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Visual Associative Memory: Age- and Individual differences during Learning & Retrieval

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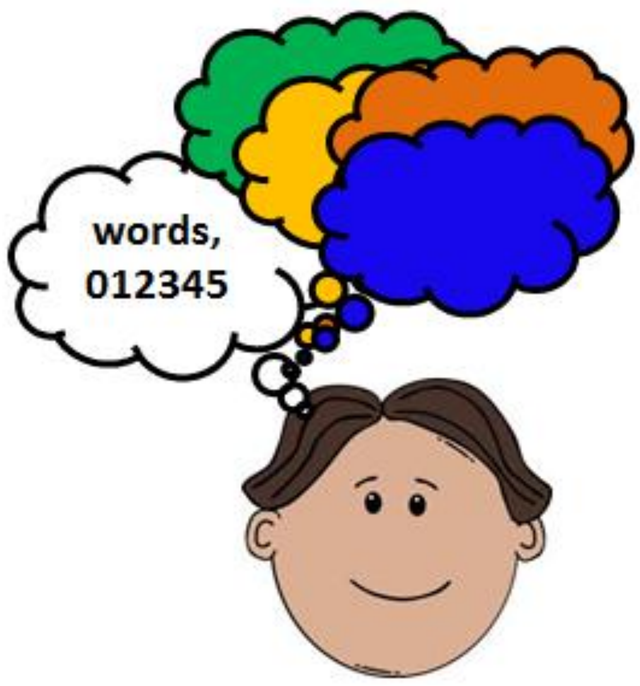
Sackler Centre for Consciousness Science

Introduction

Grapheme – colour Synaesthesia



Fact 1: Grapheme – colour Synaesthesia improves visual associative memory and visual memory in general[1]

Fact 2: Elderly participants have impaired memory for visual associations, but memory for individual items is preserved relative to control young control subjects[2]

Predictions

1. Performance accuracy on *pair – associative memory* is expected to yield a significant group effect:
   Synaesthetes > Controls > Elderly
2. Performance accuracy on *single item memory* will show the same pattern as for pair – associates, but is not expected to be significant

Exploratory question

1. Do Synaesthetes show a memory advantage during learning[3] or retrieval[1] of pair – associates**,** or both ?

Method

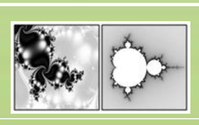
Participants

7 young Synaesthetes [M=22 (3.56)]; 7 Elderly [M=67 (7.4)];
7 young Controls [M=23 (3.4)]

Learning Phase

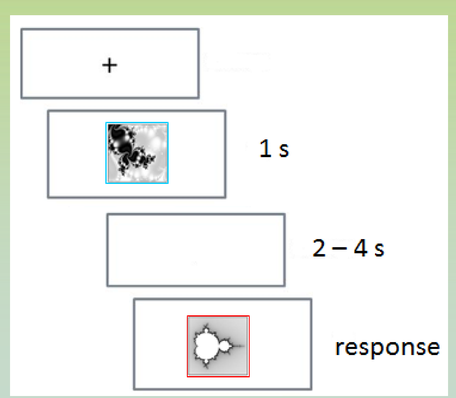
→ *Pair – associative learning*
Participants learned 8 pair – associates to 87% criterion

Memory load manipulation

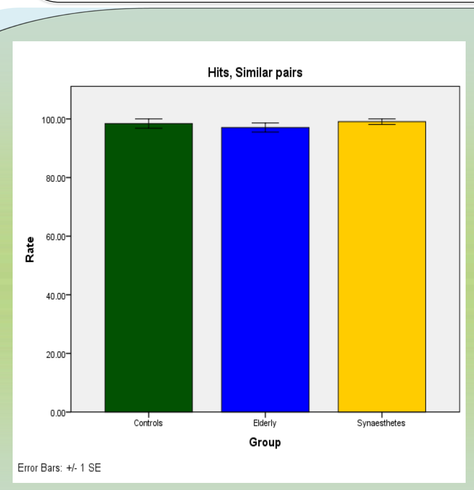
5 visually dissimilar pairs	3 visually similar pairs
	

→ *Singleton learning*
Participants learned 8 single fractal images to 87% criterion

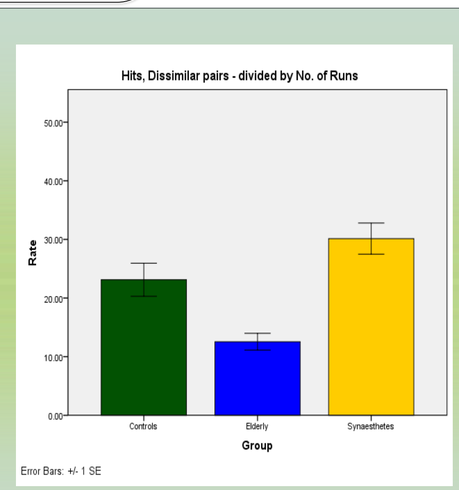
Pair – associative retrieval



Results, Pair - learning



→No effect of group $F[2,60] = .536$, $p = .588$



→Sign. effect of group $F[2,102] = 13.81$, $p < .001$

Mean No. of Runs

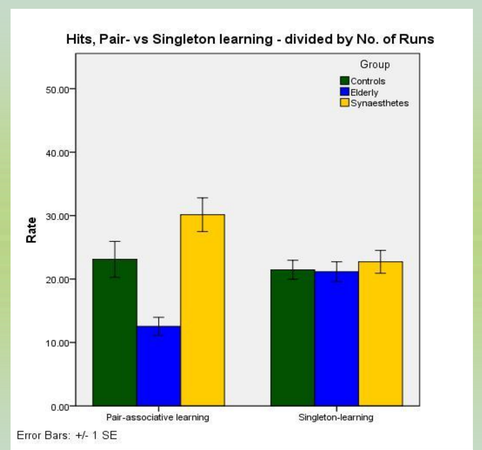
Controls = 4.14 (*SE* = .86)
Elderly = 8.14 (*SE* = 2.09)
Syns = 3.14 (*SE* = .46)

Syns > Cont, $p = .098$

Cont > Old, $p = .006$

Syns > Old, $p < .001$

Results, Pair - vs Singleton learning



Note: Pair-associative learning = dissimilar pairs only

→*No effect of Learning Type*
$F[1,102] = .01$, $p = .921$

→*Main effect of group*
$F[2,102] = 9.91$, $p < .001$

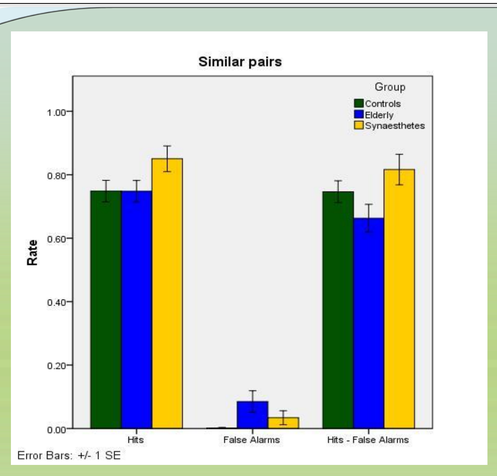
→*Sign. interaction*
$F[2,102] = 9.03$, $p < .001$

Syns > Control, $p = .058$

Control > Elderly, $p = .013$

Syns > Elderly, $p < .001$

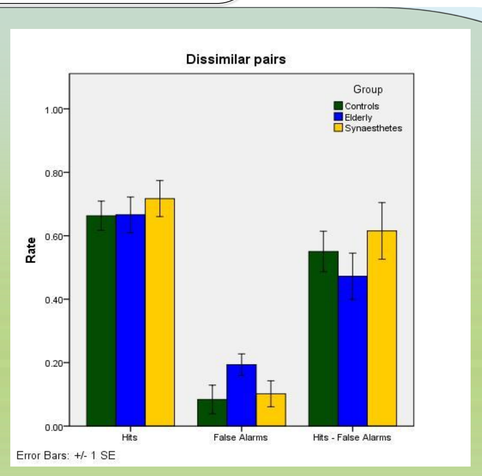
Results, Pair-associative retrieval



d-prime

Controls = 1.58 (*SE* = .07)
Elderly = 1.37 (*SE* = .12)
Synaesthetes = 1.64 (*SE* = .37)

$F[1,60] = 2.38$, $p = .101$



d-prime

Controls = 1.02 (*SE* = .08)
Elderly = .73 (*SE* = .11)
Synaesthetes = .99 (*SE* = .10)

$F[1,102] = 2.51$, $p = .086$

Note: higher d'= better discrimination between target-match and target non-match

Conclusions

Visual associative learning

→ Synaesthesia leads to a significant advantage in associative learning of visually unrelated (dissimilar) information, but shows no advantage on associating visually similar items or on learning single items.

→ By contrast, Age significantly impairs the ability to associate visually unrelated information, but spares associative learning for visually similar items and single items.

Visual associative memory

→ Synaesthetes showed no persistent associative memory advantage at retrieval, an effect that appeared to be influenced by poorer discrimination ability between true and false associations.

References

[1] Rothen, N. & Meier, B. (2010). Grapheme - colour synaesthesia yields an ordinary rather than extraordinary memory advantage: Evidence from a group study. *Memory*. 18:258 – 264.
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[3] Gross, V.C., *et al.* (2011). Superior encoding enhances recall in color - graphemic synesthesia. *Memory*. 17(2):220 – 232.

Acknowledgements

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