Exploring Visual Perception Through Eye Movements: Effects of Stimulus Structure and Task Demands

Shazia Nasreen
CogSci Lab, Indian Institute of Technology Kharagpur, India

Rajlakshmi Guha
CogSci Lab, Indian Institute of Technology Kharagpur, India

Eye movements offer a sensitive window into the cognitive mechanisms that underlie visual attention and perceptual processing. While existing research has largely focused on structured, semantically rich images, less is known about how eye parameters reflect the processing of ambiguous stimuli under varying task demands. This research addresses this gap through three complementary studies that examine eye movements during free viewing and task-based viewing of structured, ambiguous, and blank visual stimuli. Results indicate that during free viewing, Total Fixation Duration and Fixation Count most effectively differentiated stimulus type, with ambiguous stimuli eliciting greater exploratory behavior and a pronounced central fixation bias. In task-based viewing of concrete stimuli, Visit Count emerged as the most sensitive indicator. For ambiguous stimuli, increasing chromatic complexity selectively enhanced Fixation Count and Visit Duration. Overall, findings demonstrate parameter-specific sensitivity to cognitive processing and reveal distinct strategies, highlighting eye movements as robust markers of cognitive engagement.

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