

# Fear of Falling and Eye Movement Behavior in Young Adults and Older Adults: A Pilot Study

Ladda Thiamwong\* PhD., Nahal Norouzi\*\*, PhD candidate, Gregory F. Welch\*\*\* PhD.

\*College of Nursing, University of Central Florida. \*\*Computer Science, UCF College of Engineering & Computer Science;UCF Institute for Simulation & Training (IST).

\*\*\*Professor, Florida Hospital Endowed Chair in Healthcare Simulation, UCF College of Nursing,UCF College of Engineering & Computer Science; UCF Institute for Simulation & Training (IST).



## Introduction

Older adults (OAs) with fear of falling (FOF) tend to rely more on vision during walking than young adults and older adults without fear of falling. Fear in general for all ages may change pupil diameter, increase horizontal eye velocity and eye displacement. Whereas, fear of falling in older adults may change eye movement patterns such as fixation points and their order, indicative of visual attention, and duration of fixations.



## Learning Objectives

- Attendees will be able to understand how to use a mobile eye tracker to assess eye movement behavior in older adults.
- Attendees will be able to describe eye movement behavior in older adults with fear of falling.
- Attendees will be able to compare eye movement behavior in older adults with fear of falling and young adults without fear of falling.

## Aim

The aim of this case study was to explore eye movement behavior in older adults who had fear of falling compared with adults who had no fear of falling.

We measured fear of falling by the Short Fall Efficacy Scale-International (FES-I)

Short FES-I

We would like to ask some questions about how concerned you are about the possibility of falling. Please reply thinking about how you usually do the activity. If you recently don't do the activity, please answer to show whether you think you would be concerned about falling. If you did the activity, please answer to show how concerned you are at you might fall if you did this activity.

	Not at all concerned	Somewhat concerned	Fairly concerned	Very concerned
Getting dressed or undressed	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>
Taking a bath or shower	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>
Getting in or out of a chair	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>
Going up or down stairs	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>
Reaching for something above your head or on the ground	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>
Walking up or down a slope	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>
Going out to a social event (e.g. religious service, family gathering or club meeting)	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>

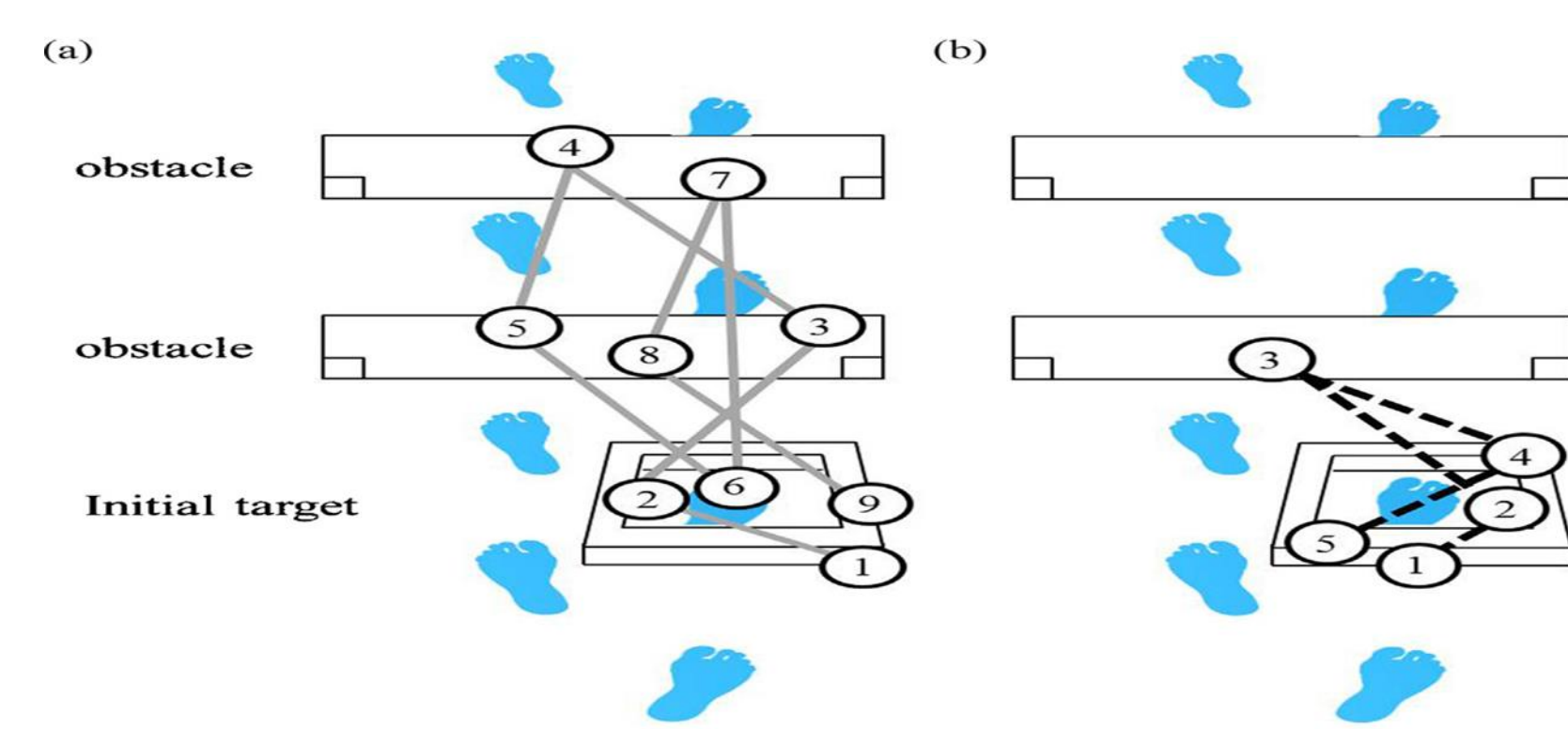
7 - 28

## Methodology

We assessed fear of falling by the short version of Fall-Efficacy Scale International and assessed eye behavior by a mobile light-weight eye tracker with world camera and eye camera that assembled from the Pupil Docs DIY headset. Two older adults who had fear of falling and three adults who had no fear of falling were recruited.

The eye tracker was calibrated by a screen nine-point marker procedure. We measured four variables including the total time of pupil fixation on targets, average pupil fixation, pupil size fluctuations and horizontal pupil displacement.

## Related Work



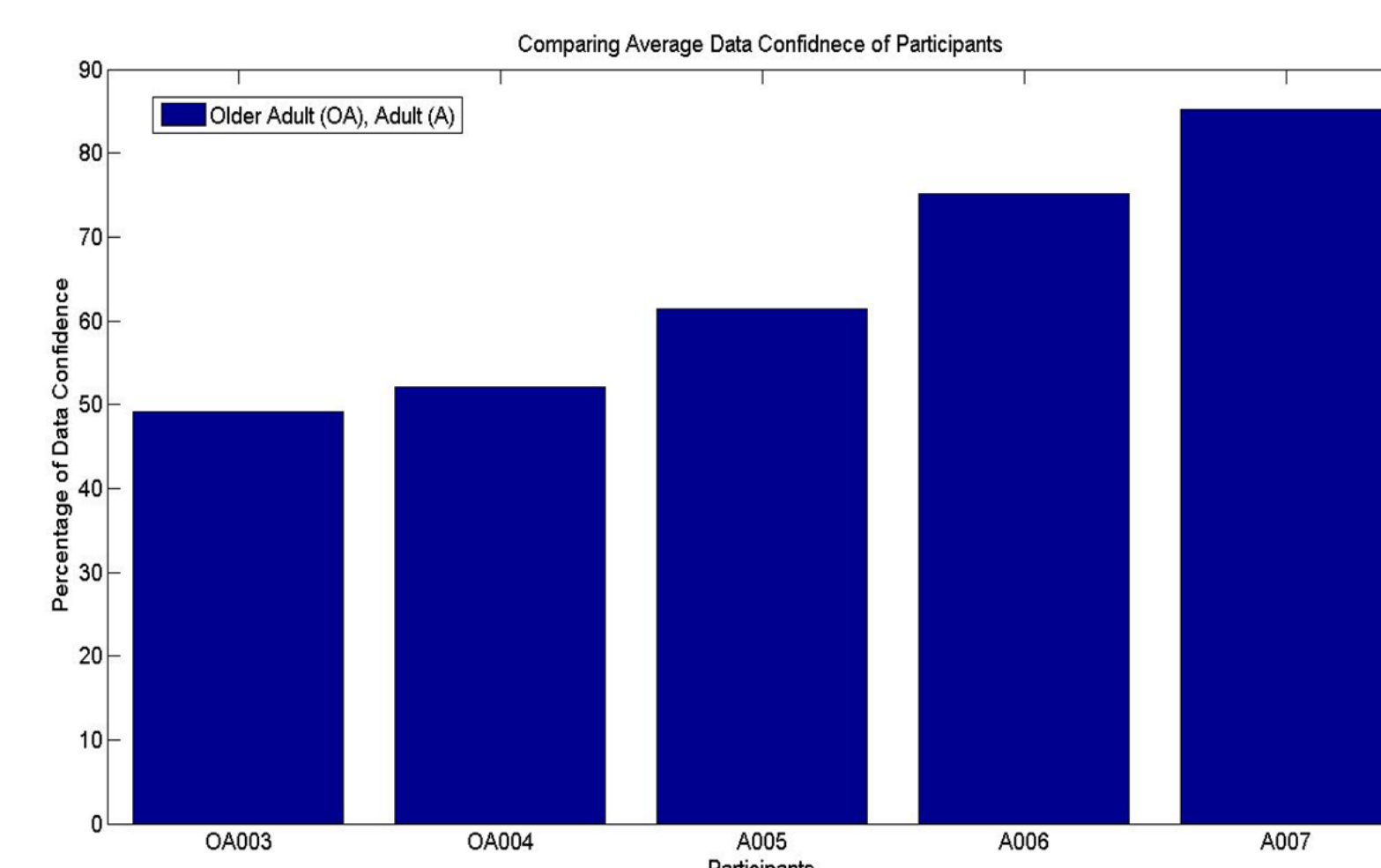
Young et al. (2015) explained in their articles how visual search pattern of OA with FOF and without FOF is different dealing with obstacles in their path.

OA= Older Adult, A= Adult

## Measured Variables

- Confidence levels of the collected data, expectation: OA<A
- Total time each participant spent fixating on their surroundings. (fixations are usually more than 180 ms), expectation: OA>A
- Average duration of one fixation for each participant, expectation: OA>A
- Pupil size fluctuations, expectation: OA>A
- Horizontal pupil displacement, expectation: OA>A

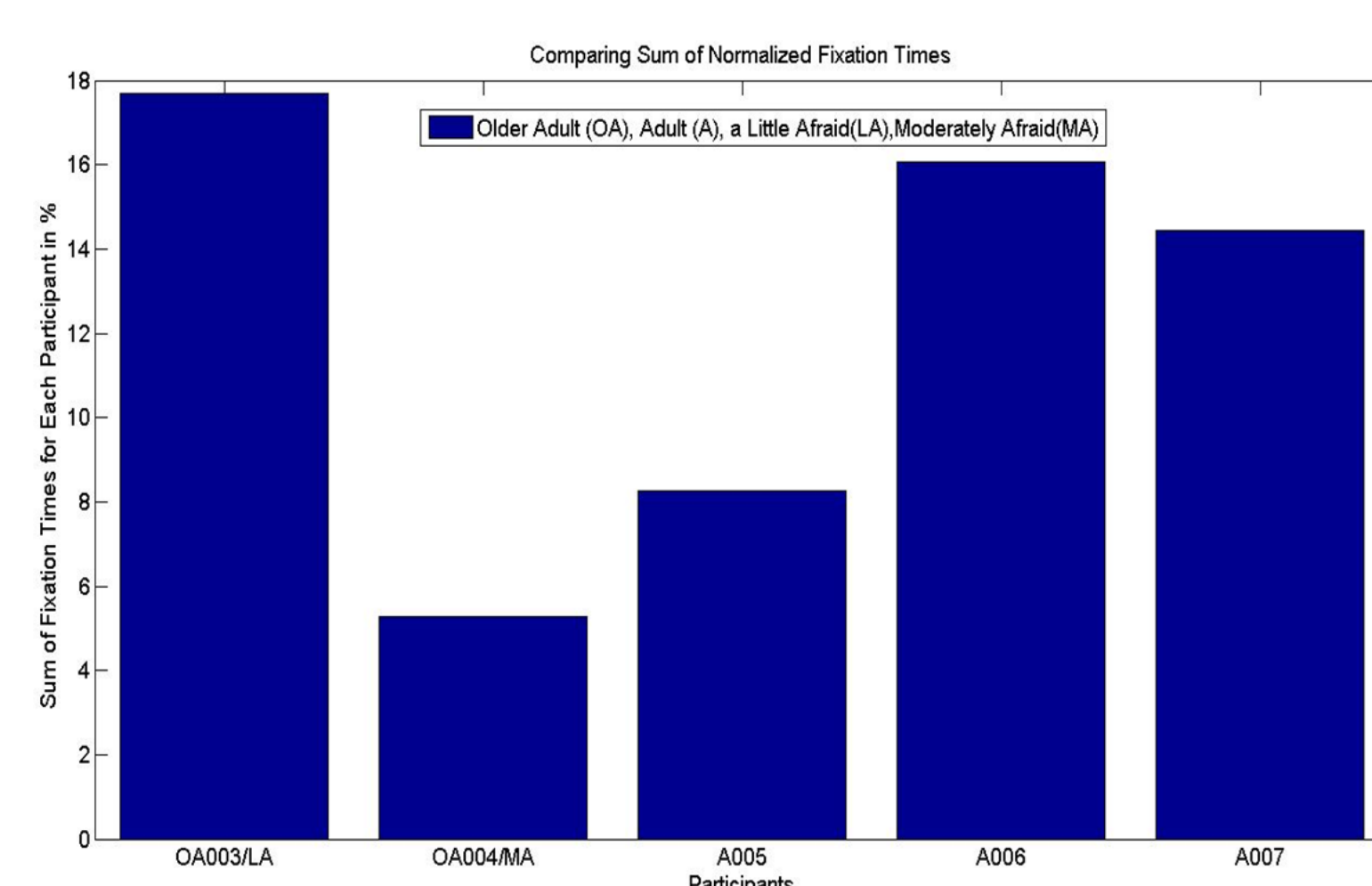
## Confidence Level of the Calibration Procedure



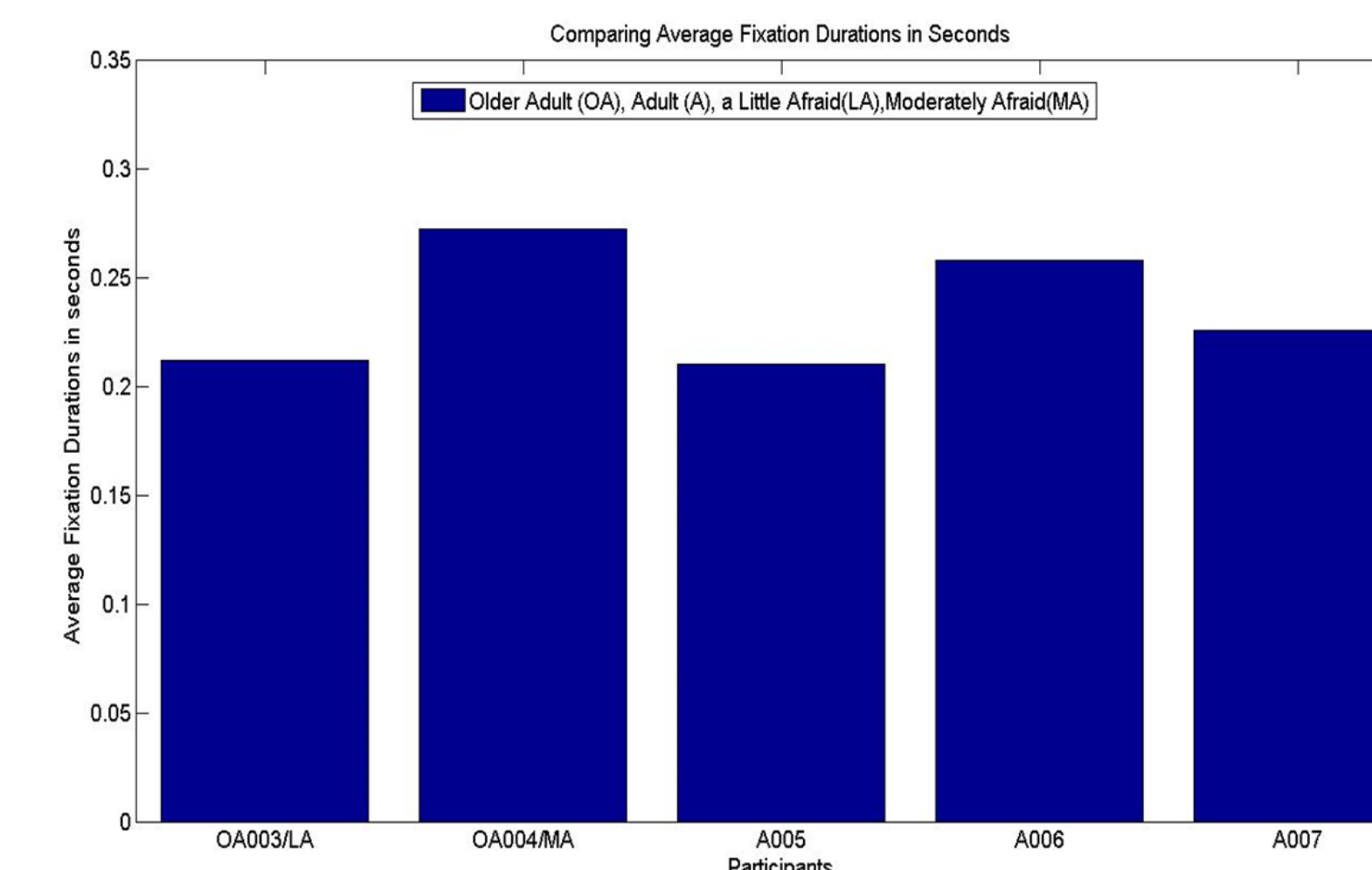
## Results

The results show that older adults with fear of falling had higher pupil size fluctuation and increased variability of horizontal pupil displacement than adults without fear of falling. However, the average pupil fixations and the total fixation duration were not consistent with what we expected from older adults since the confidence level of the calibration procedure was not high (50%-85%).

## Comparing Total Fixations Times

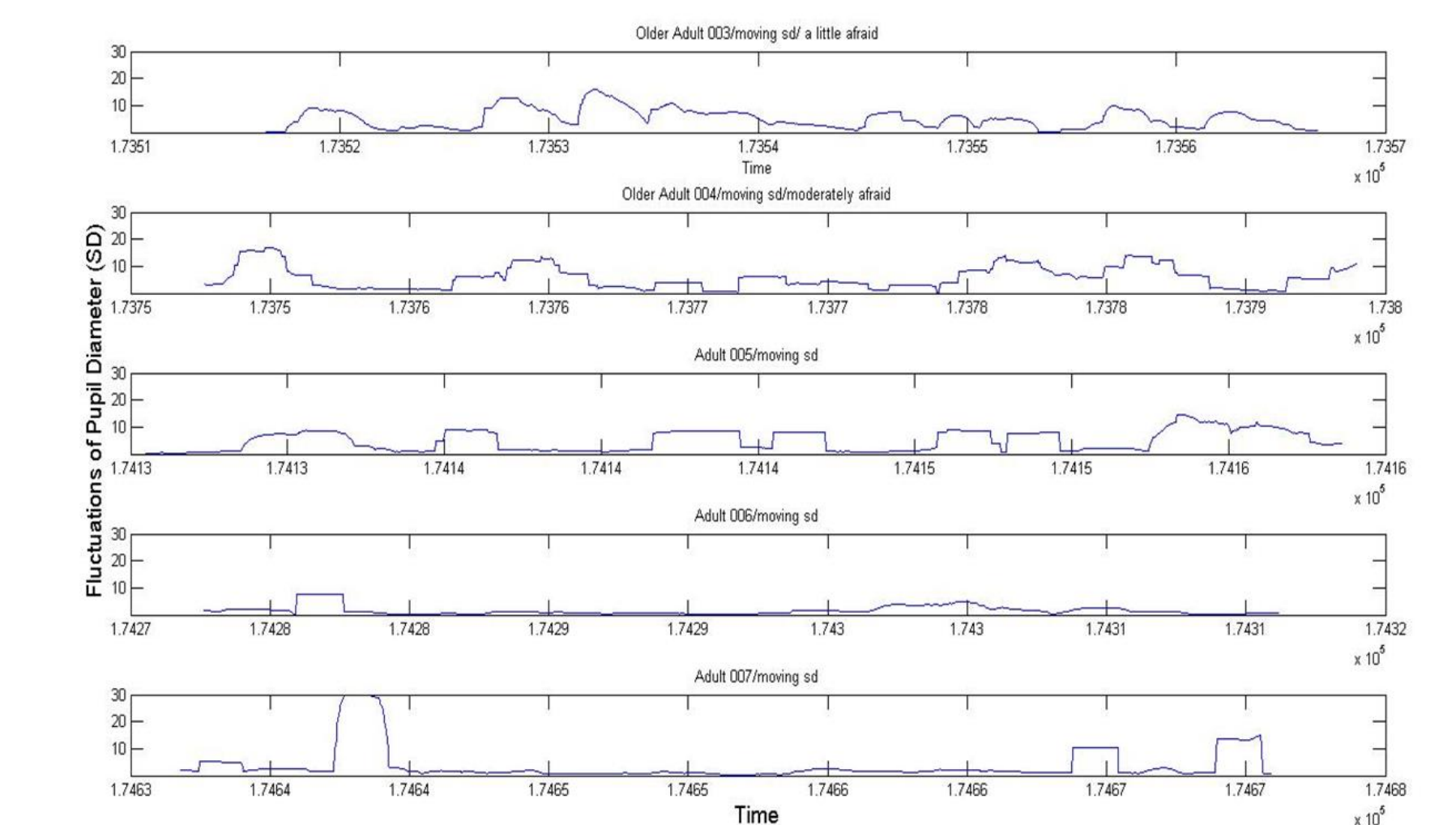


## Comparing Average Fixations Times

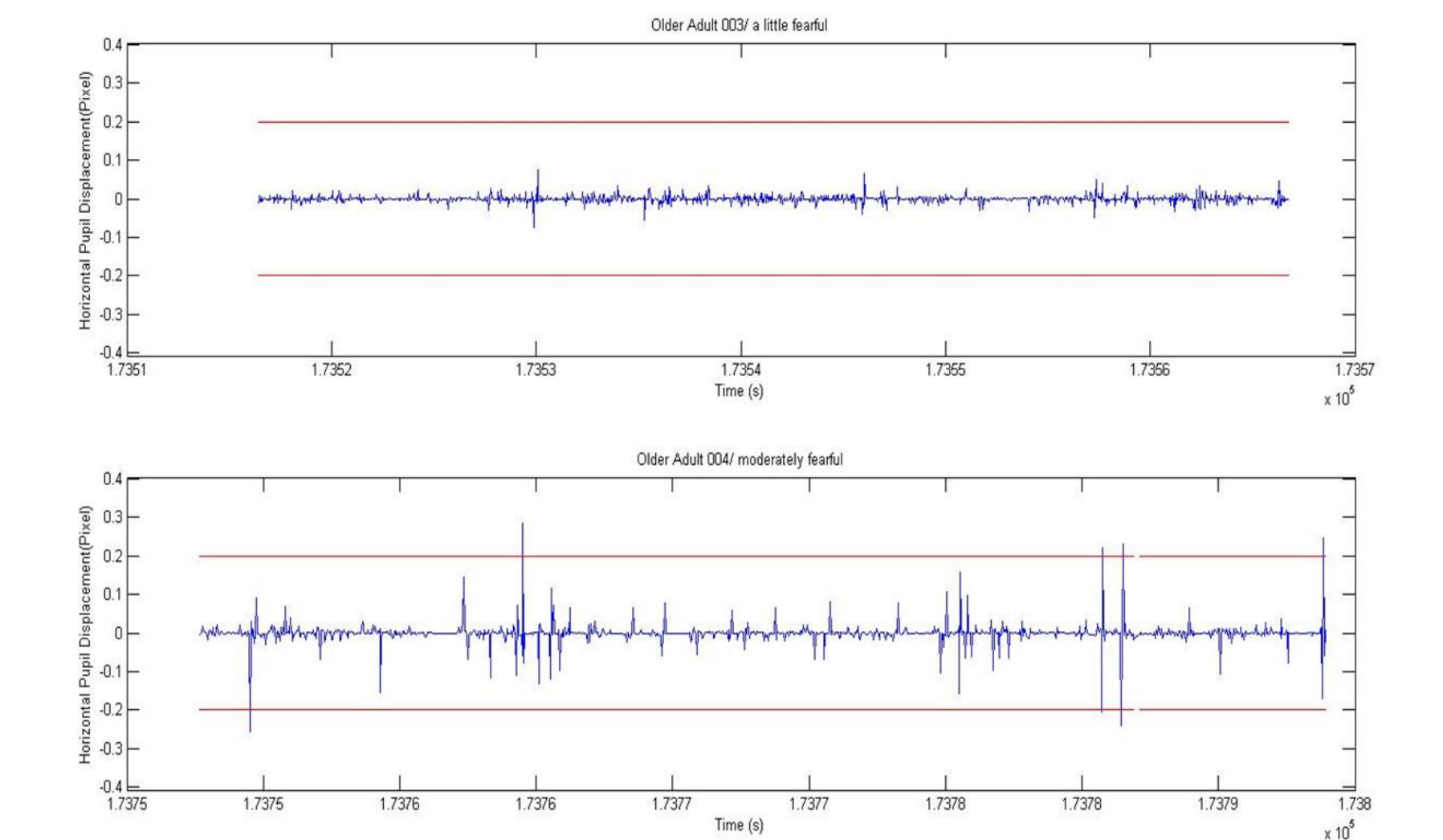


## Results continued...

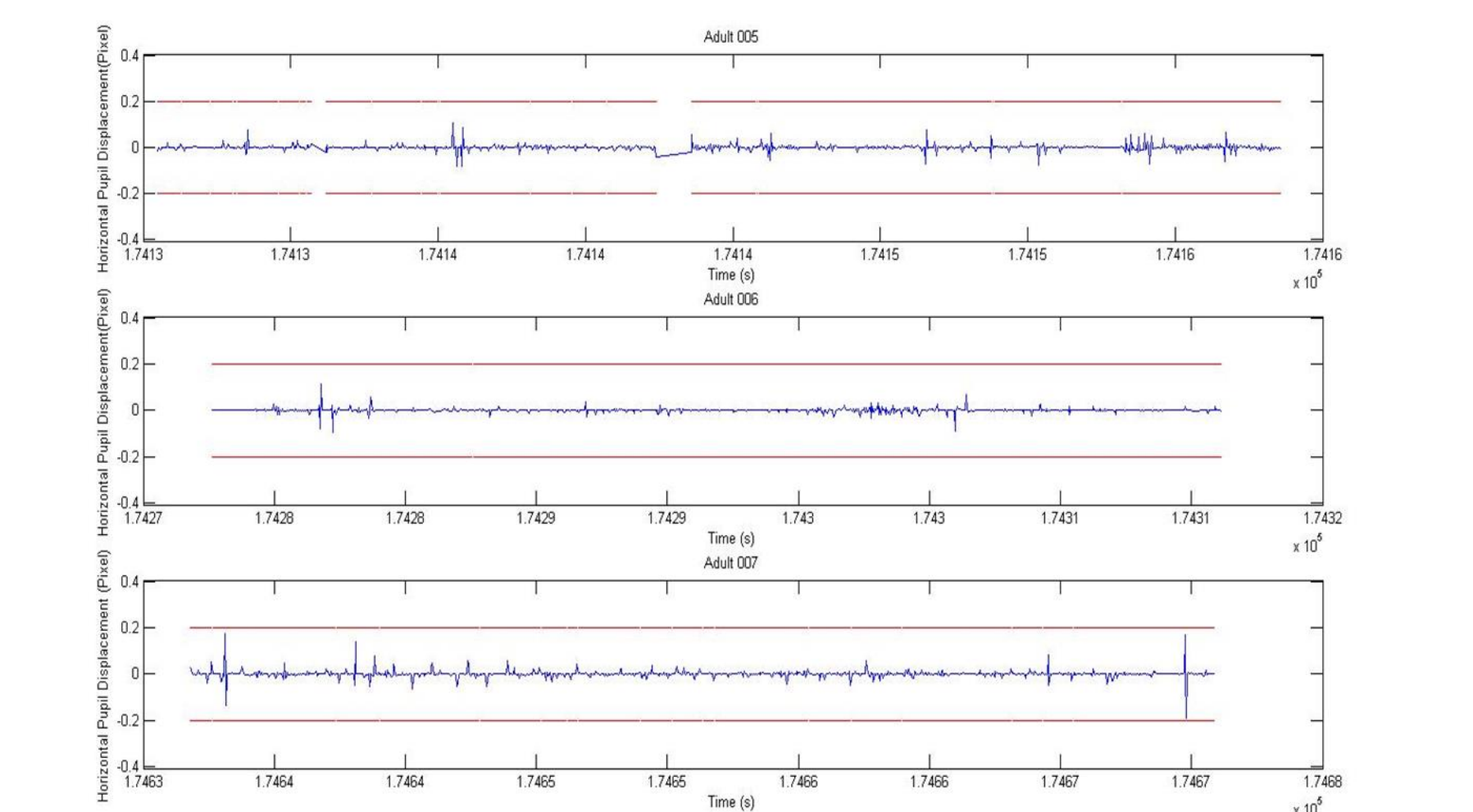
### Pupil Size Fluctuations



### Horizontal Pupil Displacement in Older Adults



### Horizontal Pupil Displacement in Adults



## Conclusion and Recommendations

Our pilot study revealed that older adults with FOF had higher pupil size fluctuation and increased variability of horizontal pupil displacement.

Rapidly growing improvements in instrument technologies such as eye-tracking systems may make it promisingly applicable to the FOF assessment.

Early identification of older adults at-risk of developing persistent FOF is essential to ensure appropriate and timely intervention, and reduces avoidable individuals' social, community and healthcare-related costs.