



The Attentional Cost of Movement in Individuals with Multiple Sclerosis

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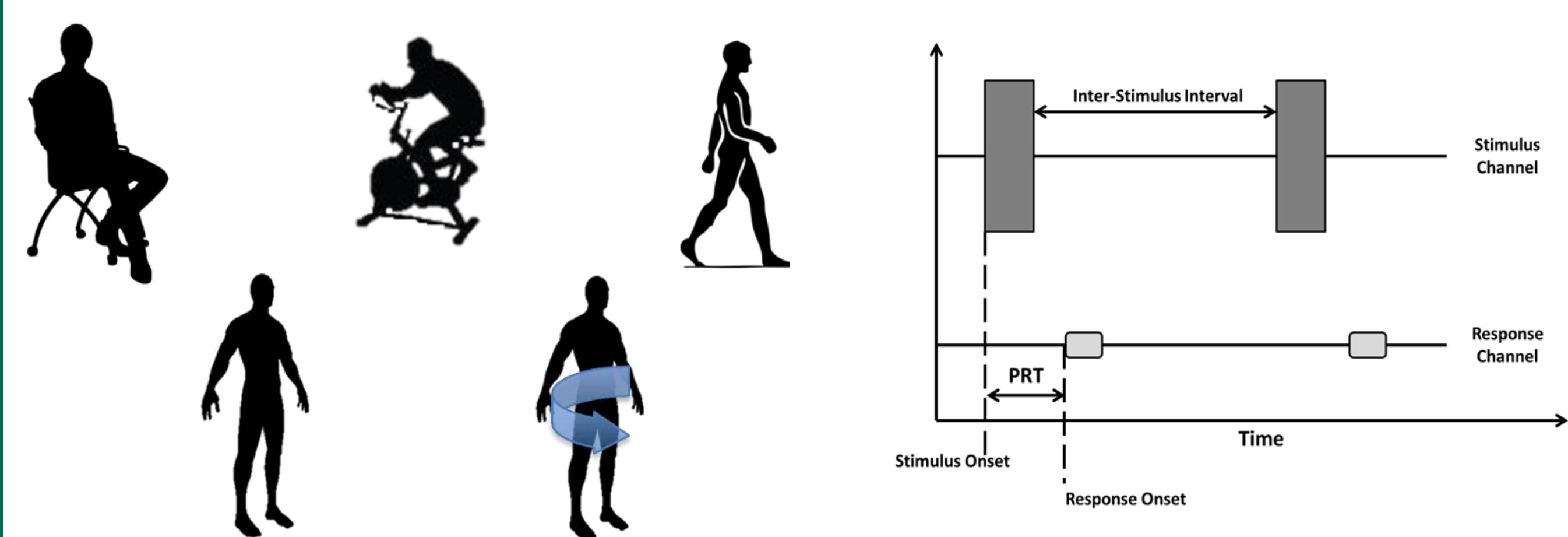
INTRODUCTION

- Mobility [1] and cognitive [2] impairments are common in individuals with multiple sclerosis.
- It is often observed that these impairments tend to be compounded when individuals with MS perform simultaneous cognitive and motor tasks [3].
- This phenomenon, cognitive-motor interference, has generally been attributed to greater attentional demands of the motor task [4].
- These increased demands cause an overload to the system when paired with the attentional costs of the cognitive task [5].
- To date, this theory has not been expressly tested in individuals with MS [3].

The aim of this study was to investigate the association between the attentional costs of movement and dual task performance in individuals with MS.

METHODS

- 20 individuals with MS and 26 age matched controls participated in the investigation.
- Upon consenting participants provided demographic information, completed the FES-I [6] and were instructed on all study procedures.
- Participants responded to 20 auditory cues during a series of five tasks designed to challenge balance and mobility [7]
- Participants were asked to respond by saying 'Pop' as quickly as possible after hearing each cue.

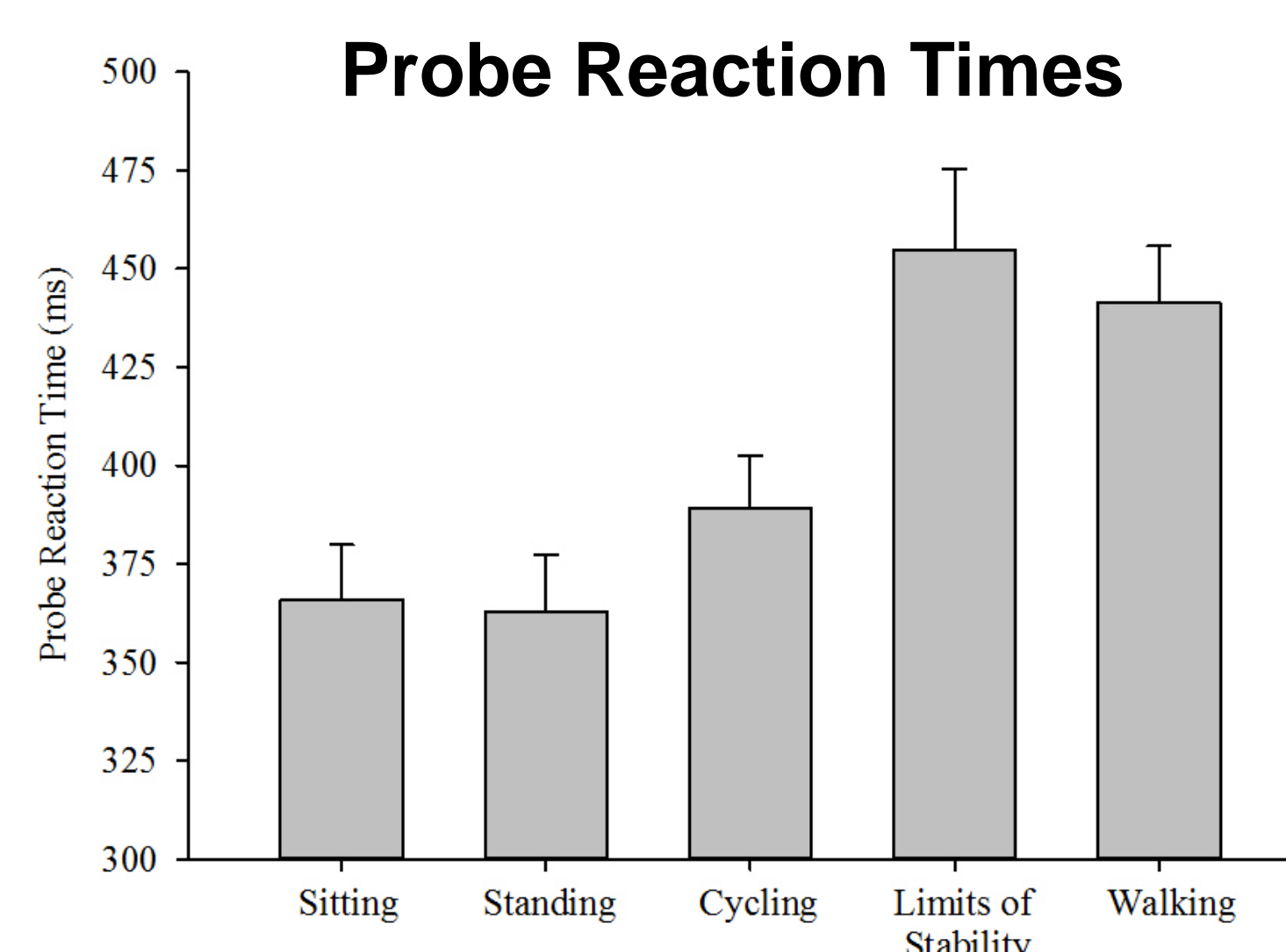


- In addition to the probe reaction time task, participants also completed a complex dual task scenario (serial 7s), tests of cognition (SDMT [8] and TMT [9]) and the physiological profile assessment [10].
- The primary outcomes were average probe reaction times (PRT) for each motor task and changes in walking and cognitive performance for the dual task.

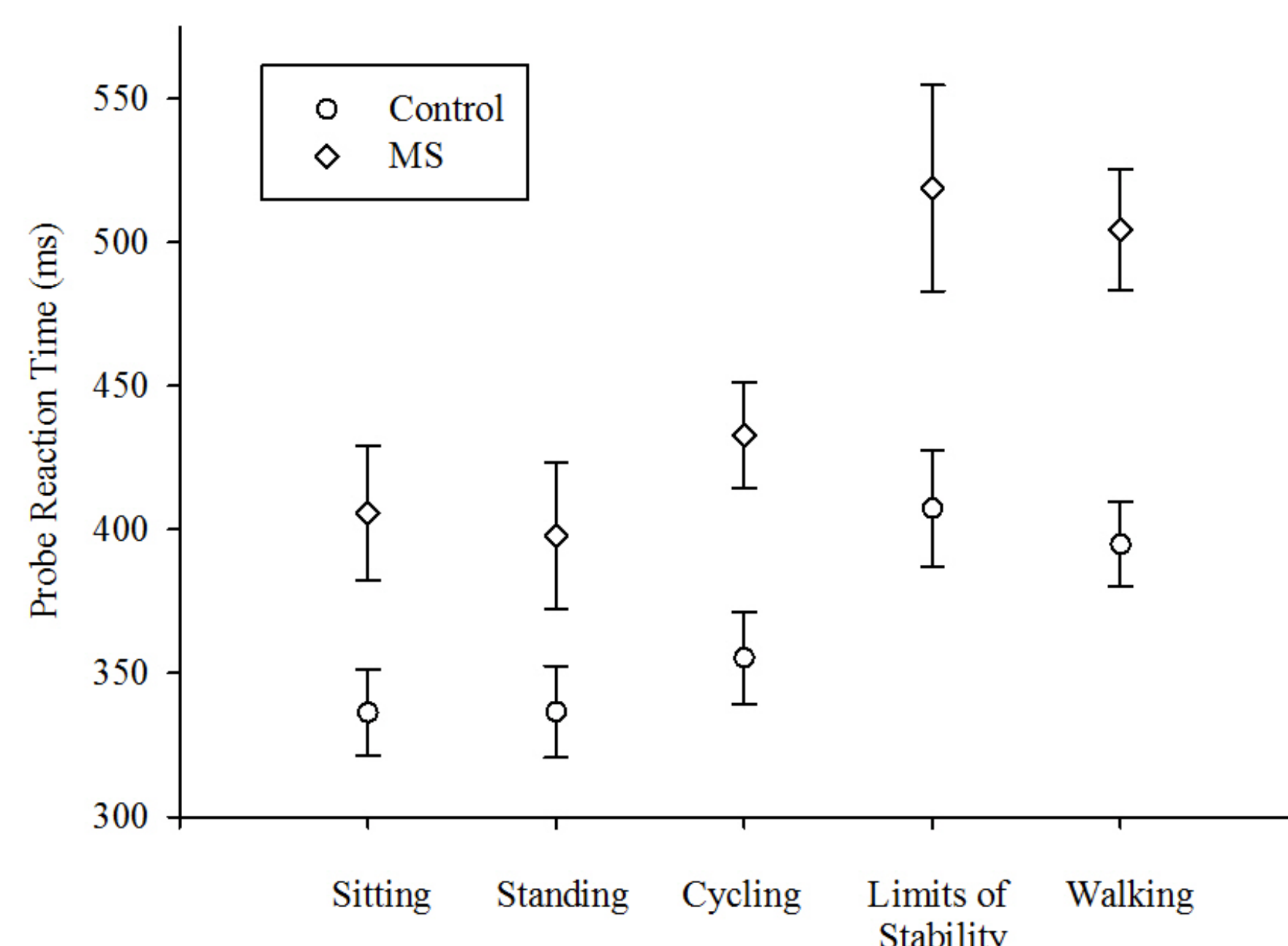
RESULTS

Participant Demographics

	MS	Control
Age (yr)	Mean = 56.4 (SD = 11.0)	Mean = 61.0 (SD = 8.7)
Gender	Female = 12, Male = 8	Female = 17, Male = 9
Years Since Diagnosis	Mean = 16.8 (SD = 8.8)	--
Assistive Device	None = 14, Cane = 6	None = 26
SR-EDSS	Median = 3.5 (IQR = 2.5)	--



- Overall, all participants took significantly longer to respond to the auditory cue during tasks requiring dynamic balance ($F = 33.4, p < 0.001$).



- MS participants had significantly greater probe reaction times compared to control subjects

Correlation Analysis Results

	Standing PRT	Cycling PRT	Limits PRT	Walking PRT
COP Velocity Standing	0.179	--	--	--
Cadence	--	-0.144	--	--
COP Velocity Limits	--	--	-0.032	--
Walking Velocity	--	--	--	-0.257

	Sitting PRT	Standing PRT	Cycling PRT	Limits PRT	Walking PRT
SDMT	-0.209	-0.161	-0.207	-0.142	-0.118
TMT	-0.056	-0.154	-0.207	-0.094	-0.165
PPA	0.344*	0.285	0.302*	0.285	0.346*
FES-I	0.351*	0.244	0.386*	0.259	0.412*

- Examining the correlation between complex DTCs of gait and cognition with PRTs during walking revealed no significant relationship between the outcomes (DTC gait: $p = -0.071, p = 0.65$, DTC cognition: $p = 0.27, p = 0.08$).
- Physiological fall risk status and falls self efficacy were significantly correlated with observed PRTs.

DISCUSSION

- Motor tasks that require dynamic stability (e.g. walking, leaning) potentially require greater attention in health and disability.
- Attentional cost of movement, as measured by PRT, was not related to motor task performance.
- The relationship between PRTs and PPA suggests a potential link between a more global measure of physiological function and PRTs rather than a specific measure
- The link between PRTs and FES-I could indicate that individuals who perceive their risk to be high during movement tasks may shift their attention towards movement and away from cognition during dual task.
- Further research is warranted to analyze the prioritization strategies in persons with MS who have varying levels of disability and self-perceived fall risks.

CONCLUSIONS

- The findings suggest that individuals with MS possibly have reduced movement automaticity and increased attentional costs compared to healthy controls.
- The lack of correlation between PRT and complex dual task performance outcomes, however, points to an inadequacy of simple attentional capacity models alone explaining deficits observed during cognitive-motor interference.

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