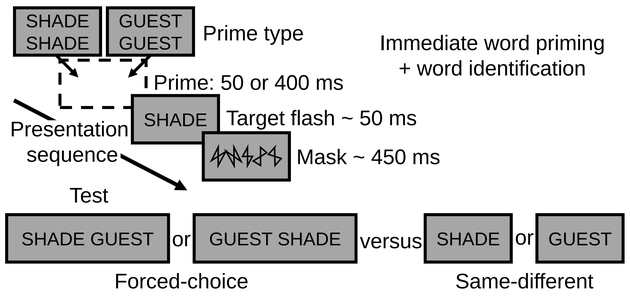
Testing a model of perceptual fluency/disfluency

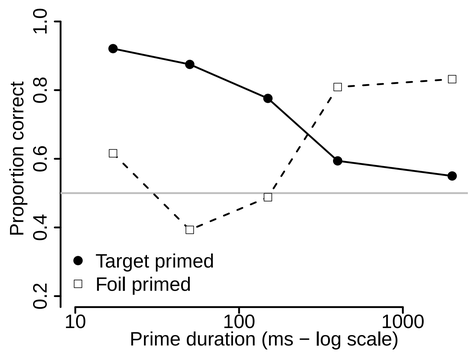
Kevin Potter*, Chris Donkin†, & David Huber*
Department of Psychology
The University of Massachusetts Amherst*, University of New South Wales†

Introduction

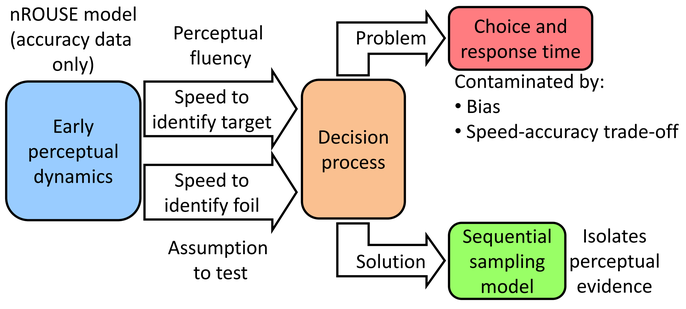
The experimental paradigm:



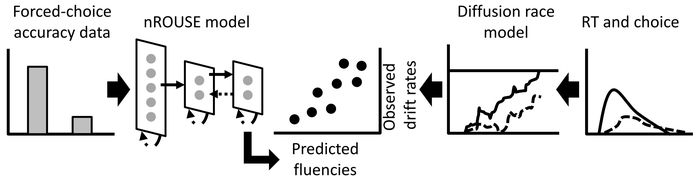
Previous data indicates that there is a cross-over interaction between prime type and duration on performance (Huber, 2008):



The nROUSE model (Huber & O'Reilly, 2003) successfully accounts for this interaction by simulating early perceptual dynamics in the visual system.



We tested the model assumptions in the following manner:



If the decision rule is based on perceptual fluency, then identification latencies from the nROUSE model should predict rates of perceptual evidence accumulation extracted from a sequential sampling model.

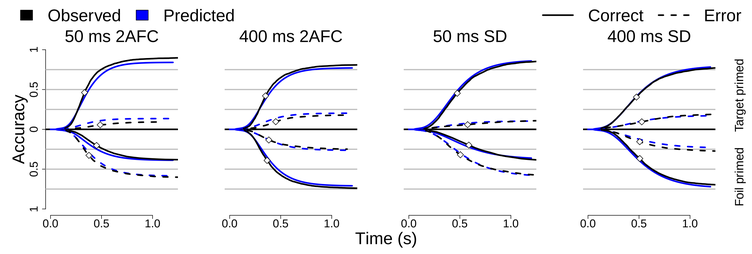
Method

As shown in the 1^{st} figure, subjects completed both forced-choice and same-different variants of a word identification task with immediate word priming.

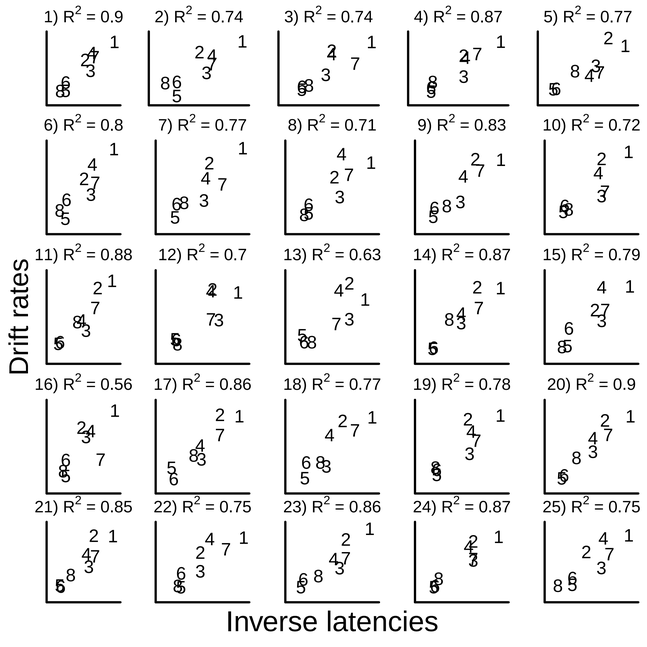
- There was usable data from 25 subjects (from a sample of 42).
- There were 80 trials per each of the 16 conditions.

Modeling results

The diffusion race model captured the observed effects:



There were strong correlations between the inverse of the predicted identification latencies and the drift rates:

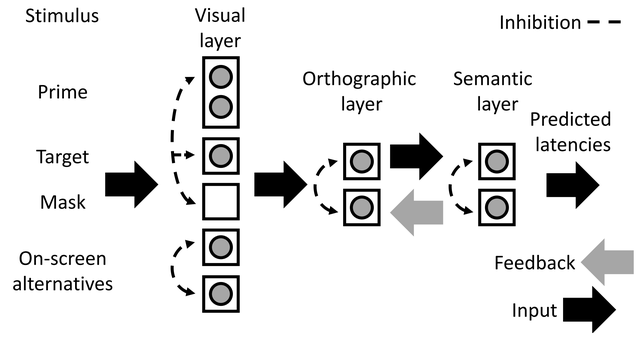


Discussion

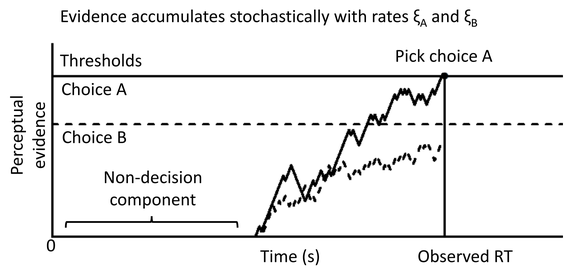
1) Despite independent estimation, there was sizeable convergence between the diffusion race and nROUSE models.
2) Supports the assumption that decision is based on perceptual identification latencies.

The models

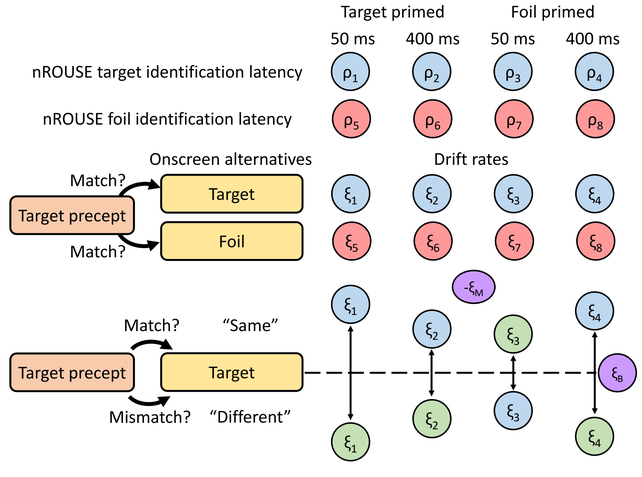
The nROUSE model is a 3-layer neural network for perceptual features:



The diffusion race model (Logan et al., 2014) is a sequential sampling model where 2 one-boundary Wiener processes race each other towards separate thresholds:



We constrained the diffusion race model in the following manner to match the structure of the nROUSE model:



Acknowledgments

This work was supported by the National Science Foundation grant BCS-1431147.

References

Huber, D. E. (2008). Immediate priming and cognitive aftereffects. *Journal of Experimental Psychology: General*, 137 , 324 – 347.

Huber, D. E., & O'Reilly, R. C. (2003). Persistence and accommodation in short-term priming and other perceptual paradigms: Temporal segregation through synaptic depression. Cognitive Science, 27 , 403 – 430.

Logan, G. D., Van Zandt, T., Verbruggen, F., & Wagenmakers, E.-J. (2014). On the ability to inhibit thought and action: General and special theories of an act of control. Psychological Review, 121 (1), 66 – 95.