Eye movements are guided by vision and the task

Martin Stritzke & Julia Trommershäuser

Justus - Liebig - University Giessen, Department of General Psychology

Email: martin.stritzke@psychol.uni-giessen.de

Introduction

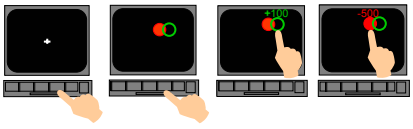
In this experiment we studied eye movements in a task in which movements of the hand, but not the eye lead to monetary consequences for the movement planner. This matches everyday situations, in which hitting or missing the target with the hand leads to different consequences than hitting or missing it with the eye.

Methods

We measured eye and hand movements simultaneously during a video-game like rapid pointing task. Subjects were instructed to touch a color-coded target region while trying not to hit a nearby penalty region. Hits into target regions yielded a win, hits into the penalty region a loss. Late responses were penalized. The hand was visible at all times during the experiment. These stimulus configurations constitute novel environments for the study of eye-hand coordination, because in our experiment, optimal target locations for the hand are not defined by the visual features of the configuration alone [1].

Recording of eye movements with an *EyeLinkII (SR Research)*. A touch monitor recorded the end point of the pointing movement.

Procedure:

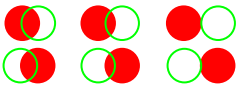


1) Fixation of screen center
2) Trial start by button press
3) Stimulus presentation
4) Time window of 700 ms for pointing response.
5) Feedback about points scored.

Basic Experimental Design:

Circle diameter: 2° (≈ 18 mm)

6 different stimulus configurations:
(randomized trial-by-trial, unpredictable position of presentation, minimum of 3 degrees from initial fixation)



Gains/ Losses:
(constant within blocks of 24 trials)

Target region: 100 points
Penalty region: 0, -100, -500 points

Experimental Details

Ia: penalty: filled red disk; target: hollow green circle.

Ib: penalty: hollow red disk; target: filled green circle.

Ic: penalty: filled red disk; target: hollow green circle. Configuration disappeared with movement onset.

Id: penalty: filled red disk; target: hollow green circle. Judgment, if penalty on right or left

N=4

IIa: penalty: hollow black circle; target: hollow blue circle.

IIb: penalty: filled black disk; target: hollow blue circle.

N=4

IIIa: penalty: hollow blue circle; target: hollow black circle.

IIIb: penalty: hollow blue disk; target: filled black circle.

N=4

The background was grey in all experiments.

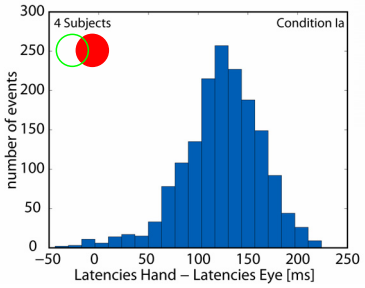
References:
[1] Trommershäuser, J., Maloney, L. T., and Landy, M. S. (2003): *JOSA A*, 20, 1419-1433.

Acknowledgments: We thank Veronika Christen and Tim Schönwetter for help with data collection.

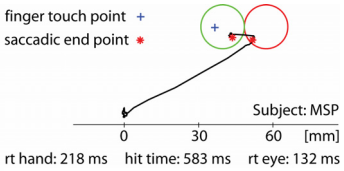
Supported by Deutsche Forschungsgemeinschaft (Emmy-Noether-Programm, Grant TR 528/1-2)

Results

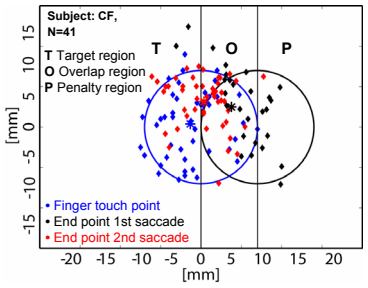
Eye movements are initiated 140 ms prior to onset of finger movement



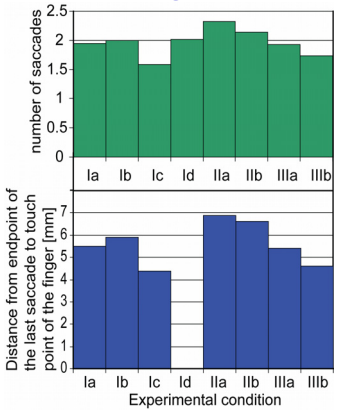
Single trial touch and eye data



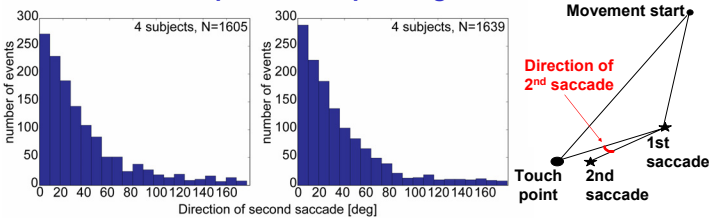
Example: Distribution of finger & saccadic end points



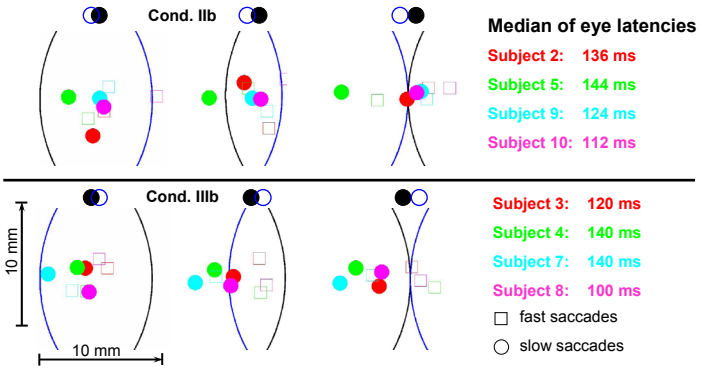
Subjects completed 2 saccades before the end of the pointing movement



The second (corrective) saccade is performed in direction of the end point of the pointing movement



Slow saccades end closer to the end point of the pointing movement



Conclusion

Subjects made two saccades on average. This number was slightly lower, when the stimulus configuration disappeared with movement onset. In all experiments, the majority of landing points of the first saccade was within the region of higher visual saliency. Fast saccades landed within the region of higher visual saliency rather than slow saccades. The landing point of the second saccade shifted closer towards the touch point of the finger. In most trials, the second saccade was concluded before the finger hit the screen.

We conclude that eye movements during pointing tasks are guided by both the visual properties of the stimulus and the task.