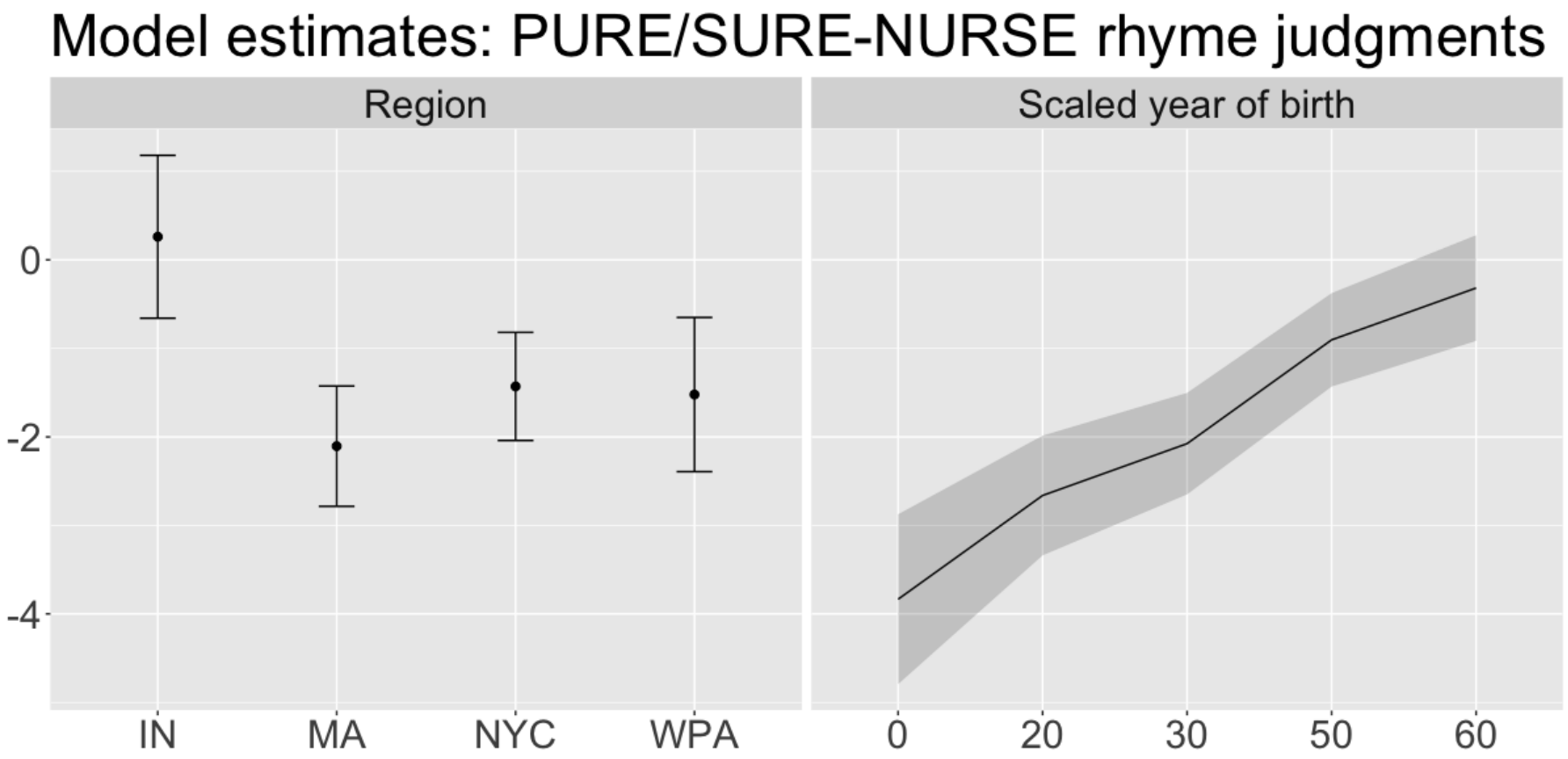
0.00

The PURE/SURE-NURSE merger

PURE/SURE is merging in perception with NURSE

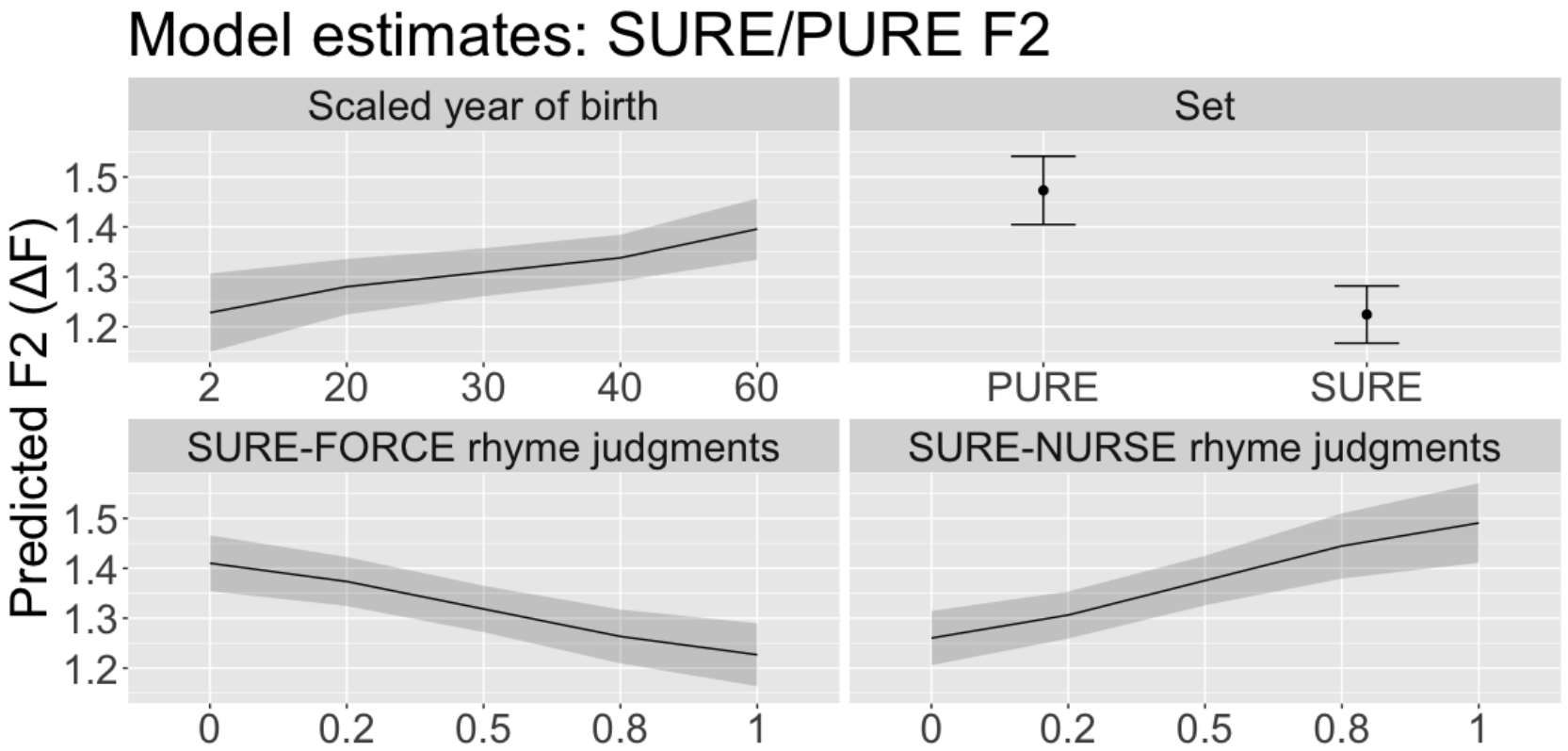


Particularly in the Inland North



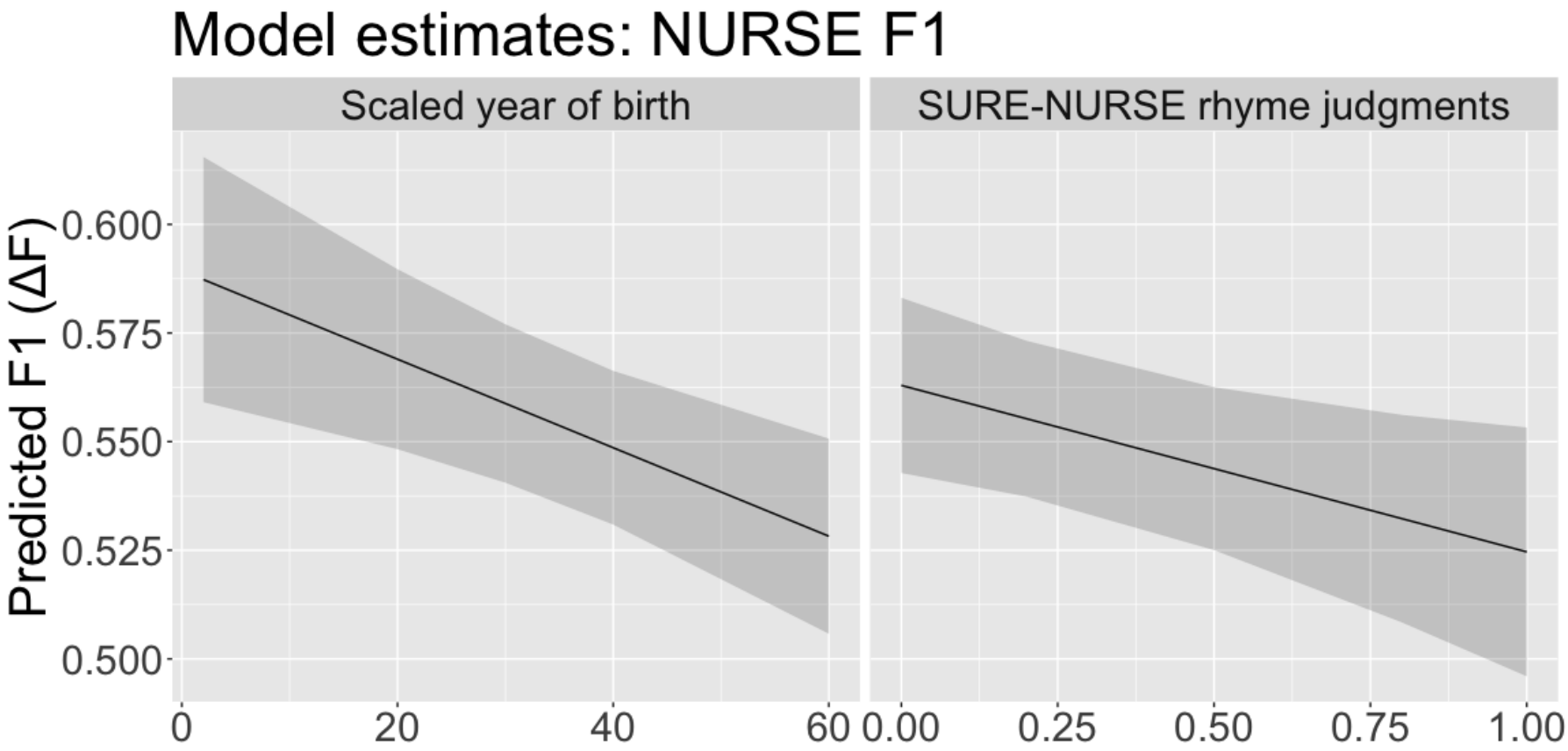
`glmer(rhyme judgement ~ scaled year of birth + region + (1 | pair) + (1 | participant), family = "binomial"). N=216. Obs=2157.`

Because PURE/SURE is fronting



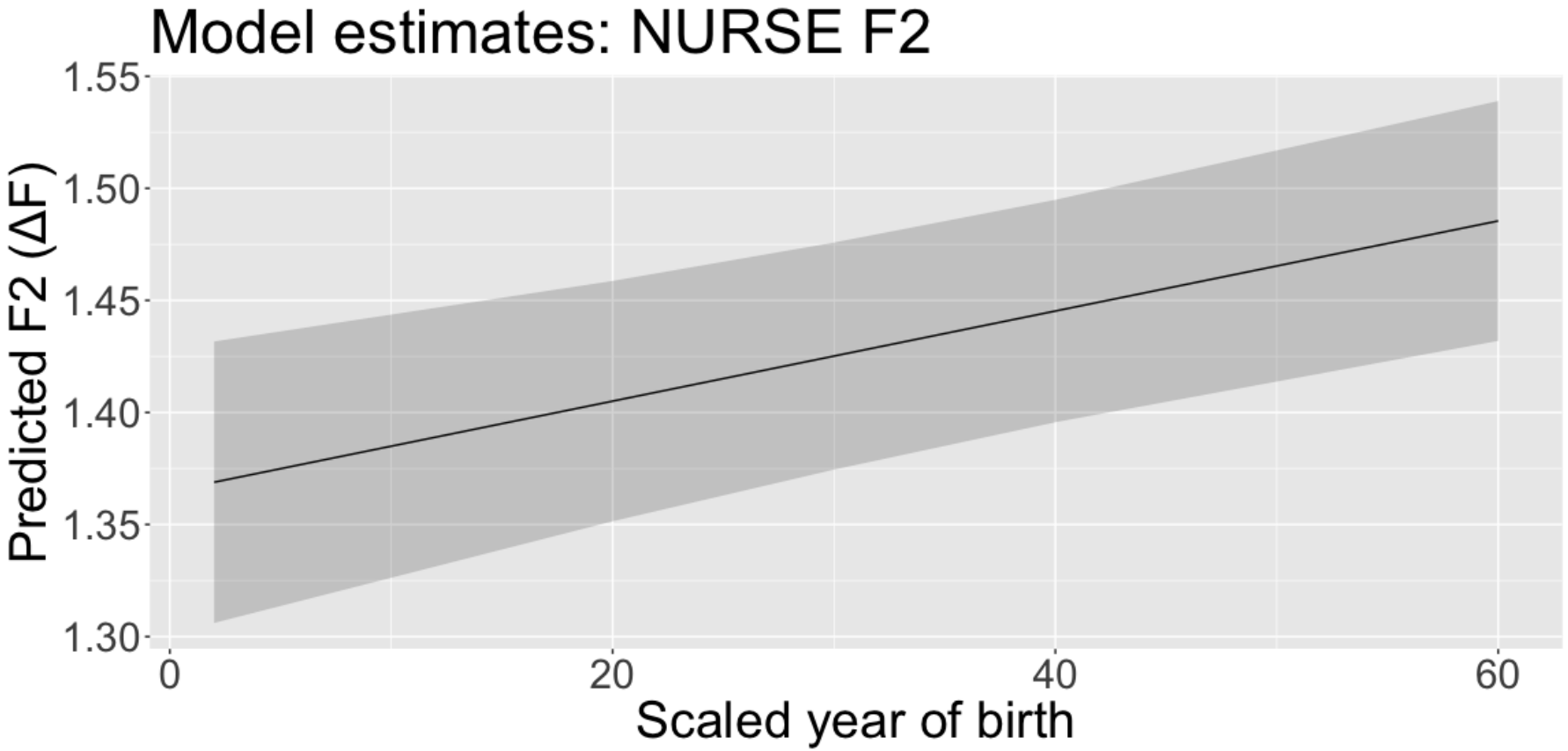
`lmer(F2 (ΔF) ~ SURE-FORCE rhyme judgments + SURE_NURSE rhyme judgments + scaled year of birth + vowel + (1 | word) + (1 + vowel | participant)). N=129. Obs=1287.`

And NURSE is raising

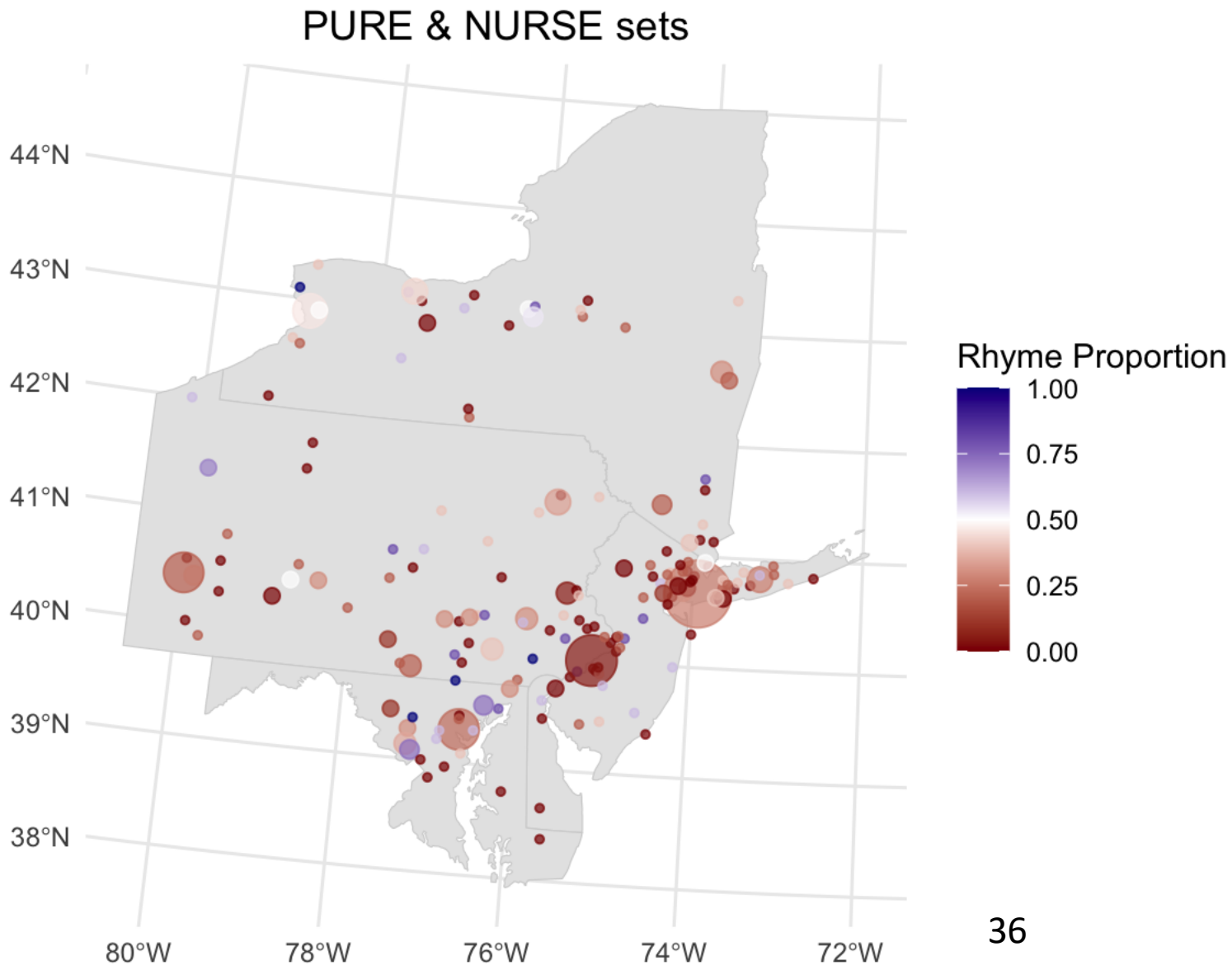


`lmer(F1 (ΔF) ~ SURE-NURSE rhyme judgments + scaled year of birth + (1 | word) + (1 + Vowel | participant)). N=129. Obs=546.`

And fronting



`lmer(F2 (ΔF) ~ scaled year of birth + (1 | word) + (1 + Vowel | participant)). N=242. Obs=1062.`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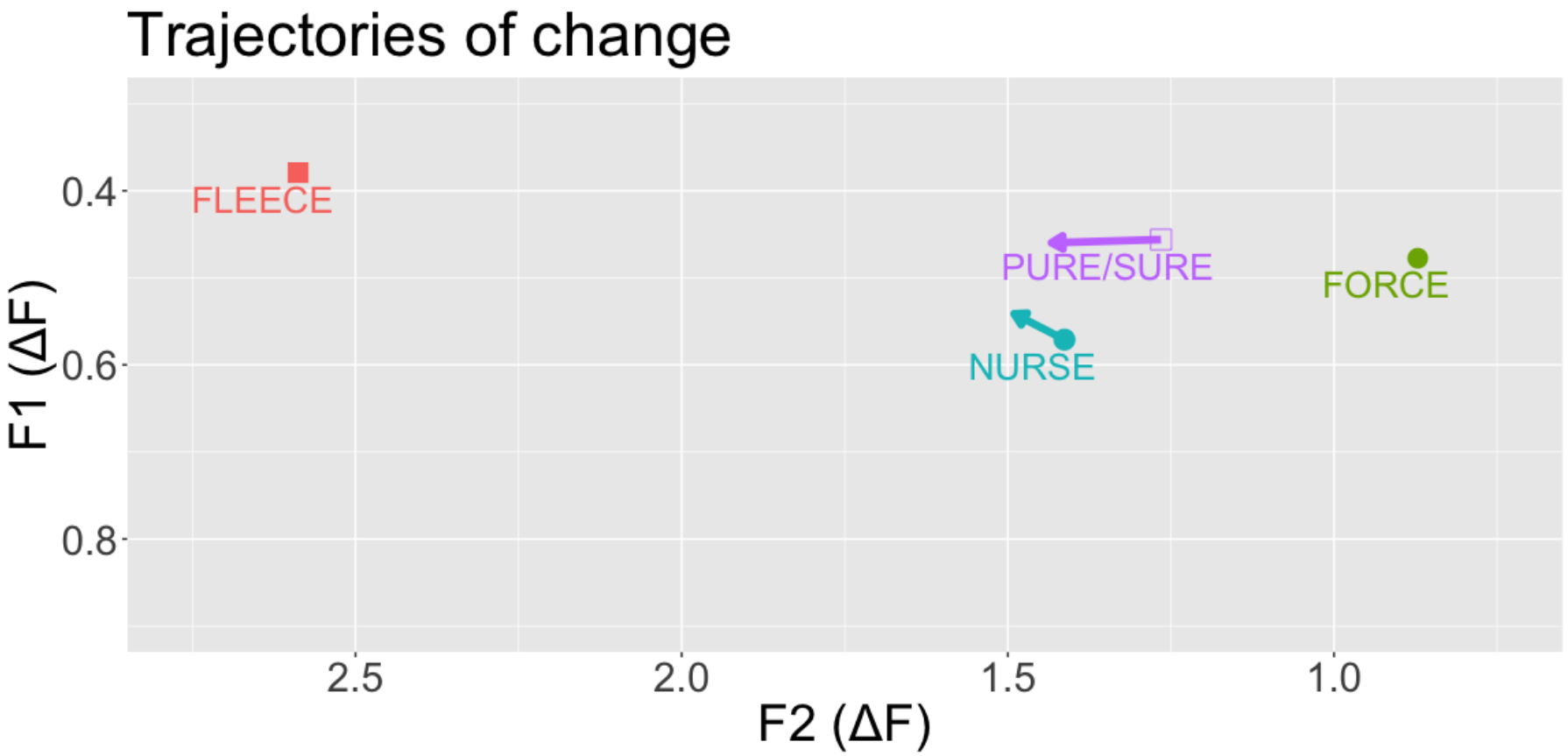
0.25
0.00

Converging to a high central position

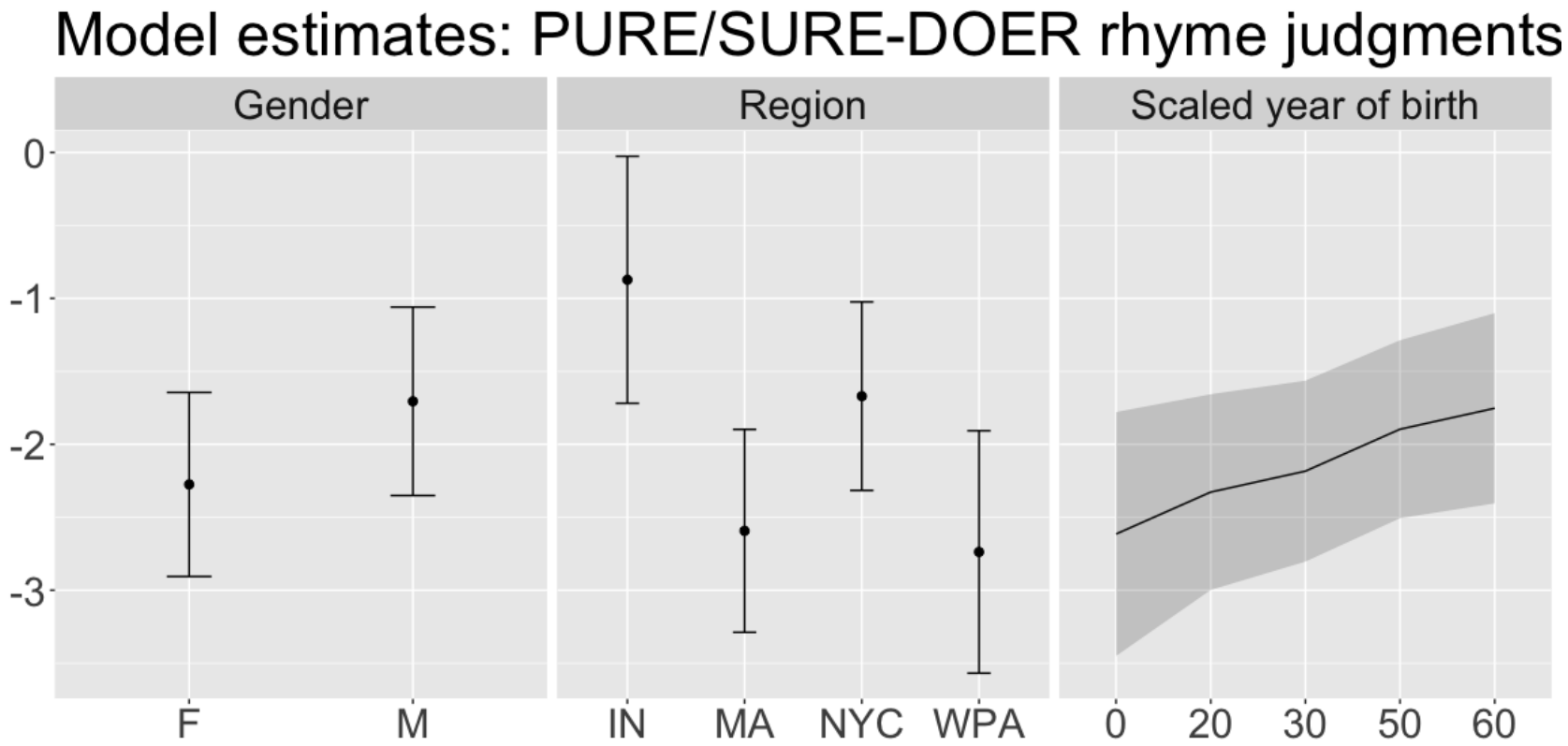


Mergers with DOER

The TOUR-DOER merger is almost non-existent

Merger	Count	Percentage
None	117	18.1%
TOUR-FORCE	520	80.6%
TOUR-DOER	3	0.5%
Mixed	5	0.8%

But the PURE/SURE-DOER merger is advancing

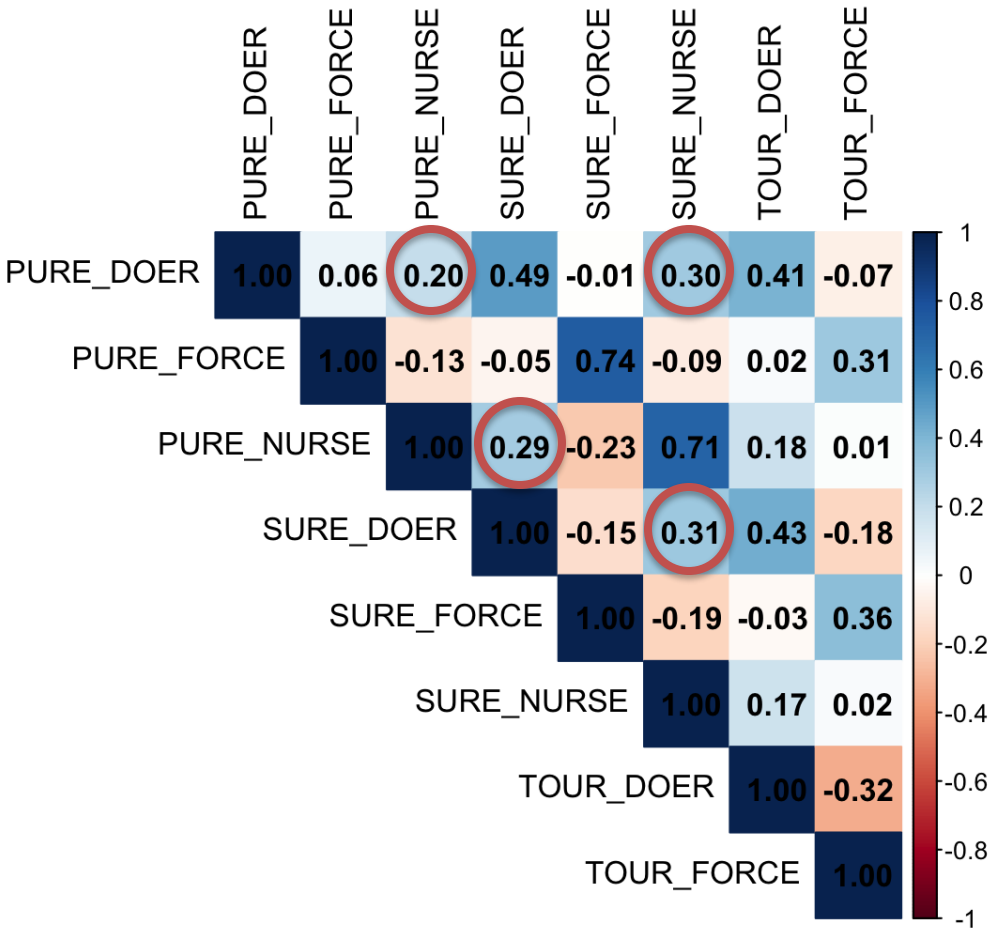


`glmer(rhyme judgment ~ scaled year of birth + gender + region + (1 | pair) + (1 | participant), family = "binomial"). N=202. Obs=2020.`

Although it remains infrequent overall

Merger	Count	Percentage*
PURE-DOER	20	5.9%
SURE-DOER	23	6.73%
*Percentage of speakers who accept /uw/-/yuw/ rhymes.		

It sometimes co-occurs with the PURE/SURE-NURSE merger



Main findings

1. The CURE class is disappearing in these varieties due to several processes of merger:
   i. The TOUR-FORCE merger is nearly complete (outside the Inland North)
   ii. The PURE/SURE-FORCE merger is somewhat frequent outside the Inland North
   iii. The unconditioned CURE-FORCE merger is less frequent than previously reported
   iv. The PURE/SURE-NURSE and PURE/SURE-DOER mergers are incipient changes led by speakers in the Inland North
2. The mergers with NURSE and DOER appear to be conditioned by yod
   a. This suggests that the historic yod in SURE words is phonologically active
   b. Some speakers demonstrate both mergers, suggesting that they have multiple representations for these words (cf. Thomas 2008)

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Acknowledgments

- Thank you to
  - ADS organizers and reviewers
  - Participants
  - Kyle Gorman for help with task design
  - PSC-CUNY for funding

Appendix A: Race/ethnicity data

Rhyme sample

Race/ethnicity	Count
Asian/Pacific Islander	68
Black/African American	84
Latinx	57
White	394
Mixed	17
Other/unknown	25

Production sample

Race/ethnicity	Count
Asian/Pacific Islander	26
Black/African American	35
Latinx	23
White	142
Mixed	8
Other/unknown	19

Appendix B: Mergers with PURE

Merger	Count	Percentage
None	199	58.2%
PURE-NURSE	41	12.0%
PURE-FORCE	72	21.1%
PURE-DOER	7	2.1%
Mixed	23	6.7%

Appendix C: Mergers with SURE

Merger	Count	Percentage
None	211	61.7%
SURE-NURSE	31	9.1%
SURE-FORCE	71	20.8%
SURE-DOER	10	2.9%
Mixed	19	5.6%

Appendix D: Model predicting TOUR-FORCE rhyme judgments

	Estimate	Std. error	z-value	Pr(>|z|)
Intercept	3.600	0.533	6.760	<0.001
Scaled year of birth	0.019	0.009	2.056	0.040
Region: Inland North	–3.018	0.496	–6.087	<0.001
Region: NYC	–1.025	0.382	–2.684	0.007
Region: Western PA	–0.680	0.539	–1.261	0.207
Home language: Bilingual	–1.708	0.367	–4.657	<0.001

```
glmer(rhyme judgement ~ scaled year of birth + region + language
+ (1 | pair) + (1 | participant), family = "binomial"). N=386.
Obs = 1928.
```

Appendix E: Model predicting SURE/PURE-FORCE rhyme judgments

	Estimate	Std. error	z-value	Pr(>|z|)
Intercept	0.893	0.348	2.566	0.010
Region: Inland North	–4.037	0.544	–7.422	<0.001
Region: NYC	–1.465	0.309	–4.747	<0.001
Region: Western PA	–0.922	0.419	–2.205	0.028

```
glmer(rhyme judgement ~ region + (1 | pair) + (1 | participant),
family = "binomial"). N=216. Obs=2160.
```

Appendix F: Model predicting SURE/PURE-NURSE rhyme judgments

	Estimate	Std. error	z-value	Pr(>|z|)
Intercept	–4.352	0.540	–8.062	<0.001
Scaled year of birth	0.053	0.010	5.385	<0.001
Region: Inland North	2.382	0.524	4.548	<0.001
Region: NYC	0.785	0.367	2.137	0.033
Region: Western PA	0.664	0.481	1.380	0.168

```
glmer(rhyme judgement ~ scaled year of birth + region + (1 |
pair) + (1 | participant), family = "binomial"). N=216. Obs=2157.
```

Appendix G: Model predicting SURE/PURE-DOER rhyme judgments

	Estimate	Std. error	z-value	Pr(>|z|)
Intercept	–3.406	0.464	–7.338	<0.001
Scaled year of birth	0.014	0.007	2.006	0.045
Gender: M	0.570	0.225	2.527	0.012
Region: Inland North	1.720	0.391	4.402	<0.001
Region: NYC	0.923	0.271	3.402	0.001
Region: Western PA	–0.144	0.372	–0.388	0.698

```
glmer(rhyme judgment ~ scaled year of birth + gender + region +
(1 | pair) + (1 | participant), family = "binomial"). N=202.
Obs=2020.
```

Appendix H: Model predicting TOUR F1

	Estimate	Std. error	DF	t-value	Pr(>|t|)
Intercept	0.399	0.016	110.2	24.834	<0.001
TOUR-FORCE rhyme judgments	0.046	0.015	126.1	3.099	0.002
Region: Inland North	0.005	0.014	125.4	0.325	0.746
Region: NYC	0.021	0.008	129.1	2.615	0.010
Region: Western PA	0.014	0.012	124.6	1.117	0.266

```
lmer(F1 (ΔF) ~ TOUR-FORCE rhyme judgments + region + (1 | word) +
(1 + vowel | participant)). N=135. Obs=598.
```

Appendix I: Model predicting TOUR F2

	Estimate	Std. error	DF	t-value	Pr(>|t|)
Intercept	0.960	0.042	32.05	22.956	<0.001
TOUR-FORCE rhyme judgments	–0.051	0.029	1.977	–1.772	0.078
Scaled year of birth	–0.001	<0.001	200.8	–2.083	0.038
Gender: M	0.046	0.016	202.5	2.902	0.004

```
lmer(F2 (ΔF) ~ TOUR-FORCE rhyme judgments + scaled year of birth
+ gender + (1 | word) + (1 + vowel | participant)). N=235.
Obs=1050.
```

Appendix J: Model predicting FORCE F1

	Estimate	Std. error	DF	t-value	Pr(>|t|)
Intercept	0.459	0.012	6.806	38.634	<0.001
Region: Inland North	0.026	0.014	126.748	1.874	0.063
Region: NYC	0.026	0.008	130.226	3.196	0.002
Region: Western PA	–0.001	0.012	125.449	–0.091	0.927

```
lmer(F1_deltaF ~ Region + (1 | word) + (1 + Vowel | participant))
```

Appendix K: Model predicting SURE/PURE F2

	Estimate	Std. error	DF	t-value	Pr(>|t|)
Intercept	1.375	0.050	50.11	27.369	<0.001
SURE-FORCE rhyme judgments	–0.183	0.038	120.8	–4.825	<0.001
SURE-NURSE rhyme judgments	0.231	0.048	120.2	4.840	<0.001
Scaled year of birth	0.003	<0.001	124.8	3.162	0.002
Vowel: SURE	–0.249	0.043	10.79	–5.752	<0.001

```
lmer(F2 (ΔF) ~ SURE-FORCE rhyme judgments + SURE_NURSE rhyme judgments + scaled year of birth + vowel + (1 | word) + (1 + vowel | participant)). N=129. Obs=1287.
```

Appendix L: Model predicting NURSE F1

	Estimate	Std. error	DF	t-value	Pr(>|t|)
Intercept	0.601	0.014	30.75	42.173	<0.001
SURE-NURSE rhyme judgments	–0.038	0.016	121.8	–2.325	0.022
Scaled year of birth	–0.001	<0.001	126.9	–3.223	0.002

`lmer(F1 (ΔF) ~ region + (1 | word) + (1 + vowel | participant)).`
`N=136. Obs=612.`

Appendix M: Model predicting NURSE F2

	Estimate	Std. error	DF	t-value	Pr(>|t|)
Intercept	1.365	0.033	8.124	41.814	<0.001
Scaled year of birth	0.002	<0.001	2.410	3.911	<0.001

`lmer(F2 (ΔF) ~ scaled year of birth + (1 | word) + (1 + Vowel | participant)). N=242. Obs=1062.`