3D Eye Tracking in Monocular and Binocular Conditions

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Results of eye tracking experiments on vergence are contradictory: for example, the point of vergence has been found in front of as well as behind the target location. The point of vergence is computed by intersecting two lines associated to pupil positions. This approach requires that a fixed eye position corresponds to a *straight* line of targets in space. However, as long as the targets in an experiment are distributed on a surface (e.g. a monitor), the straight-line assumption cannot be validated; inconsistencies would be hidden in the model estimated during calibration procedure.

We have developed an experimental setup for 3D eye tracking based on fiducial markers, whose positions are estimated using computer vision techniques. This allows us to map points in 3D space to pupil positions and, thus, test the straight-line hypothesis. In the experiment, we test both monocular and binocular viewing conditions. Preliminary results suggest that a) the monocular condition is consistent with the straight-line hypothesis and b) binocular viewing shows disparity under the monocular straight line model. This implies that binocular calibration is unsuitable for experiments about vergence. Further analysis is developing a consistent model of binocular viewing.