Submission: 7921

**Thesis proposal CSC 2015**

**Title:**

3D perception in Parkinson disease: Effects of treatment and cortical mechanisms

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**Scientific domain:**

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**Subject short description:**

Preliminary studies of our team (Séverac Cauquil et al., 2013) have shown that, on the one hand, Parkinson disease (PD) at early stages affects but does not abolish 3D vision, and on the other hand, that the administration of L-Dopa did not help to recover a correct 3D vision, but instead 3D vision was worsened as revealed by lower psychophysical performances and a slowing of brain processing of 3D stimuli. At the level of the neural mechanisms involved, alterations in various components of Visual Evoked Potentials (VEP) are present in patients, in particular changes in the neural circuits underlying visual spatial perception seem to appear, mainly in the parietal cortex. This reorganization could result from a permanent
impairment, non-restored by medical treatment.

Assumptions and outcomes
The presence of dopamine receptors has been reported in the visual cortex, but in very small proportion compared to the massive presence of noradrenergic receptors (Björklund et al., 1984 De Keyser et al, 1989, Ashton- Jones et al. 1985). However, dopamine is converted by the action of dopamine β-hydroxylase in norepinephrine in the locus Ceoruleus whose noradrenergic neurons project throughout the cortex, particularly in the visual cortex. Electrophysiological studies have described the modulatory effects of norepinephrine on the activity of neurons in the visual cortex that can be excitatory or inhibitory depending on its concentration (Armstrong- James and Fox, 1983; Ego- Stengel, 2002). Given our previous results, the question arises whether the observed effects are due to the action of norepinephrine resulting from the conversion of dopamine synthesized from L-Dopa rather than a direct effect of the dopamine. This hypothesis can be tested using dopamine agonists that act specifically on dopamine receptors in the visual cortex, without allowing the synthesis of norepinephrine.

We want in this project to compare objectively the effects of two types of medication primarily involved in the treatment of PD, dopamine agonists and L-dopa on the 3D perceptual abilities of patients and in the neural mechanisms involved, the question is to clarify whether the deleterious mode of action of L-Dopa on the 3D vision is purely dopaminergic or passes through a noradrenergic system. The corollary question is: do patients treated with dopamine agonists preserve a better vision of the three-dimensional space?

Experimental Procedures
The study of 3D perception is done by using a visual categorization task on visual stimuli presented on a computer screen. These stimuli are either "2D" (flat views) or "3D" (views in depth) and the subjects have to perform a categorization task (2D versus 3D) by quickly pressing keyboard keys. The psychophysical data expressed are success rate and reaction time. They will be complemented by electrophysiological data because it is possible to study the mechanisms underlying perceptual deficits observed in PD using VEP. Indeed, electrophysiological data from VEP have shown that visual impairment in PD cannot be explained only by the specific retinopathy disease but also from cerebral dysfunction (Bodis-Wollner and Antal, 2005).

During our preliminary study, we compared the behavioral responses and VEP in PD patients "ON L-Dopa " and " OFF L-Dopa " with those of control subjects matched for age; in this study we want to use the same experimental procedure to compare behavioral responses and VEP obtained in parkinsonian patients "ON L-Dopa" and "ON dopamine agonists" patients.

This will be performed at different stages of the disease to test whether later stages of Parkinson’s disease are characterized by a worsening of 3D vision.

Therefore, a quantified study of 3D visual disturbances based on categorization tasks associated with recordings of VEPs will allow us to estimate comparatively perceptual consequences of treatment with L-Dopa and those with treatment with dopamine agonists along with the underlying electrophysiological changes and
thus to propose hypotheses on how the visual system deals with 3D cues in Parkinson’s pathology and healthy humans.


Two major publications in the domain of PhD:


Keywords: , , , ,

Expected collaboration in China:

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