UNIVERSITY OF AMSTERDAM

From theories to models to predictions with Bayesian model comparison.

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May 14th, 2019

How can we test psychological theories?

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- Positive psychology: *Positive psychology interventions improve life satifaction.*

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- And that is appropriate.

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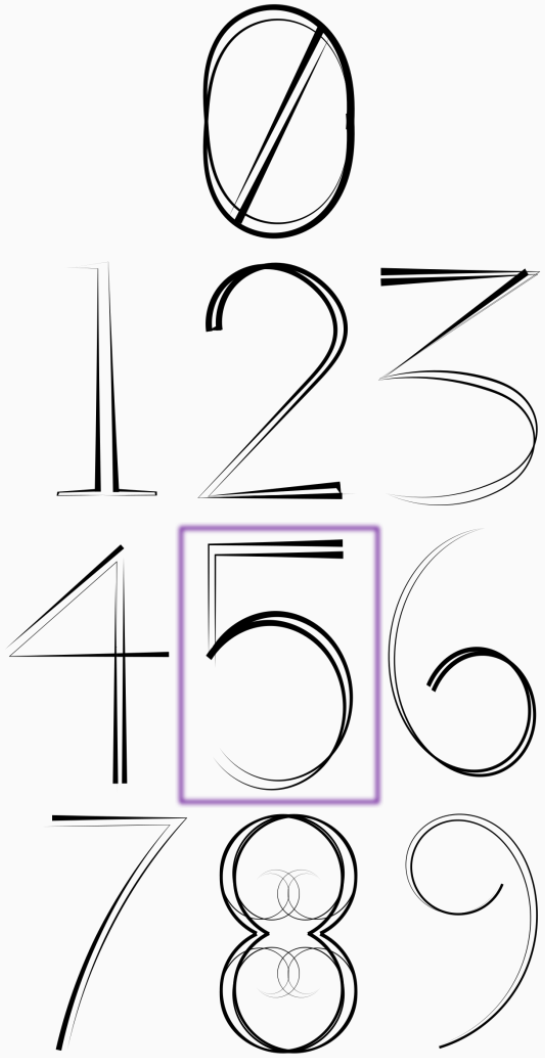
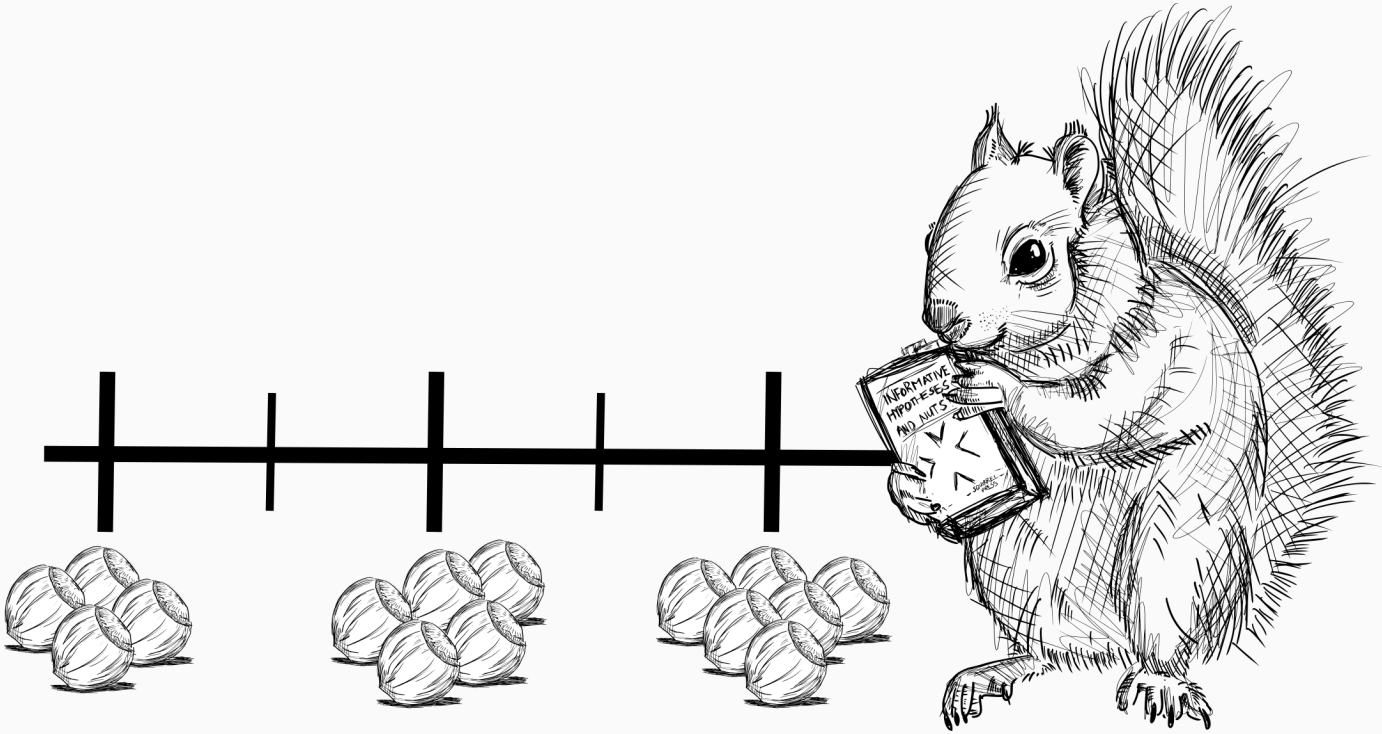
How do we represent numbers internally?



Rouder, Lu, Speckman, Sun, & Jiang (2005)

How do we represent numbers internally?

1. Analog representation.



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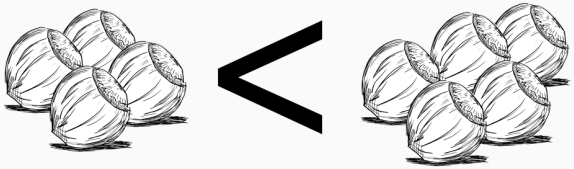

How do we represent numbers internally?

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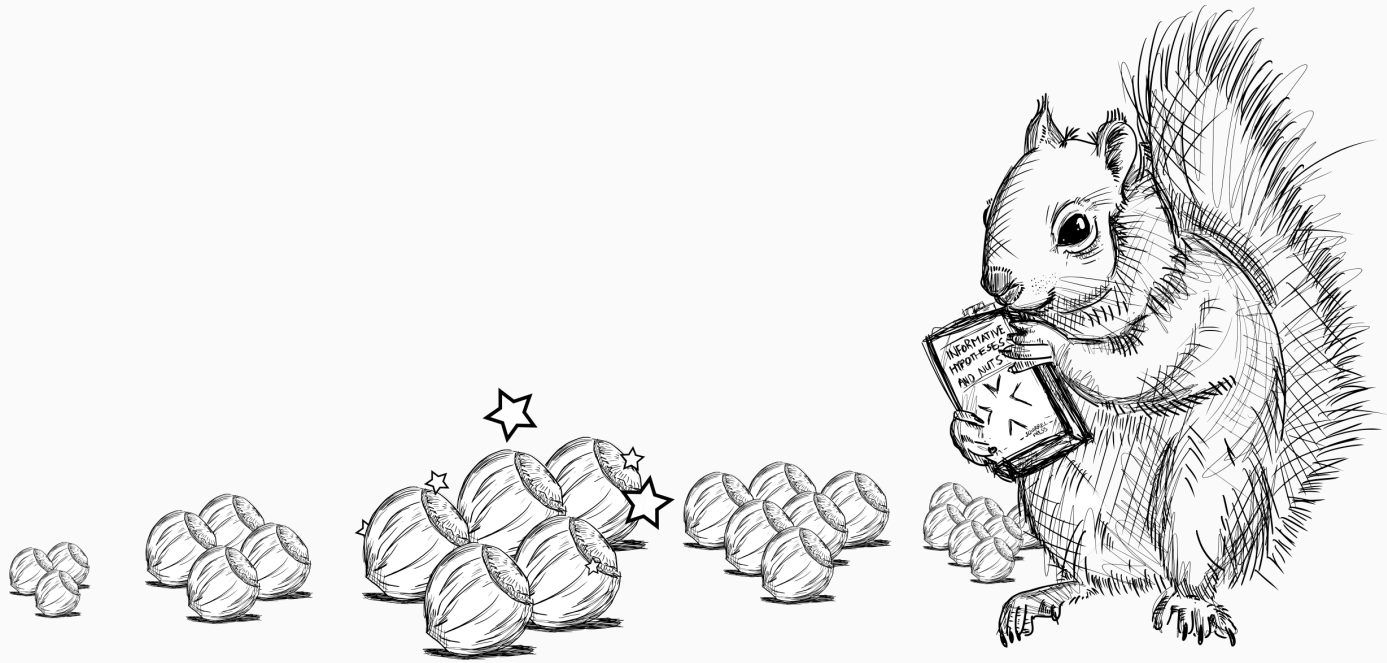
3. Priming + spreading activation.



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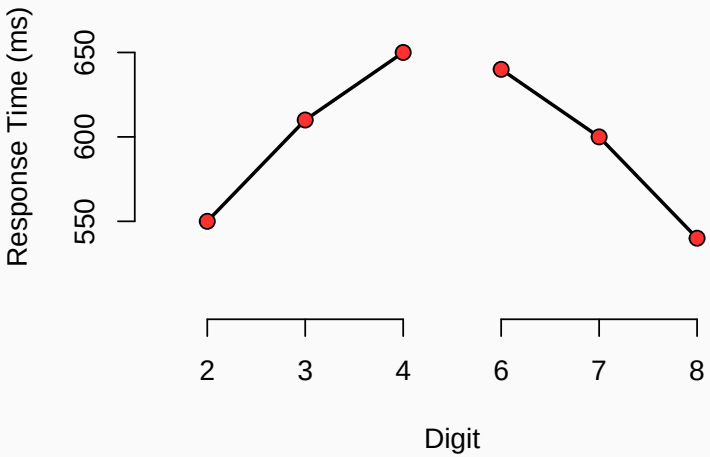
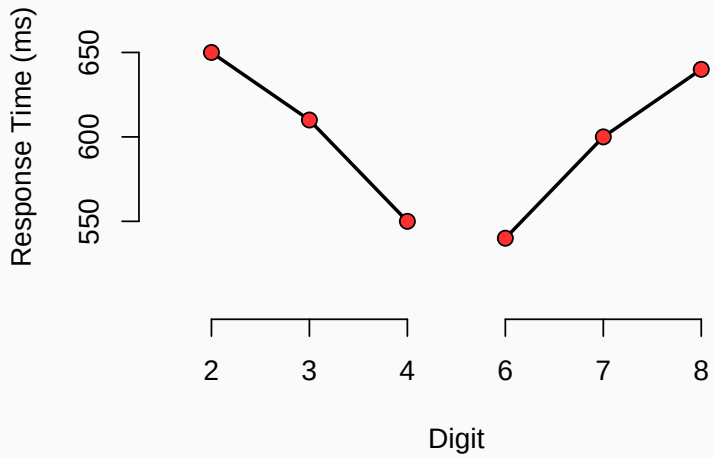
- Theoretically we are concerned with the second main effect.
- Main effect of proximity: Bayes factor of 10^{40}-to-1 in favor of the effect.
- Bayes factor of at least 59.00-to-1 against any other model.

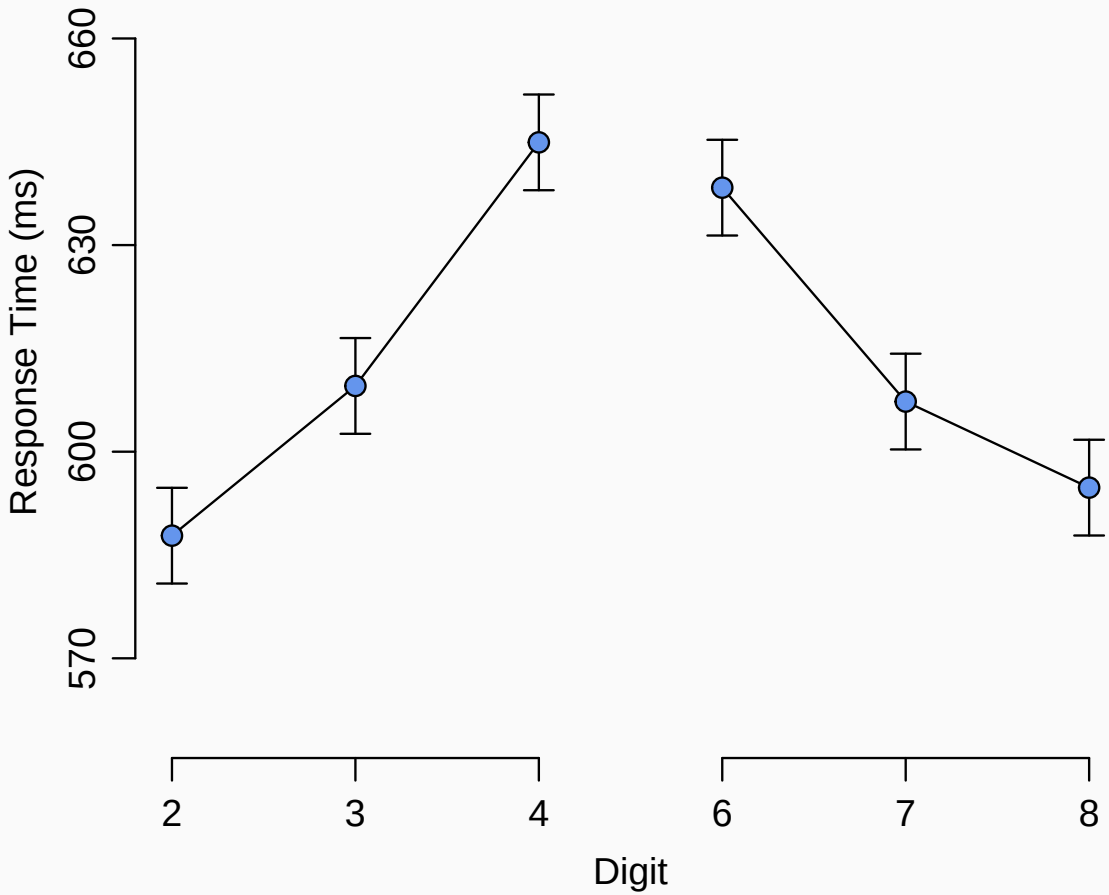
Default statistical model

But was does it mean to have significant main effect?





Number representation (Rouder et al., 2005)



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- Test main effects and interactions (preregister).
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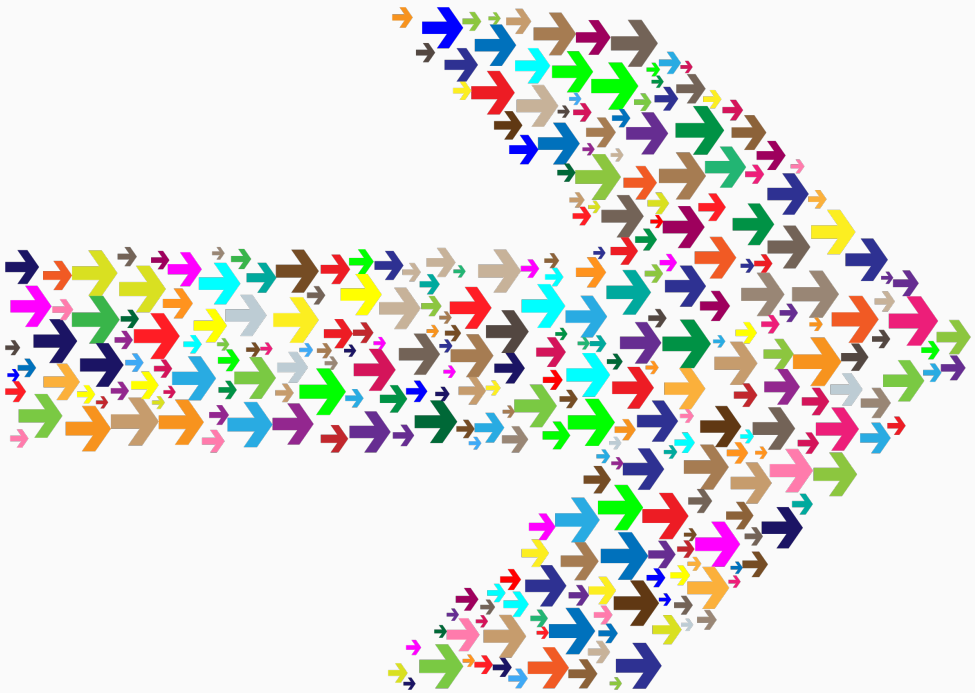
- Allows for unnecessary flexibility and posthoc reasoning.
- Specifying more constraint models may lead to more evidence for the theoretical predictions.

Ordinal models across people



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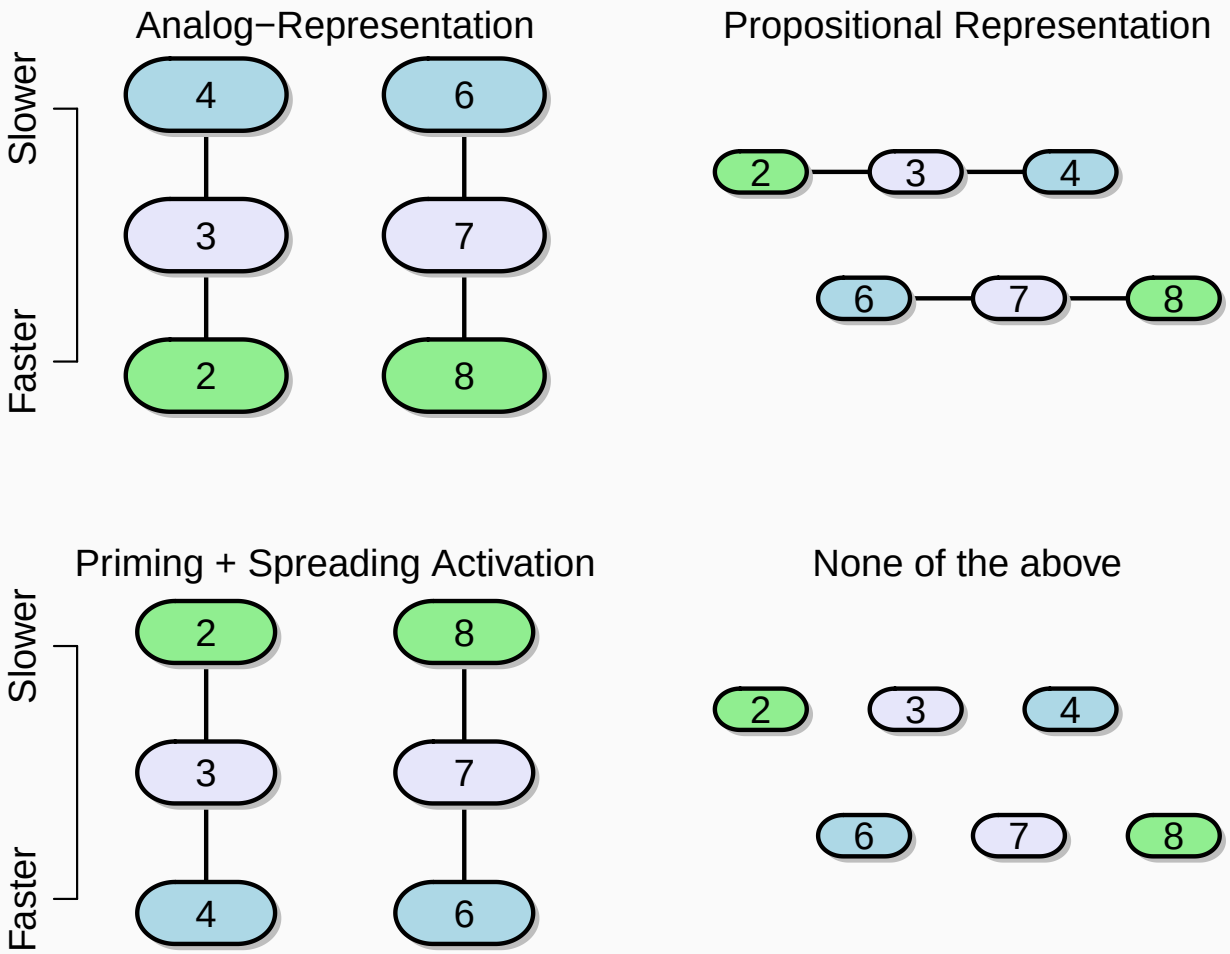
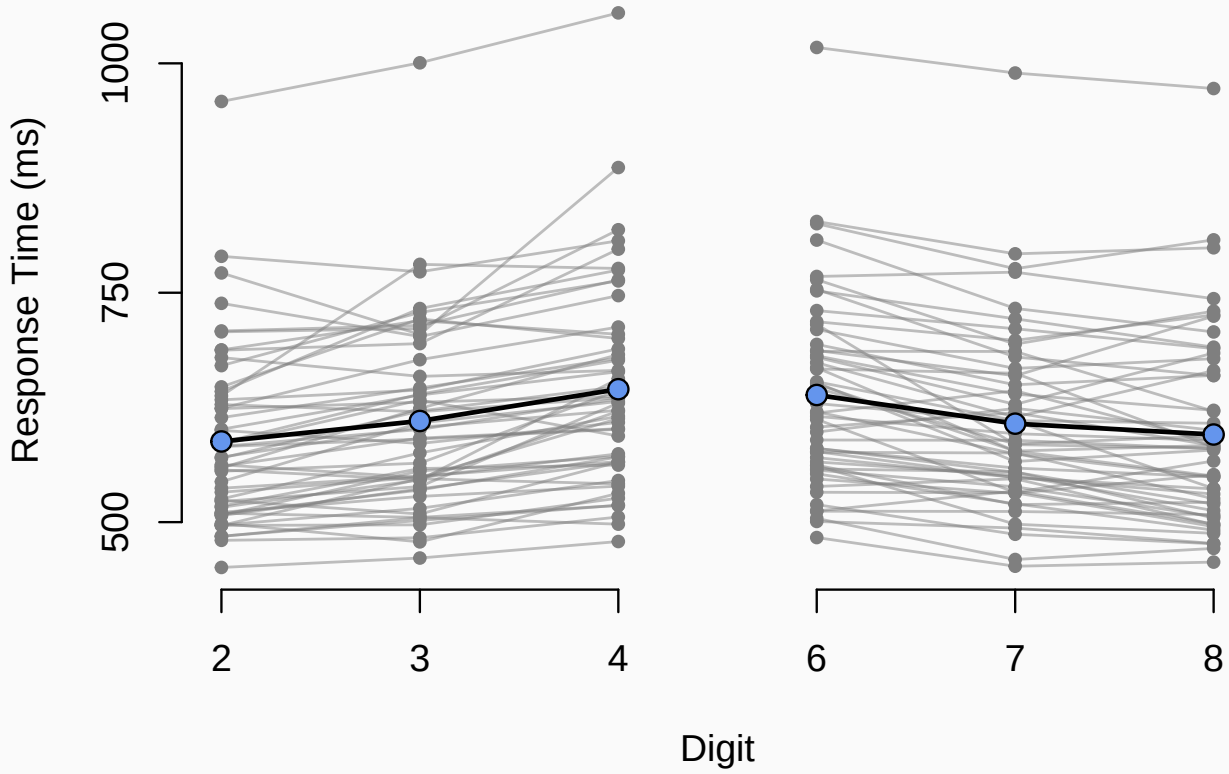
- *Mixed number representation* $\rightarrow$ more complex. What determines who has what type of number representation?

Theoretical positions as ordinal models



“Does Everyone” analysis



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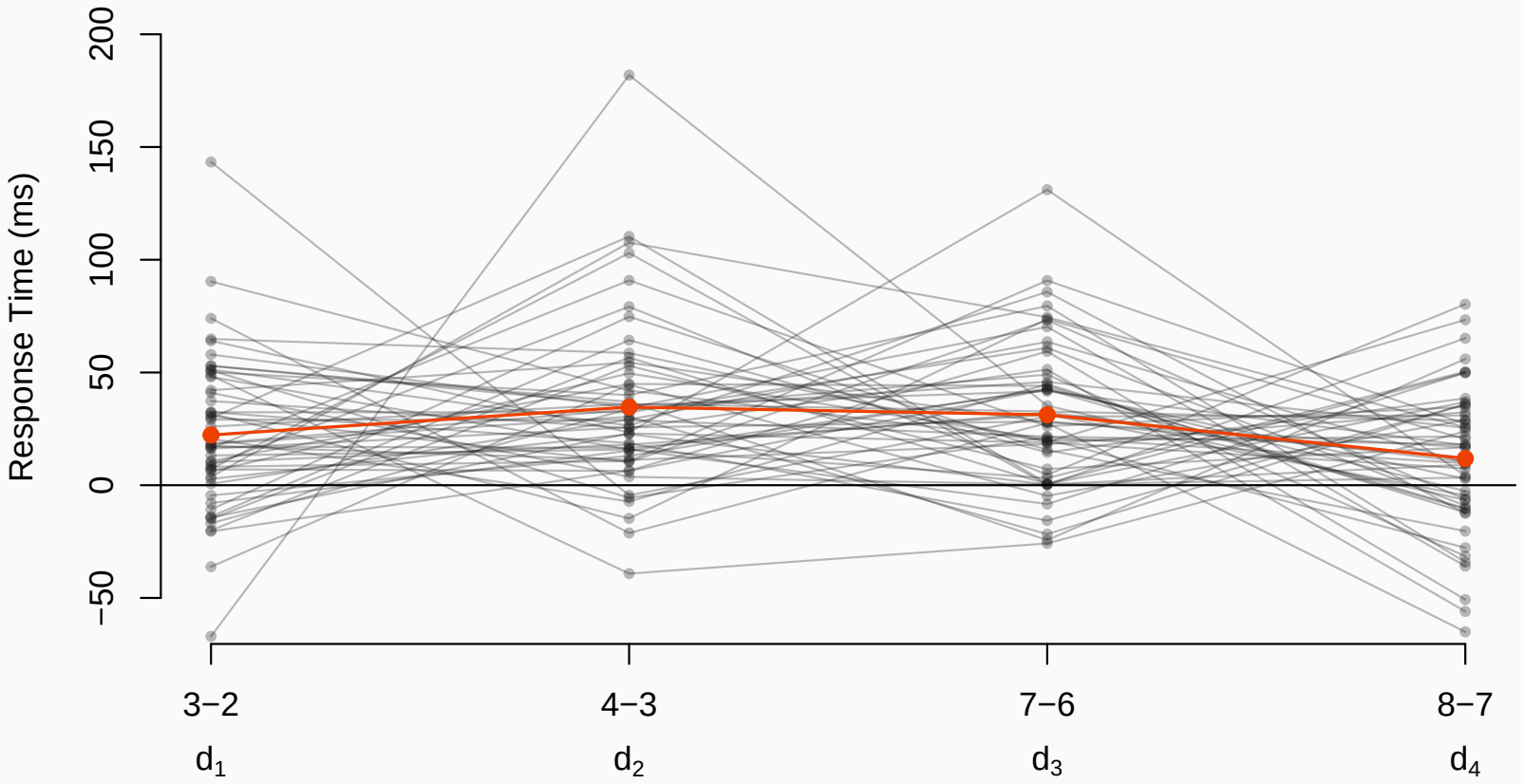

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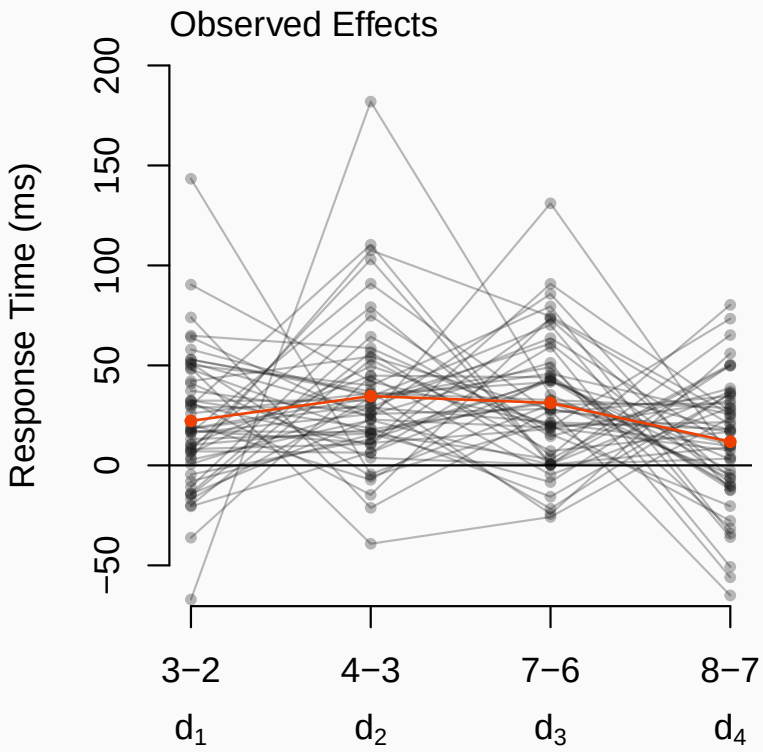

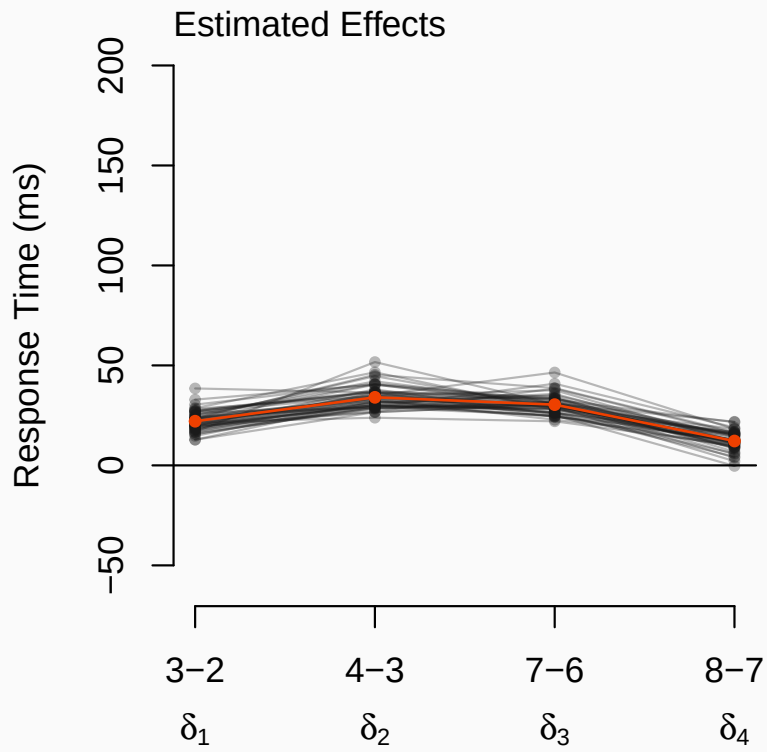

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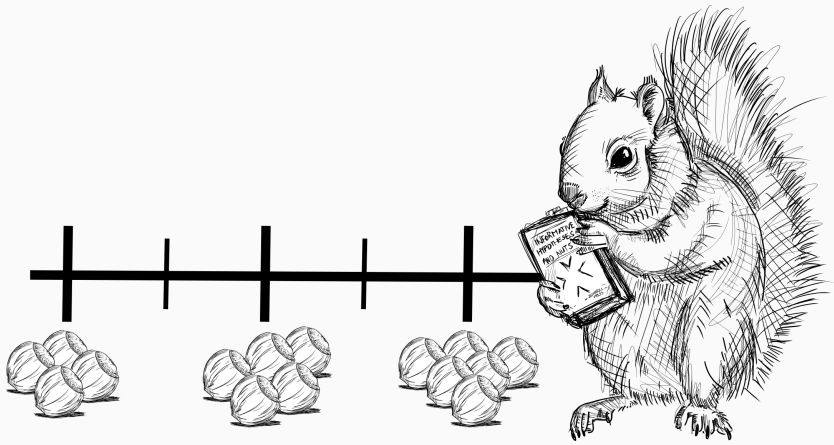

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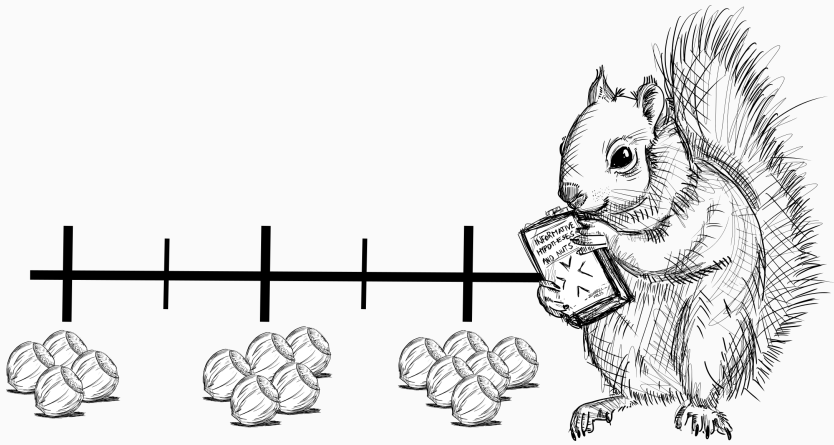

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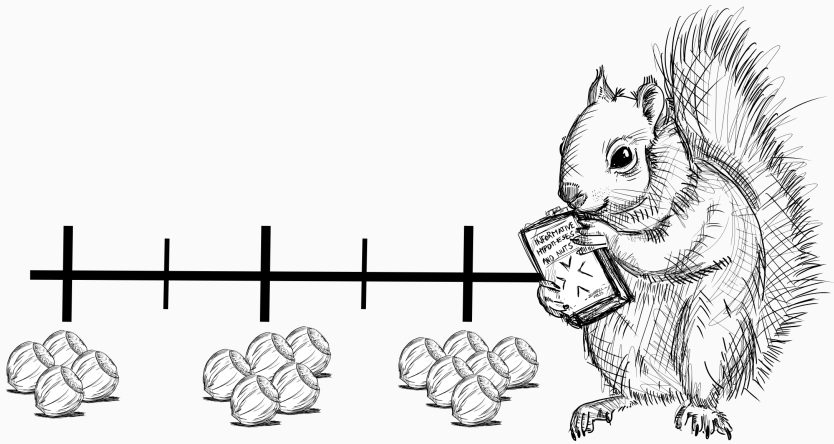

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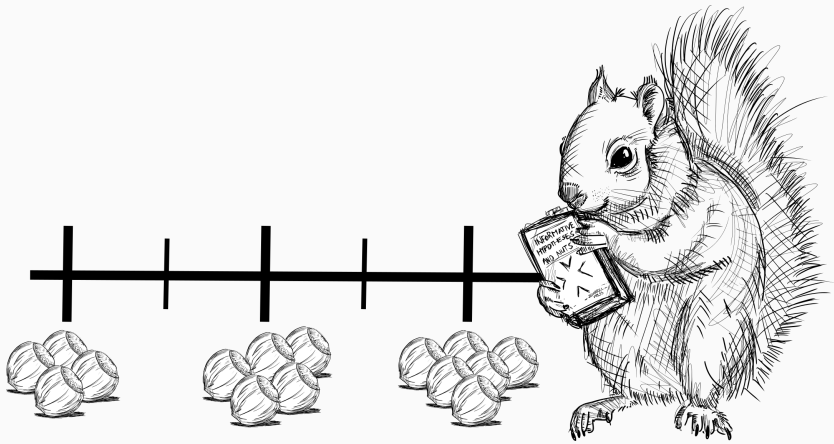
- Bayes factor for **Priming + spreading activation** model cannot be estimated



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4. Theoretical ordinal constraints may account for everyone.
5. "Everyone Does" models are parsimonious descriptions of common mechanisms.
6. To assess common mechanisms sample noise has to be taken into account.

Thank You!

Further Recources for the Pragmatic Psychologist

- Accessible book to get started with ordinal models: Hoijtink (2012)
- Software packages: `bain` or `BayesFactor` for `R` users
- "Does everyone" analysis: Haaf & Rouder (2017) and Haaf, Klaassen, & Rouder (In preparation)
- Presentation and all code is available at: tinyurl.com/OrdinalConstraint

References

Haaf, J. M., & Rouder, J. N. (2017). Developing constraint in Bayesian mixed models. *Psychological Methods*, *22*(4), 779–798.

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Rouder, J. N., Lu, J., Speckman, P. L., Sun, D., & Jiang, Y. (2005). A hierarchical model for estimating response time distributions. *Psychonomic Bulletin and Review*, *12*, 195–223.

Rouder, J. N., Morey, R. D., Speckman, P. L., & Province, J. M. (2012). Default Bayes factors for ANOVA designs. *Journal of Mathematical Psychology*, *56*, 356–374. Retrieved from http://dx.doi.org/10.1016/j.jmp.2012.08.001