

MILD COGNITIVE IMPAIRMENT AND IMPLICIT LEARNING: DISSOCIATION BETWEEN SEQUENCE LEARNING AND CONTEXTUAL CUEING.

Selam Negash¹, Lindsay E. Petersen¹, Yonas E. Geda¹, David S. Knopman¹, Bradley F. Boeve¹, Glenn E. Smith¹, Robert J. Ivnik¹, Darlene V. Howard², James H. Howard, Jr.^{2,3}, and Ronald C. Petersen¹

¹Mayo Clinic, Rochester, ²Georgetown University & ³The Catholic University of America

Abstract

The goal of the present study was to investigate implicit learning in mild cognitive impairment (MCI), a transitional zone between normal aging and dementia. We investigated two forms of implicit learning – contextual cueing and sequence learning – and tested the hypothesis that some forms of implicit learning are impaired while others are spared, when MCI patients are compared to healthy elderly controls. In the contextual cueing paradigm, people learn to use repeated spatial configurations to facilitate search for a target, whereas in sequence learning, they learn to use subtle sequence regularities to respond more quickly and accurately to a series of events. The former implicates the medial temporal lobe system, and the latter, fronto-striatal-cerebellar circuits. 24 MCI patients and 24 healthy elderly controls completed both tasks, with the order of tasks counterbalanced. Learning on both tasks was inferred from faster and/or more accurate response to predictable than unpredictable stimuli. Results revealed a dissociation; contextual cueing was impaired and sequence learning was relatively spared in MCI patients compared to healthy controls. These findings add to the growing evidence that the two forms of implicit learning rely on different neural substrates, and provide further support for the medial temporal lobe dysfunction and relative integrity of fronto-striatal systems in MCI.

Goals

- To investigate implicit learning of visual/spatial contexts in MCI patients.
- To investigate implicit learning of subtle sequential regularities in MCI patients.
- To determine whether such learning occur in the absence of declarative knowledge about the pattern.

Method

Participants:

- **24 MCI patients**
– mean age: 77.1 (SD: 6.0); mean education level: 13.8 (SD: 3.2)
- **24 healthy elderly controls**
– mean age: 76.3 (SD: 5.2); mean education level: 13.8 (SD: 2.5)

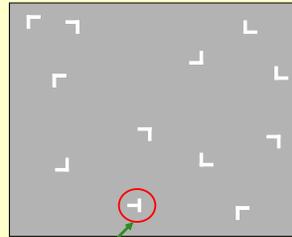
Tasks:

- Contextual Cueing & Serial Reaction Time (SRT)
- Recognition tests at the end of each task

Measures of Learning:

- **Implicit:** Difference in performance between predictable and unpredictable trials (*trial-type effect*).
- **Explicit:** Verbal reports and Recognition tests

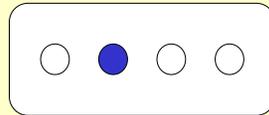
Contextual Cueing Task



Respond Left

- Visual array of 12 items
 - 11 distractors (L's--orientation varies)
 - 1 target (**horizontal T**)
- 1 block = 24 trials
 - 12 **repeated** configurations
 - 12 **novel** configurations
- On repeated trials
 - Configuration predicts **location** of T
 - NOT direction of T
- 20 blocks (1 epoch = 5 blocks)

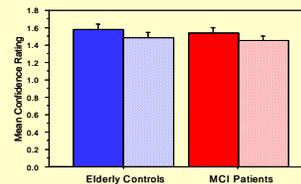
Serial Reaction Time (SRT) Task



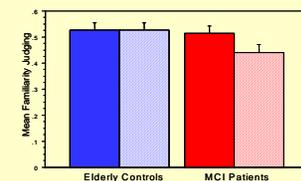
- Spatially arranged locations
- On each trial, one of the circles fills in
- Predetermined 8-element pattern:
– **1-3-4-1-2-4-3-2**
- 10 repetitions of 8-element pattern/block
- 6 blocks: **P- P- P- P- R- P**

Results #1

Learning Occurred Without Awareness



SRT Task

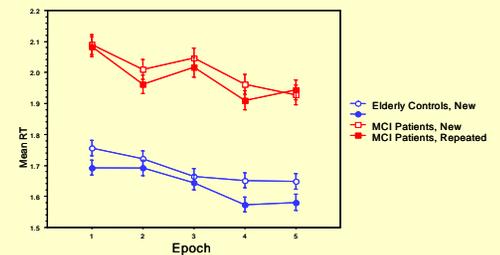


Contextual Cueing

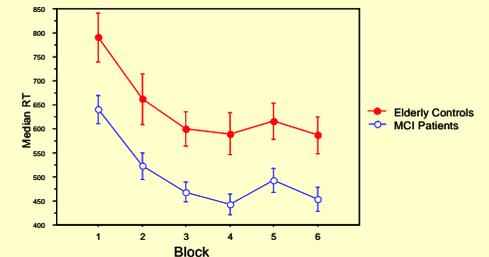
Results #2

Dissociations: Contextual Cueing Impaired and Sequence Learning Relatively Preserved

Contextual Cueing



SRT Task



Conclusions

- The learning was implicit in that participants were not able to describe the regularity or discriminate between predictable and unpredictable events
- Contextual cueing was impaired and sequence learning was relatively spared in MCI patients compared to healthy controls

➤ *These findings provide further support for the medial temporal lobe dysfunction and relative integrity of fronto-striatal systems in MCI.*

Supported by APA Postdoctoral Diversity Program in Neuroscience (DPN) Fellowship and NIA P50 AG16574, UO1 AG06786

Society for Neuroscience Meeting, Washington, DC
November 12-16, 2005