A NOVEL TASK FOR PROBING INHIBITORY CONTROL

K. SCHULTZ 1, D. DENNING 2, K. PETERSON 2, A. JOHNSON 2, V. HUFNAGEL 2, N. SWANN 2
1DEPT. OF BIO., 2 DEPT. OF HUMAN PHYS. UNIVERSITY OF OREGON

INTRODUCTION

Stopping movement is critical for adaptive, flexible behavior.

One way this is studied is with the stop signal task (SST). Speed of stopping (SSRT) is estimated from go signal reaction time, stop signal delay, and probability of stopping1, 3.

Some limitations of the standard SST are:

- SSRT cannot be directly measured.
- Successful stopping is usually compared to unsuccessful stopping (or going), instead of to other conditions that involve motoric termination of movement.
- The standard SST cannot be used for studying inhibition of continuous movement.
- Individual trial SSRTs are not available.

To address these limitations we developed a novel stop task that requires termination of continuous movement and provides a direct measure of SSRT on each trial.

METHODS

Subjects move a computer mouse in a continuous, circular motion while monitoring a countdown (1).

On most trials, the stop signal appears 1 sec after the countdown reaches 1 (planned stop). On a subset of randomly selected trials, the stop signal appears at an unexpected time before the countdown ends (unplanned stop; 1b).

Each subject performed one of 3 tasks that differed in the percentage of unplanned stop trials (10%, 30%, and 50%).

Stopping was defined using mouse coordinates (2a) and validated using accelerometry (2b).

1. TASK DESIGN

A) PLANNED STOP

Countdown begins with 6, 5, 4, or 3 with equal probability. Stop cue always presented 1 sec after countdown reaches 1. All stimuli in sequence persist for 1 sec; stop signal is predictable.

B) UNPLANNED STOP

Countdown never reaches 1. The stimulus preceding the stop signal persists for a variable duration (300-800 ms). Stop signal not predictable.

RESULTS: SSRTS

ALL VERSIONS (N = 29)

10% UNPLANNED (N = 10)

30% UNPLANNED (N = 10)

50% UNPLANNED (N = 9)

RESULTS: RTS

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DISCUSSION

SSRT differed reliably between planned and unplanned trials, while RT was invariant (as anticipated).

Preliminary data support the efficacy of this task for evaluating context-dependent termination of continuous movement (i.e. stopping that is planned vs unplanned).

Surprisingly, proportion of unplanned stop trials did not have any significant effect on any behavioral measures.

SSRT for unplanned stop trials were longer than planned trials, suggesting that participants may be engaging in ‘proactive inhibition’ prior to stop signal presentation. We plan to critically evaluate this possibility by examining relative changes in velocity prior to stop cue presentation for each condition.

SSRTs were longer than those typically observed in the standard stop signal task. This may be a feature of stopping a continuous movement. This question will be further investigated in future research.

We also plan to use this task in conjunction with electrophysiology to further explore inhibitory control in the context of a continuous movement.

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