Back Vowel Distinctions and Dynamics in Southern US English

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Overview

We investigate low/back vowels /u, oʊ, ʊ, ɔ, ɑ/ in Southern American English (SAE).

Research on SAE has analyzed changes in **position** over generational time.

Most work on **trajectories** is limited to impressionistic coding ("loss of upgliding") or reduces trajectories to summary statistics (vector length, rate of change)

We analyze both the **position** and the **shape** of back vowels' formant trajectories in apparent time, using new data from the Digital Archive of Southern Speech (DASS).

Back Vowel Fronting

GOOSE

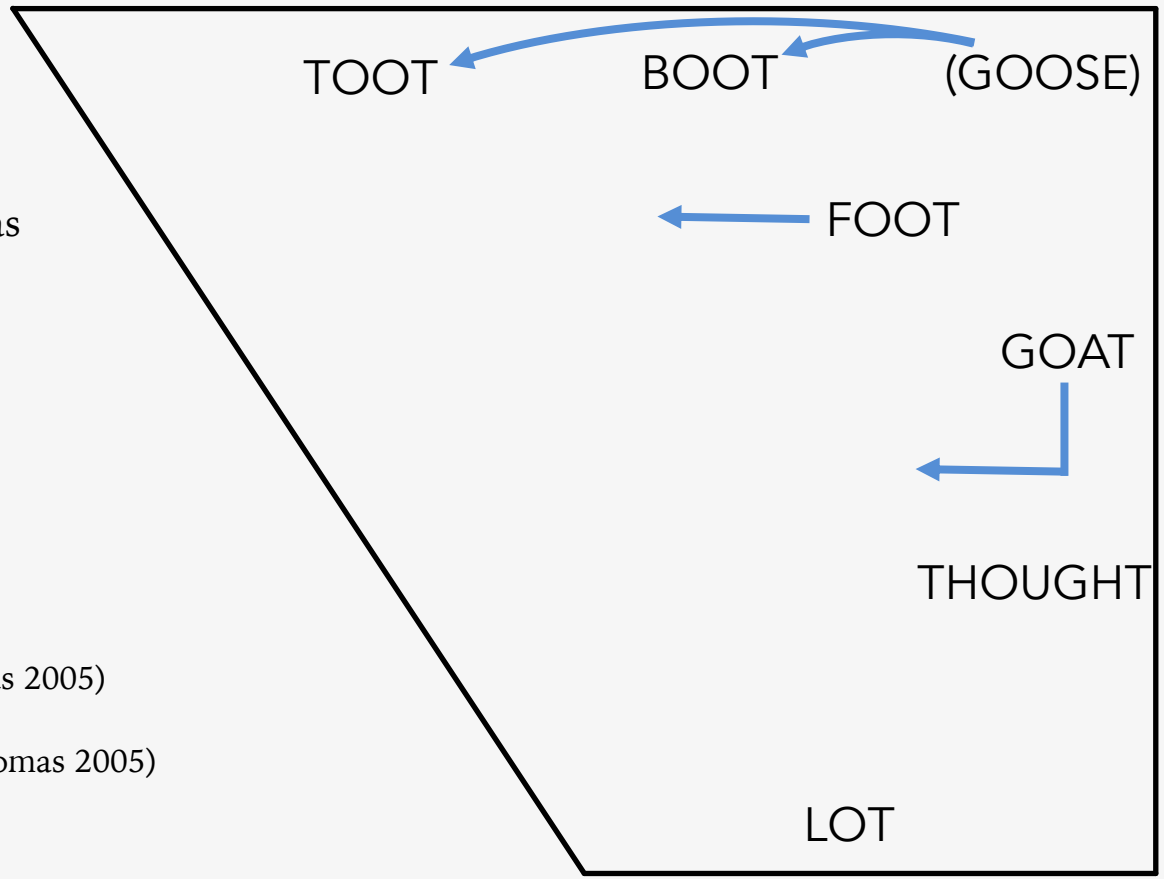
- Fronting since Civil War (Fridland 2001, Kurath & McDavid 1961)
- Fronted nucleus [ʉu] (Thomas 2007, Thomas & Coggshall 2014)
- We differentiate two allophones
  - TOOT: post-coronal
  - BOOT: non-post-coronal

GOAT

- Nucleus lowered in early 1900s (Thomas 2005)
- Fronting spread after WWII: [əu] (Thomas 2005)

FOOT

- Fronting is correlated with GOOSE and GOAT



Low Back Vowels

THOUGHT

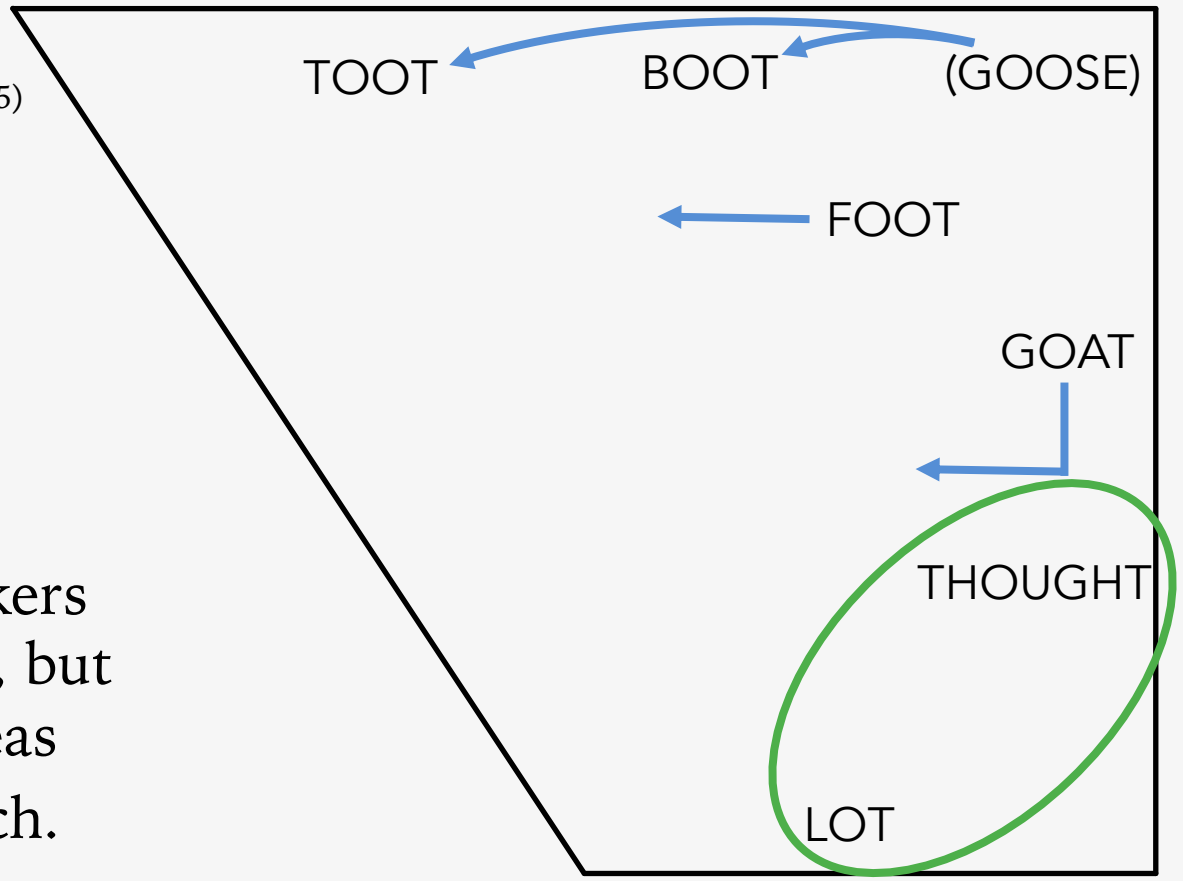
- Traditionally upgliding: [ɑɒ] (Thomas 2005)

LOT

- A very stable [ɑ] (Thomas 2005)

Low Back Merger?

- Recently spreading in younger speakers in areas like KY (Irons 2007), GA (Stanley 2019), but not Memphis (Fridland 2015) and other areas
- Not expected to occur in older speech.



Why study vowel dynamics?

Southern back vowels may be inherently diphthongal

Southern vowels' inherent formant dynamics are rarely explored

(cf. Fox & Jacewicz 2009, Farrington et al. 2018, Renwick & Stanley forthcoming)

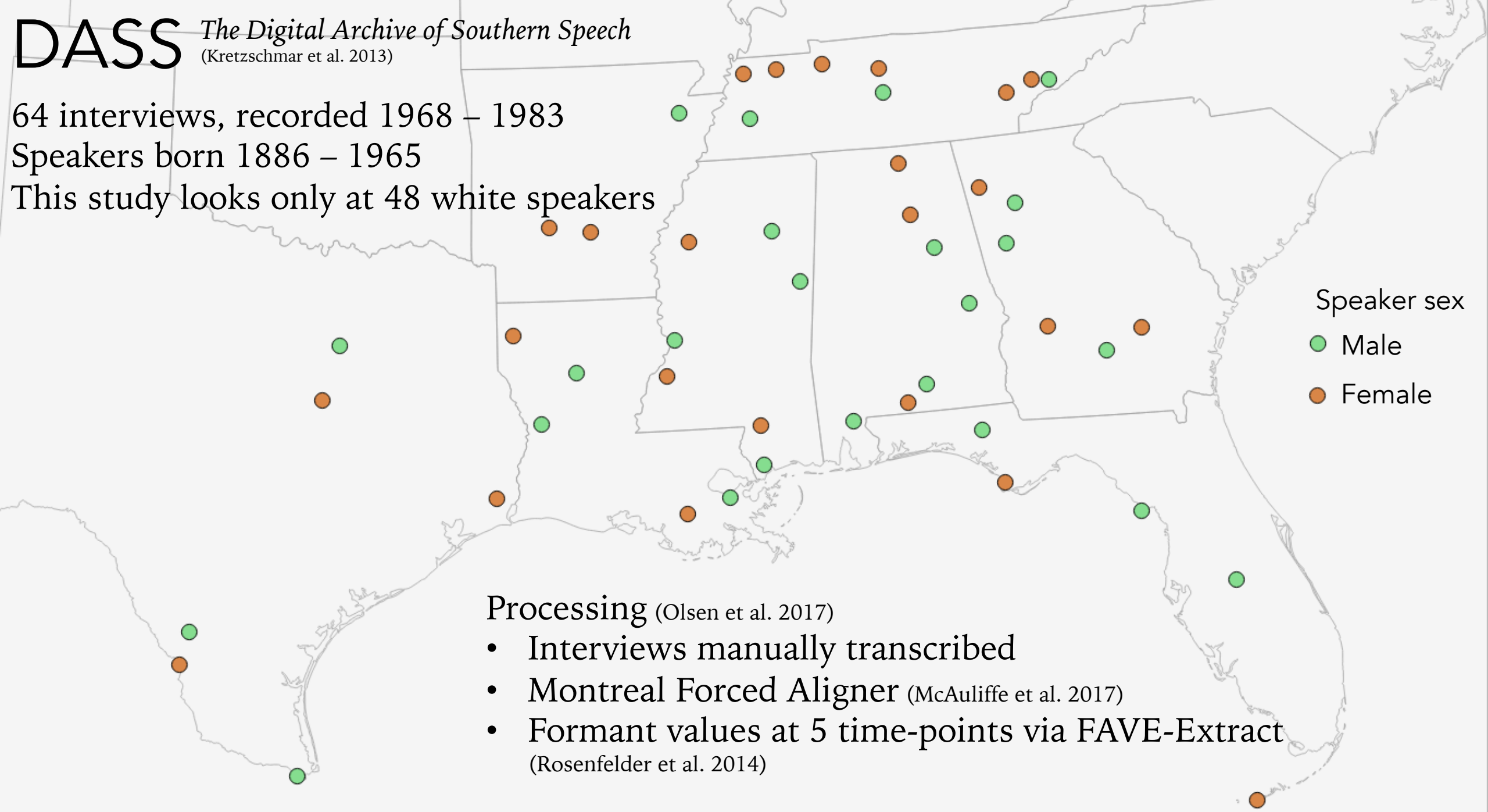
As Southern shifting is ongoing, vowel dynamics may change across generations

Our research question: How do back vowels' formant trajectory shapes and relative positions vary across male and female speakers of different generations?

Methods

DASS *The Digital Archive of Southern Speech*
(Kretzschmar et al. 2013)

64 interviews, recorded 1968 – 1983
Speakers born 1886 – 1965
This study looks only at 48 white speakers



Processing (Olsen et al. 2017)

- Interviews manually transcribed
- Montreal Forced Aligner (McAuliffe et al. 2017)
- Formant values at 5 time-points via FAVE-Extract (Rosenfelder et al. 2014)

Back vowel data

Vowel (Allophone)	Tokens
GOOSE (BOOT)	2,430
GOOSE (TOOT)	13,489
FOOT	8,965
GOAT	30,946
THOUGHT	13,157
LOT	15,962
Total analyzed	84,949

Total tokens: 243,136

- Stressed vowels only
- Stop words removed (e.g. function words)
- No pre-liquid tokens
- Outliers filtered with Mahalanobis distance according to a 95% X^2 distribution

- Analyzed tokens were Bark-transformed following Gahl & Baayen (2019)

Analyzing Trajectories

Generalized Additive Mixed-Effects Models (GAMMs; Wood 2017)

- Useful for multiple measurements per token across its duration
- Model the trajectory *itself* rather than its *properties* (length, etc.)
- Like linear models, GAMMs incorporate parametric effects
- Incorporate *smooth terms*, accounting for nonlinear predictors
- Random effects available, to account for idiosyncratic behavior

GAMMS are visualized using predicted values and difference smooths

See also Sóskuthy (2017), Gahl & Baayen (2019), Renwick & Stanley (forthcoming)

Model Specification

```
mgcv::bam(bark_raw ~

    formant_sex_vowel_gen +
    s(percent, by = formant_sex_vowel_gen, k = 4) +

    log_dur +

    s(speaker, allophone, formant, bs = "re") +
    s(speaker, allophone, formant, percent, bs = "re") +

    s(word, formant, bs = "re"),

  data = dass)
```

Dependent variable: Bark-transformed, unnormalized values; all data pooled

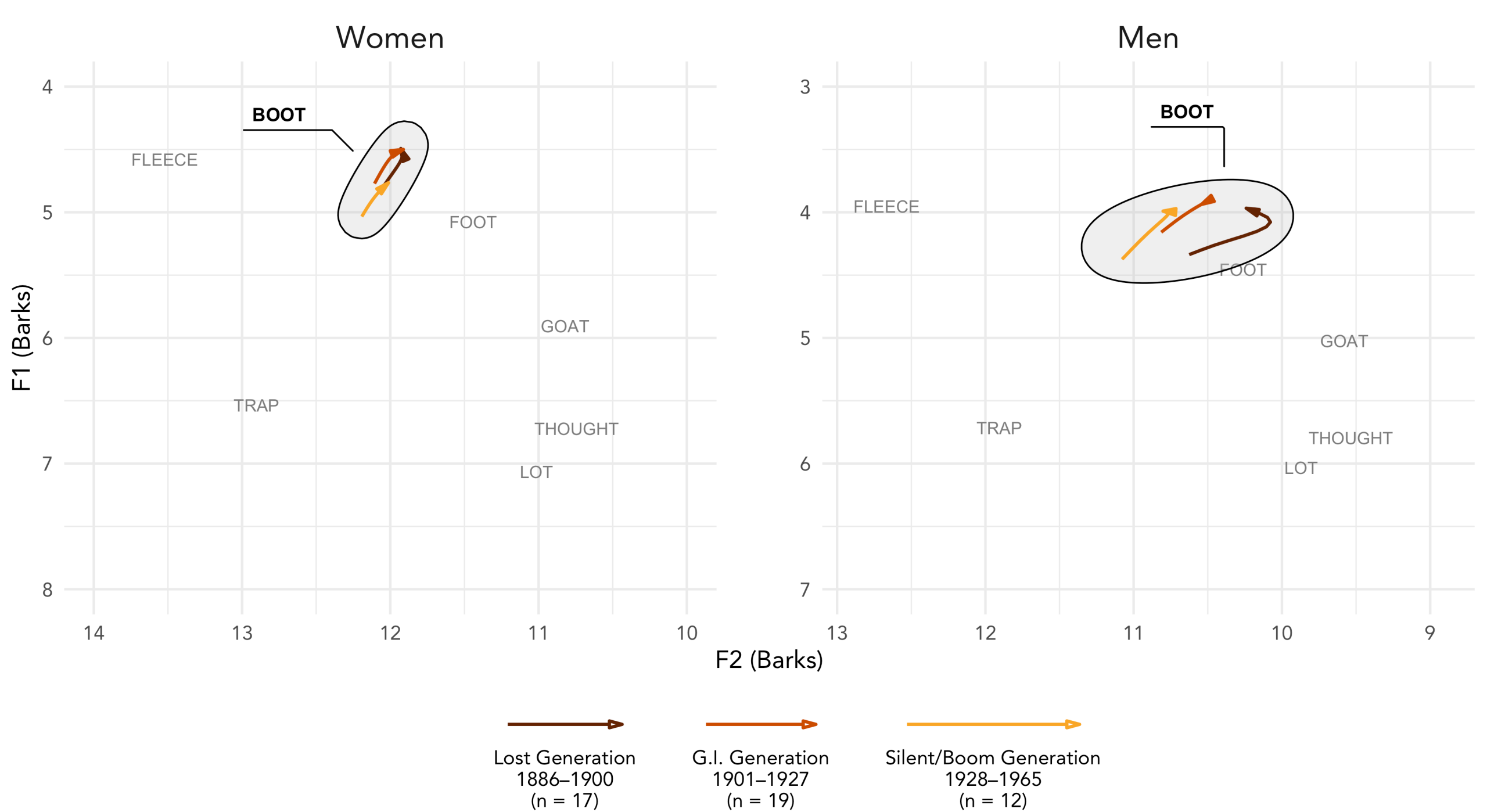
Fits different smooths for each combo of formant, sex, vowel, and generation

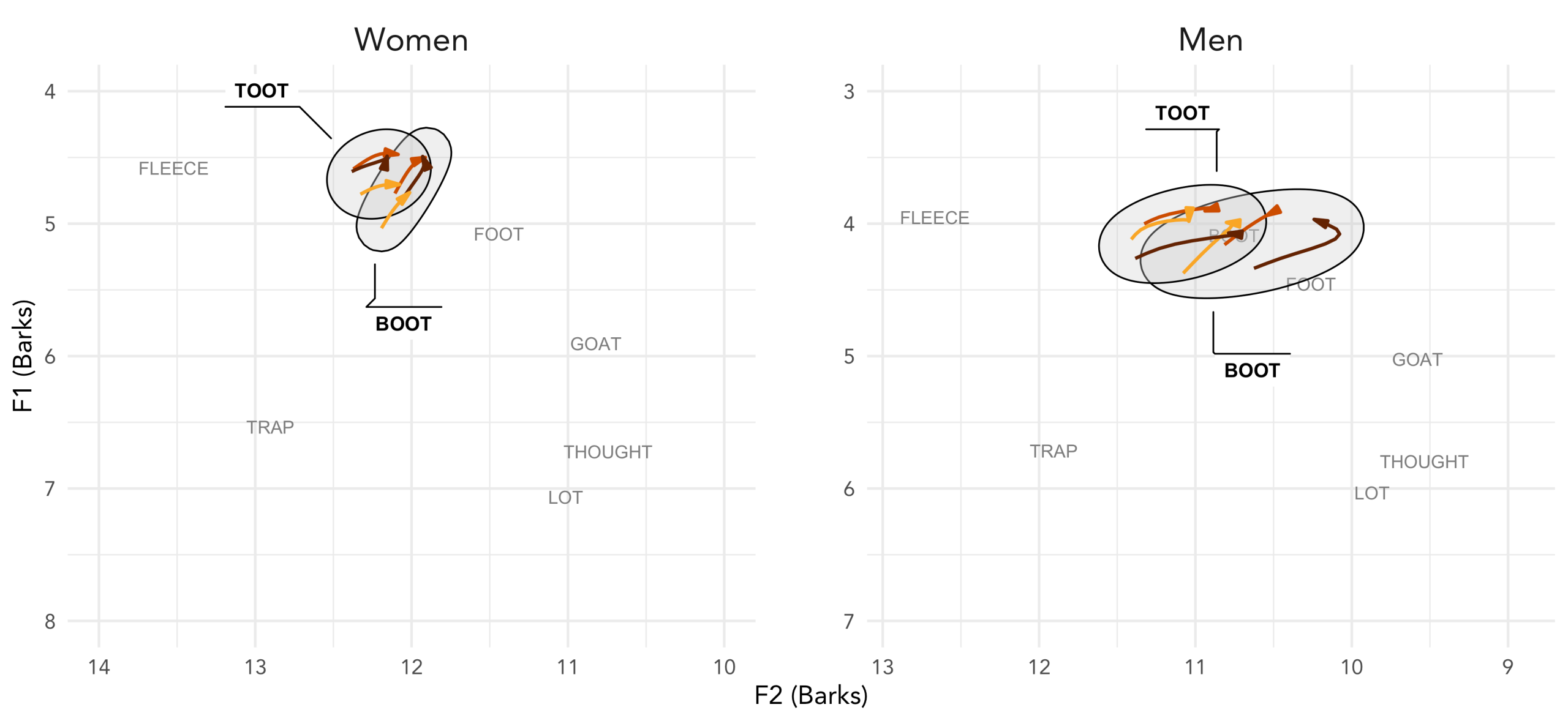
Controlled for duration

Random intercept and slope for speaker, interacting with vowel and formant.

Random intercepts for word, by formant

Results


Women
Men
BOOT
FLEECE
FOOT
GOAT
TRAP
THOUGHT
LOT
F1 (Barks)
F2 (Barks)
4
5
6
7
8
14
13
12
11
10
3
9
Lost Generation
1886–1900
(n = 17)
G.I. Generation
1901–1927
(n = 19)
Silent/Boom Generation
1928–1965
(n = 12)



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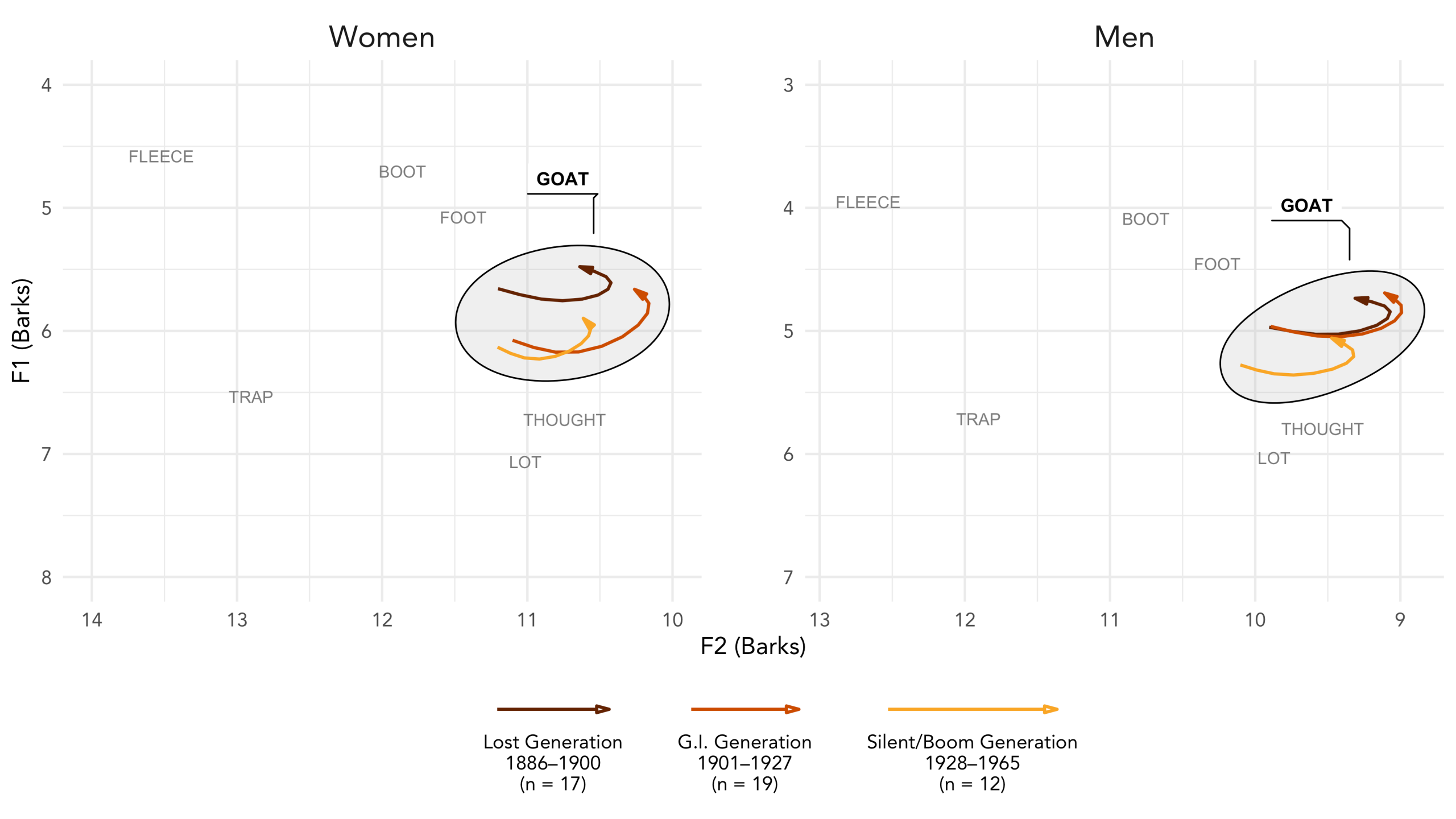
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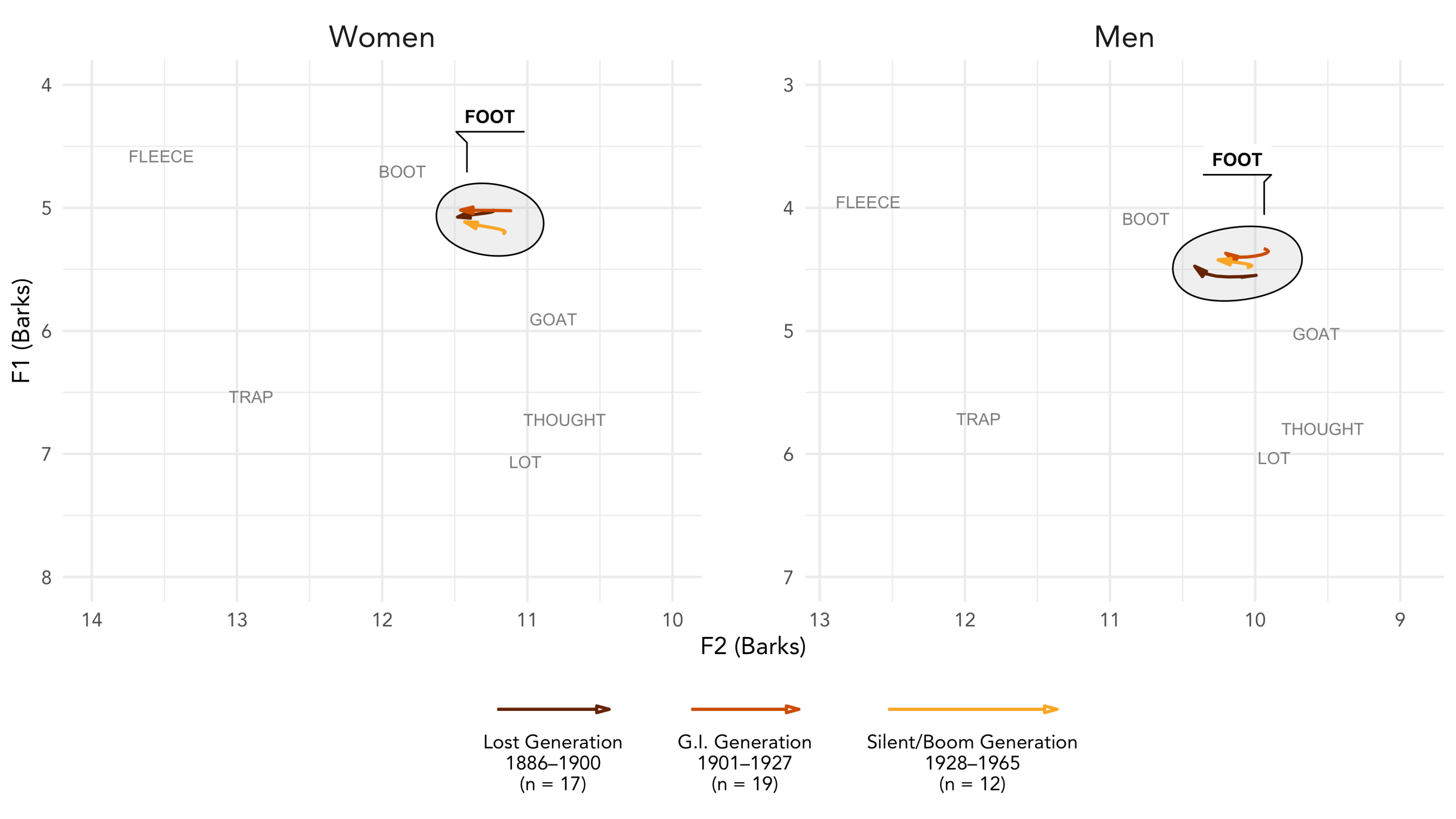
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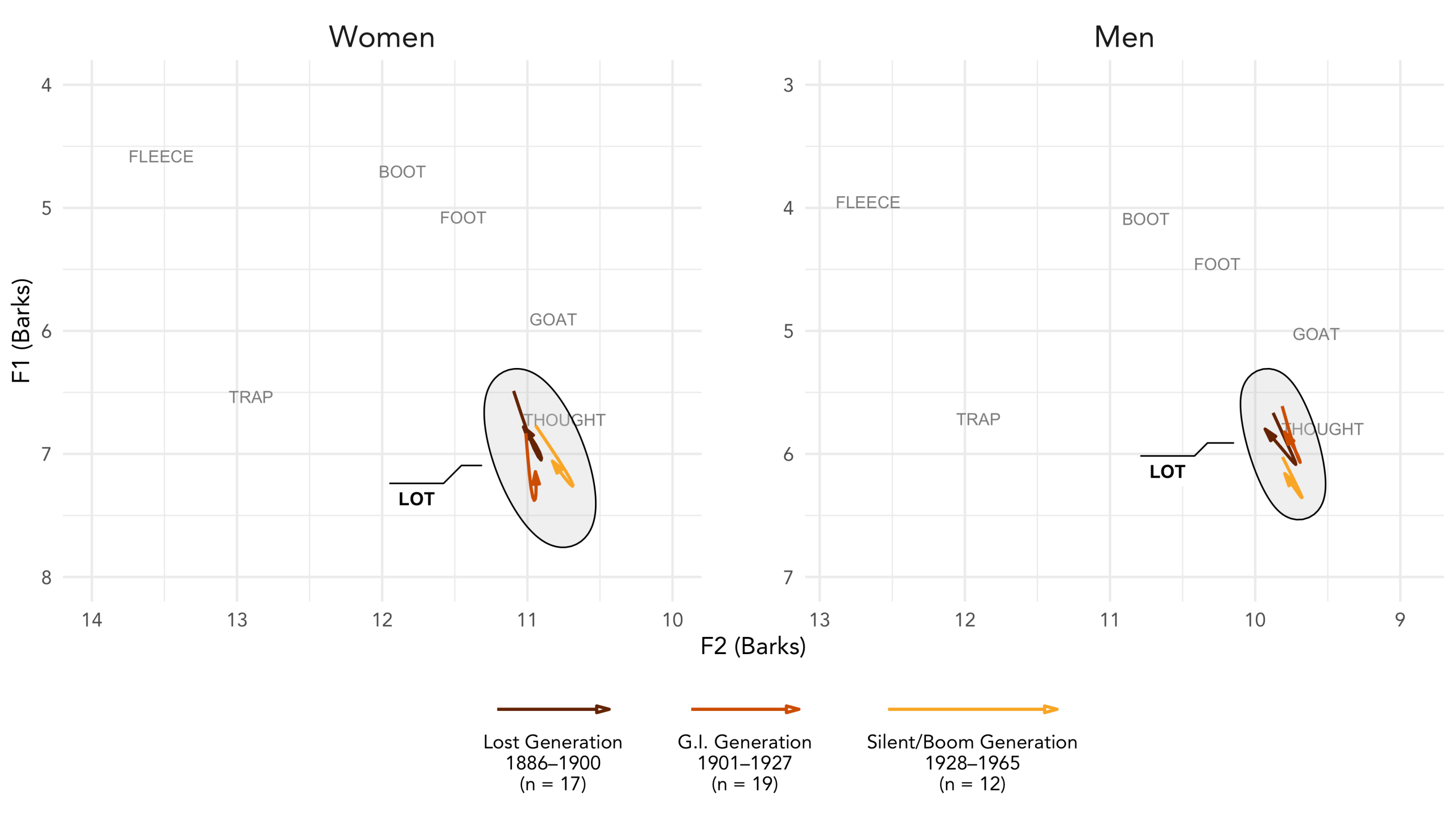
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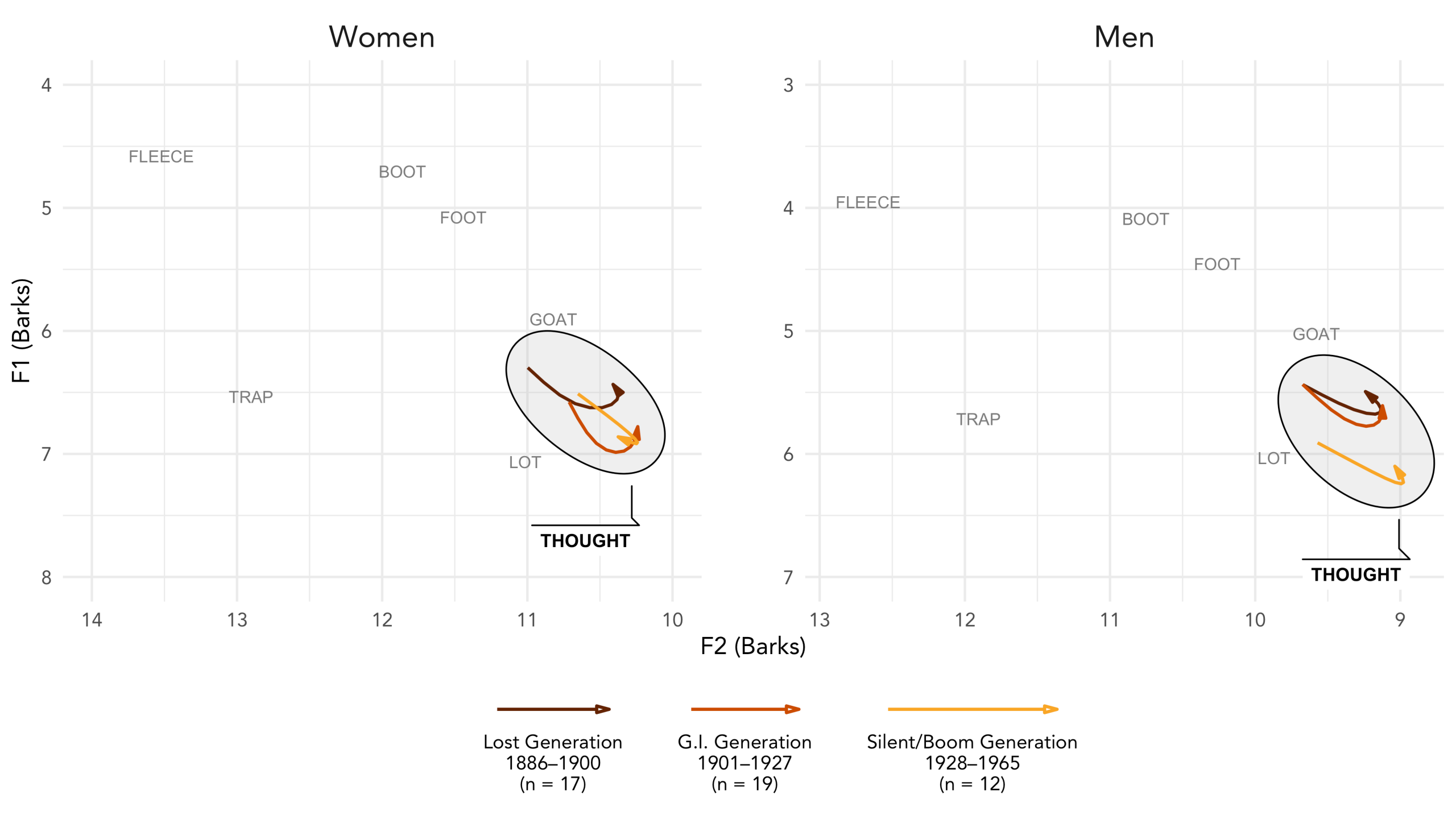
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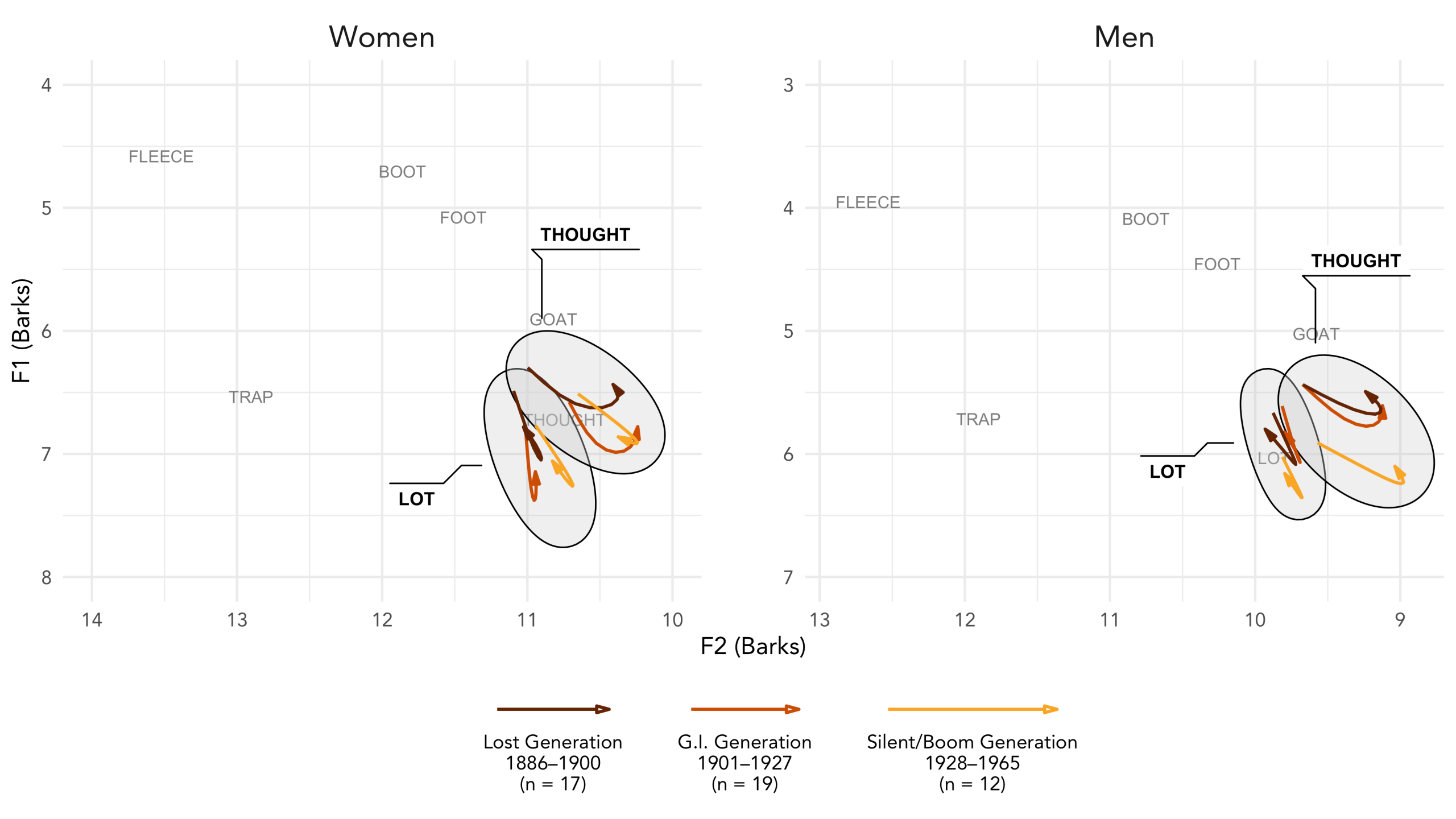
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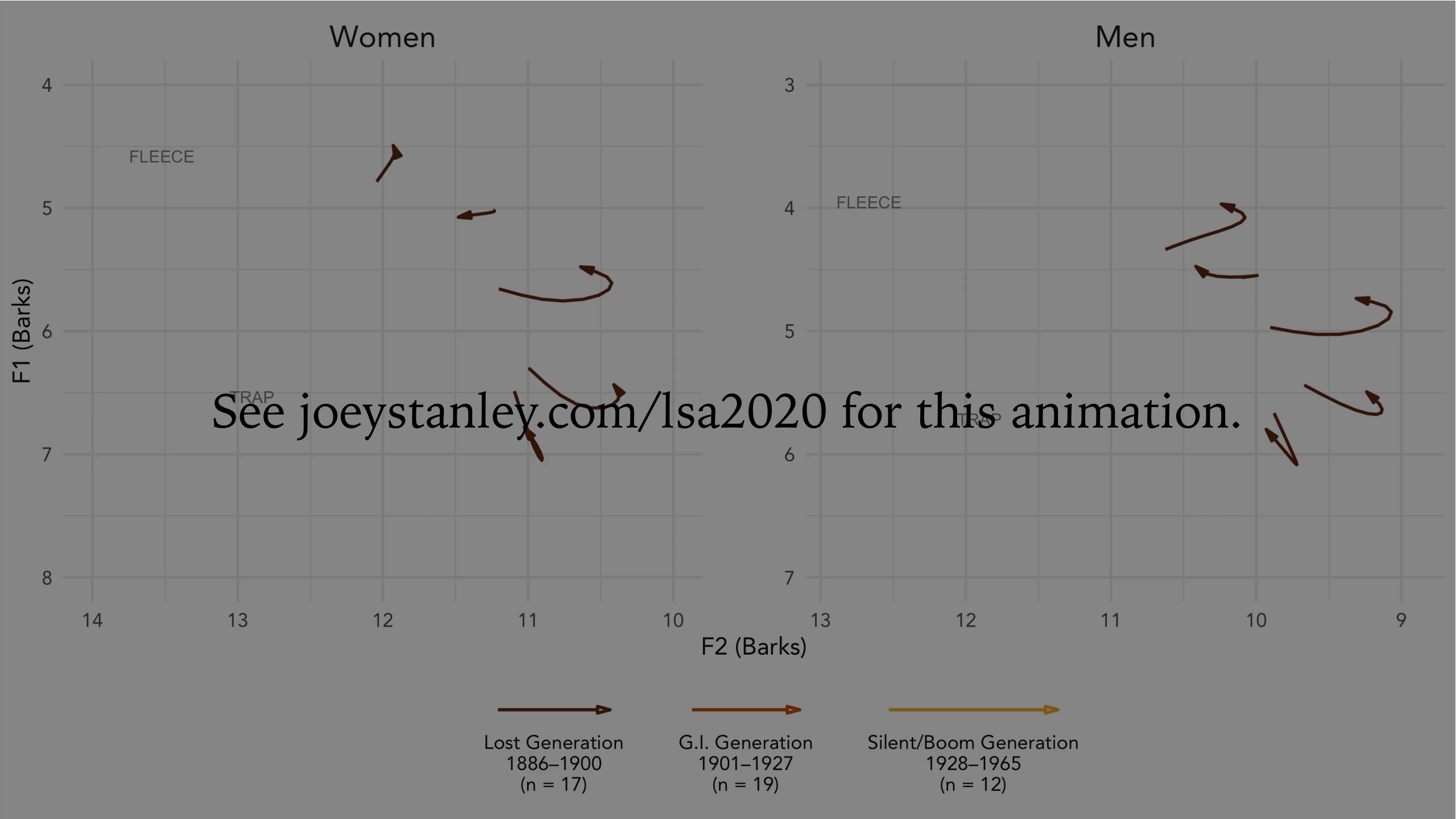

See joeystanley.com/lsa2020 for this animation.

Discussion & Conclusion

Back vowels are variably dynamic

Acoustic confirmation of impressionistic descriptions

- GOOSE-fronting is old; it was nearly complete by 1900 in these speakers.
  - Data show a completed change for women and a change in progress for men.
- GOAT-fronting is not yet apparent in this sample.
- GOAT-lowering appears to be in progress, and is later than GOOSE-fronting.
- FOOT fronting lags behind GOOSE, but may precede GOAT-fronting.
- THOUGHT is not clearly upgliding; perhaps closer to [ɑɒ] (Thomas 2005)
- LOT and THOUGHT have different trajectories and positions in the vowel space.

Within each vowel, we find relatively consistent trajectory shapes.

- Not an artifact of modeling: each vowel/gen/sex combo was fit independently.
- Within DASS, Southern US speakers appear to shift nucleus and glide in tandem.

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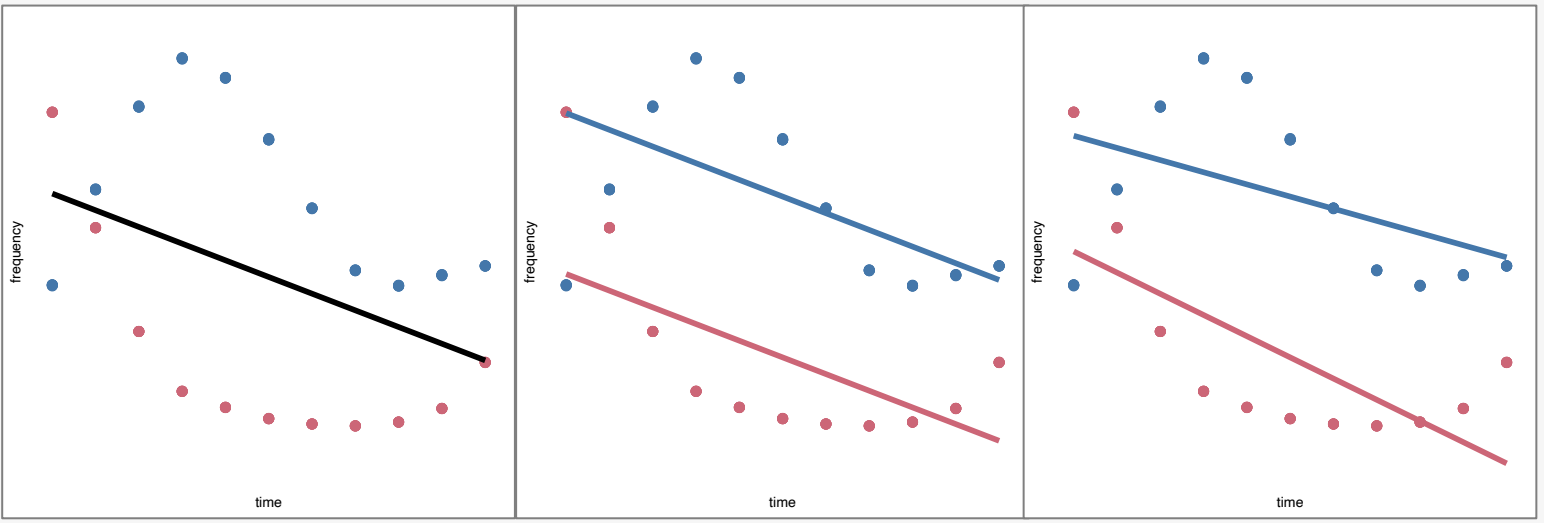
Special thanks to Rachel Olsen and Katie Kuiper

This slideshow available at
joeystanley.com/lsa2020

Bonus Slides

◀ Linear mixed-effects models




```
lm(frequency ~ time)
```

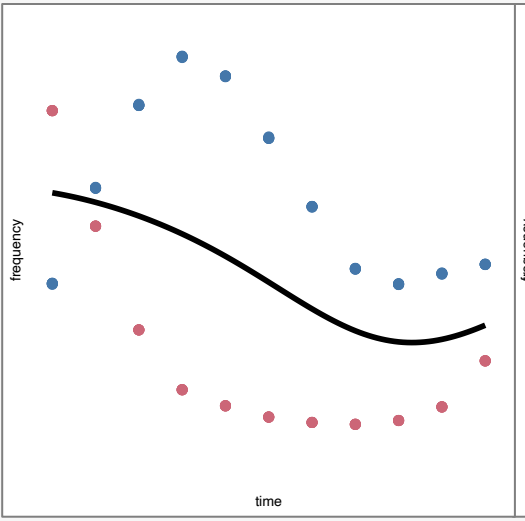


```
lm(frequency ~ time+group)
```

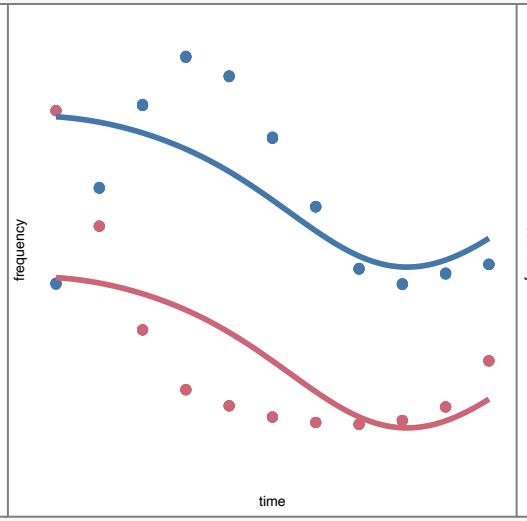


```
lm(frequency ~ time*group)
```

▼ Generalized additive mixed-effects models




```
bam(frequency ~
    s(time, by=time))
```

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bam(frequency ~ group
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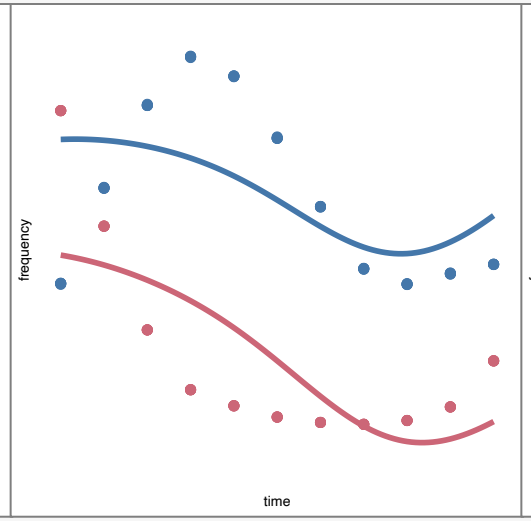
```




```
bam(frequency ~ time*group
    s(time, by=time))
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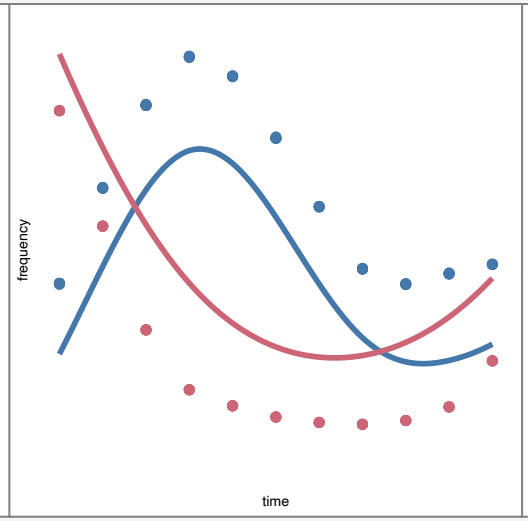


```
bam(frequency ~
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    s(time, by=group))
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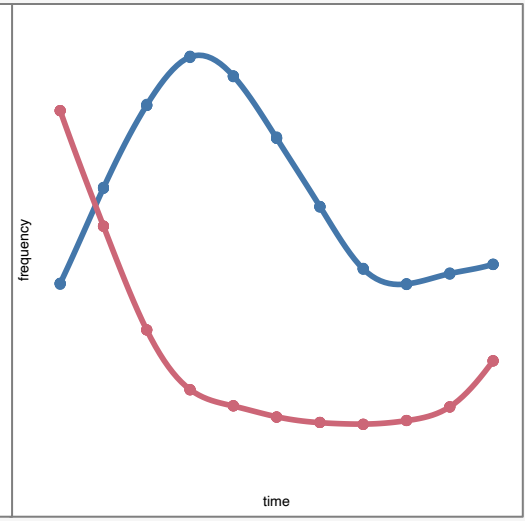


```
bam(frequency ~ group +
    s(time, by=time) +
    s(time, by=group))
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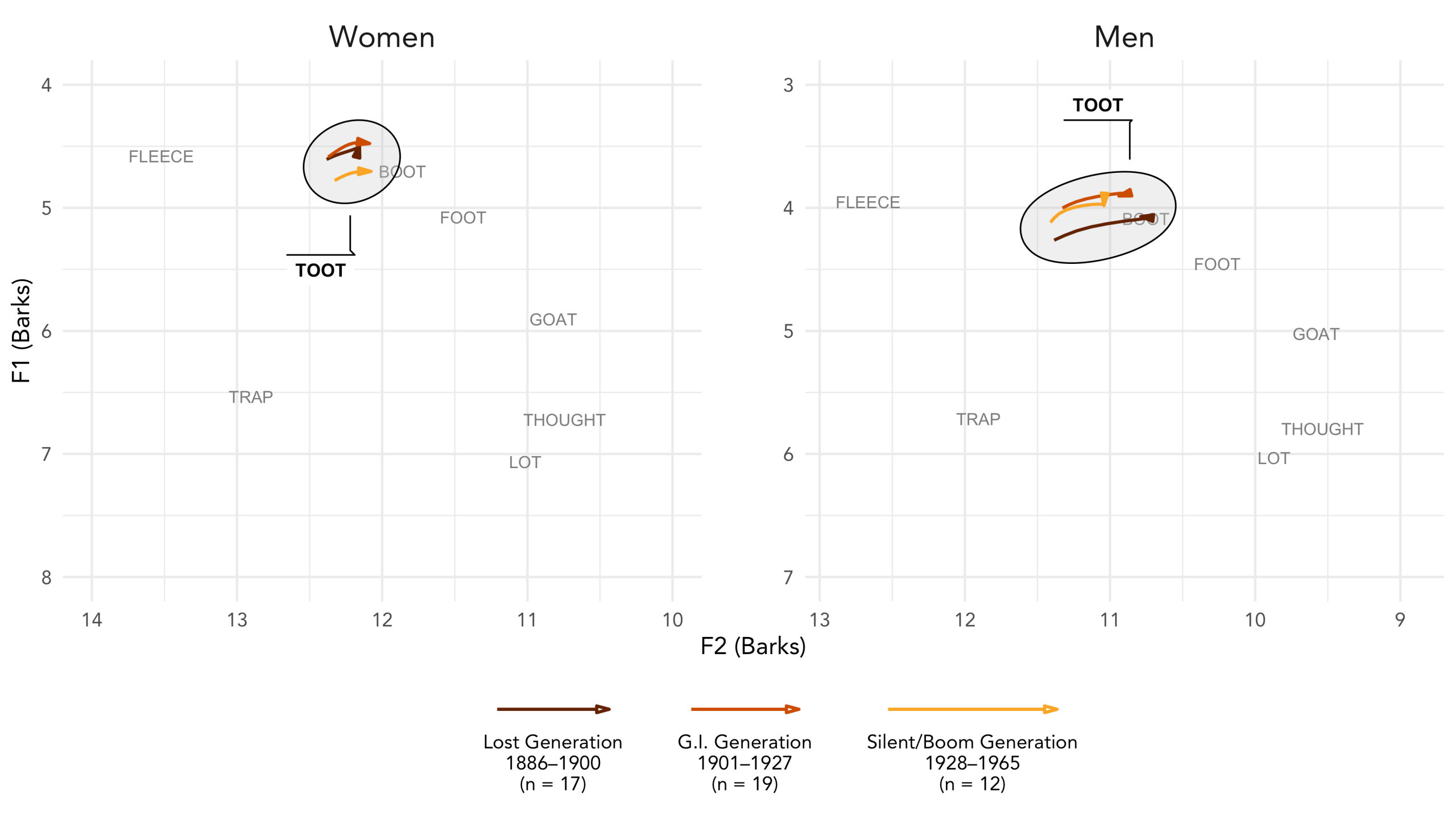
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Men
F1 (Barks)
F2 (Barks)
FLEECE
BOOT
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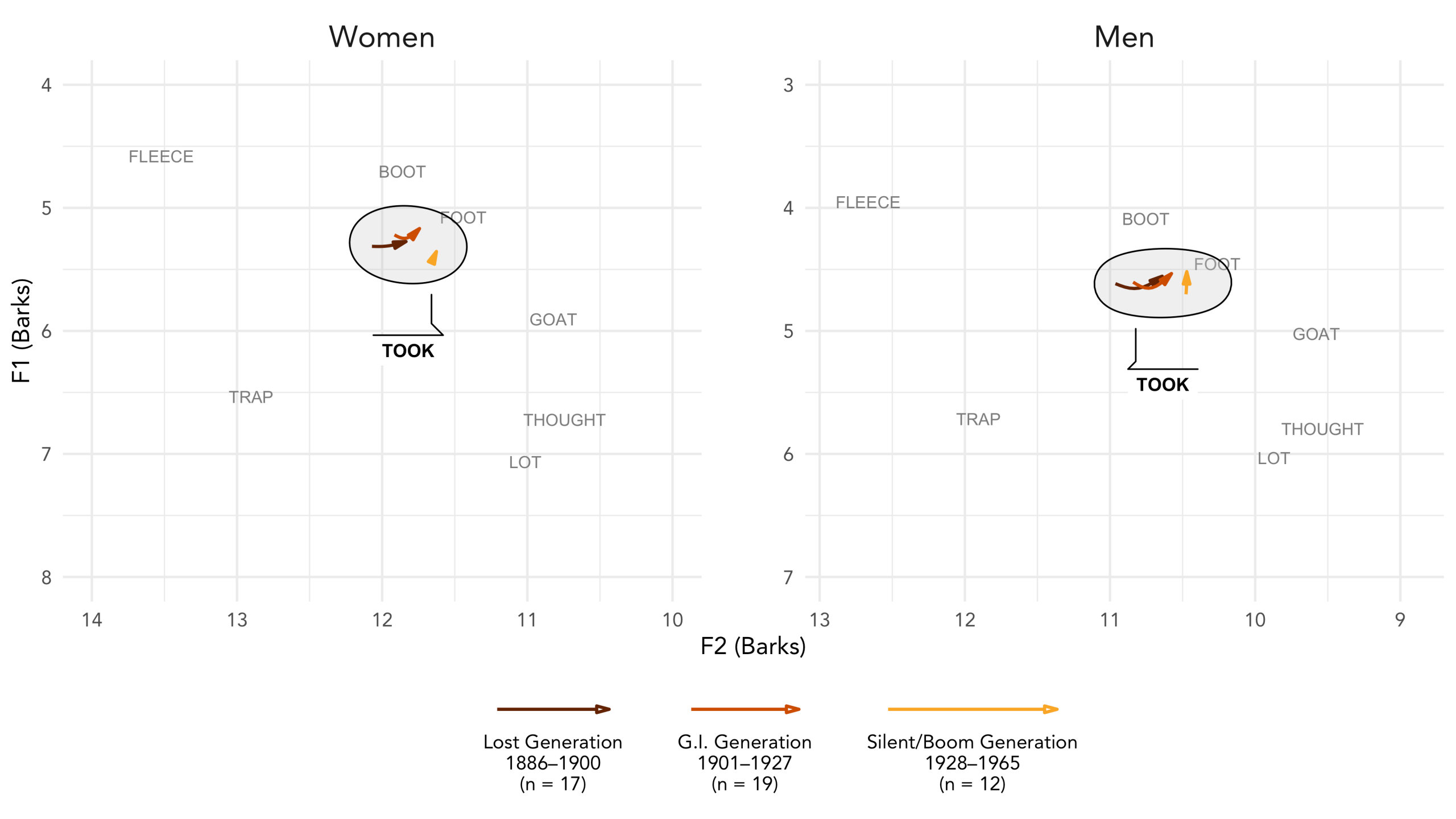
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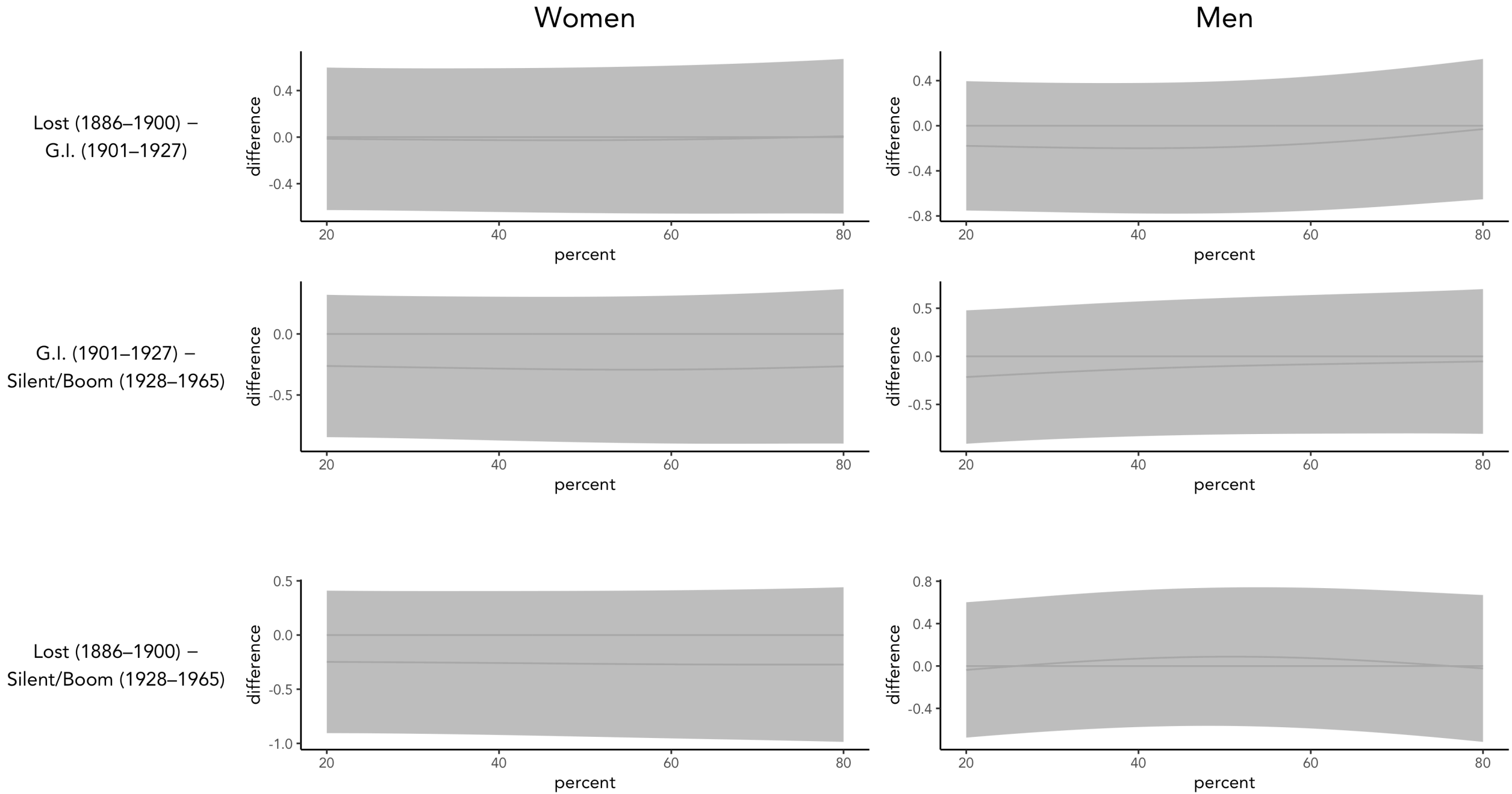
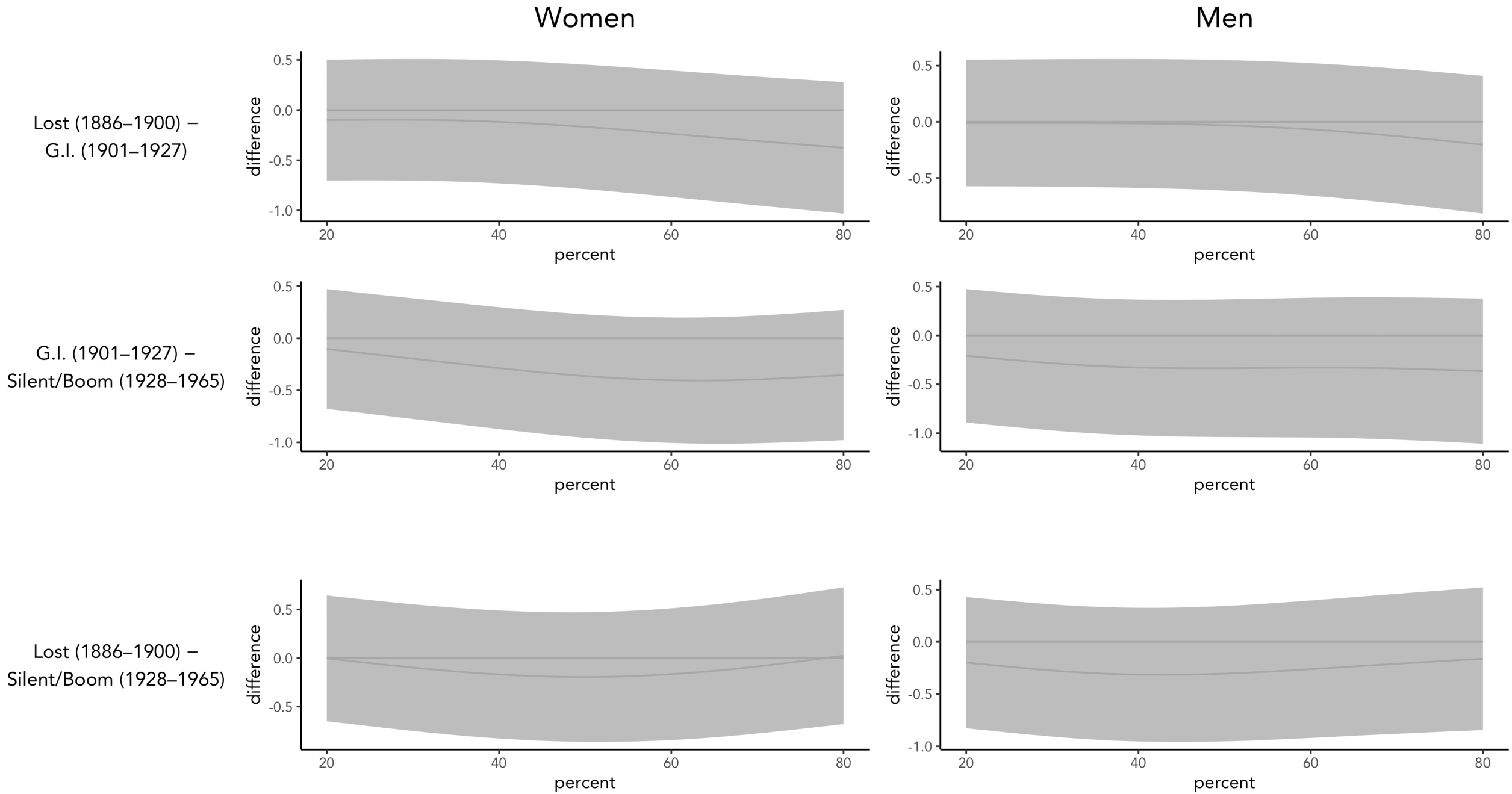
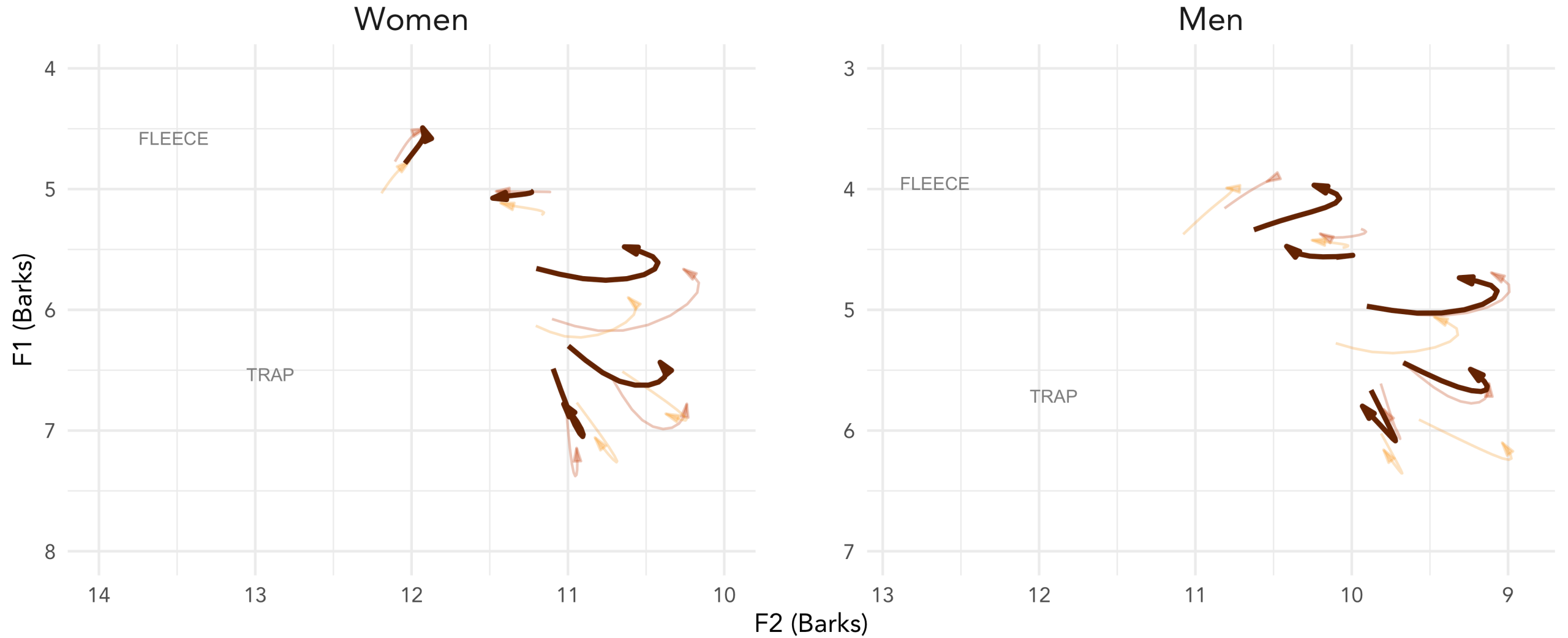
BOOT F1 Difference Smooths



GOAT F2 Difference Smooths



Lost Generation (1886–1900)



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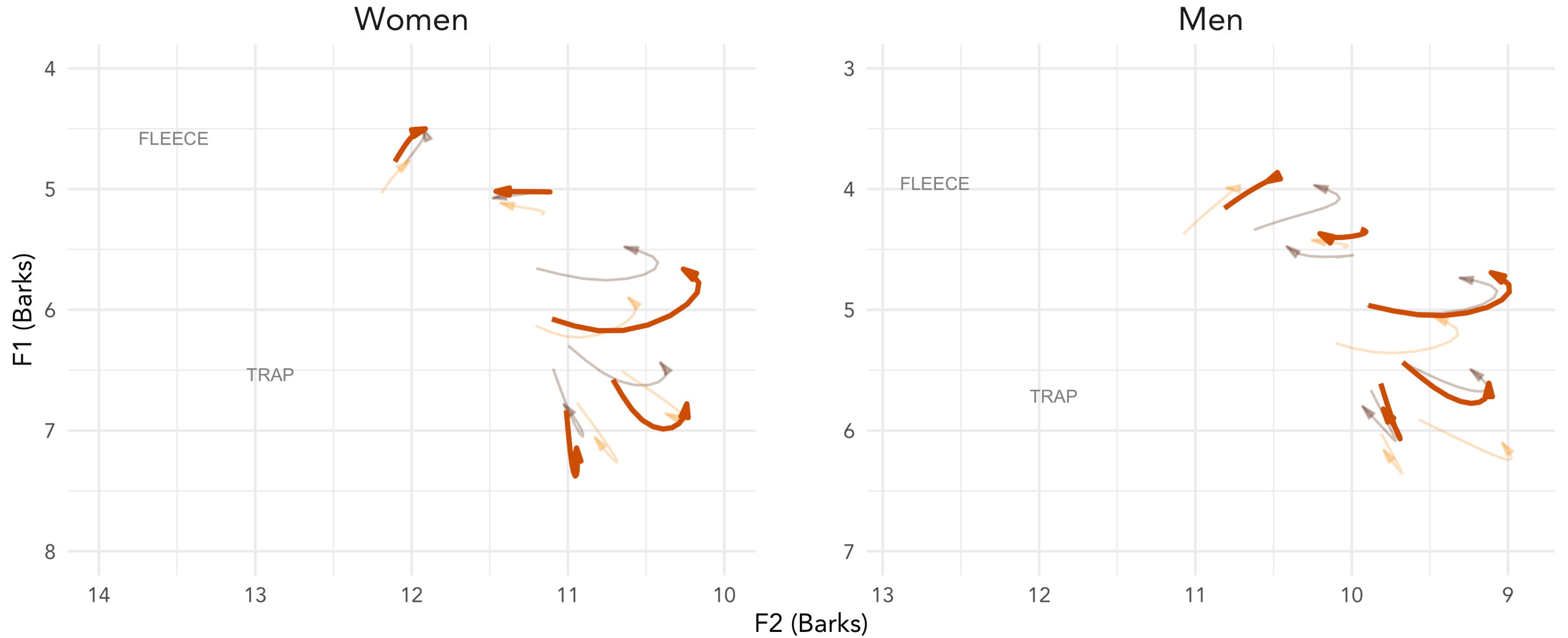

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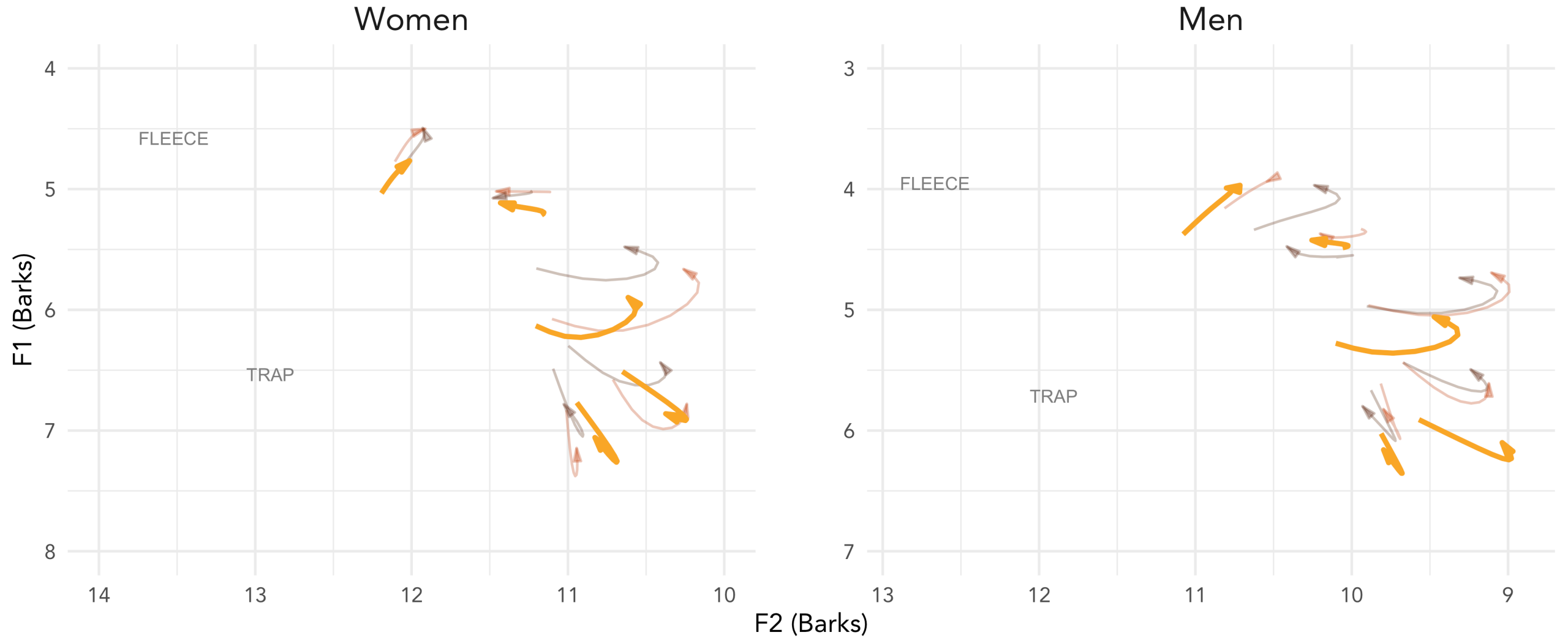

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