

The role of neuromodulation, cognitive processing and behavioral inhibition in problem gambling

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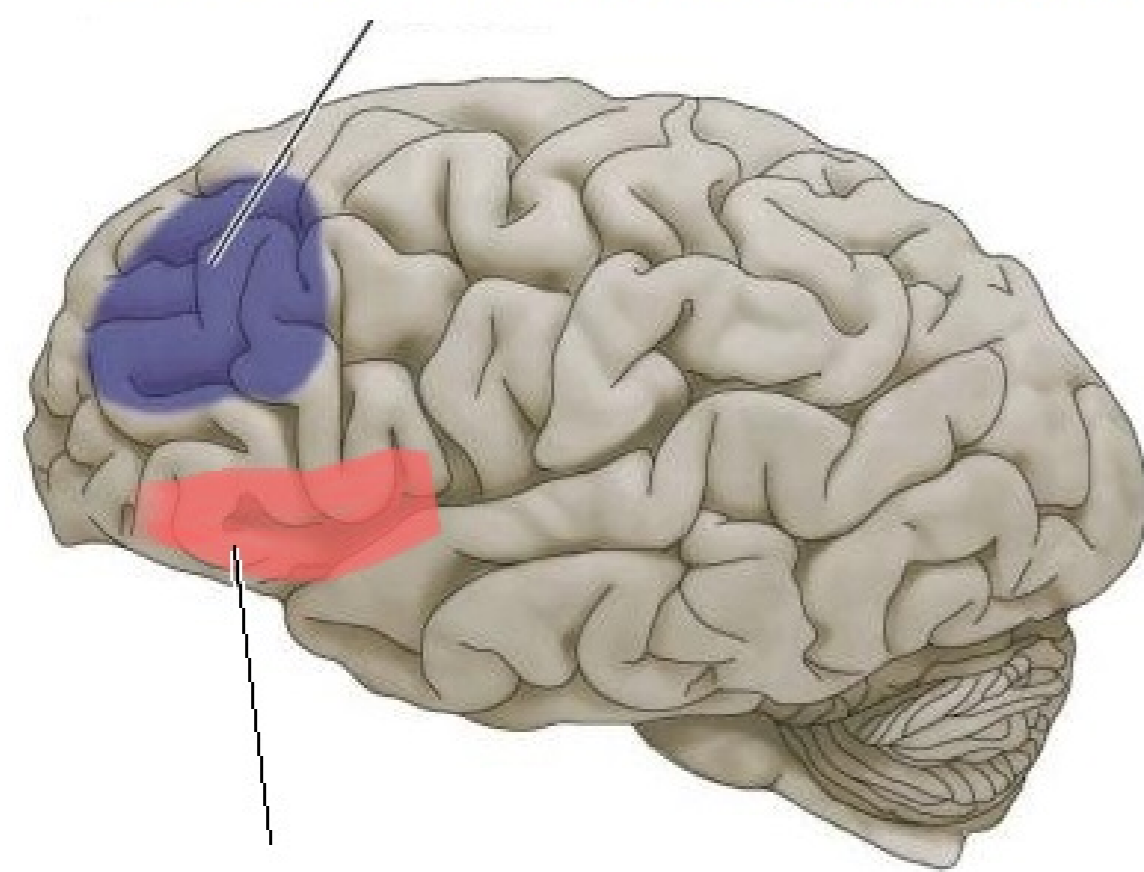
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INTRODUCTION

- Previous research identified deficits in risky decision-making in problem gamblers (PGs) (Lawrence et. al., 2009).
- Irrational thinking plays an important role in the development of problem gambling (Benhsain, Taillerfer & Ladouceur, 2004).
- Research found a link between gambling-related cognitive distortions and gambling problem severity (Xian et. al., 2008).
- Pathological gambling has been associated with elevated impulsivity (Michalczuk et. al., 2011).

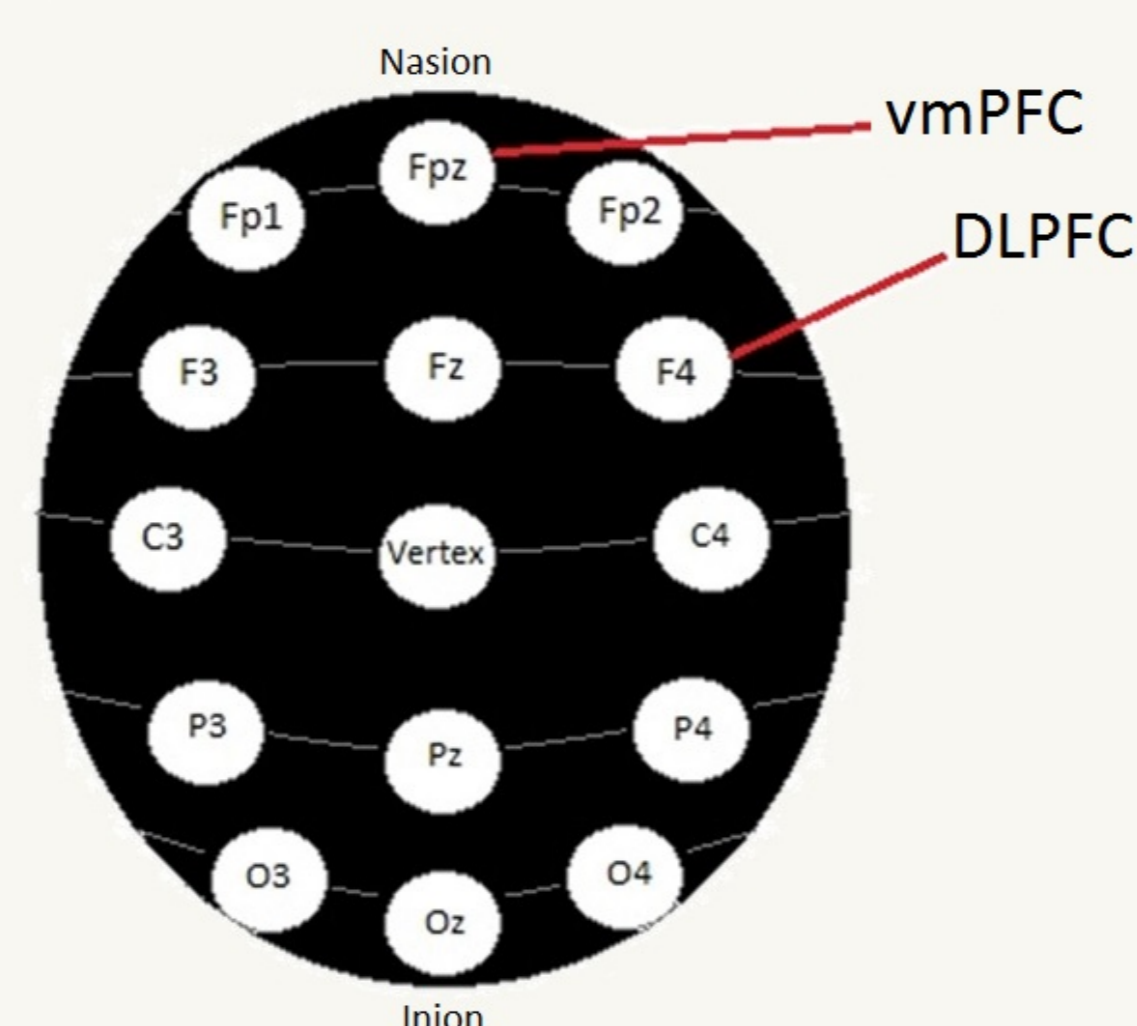
DLPFC: executive functions, control inhibition



vmPFC: emotional related, reward sensitivity

METHODS

- **Transcranial direct current stimulation (tDCS):** is a non-invasive brain stimulation technique that applies a very weak electrical current (1.5 mA) to the scalp to modulate neuronal activity.



- **Electroencephalography (EEG):** Measures the changes in brain electrical activity.

OBJECTIVES

- To investigate the role of prefrontal cortex (PFC) in problem gambling decision-making.
- To study whether neuromodulation can help to moderate cognitive distortions, impulsivity and risk taking behaviour.
- **To offer improved treatment interventions for problem gamblers.**

Problem gamblers that are receiving treatment at the National Problem Gambling Clinic attend weekly sessions of Cognitive Behavioural Therapy (CBT) that are held once per week.

EXPERIMENTAL DESIGN

n = 24

n = 12 (active control experiments)

Phase 1: neuromodulation of DLPFC and vmPFC to decide the brain area to target in phase 2.

Experiment 1 (DLPFC)	Controls	PGs	Experiment 2 (vmPFC)	Controls	PGs	Experiment 3 (active control)	Controls	PGs
Stimulation	tasks	tasks	Stimulation	tasks	tasks	Stimulation	tasks	tasks
Sham	tasks	tasks	Sham	tasks	tasks	Sham	tasks	tasks

Phase 2: Longitudinal neuromodulation of PGs not treated with CBT and PGs treated with CBT.

Experiment 4	PGs in stimulation	PGs in sham	Experiment 5 (active control)	PGs
Week 1	Transfer tasks	Transfer tasks	Week 1	Transfer tasks
Week 2	Training tasks	Training tasks	Week 2	Training tasks
Week 3	Training tasks	Training tasks	Week 3	Training tasks
Week 4	Training tasks	Training tasks	Week 4	Training tasks
Week 5	Transfer tasks	Transfer tasks	Week 5	Transfer tasks

Experiment 6	PGs + CBT in stimulation	PGs + CBT in sham	Experiment 7 (active control)	PGs + CBT
Week 1	Transfer tasks	Transfer tasks	Week 1	Transfer tasks
Week 2	Training tasks	Training tasks	Week 2	Training tasks
Week 3	Training tasks	Training tasks	Week 3	Training tasks
Week 4	Training tasks	Training tasks	Week 4	Training tasks
Week 5	Transfer tasks	Transfer tasks	Week 5	Transfer tasks

Scales	Transfer tasks	Training tasks
<ul style="list-style-type: none"> • South Oaks Gambling Screen • Kirby Monetary Choice Questionnaire • Gambling Related Cognitions Scale • UPPS Impulsive Behaviour Scale • Need for cognition scale 	<ul style="list-style-type: none"> • Cambridge Gambling Task • Numerical Stroop • Ratio bias task • Cognitive Reflection Task 	<ul style="list-style-type: none"> • Iowa Gambling Task • Game of the Dice Task • Stop Signal Task • Wisconsin Card Sorting Test

PREDICTIONS

- PGs will show higher scores in tasks that measure impulsivity, risk taking behaviour, biases and cognitive distortions than healthy controls. EEG resting activity will differ for both groups.
- The tasks performance will change after neuromodulation treatment to a larger extent in stimulation than in sham. In particular, a decrease of the above mentioned measures will be linked to improved executive function and control inhibition performance.
- Combined neuromodulation with CBT will show enhanced cognitive performance than neuromodulation treatment.

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