

Better Anchoring and Ambiguity Measurement with Mixture Models

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13 September 2020

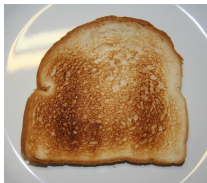
The Problem

Differential item functioning

How crunchy do you like your toast?

1. Very crunchy
2. Crunchy
3. Neither crunchy nor soft
4. Soft
5. Very soft

Anchoring items



Source: Wikimedia Commons

How crunchy is this toast?

1. Very crunchy
2. Crunchy
3. Neither crunchy nor soft
4. Soft
5. Very soft

Anchoring batteries



Source: Wikimedia Commons



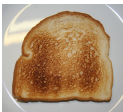
How crunchy is this toast?

1. Very crunchy
2. Crunchy
3. Neither crunchy nor soft
4. Soft
5. Very soft



How is this toast?

1. Very
2.
3. Neither nor
4.
5. Very



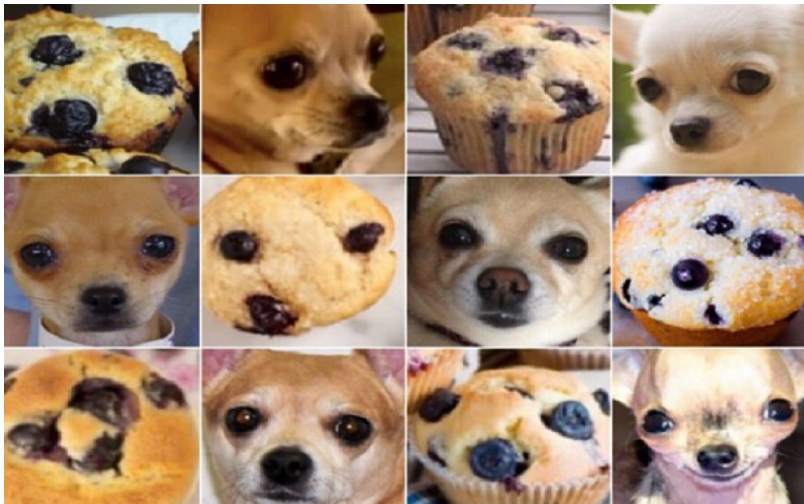
How ~~crunchy~~ **hot** is this toast?

1. Very ~~crunchy~~ **hot**
2. ~~Crunchy~~ **Hot**
3. Neither ~~crunchy~~ **hot** nor ~~soft~~ **cold**
4. ~~Soft~~ **Cold**
5. Very ~~soft~~ **cold**



How ~~crunchy~~ **hot** is this toast?

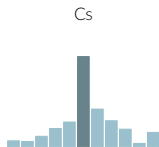
11. Very ~~crunchy~~ **hot**
22. ~~Crunchy~~ **Hot**
33. Neither ~~crunchy~~ **hot** nor ~~soft~~ **cold**
44. ~~Soft~~ **Cold**
55. Very ~~soft~~ **cold**



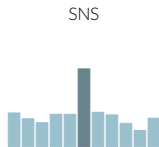
Source: telegraph.co.uk

EES Left-Right batteries

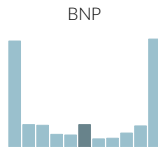
Spain 2014



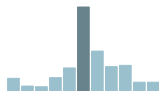
Slovakia 2009



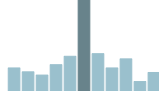
UK 2009



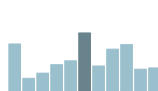
CpE



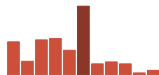
SF



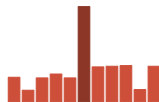
UKIP



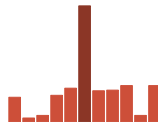
Self-Placement



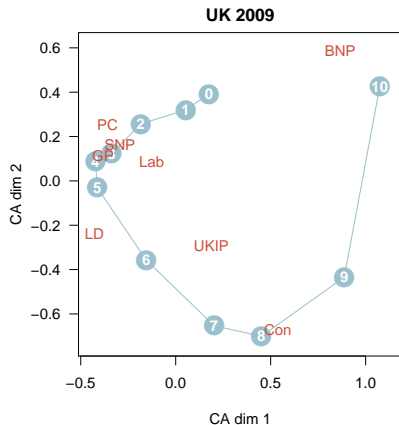
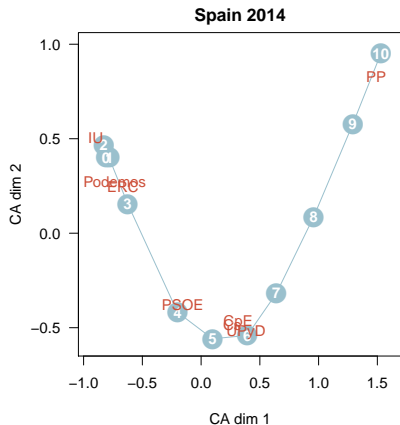
Self-Placement



Self-Placement

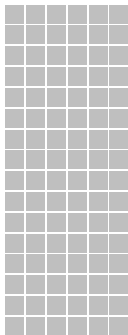


Diagnostics with correspondence analysis

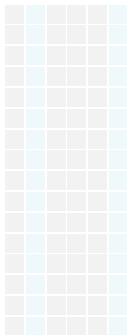


Low-quality responses

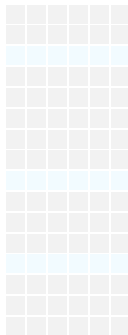
A



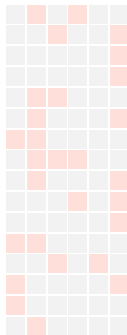
B



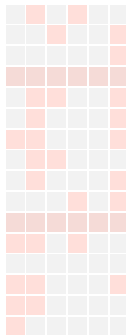
C



D

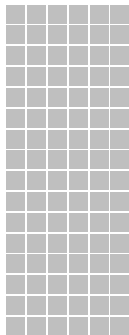


E

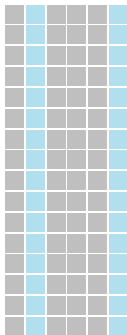


Low-quality responses

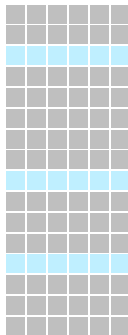
A



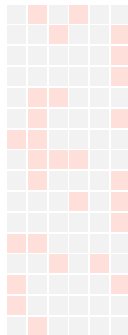
B



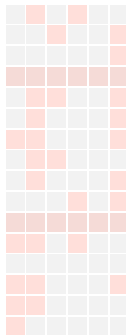
C



D

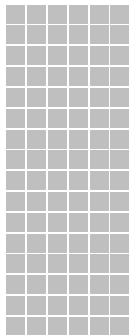


E

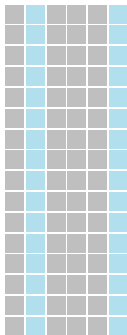


Low-quality responses

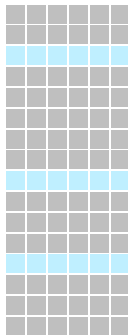
A



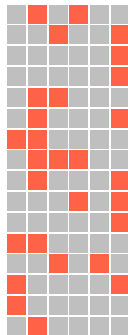
B



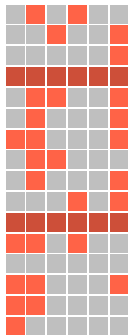
C



D



E



A Solution

A mixture framework

$$O = \pi M + (1 - \pi)C$$

O observed responses

M *informative* responses

C *uninformative* responses

π mixing weight, $\pi \in [0, 1]$

Modeling Informative Responses

Aldrich-McKelvey Scaling

Classical AMS

$$y_{ro} \sim \text{Normal}(\alpha_r + \beta_r \theta_o, \sigma)$$

Bayesian AMS (Hare et al. 2015)

$$y_{ro} \sim \text{Normal}(\alpha_r + \beta_r \theta_o, \sigma_r \sigma_o)$$

Scaling self-placements

$$\zeta_r = \frac{z_r - \alpha_r}{\beta_r}$$

Fitting complex latent variable models



Peter Fischli and David Weiss's *The First Blush of Morning*, 1984.
Source: <https://www.wmagazine.com/story/peter-fischli-david-weiss-merry-pranksters>

Measurement model

$$y_{ro} \sim \text{Categorical}(\mathbf{p}_{ro})$$

$$p_{rok} = \text{OrdLogit}((\tau_{rk} - \gamma_r \theta_o) \beta_o)$$

$$\boldsymbol{\tau}_r \sim \text{Logistic}(0, 1), \tau_{rk} < \tau_{r,k+1}$$

$$P(\gamma_r = -1) \sim \text{Beta}(0.5, 0.5), \gamma_r \in \{-1, +1\}$$

$$\ln \beta_o \sim \text{Normal}(0, 1)$$

$$\theta_o \sim \text{Normal}(0, \sigma)$$

$$\zeta_r \sim \text{Normal}(0, \sqrt{R}\sigma)$$

$$\sigma \sim \text{HalfNormal}^+(0, 1)$$

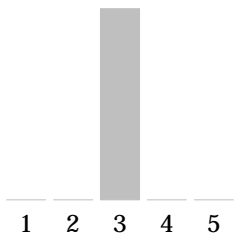
Modeling Uninformative Responses

Contamination models

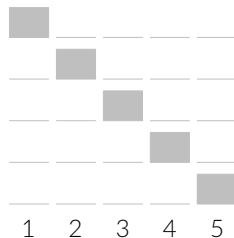
i. Pseudoguessing



ii. Midpoint



iii. Straightlining



iv. Between-respondent multidimensionality

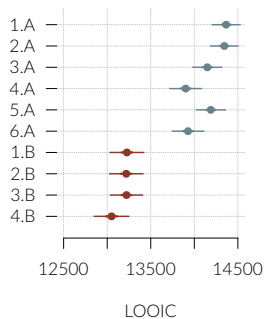
Building Mixture Models

10 mixture models

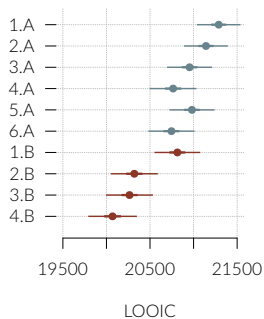
	Scale flipping	Midpoint inflation	Pseudo- guessing	Item slope
1.A				
2.A	Y			
3.A	Y	battery		
4.A	Y	item		
5.A	Y	battery	item	
6.A	Y	item	item	
1.B				Y
2.B	Y			Y
3.B	Y	battery		Y
4.B	Y	item		Y

EES: Model fit

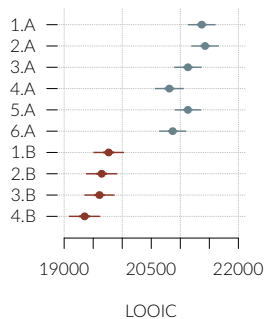
Spain 2014



Slovakia 2009



UK 2009



Model 4.B

- Respondent thresholds
- Scale flipping by respondent, population rate
- Midpoint inflation by response, item rate
- Item discrimination

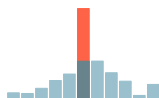
EES: Midpoint inflation estimated by model 4.B

Spain 2014

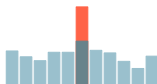
Slovakia 2009

UK 2009

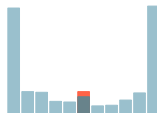
Cs



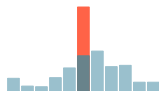
SNS



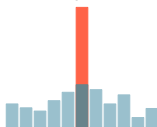
BNP



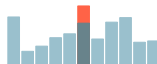
CpE



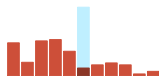
SF



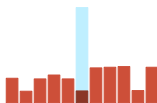
UKIP



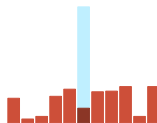
Self-Placement



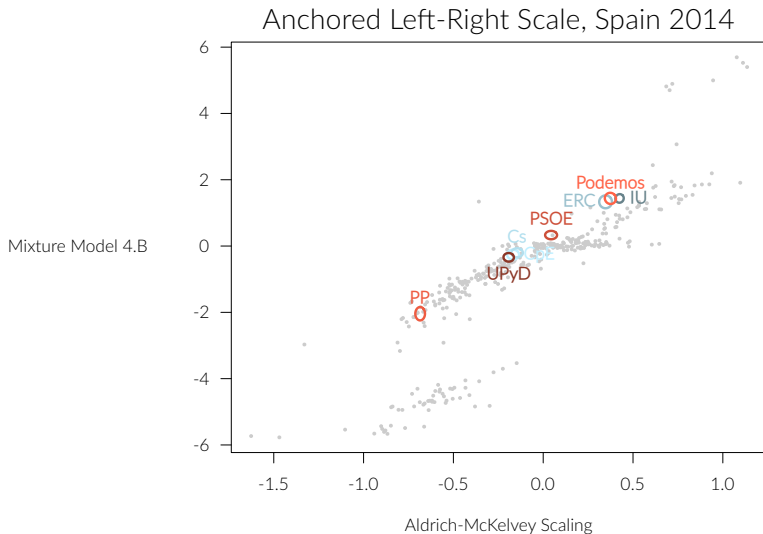
Self-Placement



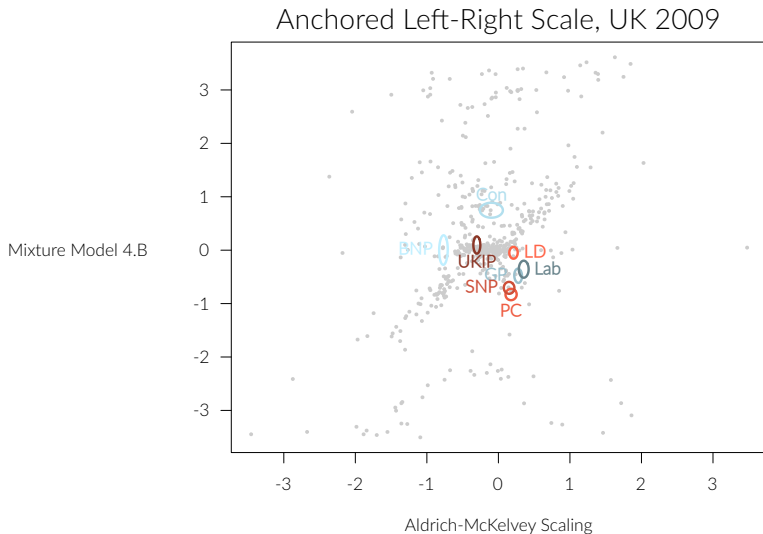
Self-Placement



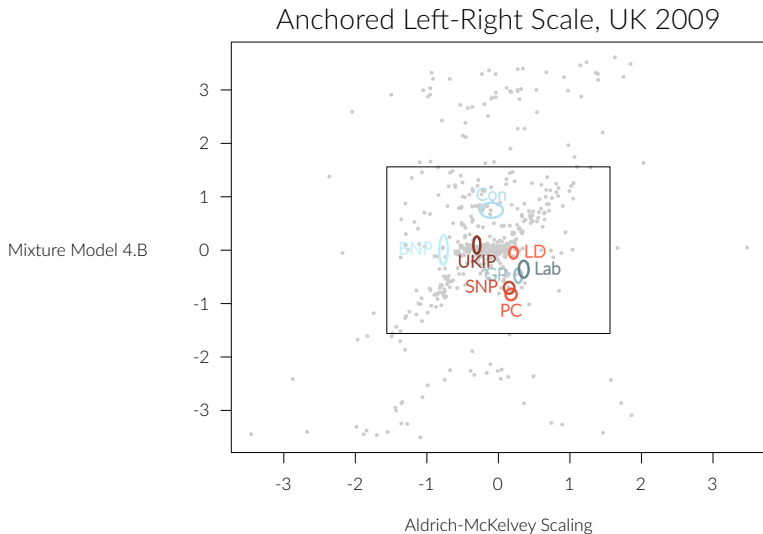
Model-based anchoring



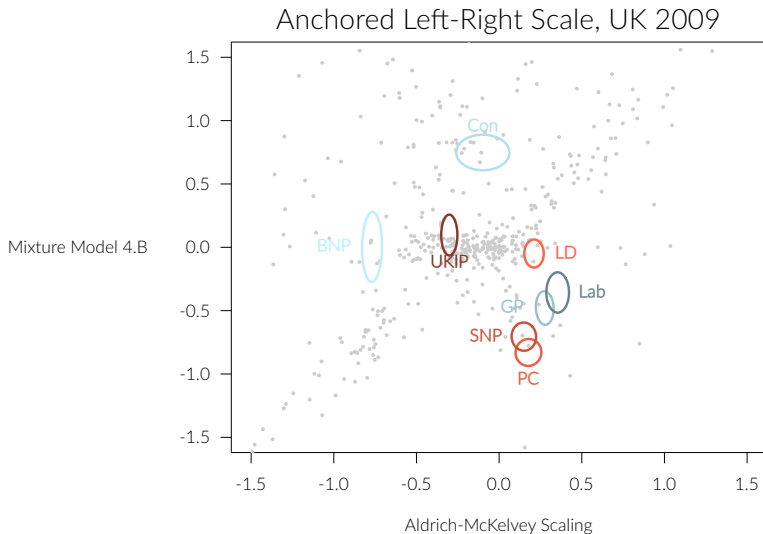
Model-based anchoring



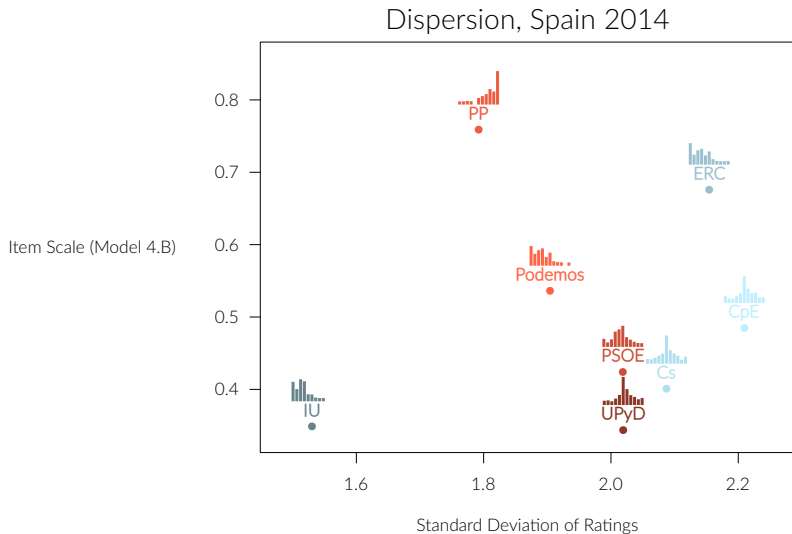
Model-based anchoring



Model-based anchoring

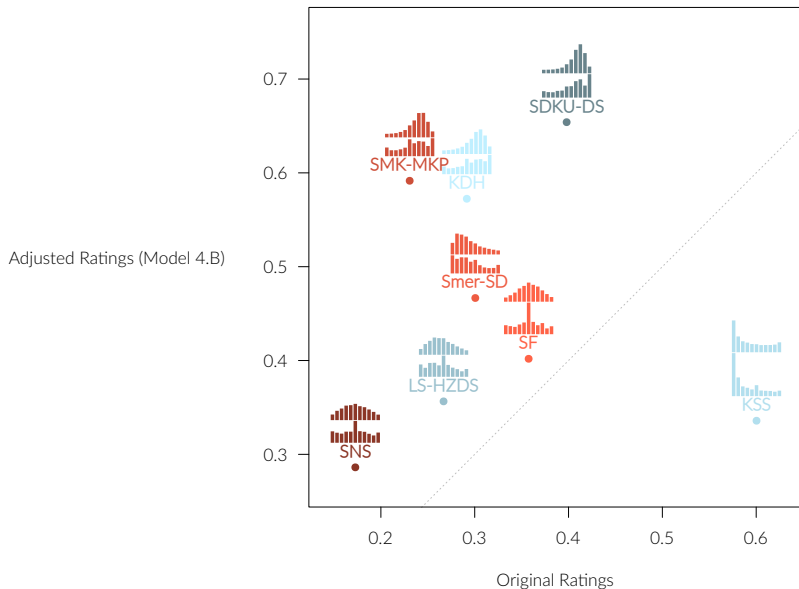


Ambiguity and dispersion



Ambiguity and agreement

Agreement, Slovakia 2009



Conclusion

Conclusion

Developing the paper

- Two-step version
- Bayesian model validation
- Replicate causal analyses

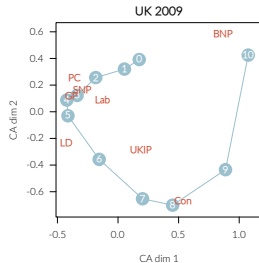
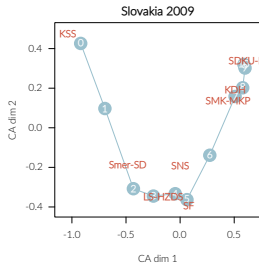
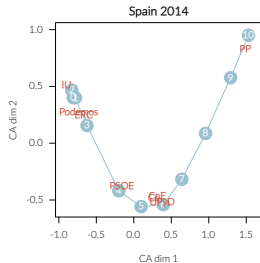
Future research

- Modeling rationalization bias (Bølstad 2020)
- Nonresponse and ambiguity (Rozenas 2013)
- More structured component memberships

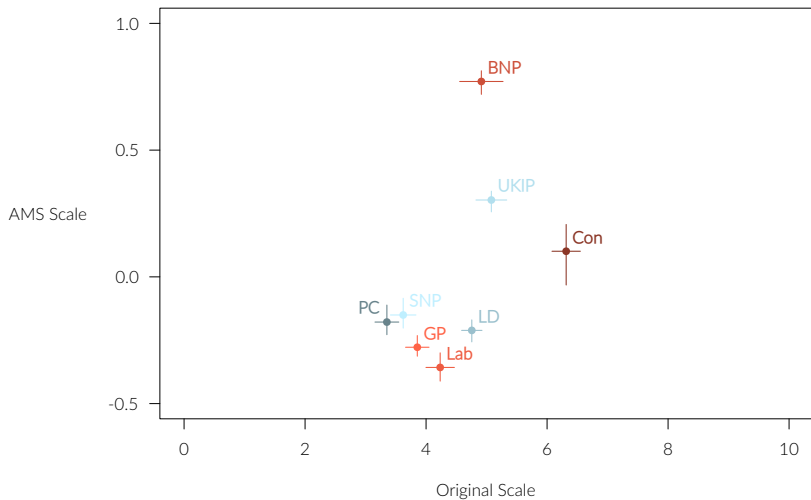
Thank you!

APPENDIX

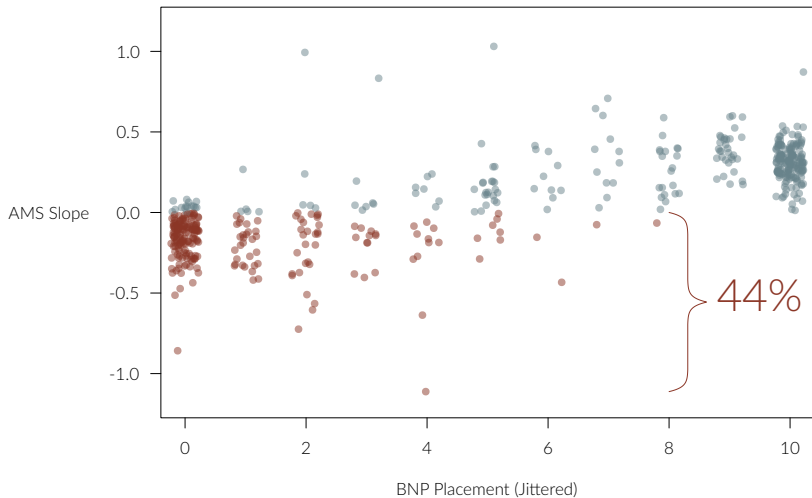
Three EES Left-Right batteries



AMS: EES UK 2009 Left-Right battery



AMS: EES UK 2009 Left-Right battery



THE END