

Can the ability to predict the timing of future events consistently enhance our response capabilities?

"Temporal prediction" is the cognitive process through which we allocate mental resources to specific moments in time to optimize responses to corresponding events, improving response speed and accuracy. Accurate temporal predictions are essential for various daily activities, such as safe driving or participating effectively in social interactions. While numerous studies highlight the advantages of temporal predictability in simple actions, adaptive behavior often involves making choices and suppressing impulsive responses. Therefore, in our previous research, we sought to determine whether the facilitative effects of temporal prediction would come at a cost in situations involving potential response conflicts. **We have shown that participants made more fast, impulsive errors when temporal cues induced expectations about the target onset time.** Yet, this impulsive behaviour could stem from the temptation to act and/or a failure to inhibit this temptation. We further demonstrated that temporal cues exacerbated a tendency to act prematurely but did not affect the inhibitory processes that allow these impulsive tendencies to be corrected. These dissociable effects reveal that timing modulates action control through discrete and dedicated functional pathways, which could have significant clinical implications. An urgent scientific challenge lies, therefore, in characterising the functional interplay between timing and action control in healthy and clinical populations.

Does temporal prediction affect impulse control in ADHD and Parkinson's Disease?

In the current proposal, we seek to build upon our previous work by characterising deficits in goal-directed behaviour that are triggered by temporal expectations in clinical populations known to exhibit difficulties in both timing and action control – namely, ADHD and PD. Both ADHD and PD have been linked to abnormalities in dopaminergic function, a neuromodulatory system that is traditionally linked to motor function, and is increasingly implicated in timing. The research will be based on theoretical models and sophisticated chronometric analysis of behavioural data and muscle activity. We will focus on two main action control processes: the initial tendency to act impulsively, and the subsequent ability to suppress these impulsive, incorrect actions. The experimental approach will be complemented by computational methods to reveal the underlying cognitive processes altered in ADHD and PD within the time course of the action.

The outcomes of the project will inform theories concerned with fundamental cognitive processes like timing and action control. Crucially, the results will be of importance for clinical populations such as ADHD and PD patients by helping to elucidate the underpinnings of deficits in motor control, which can provide new perspectives on targeting their symptoms effectively.

Summary

- **Previous research has shown temporally-triggered deficits in impulse control in situations of response conflict**
- **In the current project, we seek to reveal the indices of impulse control deficits triggered by temporal predictability in individuals with ADHD and PD**
- **We will extend and integrate existing knowledge in the separate fields of timing and action control by studying their interplay in clinical groups linked to dopaminergic dysfunction.**