**Axis-Aligned Motion Bias Effects in an Immersive, Situated Display Environment**

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**ABSTRACT**

The axis-aligned motion bias (AAM) bias is a human perceptual tendency to assume that the primary symmetry axis of a moving object accurately indicates its direction. We examined the impact of observer locomotion on the AAM bias in an immersive, situated display environment that utilizes a large floor-projection display. Participants judged the final destinations of projected geometric figures (symmetric and asymmetric) using different judgment methods which varied in degree of mobility. The findings confirm the existence of the AAM bias in a large situated display environment and demonstrate that its impact on motion perception can be mitigated by engaging the action system in real-time perceptual judgments.

**NATURAL & PERCEPTUAL REGULARITIES**

Natural regularities are highly reliable meaningful combinations of features of environment.

**Psychology of Symmetry**

- Circular/Spiral Symmetry for stationary and passively mobile living things
- Ubiquitous Symmetry
  - Bilateral Symmetry for locomotive living things

**Perception & Action**

- Neural Correlates of Symmetry Perception
  - Early cortical areas (Damasio et al., 1994)
  - Developmental Evidence: Symmetry is a fundamental early perceptual cue (Duken et al., 1989)
  - Toddlers rely on symmetry as an axis in motor/category perception (du Plessis & Abbey, 1999)

**Procedure**

- Modeling: Symmetry detection has been successfully modeled using a back-interpretation neural network.

**DYNAMIC STRATEGIES**

- Participants may utilize pursuit strategies in the mobile conditions:
  - Timed Pursuit/Interception
  - Maintaining a constant optical trajectory (Shepard et al., 1987)
  - Maintaining a constant bearing angle (Proffitt et al., 1996)

**METHODS**

**Participants**

- N = 8 (3 female, 5 male)

**Apparatus**

- The Situated Multimedia Arts Learning Laboratory (SMALLab) environment

**Procedure**

- The participants’ task was to judge the final destination of moving objects (shapes) in circular trajectories which originated on the inside of the ring (points A-D) and traveled approximately halfway across the circle and then disappeared (points A-A).

**RESULTS**

- Error Magnitude Analysis (ANOVA): Highly significant decreasing linear trend for shape-symmetry type

**Error Directionality Analysis**

**Locomotion Hypothesis Supported (post-Mobility Analysis)**

**Conclusions**

- AAM Bias Hypothesis Supported: Participants were prone to the AAM bias in a large, floor-projection based situated display environment.

- Locomotion Hypothesis Supported: Negative effects of AAM bias were mitigated by locomotion

**Take Home Messages**

- People experience an axis-aligned motion bias in an immersive, situated display environment.

- Accuracy depends on axis-trajectory alignment; misalignment causes systematic error toward axis.

- Active judgment methods are less susceptible to any negative effects of AAM bias on perception

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[Diagram and figures related to the study are not transcribed here.]

**Methods**

- **Participants**: 8 participants (4 female, 4 male) from different departments.

- **Apparatus**: The Situated Multimedia Arts Learning Laboratory (SMALLab) environment.

- **Procedure**: Participants were instructed to judge the final destination of moving objects (shapes) in circular trajectories which originated on the inside of the ring (points A-D) and traveled approximately halfway across the circle. The choice and then disappeared (points A-A).

- **Results**: Error magnitude analysis revealed a significant decreasing linear trend for shapes-symmetry type. The error magnitude was higher for asymmetric shapes compared to symmetric shapes. Post-hoc analyses using Sidak’s corrections showed significant differences between symmetric axis-aligned and axis-misaligned shapes.

- **Conclusions**: The AAM bias was confirmed in this study. Locomotion significantly mitigated the impact of the AAM bias. Participants were more accurate in the mobile conditions compared to the stationary condition.

- **Take Home Messages**: The study suggests that active judgment methods are less susceptible to the AAM bias compared to passive observation.

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