



DIFFERENCES IN PERFORMANCE ON THE ANTISACCADE TASK IN FOOTBALL ATHLETES DURING CHILDHOOD AND LATE ADOLESCENCE

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Introduction

- To date, few studies on saccadic eye movements in children and adolescents exist, especially those with mild traumatic brain injury (mTBI) suffered in a sports related environment.
- Antisaccade (AS) task in particular may be able to objectively assess for mTBI or the effects of subconcussive loading by comparing baseline to follow-up performance.
- AS task engages areas including the prefrontal cortex (PFC).
- Quantifying performance with oculomotor assessments may help to understand which brain regions may be injured during a mTBI or affected due to subconcussive loading.
- Age-based differences in oculomotor system response resulting from differences in brain development are also of importance when considering the use of an assessment modality across ages.

Methods

- Participants: high school football team males (n=92; age 13-18 YRS) and Pop Warner football team males (n=34; age 5-13 YRS)
- Saccadic eye movement data collected using EyeLink 1000 system (SR Research, Canada) with binocular eye tracking at 1000 Hz (monocular: 2000 Hz)
- AS data taken at baseline (before the beginning of the football season)
- AS metrics: number of wrong-way trials
- This is one element of a larger study that includes other oculomotor modalities, biomechanics, athletic exposure, Standardized Assessments of Concussion, etc.

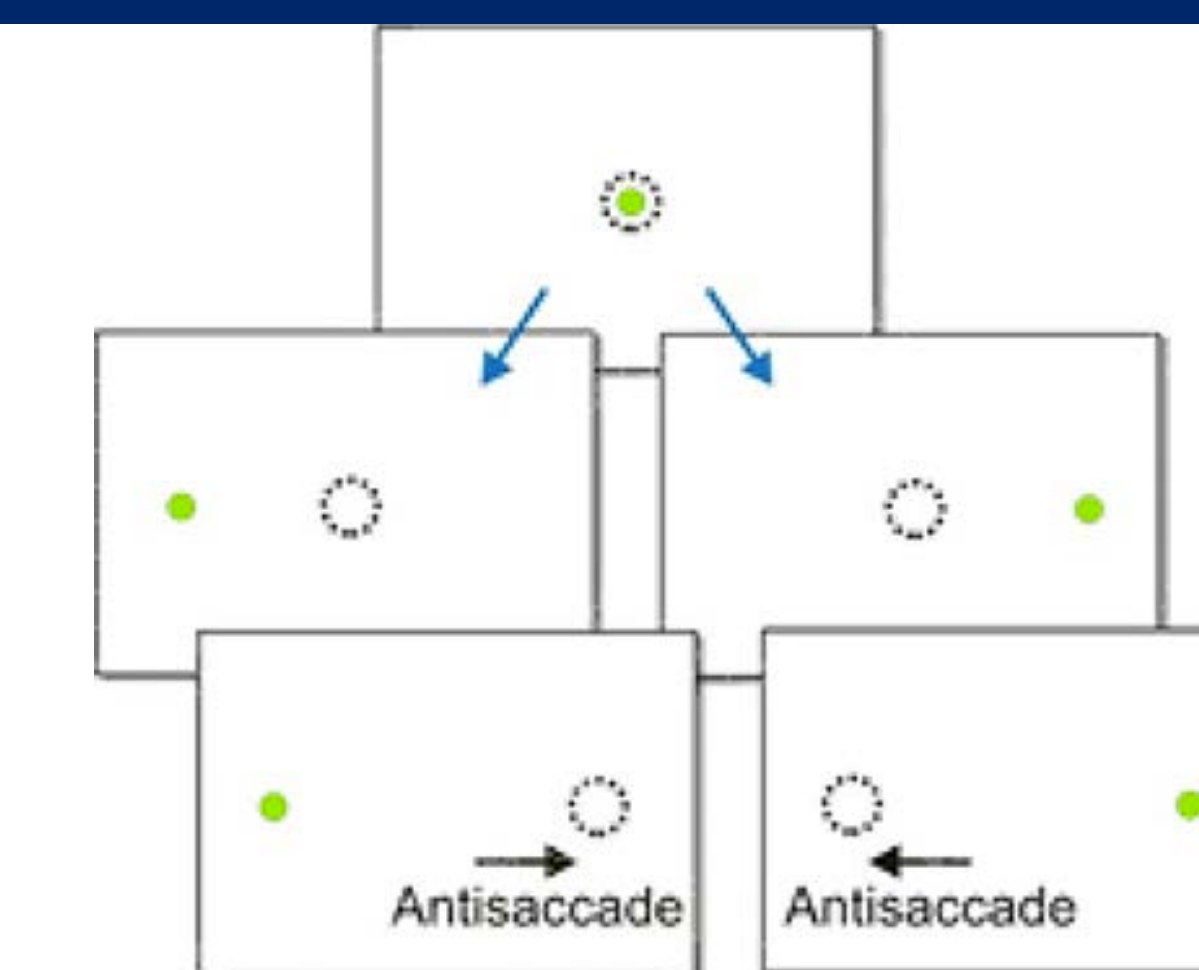


Figure 2: Sample AS Task

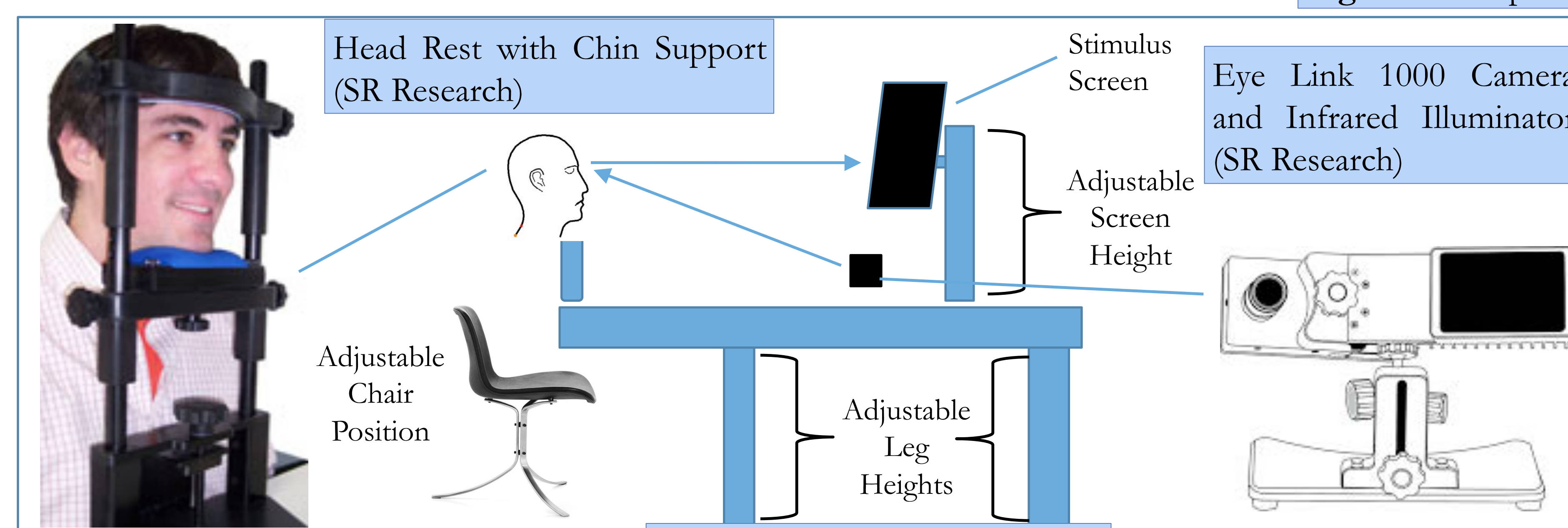
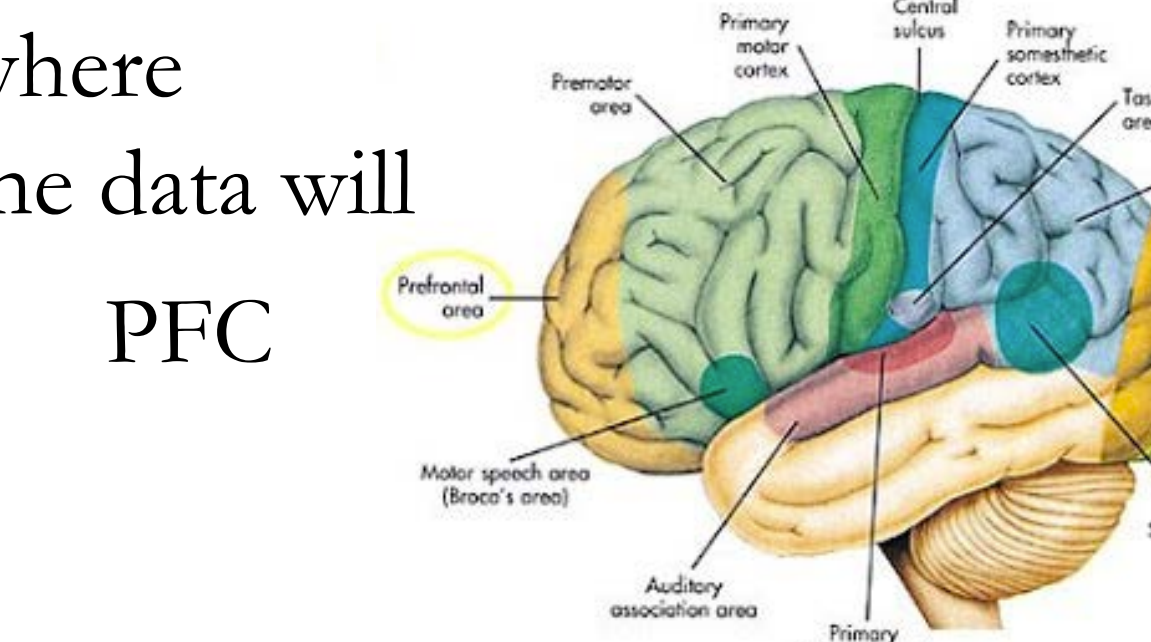


Figure 3: Full Setup Side View

Preliminary Outcomes

- Trend in the preliminary data shows the younger age group (Pop Warner participants) made a greater number of wrong way trials. A greater sample size is needed to assess for statistical difference
- This trend may suggest that the younger group was less likely to inhibit the reflexive prosaccade in accordance with development of the higher-order cortices in the PFC. Alternatively, the trend could be due to a misunderstanding of the antisaccade task by the younger cohort
- Trend of increasing number of correct trials with age matches previous studies [3,5]
- This is the first time working with this population for this study, which is scheduled to continue into a second year where additional baseline data will be acquired to increase this sample size



The Antisaccade and the Brain

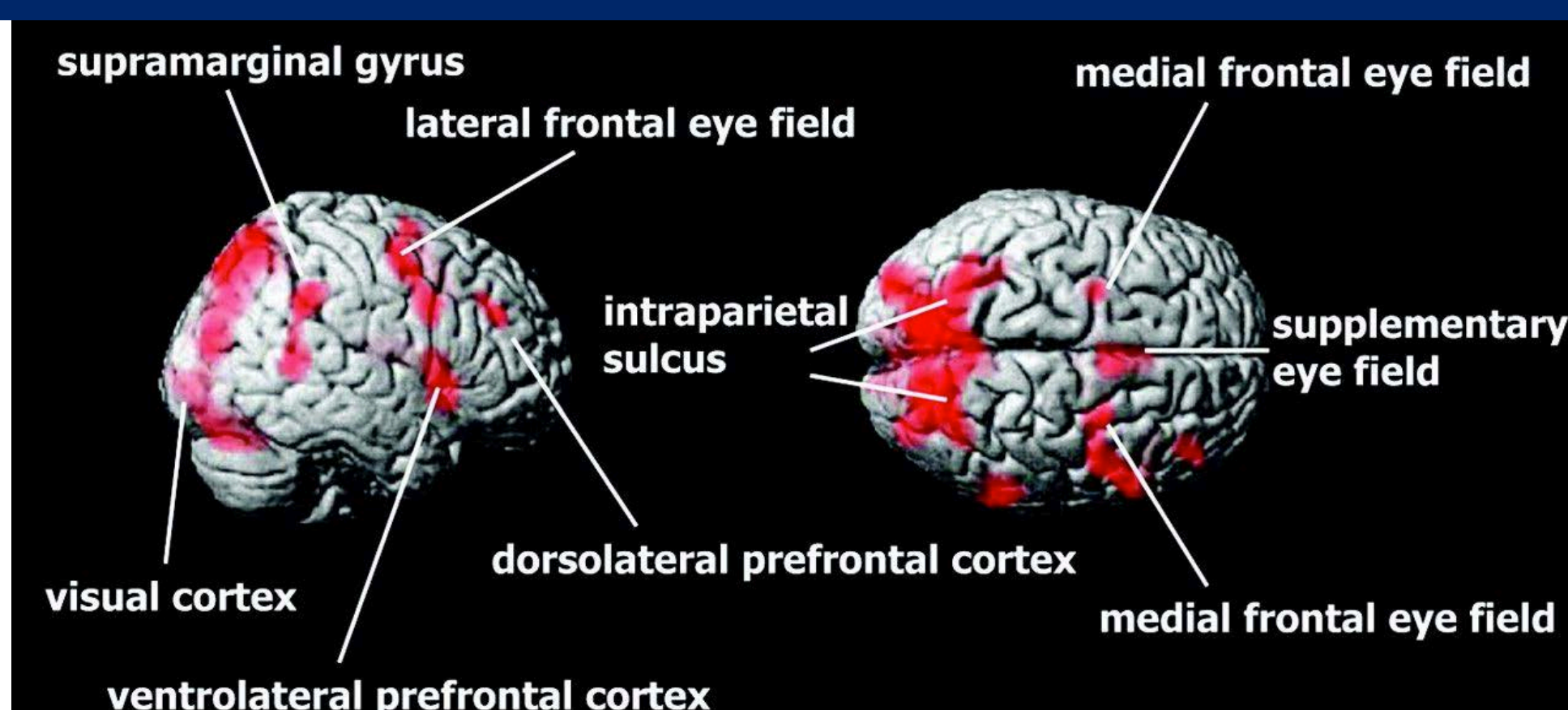


Figure 1: Cortical Activation during the AS Task (Ettinger, et al. 2008)

- AS depends on cognitive control to inhibit the reflexive prosaccade to the target and then initiate a saccade in the opposite direction (goal directed behavior)
- Intentional voluntary movements & inhibitory control processes engage the PFC [5]
- fMRI studies have also shown activation of the supramarginal gyrus, frontal eye fields, intraparietal sulcus, and prefrontal cortices during the AS test [1]
- Discrepancies on antisaccade task performance have been found between children and adults with differences between the 6-8, 9-11, 12-15, and 20-35yrs age groups [3]
- Changes in the PFC during normal childhood development include linearly increasing white matter volume [8], and the maturation of higher-order cortices only after lower-order somatosensory and visual cortices [2]

Preliminary Results

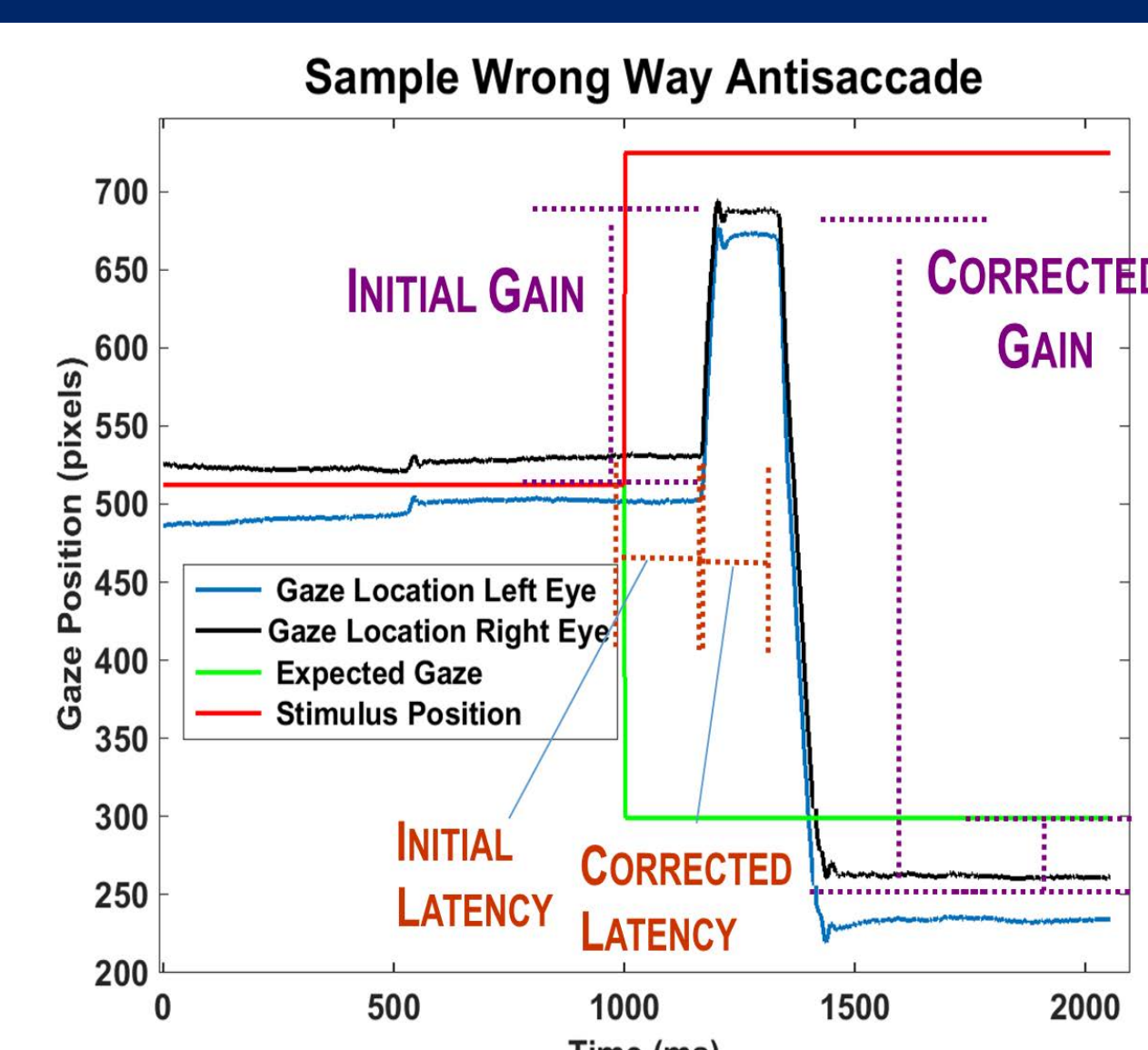
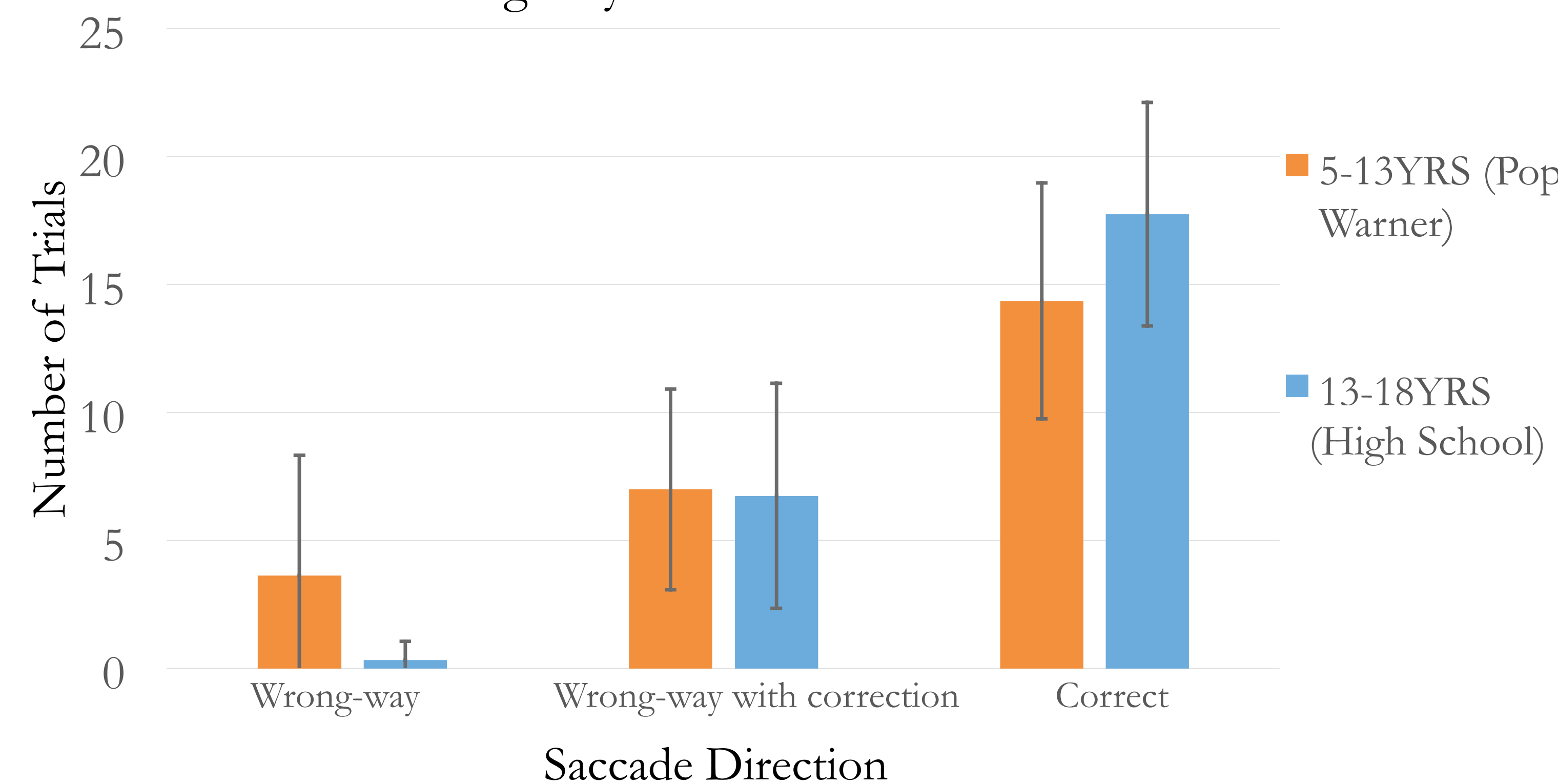


Figure 4: A representative binocular AS trial detailing the metrics associated with this eye movement task. This sample trial represents a participant that exhibited an initial wrong-way saccade with undershoot, followed after a latent period by a corrective saccade with some level of overshoot

Baseline Antisaccade Task Performance as measured by average number of wrong-way saccades with and without correction



- Preliminary results for Pop Warner participants based on small sample size of valid data (n < 20)
- Baseline data shows high school participants (age 13-18yrs) understood the antisaccade task. While many wrong-way saccades were initiated, participants performed corrective saccades in opposition to the target in nearly all cases.
- Ages 5-13yrs (Pop Warner participants) completed more wrong-way trials without correction

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Acknowledgements

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