The Motor Side of Depth Vision

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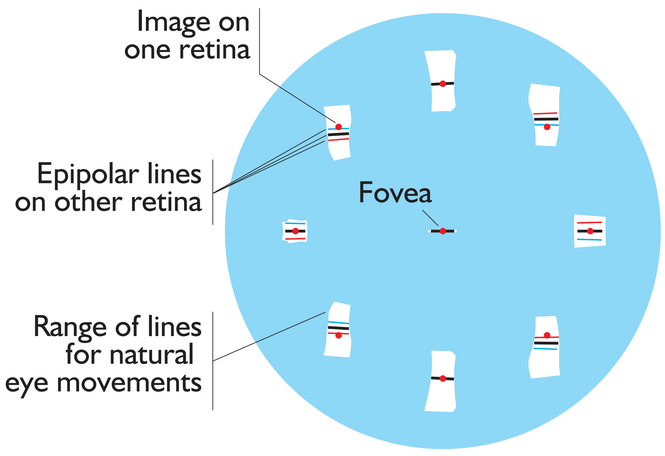
INTRODUCTION

+To achieve stereoscopic vision, the brain must search for corresponding images on the two retinas.
+In current theories, the eyes never move, so corre-sponding images lie on retina-fixed epipolar lines.
+When the eyes change position, epipolar lines move on the retinas:



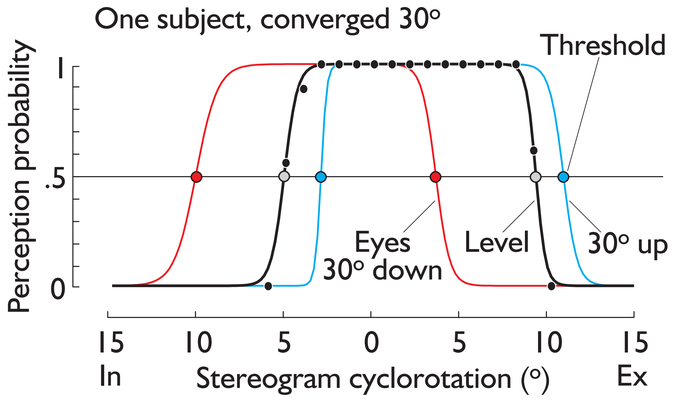
HYPOTHESES

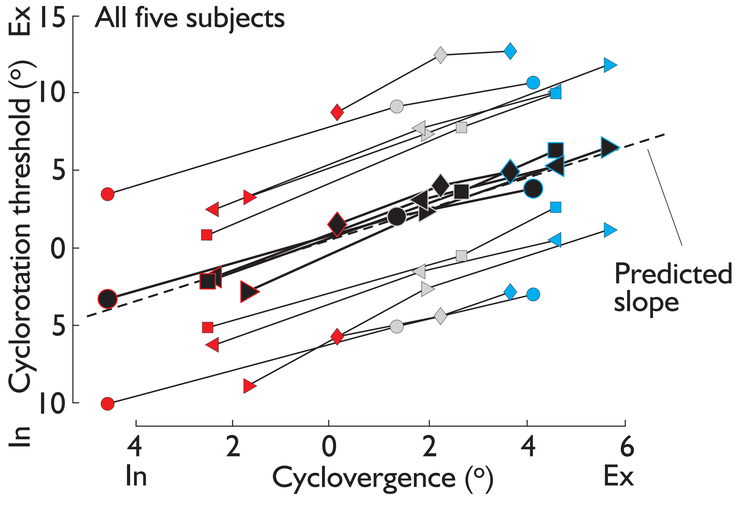
There are just two ways to have stereopsis over a range of eye positions. Either

+monitor eye position and compute epipolar lines, or
+search for corresponding images over large retina-fixed zones, not just on epipolar lines.

TEST

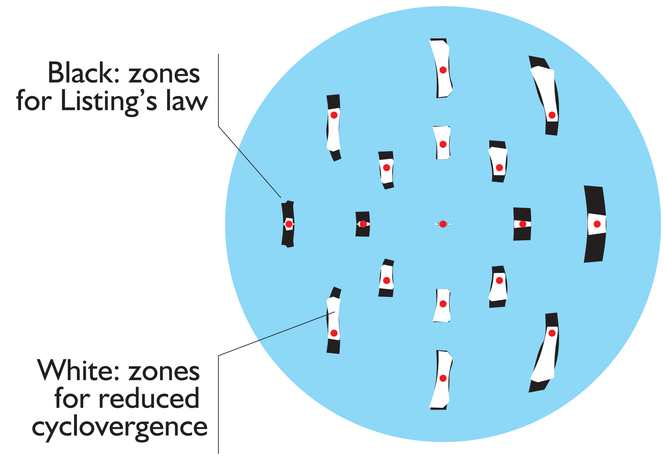
+When we converge, our eyes excycloverge on upgaze, incycloverge on downgaze.
+So if search zones are retina-fixed, we should see excyclorotated stereograms better on upgaze, incyclorotated on downgaze.





RESULTS

+Stereograms were visible only in the predicted eye positions, implying retina-fixed search zones.
+Subjects showed only 40% of the cyclovergence predicted by Listing's law of eye motion.
+This motor pattern reduces epipolar-line motion, permitting smaller search zones:



CONCLUSIONS

+The brain searches for corresponding images not just on epipolar lines, but over large retina-fixed zones.
+The eyes move in a 3-D pattern that allows smaller search zones.

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