We quantified **perceptual bias** across five visualization designs.

Icon arrays were the **most accurate** in representing true probabilities in **proportion estimation** tasks.

Icons are Best: Ranking Visualizations for Proportion Estimation

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Introduction

Visualization is widely used to communicate the likelihood of events. People make a number of decisions daily based on charts and graphs. We conducted an experiment to examine the differences in probability perception between five types of visualizations.

Experiment

Using crowdsourcing, we set up a lottery experiment where users are prompted to estimate the proportion depicted by the visualization design. Then, they were asked to choose a lottery option which will be used to determine their compensation bonus.

Results

Participants estimated the correct probability 40% of the time. Subjects in the icons condition produced 72.9% accurate estimates, while pie, circle, triangle, and bar yielded 59.8%, 10.6%, 13.7%, and 39.4% respectively.

Across all designs, participants overestimated low probabilities and underestimated high probabilities. We investigated the difference between estimated values and real values (ERROR). Overall, subjects made the least ERROR on average when shown a probability of .5.

Across all conditions, the differences in ERROR were significantly different and suggest a strict ordering of **icon>pie>bar>triangle>circle**

Future work

We leveraged the lottery scenario to uncover how visualization impacts decision-making. Instead of prompting participants to provide a probability estimate, we used the gambling game to elicit choices based on the five visualizations designs.

We evaluated their lottery choices and observed how risk seeking or risk averse they were using Relative Risk Premia as a measure of rationality.

Acknowledgments

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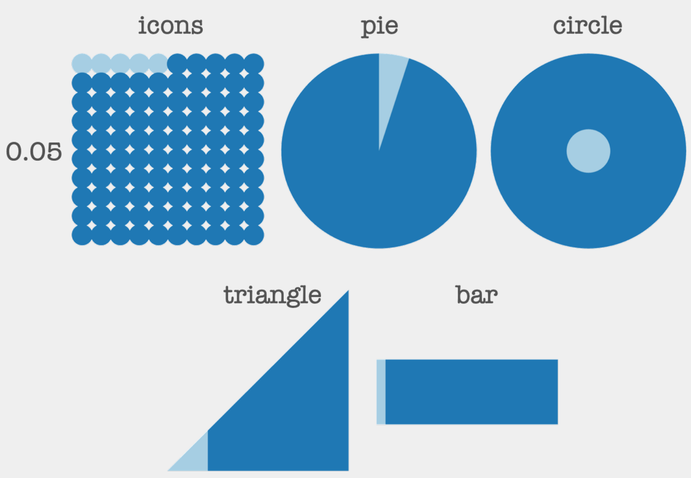

Figure 1.0. The five visualization designs used in the study

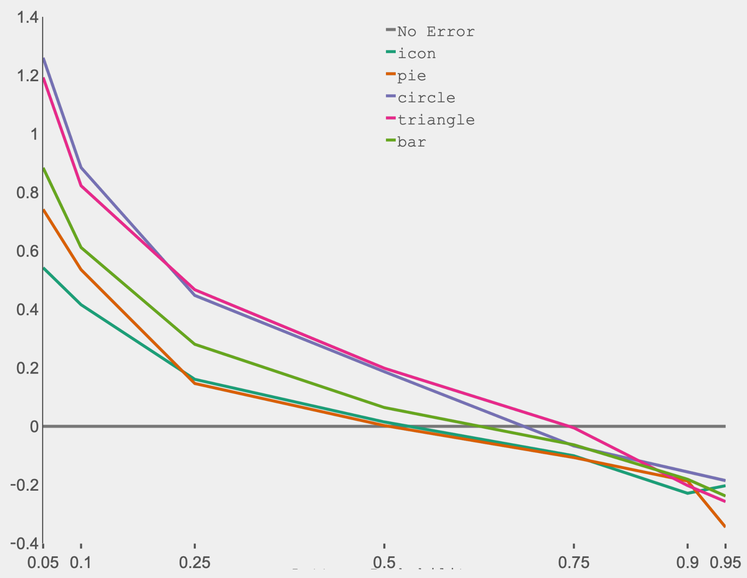

Figure 2.0. Mean error across probabilities

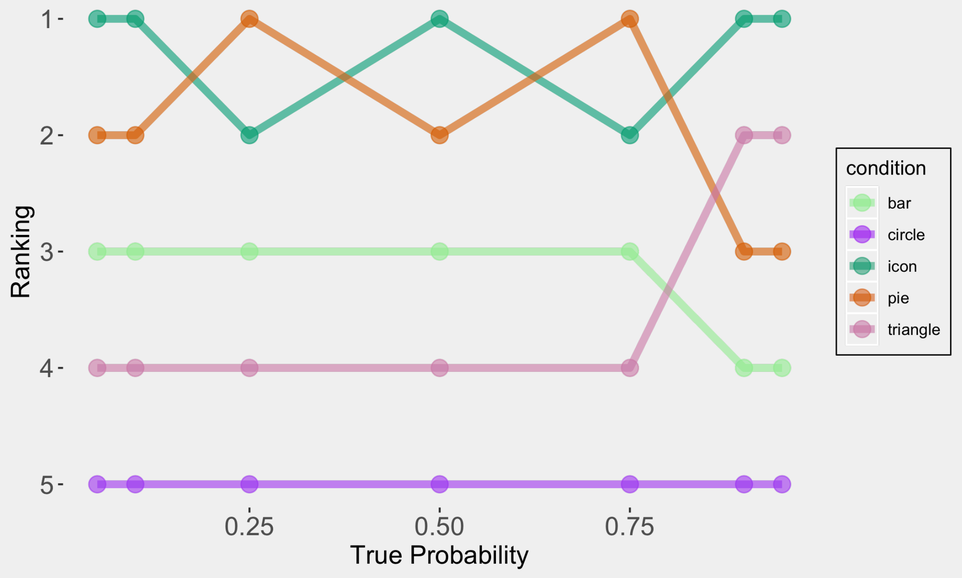

Figure 3.0. Ranking across visualizations

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