

EFFECTS OF VISUAL AND SPLIT BELT DISTORTION ON GAIT ADAPTATION

Jason Zhang, Biomedical Engineering BSE

Mentor: Hyunglae Lee, Assistant Professor

School for Engineering of Matter, Transport, and Energy

Research Question

Does split-belt distortion produce a more effective method of rehabilitation in combination with visual feedback?

In the United States, **stroke** and other forms of brain trauma form a significant portion of those suffering from physically limiting disabilities. Eng, J. J., & Tang, P. F. 2007 found that stroke was “**a leading cause of long-term disability.**” Stroke leads to muscle weakness and gait impairment. With regards to regaining walking proficiency, **current rehabilitation** involves motor-skill, range of motion, and mobility training. The use of **treadmills** forms a large portion of the rehabilitation.

The specific aims of this research are to perform human trials with an updated treadmill system designed to model gait cycles to examine the **combined effect of (1) visual (VD) and (2) split-belt (SB) distortion** on gait adaptation.

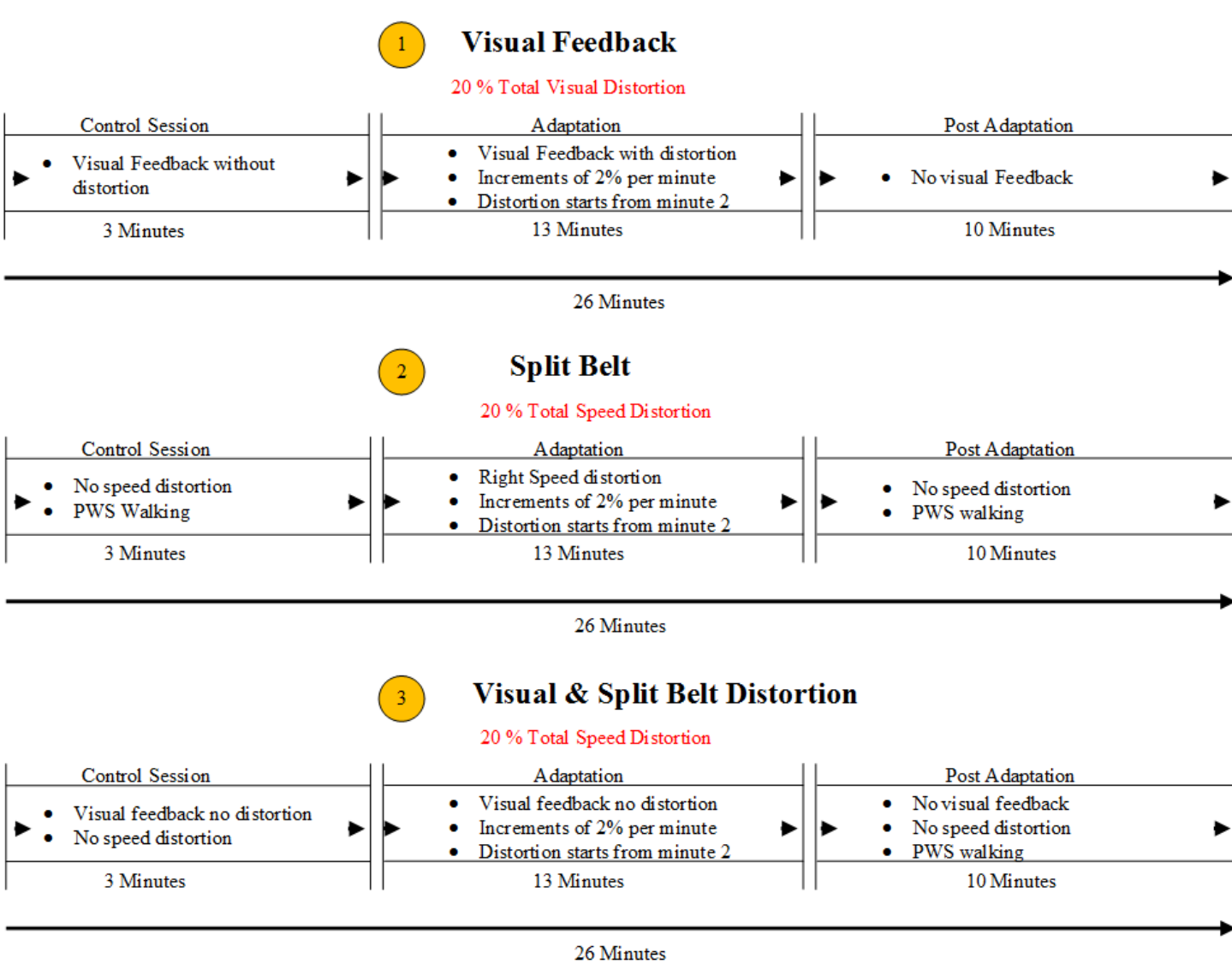


Figure 1. Experimental protocol above and experimental setup on the right

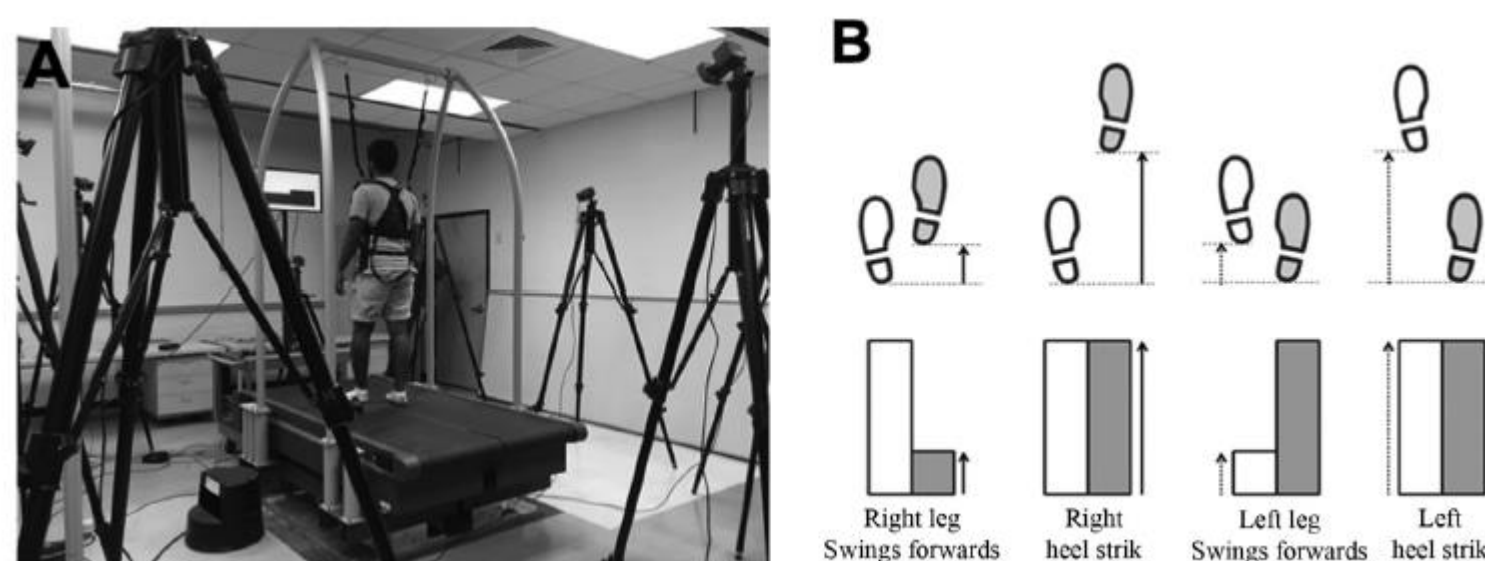


Figure 2. SB replication on the top, VD replication in the middle, and VFSB results on the bottom

Results

- Initial replication of VD and SB studies show similar replication to previous studies
- Strong correlation between the commanded distortion level and step symmetry
- Preliminary understanding of swing time patterns
- Small number of samples rules out group analysis
- Current Status: implementation of split belt distortion with visual feedback (no distortion)

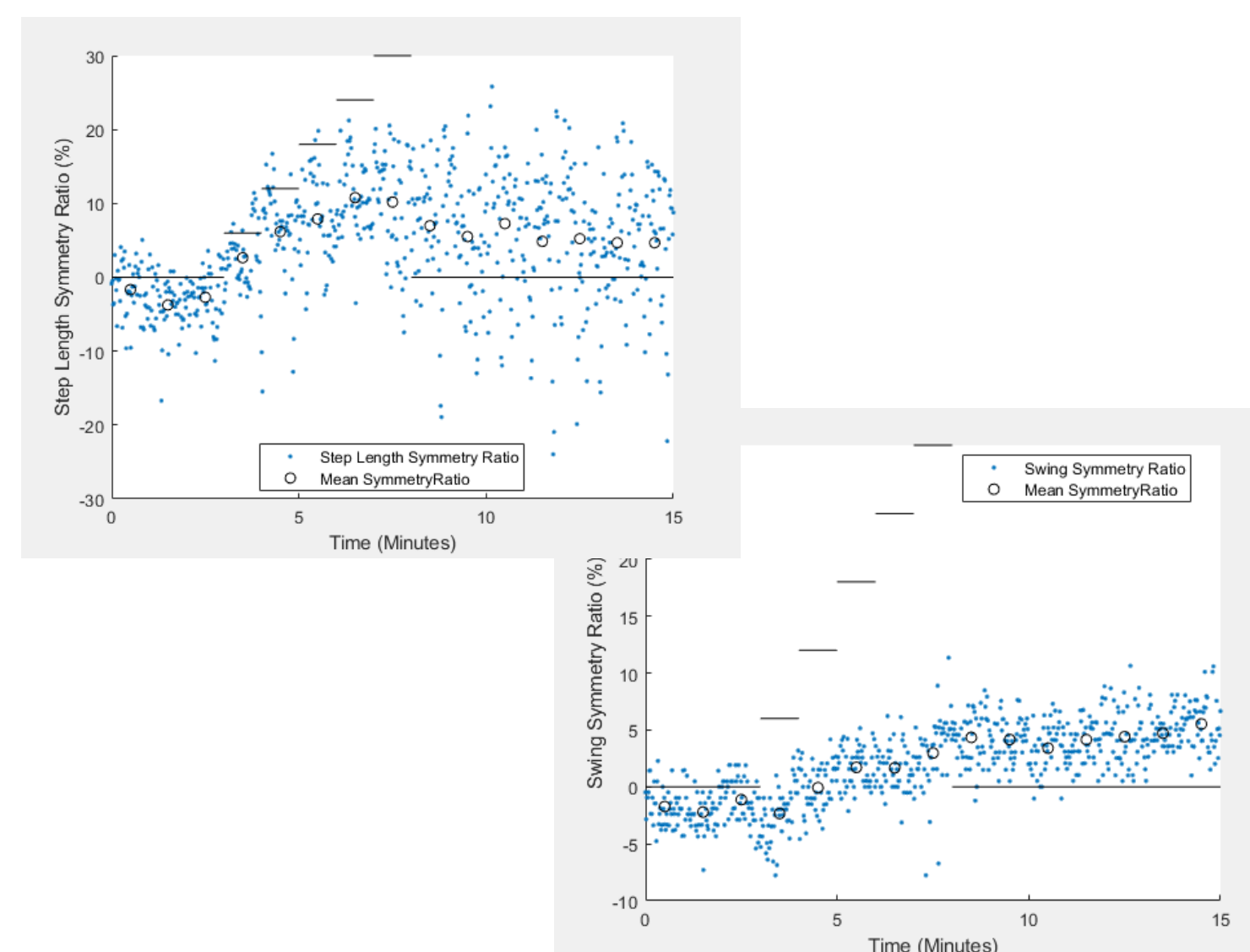


Figure 3. Step length (top) and swing time (bottom) symmetry for SB130

Swing Time Symmetry

Step length symmetry is a *spatial* measure of step symmetry, while swing time is a *temporal* measure.

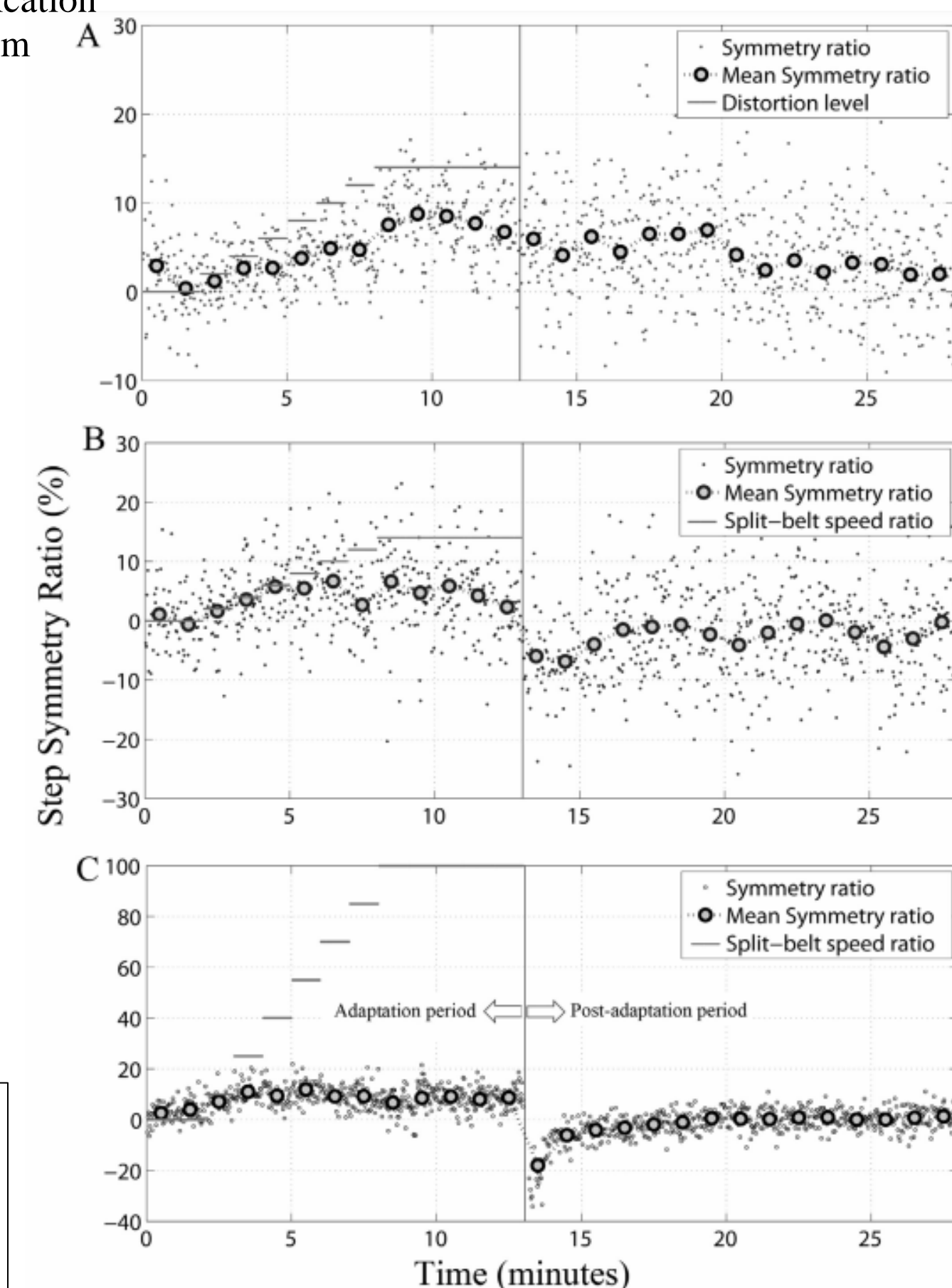


Figure 4. Results from previous study (A: VD114, B: SB114, C: SB120)

Approach

Aim: Perform human trials to examine the combined effect of VD and SB on gait adaptation and their neurological impact.

- Develop experimental protocol in preparation for human trials and get IRB approval
- Find participants for research study and record GRF and marker data from participants
- Analyze GRF and marker data to determine step symmetry
- Use statistical models to determine the impact of VD and SB on gait adaptation

- All subjects were attached to a safety harness and asked to walk on a Bertec split-belt treadmill
- 8 infrared cameras (250 Hz) as well as 16 marker sensors were strategically placed to capture movement and graphically produce step-length measurements through MATLAB

Conclusion

Although the results show support for the hypothesis, focus will be on replication of the previous representative studies. Further analysis will be necessary to identify the pattern for swing time symmetry in relation to distortion levels. Going forward, work will focus on initial replication with visual feedback (no distortion) and subsequently conducting enough trials for group analysis.

Acknowledgements

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