



# Comparison of Stop-Signal and Continuous Movement Reaction Stop Times to Measure Inhibitory Control

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## Introduction

- Cognitive control, specifically inhibitory control, can be studied experimentally with the motor inhibition tasks such as the stop signal task.<sup>2</sup>
- The stop signal task (Logan and Cowan, 1984) measures averaged SSRT over group of trials, when stopping a planned movement from occurring.<sup>1</sup>
- We used a previously published version of the standard stop signal task (Verbruggen et. al 2019) to be administered online.<sup>3</sup>
- While useful, some limitations of the stop signal task include the inability to estimate stopping for individual trials.
- We developed a novel continuous movement stopping task to overcome these limitations

## Research Question

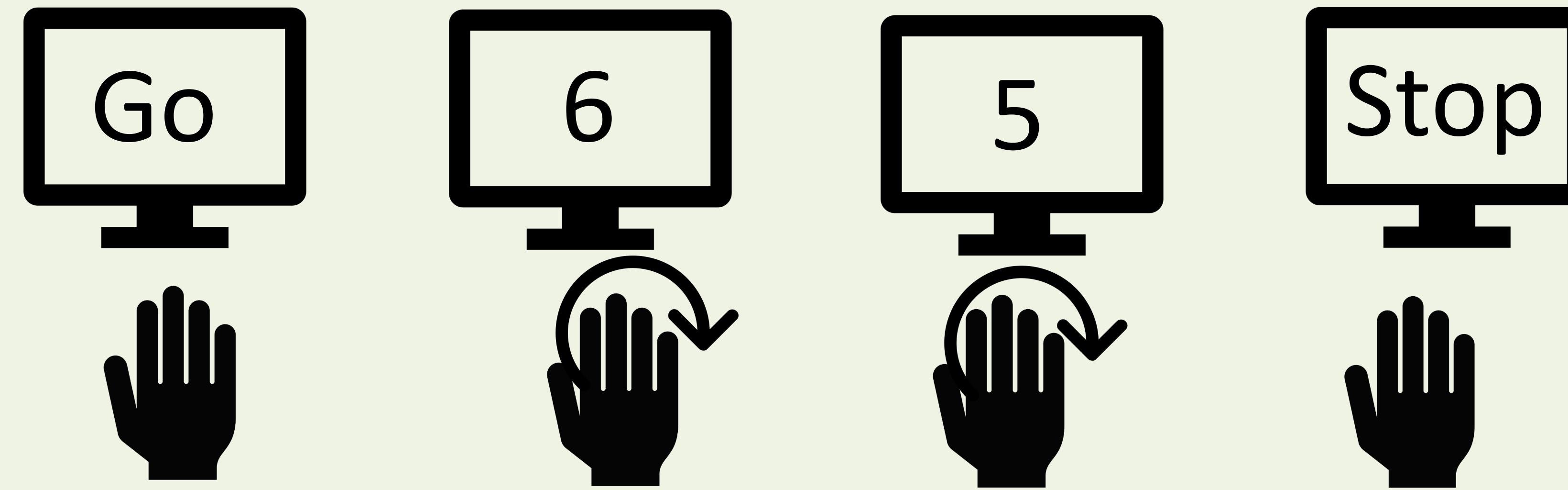
How does stopping a continuous movement- as implemented in our novel task – compare with stopping in the standard stopping task?

## Methods

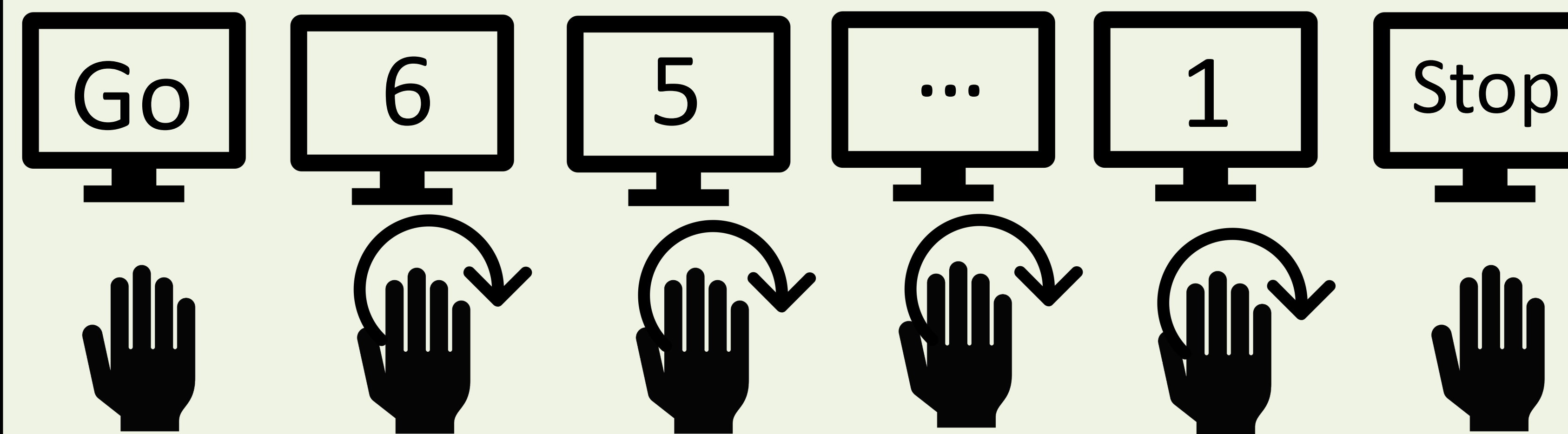
- Participants completed continuous movement task in the lab between June 2019, and March 2020.
- Continuous Movement task consists of 12 blocks of 20 trials where participants move a computer mouse in a circle during a countdown. A predetermined percentage of trials have an interrupted countdown where the participant must terminate their movement.
- In May 2020 previous continuous movement participants were contacted to take place in this comparison study and sent a link for a previously published and available version of the standard stop task (Verbruggen et. al 2019).
- Stop Signal Task consists of 4 blocks of 64 trials each. The participant was shown either two left or right arrows that corresponded with the arrow key that they were supposed to respond with. In 25% of the trials the arrows would turn red signaling for the participant to not hit an arrow key.

## Task Design

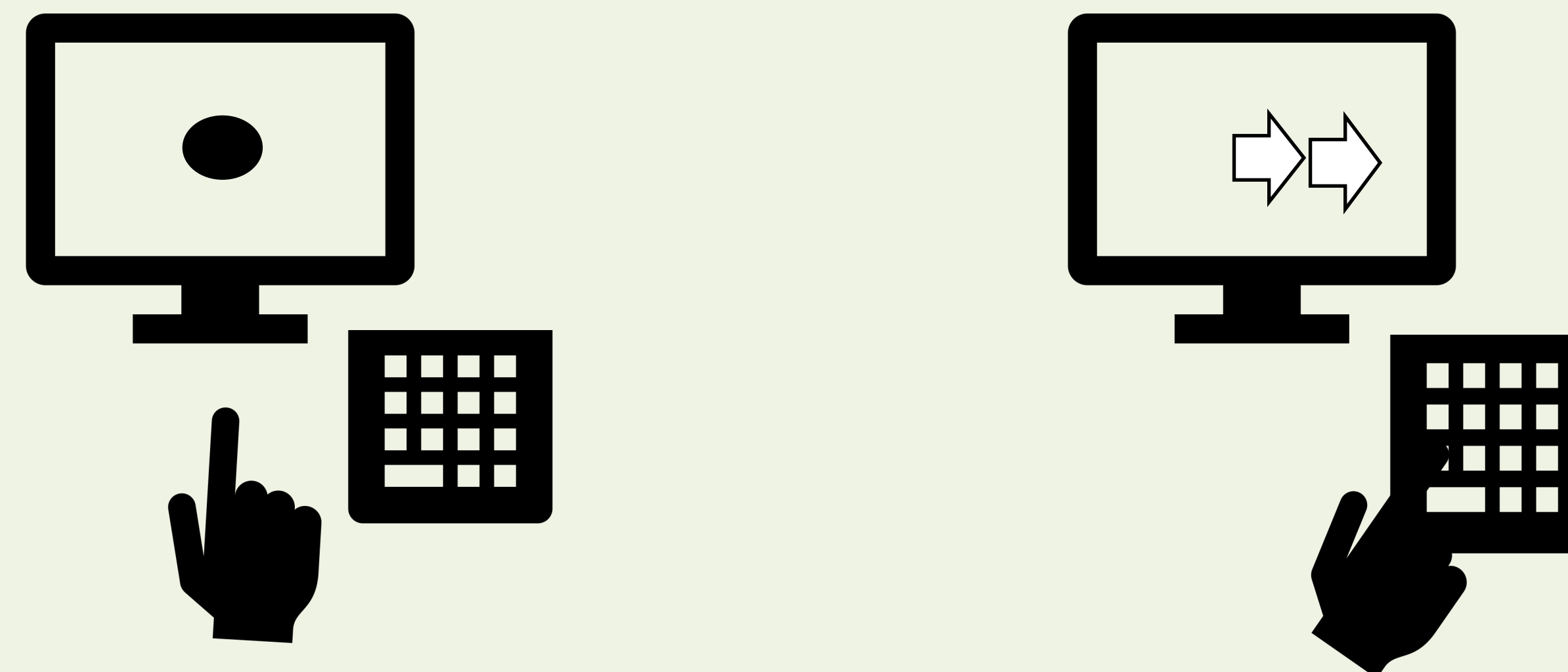
### Continuous Movement Stop Task Unplanned Stop Trial



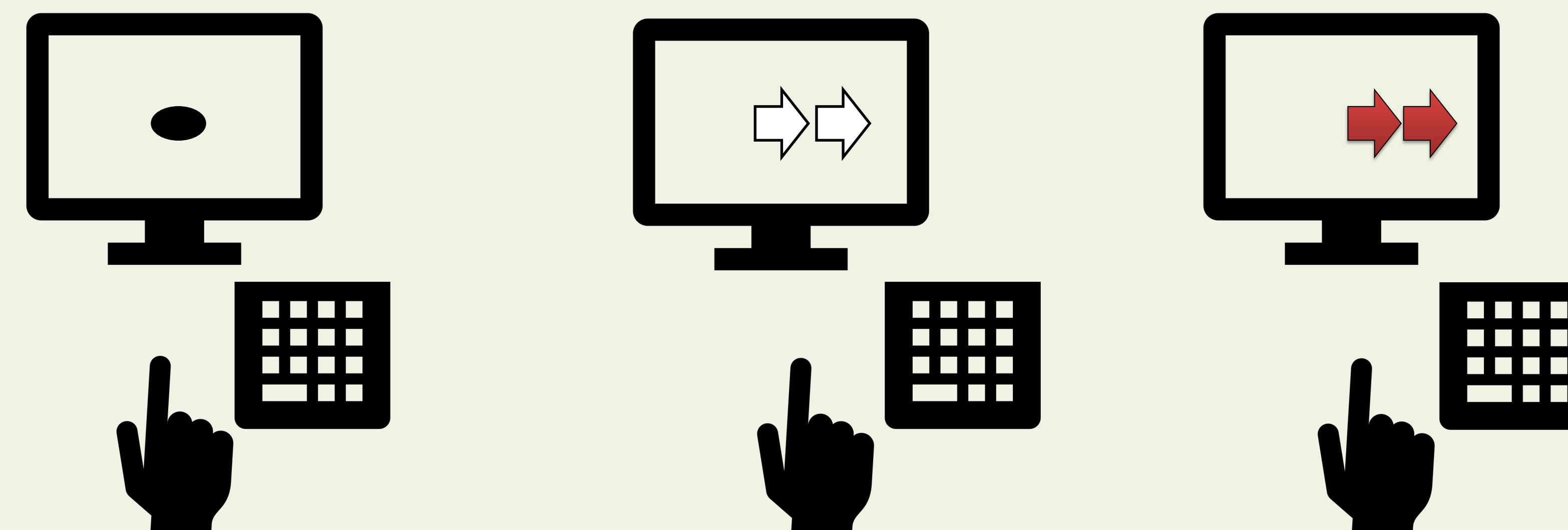
### Continuous Movement Planned Stop Trial



### Stop Signal Task Go Trial



### Stop Signal Task Stop Trial



## Results

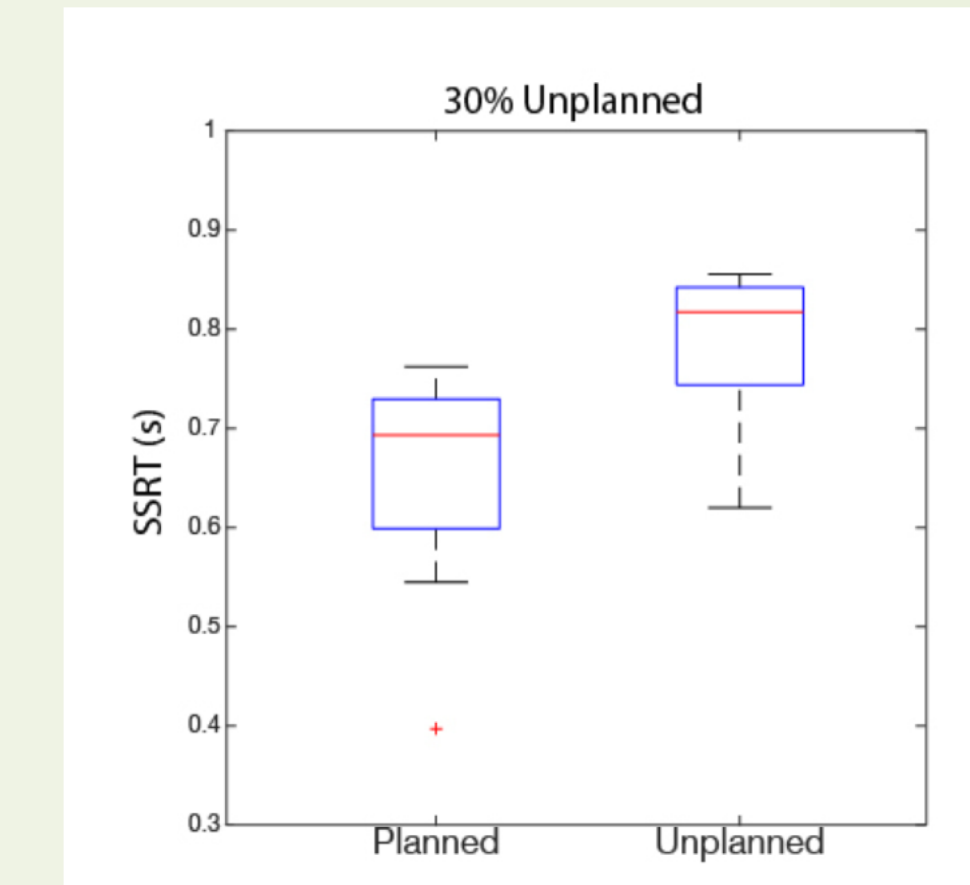


Figure 1: SSRTs of participants for the continuous movement stopping task. Planned was  $0.66 \pm 0.09$  and unplanned was  $0.78 \pm 0.07$  n=14

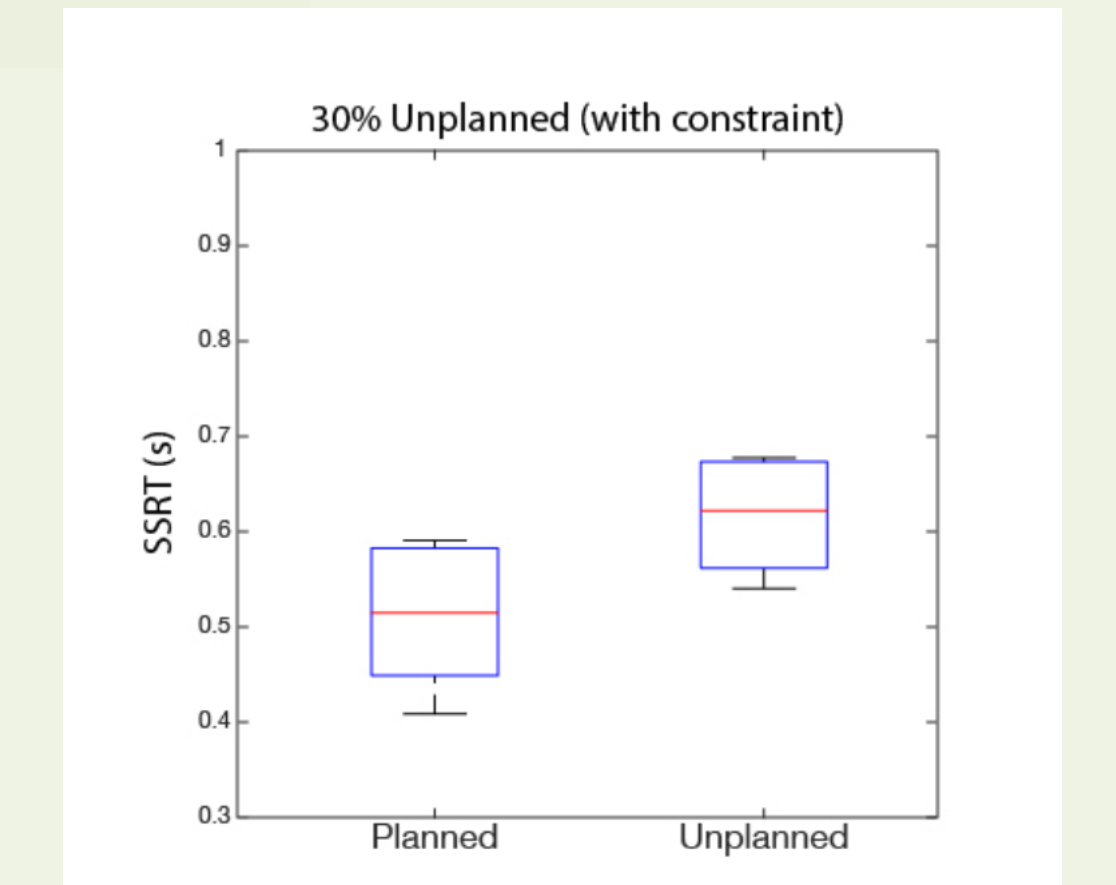


Figure 2: SSRTs of participants for the continuous movement stopping task with constraint. Planned was  $0.58 \pm 0.22$  and unplanned was  $0.67 \pm 0.16$  n=8

CMST	SST
0.62009	x
0.82509	x
0.82312	x
0.76277	x
0.72428	x
0.76814	x
0.82731	x
0.66328	x
0.84215	x
0.84215	x
0.85568	x
0.81102	x
0.57574	x
0.66921	x
0.58523	x
0.54804	x
0.67731	x
1.0764	x

Table 1: Left column are the mean unplanned SSRTs for the continuous movement stopping task. Right column are the SSRTs for the standard stop signal task.

## Conclusions

- Results from the continuous movement stopping task (Figures 1 and 2) show that unplanned stopping is slower than planned stopping.
- We are still unsure of how stopping in our novel task compares to the standard stop signal task as data collection is ongoing.

## References

1. Logan, G.D., Cowan, W.B. (1984) On the ability to inhibit thought and action: a theory of an act of control. *Psychol Rev* 91:295–327.
2. Swann, N., Tandon, N., Canolty, R., Ellmore, T.M., McEvoy, L.K., Dreyer, S., DiSano, M., Aron, A.R. (2009). Intracranial EEG Reveals a Time- and Frequency-Specific Role for the Right Inferior Frontal Gyrus and Primary Motor Cortex in Stopping Initiated Responses. *J Neuro*, 29(40):12675–12685.
3. Verbruggen, F., Aron, A. R., Band, G. P., Beste, C., Bissett, P. G., Brockett, A. T., Boehler, C. N. (2019). A consensus guide to capturing the ability to inhibit actions and impulsive behaviors in the stop-signal task. *ELife*, 8, e46323. <https://doi.org/10.7554/eLife.46323>

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