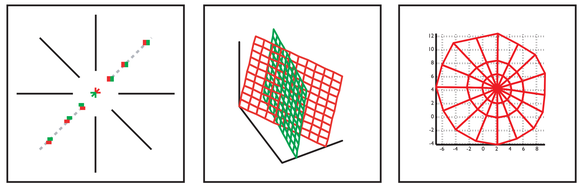
EYE POSITION AND THE 2D PATTERN OF RETINAL CORRESPONDENCE

KM Schreiber, HF Rose, JM Hillis, CM Schor and MS Banks

F-26

Introduction

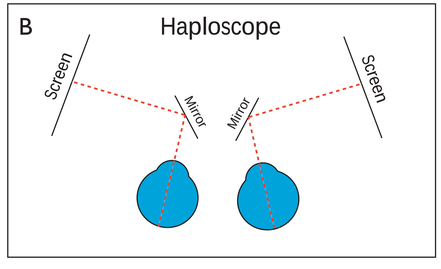
Different physical target configurations project onto different retinal patterns (A). We examined the 2D pattern of retinal correspondence for a central retinal region with a diameter of 8 degrees of visual angle. Using our subjects' oculomotor behaviour, we then determined whether the retinal correspondence pattern was optimized for a particular binocular eye position and surface orientation.



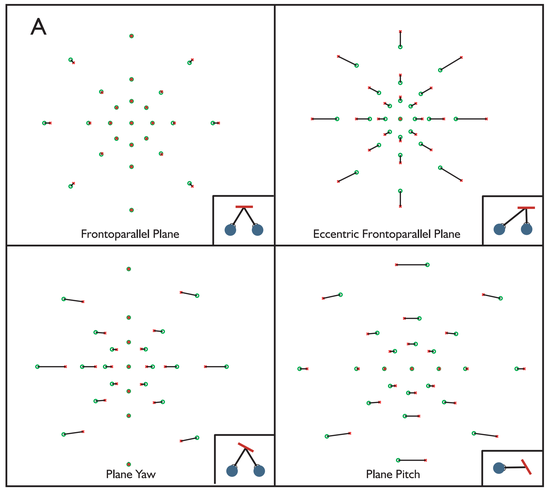
1. Measure retinal correspondence
2. Determine eye movement pattern
3. Try to find best fusable surface

Apparatus

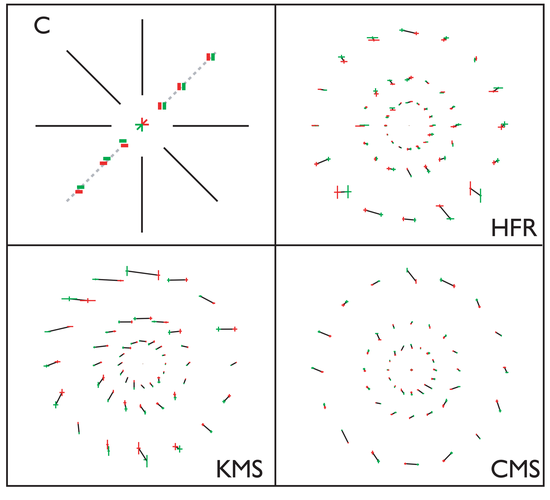
Stimuli for the psychophysical experiments (C, top left) were presented on a haploscope (B).



Patterns of Retinal Projection

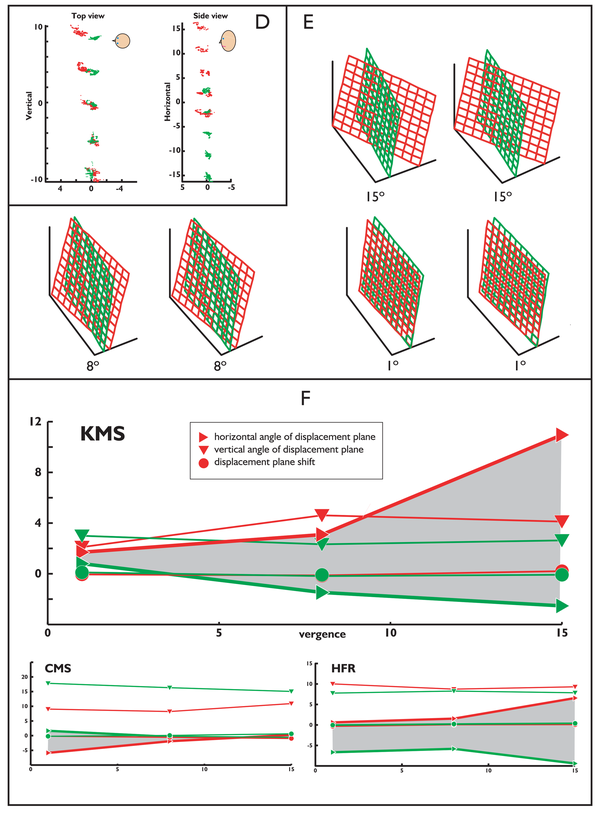


Stimulus and Results



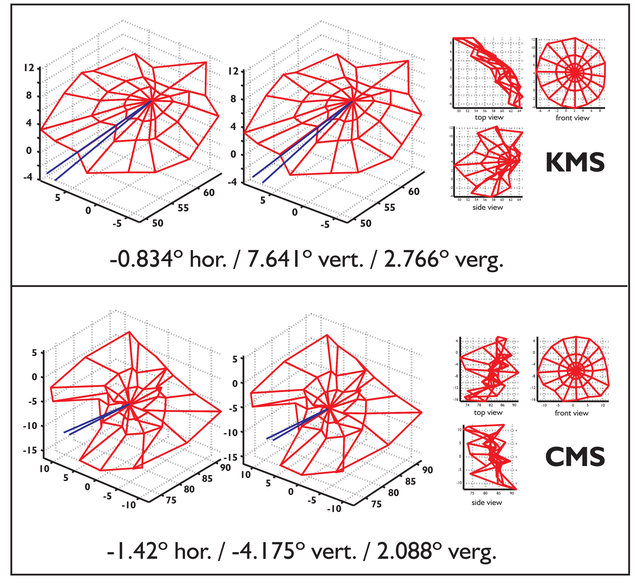
Ocular Kinematics

We presented a 5x5 array of fixation targets ranging from -10° to 10° horizontally and vertically at three different vergence angles (1°, 8° and 15°). We recorded 3D eye position using VOG as rotation vectors (shown in D for 15° vergence), fitted displacement planes for each vergence condition (stereo pairs in E) and determined normal vector components and plane shifts (F).



Optimal Eye Position and Surface

For each eye position (F) we computed the unique surface in space that projects closest to the corresponding points (C). The root mean square of the deviation of this projection from the corresponding points was minimized to determine the binocular eye position for which the pattern of retinal correspondence is optimized. For subject HFR there was no such optimal eye position within the physiological range.



Result

We determined the 2D pattern of retinal correspondence in three subjects. In two subjects we showed this pattern to be binocularly optimized for gaze direction. The third subject showed no such optimization. This subject had intermittent exotropia as a child, and while HFR has normal stereo vision today, the horopter data is unusual (C), probably explaining the lack of optimization.