

# Spatial Grouping and Visual Enumeration Performance: Signal Detection Analysis



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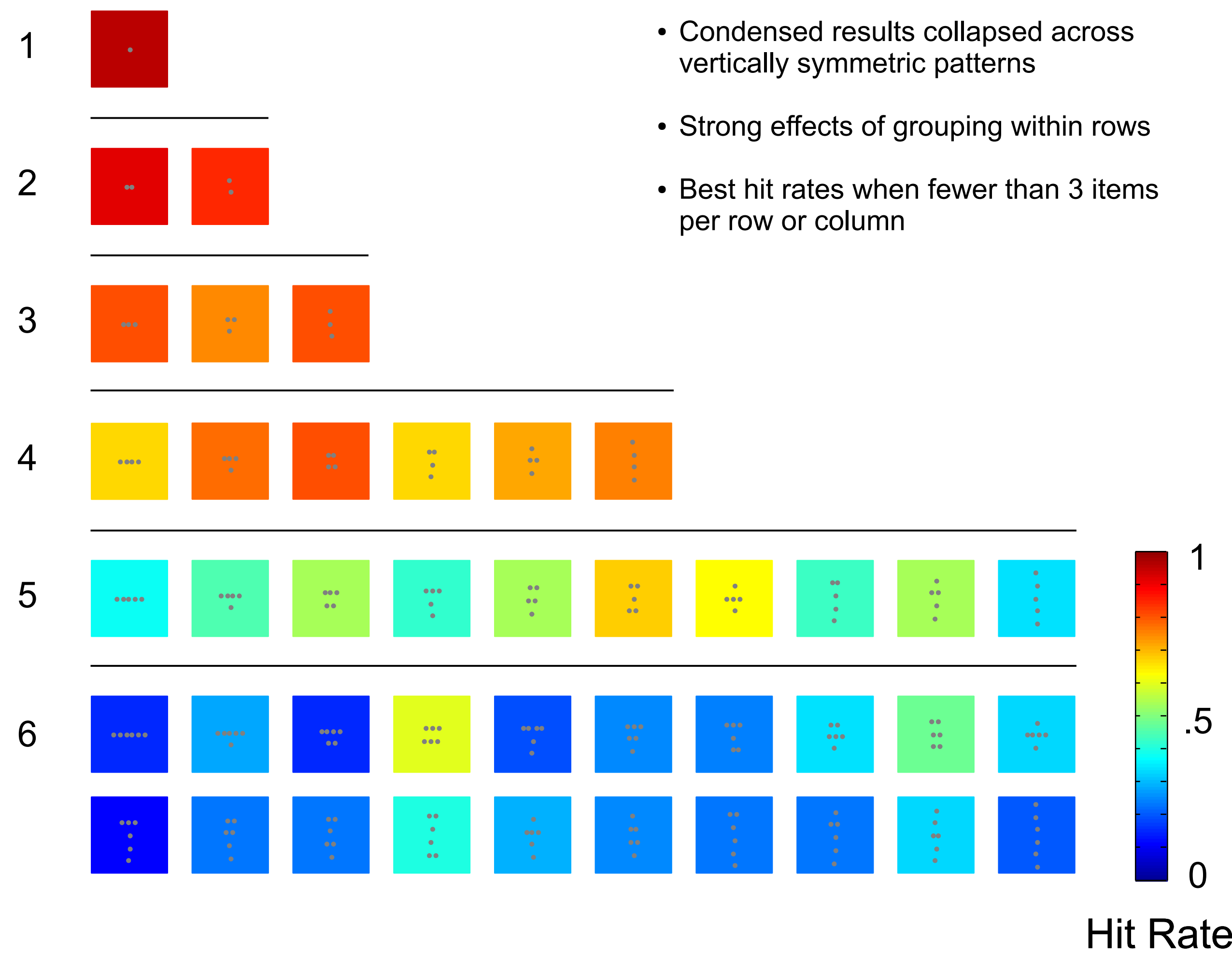
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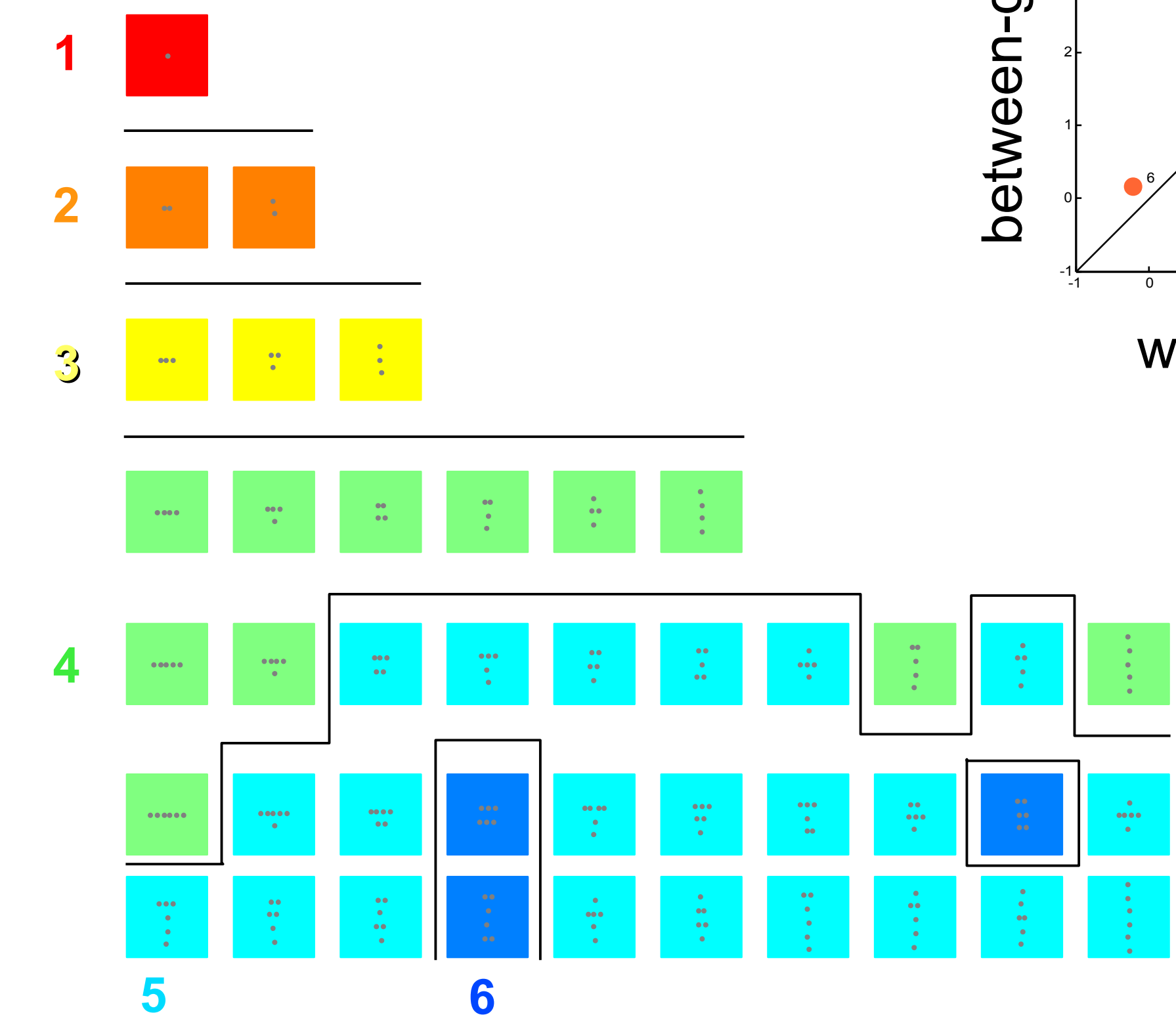
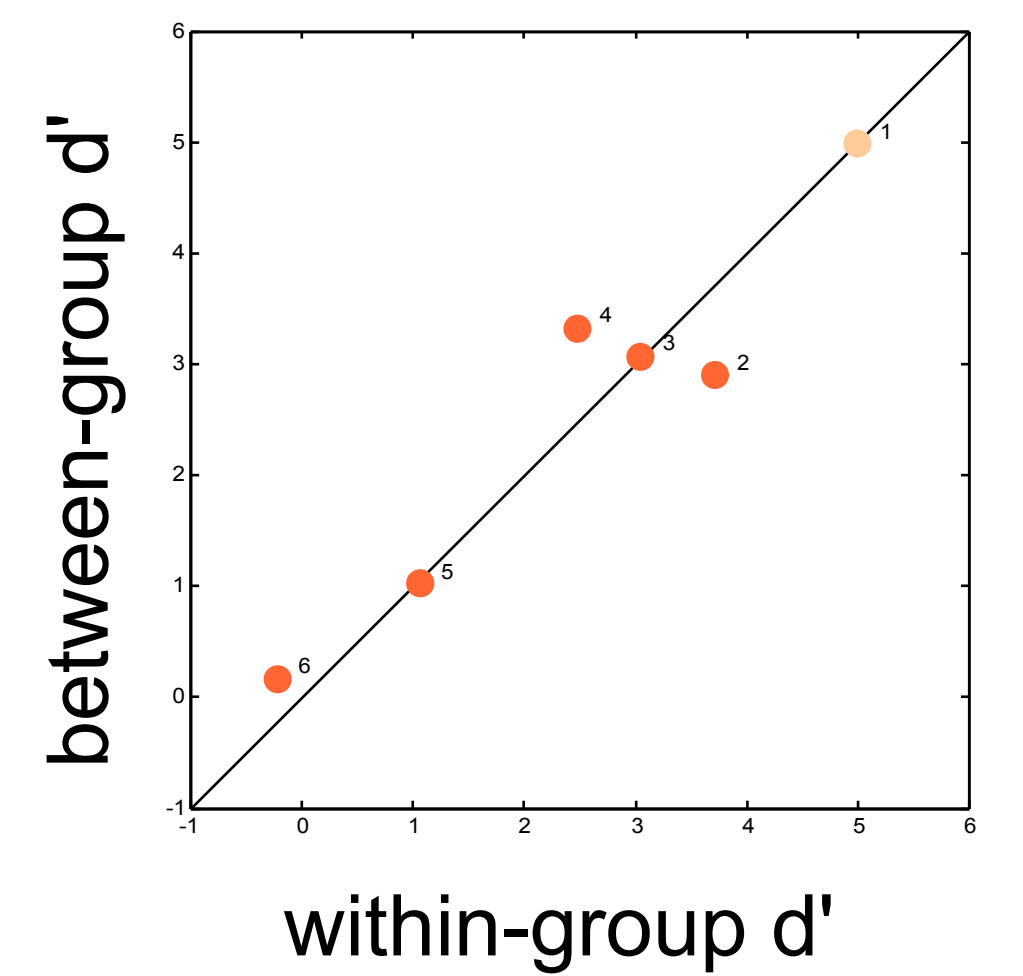
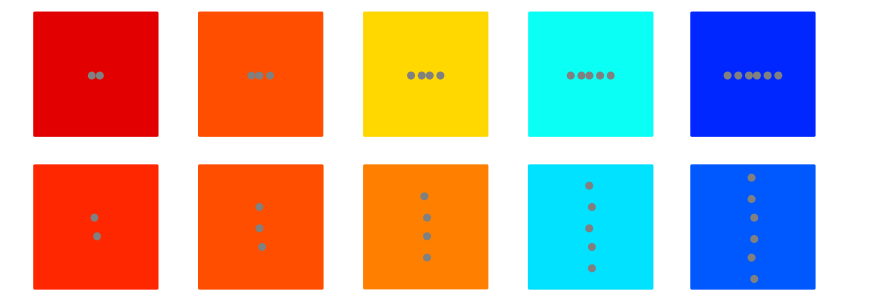
## GOALS

- Examine effects of grouping by proximity on visual enumeration
  - For small numbers of dots (1-6)
  - Exhaust all possible configurations to avoid bias in stimulus set
  - Consider both local and global features of patterns
- Enable signal detection analyses
  - Display stimuli at threshold
  - Collect confidence ratings for all responses
  - Define False Alarm trials separately for each number

## RESULTS

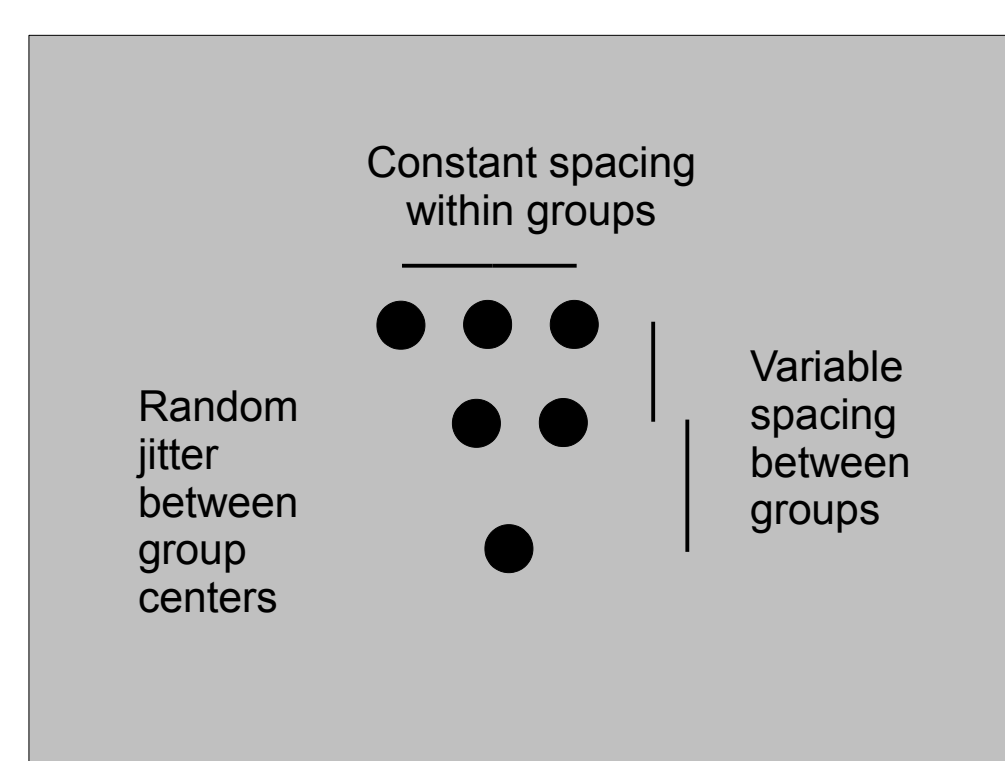


- Within/between dot groups comparison special case: rows vs. columns
- Better  $d'$  *between* groups for 2-4 item range

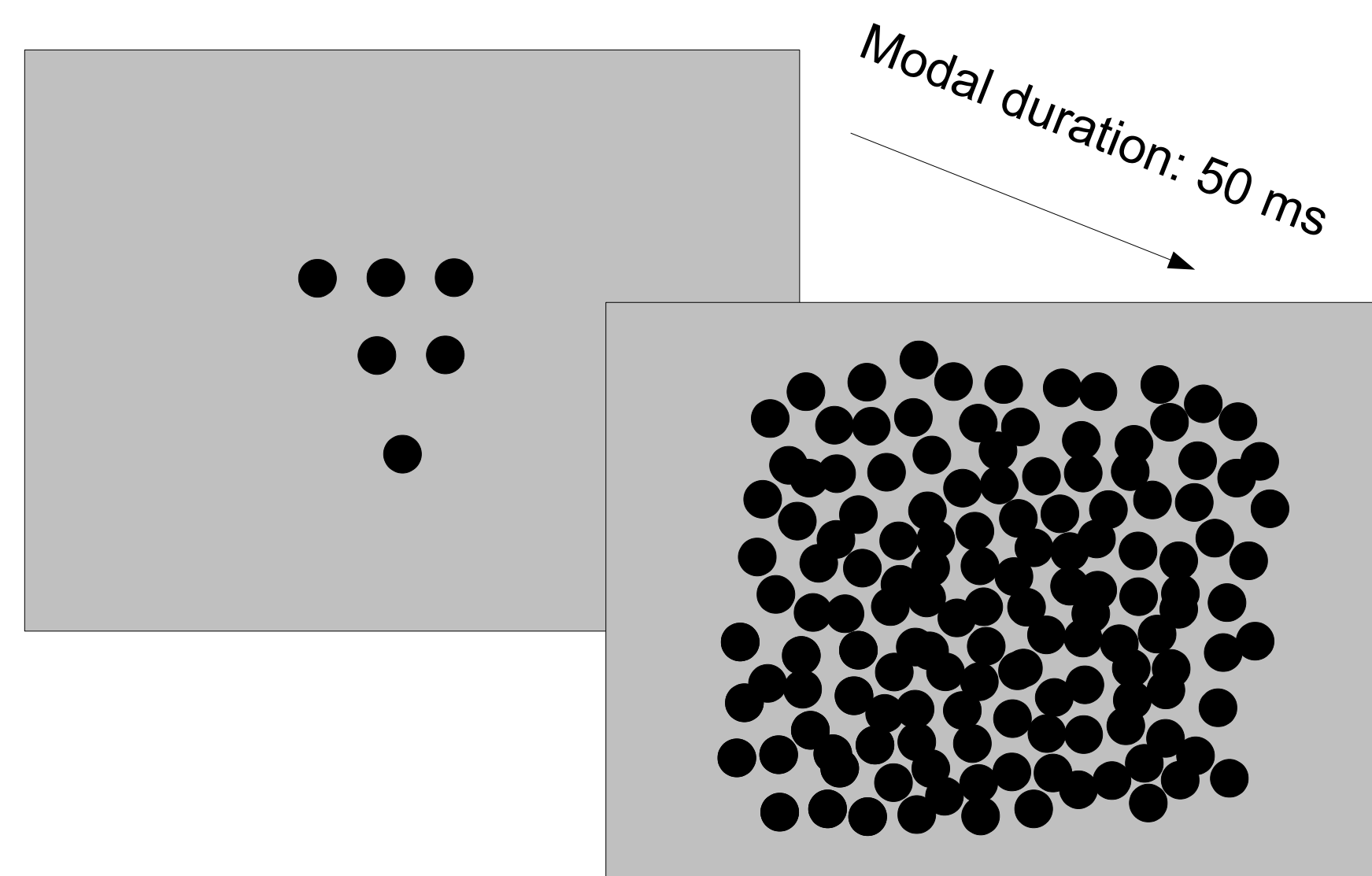


- **Modal responses** for each pattern
- Positively skewed
- Global symmetry and/or local within group item limits important for larger numbers
- Benefits of grouping may be limited to 4 within-group items; also strong "4" bias

## PROCEDURE

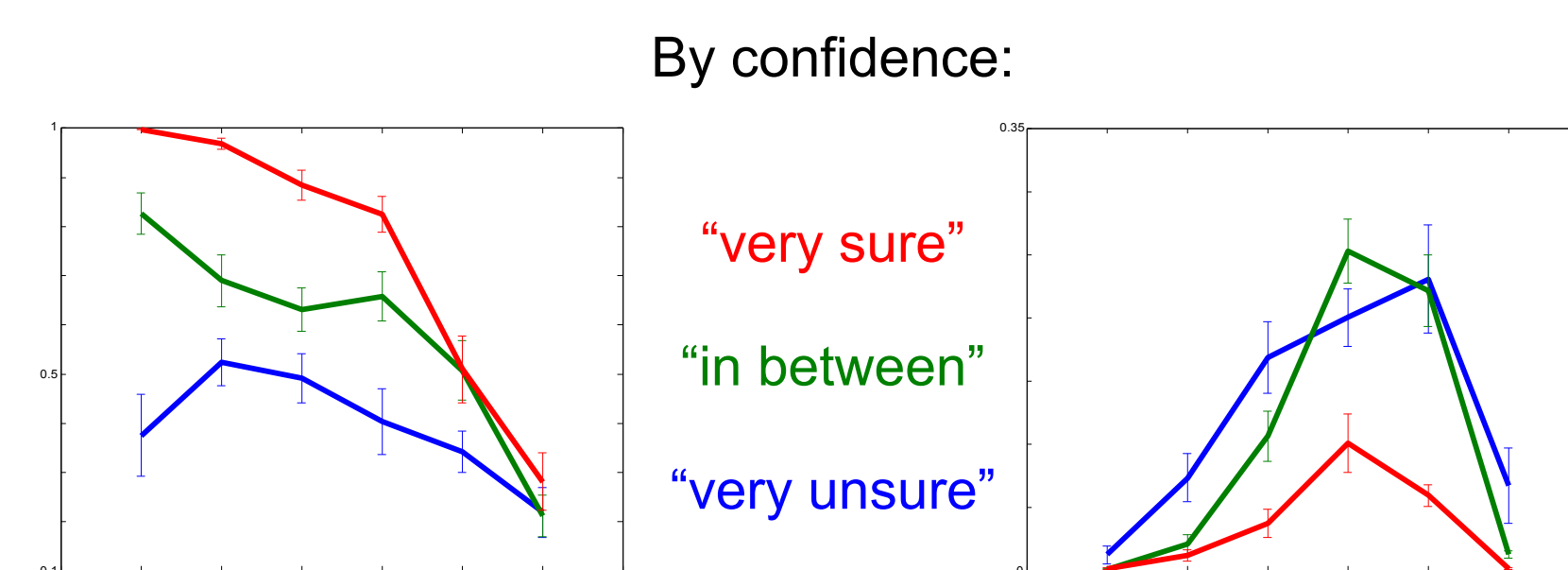
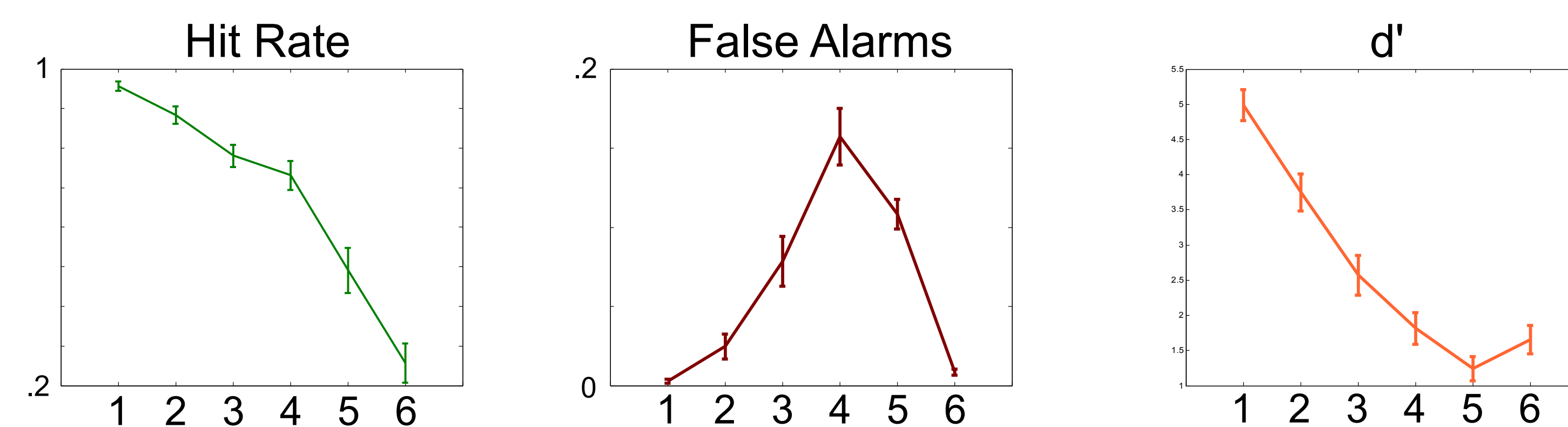


Overall hit rate criterion: 67%  
Display duration determined in preliminary threshold block for each participant

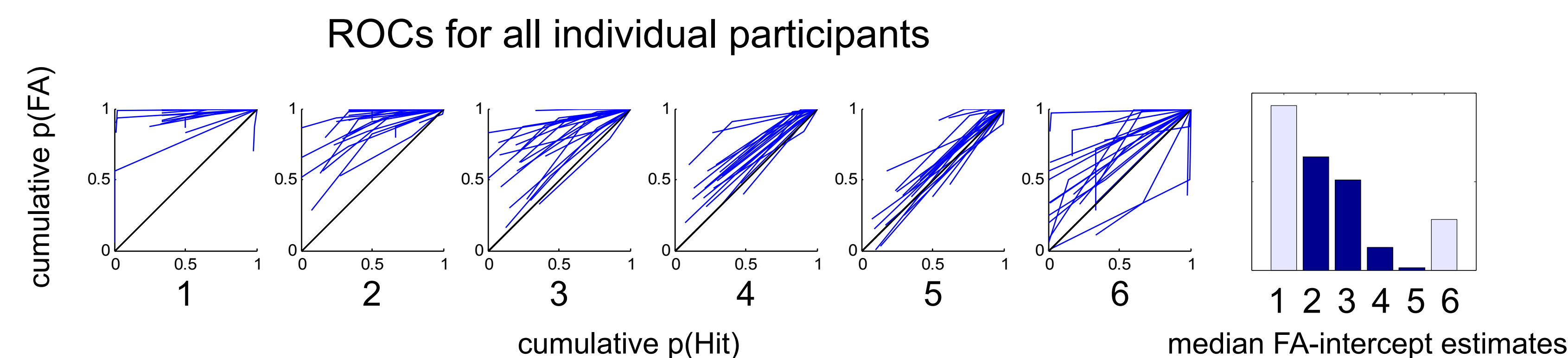


Key presses to indicate number response and confidence (3 intervals)

## Signal detection analyses



- Hit rate slope change is misleading
- $d'$  shows linear trend
- ROC analysis gives evidence for process distinctions for very small numbers only (2-3)



## CONCLUSIONS

- Strong effects of grouping locally, and possibly of global symmetry
- Best performance with ~3 items per group and ~3 groups
  - Able to efficiently enumerate up to 9 well-configured items?
- $d'$  approximately linear for this small range
- Strong bias to respond "4"
- **ROC analysis gives evidence for possible process distinction** (c.f. Aly & Yonelinas 2012) for enumeration around 3-item watershed.