

INTRODUCTION

Intentional memory refers to the intentional and often effortful memorization, whereas **incidental memory** refers to the unintentional and effortless encoding of information that occurs most frequently in everyday life (Vingerhoets, 2005). Yet, that latter form of memorization, has not been studied as systematically as the former.

Previous studies that have explored the incidental memory performance patterns of patients with PD have revealed **contradictory results**

For example, some studies have revealed that incidental memory, in comparison to intentional memory, appears to remain intact in patients with PD (Cooper & Sagar, 1993; Vingerhoets et al., 2004). However, another study suggested that patients with PD demonstrated a significant impairment in incidental memory (Ivory et al., 1999). Finally, other studies indicated that PD patients had a deficit in memory both on incidental and intentional tasks (Ellfolk et al., 2013; Ellfolk et al., 2012).

The purpose of the present study was to investigate incidental & intentional memory performance in non-demented patients with PD compared to cognitively intact individuals.

PATIENTS & METHODS

- Seventeen PD patients (mean age: 63.5±8.5 years) and 17 healthy participants (mean age: 59.2±10.6 years) were included in the study.
- Participants underwent a **driving simulation experiment** and were evaluated through a comprehensive **neuropsychological battery**.
- Each participant was examined by a neurologist to verify the diagnosis of PD according to the established criteria (UK Parkinson's Disease Society Brain Bank, Hughes et al., 1992).
- Inclusion criteria: a CDR score ≤ 0.5, a Hoehn & Yahr (H&Y) score ≤ 3. Moreover, the PD patients were in On phase during their driving assessment.
- Incidental memory was assessed with an **8-item questionnaire**, developed by our research group, including elements from their driving task, **without warning** (Table 1).
- Intentional memory was measured by **Hopkins Verbal Learning Test-Revised (HVLt-R)**.
- Raw scores of both incidental and intentional memory tasks **were converted into percentages** to allow the comparison between the two types of memory
- No significant differences were observed in age, educational level, general cognitive function, and depressive symptoms between the PD group and the control group (Table 2).**

Table 1. Incidental Memory Questionnaire – Free Recall task

- What was the speed limit in the rural area?
- What kind of animal or animals crossed the road in the rural area?
- How many lanes were in each direction in the rural area?
- What was the speed limit in the urban area?
- What was the color of the ball that crossed the road with a child in the urban area?
- What kind of animal was shown in the sign in the rural area?
- What was the maximum number of lanes that you met in the urban and rural area?
- What was in the pond in rural area?

Figure 1: Driving landscape in the rural and the urban region



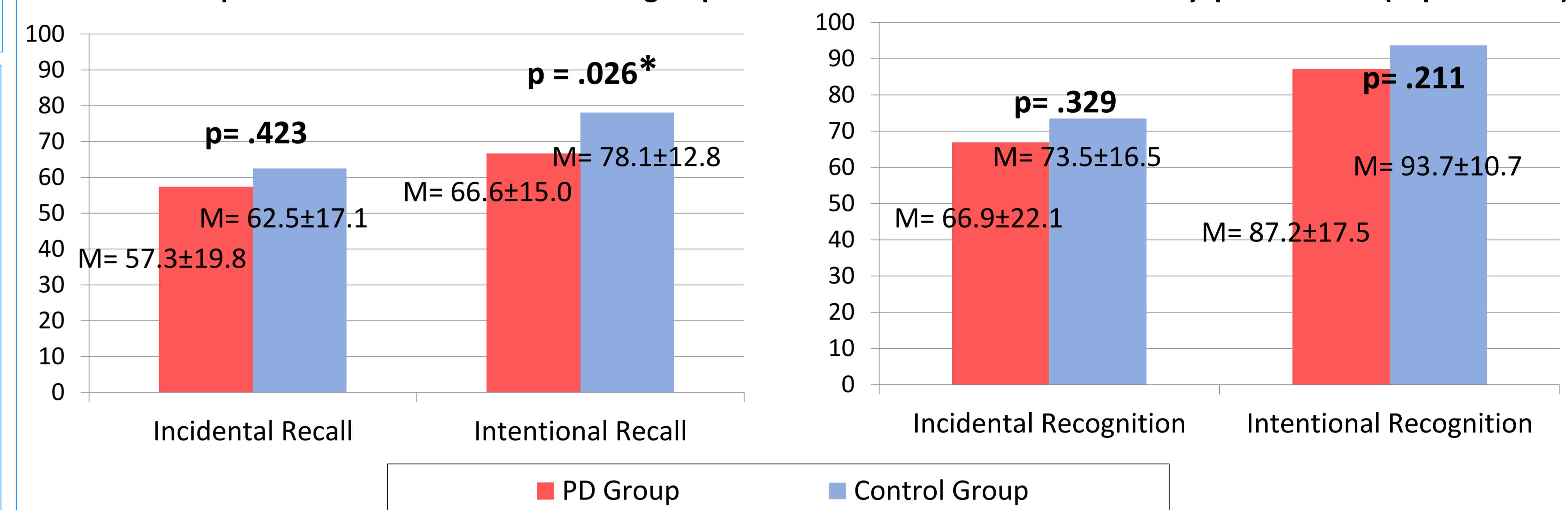
RESULTS

Table 2. Descriptive statistics of the patients with PD and of the control group.

Memory Tasks	PD group		Control group		T-test	
	Mean	SD	Mean	SD	t	p
Age	63.5	8.5	58.8	10.6	-1.43	.164
Education	13.9	3.5	16.0	3.5	1.69	.101
MMSE	28.5	1.6	29.2	1.1	1.39	.172
GDS	3.7	3.3	1.8	2.0	-1.95	.060

Note: MMSE: Mini Mental State Examination, GDS: Geriatric Depression Scale

Chart 1. Independent t-test for Control and PD groups in Incidental and Intentional memory performance (in percentiles)



DISCUSSION/CONCLUSION

- In comparison to the control group, PD patients appeared to have significant **deficits only in intentional recall** whereas **incidental memory was well preserved**.
- Concerning that intentional memory is a more effortful and demanding cognitive process (Vingerhoets, 2005, Karrasch et al., 2010) the significant difference in the intentional memory task between PD patients and the control group could be attributed to **attentional frontal-related impairments** that commonly appear in PD patients (Zgaljardic et al, 2003).
- Furthermore, our findings indicated that PD patients performed worse in the intentional recall task while their recognition performance was intact. This pattern of findings supports the view that the difficulties in intentional recall maybe explained by a **frontal/executive dysfunction** and not from a primary dysfunction of the medial temporal lobe structures (Dubois & Pillon, 1996).
- Future studies are needed in order to explore whether the aforementioned findings are independent of the test modality and of the procedure that were applied in the current study.

REFERENCES/ACKNOWLEDGEMENT

- Dubois, B., & Pillon, B. (1996). Cognitive deficits in Parkinson's disease. *Journal of neurology*, 244(1), 2-8.
 - Karrasch et al. (2010). The diagnostic accuracy of an incidental memory modification of the Boston Naming Test (memo-BNT) in differentiating between normal aging. *The Clinical Neuropsychologist*, 24(8), 1355-1364
 - G.Vingerhoets, E Vermeule, P. Santens (2005). Impaired intentional content learning but spared incidental retention of contextual information in non-demented patients with Parkinson's disease. *Neuropsychologia* 43(5): 675-681
 - Cooper, J. A., & Sagar, H. J. (1993). Incidental and intentional recall in Parkinson's disease: an account based on diminished attentional resources. *Journal of Clinical and Experimental Neuropsychology*, 15(5), 713-731.
 - Ivory, S. J., Knight, R. G., Longmore, B. E., & Caradoc-Davies, T. (1999). Verbal memory in non-demented patients with idiopathic Parkinson's disease. *Neuropsychologia*, 37(7), 817-828.
 - Ellfolk, U., Huurinainen, S., Joutsa, J., & Karrasch, M. (2012). The effect of encoding condition on free recall in Parkinson's disease: incidental and intentional memory are equally affected. *The Clinical Neuropsychologist*, 26(6), 909-925.
 - Hughes, A. J., Daniel, S. E., Kilford, L., & Lees, A. J. (1992). Accuracy of clinical diagnosis of idiopathic Parkinson's disease: a clinico-pathological study of 100 cases. *Journal of Neurology, Neurosurgery & Psychiatry*, 55(3), 181-184.
 - Zgaljardic, D. J., Borod, J. C., Foldi, N. S., & Mattis, P. (2003). A review of the cognitive and behavioral sequelae of Parkinson's disease: relationship to frontostriatal circuitry. *Cognitive and behavioral neurology*, 16(4), 193-210.
- This paper is based on two research projects implemented within the framework of the Operational Program "Education and Lifelong Learning" of the National Strategic Reference Framework (NSRF), namely the Research Funding Program: THALES. Investing in knowledge society through the European Social Fund, and the Action: ARISTEIA (Action's Beneficiary General Secretariat for Research and Technology), co-financed by the European Union (European Social Fund) and Greek national funds.