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### **Implicit learning of eye movement search in Parkinson's Disease**

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*Abstract:* External visual landmarks are known to facilitate Parkinson's patients' orientation of attention, whereas, internally generated top-down orientating of attention is impaired. We examined how this characteristic of Parkinsonism relates to reward-oriented eye movements in a natural task. The search task (Chukoskie, et al. 2005) assessed the implicit learning abilities in patients with Parkinson's disease, both on and off of their dopamine replacement therapy, and also in age-matched control subjects. The task required subjects to associate a rewarding tone with an eye position to establish the informative portions of the image.

The target of the search was hidden in a location that varied spatially with a Gaussian probability distribution. Subjects found the target initially through blind search and later by history of past rewarded trials. A tone indicated that the target was found and ended the trial.

Patients with Parkinson's disease off dopaminergic therapy were generally less able to use past history of reward to guide subsequent search. Although we observed some learning in patients, it was less than that observed in controls. In particular, patients were less likely to reduce the span of their search to match the span of the target distribution. Patients were also no more likely to guide their first saccade to the center of the target distribution than any of the subsequent saccades; unlike age-matched controls, who directed their first saccades toward the center of the target distribution significantly more often than subsequent saccades. We observed no significant effects of dopamine replacement medication on search performance, which may underscore the importance of dopamine transients over static dopamine levels.

We conclude that in addition to the well-known deficits in Parkinson's patients' movement ability, patients also show deficits in using rewarding cues to optimally guide eye movements in a natural task.

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