Age-related differences in immediate and delayed feedback probabilistic classification learning

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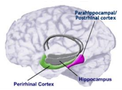
Introduction

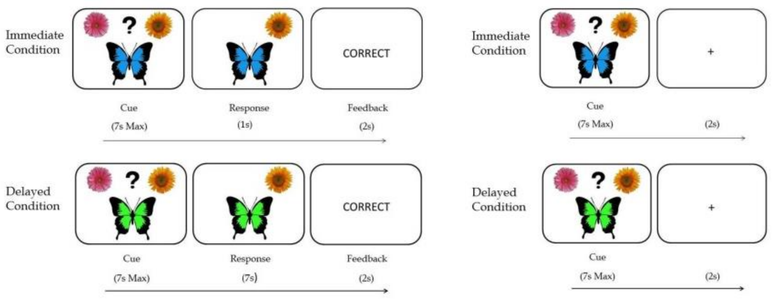
- Two learning systems are involved in feedback learning (Foerde, Race, Verfaellie, & Shohamy, 2013)
  1. Delayed feedback is supported by the medial temporal lobe (MTL)
  2. Immediately presented feedback is supported by the striatum
- The striatum shows decline with healthy aging
  - May impact older adults' ability to effectively learn from immediate feedback compared to younger adults
- The present study examines a group of college aged adults and a group of older adults on a probabilistic feedback learning task

MTL	Striatum
	
Delayed Feedback Learning	Immediate Feedback Learning

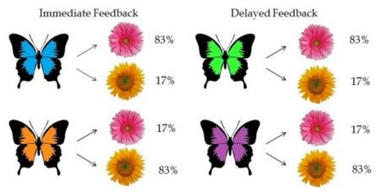
AIM 1: Younger adults will show better task performance overall than older adults, reflecting general age related cognitive decline
AIM 2: Older adults will be impaired in immediate feedback learning but not delayed feedback learning compared to younger adults, reflecting decline of the striatum

Methods

- Delayed feedback probabilistic learning task modeled after Foerde et al. (2013)
- 17 younger adults and 17 older adults
- On each trial participants chose which of two presented outcomes was associated with the presented cue by pressing a corresponding key
- Delay of 1 ("immediate") or 7 ("delay") seconds followed before presentation of feedback



- Cues probabilistically correlated with outcomes
- Random assignment of delay and immediate conditions
- Practice block, 5 trials, no feedback • Learning phase, 96 trials • Testing phase 24 trials, no feedback
- Post experimental questionnaire to test for explicit knowledge

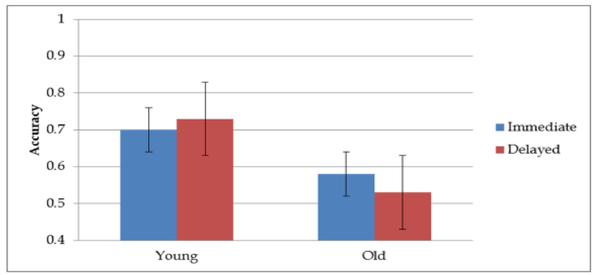


Results

Variable	Young adults		Older adults
Gender	14 female, 3 male		9 female, 8 male
Age (in years)	18. 59 (0.71)		73.94 (7.82)
Health (self-rated)	4.53 (0.62)		3.94 (0.66)
WMS-III Digit Span Forward	10.06 (1.71)		11.94 (2.28)
WMS-III Digit Span Backwards	5.88 (2.00)	*	9.00 (4.73)
WAIS Digit Coding	84.88 (16.37)	*	58.41 (14.16)
WAIS Digit Pairing	14.71 (2.64)	*	9.53 (4.91)
WAIS Digit Free Recall	7.35 (1.17)		7.19 (1.38)
NAART35 Vocabulary	20.59 (6.00)		7.47 (7.57)

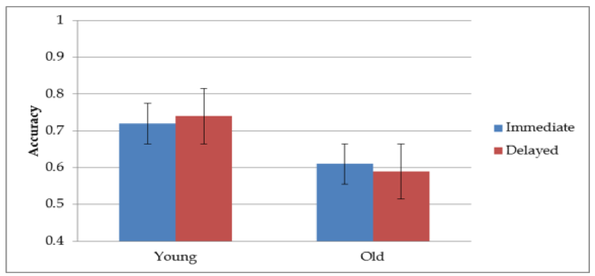
- Outside of working memory scores, these results display the typical pattern of age differences

Learning Phase



- Significant main effect of age, younger adults show greater accuracy than older adults at both feedback delays, $p < .05$
- No significant main effect of feedback delay or interaction between age group and feedback delay

Testing Phase



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Results

- Learning was measured using mean accuracy scores which indicated the number of correctly chosen cue outcome pairs across trials.
- Overall learning phase performance revealed an age group difference, as younger adults performed better overall than older adults during both feedback delays. Contrary to expectations, there was no interaction between age group and feedback delay.
- Overall testing phase performance revealed an age group difference with younger adults performing better overall than older adults during both feedback delays. Again, there was no interaction between age group and feedback delay.

Discussion

- General age difference in feedback learning
  - Younger adults perform better overall than older adults
- Patterned behavior consistent across both learning and testing phases
- No interaction between age and feedback delay
  - Does not support our prediction that age related striatal decline would impact immediate feedback learning
- Likely reflect individual differences in aging and cognitive decline
  - Could be that this high functioning sample of older adults do not demonstrate cognitive decline due to striatal dysfunction

Limitations and Future Directions

- Future research should include additional variations in feedback timing
  - Here "immediate" was defined as a 1 sec delay, future studies should observe learning from feedback presented after a 0 sec delay
  - Truer "immediate" feedback presentation may show more pronounced differences in immediate and delayed feedback learning
- Future research examine a larger sample with a greater age distribution to evaluate the timescale at which feedback learning begins to decline
  - This study had a narrow age distribution, particularly within the younger adults sample

Acknowledgements

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References

Foerde, K., Race, E., Verfaellie, M., & Shohamy, D. (2013). A role for the medial temporal lobe in feedback-driven learning: evidence from amnesia. The Journal of Neuroscience, 33(13), 5698-5704. doi:10.1523/JNEUROSCI.5217-12.2013