# Effects of Parkinson's Disease on Cognition, Perception and Gait

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Abstract: Non-motor aspects of Parkinson's disease (PD) such as deficient perception and cognition are a source of a significant decline in daily functional activities and quality of life. Among the most important functions affected in PD is visuospatial ability, which enables the perceptual and cognitive comprehension and navigation of the visual environment. Deficits in this domain arise from pathological changes in high-order association areas of the brain as well as from defective input from more basic visual processing areas. Of potential importance to understanding the visuospatial sequelae of PD is consideration of the side of initial motor impairment, as PD nearly always has unilateral onset of neurodegeneration, and the right hemisphere is especially engaged in many aspects of visuospatial processing. We aim to define the relation between basic vision and visuospatial problems in PD (without dementia) and to examine underlying neural changes. To accomplish our goals, we have marshaled the expertise of scientists from complementary disciplines, including neuropsychology, visual psychophysics, cognitive neuroscience and neuroimaging, and clinical movement science. The application of psychophysical, cognitive and imaging techniques that could predict the integrity of higher-level cognitive and daily functions in PD will be useful clinically, enabling the identification of potential spatial problems for the patient at diagnosis. Our tests target visual, visuospatial, and functional symptoms reported by the patients themselves, ensuring that the elucidation of mechanisms will have clinical relevance.

Topics to be discussed:

Vision and cognition in PD (Cronin-Golomb). PD patients with motor onset on the left side of the body (LPD) show a distinct visuospatial profile, with poorer overall performance and correlations with executive function relative to those with right-side motor onset (RPD). We are examining the relation between visuospatial function and the following: structural and functional integrity of the retina; ocular scanning patterns; contrast sensitivity.

Spatial navigation in PD (Ross). We are investigating the ability of PD patients to navigate spatial mazes and to perceive optic flow. Our fMRI results suggest cortical compensation for decreased striatal and hippocampal function during spatial navigation; the failure to encode optic flow may explain navigational difficulty.

Perceptual influences on gait in PD (Wagenaar). Using a virtual reality display, we are manipulating various components of the visual array while PD patients walk. Our functional measures point to the role of spatial frequency sensitivity in the adjustment of walking patterns.

Taken together, these findings offer new avenues for potential interventions to improve perception, cognition and gait in PD.