Heading perception depends on time-varying evolution of optic flow

**Aim:** Is instantaneous optic flow sufficient for heading perception?

**Background**

- Optic flow field: retinal image motion caused by an observer’s movement through their environment.
- Rotation problem: heading direction corresponds to singularity for pure translation, but not for translation + rotation.

**Experimental protocol**

- Task: 2-AFC heading discrimination, relative to straight ahead.

**Heading bias**

- Heading bias much larger for phase motion than envelope motion.
- Heading bias: point of subjective equality of psychometric function.
- Heading discrimination threshold: 1 / slope of function.

**Discrimination threshold**

- Heading perception strongly biased for phase motion, but nearly veridical for time-varying phase motion.
- Little difference in bias between first and last flow fields; i.e., bias depends on rotation velocity, not singularity.

**Null model:** an upper bound on heading bias

- Null model computes heading as singularity location, a biased strategy for translation + rotation.
- Observers interpret rotation as additional translation when only given access to instantaneous optic flow.

**Conclusion:** Instantaneous optic flow is insufficient. Time-varying optic flow is needed for accurate and precise heading perception.

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