

Fall 2018

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Recommended Citation

Mickelson, Connor; Cooke, Morgan; Friend, Mercedes; and Shellooe, Laura, "Exploration of a Novel Approach to Measure Brain Smudging in Dancers" (2018). *Physical Therapy Research Symposium*. 46.
<https://soundideas.pugetsound.edu/ptsymposium/46>

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Exploration of a Novel Approach to Measure Brain Smudging in Dancers

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Introduction

The specific physical, mental, and emotional demands of dancers' careers put constant strain on their bodies to perform at the level required and can lead to injury or a higher risk for reinjury.^{1,2,3,4} Traditional interventions often do not address **central consequences of injury on the body**, such as motor cortex reorganization, also known as brain smudging.^{5,6} These brain changes may lead to longer rehabilitation times and greater chance for future injury. By recognizing brain changes earlier, **intervention can be tailored to address these deficits** as part of a comprehensive rehabilitation program. The degree of brain smudging that occurs in injured dancers is currently unknown. Ability to discriminate between right and left sides of the body has been proposed as a **means of measuring this smudging**.^{7,8,9,10}



Figure 1. Alvin Ailey American Dance Theater dancers showcasing the type of high energy movement that requires precision and care to prevent injury. Photo by Andrew Eccles.

THE OBJECTIVE: Obtain baseline accuracy measurements of right/left discrimination in actively performing dancers without performance-inhibiting injuries.*

THE PURPOSE: Gather data that can be used in future studies to expand understanding of brain smudging in dancers.

*Study protocol was approved through the University of Puget Sound Institutional Review Board. Participation was completely voluntary and informed consent was obtained prior to testing.

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Financial Disclosures: Karin Steere, Morgan Cooke, Mercedes Friend, Connor Mickelson and Laura Shellooe have no financial disclosures that would be a potential conflict of interest with this presentation.

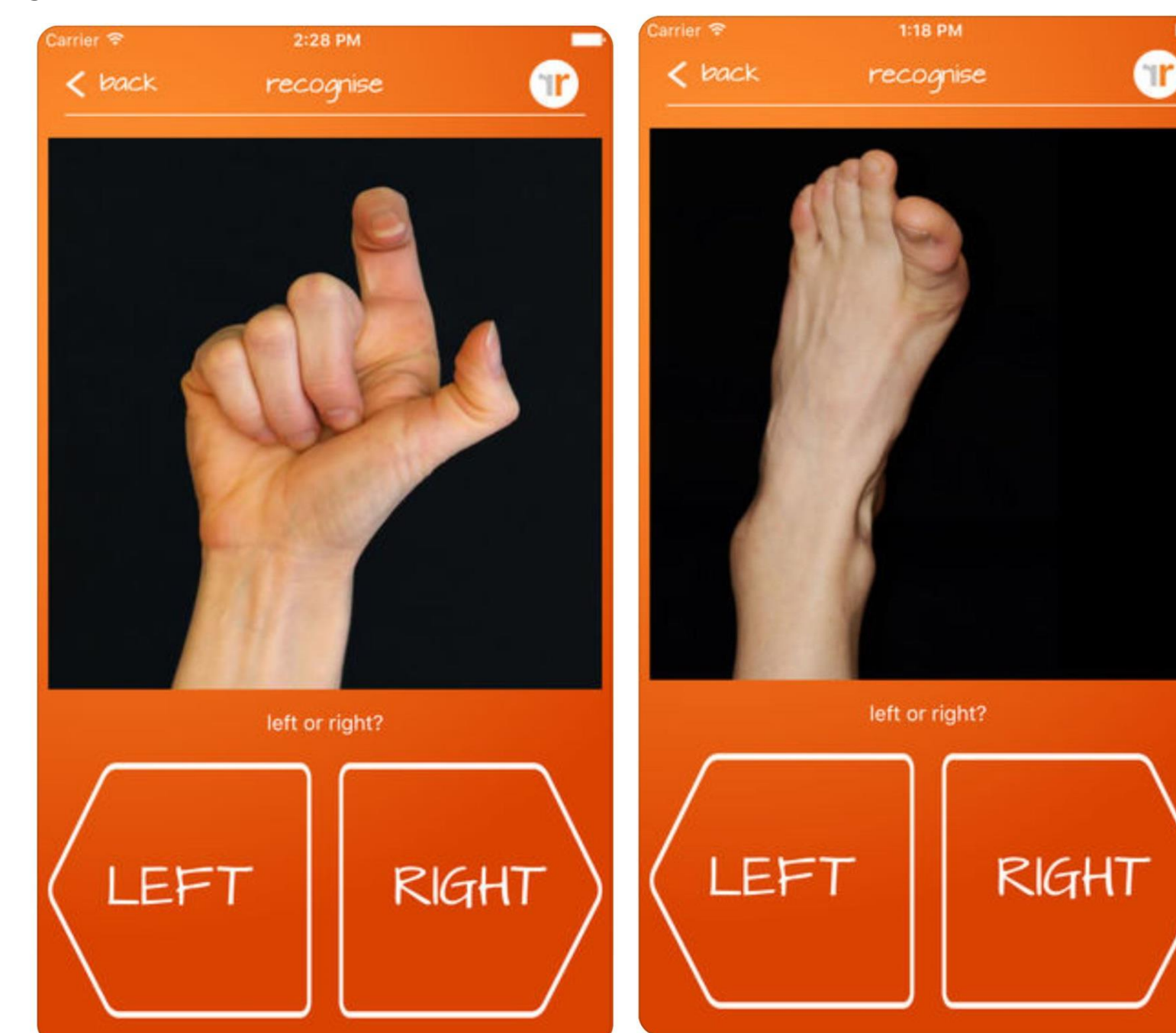
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Methods

Data Collection:

- 22 dancers from 2 local professional dance organizations (rehearsing >20hrs/wk, actively performing without performance-inhibiting injuries)
- 2 short laterality tests were administered via iPad applications to test discrimination between right and left hands in Recognise Hand™, and between right and left feet in Recognise Foot™¹⁰
- 20 images in each game with 2 seconds/image
- iPad games were completed within dancers' respective facilities before dance rehearsals and accuracy scores recorded

Figure 2. Recognise Hand™ (left) and Recognise Foot™ (right) applications.¹⁰



Data Analysis: Means and standard deviations calculated with IBM® SPSS Version 25

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Results

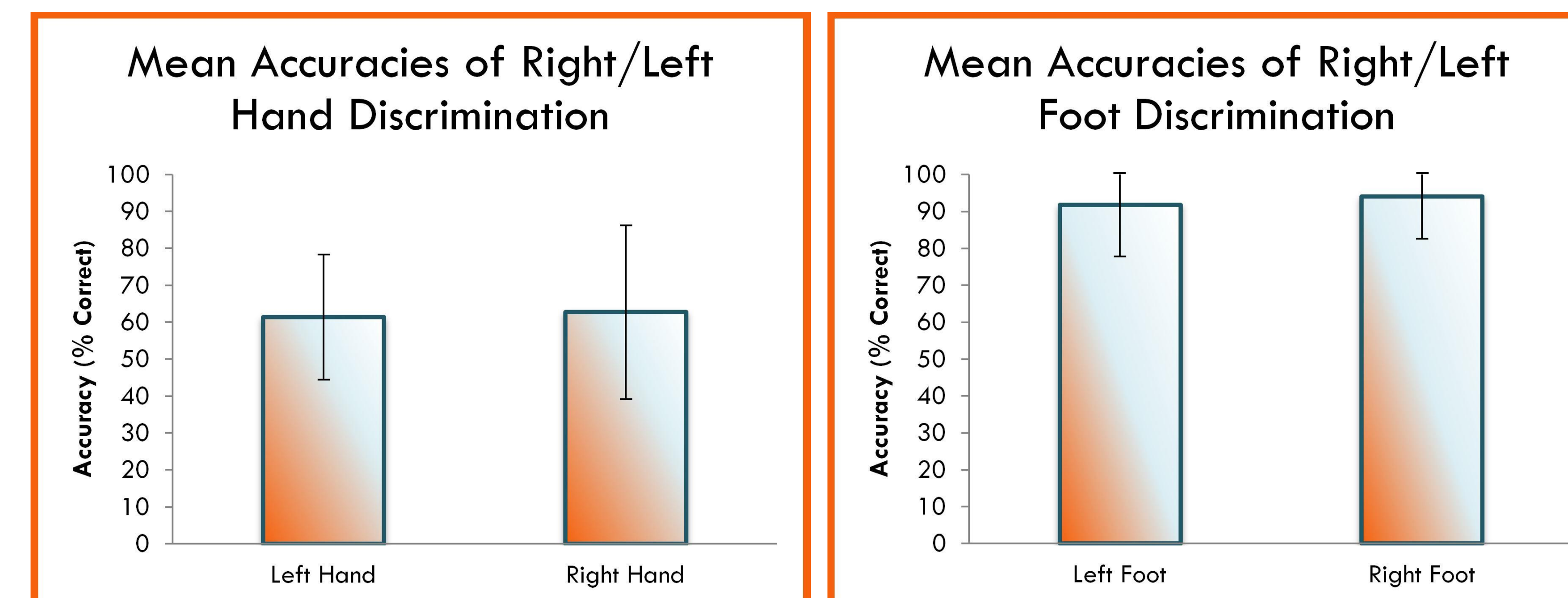


Figure 3. Mean accuracy data from right/left discrimination of hands (left) and feet (right) as follows: right hand was 62.73 (SD=23.53), left hand was 61.36 (SD=16.99), right foot was 94.09 (SD=11.41) and left foot was 91.82 (SD=14.02).

Acknowledgements: This research was supported in part by the UPS School of Physical Therapy, the UPS University Enrichment Committee and UPS Student Physical Therapy Association.

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Discussion

Accuracy values are higher for right/left discrimination of feet than of hands (Figure 3)

- Heavier workload is typically placed on the lower extremities in dancers^{1,2}
- Increased dexterity of hands may add a level of complexity to the hand images
- Scores may be predictive of brain smudging and increased risk of future injury



Figure 4. The majority of dance emphasizes strength and articulation of feet, such as in pointe dancing. Photo of an American Ballet Theatre principal dancer by NYC Dance Project.

Further research is needed to establish scores for dancers with current performance-inhibiting injuries

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Clinical Relevance

Currently, there are few noninvasive ways to measure cortical reorganization. **The Recognise™ applications may provide a quick, noninvasive mechanism for measuring these neuroplastic changes.** The baseline data gathered in this study may be used to support future research studying brain smudging in dancers to allow for earlier intervention, shorter rehabilitation duration, and decreased risk of reinjury.

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