Comparing the Short-term Memory Binding test and RAVLT as predictors of hippocampal atrophy

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Background

The Rey Auditory Verbal Learning Test (RAVLT) assesses the long-term verbal episodic memory, while the short-term memory binding (STMB) tests assess conjunctive memory binding. In the STMB, participants should remember the integration of shapes (or objects) and colors, forming a unique representation in memory.

Objectives

The objective of this study was to compare the STMB and the RAVLT as predictors of hippocampal atrophy

Methods

All participants underwent neuropsychological assessment and MRI data were collected. Participants were 17 patients with mild cognitive impairment (MCI) and 12 patients with Alzheimer's disease (AD). All participants performed the RAVLT test and two different paradigms of the STMB test: change detection and free recall. In the change detection task, patients need to recognize if there was a difference in shapes and colors (unbound) or shape-color integrations (bound) between two consecutive screens. In the free recall task, patients were asked to recall aloud objects and colors individually (unbound condition) or object-color integrations (bound condition) that they had just seen in a screen. The groups were compared using T-student analyses, and regression analyses were used to evaluate which cognitive paradigm better predicted the hippocampal atrophy.
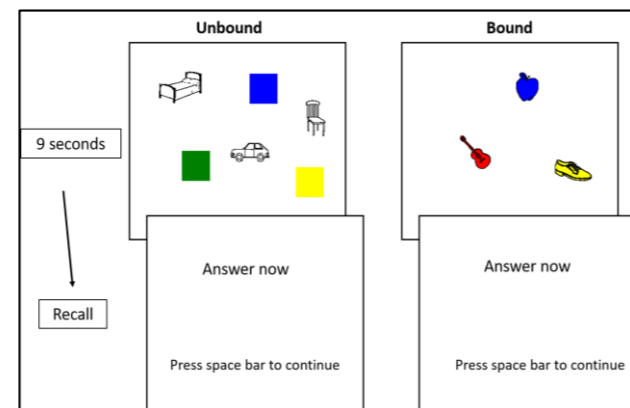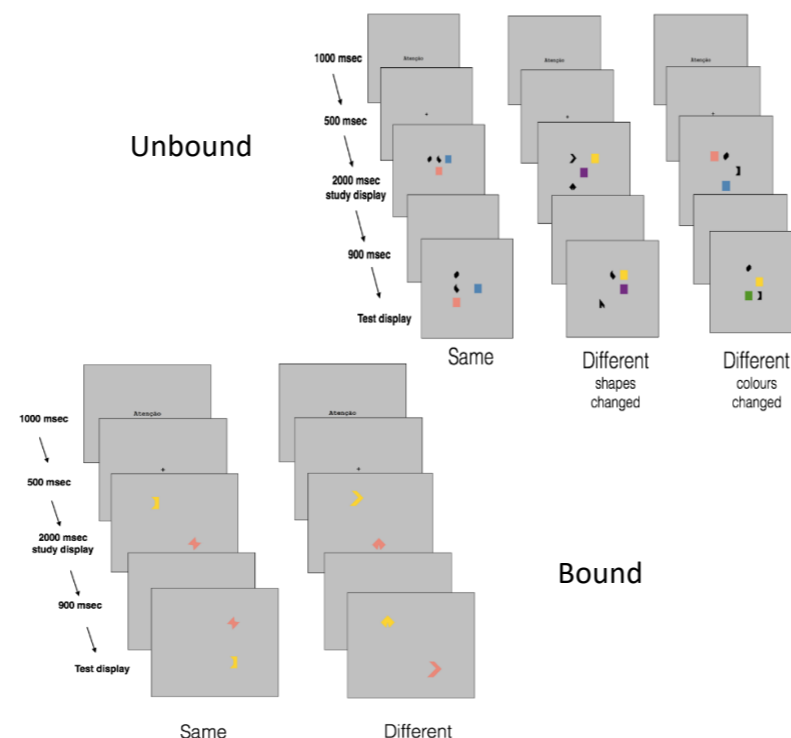

Figure 1. Free recall task

Figure 2. change detection task

Results

	No Atrophy (n = 10)	Atrophy (n = 19)	p-value
Age	66.80(7.60)	72.42(6.11)	0.039
Education	8.60(4.33)	8.53(5.94)	0.973
MMSE	26.50(2.27)	24.00(4.00)	0.08
CDR*	(1, 7, 0, 0)	(1, 14, 3, 0)**	0.418
FAQ	3.10(3.18)	7.67(5.20)	0.018
FAS	27.60(8.06)	21.63(7.60)	0.059
RAVLT 5 trials sum	36.00(13.12)	26.26(7.10)	0.015
RAVLT delayed	5.10(2.96)	2.68(2.26)	0.021
DRS Total	132.00(6.39)	121.68(22.87)	0.017
CD Unbound	71.88(11.51)	66.45(11.45)	0.236
CD Bound	85.00(12.57)	67.43(15.11)	0.004
FR Unbound	63.61(11.67)	54.53(15.02)	0.108
FR Bound	58.33(15.77)	40.06(19.03)	0.015

Note. Mean (SD). * = Percentage of CDR = 0, 0.5, 1.0 and 2.0 respectively; p value refers to Student's T test, ** Chi-squared test; MMSE = Mini Mental State Examination; DRS = Dementia Rating Scale; FAS = phonemic verbal fluency task; RAVLT = Rey Auditory Verbal Learning Test; RAVLT 5 trials = sum of the first five trials of the RAVLT; FR = Free Recall task; CD = change detection task .

10 patients showed no hippocampal atrophy (all were MCI patients) and 19 had atrophy (7 MCI and 12 AD). The group with atrophy was older and showed worse performance in the cognitive tasks. The regression model using the atrophy (positive or negative) as the dependent variable, and all the binding tasks (change detection and free recall, bound and unbound conditions), RAVLT delayed score, FAQ, CDR, age and education as the predictors, indicated that only the change detection bound task was retained in the model (R = 0.499, R2 = 0.216, p = 0.011), explaining 21.6% of the variance.

Conclusion

Present findings suggest that the change detection STMB task may be a better marker of neurodegeneration than the other tests.