Analysis of sub-threshold errors reveals **no deficit in response inhibition** in mild to moderate Parkinson's

Jade S Pickering, Jennifer McBride, Iracema Leroi, Ellen Poliakoff
Neuroscience and Experimental Psychology, University of Manchester, UK

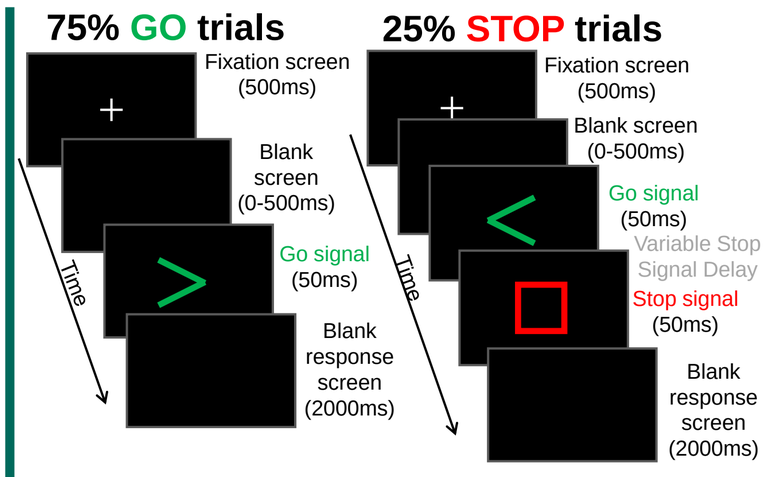
1. INTRODUCTION

- Response inhibition is the ability to withhold or cancel an action once it has already begun
- Previous work has not concluded whether people with Parkinson's (PwP) have difficulty with response inhibition (Stop Signal task) and conflict (Simon task). We aimed to address this using a more sensitive measure.

2. METHODS

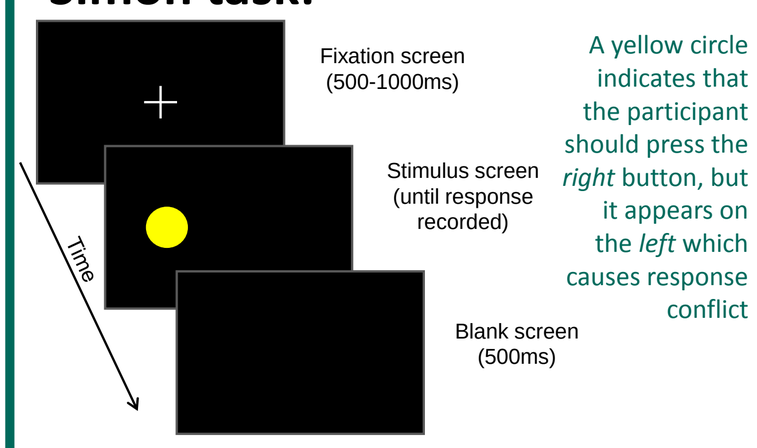
- 25 mild-moderate PwP and 23 healthy controls (HC) completed the Stop Signal task and Simon task
- As well as button presses, we continuously recorded the force placed upon the response keys to see whether there were any undetected partial errors

Stop Signal task:



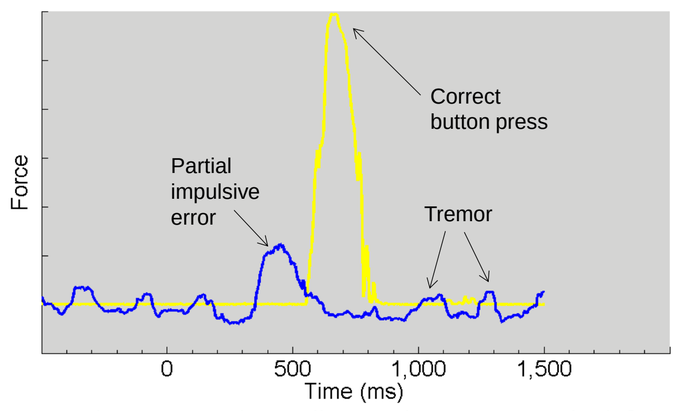
Participants must press the left or right button according to the direction of the arrow (Go signal), but withhold their response when a red square (Stop signal) appears

Simon task:



A yellow circle indicates that the participant should press the *right* button, but it appears on the *left* which causes response conflict

Example force trial:



A PwP on the Simon task. A yellow circle appears on the left hand side, and a partial error is seen briefly with the left hand before a correct button press in response to the yellow circle is executed with the right hand.

Bayes Factors (BF_{10}):

The BF_{10} indicates evidence in favour of…

…the null hypothesis		…neither hypothesis		…the alternative hypothesis
	0.3		3	

NB: these are not strict benchmarks

3. RESULTS

- Button-press data: no significant group differences in stop signal reaction time (an estimate of how long it takes an individual to successfully stop a response), nor in the interference effect (the amount an individual slows their response upon seeing a stimulus that induces response conflict) (*see data table*)
- Partial errors in response force: significantly more frequent on Stop trials than Go trials (force recorded in the absence of a button press), and on Incongruent trials than Congruent trials (force recorded on the opposite hand to the one that provided a button press). The % of partial errors did not differ between groups (*see Fig 1.*)

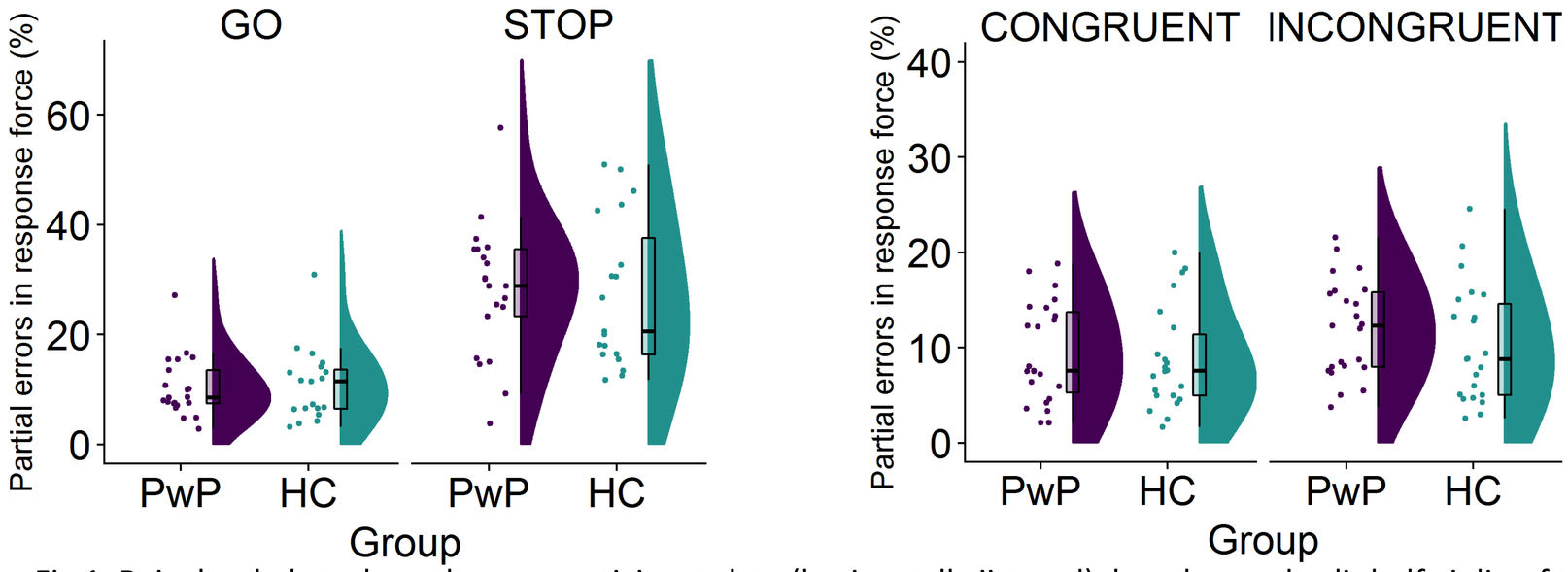


Fig 1. Raincloud plots show the raw participant data (horizontally jittered), boxplot, and split half violin of the density. NB: Each plot has a different scale on the y-axis

Data:

	PwP	HCs	Test statistics
Simon Task			
Interference effect (RT)	37.96ms ± 22.86ms	40.46ms ± 21.42ms	$t(46)$=039, p=0.7, BF_{10}=0.31
Congruent partial errors	9% ± 5%	9% ± 5%	$t(43)$=0.46, p=0.65, BF_{10}=0.32
Incongruent partial errors	12% ± 5%	10% ± 6%	$t(43)$=1.19, p=0.12, BF_{10}=0.89
Stop Signal Task			
Stop signal RT	290ms ± 59ms	272ms ± 41ms	$t(39.32)$=1.14, p=0.14, BF_{10}=0.82
Go partial errors	10% ± 5%	11% ± 7%	$t(38)$=0.17, p=0.86, BF_{10}=0.31
Stop partial errors	28% ± 12%	27% ± 13%	$t(38)$=0.18, p=0.43, BF_{10}=0.35

4. DISCUSSION

By using a more sensitive measure of recording responses, we demonstrated that people with mild to moderate Parkinson's perform similarly to healthy control participants on the Stop Signal task and Simon task

- Specifically, the strength of our evidence indicates that the null hypothesis can be accepted (see *Bayes Factors*) except in the case of *stop signal reaction time* and *incongruent partial errors* where we did not have enough evidence to accept nor reject it.
- Continuous response force provides a more sensitive way of measuring the cognitive processes of response inhibition and conflict. The lack of group differences may mean that dopaminergic depletion does not affect this type of cognitive control.

The University of Manchester

jade.pickering@manchester.ac.uk

@Jade_Pickering / @BEAM_Manchester

Take a picture or go to https://osf.io/pgafe for more details about the study