# Opportunity for verbalization does not improve visual change detection performance

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# Opportunity for verbalization does not improve visual change detection performance: **A state-trace analysis**

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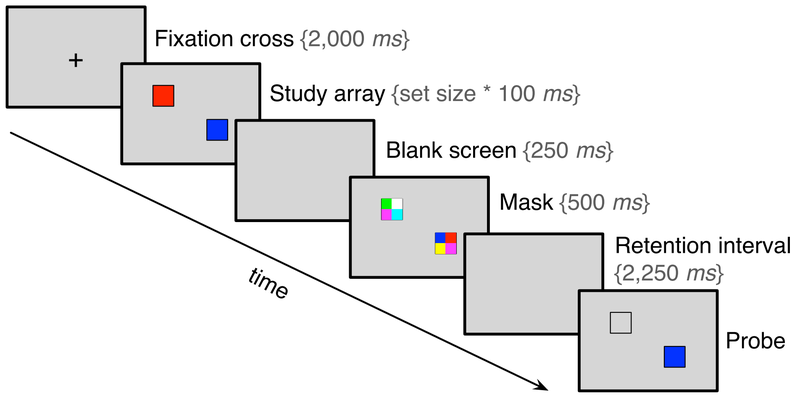
## Background

People can verbalize visual information. To **study visual working memory**, cognitive psychologists need to **isolate visual components** of working memory from other components.

This has typically been done using **articulatory suppression**. Recently, it has been debated whether articulatory suppression is actually necessary.

Known **methodological issues in this debate**: claims are based on significant interaction effects or null-findings. **State-trace analysis and Bayes factors offer a solution**.

## The visual change detection paradigm




**Dependent variable**: binary response {same, change}

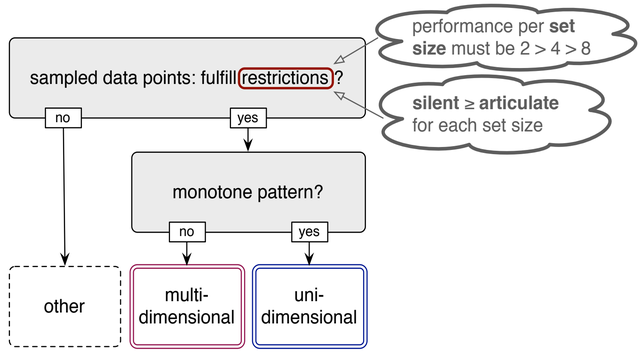
**Independent variables**:
- simultaneous vs. sequential presentation of stimuli
- silent vs. articulate during trial
- set size {2, 4, 8}

Data from 15 participants (8 female) that came in for 5 sessions of 504 trials each.

## State-Trace Analysis

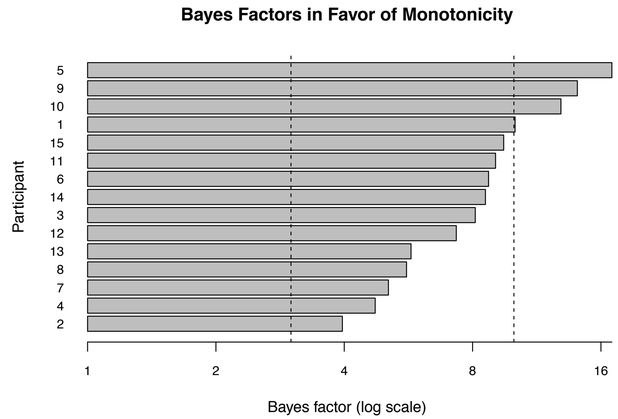
State-trace analysis allows us to probe the **dimensionality of a latent system**. The system of interest here is working memory. We start with assuming a uni-dimensional model and only reject it if the data cannot support it.

If the variation in the outcome variable is caused by a single dimension, their relationship must be monotonic when plotted against each other. Only a multi-dimensional system can produce non-monotonicity.

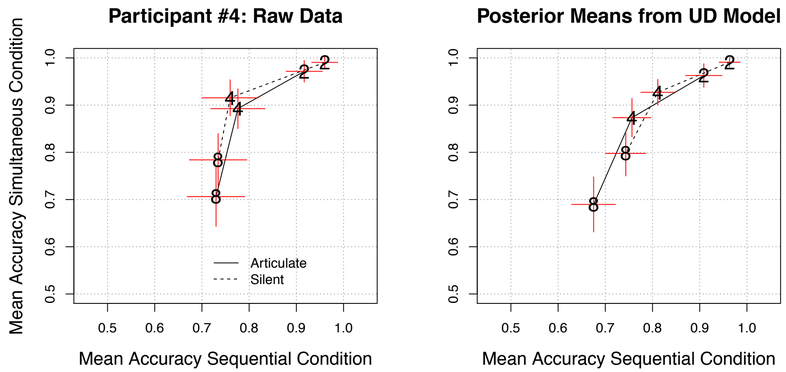


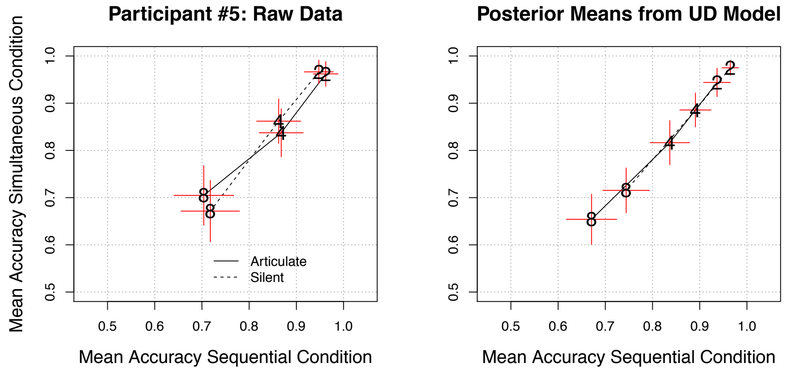

$$BF = \frac{Pr(M_1 \mid D)}{Pr(M_2 \mid D)} \Big/ \frac{Pr(M_1)}{Pr(M_2)} = \frac{\#\ UD\ samples}{\#\ MD\ samples} \Big/ \frac{\#\ UD\ orderings}{\#\ MD\ orderings}$$

**Bayes factors let us quantify the relative evidence** the data provide for two competing models: the restricted versus the encompassing model.




## Selected State-Trace Plots




## Conclusions

Support for the uni-dimensional model is very strong.

State-trace analysis is an appropriate and informative alternative to conventional methods.

Pre-cautionary articulatory suppression does not seem to be necessary (in this particular setup).

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