Correlation Judgment as a Model of Weber's Law, Power Laws, and Visualization Features: A Comparative Study

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Graphical perception studies are a pillar of visualization research, providing a foundational understanding of how people extract information from arrangements of visual marks. Recently, research has begun using experimental techniques and perceptual models from the vision science community. One example of the use of perceptual models such as Weber's law to model the perception of correlation in scatterplots. While this thread of research has progressively refined a model of the perception of correlation in scatterplots, it remains unclear as to why the perception of correlation in scatterplots can be modeled using linear and log-linear functions. In this paper, we investigate a longstanding hypothesis that people use visual features in a chart as a proxy for statistical measures such as correlation. For a given scatterplot, we extract 48 candidate visual features, and apply a set of criteria to evaluate which features best align with existing models and participant's perceptual judgments. The results support the hypothesis that people attend to a small number of visual features, when discriminating correlation in scatterplots. We discuss how this result may account for prior conflicting findings, and how visual features provide a baseline for future model-based approaches in visualization evaluation and design.