

Visual Cognition In Alzheimer's Disease: The IPC Task

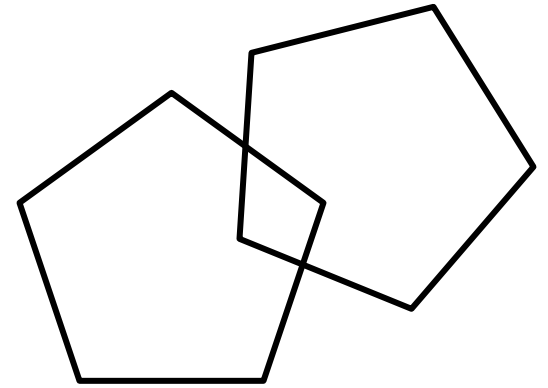
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BACKGROUND

- 10% of Americans over the age of 65 and 50% of Americans over the age of 85 have Alzheimer's disease (AD).
- In addition to memory impairment, patients with AD have problems **reading, driving**, and performing tasks that depend on **visual cognition**.¹
- The **mini-mental state exam (MMSE)**² is a 30 point test that is the most commonly used screening test and outcome measure in AD. The only task on the MMSE involving vision is the **intersecting pentagon copying (IPC) task**. 1 point is given if the IPC task is completed properly (Fig.1).

- In healthy elderly subjects, the ability to perform the IPC task depends on the function of multiple cognitive domains in addition to visual cognition.³
- If IPC task in patients with AD is dependent on the function of multiple cognitive domains, as measured by the total MMSE score, then the IPC task is a poor indicator of visual disability in AD.

Figure 1. IPC Task. On the MMSE, patients are asked to copy this drawing of intersecting pentagons.



OBJECTIVE

- To compare IPC task performance with MMSE performance by patients with autopsy-proven AD.

METHODS

- We designed the Intersecting Pentagon Assessment Scale (IPAS) to score performance on the IPC task (0-30 points). The intra- and inter-rater reliability of the IPAS was determined for the scores given by 17 volunteers for 12 IPC task drawings previously published.⁴
- 20 charts of patients with dementia and an autopsy study of the brain were reviewed for a diagnosis of Alzheimer's disease.

- 8 patients with autopsy-proven AD had MMSE and IPC drawings available for our review and analysis. 29 IPC tasks were scored and compared to the corresponding 29 MMSE scores.

RESULTS – IPAS Reliability

1. IPAS intra-rater reliability: 0.927 - 0.999
2. IPAS inter-rater reliability trial 1=0.953 and trial 2=0.946

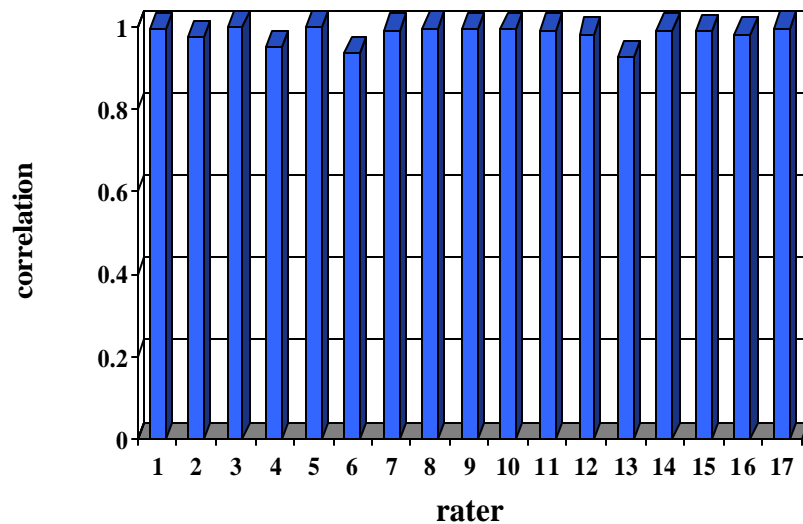


Fig. 2. Intra-rater Reliability

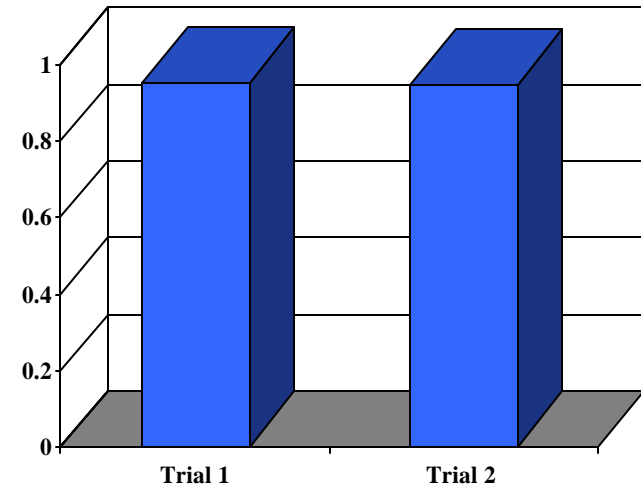


Fig. 3. Inter-rater Reliability

RESULTS - IPAS v.MMSE

1. In 7/8 pts, MMSE impairment ³ IPAS impairment
2. 3/8 pts had prominent visual complaints (PVC)
 - 1pt with PVC: MMSE impairment < IPAS impairment

Fig. 2. IPAS v. MMSE Correlation

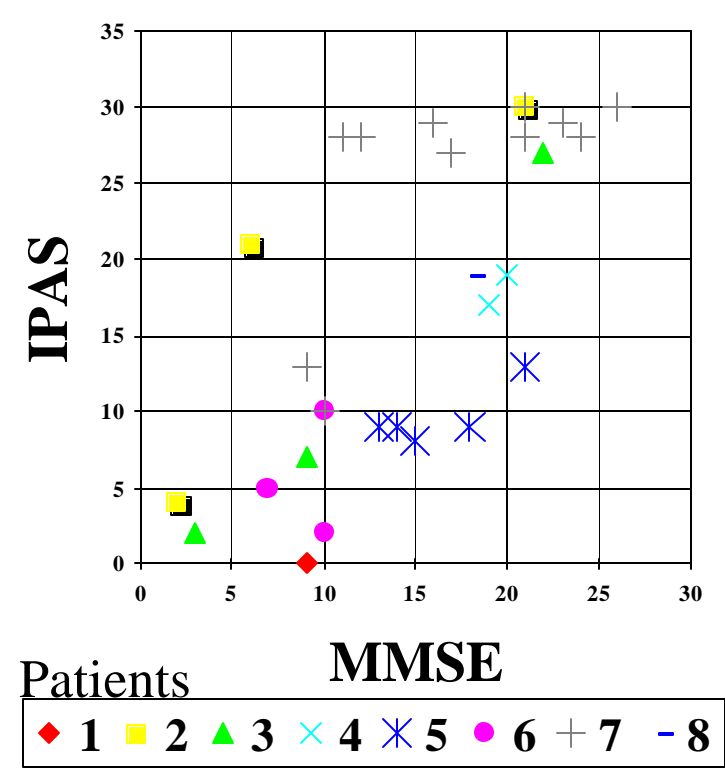


Fig. 3. Category Scores 7/8 pts

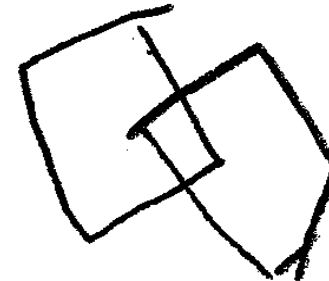
IPAS	MMSE		
	Mild	Mod	Sev
Mild	7	4	1
Mod	0	5	1
Sev	0	0	5

PVC Patient 3

MMSE

IPAS

	Mild	Mod	Sev
Mild	1		
Mod			
Sev			2



MMSE=22

IPAS=27

Example patient 3 IPC Task

PVC Patient 7

MMSE

IPAS

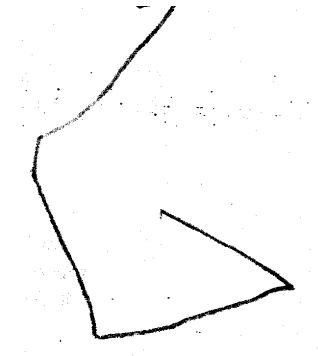
	Mild	Mod	Sev
Mild	5	4	
Mod		1	1
Sev			

PVC Patient 5

MMSE

IPAS

	Mild	Mod	Sev
Mild			
Mod	1		
Sev		4	



MMSE: 14

IPAS: 9

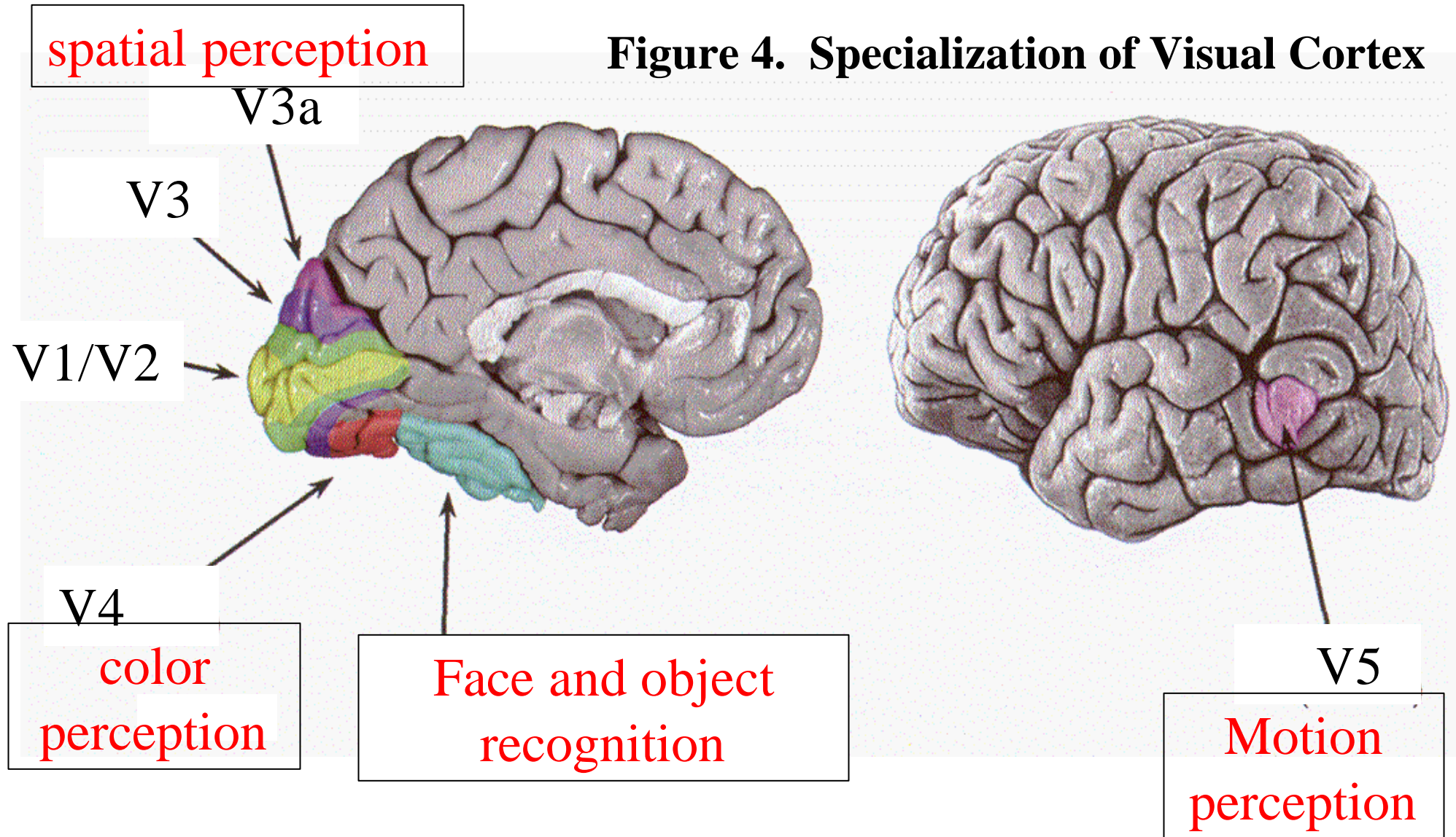
Example Patient 5 IPC Task

CONCLUSIONS

1. IPC task in patients with AD is dependent on the function of multiple cognitive domains, as measured by the total MMSE score. This was true even in patients with prominent visual complaints.
2. The IPC task and other geometric design copying tasks are poor indicators of visual disability in patients with autopsy-proven AD.

3. Based on our knowledge of the visual processing centers of the brain (Fig. 4), we believe that new technologies hold the greatest promise for assessing *AD-specific* visual cognitive impairment.
4. We propose to use computer-based interactive visual paradigms, such as driving simulator tests, to assess visual cognition in AD and related conditions.

Figure 4. Specialization of Visual Cortex



References

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3. Mitrushina M, Satz P. Utility of mini-mental state examination in assessing cognition in the elderly. *Aging Clin. Exp. Res.* 6:427-432, 1994.
4. Ala TA, Hughes LF, Ghobrial MW, Elble RJ. Pentagon copying is more impaired in dementia with Lewy bodies than in Alzheimer's disease. *J Neurol Neurosurg Psychiatry* 70:483-488, 2001.