Sensitivity of catch-up saccades kinematics to repeated unperceived changes of target velocity

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Introduction

Background

Saccades and smooth pursuit are combined to ensure clear vision while tracking a moving object. In addition, visual acuity decreases during vision, and the saccade behavior is sensitive to a step of target velocity.

Experimental conditions

- 32 human subjects (21 male) without oculomotor disturbances, or visual abnormalities participated to the study.
- Subjects sat in a dark room 63 cm from a screen (refresh rate: 124 Hz). Head movements relative to the camera (EyeLink, s-research, Ontario, Canada. Refresh rate: 256Hz) were prevented using a bite bar.
- Real-time computers (ESX/VEX system) controlled the position of the target.

Paradigm

- 25 successive fixation targets
- Second order calibration procedure to account for non-linearity

Validation of the detection method

Distribution of latency

Methods

Analyses

- Data were collected from a third-order Savitzky-Golay filter and a 41 ms window.
- Saccades were detected using a particle filter [4].

Pursuit behavior

- V1: smooth eye velocity 40 ms after the catch-up saccade offset.
- V2: target velocity before the change.
- Velocity gain was defined as the ratio between V1 and V2.

Saccadic behavior

- Block P1: a decreased gain (-0.75), or
- Block P2: an increased gain (1.75).

Could it be an effect on stimulus?

Online saccade detection

Saccade detection method

- Target position as the number of trials increases.

Pursuit behavior changes with velocity steps

Validation of the detection method

- The saccade behavior is sensitive to a step of target velocity.

Saccade behavior changes with velocity steps

- Median values of parameters for the increase gain (P2):
  - P1 A B C
  - S1 0.80 0.68 76
  - P2 A B C
  - S1 1.20 0.45 31

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References


Acknowledgements

Institut du Cerveau et de la Moelle épinière (ICM, France), CNRS, ECMR, Foundation de Recherche Médicale (FRM, France), École Centrale d'Electronique (ECE, France)