

Gender effects on inter and intra-speaker variance in sound change

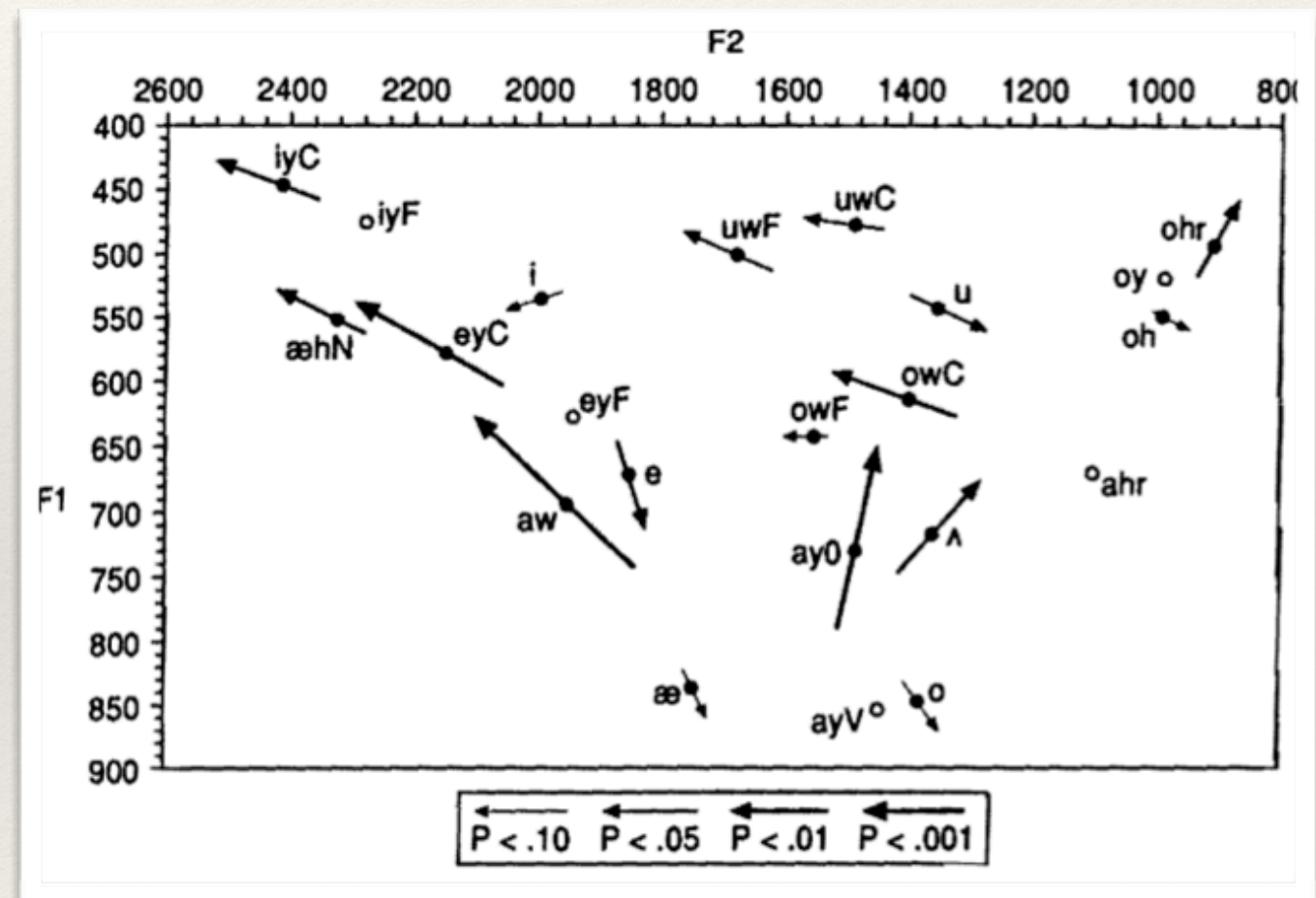


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The Dynamics of Sound Change

The study of vowel shifts has largely focused on shifts in the *average* value of vowels in the Hz space.

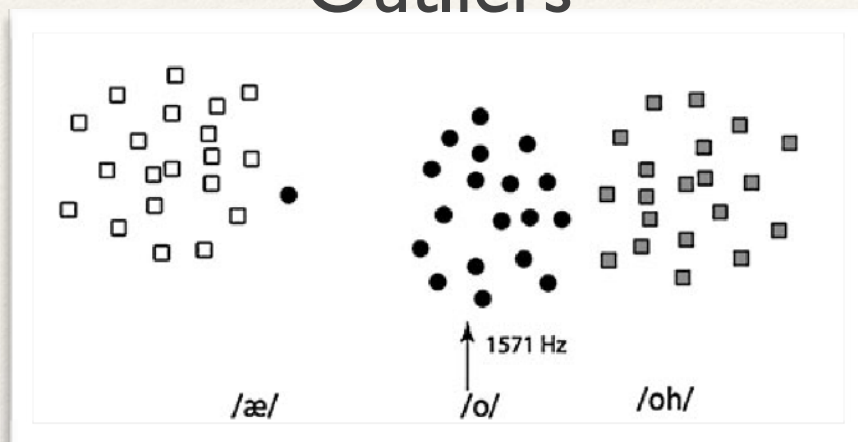


Labov (2001)

The Dynamics of Sound Change

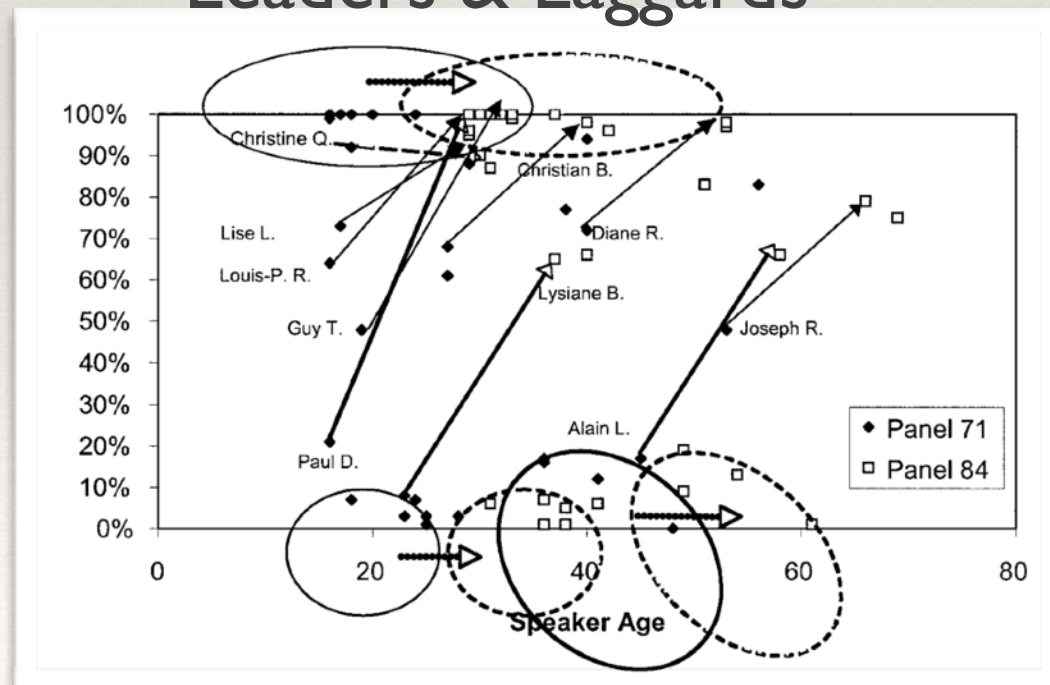
But other distributional properties have always been of some interest.

Outliers



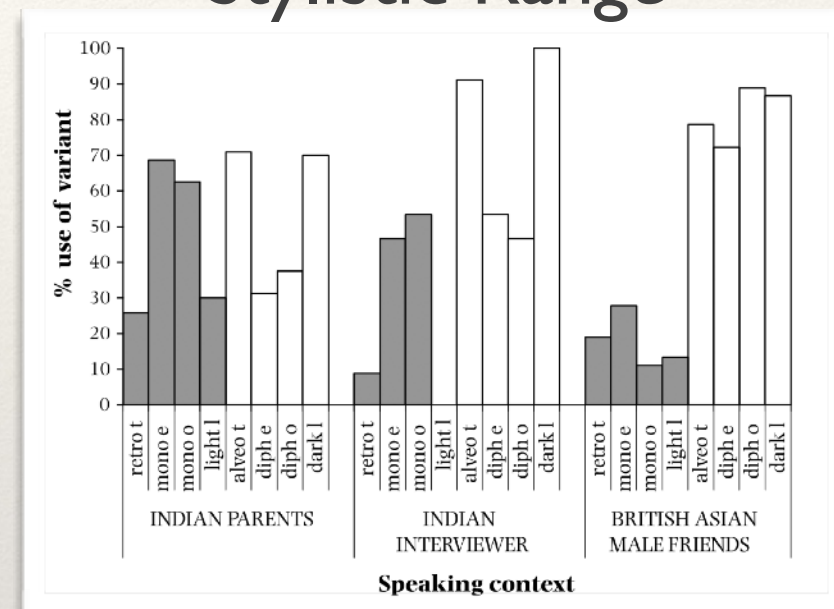
Labov, Baranowski, Dinkin (2010)

Leaders & Laggards



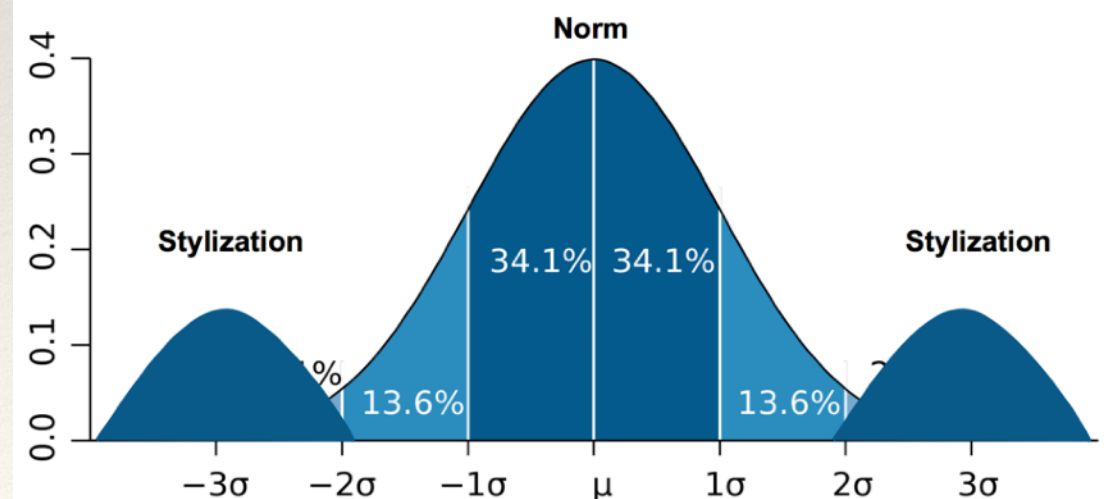
Sankoff & Blondeau (2007)

Stylistic Range



Sharma (2011)

Multi-modal distributions



Van Hofwegen (2015)

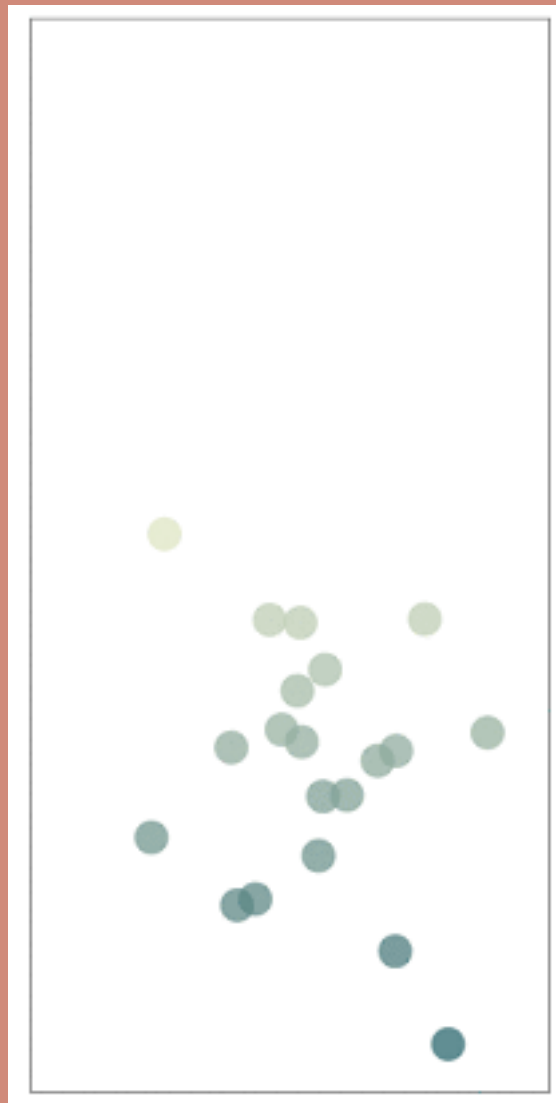
The Dynamics of Sound Change

They play an important role in sound change theory more broadly.

Error Accumulation

One Speaker's
Representation

Ohala (1981, among others)



Convergence Model

Speakers in a
Community

Baker et al (2011)

Blevins (2004)



The Dynamics of Sound Change

I've previously investigated language internal effects on variance parameters:

/ay/

[ayT] — Raised

[ayD] — Stayed the same

/ey/


[eyC] — Raised

[eyV] — Stayed the same

There were no substantial changes to variance parameters over the course of the change for allophones that changed compared to those that didn't.

- * Speakers stayed similarly clustered wrt to each other.
- * Speakers had similar ranges of use.

Gender...



Age	Sex	Eth	Edu	Street	Year	DOB
86	f	r	12	Kensington	1974	1888
84	m	r	4	Wicket	1973	1889
78	f	i	12	Daley	1973	1895
72	f	r	8	Daley	1973	1901
84	m	o	6	Birchwood	1985	1901
75	m	w	12	Mayfair	1978	1903
69	f	i	8	Daley	1973	1904
74	f	g	12	Mayfair	1978	1904
75	f	u	u	Bottom	1979	1904
73	m	i	u	Bell	1977	1904
74	m	w	8	Mayfair	1978	1904
75	m	i	4	Bottom	1979	1904
79	f	i	12	Warwick	1984	1905
71	m	w	u	Abbott	1976	1905
68	f	r	8	Gladstone	1975	1907
70	f	i	11	Bell	1977	1907

Gender



Distributional Properties and Gender

This is a largely exploratory analysis, but it has a few clear implications for sound change, gender

Leaders and Laggards in Sound Change

Women tend to lead sound change.

Flamboyant personae (Eckert, 2011) = larger variance?

As changes progress, does it affect speakers stylistic range?

Sociolinguistic Change? (Coupland 2009)

Do the ways of being a man or a woman wrt to the linguistic performance change with sound change?

To investigate these effects, I contrast a strongly gendered sound change with a weakly gendered sound change.

The Data

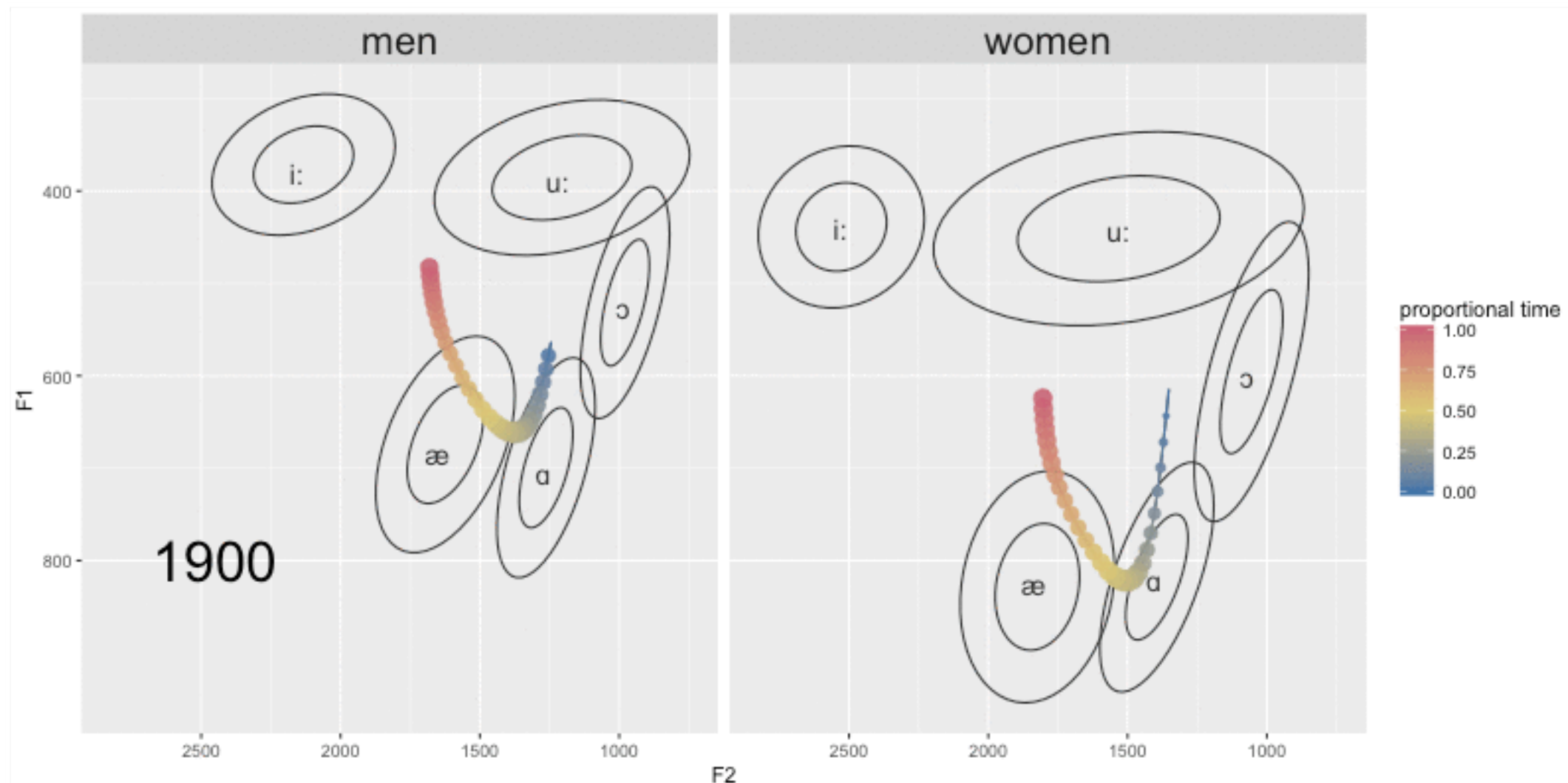
- ❖ Data drawn from the Philadelphia Neighborhood Corpus
 - ❖ 325 White speakers from Philadelphia
 - ❖ Interviewed between 1973 and 2013
 - ❖ Dates of Birth between 1888 and 1998
 - ❖ Sociolinguistic interviews that have been transcribed & FAVEd.
- ❖ 2 Changes
 - ❖ ay0 — pre-voiceless /ay/ raising
 - ❖ aw — /aw/ raising and fronting

The Sound Changes

/ay0/

19,383 tokens

325 PNC Speakers



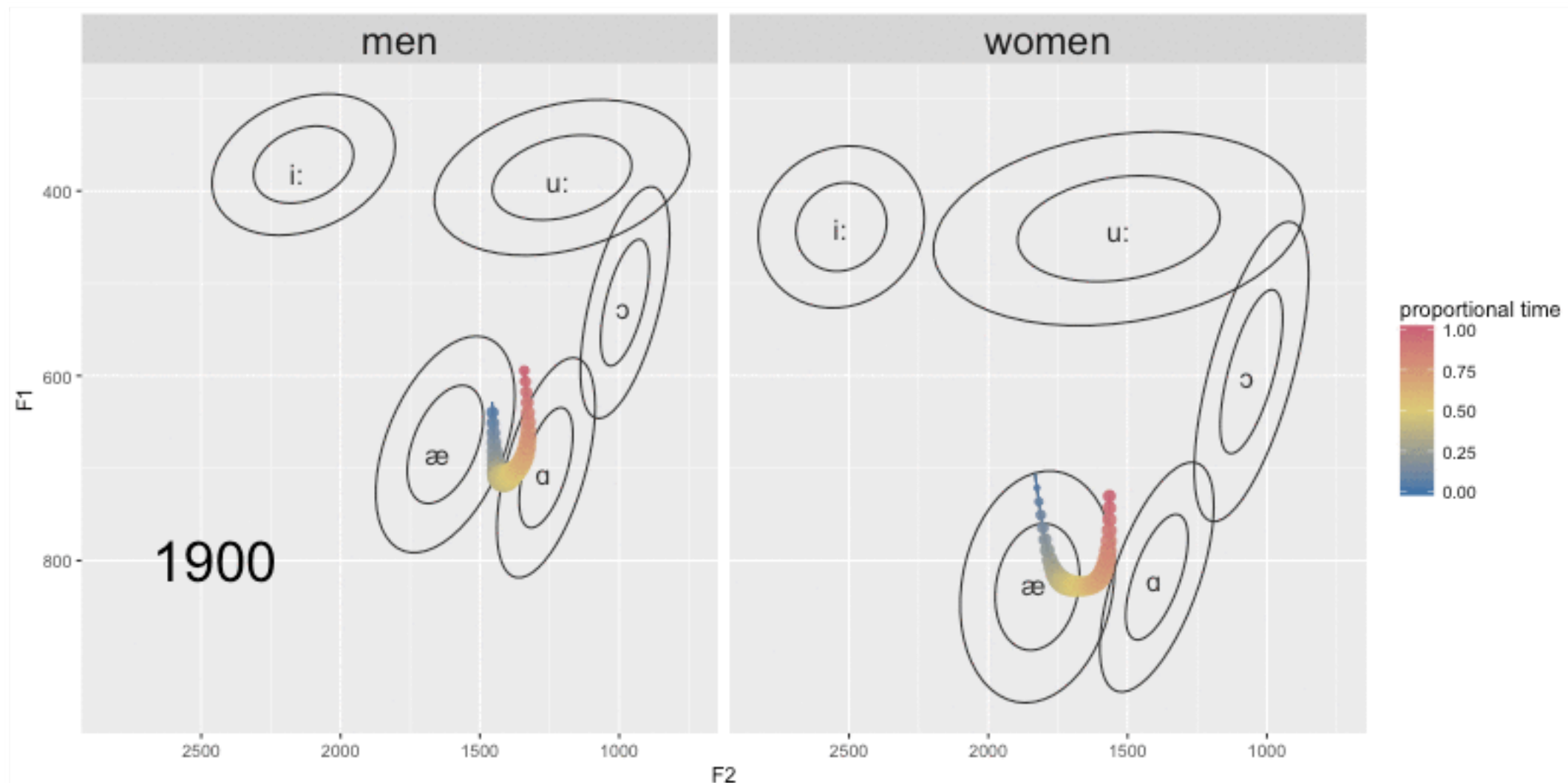
Recently, men's backer realizations associated with masculinity and toughness. (Conn, 2005; Wagner, 2007)

The Sound Changes

/aw/

6,720 tokens

321 PNC Speakers



Women have both the raising and fronting of /aw/ and then the subsequent reversal.

Modeling Variance

Standard LMMs

- *Generate inter-speaker variance estimates
- * Can't vary wrt other variables
- *Assume a constant intra-speaker variance estimate

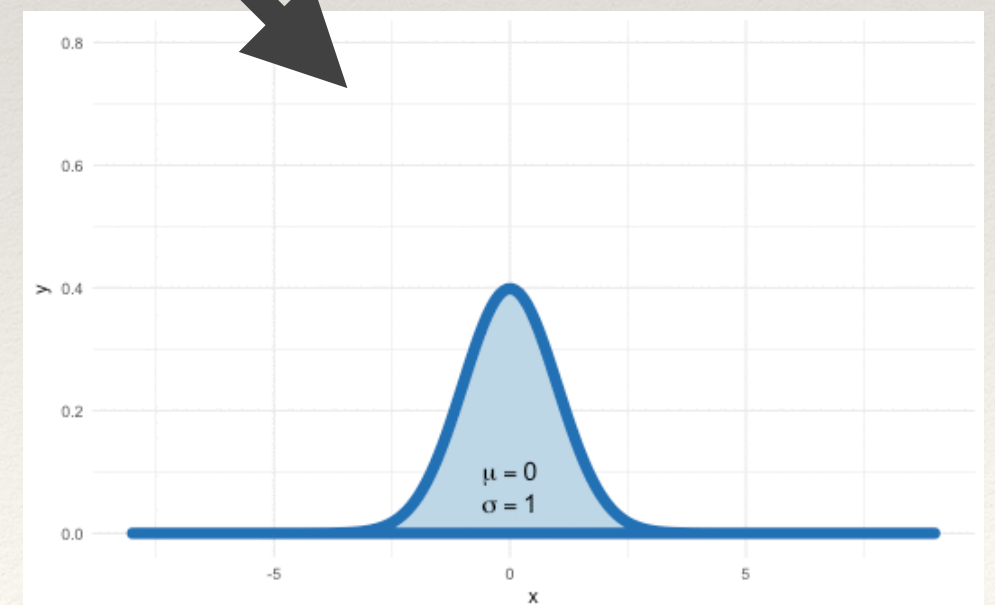
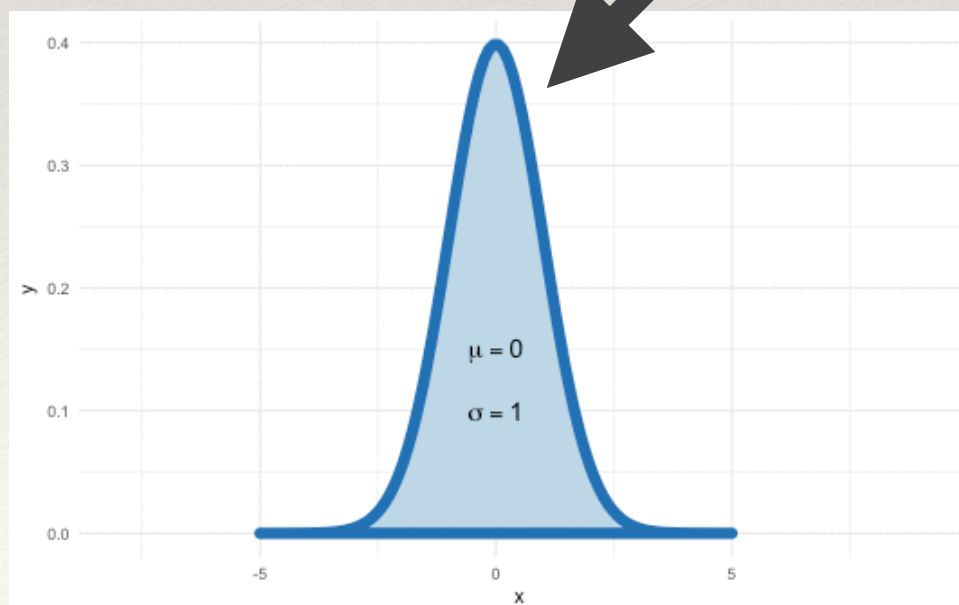
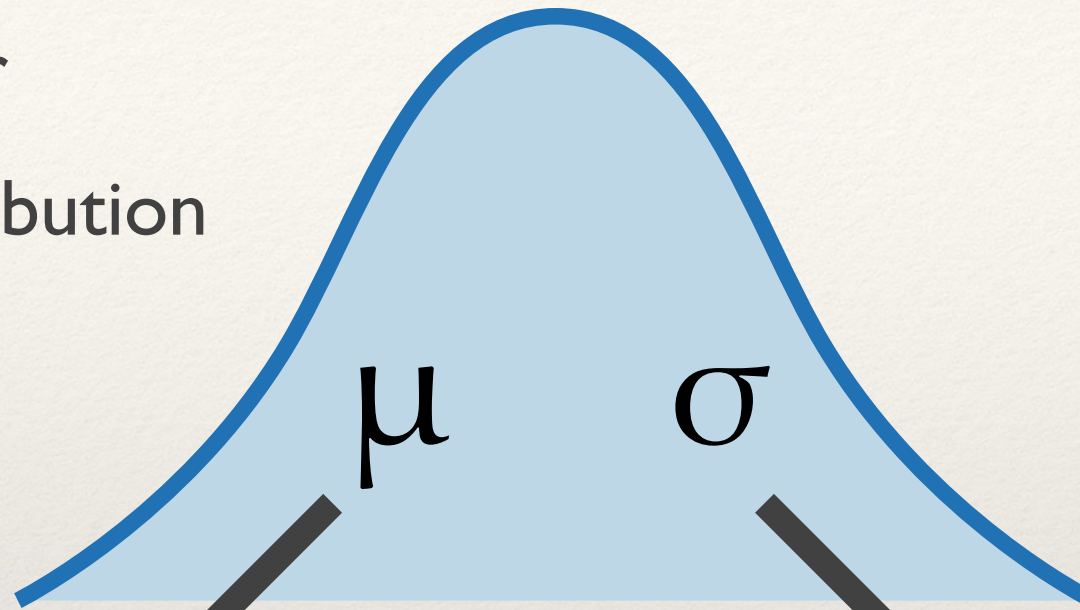
Bayesian Modeling

- *Exceptionally flexible in what they can estimate.
- *Researcher must fully define the model.
- *They must be explained in detail

For this project, I've defined a custom Bayesian Model implemented in Stan.

The Model

Either an intra-speaker
Or inter-speaker distribution



The Model

“Autoregression”

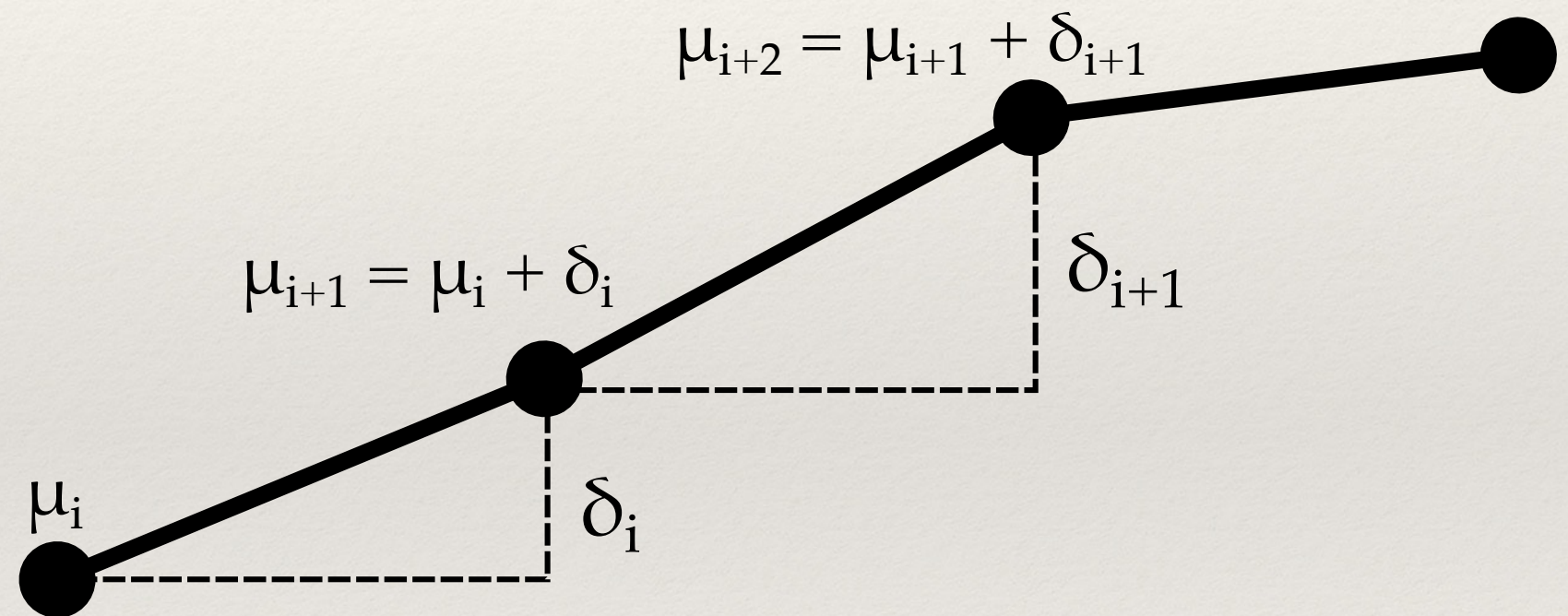
μ_i = the estimated mean for each year of birth

δ_i = the difference from the prior year

If $\delta_i = 0$, no change

If $\delta_i > 0$, increase

If $\delta_i < 0$, decrease



$$\delta_i \sim \text{normal}(\delta_{i-1}, \sigma)$$

The Model

“Autoregression”

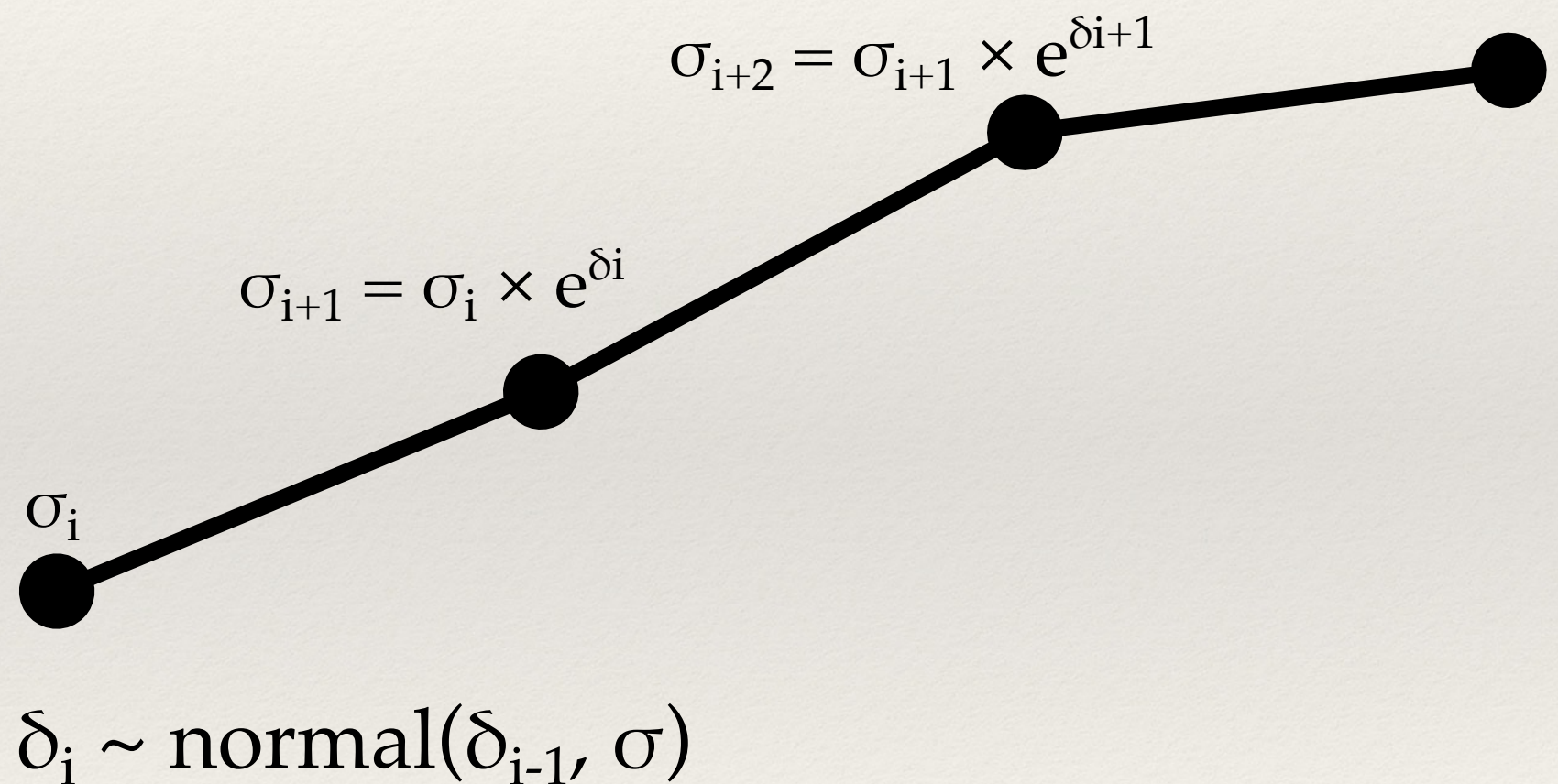
σ_i = the estimated variance

e^{δ_i} = how many times the previous year

If $\delta_i = 0$, no change

If $\delta_i > 0$, increase

If $\delta_i < 0$, decrease



The Models

It's too complex to model both intra-speaker and inter-speaker variances using an AR process at the same time.

Intra-Speaker Model

- *Within speaker variances are estimated as an AR process, and can vary over DOB
- *Between speaker variances are estimated as a fixed parameter.

Inter-Speaker Model

- *Within speaker variances are estimated as a fixed parameter.
- *Between speaker variances are estimated as an AR process and can vary over DOB

Both models:

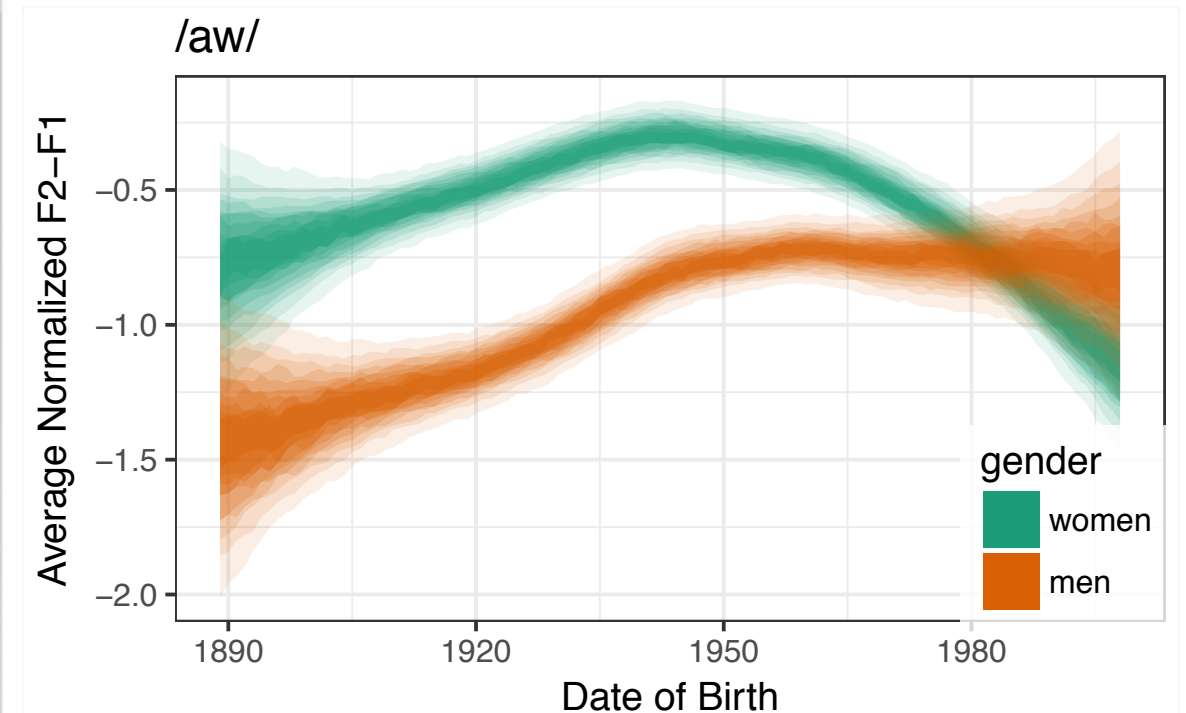
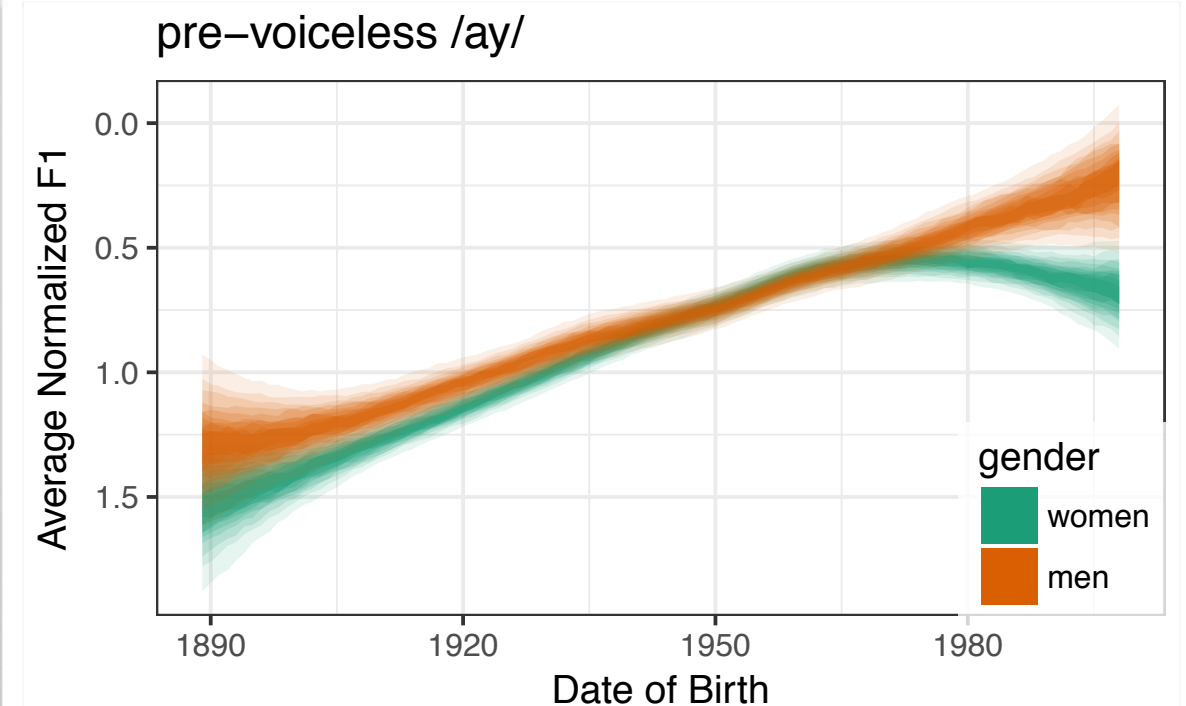
The estimated average for DOB cohorts is estimated as an AR process.
Random intercepts by word

Intra-Speaker Results: μ

Estimated *averages* by DOB and gender.

The trends are what we would expect from earlier work (Labov et al 2013)

The fuzziness of the boundaries indicate that we actually get out probability distributions from the model.

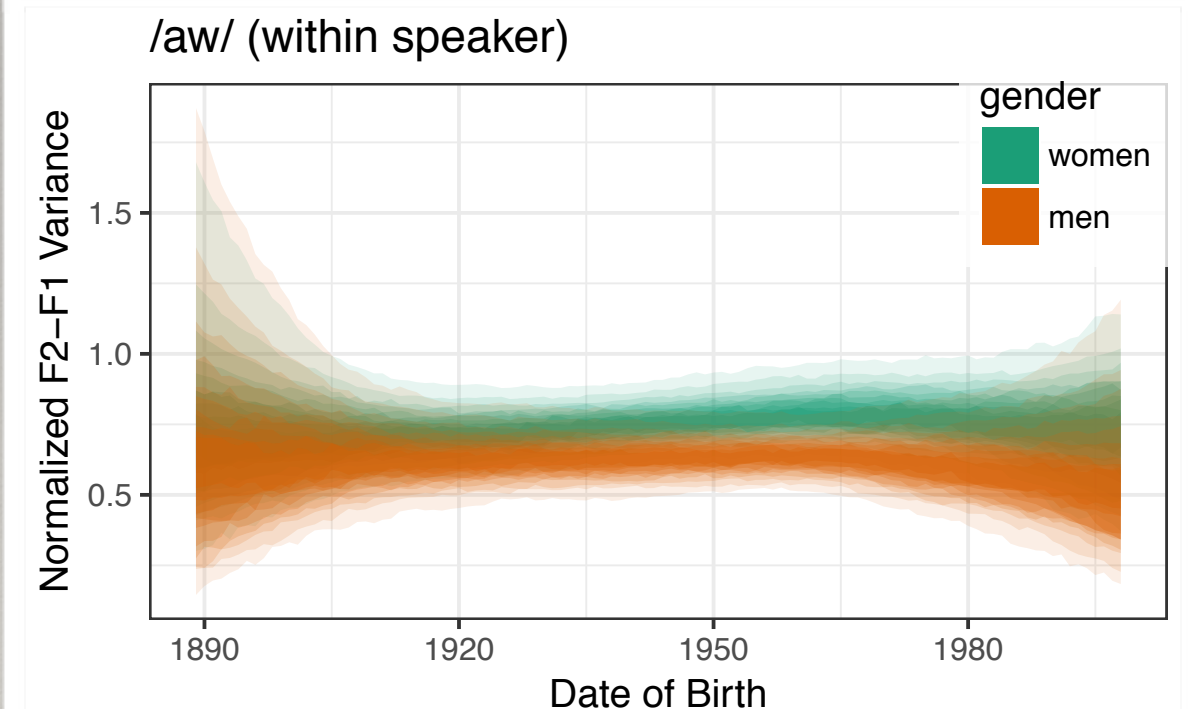
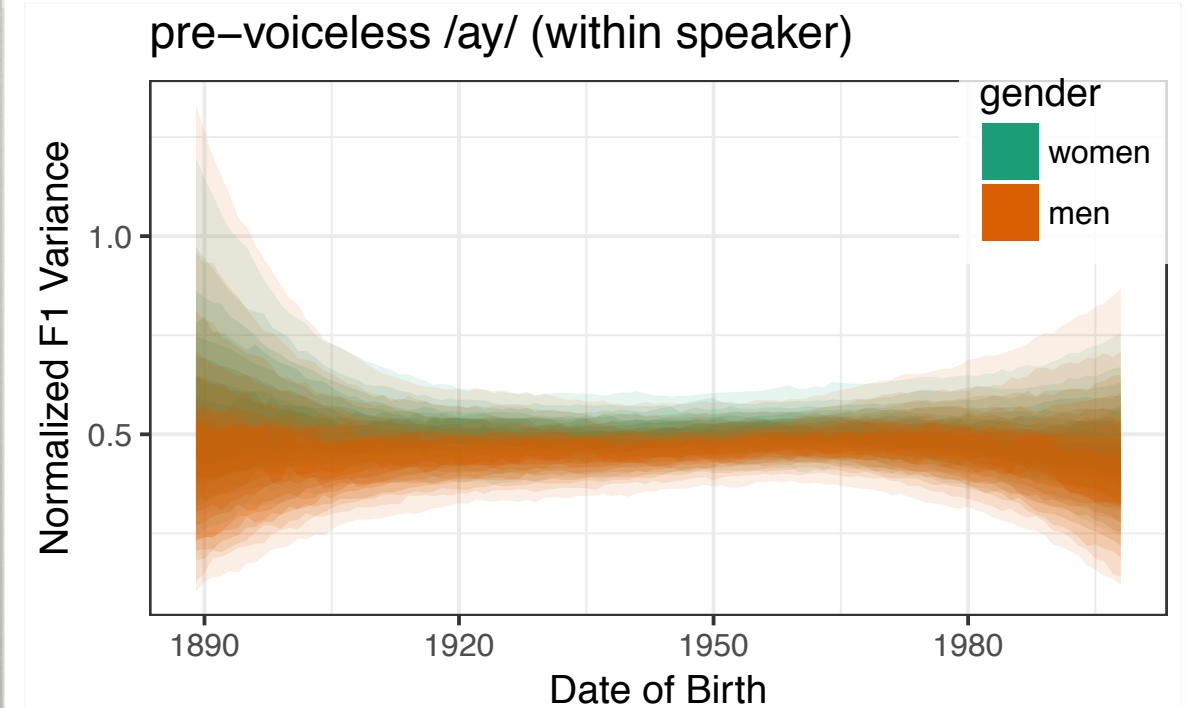


Intra-Speaker Results: σ

These are how the intra-speaker variance is estimated to change over time.

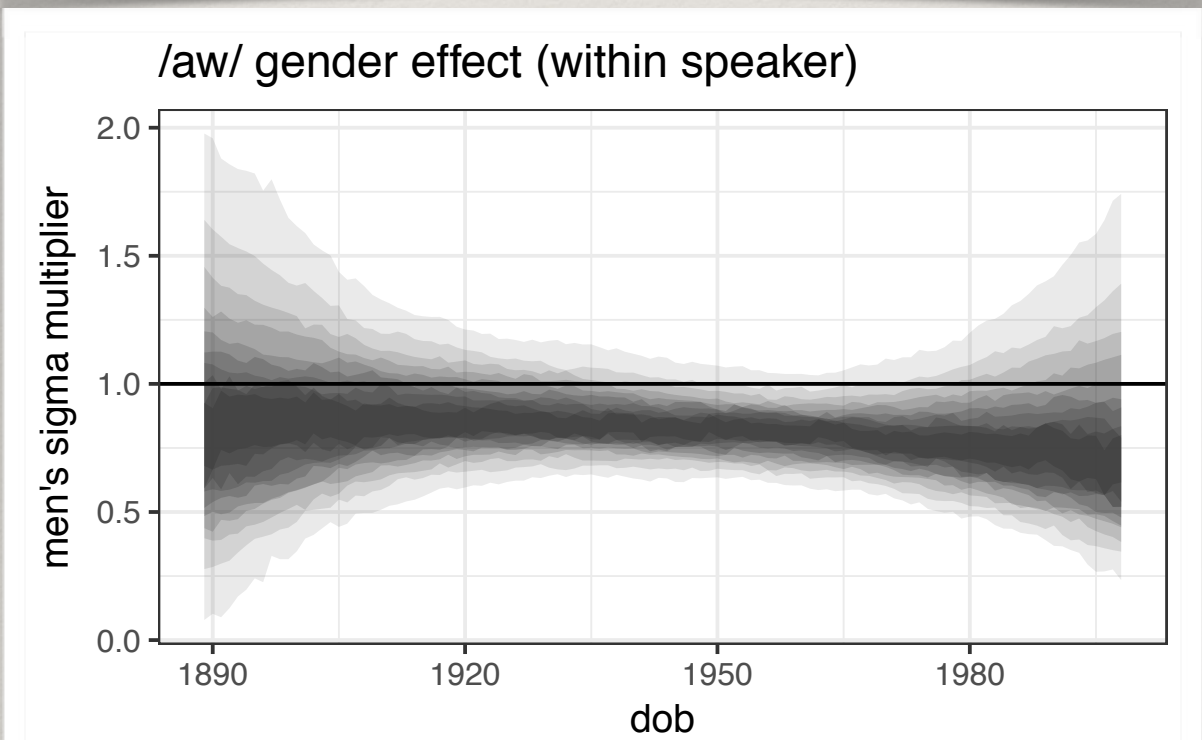
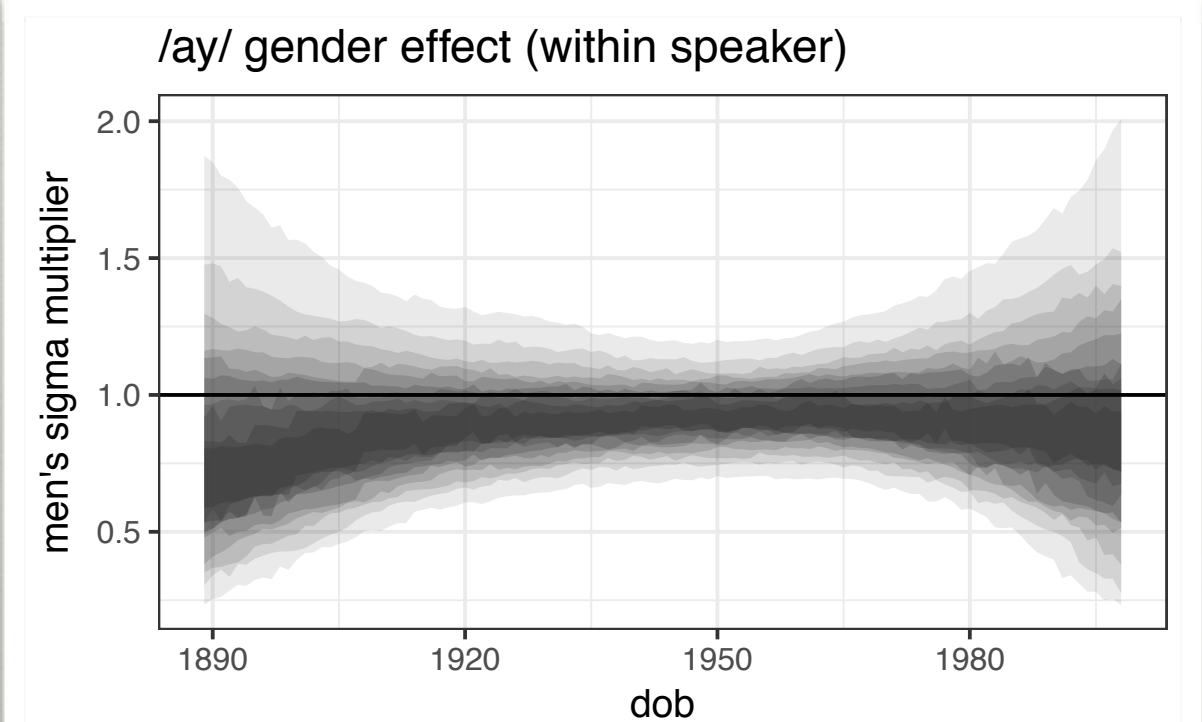
There is no gender effect on /ay/.

There is weak evidence for a gender effect on /aw/



Intra-Speaker Results: σ

This is estimated difference between the curves. Where the bands include 1, there isn't a robust difference.



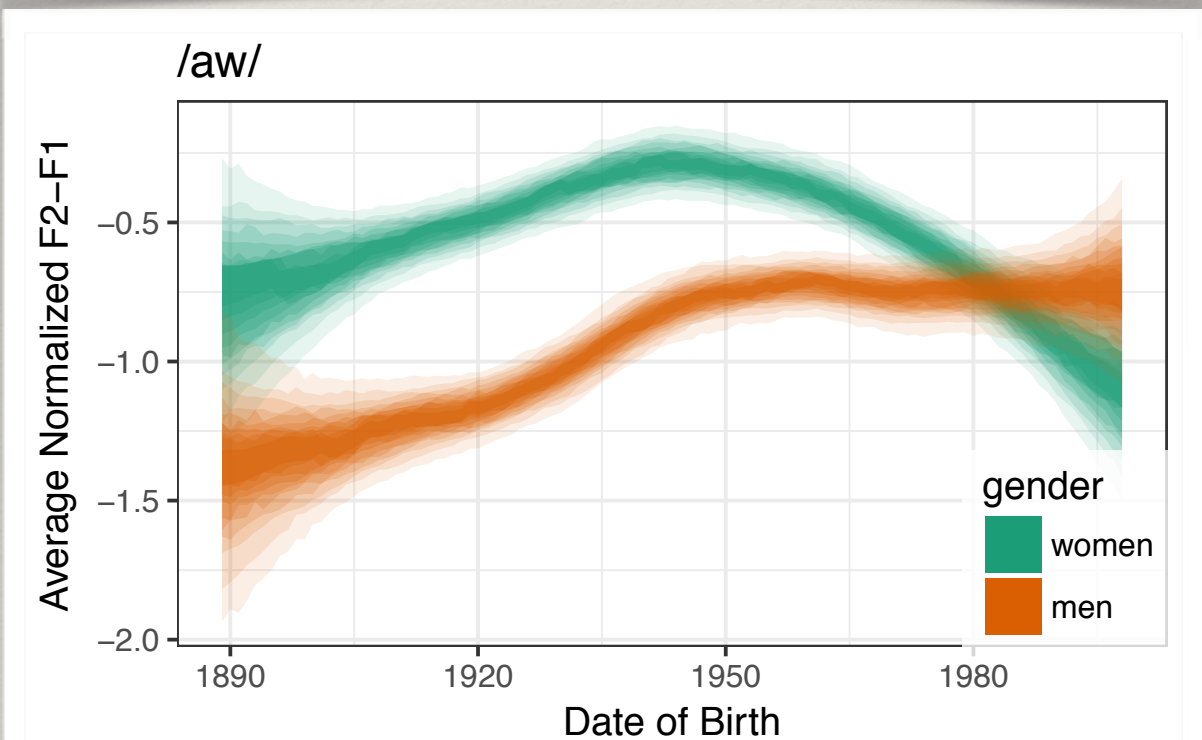
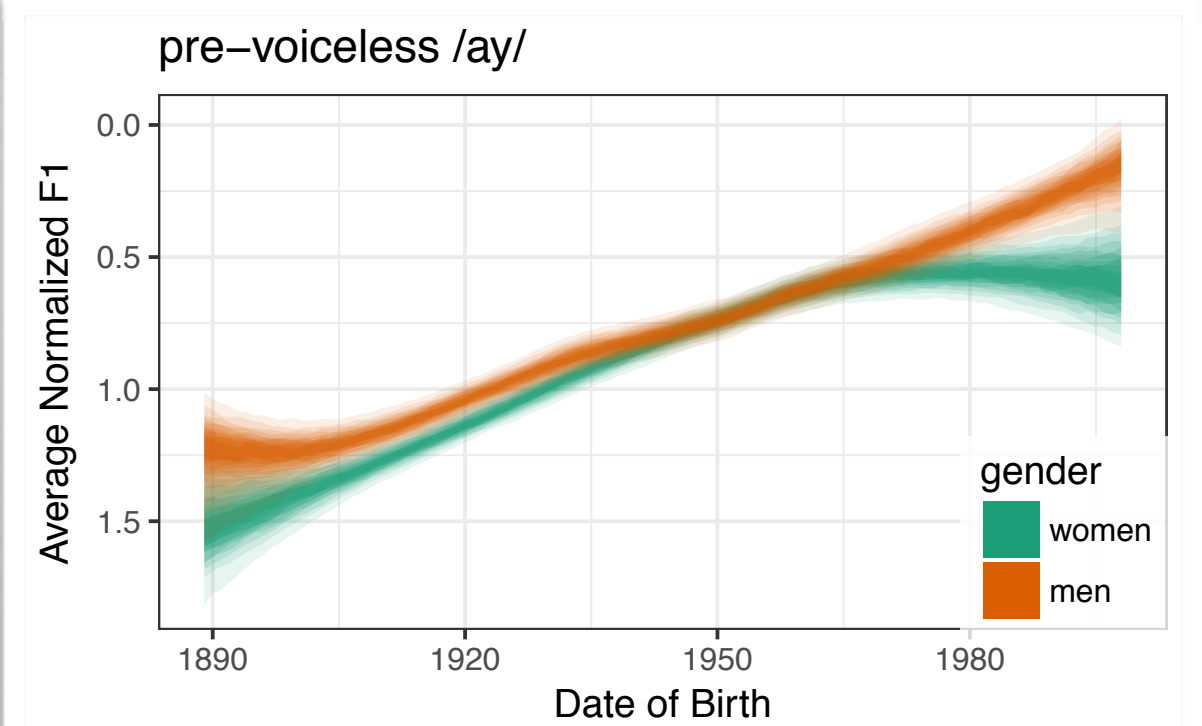
Intra-Speaker Results

- ❖ The range of intra-speaker variation looks remarkably similar for /ay/ and /aw/, despite looking very different in their overall means.
- ❖ The evidence for gendered differences in intra-speaker range (style, etc.) is limited,
- ❖ The evidence for changes in intra-speaker range (gendered or otherwise) is limited.
- ❖ These results may be limited by the (non)range of linguistic activities these speakers are engaged in.

Inter-Speaker Results: μ

Estimated *averages* by DOB and gender.

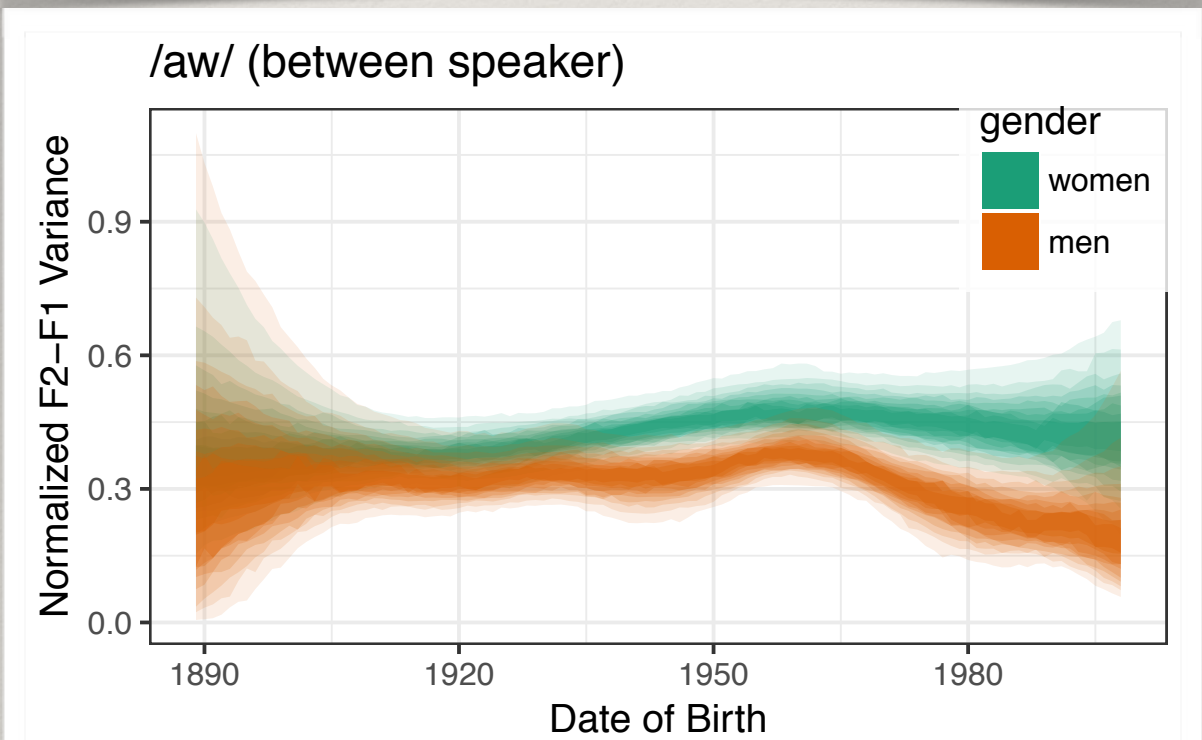
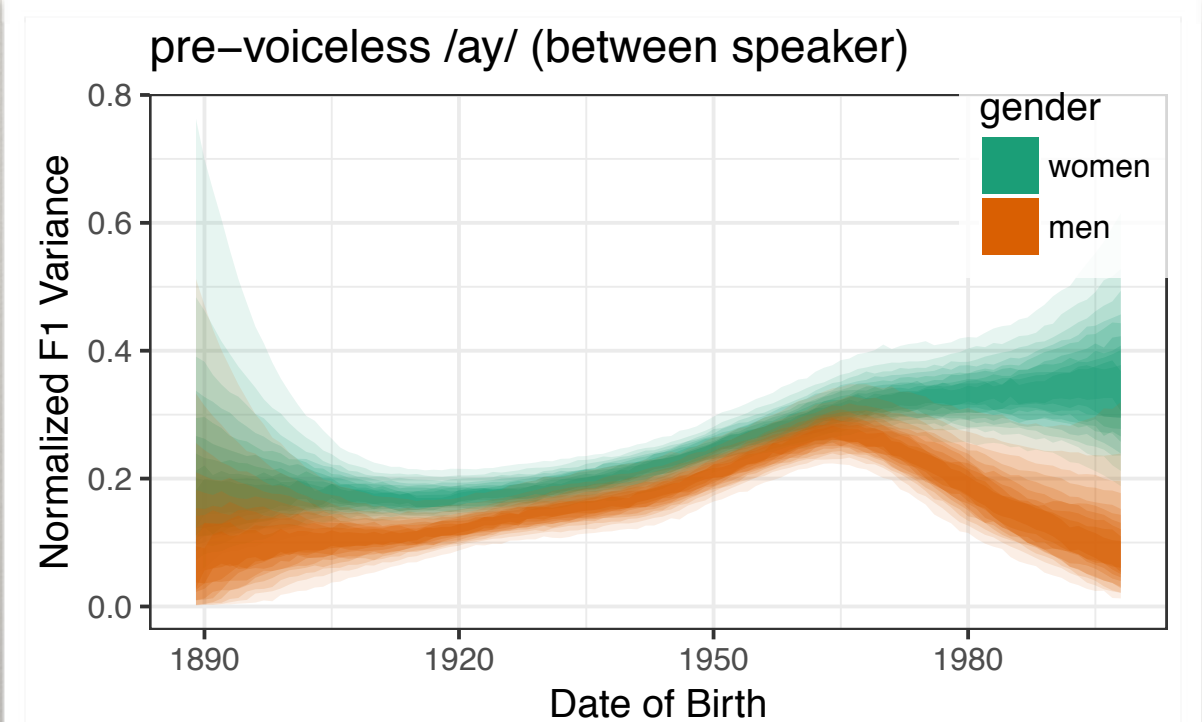
These are just here for a sanity check that the model is estimating the parameters well.



Inter-Speaker Results: σ

For /ay/ there is a stronger trend for men to be more tightly clustered together, which is amplified at the same time the change tapers off for women.

For /aw/, there is better evidence that women are less tightly clustered together than men.

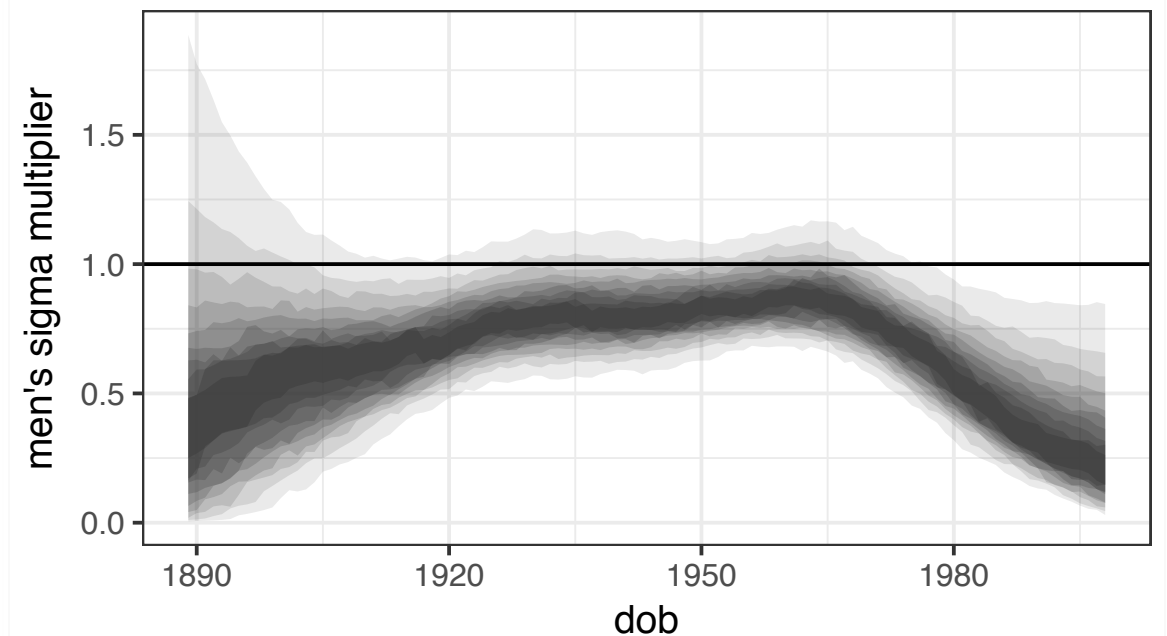


Inter-Speaker Results: σ

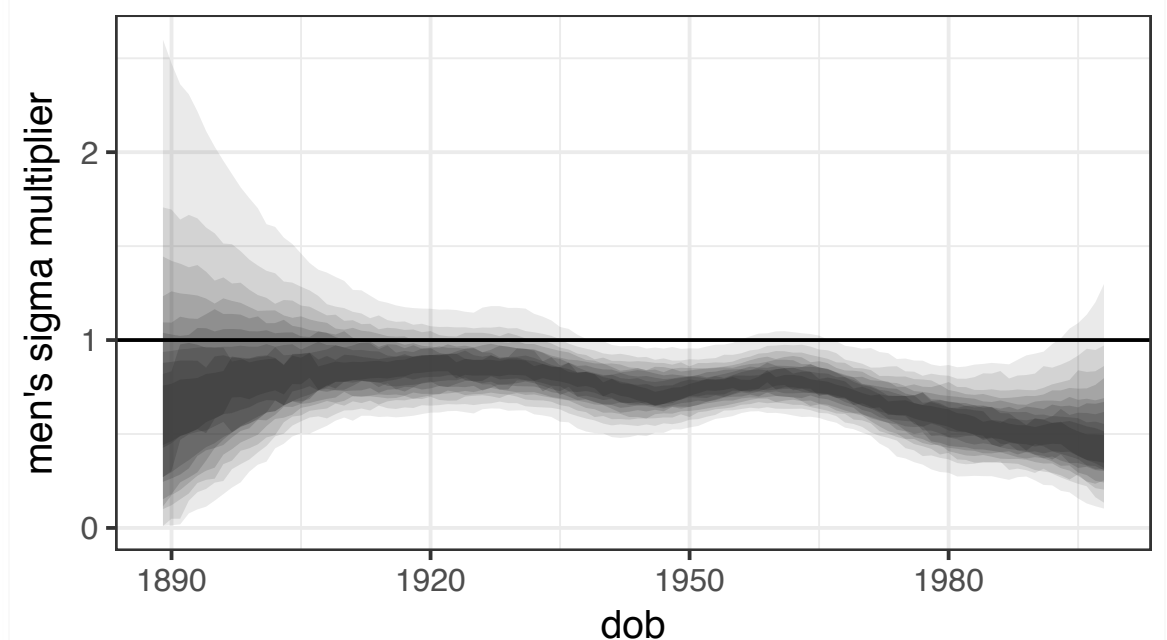
For /ay/, there isn't strong evidence for gendered differences in inter-speaker range till late in the 20th century (at the same time the change levels off for women).

For /aw/, there is reliable gendered differences in inter-speaker range relatively early, but it's also fairly stable, unconnected to the patterns in the means.

/ay/ gender effect (between speaker)



/aw/ gender effect (between speaker)



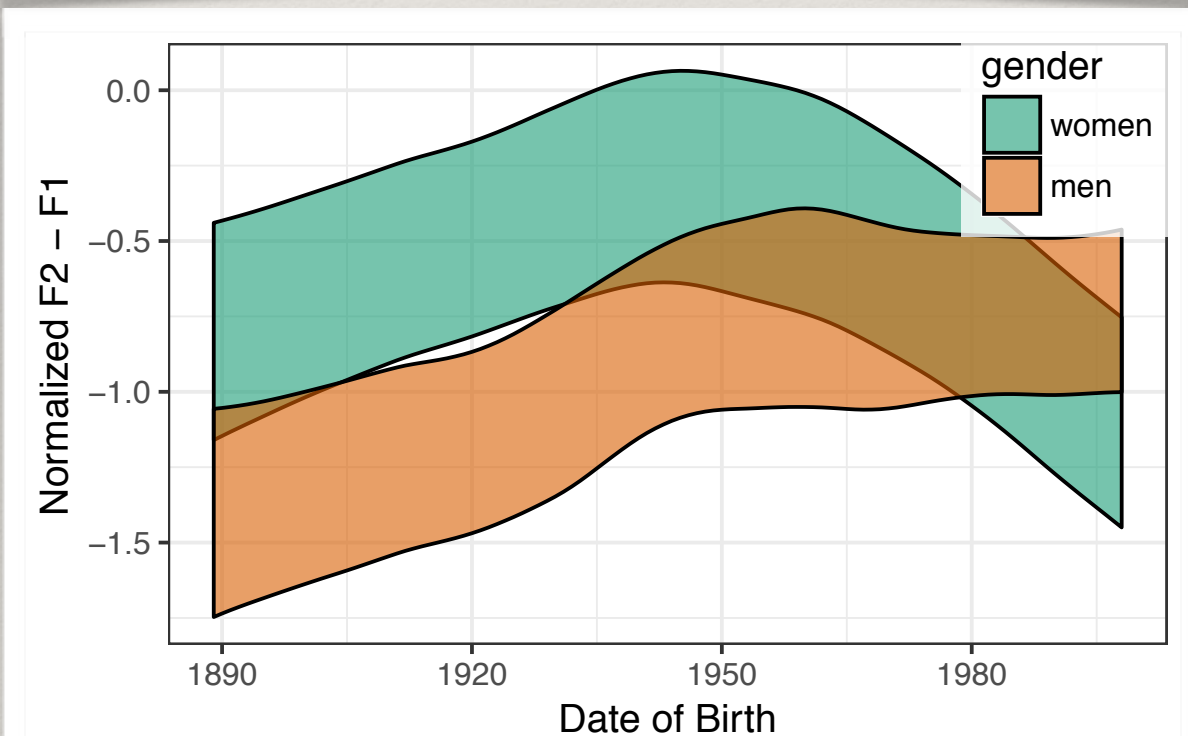
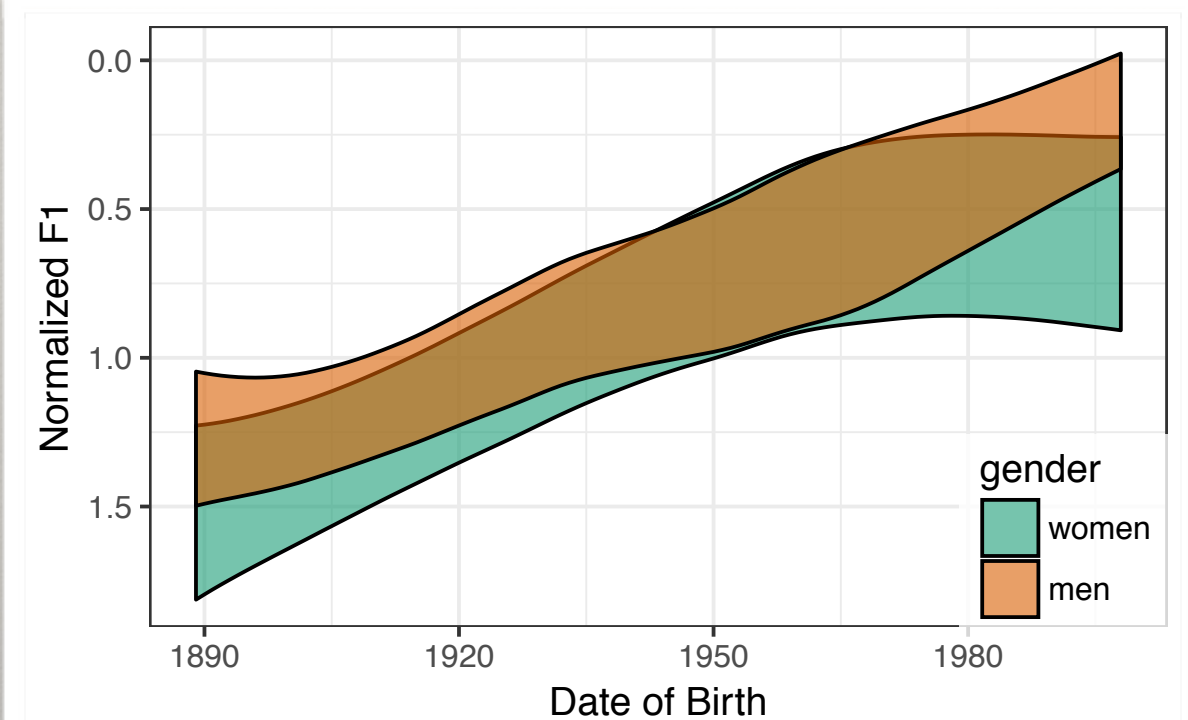
Inter-Speaker Results

- ❖ If there is a consistency in these results, it is that there is a narrower range of inter-speaker variation for men than for women.
 - ❖ Could be directly due to differently available range in gender performance.
 - ❖ Could be due to differences in the nature and constitution of social networks. (Dodsworth, ~1 hour from now?)
- ❖ This narrowing of inter-speaker range appears to develop later for /ay/.
 - ❖ Possibly coincides with the association of backed [ay0] with masculinity and toughness (Conn 2005, Wagner 2007).
- ❖ The size of inter-speaker range doesn't seem to be related to who is leading the sound change in any way.



Inter-Speaker Results

This is what the estimated inter-speaker distributions actually look like.

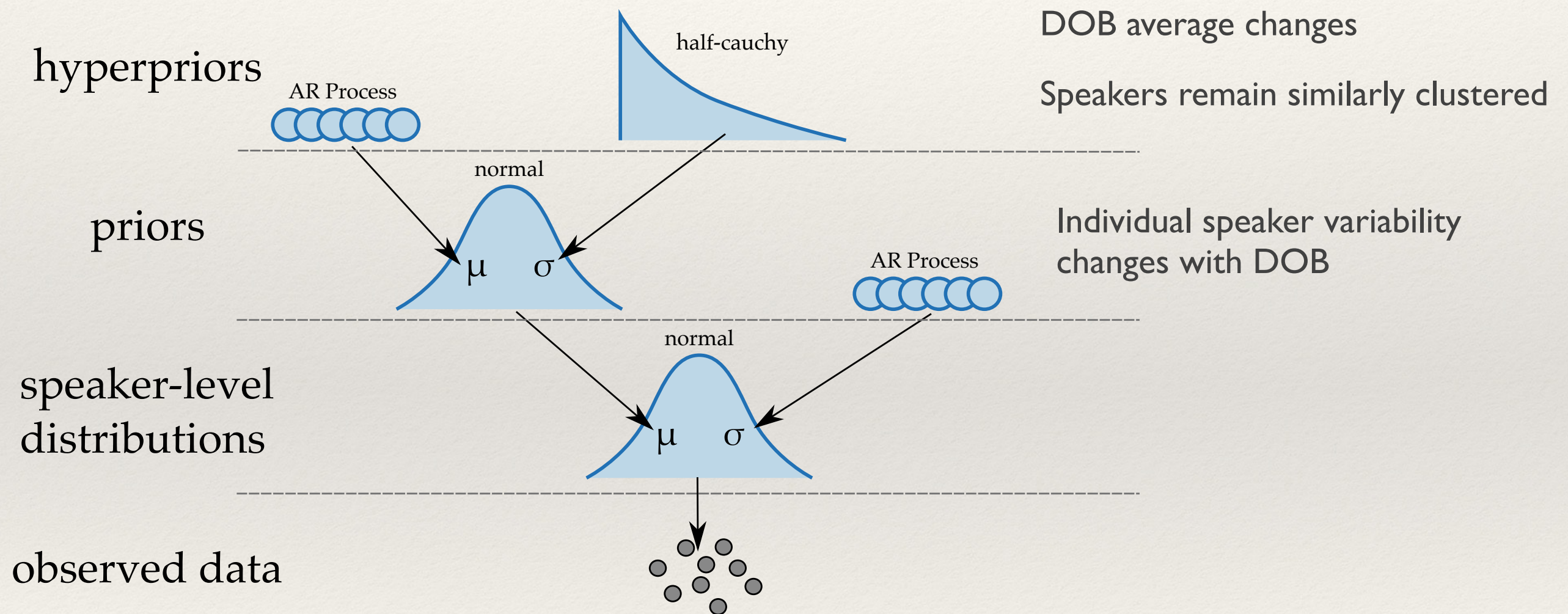


Conclusions

- ❖ Despite having very similar intra-speaker ranges to each other, women appear to have a broader range of inter-speaker averages than men.
- ❖ The narrowing of the inter-speaker range for /ay/ is open to a number of interpretations:
 - ❖ Association of /ay/ with toughness focuses men's averages around a dimension of gender expression they were already narrowly arranged along?
 - ❖ Perhaps there has been a sociolinguistic change, eliminating a possible way of doing /ay0/
- ❖ These (non)shifts in variance don't seem to be tightly connected to the shifts in the averages.
- ❖ Variance modeling can uncover interesting trends, and some surprising results.

Thanks!

The Intra-Speaker Model



The Inter-Speaker Model

