Memory Load Affects the Magnitude of Implicit Spatial Context Learning

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Background and Purpose

Implicit Spatial Context Learning
- The acquisition of knowledge about a visual scene that occurs without intent or conscious awareness

Spatial Contextual Cueing Task (SCCT)
- Identify targets faster when the spatial configuration of distracters covaries with target location (Chun & Jiang, 1998; Howard et al., 2004)

Mechanisms of Spatial Context Learning
- Involves perceptual and memory processes (Chun, 2000)
- Some perceptual manipulations affect the magnitude of learning (e.g. varying the number of distracters), but others do not (e.g. varying the identity of distracters) (Chun & Jiang, 1998)
- Memory manipulations have not been examined with the SCCT task

Purpose
- To determine if the magnitude of learning is affected by memory load: Do people learn more when there are fewer arrays to be learned?

Methods

Participants
- 37 Young Adults
- 20.4 ± .8 years
- 10 male; 27 female

SCCT Task
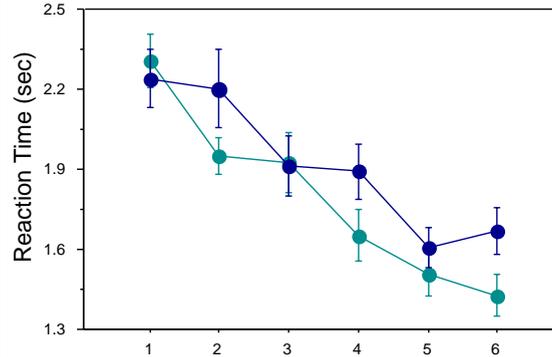- View arrays
  - 11 distracters (offset L's)
  - 1 target (horizontal T)
- Respond to direction of target T (left vs. right)

Respond LEFT   Respond RIGHT

- Array types
  - Familiar - repeat across blocks
    - Configuration of distracters predicts target location
  - Novel - newly generated each presentation

- Load conditions (vary # of arrays/block)
  - High load - 12 familiar & 12 novel (n= 18)
  - Low load - 6 familiar & 6 novel (n= 17)
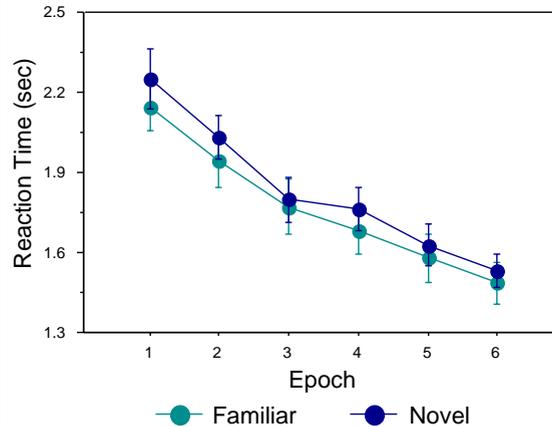
- 30 blocks of 24 (high load) or 12 (low load) trials
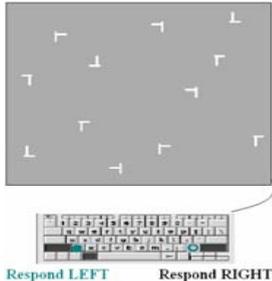
Analyses compare reaction time to familiar versus novel arrays in the two load conditions

Results: Reaction Time


Low Load Condition

High Load Condition

●— Familiar   ●— Novel

Results Summary

Reaction Time
- Significant array type x load x epoch interaction ($p < .05$)
  - Low load - Significant learning (array type, $p < .08$; array type x epoch, $p < .03$)
  - High load - No significant learning (p's > .16)

Accuracy
- Low load - 98.0 ± 2.0 %
- High load - 98.7 ± 1.4 %

Implicitness

Post-experiment interview
- 12 participants (3 in high load; 9 in low load) indicated that they noticed arrays repeating across blocks
- However, no subject accurately described the regularity

Recognition Trials
- View arrays with the target T replaced by a distracter L
- Indicate in which quadrant the target would have been presented

- Low Load, Familiar
- Low Load, Novel
- High Load, Familiar
- High Load, Novel
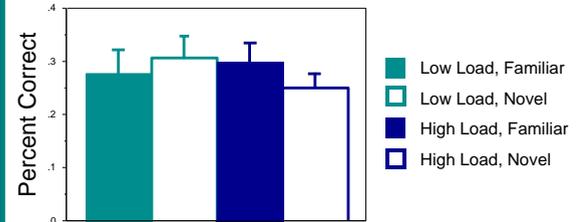
- Recognition accuracy equal for familiar and novel arrays in both conditions
- Recognition accuracy at chance for both conditions
- Chi Square analyses for each participant confirmed that no individual identified the target quadrant for familiar arrays more than novel arrays

Discussion

- Implicit learning of spatial context information increases when memory load is decreased
  - People learned more on the SCCT task when there were fewer arrays to be learned
  - Importantly, this manipulation did not compromise the implicit nature of the task

- Implications for studies in patient groups, children, and older adults because the low memory load condition yields more learning with shorter training and no signs of awareness