

**19^e Symposium scientifique
sur l'incapacité visuelle
et la réadaptation**

The Influence of Fixation Stability on Posture and Balance in Central Vision Loss

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Symposium organisé par l'Institut Nazareth et Louis-Braille du CISSS de la Montérégie-Centre
et par l'École d'optométrie de l'Université de Montréal, Montréal, 13 février 2018.

Introduction

- Poor balance and posture can lead to falls
- 1/3 of individuals aged 65+ fall each year
- In 2012, medical costs for falls among older adults cost approximately \$30 billion and is expected to more than double by 2020.



(Zhang et al., 2015)

Vision: The Most Overlooked Factor

- Often forgotten when considering effect on balance because changes are progressive and slow
- Research has shown that visual impaired people (VIPs) have trouble with balance and older adults show greater visual sensitivity in postural control compared to younger adults.

What About Fixation Stability?

- When attempting to fixate on a target, eyes are not completely static
 - Tremors
 - Drift
 - Saccades
- For those with normal vision, those movements are small in magnitude, keeping the fovea on target
- VIPs with central vision loss often compensate by using their peripheral retina
- This can result in non-central, often unstable fixation

Methods: Part I

- Participants (N=44)
 - ▶ Age: 50-89 years
 - ▶ Central vision loss
 - ▶ Visual Acuity 20/200 or better
- Divided into two groups
 - ▶ Stable Fixation
 - ▶ Unstable Fixation
- ETDRS Visual Acuity
- Mirametrix Eye Tracker
- Timed Up-and-Go
- Activities-specific Balance Confidence (ABC) Scale

Results I: Timed Up-and-Go (TUG)

- Performance on the TUG was significantly different between groups, with the unstable fixation group having a slower TUG time.
- Clinically, taking longer than 12 seconds to complete the task indicates an increased risk of falls
- The poor-fixation stability group had a mean score of 14.3 seconds



Results I: ABC Scale

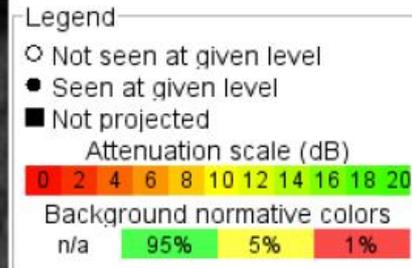
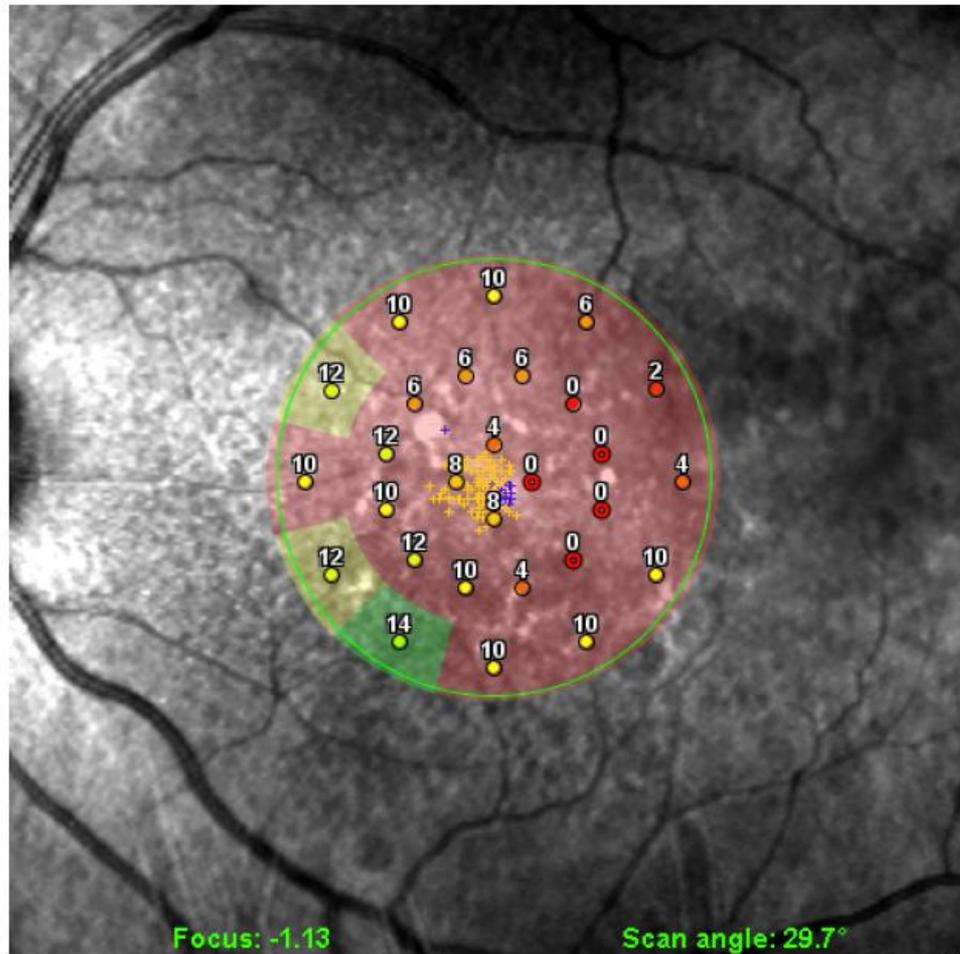
- “How confident are you that you will not lose your balance or become unsteady when you...”
 - ▶ ...walk up or down stairs?
 - ▶ ...walk in a crowded mall where people rapidly walk past you?
 - ▶ ...get into or out of a car?

- Subjects with poor fixation stability were less confident about their balance compared to their stable-fixation counterparts

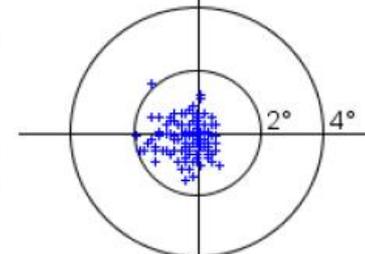
Methods: Part II

- Participants (N=10)
 - ▶ Age: 50-89 years
 - ▶ Central vision loss
 - ▶ Visual Acuity 20/200 or better
 - Age-matched normative data from Greffou et al. 2013
- ETDRS Visual Acuity
 - Optical Coherence Tomographer Scanning Laser Ophthalmoscope (OCT/SLO)
 - The CAVE

Specification of Central Vision Loss

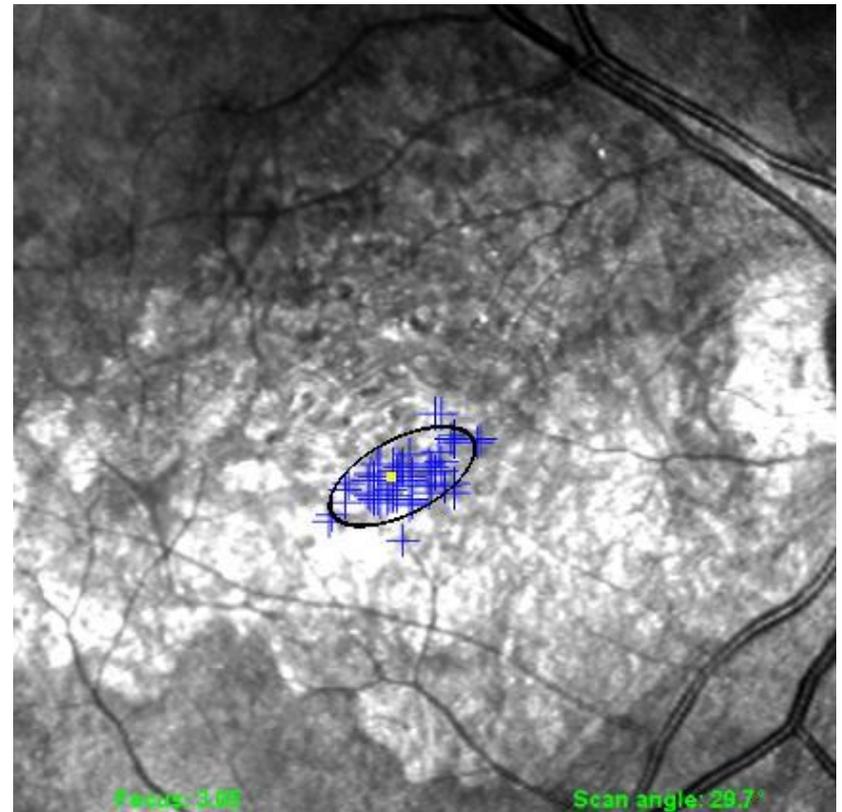
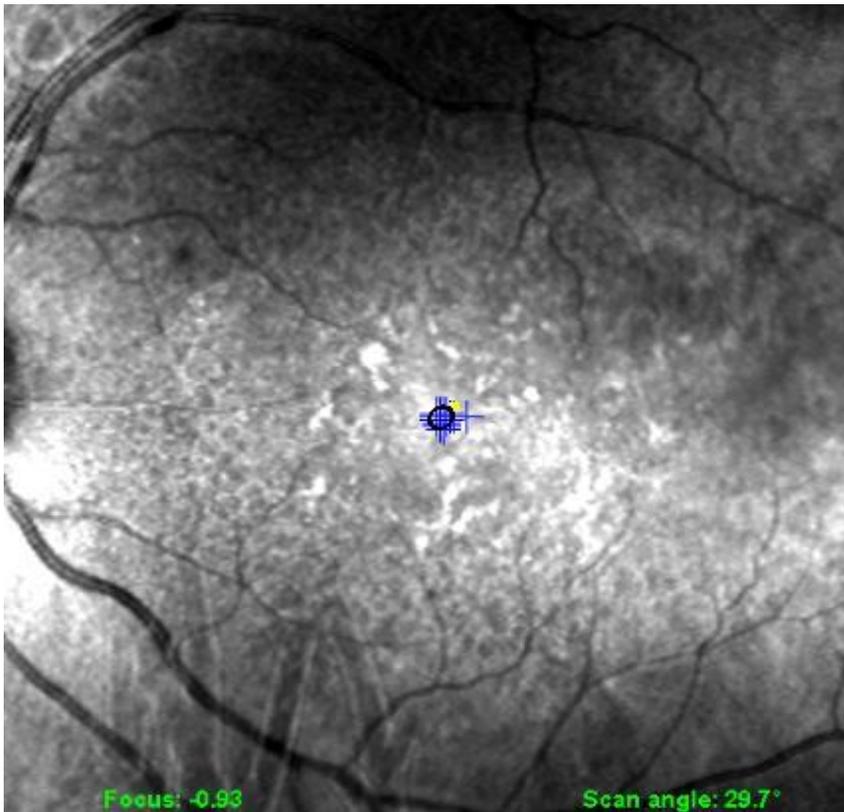


Eye Movement



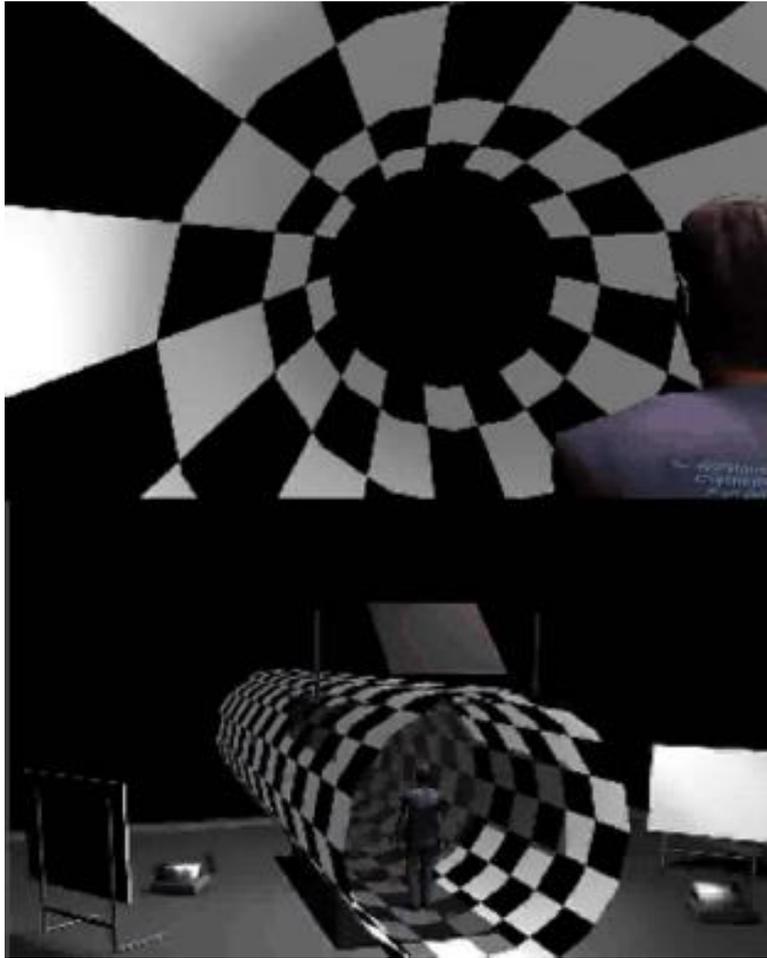
Within 2°: 99%
Within 4°: 100%

Fixation Stability



BCEA: Bivariate Contour Ellipse Area

The CAVE: Virtual Tunnel Paradigm

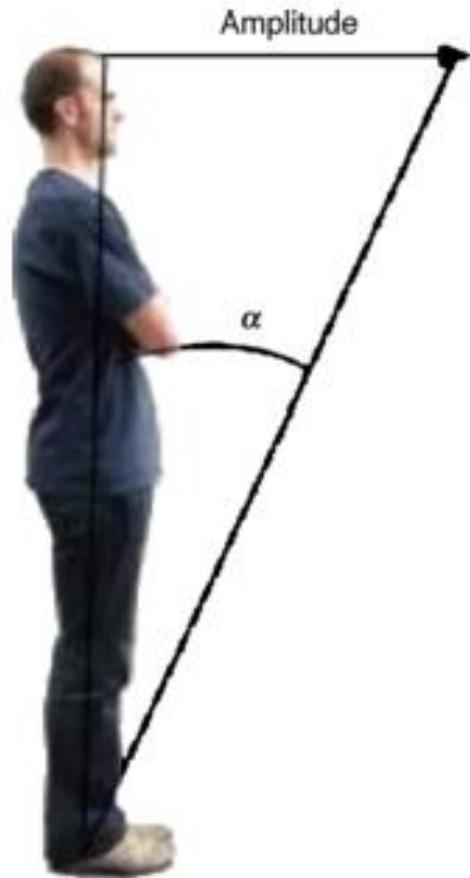


The CAVE in Action



Visual Psychophysics and Perception Laboratory

Body Sway in the CAVE



- Anterior-posterior displacement measured in degrees
- Reflects participant's capacity to react and synchronize with the tunnel frequency

CAVE Results

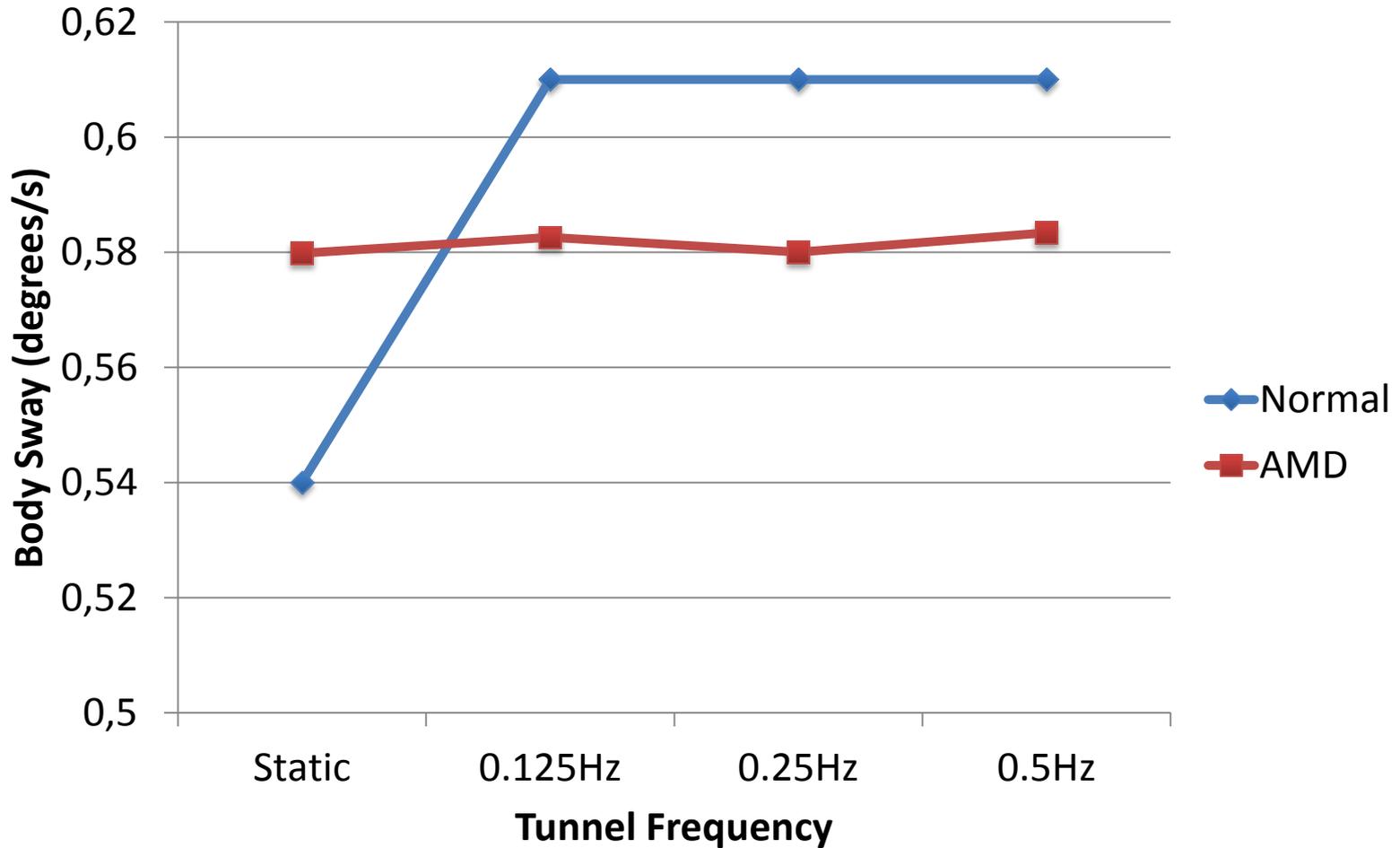
Overall

- No significant correlations with visual or balance measures

Individuals

- The participant who was clinically at risk of falling according to the TUG had the greatest body sway under static conditions
- The participant with the poorest fixation stability showed the least response to the tunnel

Central Vision Loss v. Controls



What We Learned

- Fixation stability is a visual component that affects balance
- Poorer fixation stability can lead to less confidence in balance abilities
- Fixation stability has a stronger correlation with fall risk and past falls compared to visual acuity
- Those with central vision loss have greater baseline body sway than age-matched peers and do not respond to peripheral visual stimuli

What's Next?

- Overcome study limitations
- Can current fixation stability programs improve balance too?

Acknowledgements

- Olga Overbury, PhD
- Jocelyn Faubert, PhD
- Jesse Michaels, BA
- David Nguyen-Tri, PhD
- Volunteers
- Participants



Hôpital général juif
Jewish General Hospital



Centre universitaire de santé McGill
McGill University Health Centre

École d'optométrie

Université 
de Montréal