Quantitative temporal and spatial measures of gait in older people and neurodegenerative diseases.

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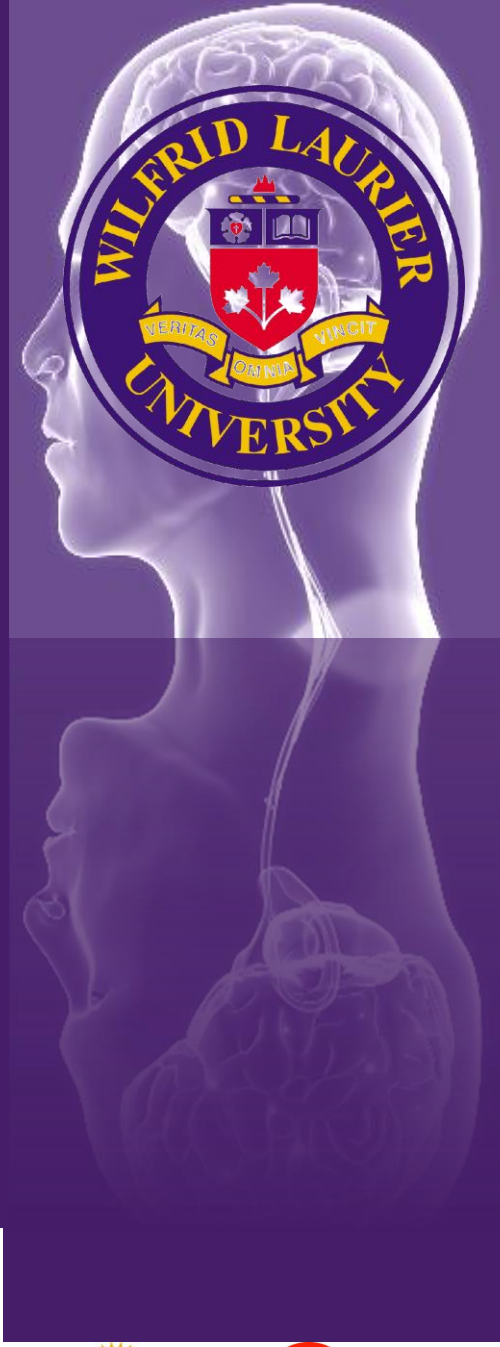

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Outline

- Quantitative measures – commonly used
- Quantitative measures – not so commonly used
  - Differences between older adults vs. neurodegenerative populations
- Are instructions/protocol for tests important?
  - Single or dual task or both?
  - Self-paced or
- Could medications be an important consideration..
- Sensitivity to interventions?

Timing during Gait: Dopamine-Responsive?

Movement Disorders
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Dopaminergic Modulation of Timing Control and Variability in the Gait of Parkinson's Disease

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Abstract: The basal ganglia have been implicated in timing control, yet the nature of timing disturbances in Parkinson's disease (PD) is poorly understood. We evaluated the influence of timing cues on spatiotemporal aspects of gait control and its variability, and the impact of dopaminergic treatment on timing. Three separate groups: 19 PD (OFF state); 24 PD (ON state); and 30 control participants were tested. Participants walked on a computerized carpet at four randomized and metronome-controlled rates: self-paced, 60, 80, or 100 steps/min. To our knowledge, this is the first study to demonstrate that medicated PD patients had poorer timing control than patients withdrawn from medication and healthy participants when modulating timing to an external stimulus. Increased step-to-step timing variability and deficits in mean temporal gait characteristics revealed that the medicated PD group (in contrast to nonmedicated PD group) performed least like healthy participants. This was observable in externally-cued conditions, but *not* during self-paced gait. Similar to previous research, step length contributed to overall slowness in PD, while temporal characteristics of gait did not. Interestingly, healthy participants increased stride length with each increase in cue rate, whereas both PD groups locked their step length regardless of temporal demand. Step-to-step variability differences between PD and healthy (e.g. step and double-support time measurements) may be indicative of specific basal ganglia involvement in temporal control of gait. © 2007 Movement Disorder Society

Key words: basal ganglia; Parkinson's disease; gait; variability; timing

Timing control is worse with meds!

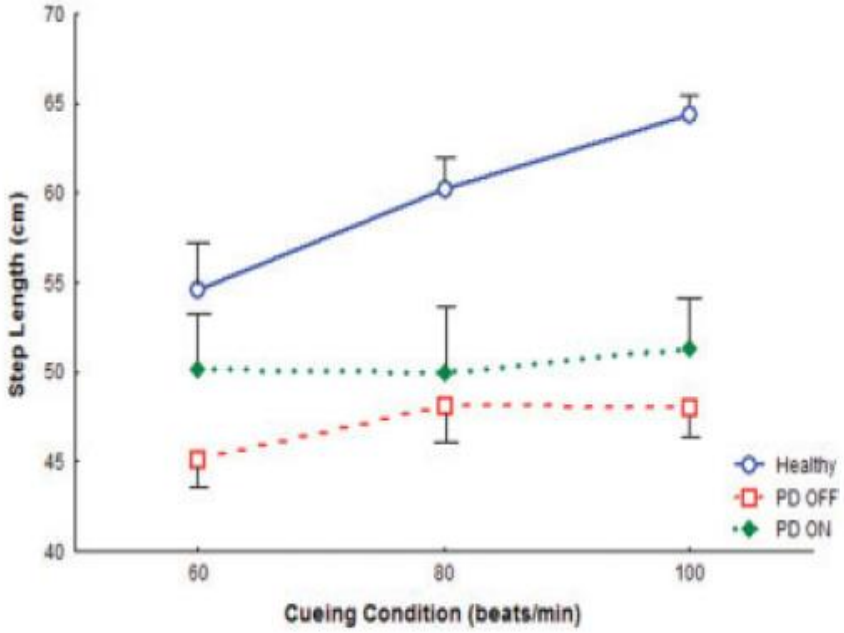
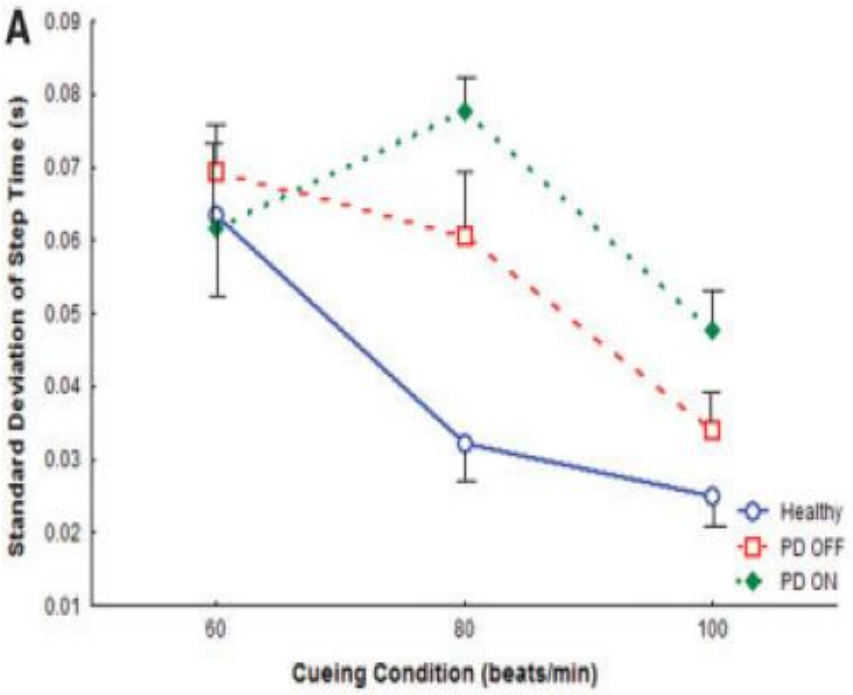
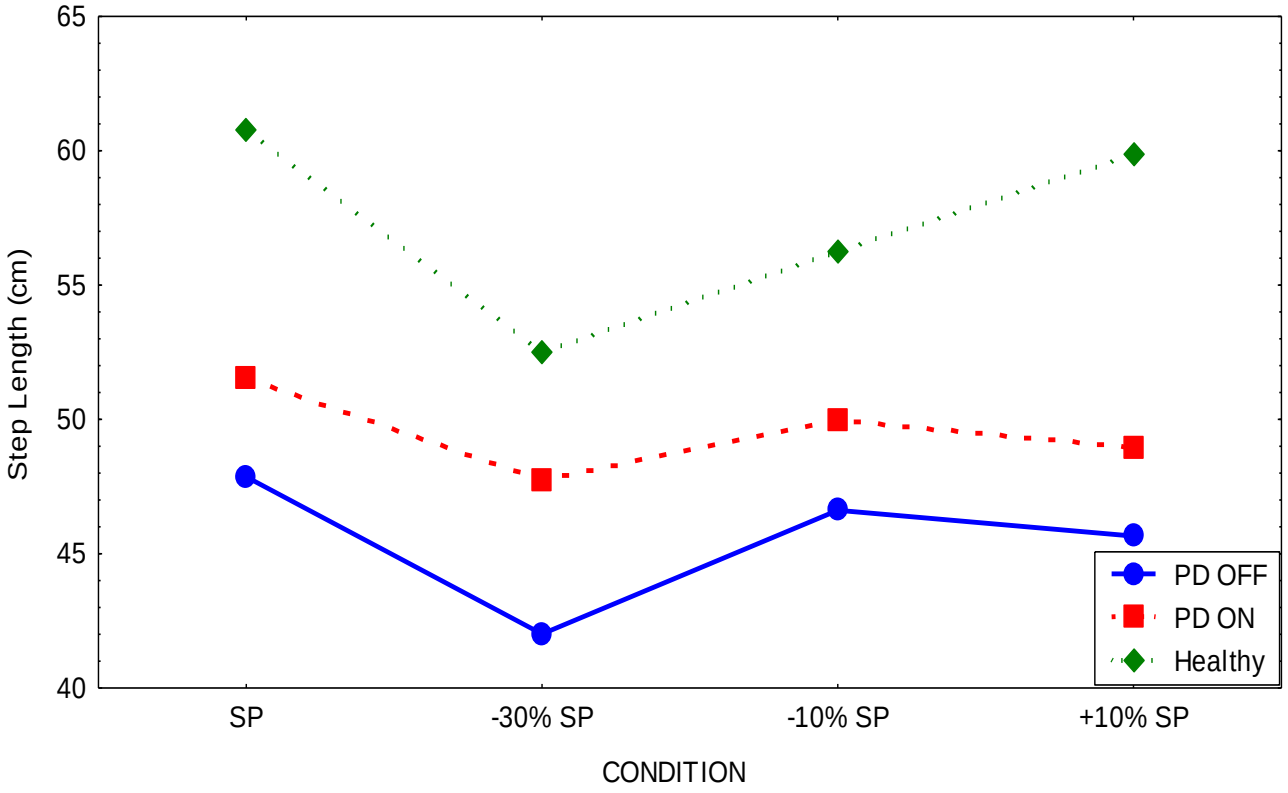


FIG. 2. Externally-paced step length for healthy participants, PD OFF, and ON.



Almeida et al., Movement Disorders 2007

Is timing error a sensory issue?

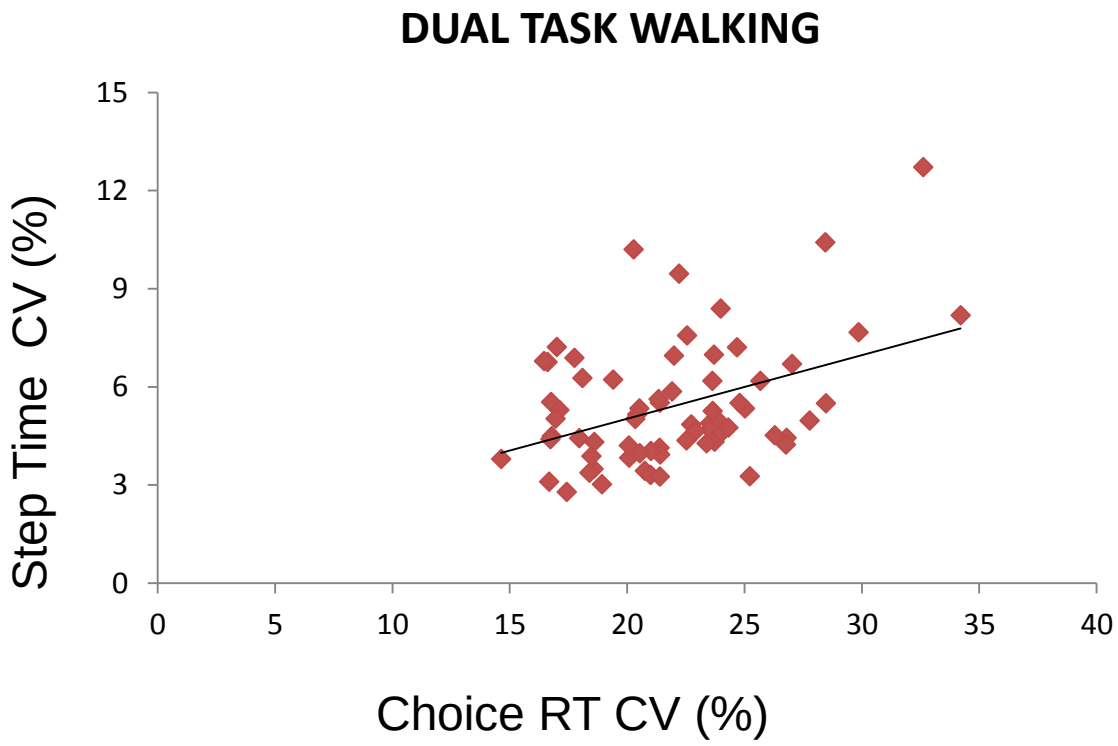


Adapted from Almeida (2012)"Timing control in PD", Mechanisms in Parkinson's Disease; Ed(s): Dushanova., In Tec Publishing.

ISPGR 2015:

Does inconsistency in attentional control predict gait variability in Parkinson's disease?

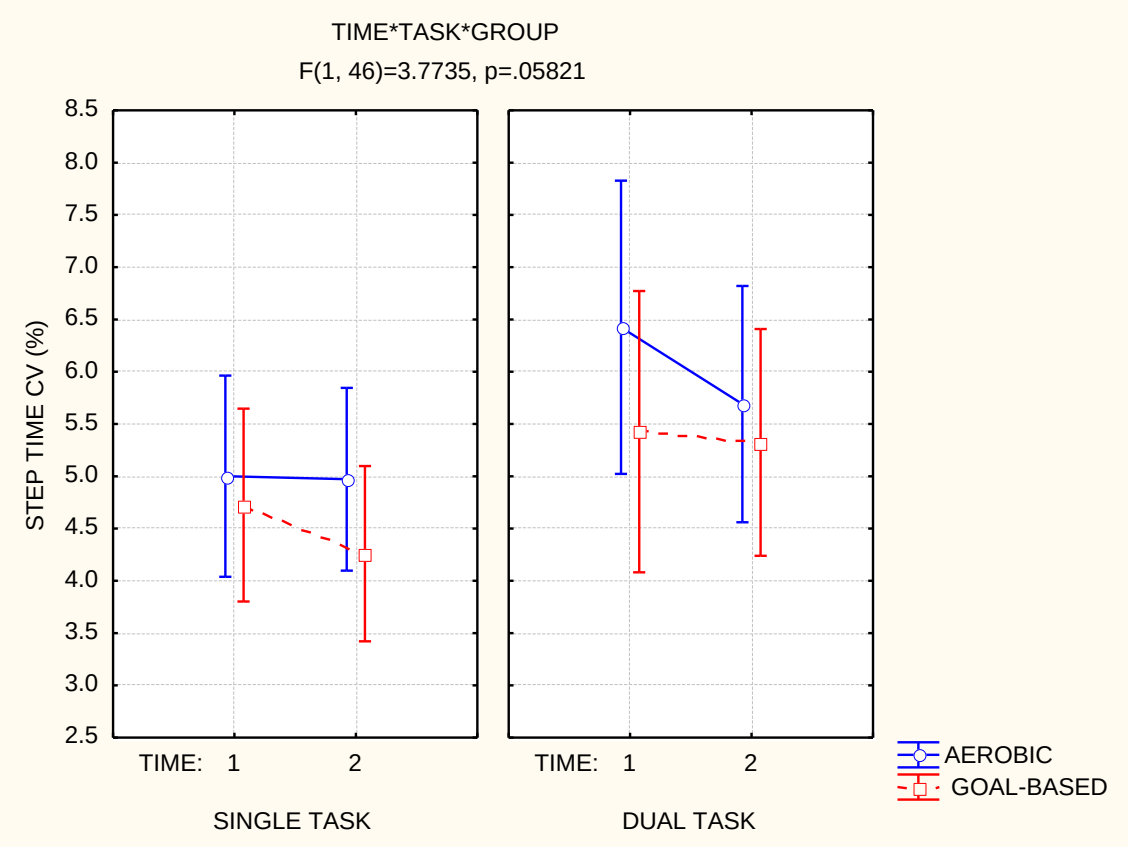
Key results: For **dual task**, variability in choice reaction time was the sole predictor of variability in step length, step time , and stride velocity. **Variability in simple reaction time did not predict gait variability in either single task or dual task walking conditions.**



CGS 2015:

Effects of exercise on cognition in Parkinson's disease: The link between executive functions and gait.

Key result: An interaction between time, walking task, and group for step time variability neared significance (p=0.058), demonstrating that, while goal-based exercise decreased variability in the single task, aerobic exercise decreased variability in the dual-task condition at post-test."



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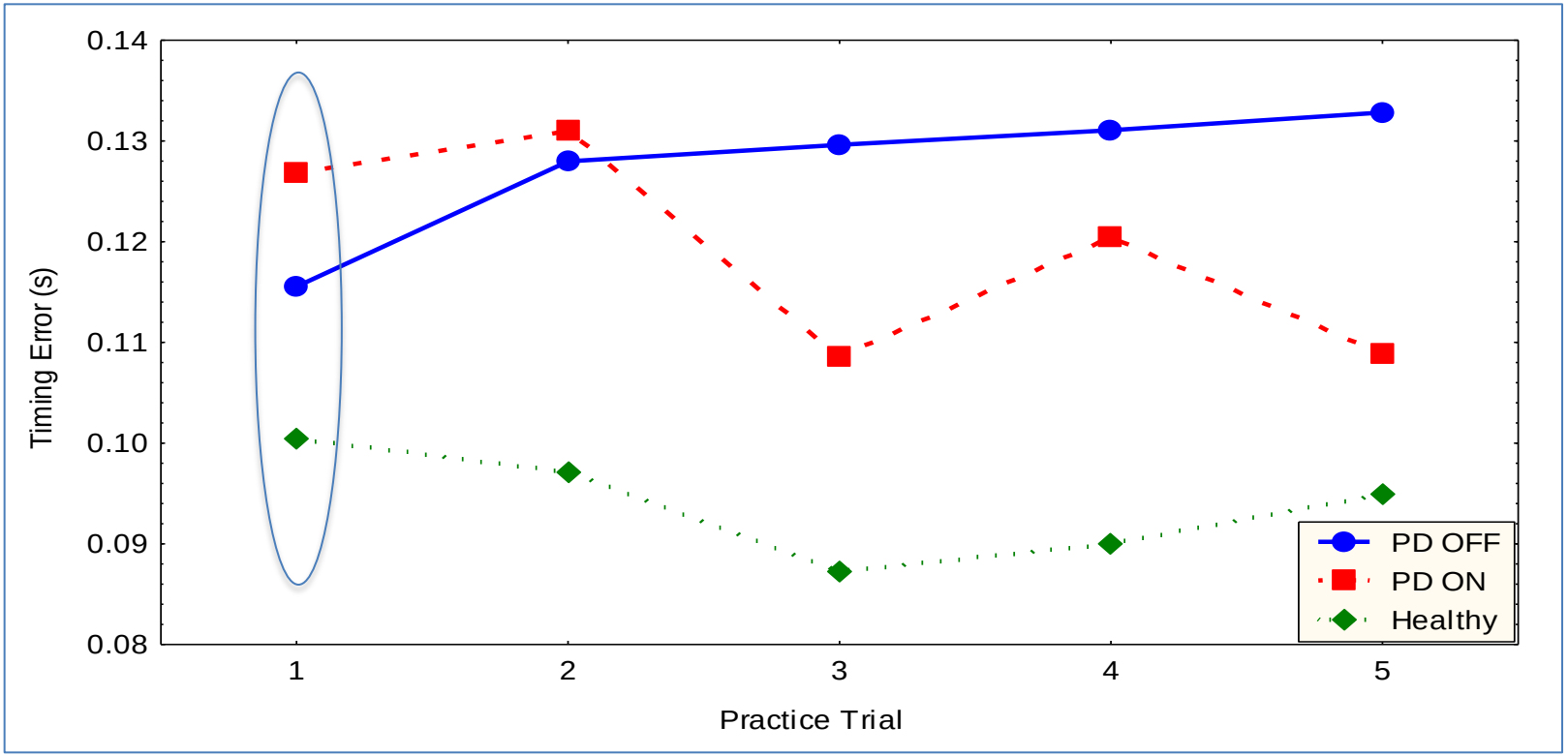

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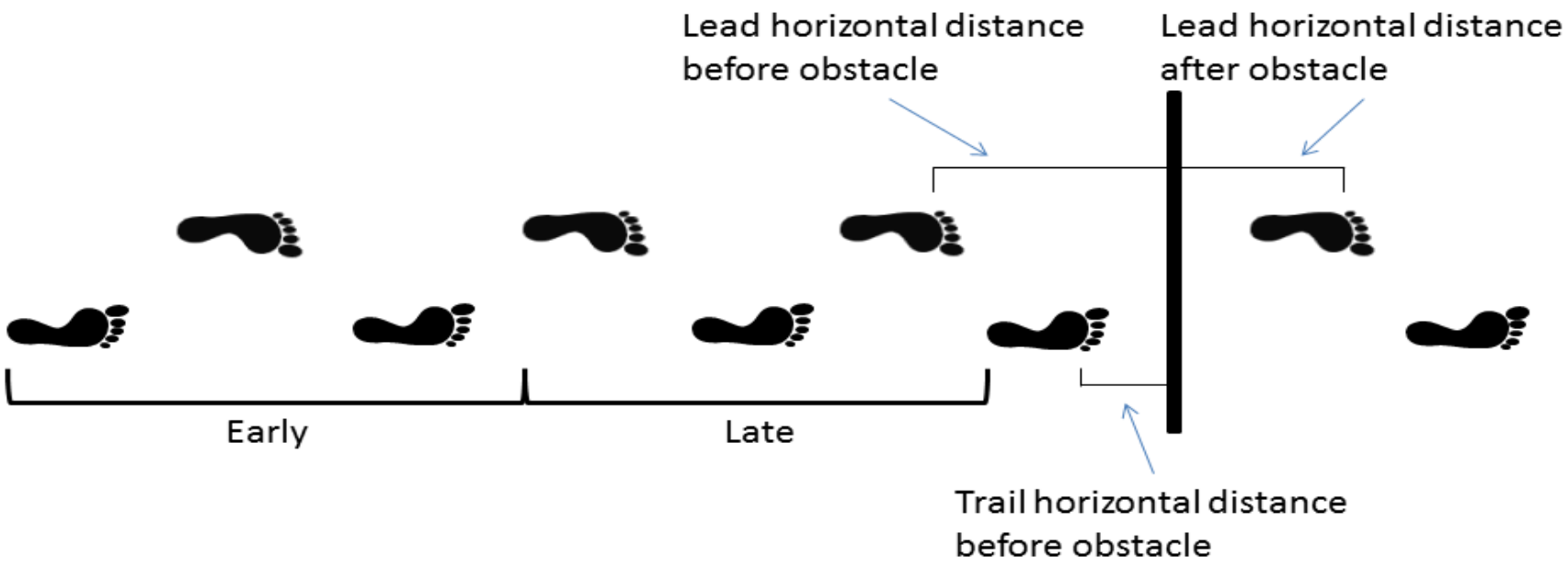
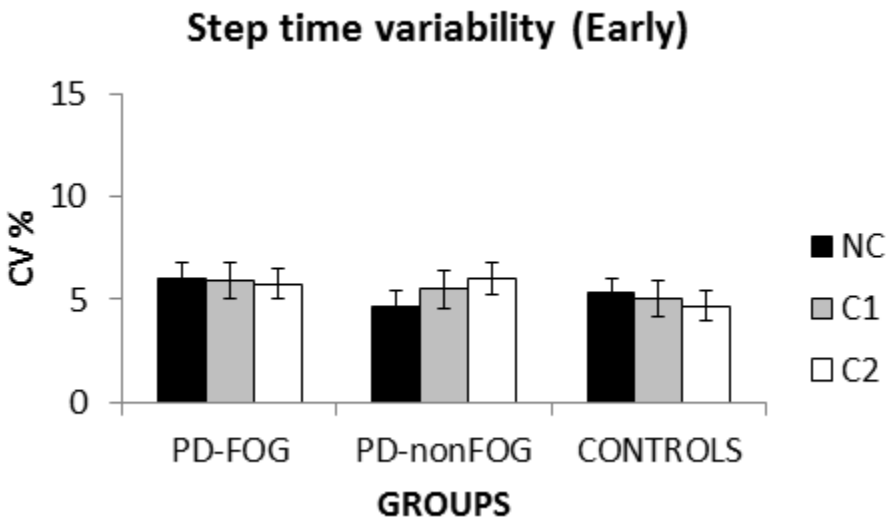
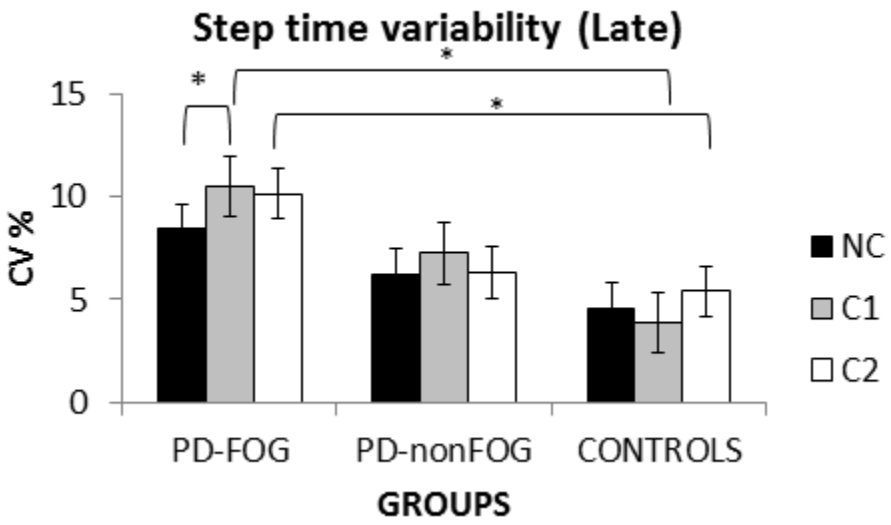


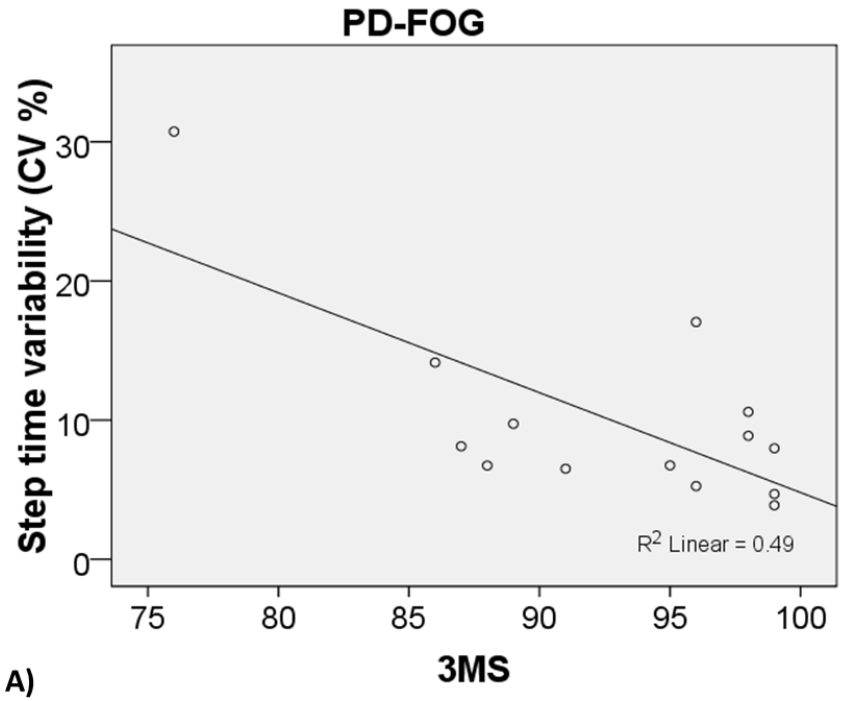
Pieruccini-Faria, Jones & Almeida (2014), *Brain & Cognition*



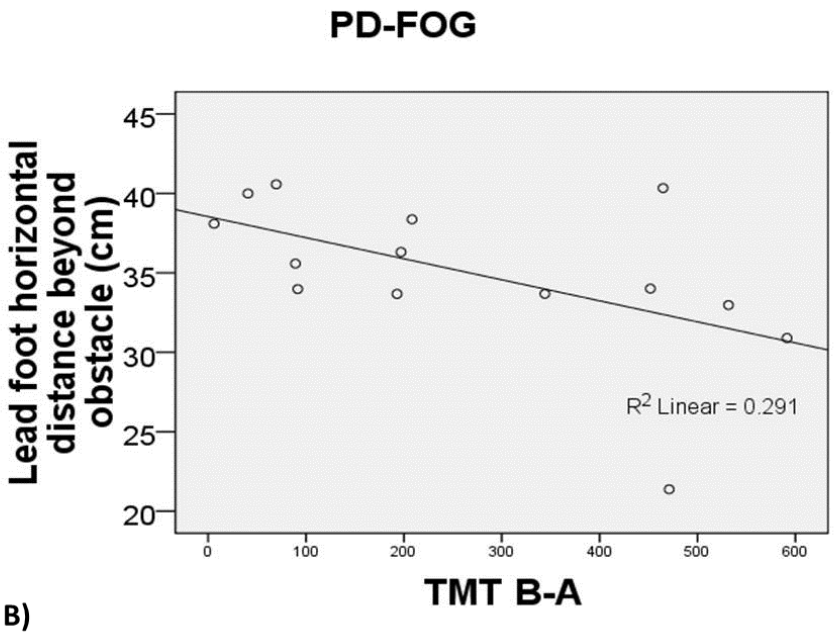


NC = Not counting
C1 = Counting one digit
C2 = Counting two digits

Pieruccini-Faria, Jones & Almeida (2014), *Brain & Cognition*



A)



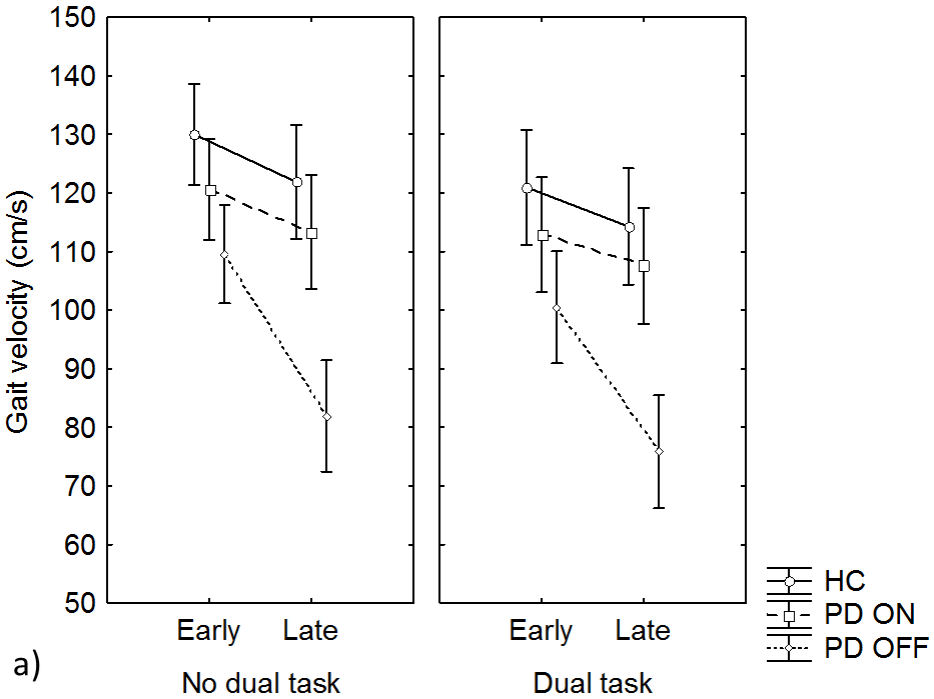
B)

Figures

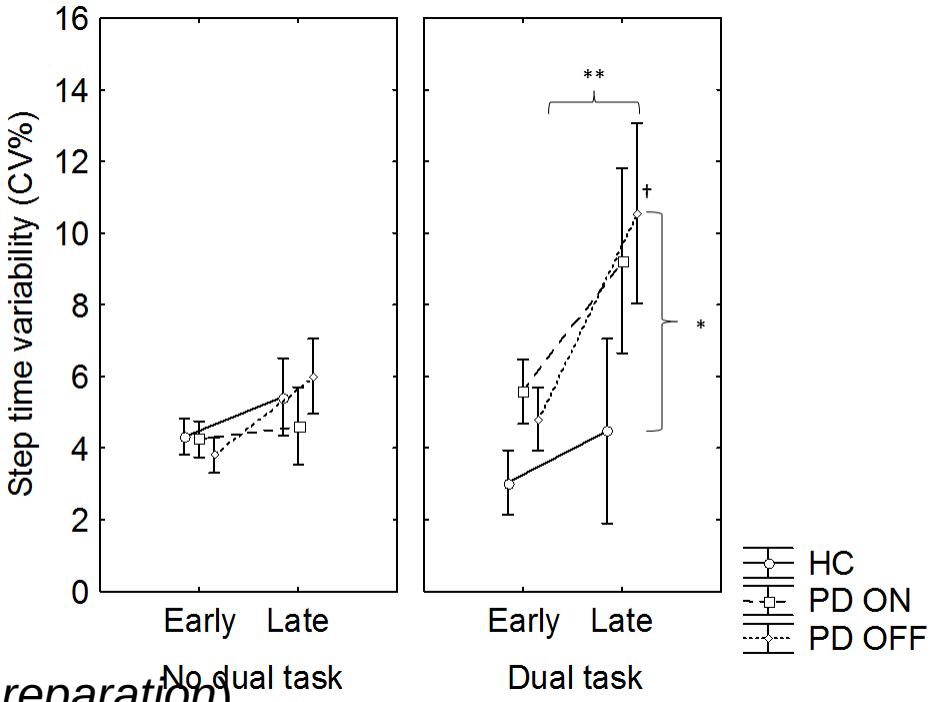
A) Step time variability in the late phase is lower in freezers with better cognitive status;

B) Freezers with preserved executive functions had better planning of foot-obstacle dista

These results are described in our Brain & Cognition (2014) publication. However these graphs were not presented in the paper. These graphs are only presented in my dissertat



a)

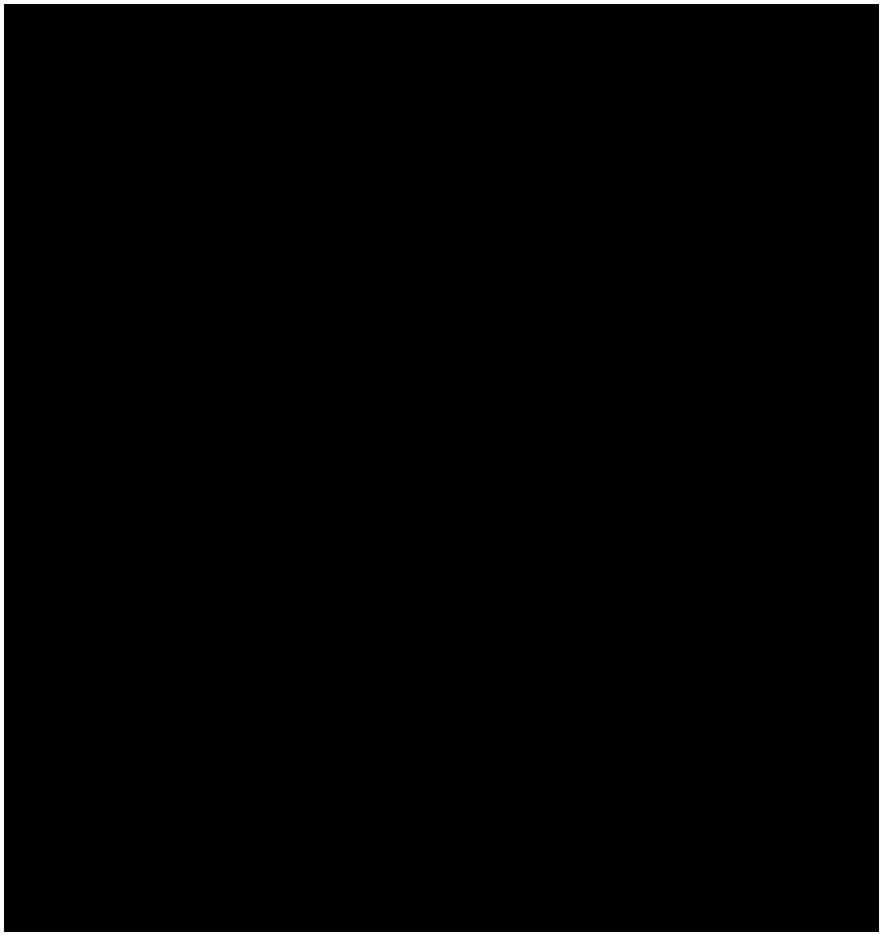


Pieruccini-Faria, Jones & Almeida, 2014 (*in preparation*)

Future directions?

- Only 5 minutes of treatment
- What are the long-term effects of multiple sessions?
- How long does the effect last?
- Are there neurological changes?
    - Need imaging proof

Forced High Frequency Exercise…



- **Forced-Exercise** **(Alberts & colleagues, 2010)**
  - **10 PD per group, forced exercise on tandem bike vs. voluntary biking**
  - **8 weeks, 1 hour sessions x 3/week**
  - **Results showed 30% improvement of symptoms, and 20% after 2 weeks of no exercise**
  - **No gait assessment??**
  - *****Key Rate – 80 to 90BPM, could be done with cycling, treadmill, arm ergometer**

Parkinson's Disease Treatment Thru Exercise and Bicycling at Cleveland Clinic - YouTube.m4v

QUESTIONS?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