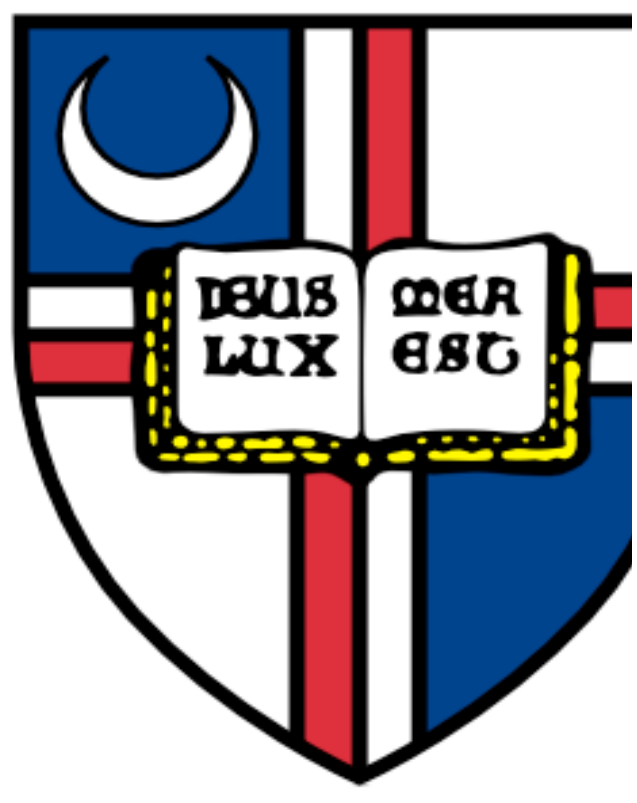




ARE AGE-RELATED DEFICITS IN IMPLICIT SEQUENCE LEARNING DUE TO HIGHER-ORDER STRUCTURE OR TO RANDOM ELEMENTS?



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Abstract

Age-related deficits in implicit learning of sequences appear consistently when the structure to be learned is higher-order, i.e., spans three or more events, but not when the sequence contains lower-order structure (e.g., Curran, 1997; Howard & Howard, 1997; Howard, Howard, Japikse, DiYani, Thompson, & Somberg, In press; Howard & Howard, 1992). This suggests that the age deficit is due to a resource limitation in that older adults have difficulty activating non-adjacent events. However, most studies demonstrating age deficits have used sequences in which random elements are interspersed with predictable ones, and therefore the deficits could be due to interference from these, rather than to the number of items to be activated simultaneously. The present experiment aimed to rule out the latter possibility by using completely predictable 12-element long sequences containing only higher-order structure, but without interspersed random elements. As in the typical serial response time task, participants responded to spatial locations of targets, but rather than the targets being the usual asterisks, they were randomly determined three-letter words. The purpose of using irrelevant word targets was to decrease awareness and explicit learning of the spatial regularity. Results revealed that both age groups learned the higher-order regularity implicitly, but young people learned more than older people. This finding of age deficits in learning, even when higher order structures result in a completely predictable sequence, suggests that age deficits are due to the number of items older people can activate simultaneously, rather than to interference from random, unpredictable elements.

Goals

- To determine whether age deficits in implicit learning will occur on a completely predictable higher order sequence in the absence of random elements
- To investigate whether these deficits are due to the number of items being simultaneously activated
- To determine whether such learning occurs in the absence of explicit knowledge of what has been learned

Participants

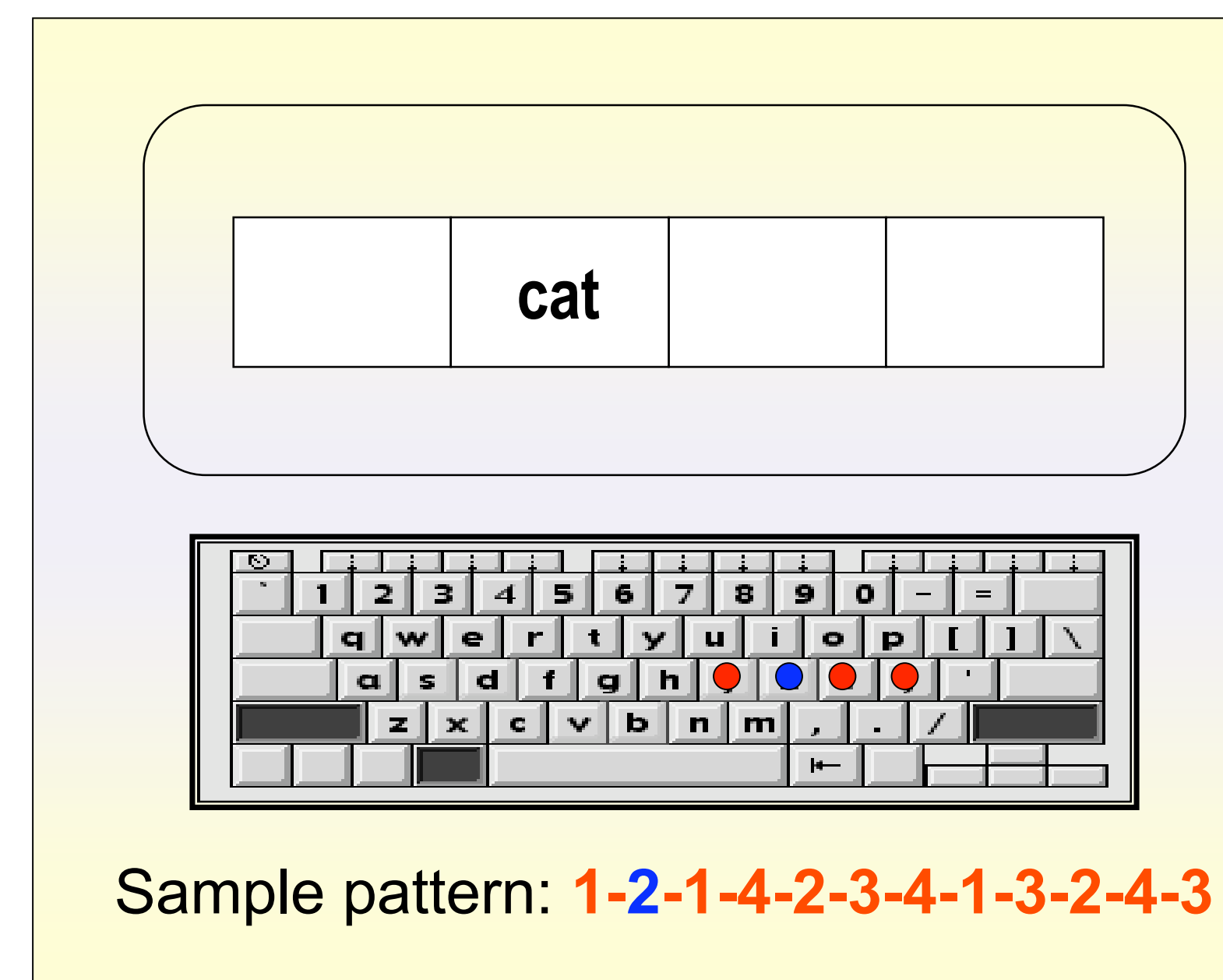
	Young	Old
Gender	8F, 4M	5F, 7M
Age	21 (2.67)	73 (7.78)
Education	14.92 (1.88)	16.42 (2.64)
Self-rated health	4.58 (0.52)	3.83 (1.03)

Note: Standard deviations in parentheses

Method

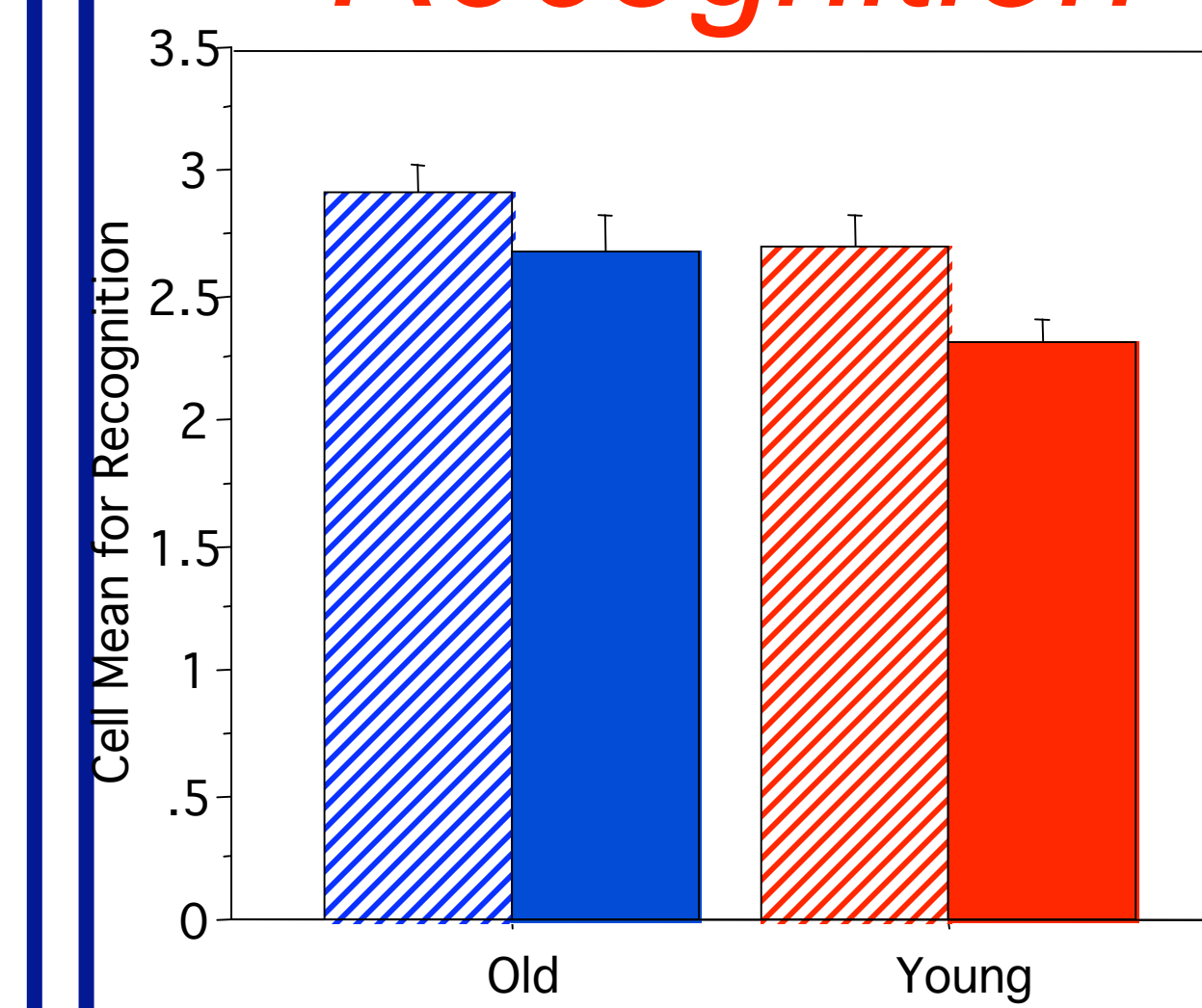
Serial Response Time (SRT) Task

- Spatially arranged locations
- On each trial, one of the boxes fills in with 3-letter word
- Subject responds with right hand
 - 1 block = 120 trials
 - 1 session = 6 blocks
 - Blocks 1-4 and 6 are pattern
 - Block 5 is reverse pattern

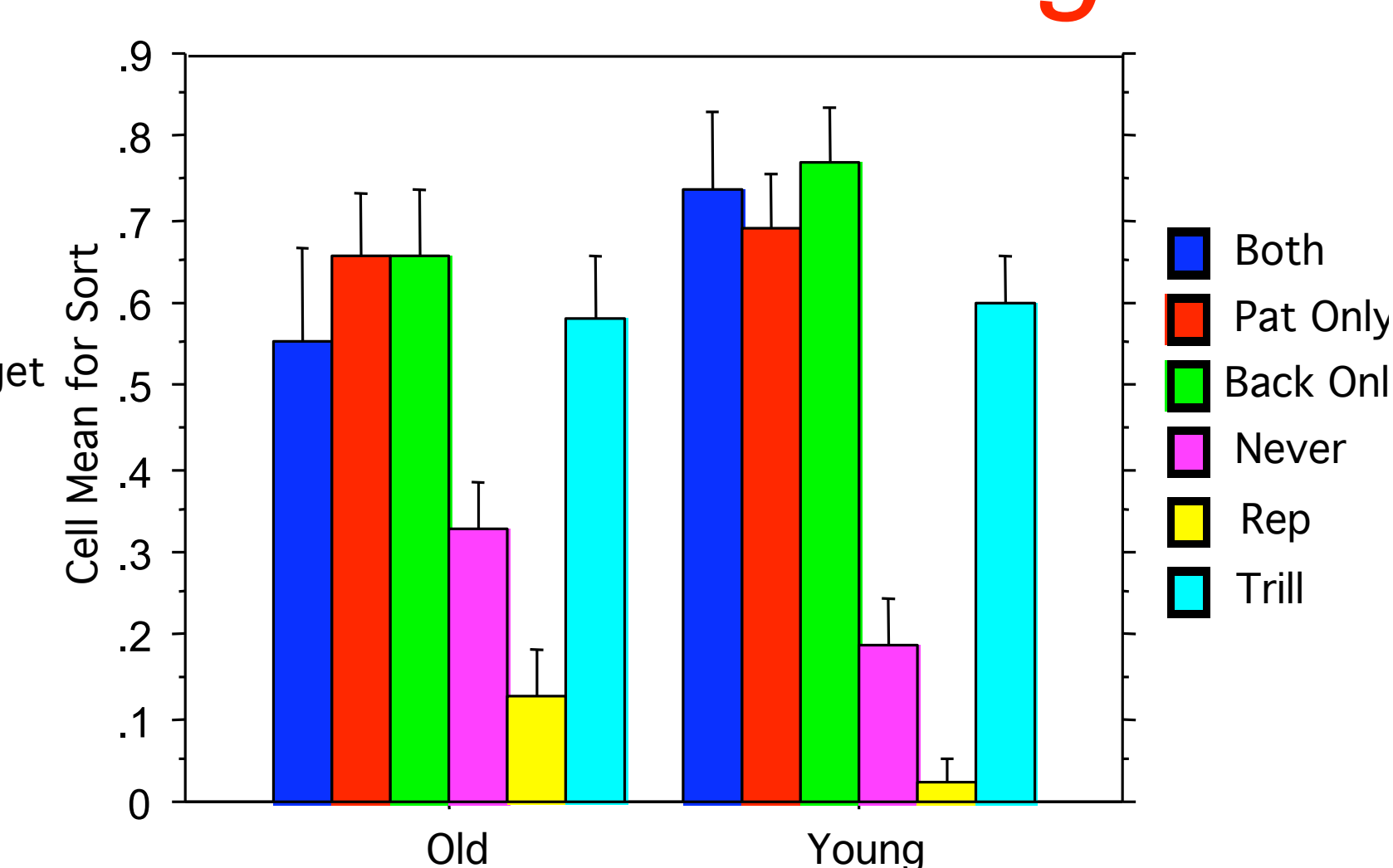


Explicit Measures

Recognition



Card Sorting



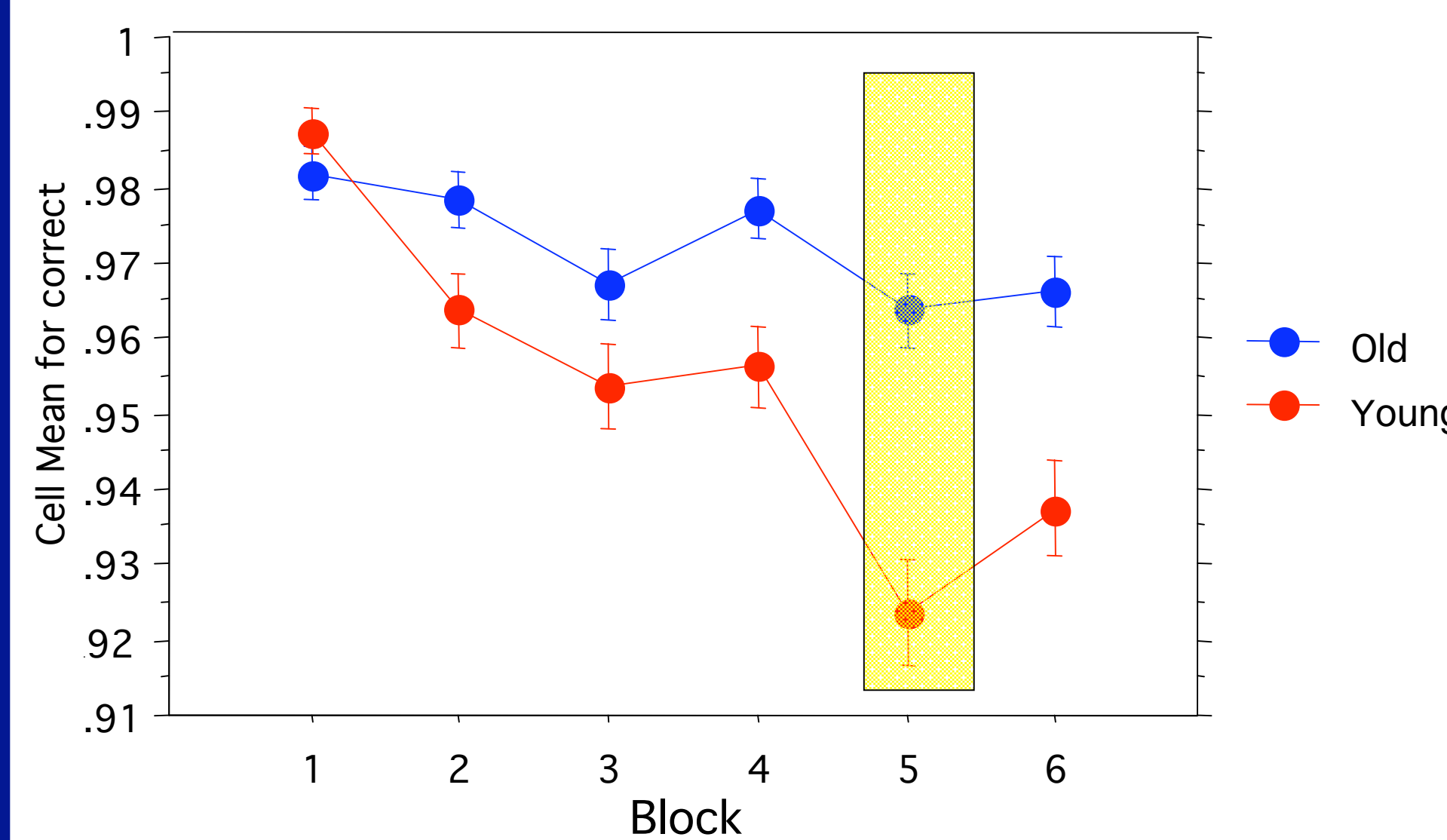
> Recognition does not correlate with SRT learning

Accuracy	RT
$r(22) = .08, ns$	$r(22) = .16, ns$

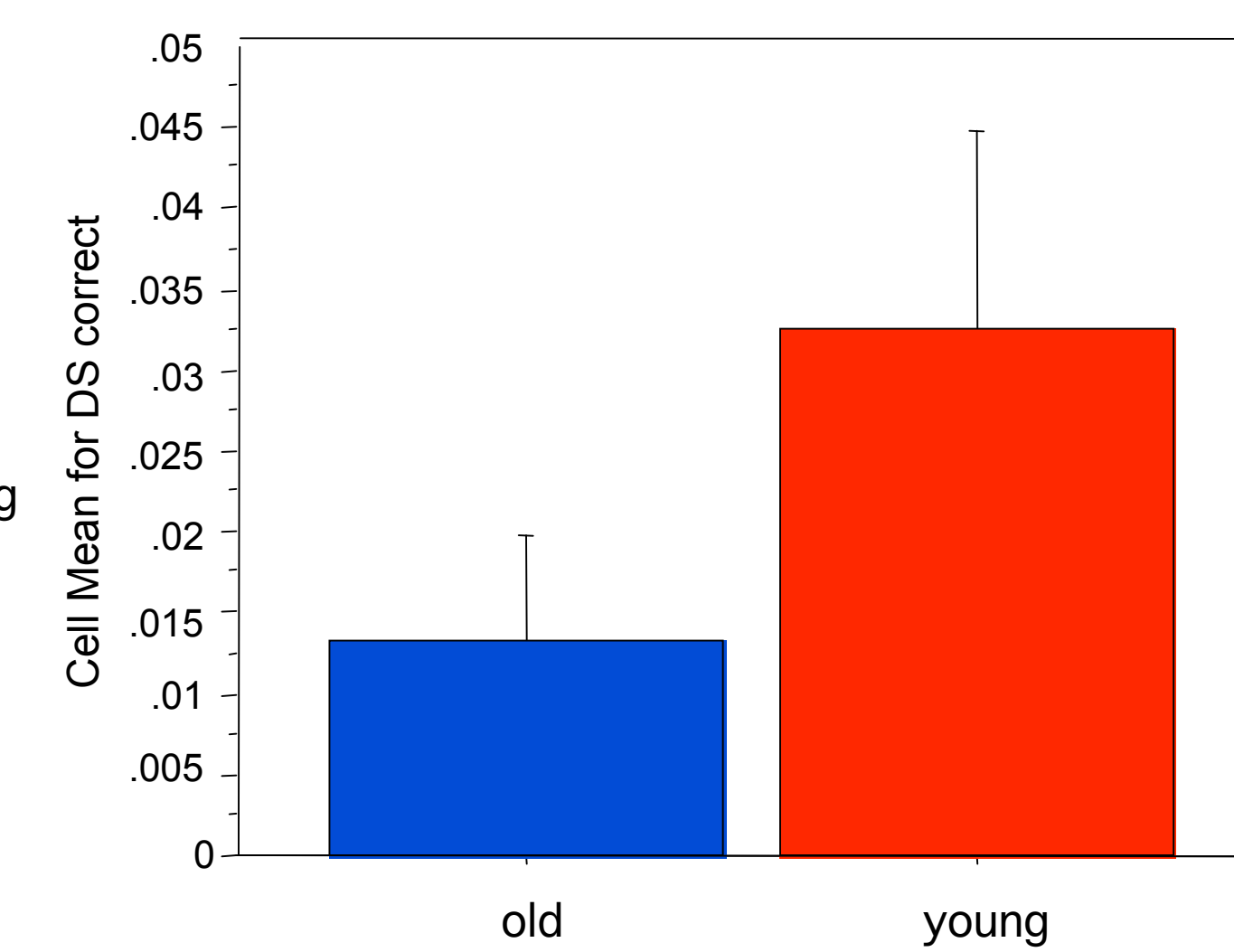
Learning on SRT Task

Accuracy

Raw Scores

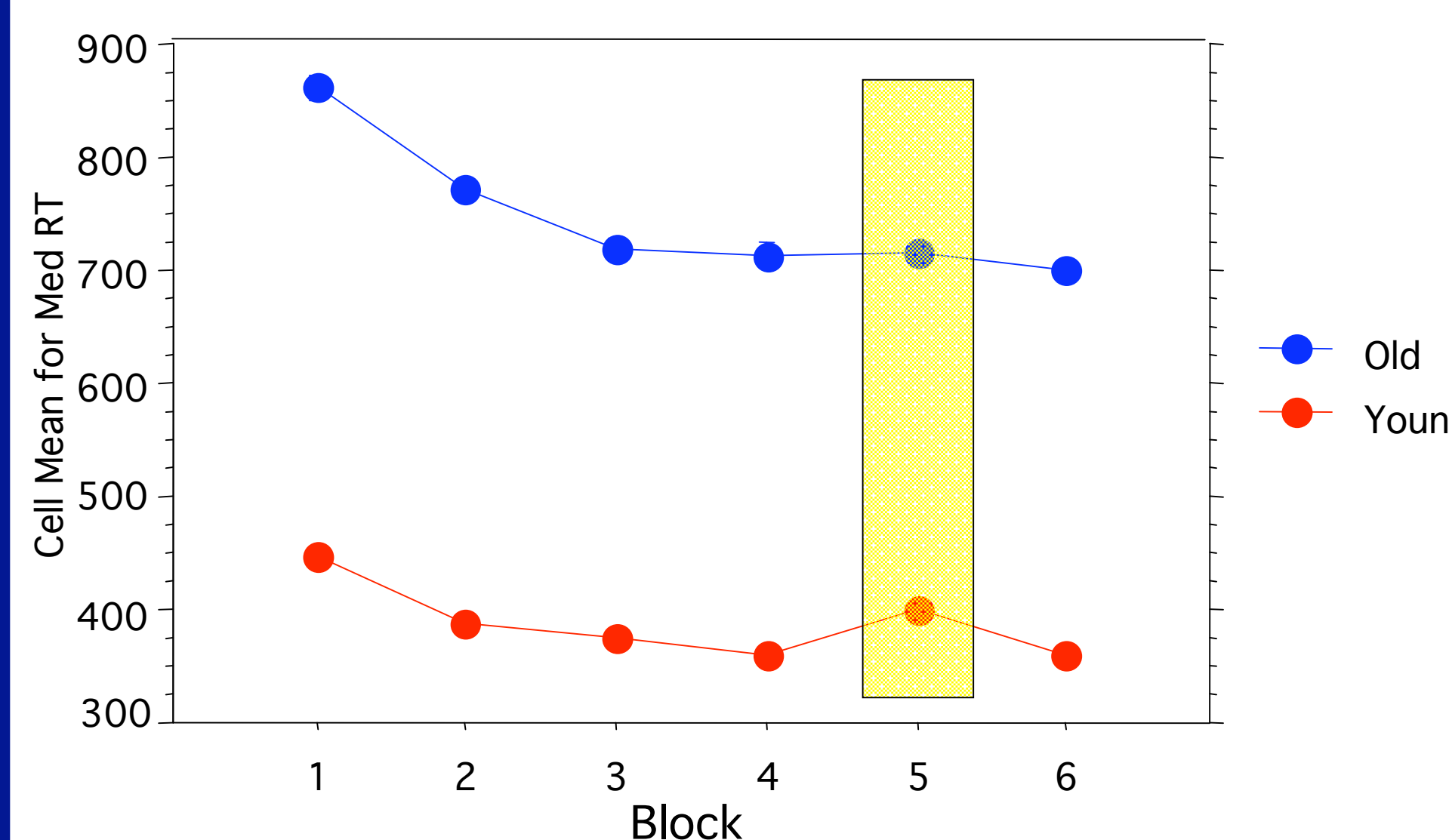


Difference Scores

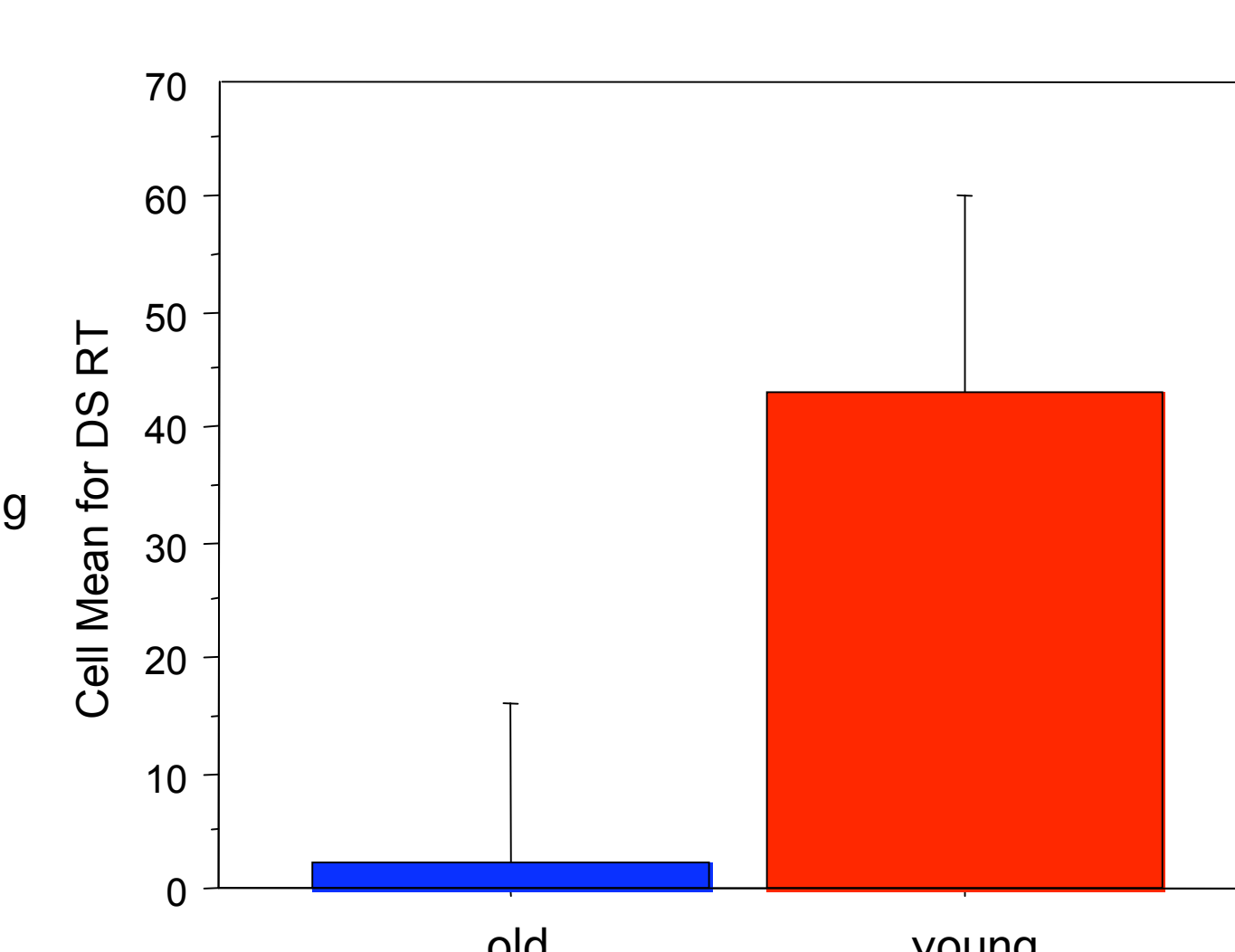


Reaction Time

Raw Scores



Difference Scores



Conclusions

- Age deficits in learning higher order structure, even with a highly predictable sequence
- Age deficits not due to explicit knowledge
 - Both ages above chance recognition
 - No age differences in recognition
 - Recognition does not correlate with SRT learning
- Suggests age-related SRT learning deficits due to
 - the number of items can activate simultaneously
 - deficits in processing resources

References

Curran, T. (1997). Effects of aging on implicit sequence learning: Accounting for sequence structure and explicit knowledge. *Psychological Research*, 60, 24-41.

Howard, J. H., Jr., & Howard, D. V. (1997). Age differences in implicit learning of higher order dependencies in serial patterns. *Psychology and Aging*, 12, 634-656.

Howard, D. V., Howard, J. H., Jr., Japikse, K. C., DiYani, C., Thompson, A., & Somberg, R. (2004). Implicit sequence learning: Effects of level of structure, adult age, and extended practice. *Psychology and Aging*, 19, 79-92.

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