

Heading Perception of Tunnel-Vision Patients

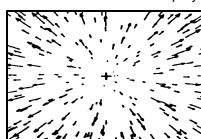
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Introduction

Human observers can perceive heading from optic flow even when the field of view is restricted to 5–10 deg (Crowell & Banks, 1993; van den Dobbelaen & Cornelissen, 1999; Warren & Kurtz, 1992).

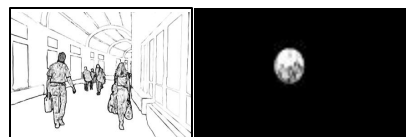
3D random-dot cloud display



Limitations:

- simulated field defect
- unnatural cloud display

Question: Can tunnel-vision patients perceive heading from natural flow displays?



- natural field loss
- natural display

Experiment 1

Subjects

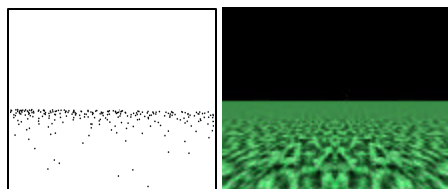
- 4 retinitis pigmentosa (RP) patients (2 patients, Visual Field = ~5 deg; 2 patients, Visual Field = ~10 deg)
- 4 age-matched normal controls

Displays

- Simulated observer forward motion over ground (2 m/s)
- Field of View = 11.2° x 9.5° V
- Duration = 3 sec

(a) Random-dot Ground

(b) Textured Ground



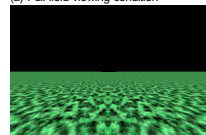
- static depth
- less noise compared with random-dot cloud

- static depth
- more natural

Methods

Viewing Conditions:

(a) Full-field viewing condition



- no fixation
- scanning eye movements

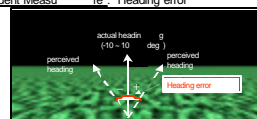
(b) Aperture viewing condition



- fixed fixation
- no eye movements

Task: Place probe in the perceived heading direction

Dependent Measure: Heading error

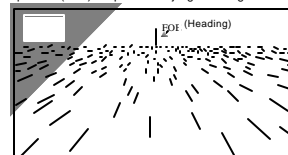


Design: Mixed design

- between subjects - patients vs. normals; 5deg VF vs. 10 deg VF
- within subject - random-dot vs. textured ground display; full-field vs. aperture viewing condition

Experiment 2

Question: Do tunnel-vision patients look for the Focus of Expansion (FOE) in optic flow to judge heading?

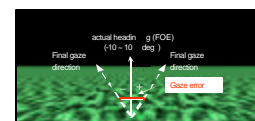


Methods

Viewing Condition: Full-field viewing condition

Task: Eye tracking during heading judgments

Dependent measure: Gaze error in last 5 frames



Conclusions

- With full-field viewing, active scanning eye movements allow RP patients to perceive heading.
- RP patients can seek FOE in the optic flow to perceive heading.

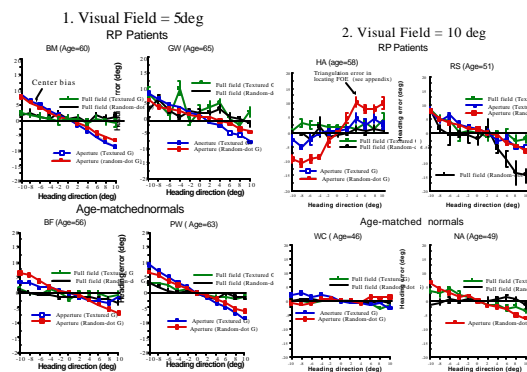
Acknowledgements

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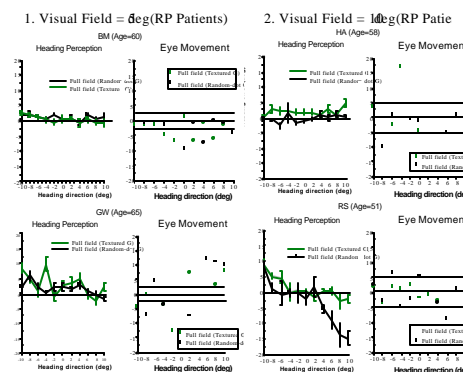
References

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Heading Perception Results



Eye Tracking Results

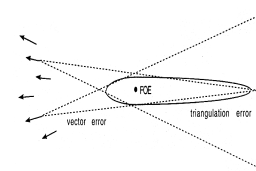


Results Summary

- Comparable heading perception performance on textured ground and random-dot ground displays.
- For both RP patients and normal controls, heading performance gets worse with restricted visual field and fixed fixation.
- With free eye movements, RP patients looked at the FOE for most of the trials.

Appendix

Triangulation error in locating FOE to find heading (Bard/Warren, & Kay, 1999).



Eye Movement (Normal Control) FVM (Age = 30)

