Statistical Learning from Visual Sequences in Young and Older Adults

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BACKGROUND & PURPOSE:

Why is statistical learning important?

• Key to making predictions, which allows anticipation of events in temporal sequences and preparation of responses (Hunt & Aslin, 2001).

Statistical learning throughout development:

• Infants:
- o Segment speech sounds (Saffran, Aslin, & Newport, 1996) and non-speech sounds (Saffran, Johnson, Aslin, & Newport, 1999).
- o Distinguish familiar from unfamiliar patterns of shapes in stationary scenes (Fiser & Aslin, 2002b) and in temporal sequences (Kirkham, Slemmer, & Johnson, 2002).

• Children:
- o Segment speech sounds (Saffran et. al., 1997).

• Young Adults:
- o Segment speech sounds (Saffran, Newport, Aslin, 1996; Saffran et. al., 1997) and non-speech sounds (Saffran, Johnson, Aslin, & Newport, 1999).
- o Learn regularities in visuomotor sequences (Hunt and Aslin, 2001).
- o Distinguish familiar from unfamiliar patterns of shapes in stationary scenes (Fiser & Aslin, 2001) and in animated sequences (Fiser & Aslin 2002a).

• Older Adults:
- o Impaired statistical learning based on auditory speech (Love, 2000) and tone (Fallon & Wingfield, 2006) sequences.
  - o But, some of these deficits could be due to hearing difficulties.

Questions:

Are older adults capable of statistical learning from temporal, visual shape sequences?

Do young and older adults' statistical learning capacities differ?

METHOD:

Participants:

11 young adults

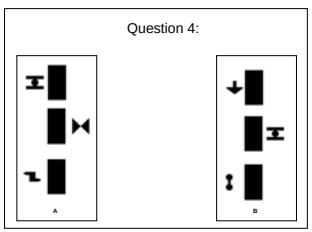
Exp. 1: (5 M, 6 F, M(age) = 20.6, range 20-24)

Exp. 2: (1 M, 10 F, M(age) = 19.6, range 19-21)

• 11 older adults

Exp. 1: (7 M, 4 F, M(age) = 73.5, range 65-84)

Exp. 2: (5 M, 6 F, M(age) = 72.9, range 65-89)



Sample question from the stationary test

Stimuli and Testing Materials:

• Provided by Fiser and Aslin (2002a).

• Stimulus: 12 minute movie with a continuous stream of shapes.
- o Shapes appeared one at a time, moving back and forth behind a black bar.
- o 12 basic shapes grouped into 4 base triplets.
- o Each shape presented as part of its base triplet.
- o Order of base triplets' appearance randomized.

• 2 discrimination tests:
- o Animated test: sequences of moving elements (as in Fiser & Aslin, 2002a)
- o Stationary test: sequences of static elements (addition to Fiser and Aslin, 2002a)
- o Choose more familiar of 2 sequences – base triplet with joint probability .083 and impossible triplet with null probability.

• Questionnaire

• Card sorting task: order 12 shapes into 4 sequences of 3 elements.

• Experiment 2: 2 modifications to reduce fatigue and distraction:
- o Stimulus: reduced to 6 minutes
- o Neuropsychological battery: given last (originally before the training movie)

RESULTS – Recognition Tests:

Do young and older adults show statistical learning?

• Young adults: Yes.
- o *Exp. 1*: Results *more variable* than for Fiser & Aslin (2002a). (Animated and Stationary Tests: $p < .05$)
- o *Exp. 2*: Results in accordance with Fiser and Aslin (2002a). (Animated and Stationary Tests: $p < .0001$)

• Older adults: Yes.
- o *Exp 1:* Significant. (Animated and Stationary Tests: $p < .05$)
- o *Exp. 2:* Marginal. (Maximum Test Score: $p < .06$)

Do older adults learn significantly less than young adults?

• *Experiment 1*: No. (No significant p's)

• *Experiment 2*: Yes. (All $p < .0001$)

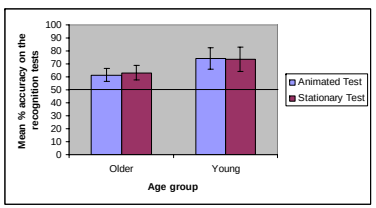
Is there a significant correlation between age and accuracy?

• *Experiment 1*: No.
(Animated Test: $r = -0.29$; Stationary Test: $r = -0.23$)

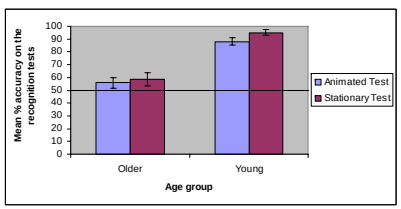
• *Experiment 2*: Yes.
(Animated Test: $r = -0.81$; Stationary Test: $r = -0.81$)

Noteworthy finding:

• *Experiment 1*: Positive correlation between the two tests significant for the young adults ($p<.0001$), but not for the older adults ($p>.10$).
- o Single measure might not adequately assess how much older adults learn.



Exp 1: Mean score on the tests (with SE bars)



Exp 2: Mean score on the tests (with SE bars)

RESULTS - Questionnaire:

• *What did subjects expect to be tested on?*

- Patterns or sequences of shapes, shape recall or recognition, the number of distinct shapes, frequency of individual shapes.

• *Did subjects notice reoccurring patterns in the training movie?*

	Experiment 1		Experiment 2	
	Recall Triplet	*Recall Pair*	*Recall Triplet*	*Recall Pair*
Young	54.6%	54.6%	54.6%	90.9%
Older	0%	45.5%	9.1%	18.2%

•*Which kind of test did subjects find easier?*

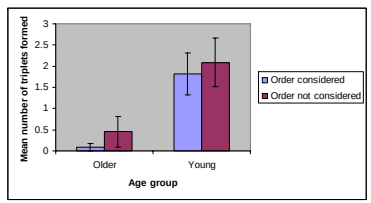
	Experiment 1		Experiment 2	
	Young	*Older*	*Young*	*Older*
Animated Test	27.27%	0%	9.09%	18.18%
Stationary Test	54.55%	27.27%	63.64%	27.27%
Neither	18.18%	72.73%	27.27%	54.55%

RESULTS - Sorting:

• Young adults produced significantly more familiar triplets than older adults.
(Both experiments, all $p < .05$)

• Age negatively correlated with triplet making accuracy.
Exp 1: Order considered: $r = -.60$; Not: $r = -.48$
Exp 2: Order considered: $r = -.64$; Not: $r = -.82$

•Maximum recognition test score positively correlated with triplet making.
Exp 1: Order considered: $r = .79$; Not: $r = .86$
Exp 2: Order considered: $r = .67$; Not: $r = .83$



Exp 1: Mean # of correct triplets formed (with SE bars)

SUMMARY:

• Young and older adults can recognize familiar sequences.
- o Young: performance weakened by boredom and inattention (in Experiment 1).
- o Old: performance weakened by reduced exposure to training (in Experiment 2).

• Older adults poorer than at:
- o Recognizing familiar sequences (Experiment 1 only).
- o Generating familiar sequences.

CONCLUSION:

Both young and older adults show statistical learning from visual sequences, but older adults learn less.

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