# The Effects of a Weighted Pen with a Grip compared to Auditory Cues in Handwriting for Individuals with Parkinson's Disease

Latimer N, Woods G, Zaman A, Stegëmoller E Ph.D.
Department of Kinesiology, Iowa State University

Neurophysiology Lab

ISU Neurophysiology Lab

## INTRODUCTION

- Previous research has demonstrated that auditory cues reduce variability on fine motor tasks, such as finger tapping.
- Weighted pens are commonly used in therapeutic settings to improve handwriting in people with Parkinson's and other populations
- Verbal auditory cues have also been shown to benefit writing in people with Parkinson's disease through lowering variability in cycle time and amplitude.
- There is limited research examining the significance of a weighted pen with a grip and handwriting variability.

## PURPOSE

- We **aim** to determine how a weighted pen with a grip will affect variability in fine motor tasks, such as handwriting.
- We **hypothesize** that the use of a weighted pen will decrease variability in peak acceleration and movement time during handwriting when compared to a writing with a standard ballpoint pen with auditory cues.

## PARTICIPANT DEMOGRAPHICS

| N | 6 |
|---|---|
| Age (Mean ± SD) | 65 + |
| Female (%) | 50 |
| Right-handed (%) | 100 |
| Caucasian (%) | 100 |

**Table 1.** Participant demographics

## METHODOLOGY

**Experimental Setup**

- Participants used a standard ballpoint pen with an electromagnetic sensor attached.
- The electromagnetic position collecting sensor was placed directly in front of the paper.
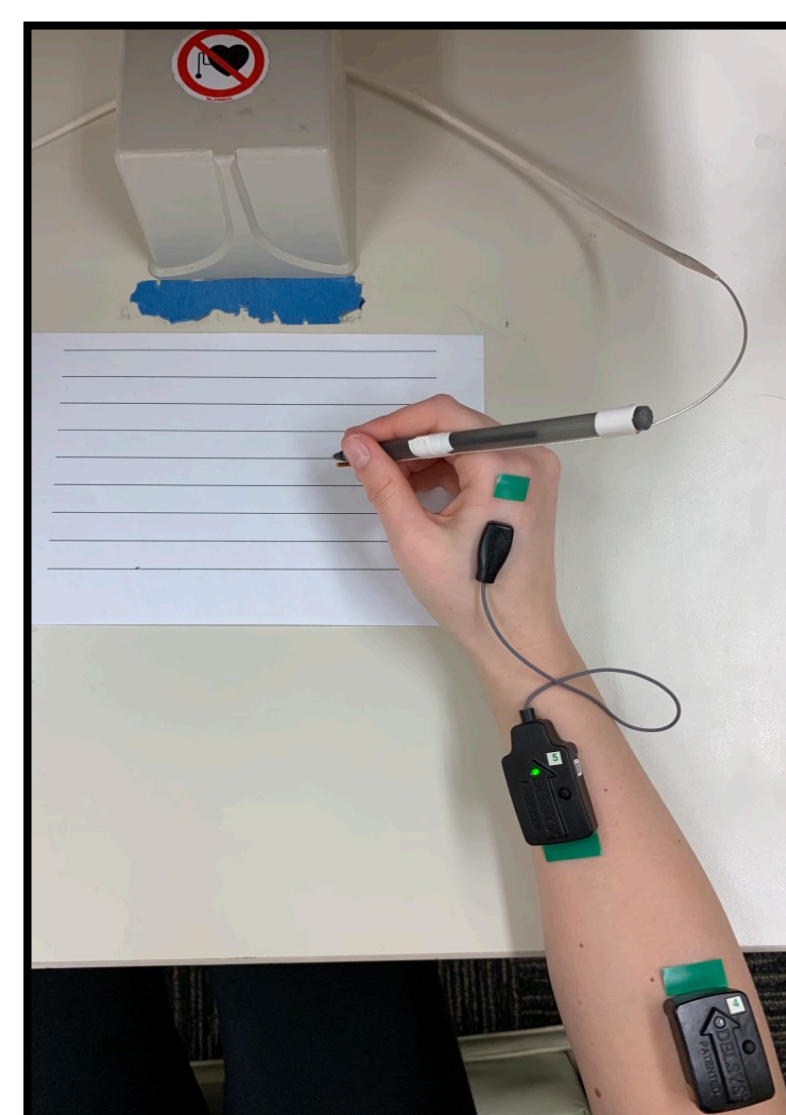- The software Motion Monitor was used to measure electromagnetic sensor activity.

**Figure 1.**
Experimental setup

## METHODOLOGY (CONT.)

**Data Collection**

- Participants were asked to write continuous, lowercase cursive L's on a 1.5 cm lined paper (Figure 2).
- Participants were given an optional practice trial.
- Each condition was completed 3 times for a total of 9 trials.
- The same randomization order was used for the weighted pen.
- Participants were randomly assigned the order of one of the 3 conditions.
  - No Music with Normal Pen(Control)
  - Activating Music with Normal Pen
  - No Music with Weighted Pen
- Each participant's self-pace was calculated during their first control trial and used in subsequent conditions.
- The software Pitch Switch was used to accommodate each participant's self-pace handwriting.
- Participants had ten seconds to complete each trial.
- The subjects began listening to the designated auditory cue for 5 seconds prior to beginning the writing task.
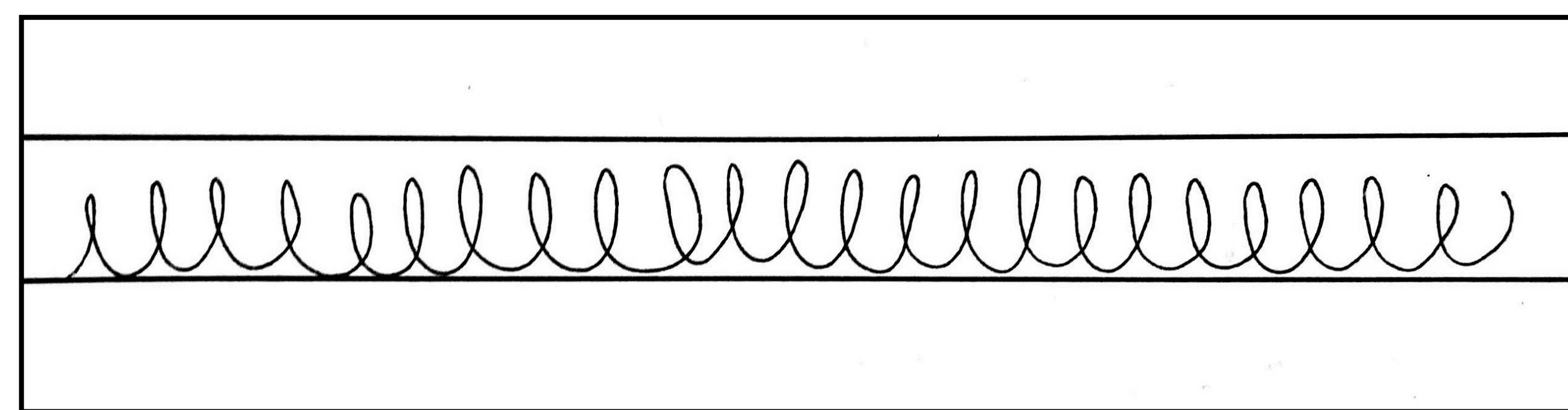
**Figure 2.**
Example of participant handwriting

**Outcome Measures**

- Coefficient of variation for time between letters
- Coefficient of variation for peak acceleration

**Data Analysis**

- Kinematic variability was measured and analyzed through recording the time and peak acceleration of written "L"s.
- Coefficient of variation is the standard deviation divided by sample mean.
- A four-way repeated measures ANOVA was used to compare outcome measures in each condition.
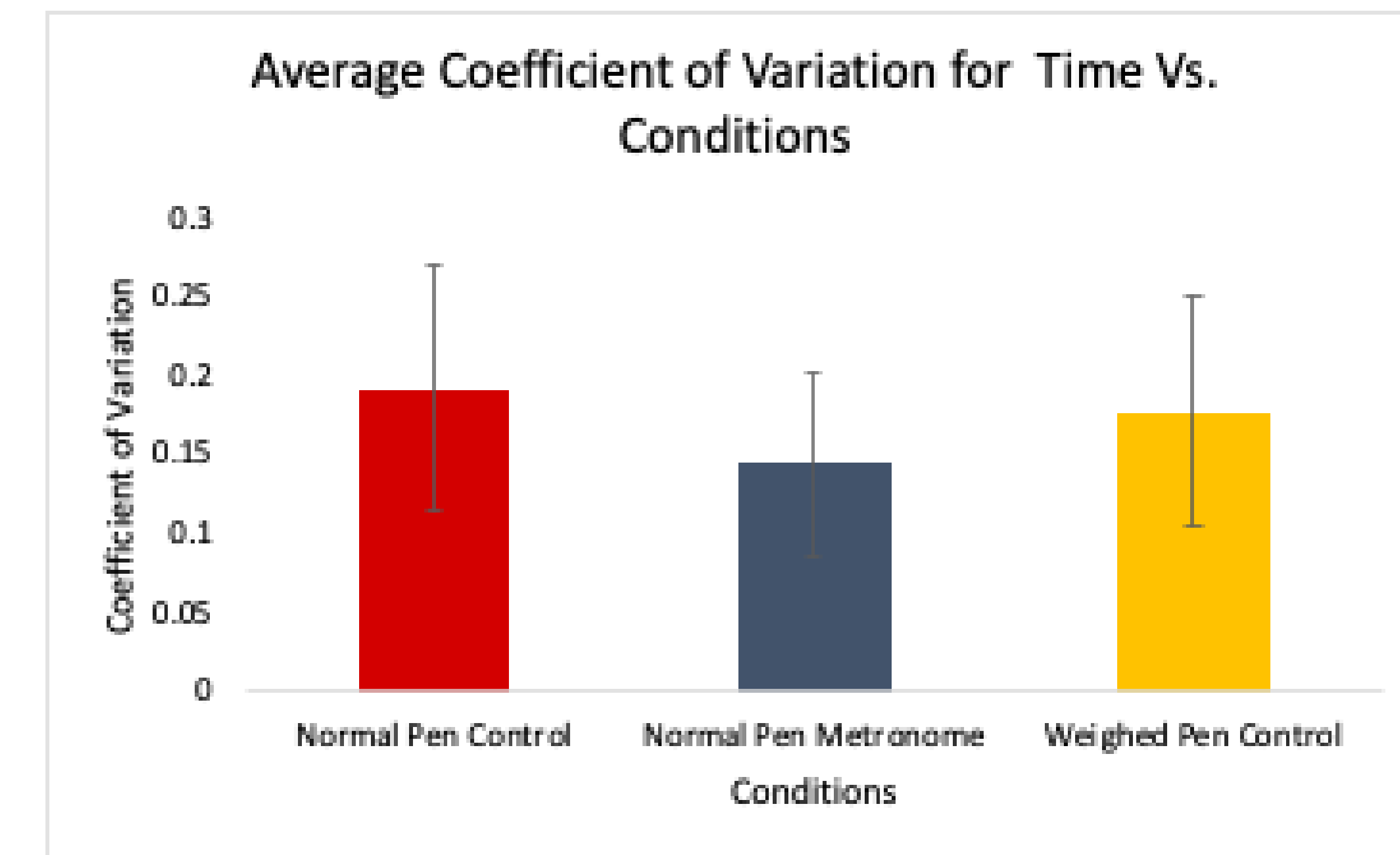- Significance was set at $\alpha = 0.05$.

## RESULTS

**Figure 3:** Coefficient of variation for time between letters

In the figure above, the lines show the coefficient of variation for time between letters. The normal pen with a metronome showed the lowest variability in time between letters, which does not support our hypothesis.
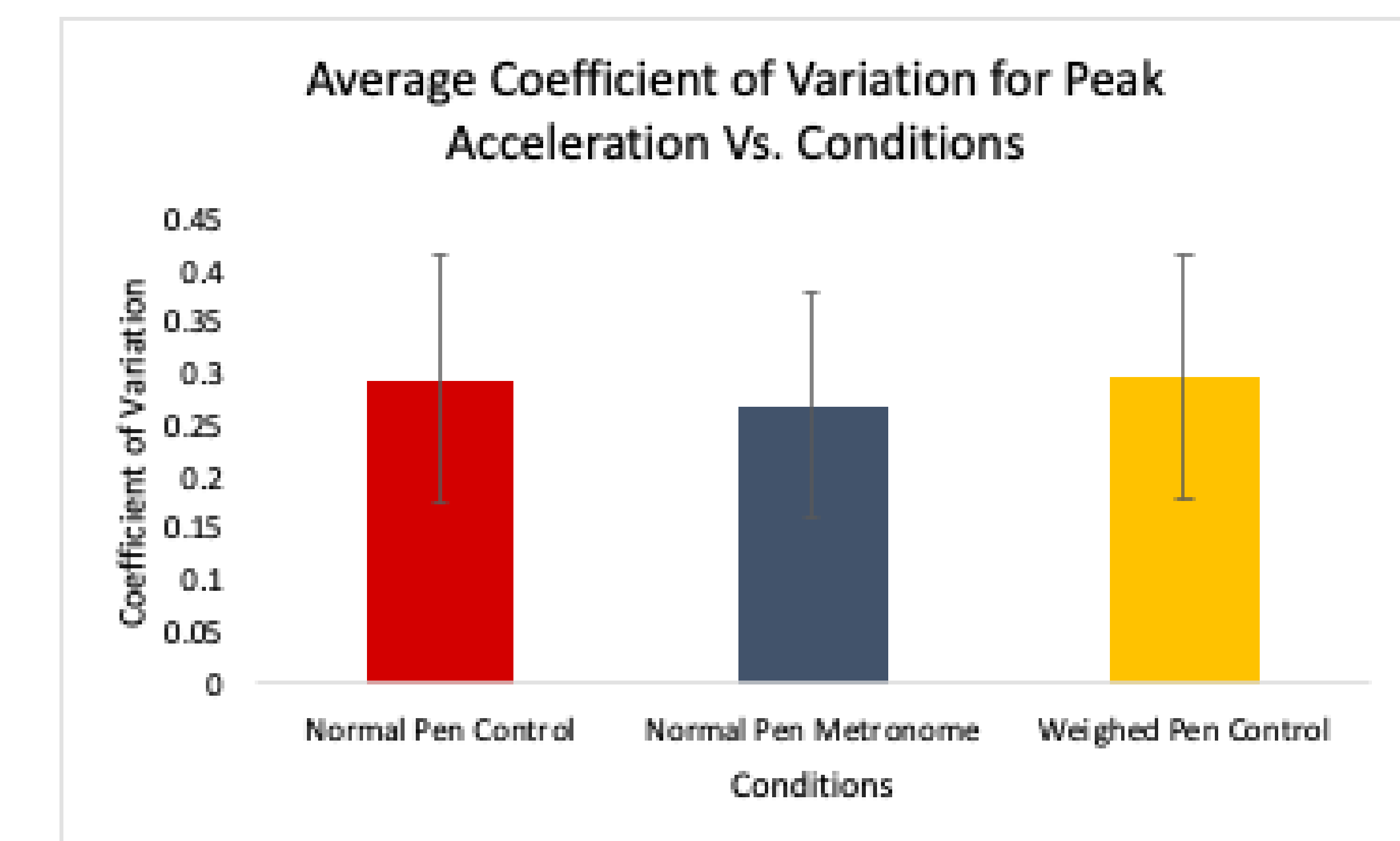
**Figure 4:** Coefficient of variation for peak acceleration

In the figure above, the lines show coefficient of variation for peak acceleration. Our normal pen with a metronome showed that the cursive "L"'s were more consistent, which does not support our hypothesis.

## DISCUSSION

- Results suggest that the normal pen with a metronome showed the lowest variability in movement time and peak acceleration, compared to the weighted pen which does not support our hypothesis.
- We had a small sample size with limited diversity, however, the trends offer insight for further research.
- Future directions include collecting on healthy older adults.
- Further research studies will be conducted on persons with Parkinson's disease to examine strategies for improving handwriting impairment in this population.