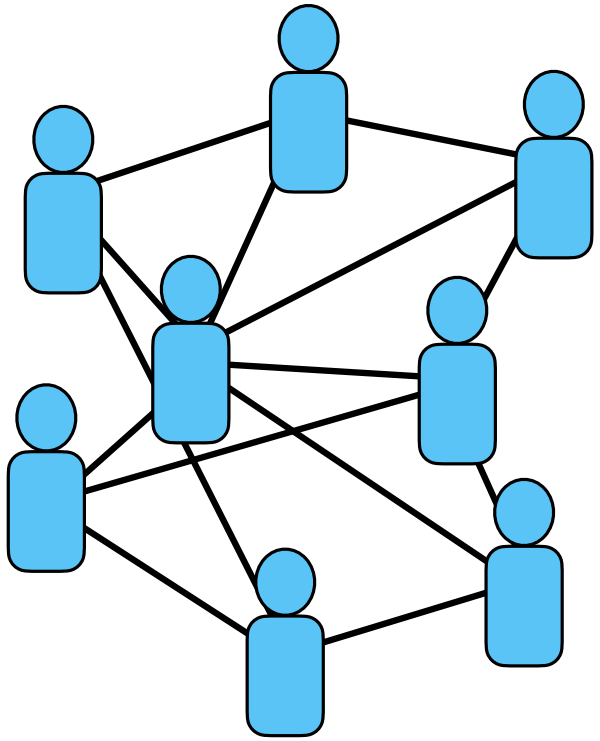
Diachronic Verb Usage Statistics and Sentence Processing Across the Lifespan

Ellis Cain, Sarah Brown-Schmidt, Rachel Ryskin

Language as a complex adaptive system

- System of speakers in a speech community
- Feedback loop between past interactions and future usage patterns

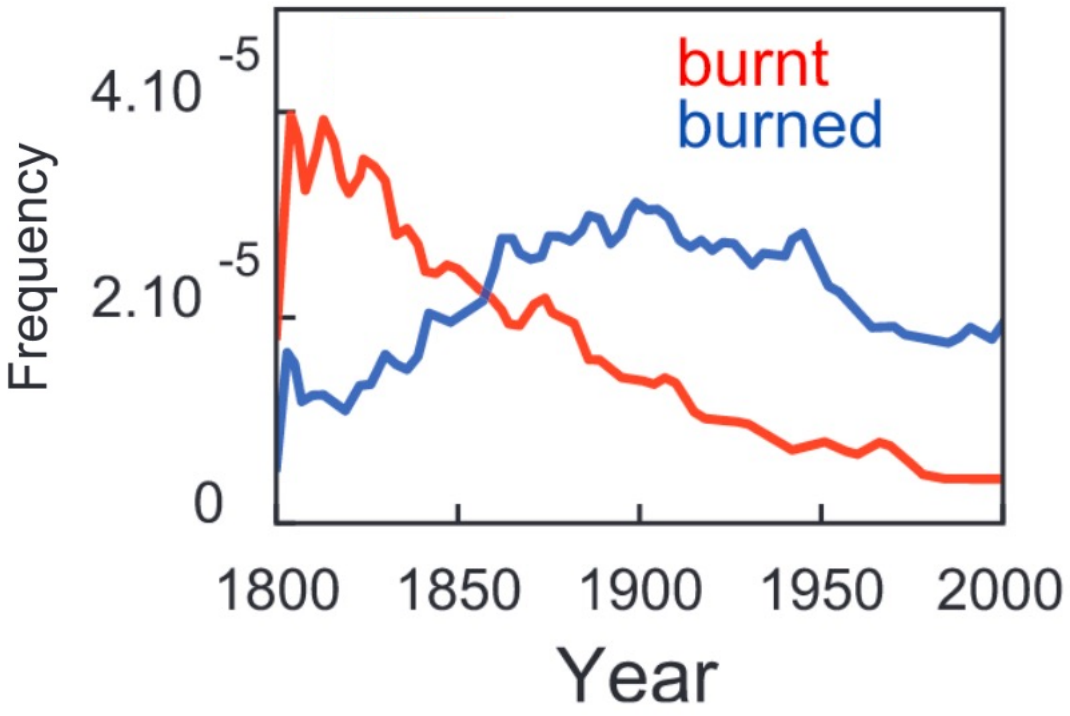


Beckner et al., 2009; Michel et al., 2011

Language as a complex adaptive system

- System of speakers in a speech community
- Feedback loop between past interactions and future usage patterns

- Language change as an <u>emergent</u> property



Beckner et al., 2009; Michel et al., 2011

Syntactic ambiguity

Pet the frog with the feather

Syntactic ambiguity

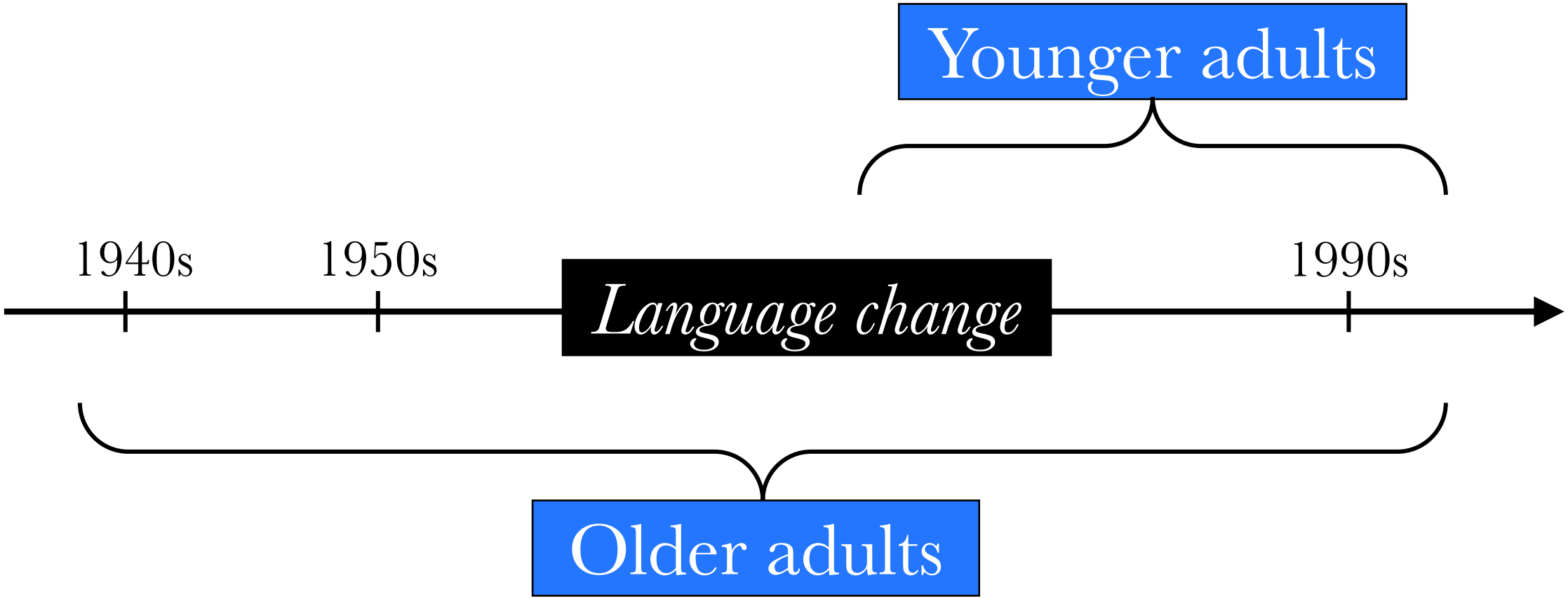
Pet the frog [with the feather]

Modifier

Syntactic ambiguity

Pet the frog [with the feather]

Instrument


Younger adults
1940s
1950s
Language change
1990s
Older adults

Verb biases

People's interpretations reflect the usage patterns of verbs

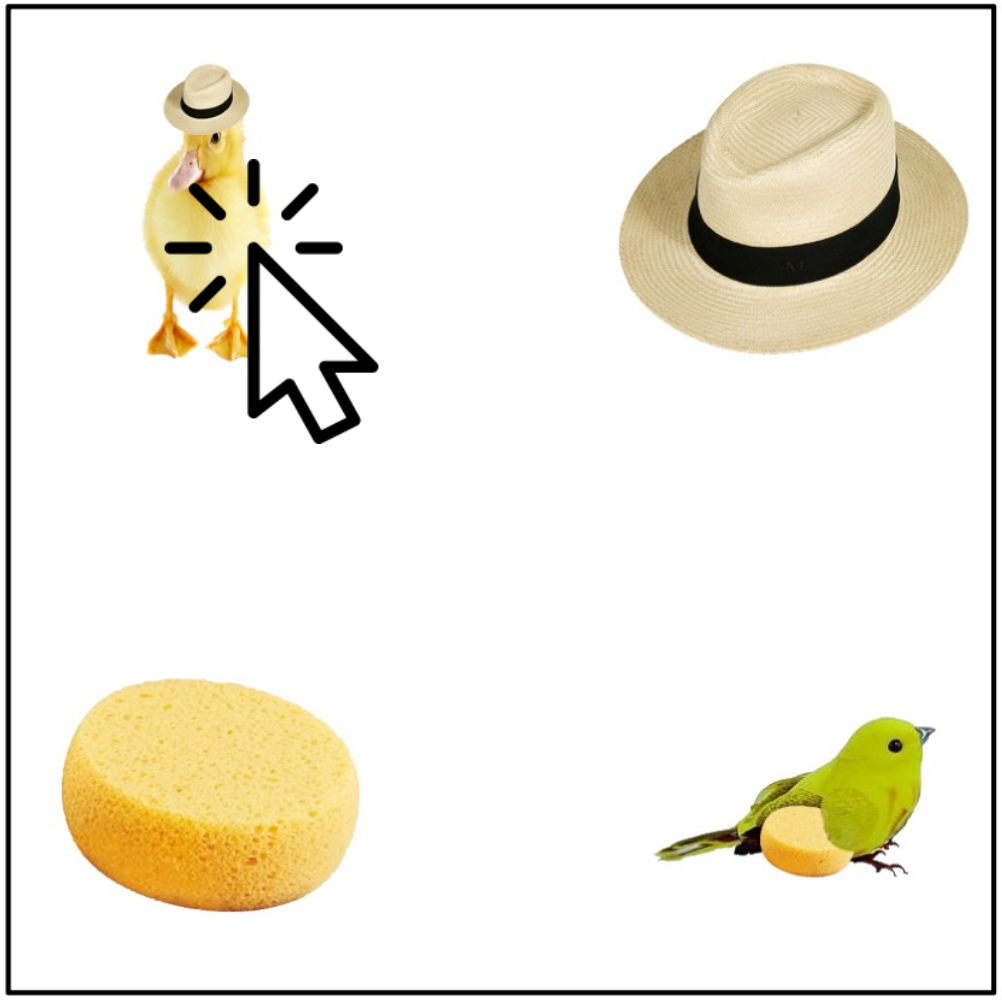
Ryskin et al., 2017; Snedeker & Trueswell, 2004

Verb biases

Participants are presented with a scene:

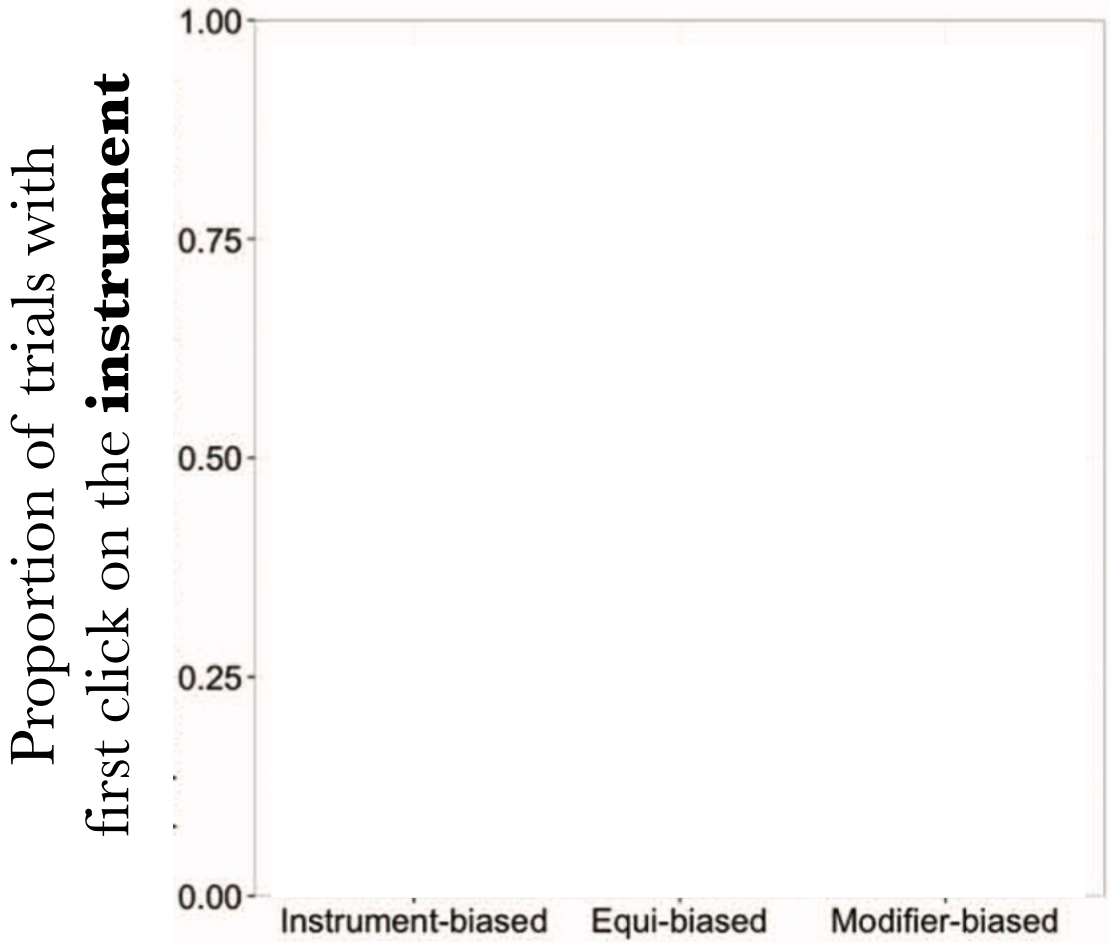
"**Find** the duck with the hat"

Modifier



Ryskin et al., 2017; Snedeker & Trueswell, 2004

Biases can be modified by experience



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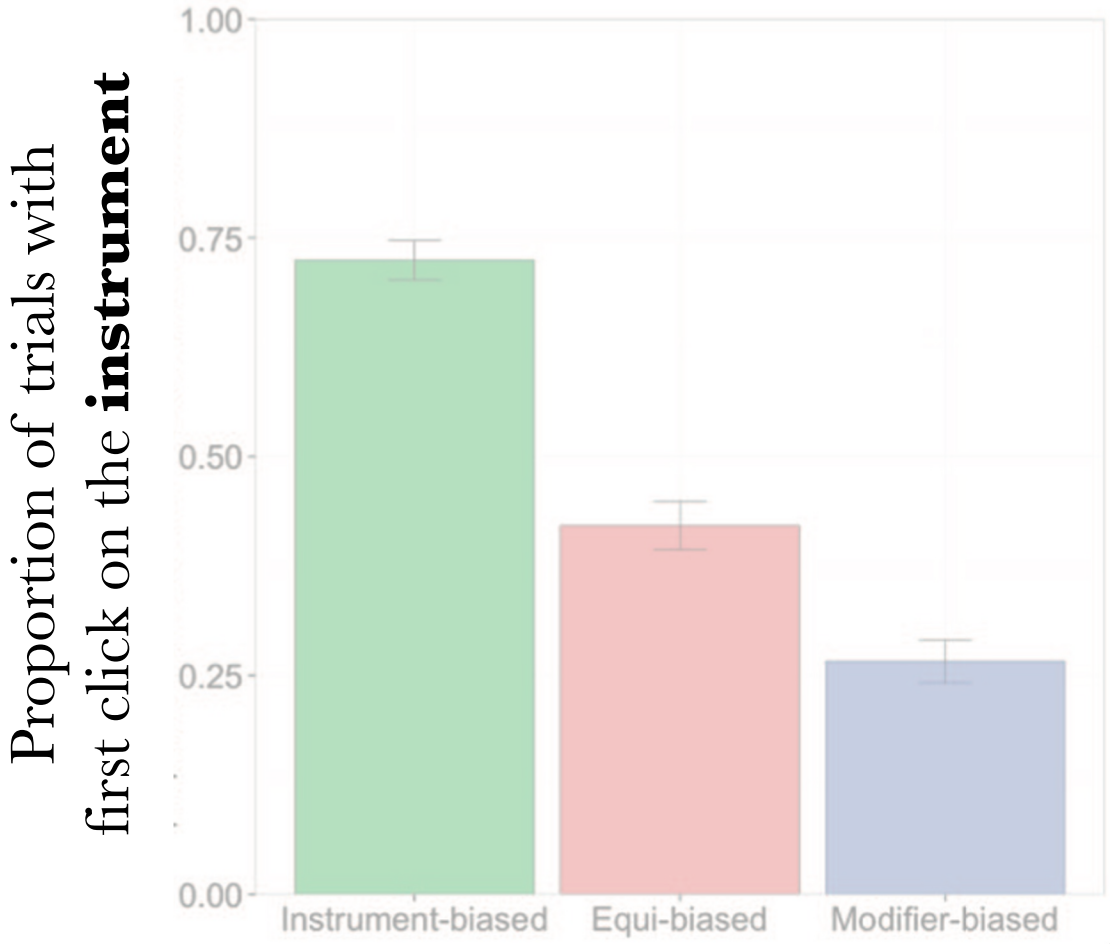
Biases can be modified by experience

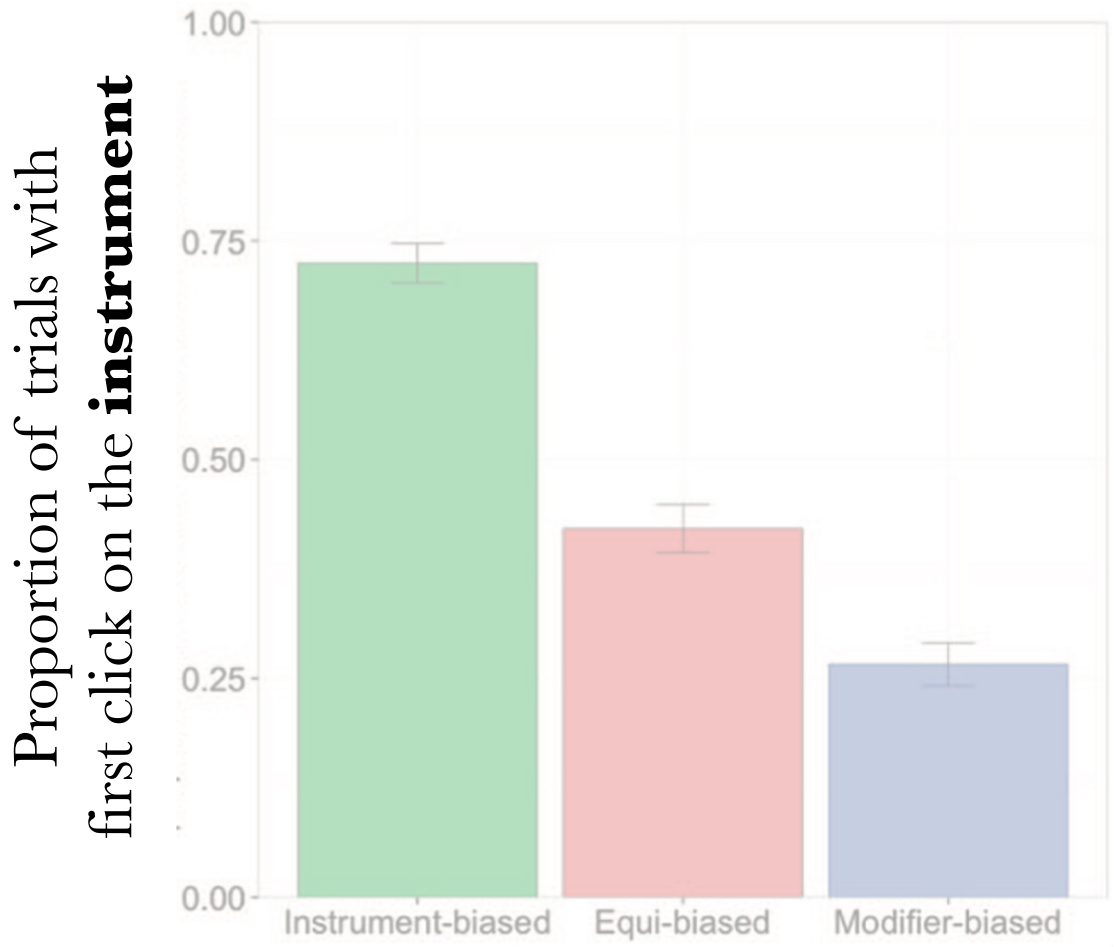


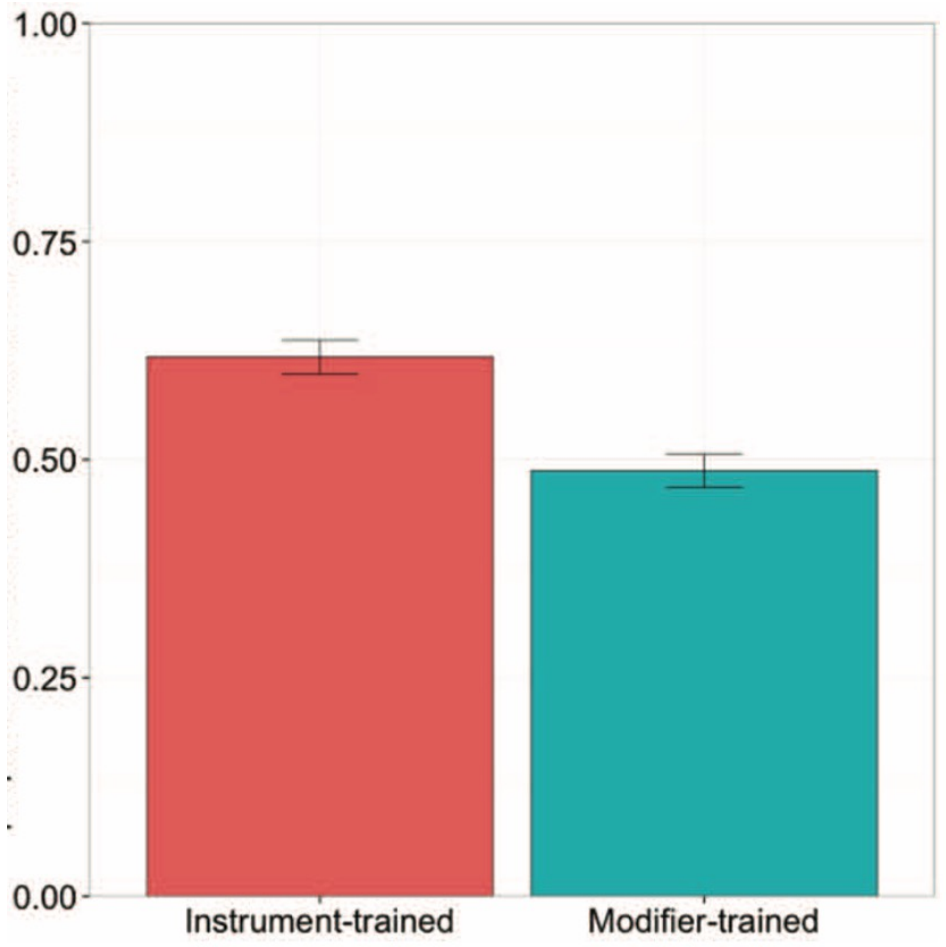
Unambiguous training:

"Rub the bunny with the bottle"

Ryskin et al., 2017; Snedeker & Trueswell, 2004

Biases can be modified by experience





Ryskin et al., 2017; Snedeker & Trueswell, 2004

Research questions

1. Do verb biases change over time?
2. Are there differences in interpretations across the lifespan?
3. Is there a relationship between usage statistics and changes across the lifespan?

Do verb biases change over time?

Syntactic n-gram corpus (Goldberg & Orwant, 2013)

- Dependency tree fragments from Google books corpus
- Extracted constructions from 1940s - 2000s

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point/VBP/rcmod/0 to/TO/prep/2 bronchitis/NN/pobj/3 with/IN/prep/4 emphysema/NN/pobj/5
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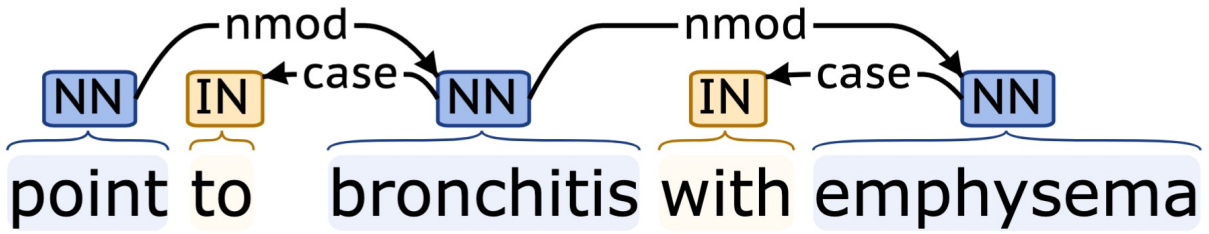


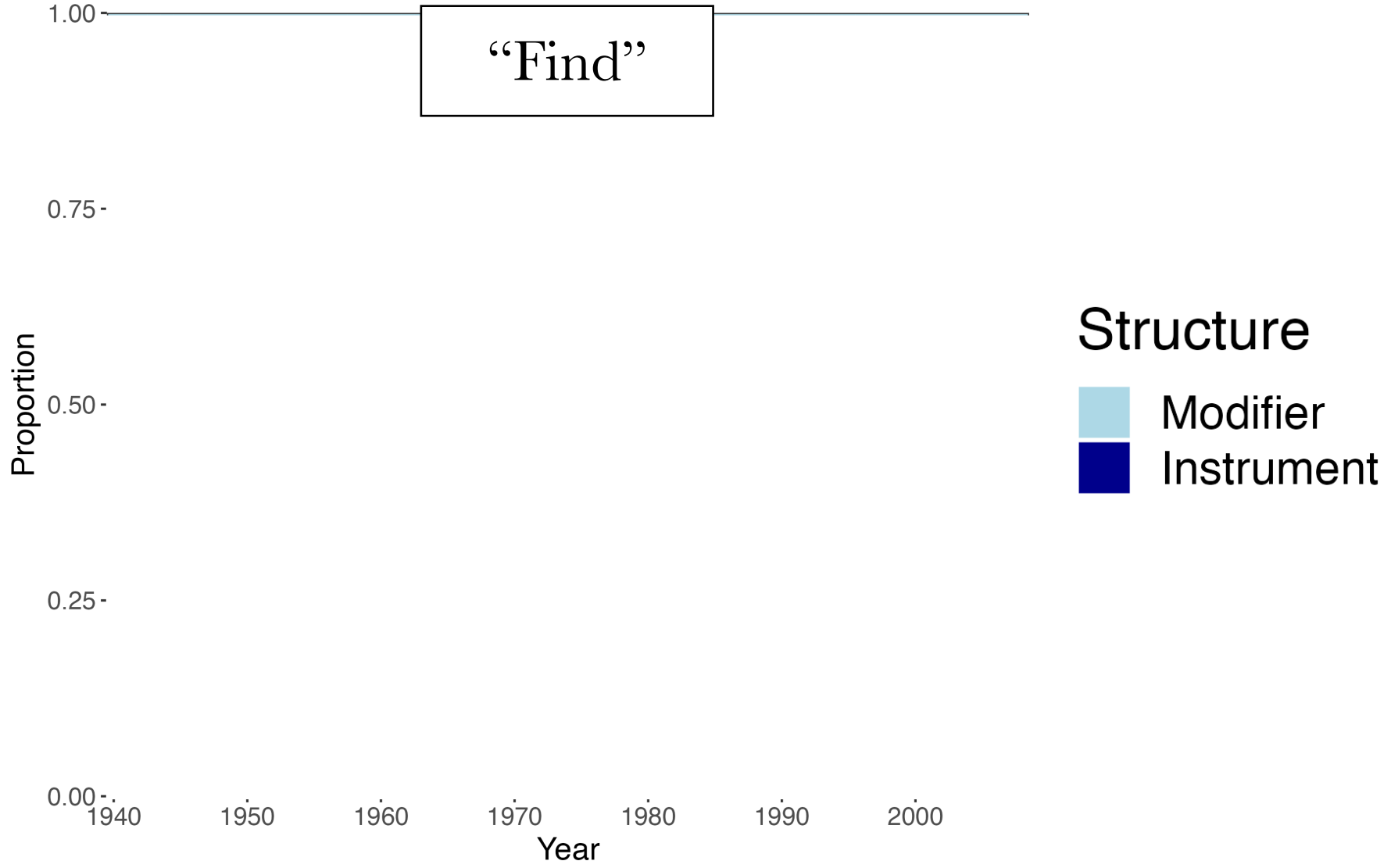
Do verb biases change over time?

Syntactic n-gram corpus (Goldberg & Orwant, 2013)

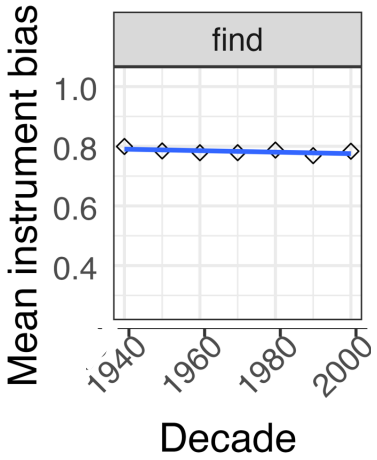
Verbs from Ryskin et al., 2017

Strike	Smack	Knock on	Pet	Hug
Whack	Clean	Pat	Look at	Select
Hit	Tease	Locate	Squeeze	Choose
Rub	Feed	Feel	Pick out	
Poke	Scuff	Spot	Cuddle	
Bop	Pinch	Point to	Find	

Verb biases change over time



Verb biases change over time



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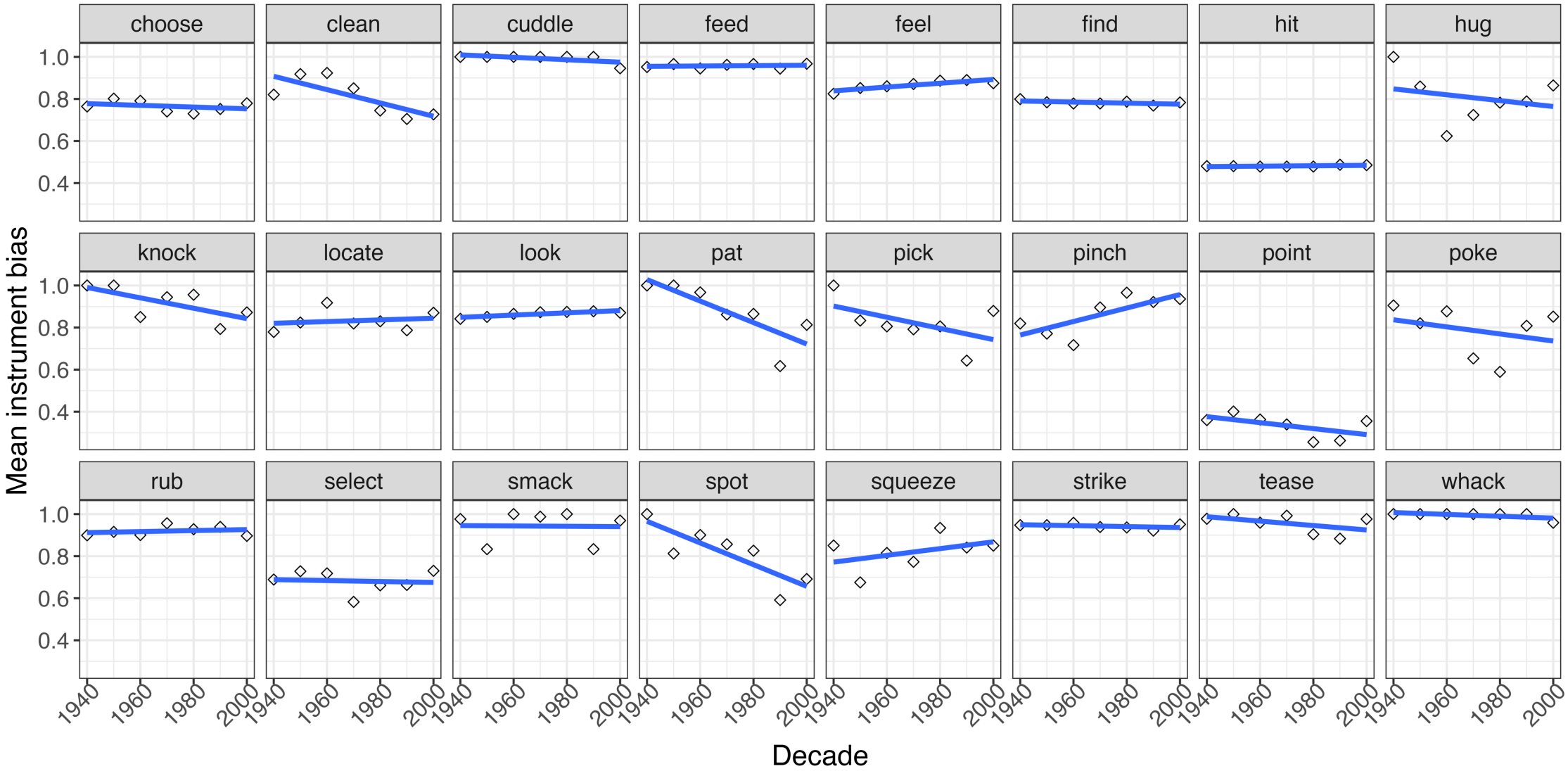
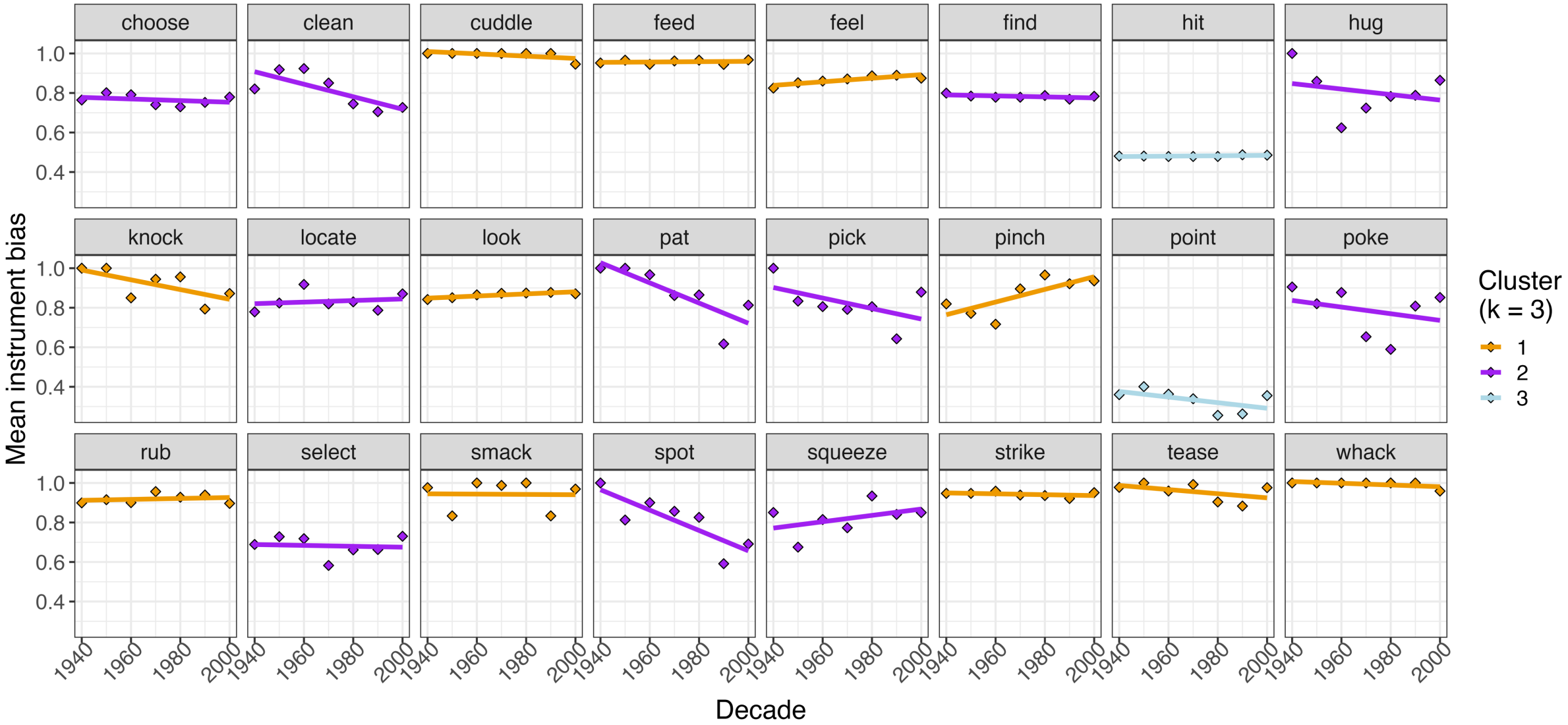


Verb biases change over time



Verb biases change over time

Correlation across decades:

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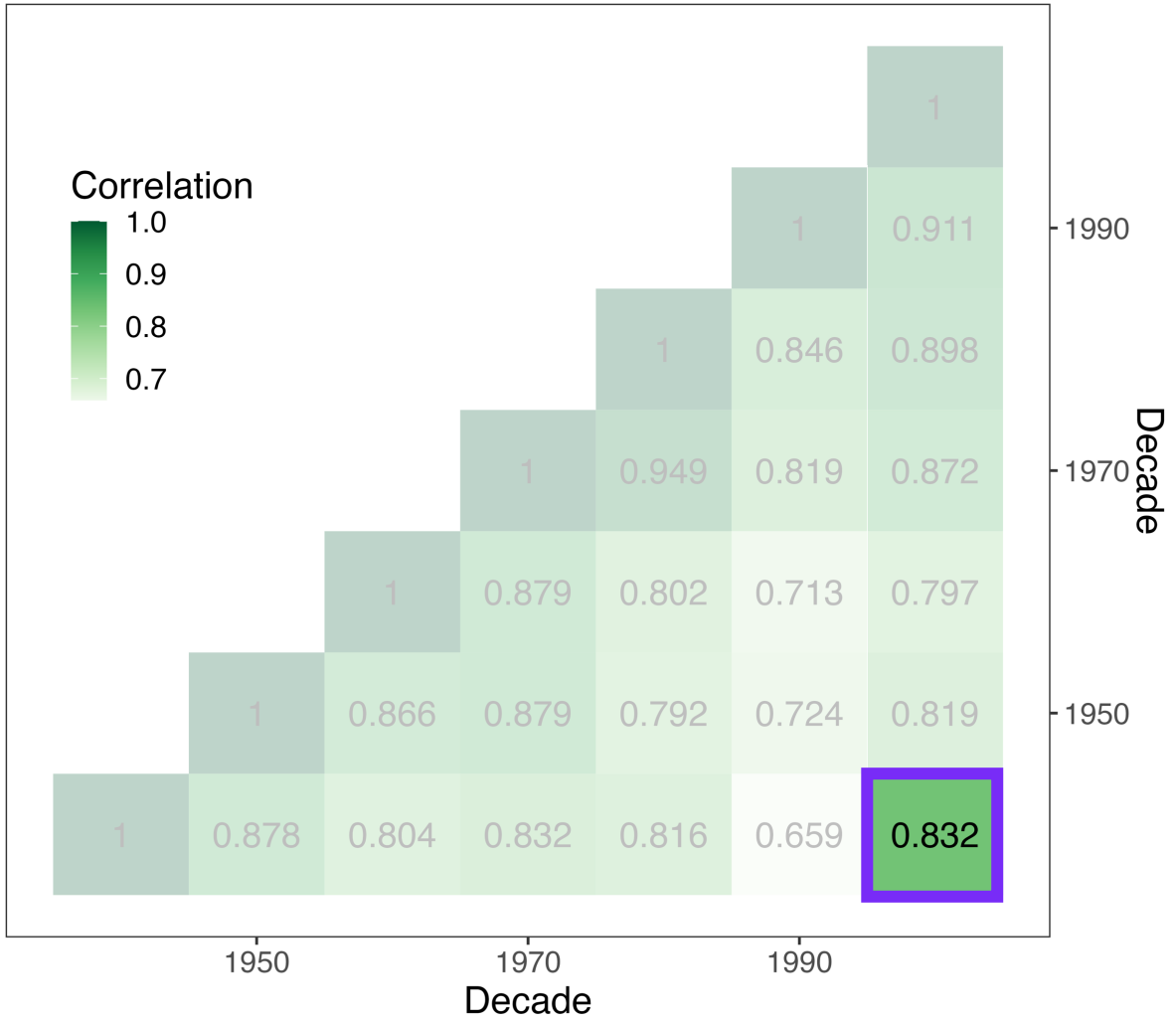
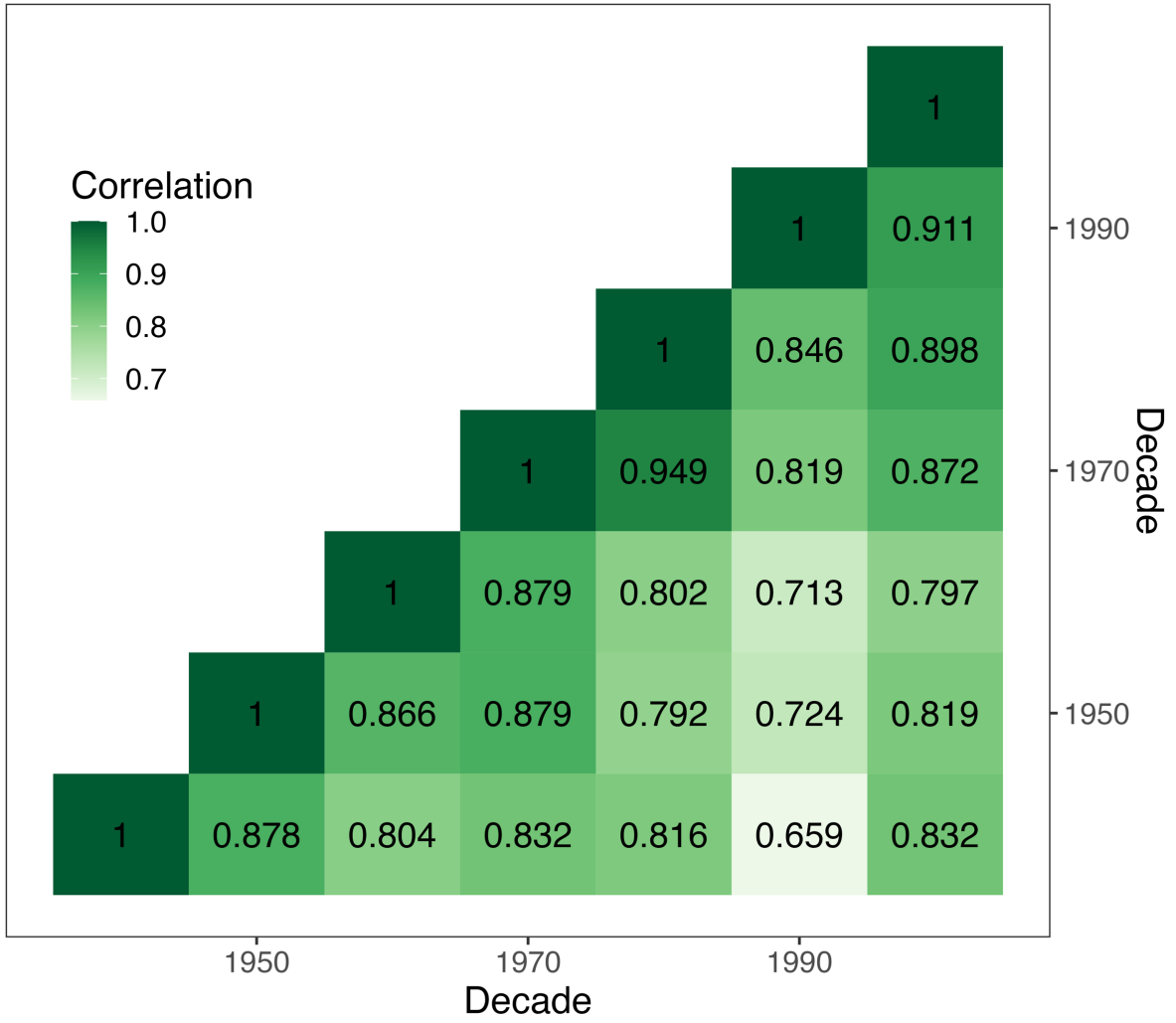
Verb	1940	…	2000
Choose	0.78	…	0.77
Clean	0.8	…	0.76
…	…	…	…
Whack	0.98	…	0.93



Verb biases change over time

Correlation across decades:

Temporally distant decades have less similar verb biases



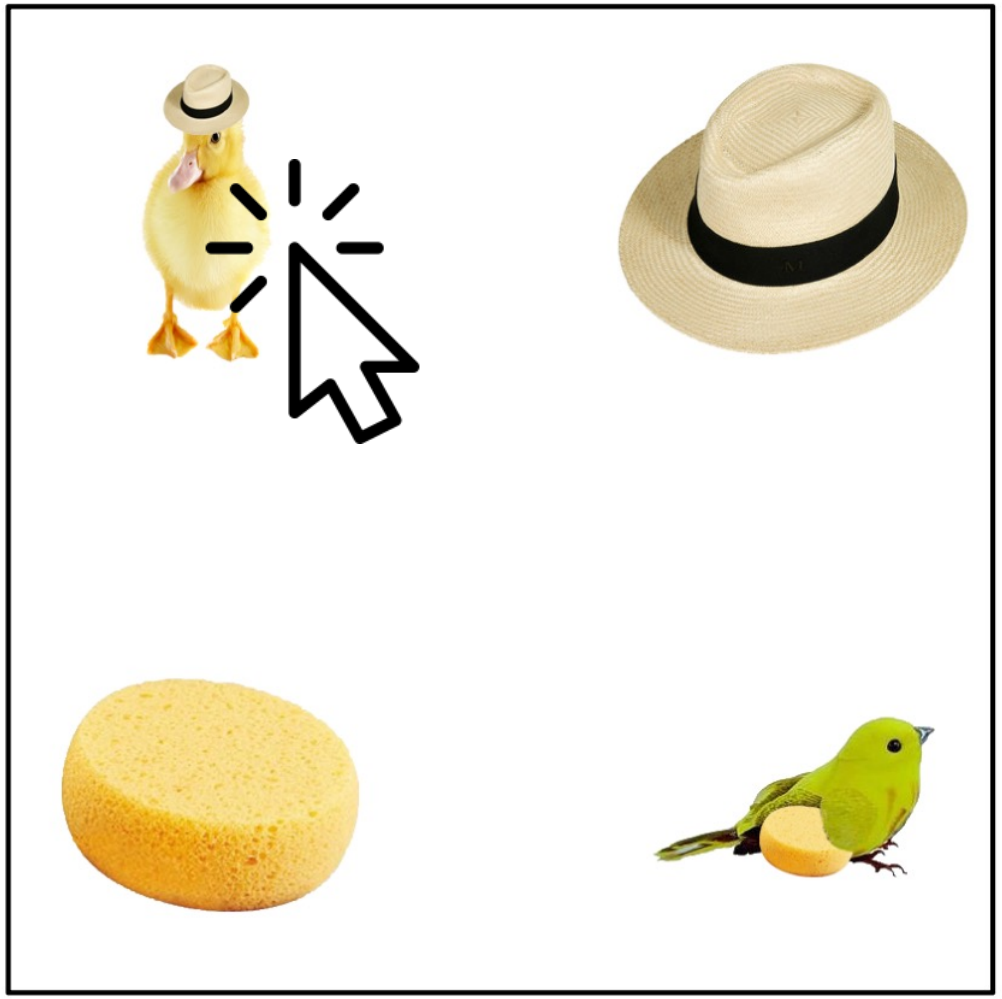
Research questions

- Do verb biases change over time? ✓
- Are there differences in interpretations across the lifespan?
- Can we describe the relationship between usage statistics and changes across the lifespan?

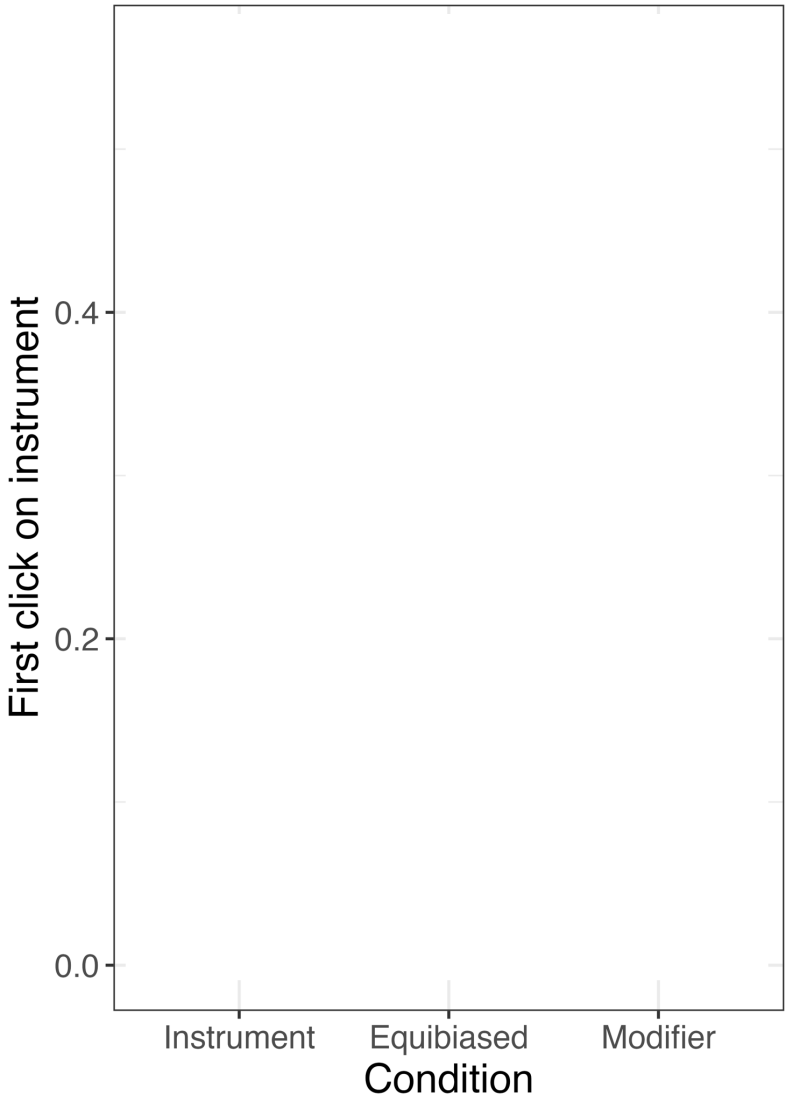
Do interpretations change across the lifespan?

Online experiment

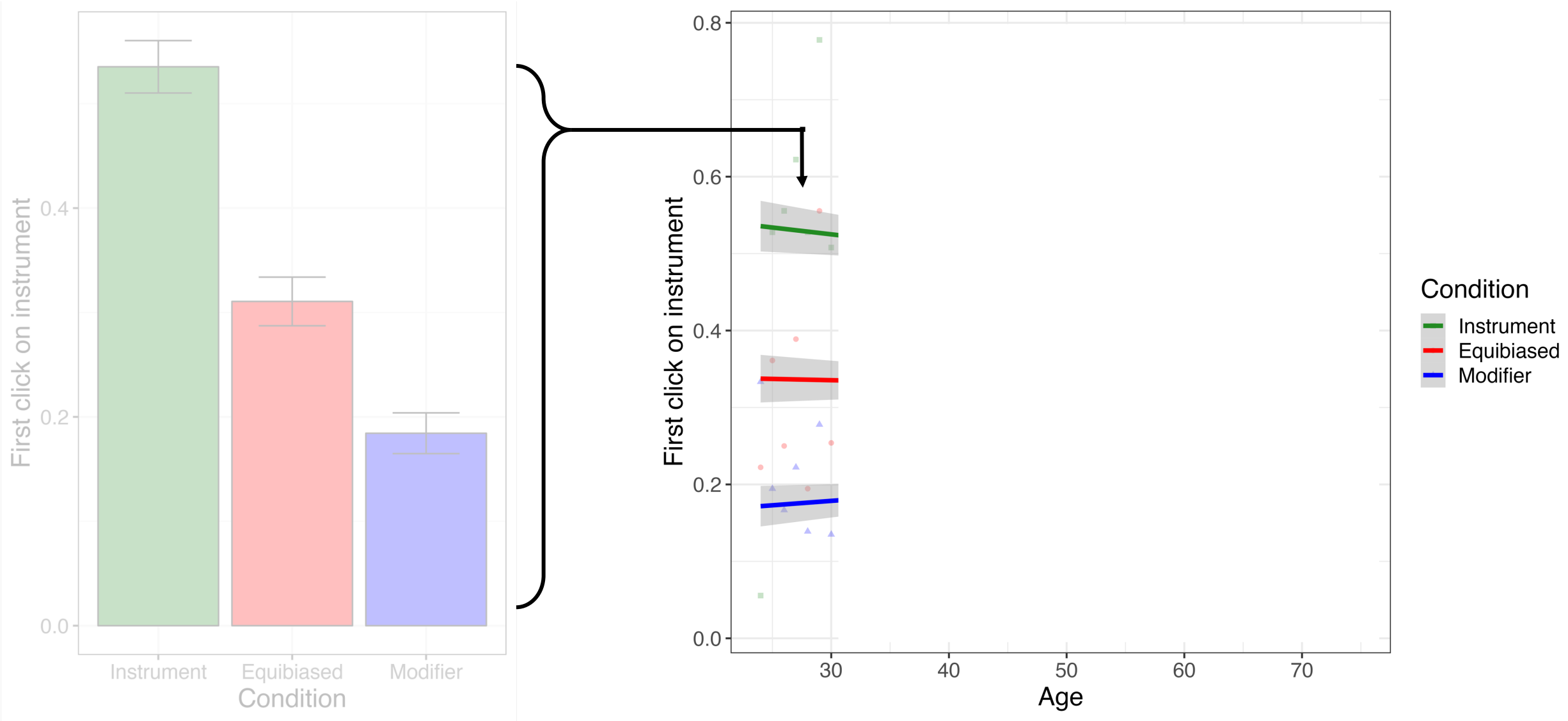
- 209 Native English speakers from MTurk
- Between 25 and 75 years old



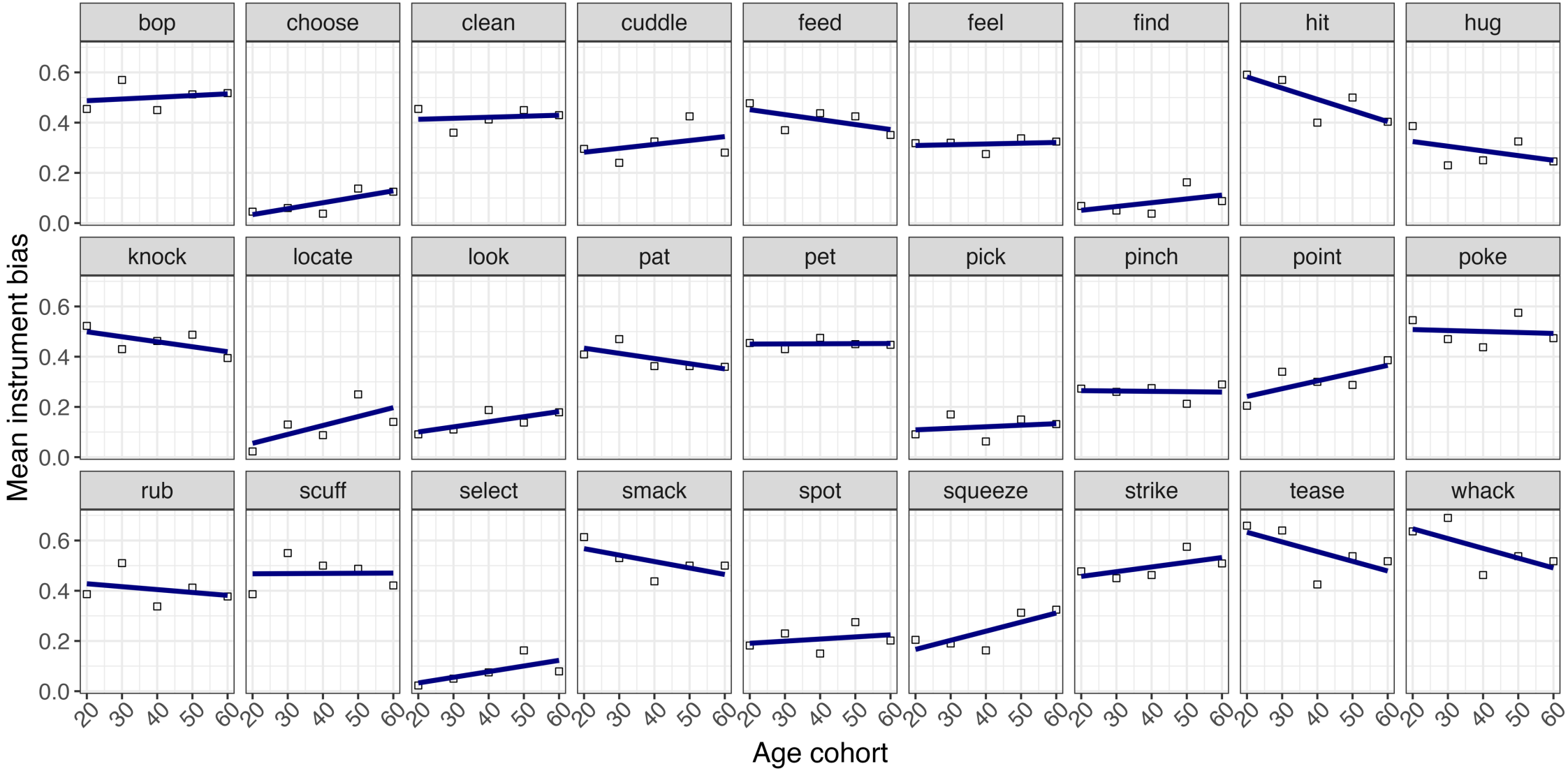
Verb biases vary across the lifespan



Verb biases vary across the lifespan



Verb biases vary across the lifespan



Verb biases vary across the lifespan

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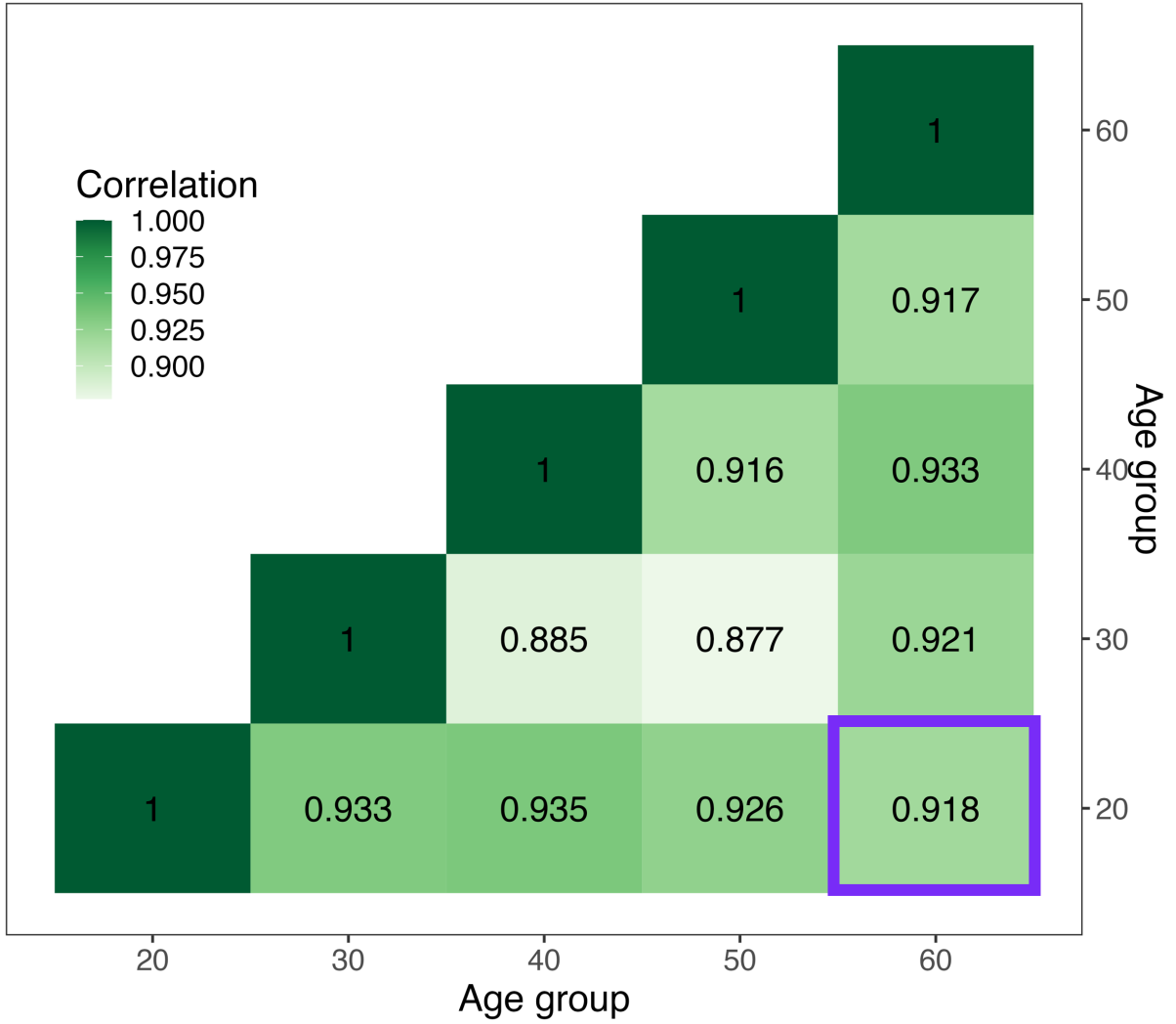
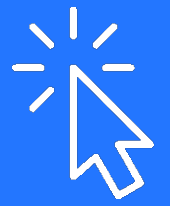
Verb	**20 y.o.**	…	**60 y.o.**
Choose	0.78	…	0.77
Clean	0.8	…	0.76
…	…	…	…
Whack	0.98	…	0.93

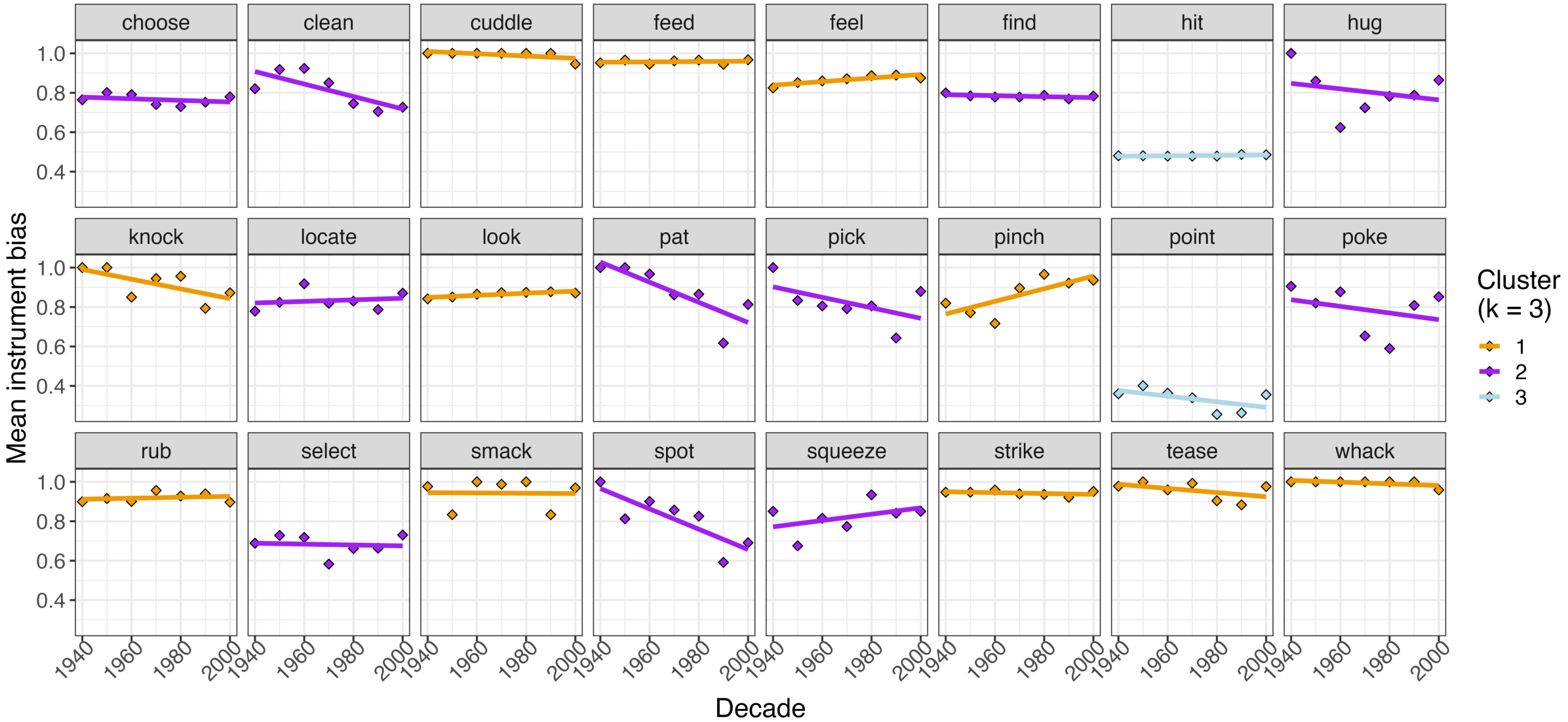


Research questions

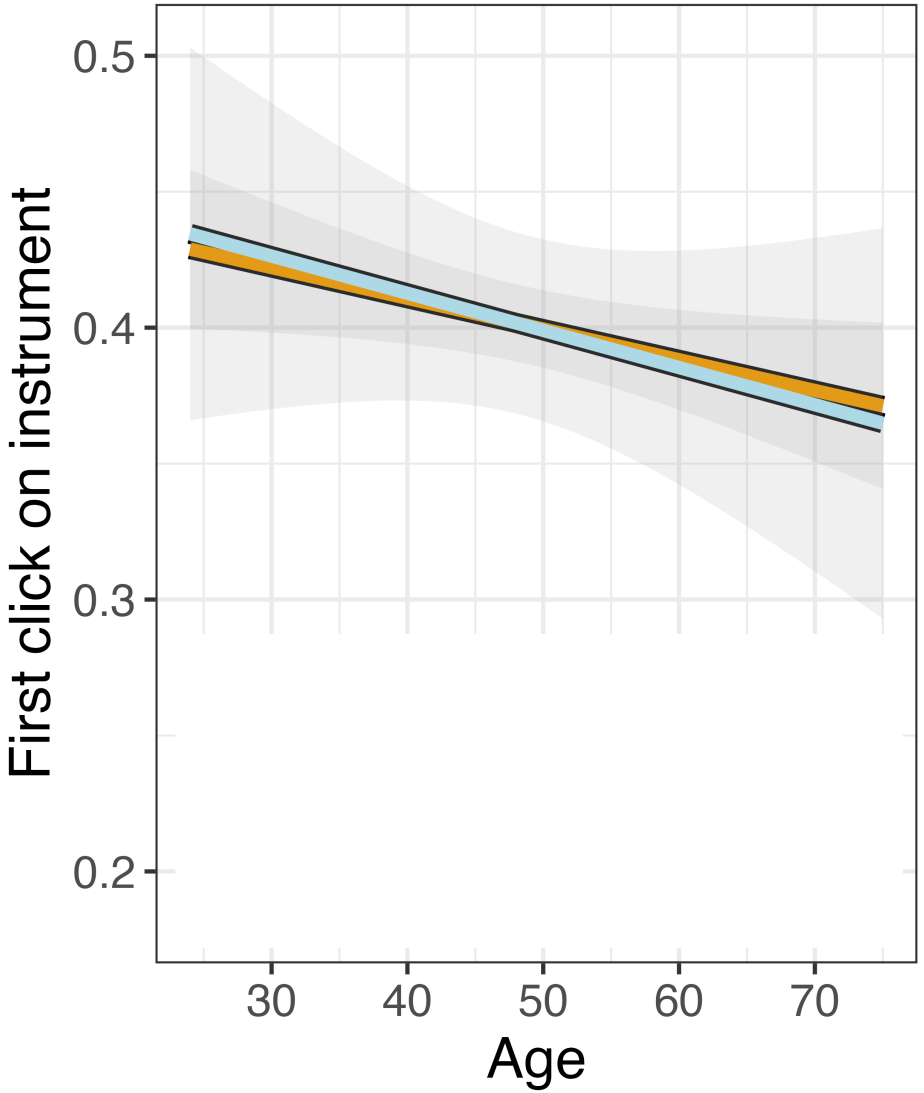


- Do verb biases change over time? ✓
- Are there differences in interpretations across the lifespan? ~
- Can we describe the relationship between usage statistics and changes across the lifespan?

Verb biases change over time

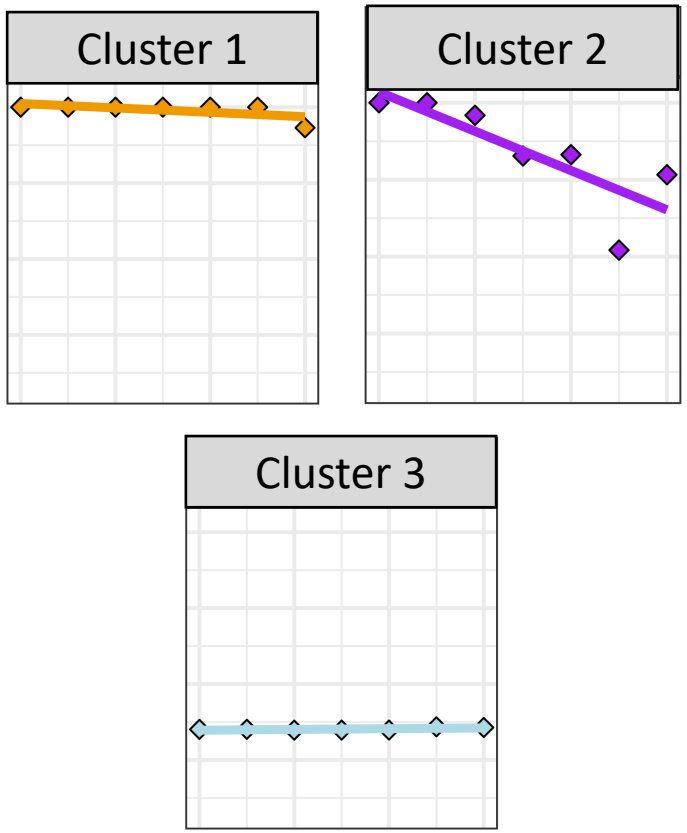


Predicting behavioral data from corpora trends



N-gram cluster

1. High instrument
2. Declining instrument
3. Low instrument



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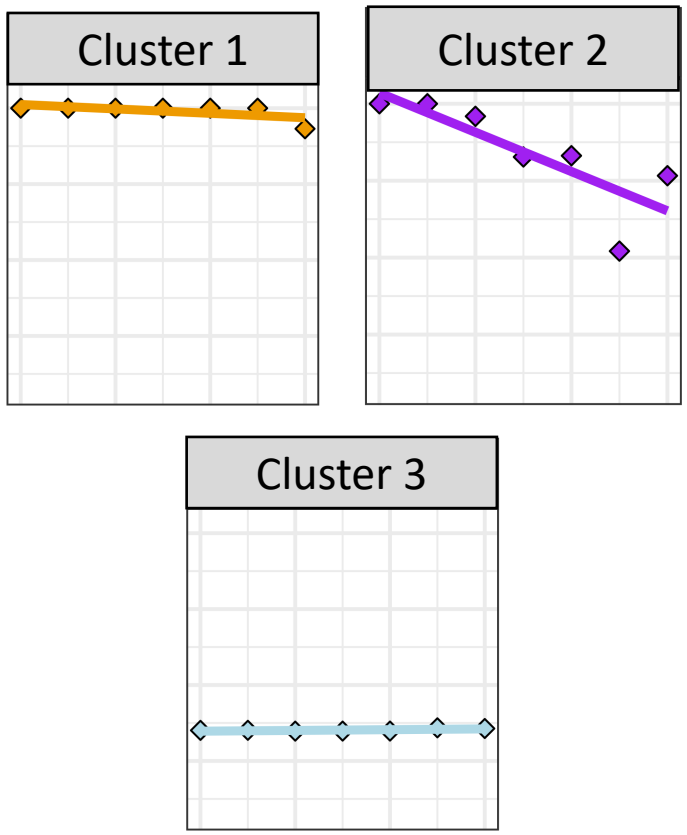


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Clicked on instrument ~ age * ngram cluster +
(1+age | verb) + (1+ngram cluster | subject)
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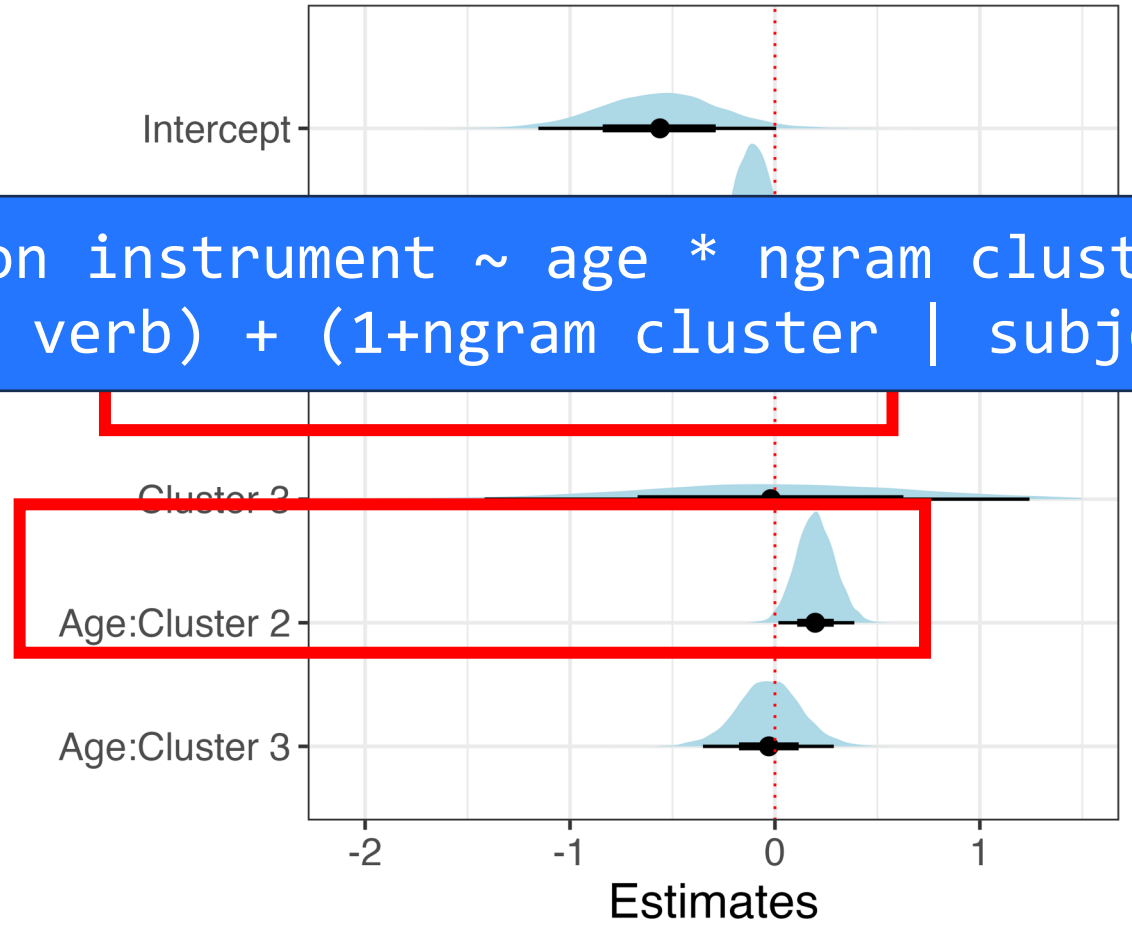

Summary

- Do verb biases change over time? ✓
- Are there differences in interpretations across the lifespan? ~
- Can we describe the relationship between usage statistics and changes across the lifespan? ✓*

Limitations and extensions

- Google Books corpus issues
  - Genre distribution
  - Varied amount of constructions
- 2/3 clusters did not change
- Limited set of verbs

Limitations and extensions

- Google Books corpus issues
  - Genre distribution
  - Varied amount of constructions
- 2/3 clusters did not change
- Limited set of verbs

- Check other corpora (COHA)
- Collect participant sentence completion data from across lifespan

Thank you!

Questions?

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