

Visual Attention and Comprehension Across Chart Types: An Eye-Tracking Analysis

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Abstract

Data visualization plays a critical role in how users perceive, interpret, and communicate information by transforming complex datasets into clear visual representations such as charts and graphs. Effective visualizations enable users to quickly identify trends, patterns, and outliers, supporting understanding among both technical and non-technical audiences. This study evaluates the efficiency of three common visualization types—bar charts, pie charts, and scatter plots—using eye-tracking technology. Eye-tracking metrics, including gaze patterns and fixation duration, were used to assess how participants visually interacted with each chart type. After individual calibration, participants viewed each visualization in randomized order and completed brief comprehension surveys, followed by a final survey assessing overall effectiveness. Results showed that bar charts produced the shortest total fixation duration (1.473 s), indicating faster comprehension, followed by pie charts (3.507 s), while scatter plots required the longest fixation duration (6.118 s). A repeated-measures ANOVA revealed a significant effect of chart type on fixation duration, $F(2, 10) = 40.81$, $p < .001$. These findings suggest that bar charts provide the most efficient and easily understood visualization, offering practical guidance for selecting effective visual formats in data-driven communication and decision-making.

Keywords

Visual Attention, Eye-Tracking Analysis, Gaze patterns