



Induced stress during dual task improved secondary task performance at the sacrifice of primary task performance

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INTRODUCTION

- Completing a simultaneous secondary task while standing or walking, i.e. a high cognitive load situations, may disrupt one's postural control [1,2].
- Several factors such as pathology, aging, and stress may have an effect on the performance of each task being completed [3].

PURPOSE:

- We aimed to investigate the effect of induced stress on the performance of each task during a high cognitive load situations. The high cognitive load situations S included standing while completing a secondary motor task (wire maze).

METHODS

- Participants (Tab. 1) were asked to randomly stand 1) quietly, or while completing the wire maze 2) with or 3) without a loud buzzer noise (Fig. 1). Stress was induced through a loud buzzer when the ring contacted the maze.

Table 1. Demographic data

Group	N	Age (years)	Body mass (kg)	Height (m)
Healthy Young	18	24.76±3.56	68.85 ±11.85	1.72±0.07

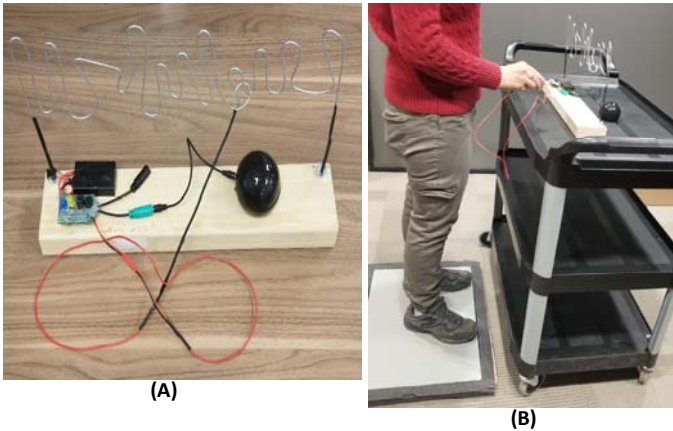
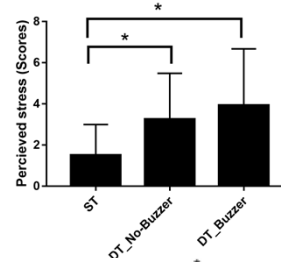


Figure 1. (A) The wire maze device including a wire path and a ring. The wire maze was composed of a metal wire path (maze) and a single ring, held in one hand that was moved over the maze without contacting the maze itself. (B) Study Protocol – Participants stand on a force-plate for three minutes during quiet standing compared to standing while doing wire maze.

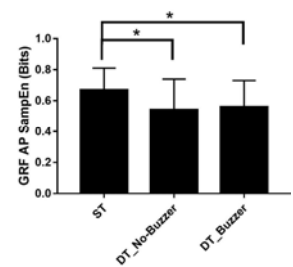
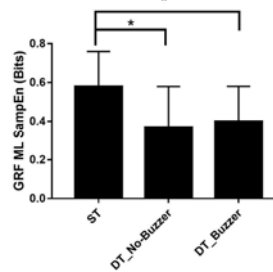
MEASUREMENTS:

- Perceived stress was measured after each trial. Scores ranged from 1 to 10 with 10 representing the highest level of stress.
- Both task performances were assessed :
 - Primary task performance: Ground reaction force sample entropy in the anterior posterior (AP) and mediolateral (ML) directions during quiet standing, and standing while doing wire maze [4].
 - Secondary task performance: The number of times the subject touched the metal ring to the wire maze was recorded as the number of errors.
- One-way repeated measures ANOVAs were used to compare dependent variables during the three conditions ($\alpha=0.05$).

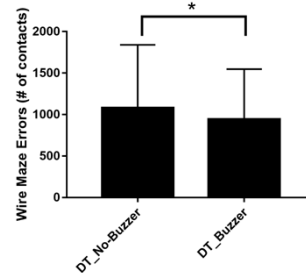
RESULTS



LEFT: Perceived stress was significantly lower during quiet standing (single task: ST) compared to standing while completing the wire maze (dual task: DT) with ($p=0.001$) and without buzzer ($p=0.007$) conditions.



ABOVE: Posture was more irregular during quiet standing (ST) compared to standing while doing wire maze (DT) with and without the buzzer in both the AP and ML directions ($p=0.02$, $p=0.001$, respectively in AP) & ($p=0.004$, $p<0.0001$, respectively in ML). (NOTE: GRF=Ground Reaction Force, SampEn=Sample Entropy).



LEFT: Wire maze errors were significantly higher during standing while doing wire maze (DT) without the buzzer compared to the buzzer DT condition ($p<0.0001$).

DISCUSSION and CONCLUSIONS

- During the most stressful high cognitive load situations, the high level of perceived stress coincided with less wire maze errors.
- The addition of a secondary task increased the regularity of the ground reaction force in both directions, which might be due to more automatic and less flexible postural control.
- Induced stress during high cognitive load situations caused a cost for postural control, yet a benefit for wire maze performance, indicating task prioritization under stress.
- Identifying the strategies underlying task prioritization can help clinicians design appropriate interventions to challenge patients appropriately to improve performance during high cognitive load situations

ACKNOWLEDGMENTS

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[3] Han et al. Atten Percept Psychophys, 75, 1395-1405, (2013).

[4] Ónell, Gait & Posture, 12, 7-13, (2000).