Title: Presence hallucination in Parkinson’s disease results from sensorimotor conflict and fronto-insular gamma disconnection

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Abstract:

Hallucinations in Parkinson’s disease (PD) are frequent, progressive and constitute a significant risk factor for adverse clinical outcomes (e.g., depression and dementia). Despite the high prevalence and the importance of an early detection, hallucinations are underdiagnosed and little is known about their neural correlates. Minor hallucinations, which include presence hallucination (PH; ‘feeling’ of someone present when no one is actually there) and passage hallucinations (a shadow passing through the peripheral visual field), occur at early stage of the disease, can precede the onset of the motor symptoms and might predict the onset of more severe hallucinations (e.g., visual) and psychosis. Here, we developed a robotic system that generates specific sensorimotor conflicts that allowed us to induce the PH in patients with PD with symptomatic PH (PD+) and patients without (PD-) and healthy controls. Interestingly, PD+ reported that the robotically-induced PH mimicked the sensations of the symptomatic PH. Our behavioral data show that the intensity of the robot-induced PH is modulated by the degree of the sensorimotor conflict and that the qualitative and quantitative experience of the robot-induced PH differs among the three sub-groups. Also, the subjective intensity rating of the induced PH, predicts whether the patient has the symptomatic PH. Finally, using electroencephalography, we identified the functional processes that differentiated PH from other hallucinations, within the neural network previously associated with the robotic-induced sensorimotor stimulation. These results represent the first delineation of the mechanism of the PH and provide new insights and technology to quantify and qualify hallucinations in PD.