AGE DIFFERENCES DO NOT EXPLAIN AGE-DEFICITS IN IMPLICIT PROBABILISTIC SEQUENCE LEARNING

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Goal

To investigate whether previously observed age-related deficits in implicit higher-order sequence learning (Howard et al. 2008) persist even when young adults are matched to older adults on overall accuracy

Abstract

Many aspects of cognitive function including problem solving, language and skill learning rely on knowledge of the sequential relationships among events which are often acquired implicitly, or without effort or awareness (e.g., Reber, 1989). Such *procedural* learning is distinct from *declarative* learning in its behavioral characteristics, as well as in its neural bases (Forkstam & Petersson, 2005; Squire, 2004). The Triplets Learning Task (TLT) (Howard, Howard, Dennis & Kelly, 2008) is one way of studying learning that occurs automatically. During the TLT people are presented with a series of discrete, structured three-event sequences or triplets consisting of two cue events in which people are asked to simply observe a light onset at a particular location on the screen followed by a target event, a light which people respond to. Statistical relationships among the three events are created by manipulating the relative frequency with which the triplets occur making the target more or less predictable from the cues. In a previous study it was found that both older and younger adults were able to learn the statistical relationships among events in the TLT, but older adults (aged 65-80) showed less learning than college-age adults (Howard et al, 2008). However, older adults were significantly slower and more accurate in their overall performance than their younger counterparts raising the possibility that overall performance differences contributed to the age-related learning deficit. In the present study instructions and end-of-block feedback were used to encourage a group of young adults to respond with high-accuracy matching that of the healthy older adults to address the role of overall accuracy on sequence learning. Results show that the age deficit in implicit learning persists even when young adults are matched to older adults on overall accuracy, providing evidence that the age-related learning deficit previously observed is not likely the result of differences in overall accuracy.

Participants

	Young	Old	Young High Accuracy (YoungHA)
Gender	13 F, 5 M	12 F, 6 M	4 F, 5 M
Age	18.89 (1.28)	70.44 (5.14)***	19.11 (1.36)***
Education	12.89 (1.37)	15.83 (2.98)**	13 (1.00)*
Self-Rated Health1	4.28 (0.56)	4.44 (0.51)	4.28 (0.44)
WAIS Digit Coding	90.89 (10.32)	57.56 (21.50)***	91.56 (17.20)**
WAIS Vocabulary	30.50 (7.88)	36.35 (6.78)*	38.89 (7.11)*
WMS-III Digit Span	17.06 (3.69)	17.88 (3.04)	17.11 (4.94)

Young vs. Old	Young vs. YoungHA	Old vs. YoungHA
p < .05*	p < .05*	p < .05*
p < .001**	p < .001**	p < .001**
p < .0001***	p < .0001***	p < .0001***

1(poor = 1 – excellent = 5)
2gender was not recorded for two participants
WAIS: Wechsler Adult Intelligence Scale III (Wechsler, 1997a)
WMS: Wechsler Memory Scale III (Wechsler, 1997b)

Note: Young and Old group are from previous study (Howard et al, 2008, Exp. 3); the new group, Young High-Accuracy, was matched to the original Young group in age, but matched to the Old group on triplet responding accuracy

Method

Learning
- 6 sessions of 20 blocks each
- 50 triplets per block
- Each triplet contains 2 NO-GO then 1 GO event
- Respond only to third, GO event
- Triplet frequencies match those in 2nd-order sequence learning task
  - high frequency: 80% of trials where E1or E2 predicts E3
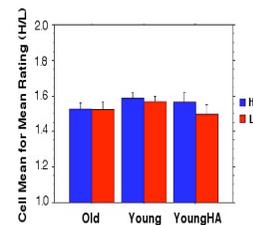 - low frequency: 20% of trials they do not

Explicit Recognition
- Observe all 64 possible triplets (black) in 1 session
- Rate whether each occurred frequently (2) or infrequently (1)

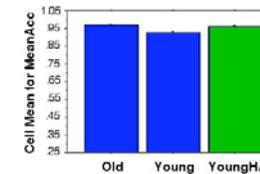E1   NO-GO

E2   NO-GO

E3   GO
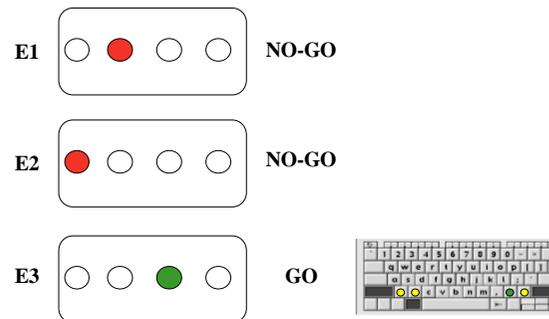
Explicit Recognition

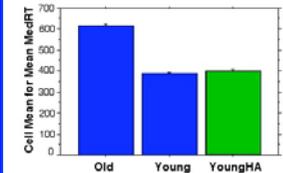- No group explicitly distinguished between high and low frequency triplets

Mean Accuracy

The Old and Young High-Accuracy groups had significantly higher accuracy than the Young group, but were not significantly different from each other

Reaction Time

Despite being matched in accuracy to the Old group, the Young High-Accuracy group had significantly faster reaction times than the Old group

Implicit Learning
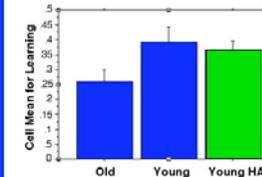
- The original Young group and the Young High-Accuracy group did not significantly differ in learning

- The Young High-Accuracy group had significantly higher learning than the Old group

Note: Learning scores were based on the correlation between actual triplet frequency and RT determined for each individual. Thus, higher scores reflect greater sensitivity to the triplet frequency and more learning. This measure permits comparisons across groups with very different overall RTs since it does not depend on RT magnitude (see Howard et al, 2008).

Conclusion

Results indicate:
- There was not a significant difference in learning between the original Young group and the Young High-Accuracy group despite the Young High-Accuracy group being significantly more accurate

- Although the Young High-Accuracy group was matched in accuracy to the Old group, they showed significantly more learning than the older adults

Therefore:
- The age-related learning deficit observed in previous implicit sequence learning cannot likely be attributed to a difference in overall accuracy
- Consistent with an age-deficit in the probabilistic sequence learning

References

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