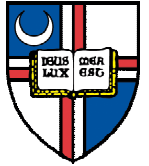




AGE-RELATED DIFFERENCES IN IMPLICIT LEARNING OF SECOND-ORDER DETERMINISTIC PATTERNS

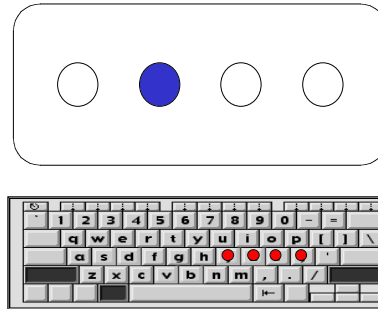
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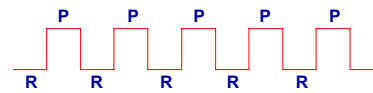
Abstract

The main goals were to determine whether there are age-related differences in learning second-order deterministic regularities, and to develop a protocol for investigating the neural substrates involved in implicit sequence learning in aging. We tested 12 younger (18-22 years old) and 12 older (66-75 years old) adults for two sessions each on a serial reaction time (SRT) task in which the pattern stimuli followed a second-order regularity. That is, any trial could be predicted by events on the two previous trials. No lower-level regularity was present, in that all individual events and non-repeating pairs of events occurred with equal probability. Each session contained four epochs in which a 12-item pattern sequence alternated with a 12-item random sequence. Unlike the usual SRT task, where the inter-stimulus interval (ISI) depends upon the participant's response time, we held the ISI constant at 1500 milliseconds. Explicit knowledge was probed by post-experimental interview, a card sorting task, and a recognition test. Implicit learning was measured by the difference in performance between pattern and random sequences. We found that older people showed significantly less learning than younger people on the implicit response time measure. Earlier studies have shown age-related deficits in learning sequences that have second-order probabilistic structure. The present findings suggest that age deficits in implicit learning extend to sequences that are deterministic and in which both ages experience the same timing of events.

Serial Reaction Time Task



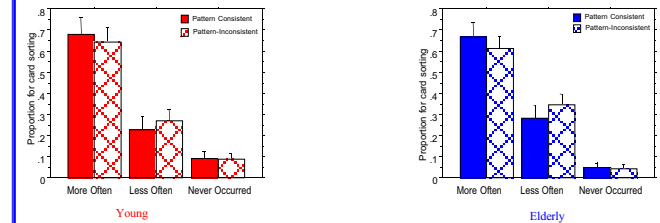
Procedure



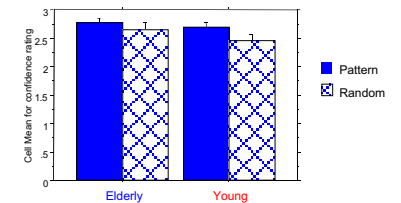
- P = Pattern sequence (1-2-1-4-2-3-4-1-3-2-4-3)
- R = Random sequence (RRRRRRRRRRRR)
- 1 block = 24 trials (two repetitions of the sequence)
- 1 run = 10 blocks (5 Pattern & 5 Random)
- Participants completed 9 runs (in run 1, random sequence repeated only once)
- Stimuli followed a fixed inter-stimulus interval (ISI) of 1500ms
- Measure of learning: **trial-type effect: difference in performance between pattern and random trials on RT and accuracy measures**

Results #2: Pattern learning occurred in the absence of declarative knowledge

Card Sorting Task



Recognition Task



- Participants were not able to discriminate significantly between pattern and random sequences on either measure

Goals

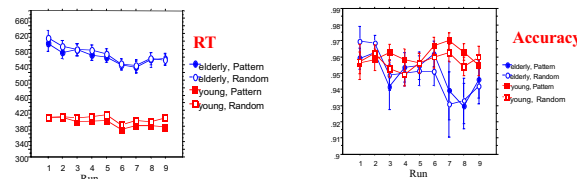
- To determine whether there are age-related differences in learning deterministic patterns that follow higher order regularities
- To determine whether young and elderly people learn higher order deterministic sequences when a fixed inter-stimulus interval is used
- To develop a protocol appropriate for fMRI studies of implicit learning in aging.

Participants

	Young	Elderly
Gender	8F, 4M	8F, 4M
Age	20 (1.15)	70 (2.95)
Education	14.33 (1.07)	16.75 (2.89)
Self-rated health	4.66 (0.65)	4.33 (0.65)

Note: Standard deviations in parentheses

Results #1: Age-related deficits in learning deterministic patterns



- Elderly people showed significantly less sequence learning on the response time measure
- The two age groups did not differ from each other on the accuracy measure

Conclusion

- ❖ Elderly people showed deficits in learning higher order deterministic patterns
- ❖ Implicit sequence learning occurred under a fixed inter-stimulus interval where both age groups experienced the same timing of events
- ❖ Learning was implicit in that neither age groups was not able to discriminate between pattern and random sequences

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