WRAPPING UP

EXPECTATIONS

What we will cover


The conceptual framework of Bayesian inference


How to run (generalized) linear models using brms


How to specify priors and interpret results


How to draw probabilistic inferences from results

what we won't cover


Introduction to R / data carpentry in R


Introduction to (generalized) linear models

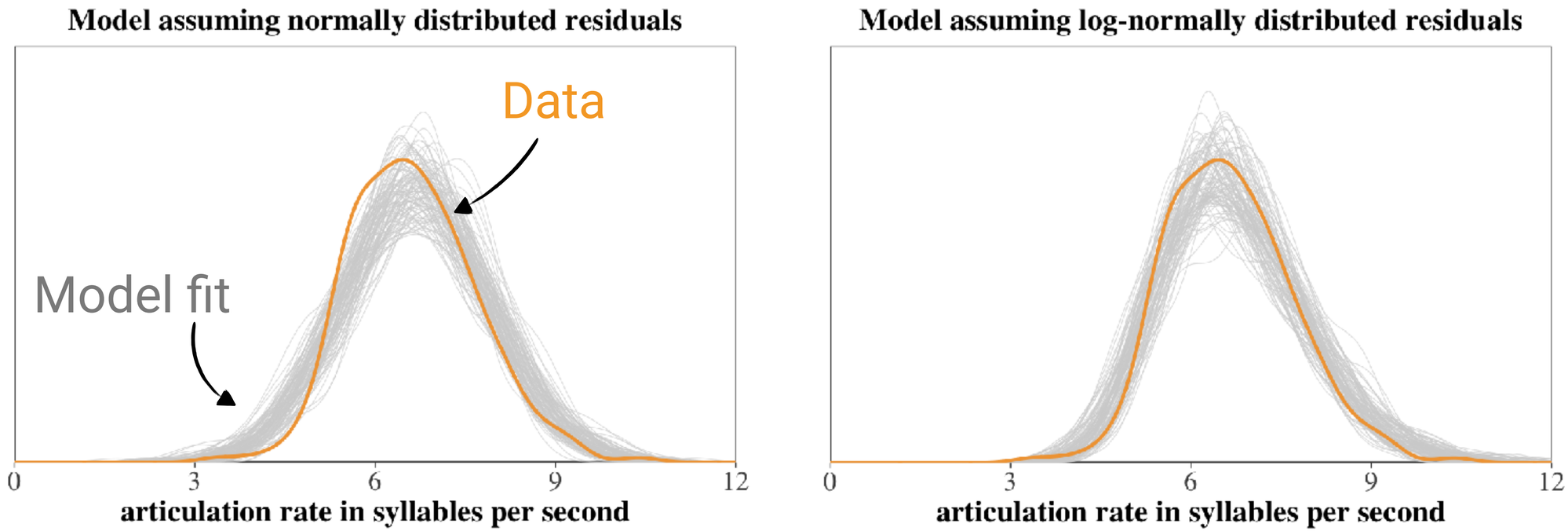
WORKFLOW

1. Think!
2. Formulate an appropriate model
3. Check what priors need to be specified (`get_prior()`)
4. Specify weakly informative priors for all parameters

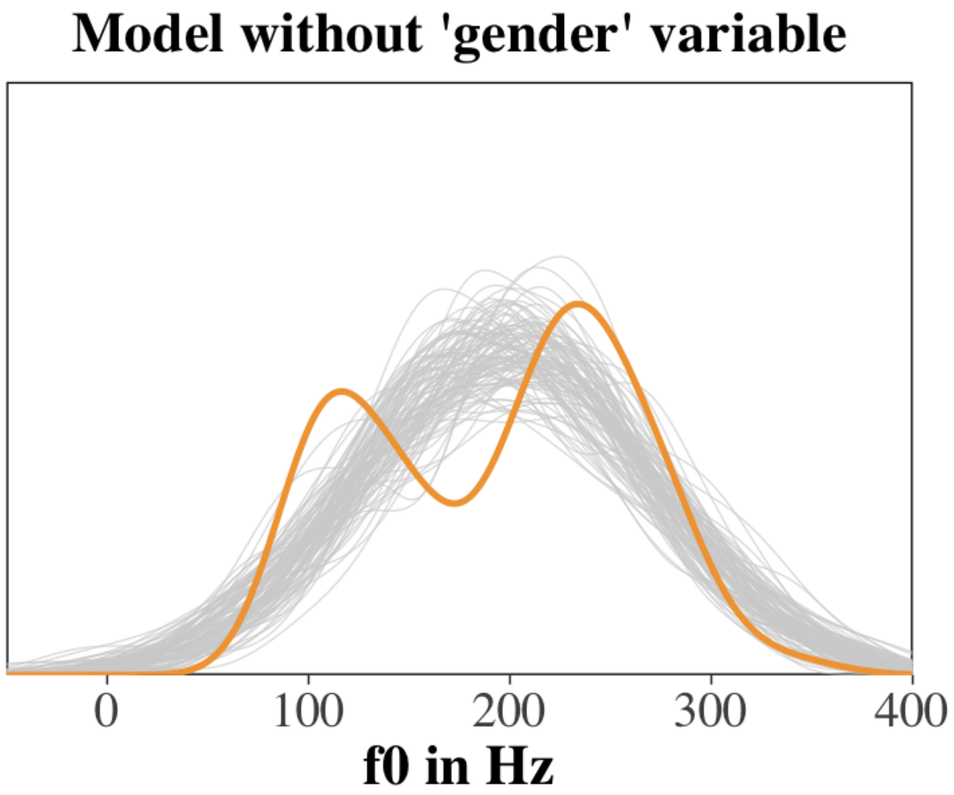
WORKFLOW

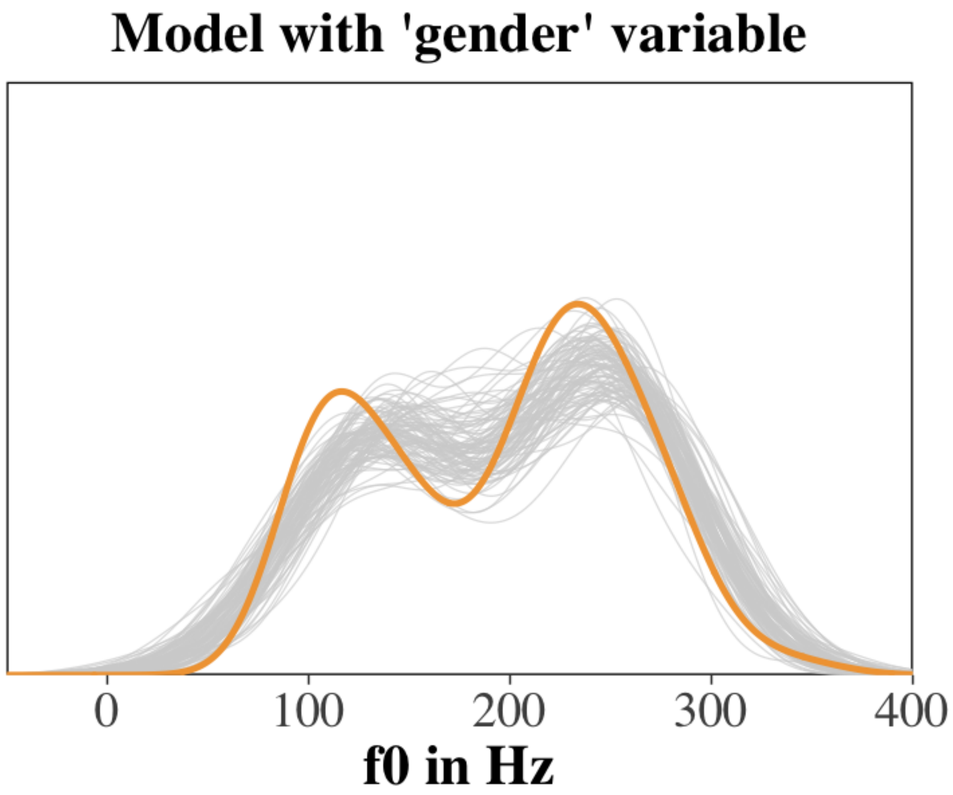
1. Think!
2. Formulate an appropriate model
3. Check what priors need to be specified (`get_prior()`)
4. Specify weakly informative priors for all parameters
5. Run the model
6. Resolve sampling issues if they occur (e.g. up iterations, change priors, etc.)
7. Critically evaluate the fit, and refit if necessary (`pp_check()`)
8. Interpret the results quantitatively and draw probabilistic inference

Thinking more about the generative model

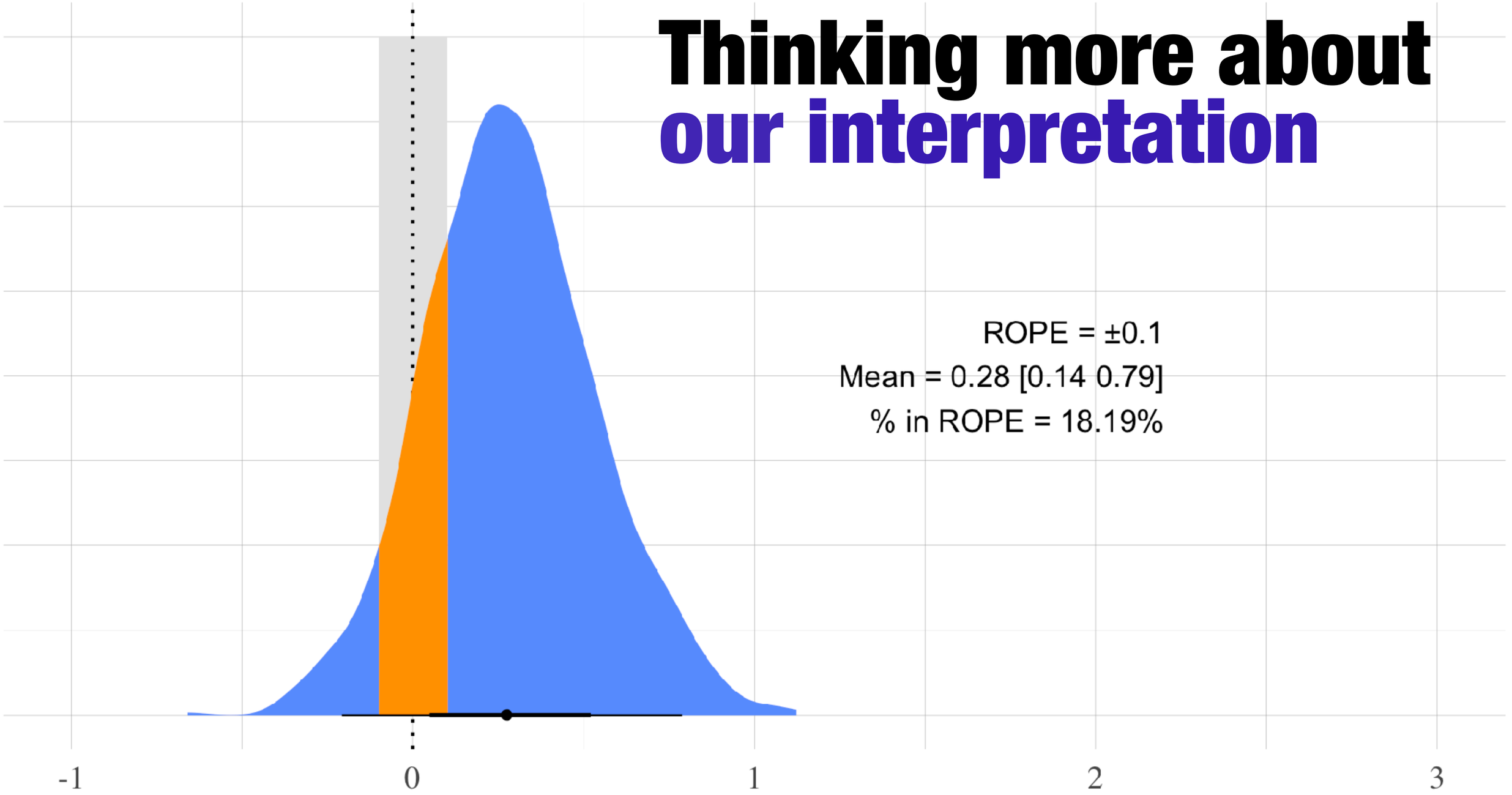


Thinking more about the generative model





Thinking more about our interpretation




CRAFTSMAN
NICKEL PLATED


SHOW REEL
the power of brms

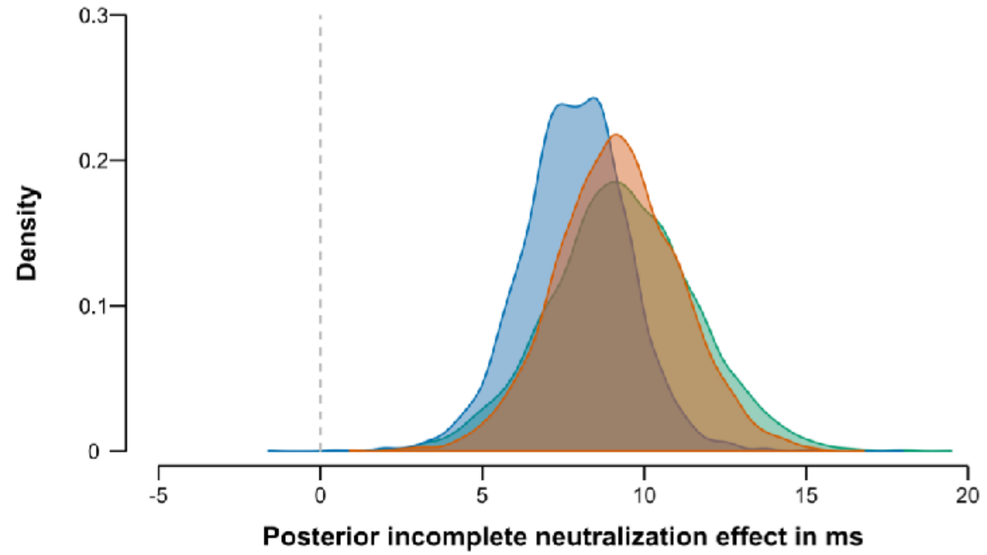
Mixed linear models

add random intercept and slopes

Roettger & Baer-Henney (2019)

https://osf.io/9kywf/

```
formula = measure ~ predictor +
     (1 + predictor | speaker) +
     (1 + predictor | item)
```



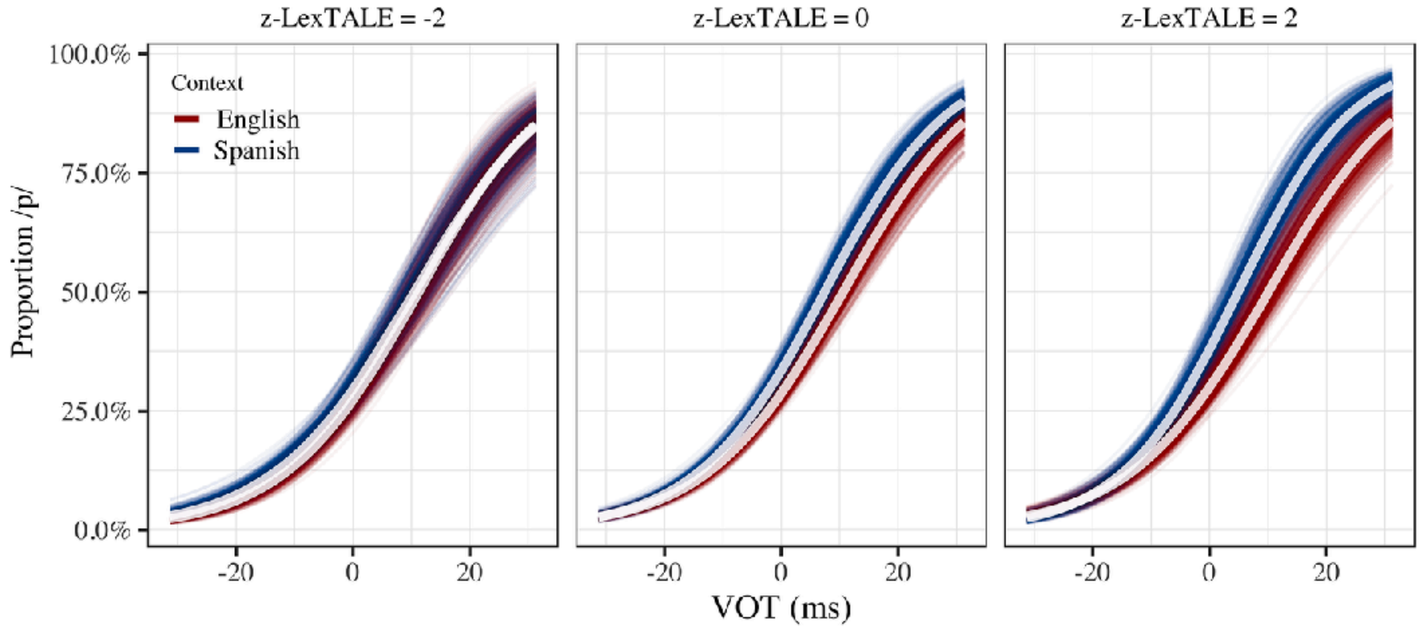
Generalized linear models (binomial)

dichotomous dependent variable

Lozano-Argüelles et al. (2020)

https://osf.io/cp9bs/

```
formula = correct ~ predictor,
  family = "bernoulli"
```

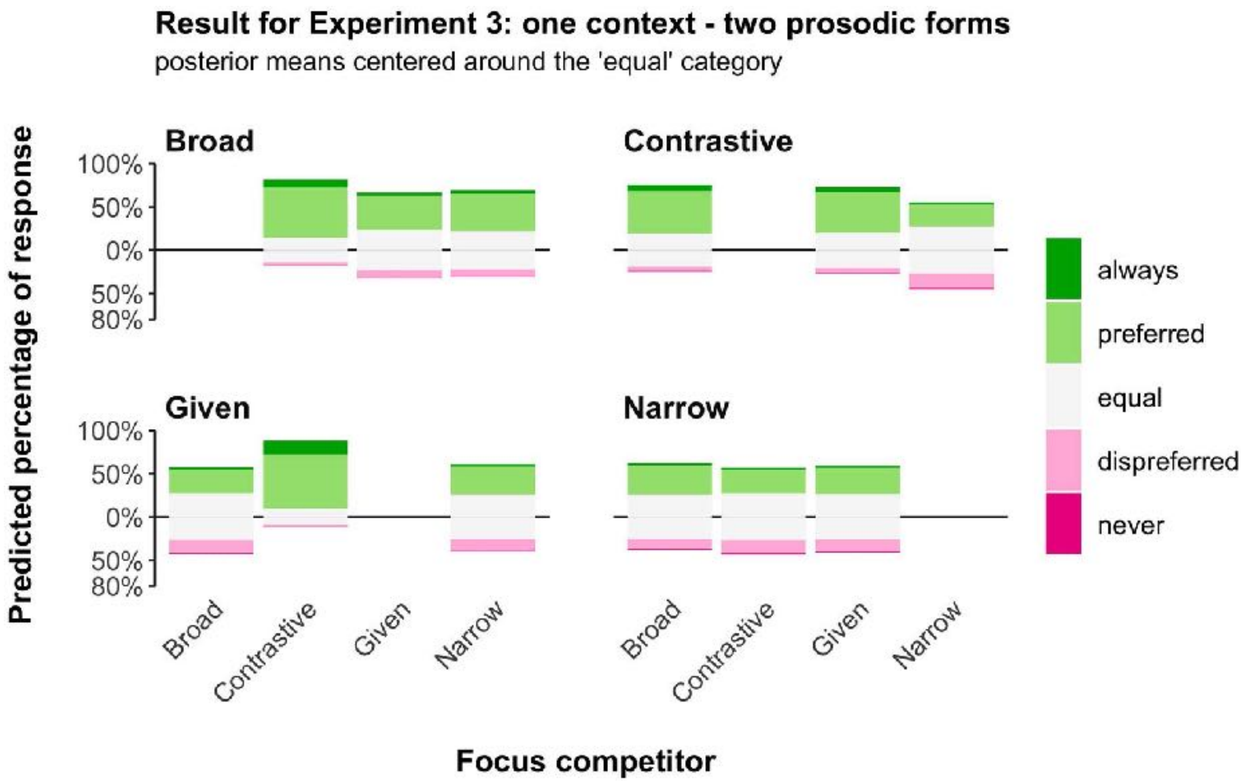


Generalized linear models (ordinal)

ordered dependent variable

Roettger, Mahrt, & Cole (2019)
https://osf.io/4qxmh/

```
formula = likert ~ predictor,
   family = "cumulative"
```

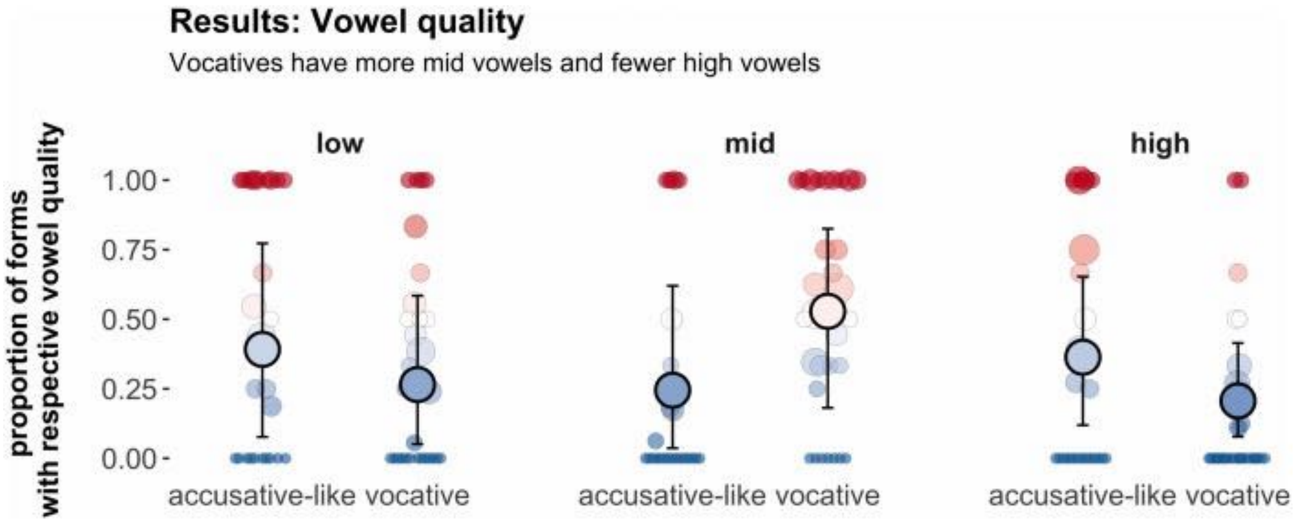


Generalized linear models (multinomial)

categorical
dependent variable

Sóskuthy & Roettger (2020)
https://osf.io/ejr8m/

```
formula = category ~ predictor,
   family = "categorical"
```

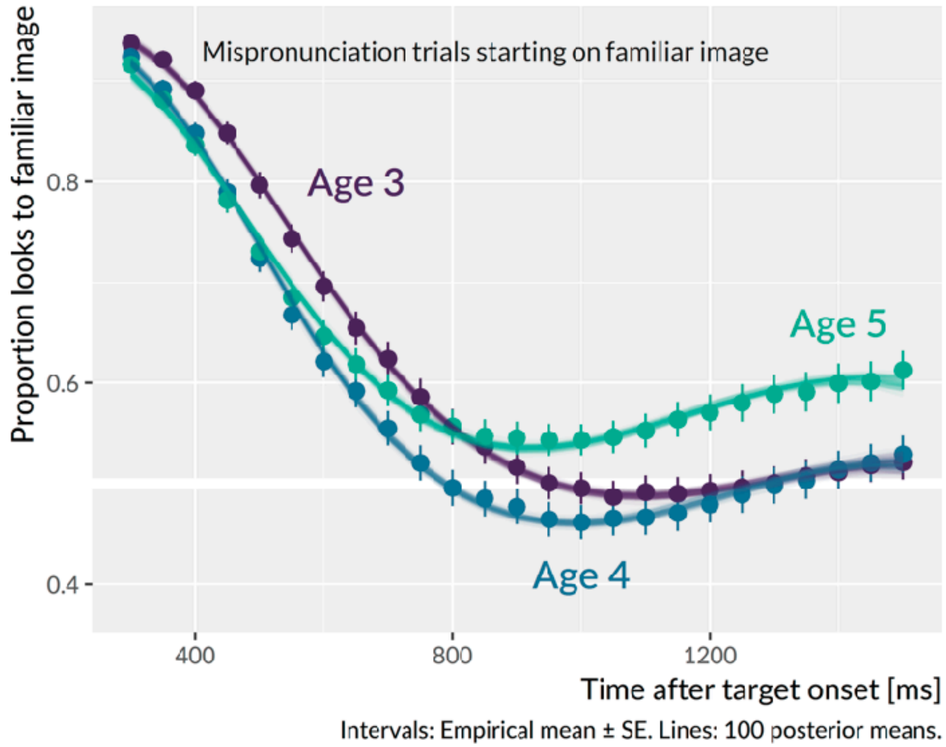


Growth Curve & Generalized additive models (GAMs)

nonlinear relationships

Mahr (2018)
https://www.tjmahr.com/dissertation/

```
formula = measure ~ s(time)
```



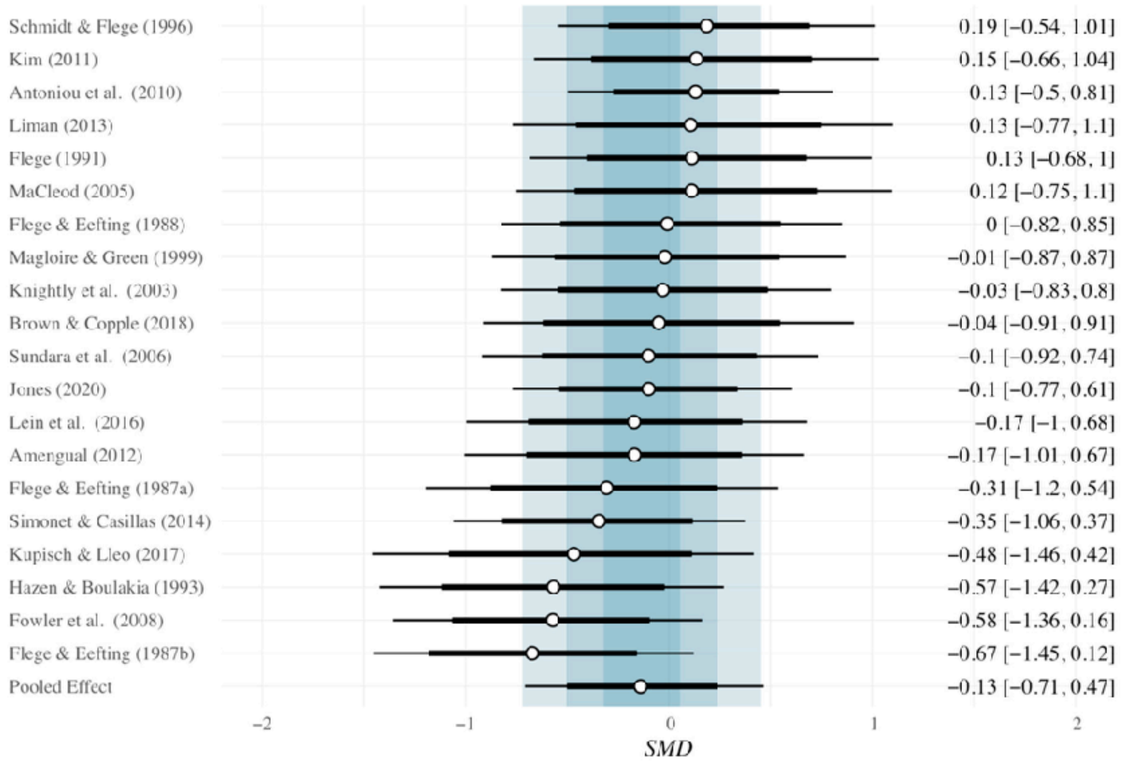
Meta analysis

modelling data across multiple studies

e.g. Casillas (2021)

https://osf.io/un45x/.

```
formula = es | se(se) ~ 1 +
  (1 | study)
```



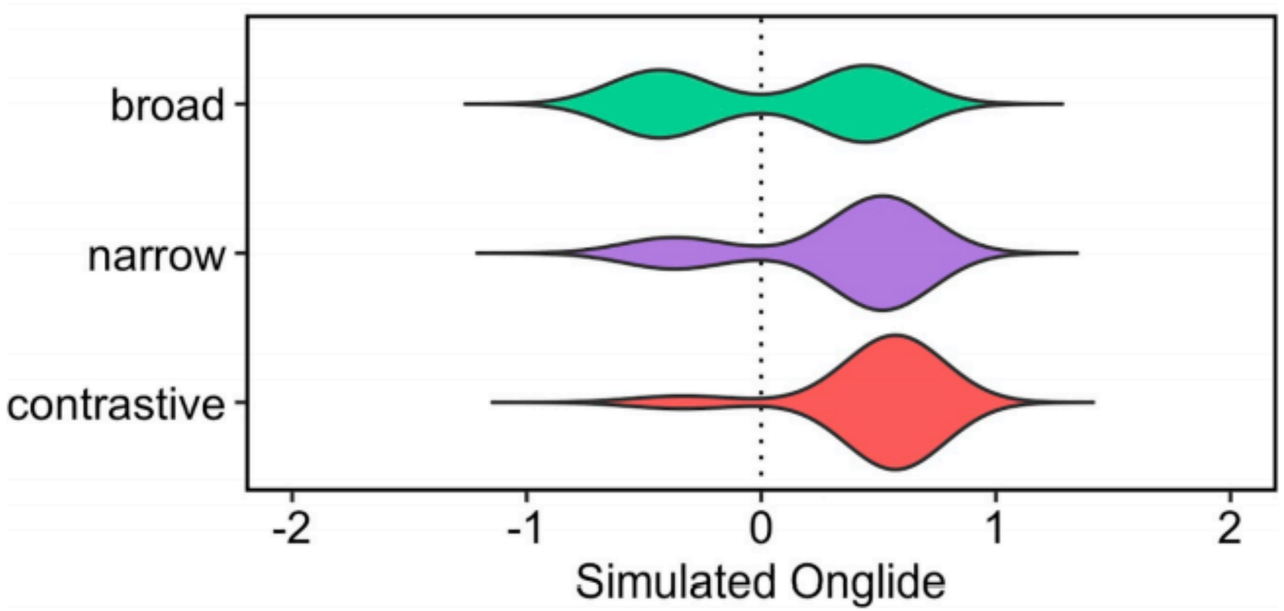
Mixture models

assuming that dv is generated by mixture of gaussian processes

Roessig, Mücke & Grice (2019)
https://zenodo.org/record/2611316

```
mix <- mixture(gaussian, gaussian)

formula = measure ~ predictor,
   family = "mix")
```



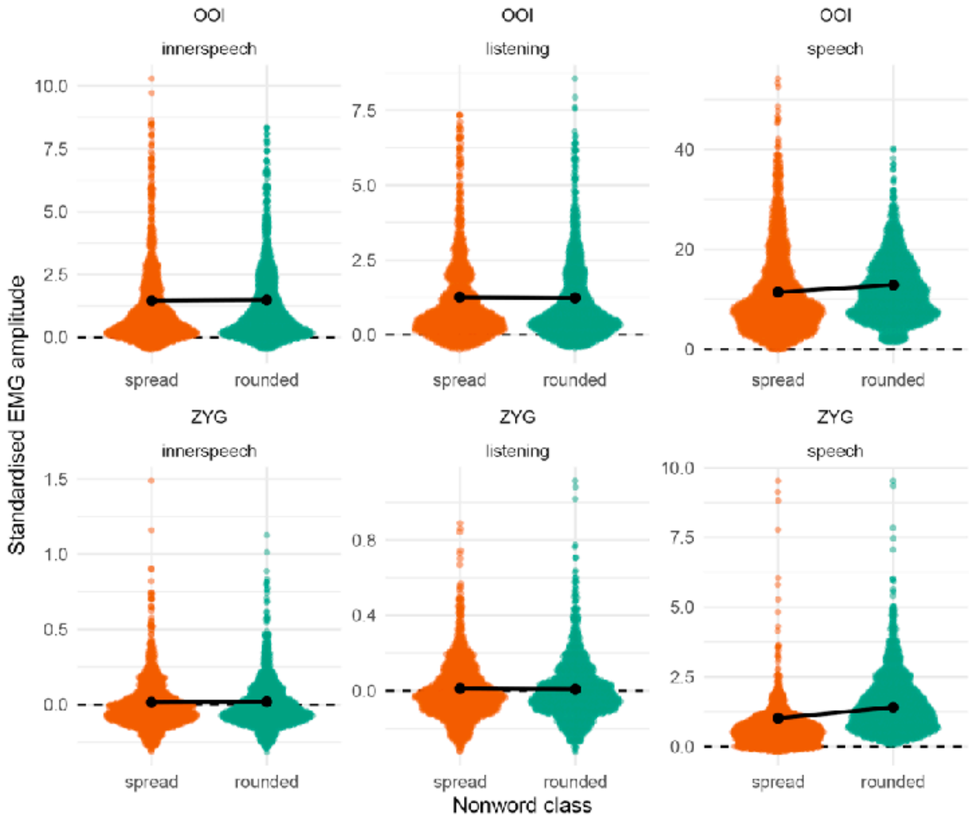
Multivariate models

modelling more than one DV

Nalborczyk et al. 2020

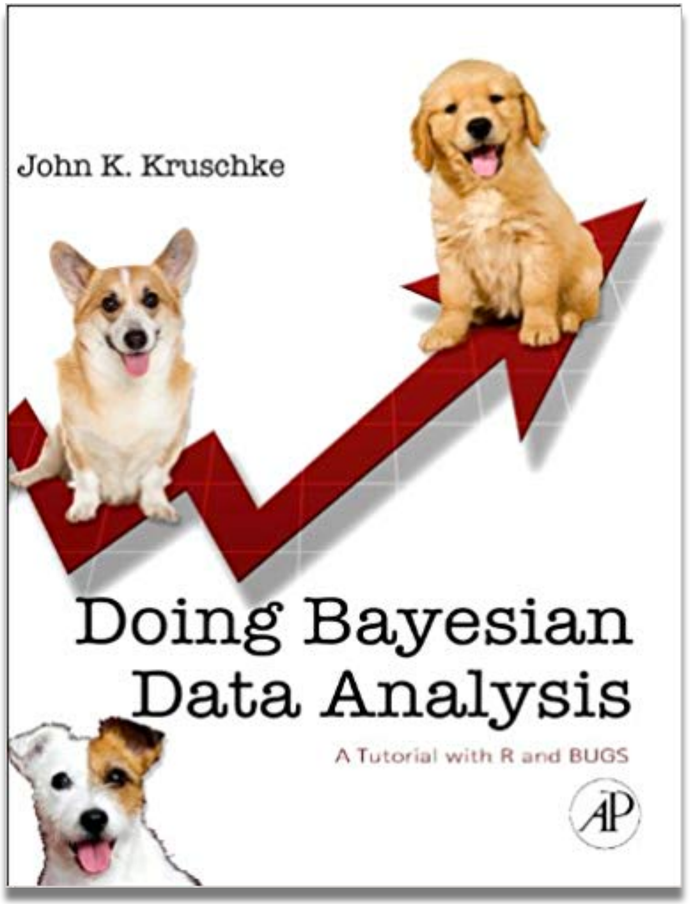
https://osf.io/czer4/

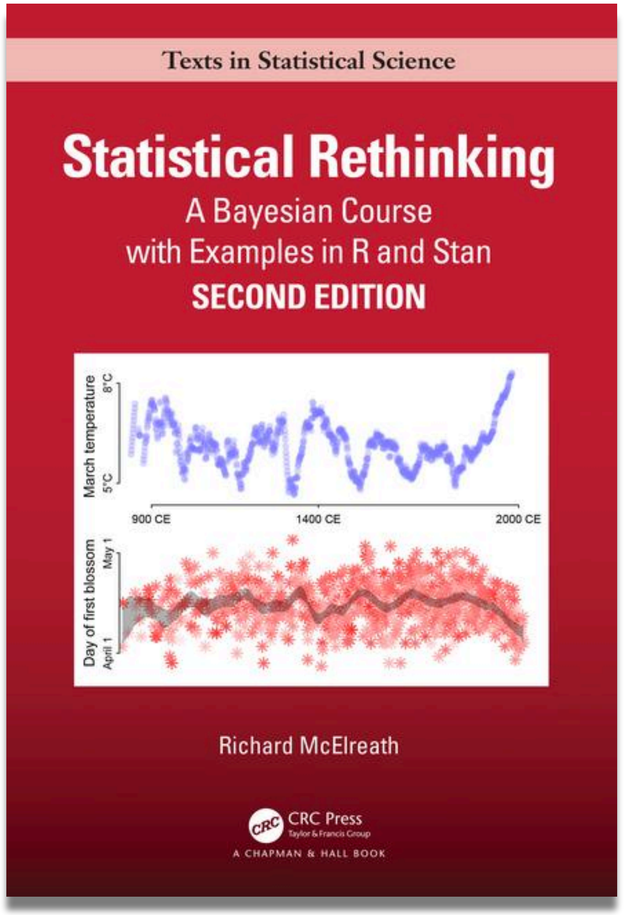
```
formula =
cbind(DV1, DV2) ~ predictor
```



RESOURCES

Reading recommendations





translated into brms by

https://bookdown.org/content/4857/

Tutorials for speech scientists

Nalborczyk, Batailler, Lœvenbruck, Vilain & Bürkner (2019). An introduction to Bayesian multilevel models using brms: A case study of gender effects on vowel variability in standard Indonesian. *Journal of Speech, Language, and Hearing Research*, *62*(5), 1225-1242.

Vasishth, Nicenboim, Beckman, Li & Kong (2018). Bayesian data analysis in the phonetic sciences: A tutorial introduction. Journal of phonetics, 71, 147-161.

Franke & Roettger (2019). Bayesian regression modeling (for factorial designs): A tutorial. Unpublished manuscript. https://doi.org/10.31234/osf.io/cdxv3

Online forum

https://discourse.mc-stan.org

https://stackexchange.com/

Community

our Slack Channel :)

ROADMAP

DAY 1

1st Bayesian Model
Run your first Bayesian Model

Bayes Theorem
What does it mean to think like a Bayesian?

Priors - Part 1
What are priors?

Priors - Part 2
How do I specify priors?

NHST vs. Bayes
Why are we doing this again?

DAY 2

Review
Day 1 in a nutshell

Inference
How do I answer my research question without a p-value?

More on priors
Why is it a good idea to specify priors?

Mixed Models
Run linear mixed effects models with brms

Sampling
What happens under the hood?

DAY 3

1:1 sessions

1:1 sessions

1:1 sessions

References

Nalborczyk, Batailler, Lœvenbruck, Vilain & Bürkner (2019). An introduction to Bayesian multilevel models using brms: A case study of gender effects on vowel variability in standard Indonesian. Journal of Speech, Language, and Hearing Research, 62(5), 1225-1242.

Kruschke (2011). Doing Bayesian data analysis: A tutorial with R and BUGS. Elsevier Academic Press.

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Franke & Roettger (2019). Bayesian regression modeling (for factorial designs): A tutorial. Unpublished manuscript. https://doi.org/10.31234/osf.io/cdxv3

Casillas (2021). Interlingual interactions elicit performance mismatches not “compromise” categories in early bilinguals: Evidence from meta-analysis and coronal stops. Languages, 6(1), 9.

Roettger & Baer-Henney (2019). Toward a replication culture: Speech production research in the classroom. Phonological Data and Analysis, 1(4), 1-23.

Sóskuthy & Roettger (2020). When the tune shapes morphology: the origins of vocatives. Journal of Language Evolution, 5(2), 140-155.

Argüelles, C. L., Arroyo, L. F., Rodriguez, N., López, E. M. D., Pozu, J. J. G., Markovits, J., ... & Casillas, J. V. (2020). Conceptually-cued perceptual categorization in adult L2 learners.

Nalborczyk, Grandchamp, Koster, Perrone-Bertolotti & Loevenbruck (2020). Can we decode phonetic features in inner speech using surface electromyography?. PloS one, 15(5), e0233282

Roessig, Mücke & Grice (2019). The dynamics of intonation: Categorical and continuous variation in an attractor-based model. PloS one, 14(5), e0216859.

Mahr (2018). Development of word recognition in preschoolers. The University of Wisconsin-Madison.