

# Icon arrays are significantly more accurate in representing true probabilities in proportion estimation tasks compared to area proportioned visualizations

## Icons are Best: Ranking Visualizations for Proportion Estimation

Zhengliang Liu, Melanie Bancilhon, Alvitta Ottley

### Introduction

Visualization is widely used to communicate the likelihood of events. People make a number of decisions daily based on charts and graphs. Graphical perception, the act of decoding visual information, is fundamental to reason about this data. 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

We found that 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 10.6%, 13.7%, and 39.4% respectively. Accuracy across all pairs of visualization conditions were significantly different except for the circle and triangle pair. We also found that across all conditions, participants were more accurate when shown a probability of .5.

We investigated the difference between estimated values and real values (ERROR). Across all conditions, the differences in ERROR were significantly different and suggest a strict ordering of **icon>pie>bar>triangle>circle**

### Discussion

We conclude that judgment with icon arrays were the most accurate and that area proportioned charts were challenging for people in these groups. Our study allowed us to isolate differences in graphical perception in the charts and established a baseline for visualization selection

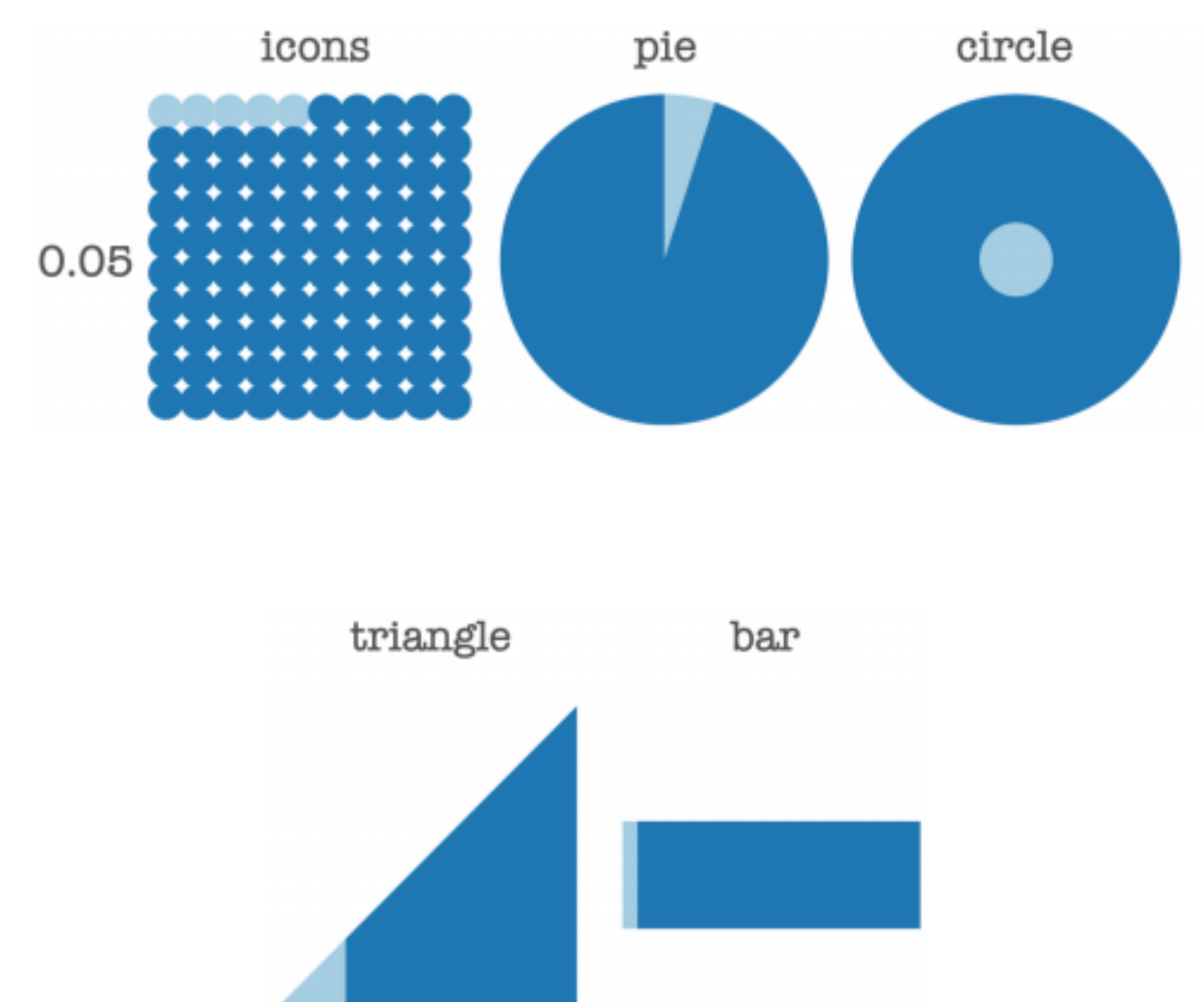


Figure 1.0. The five visualization designs used in the study

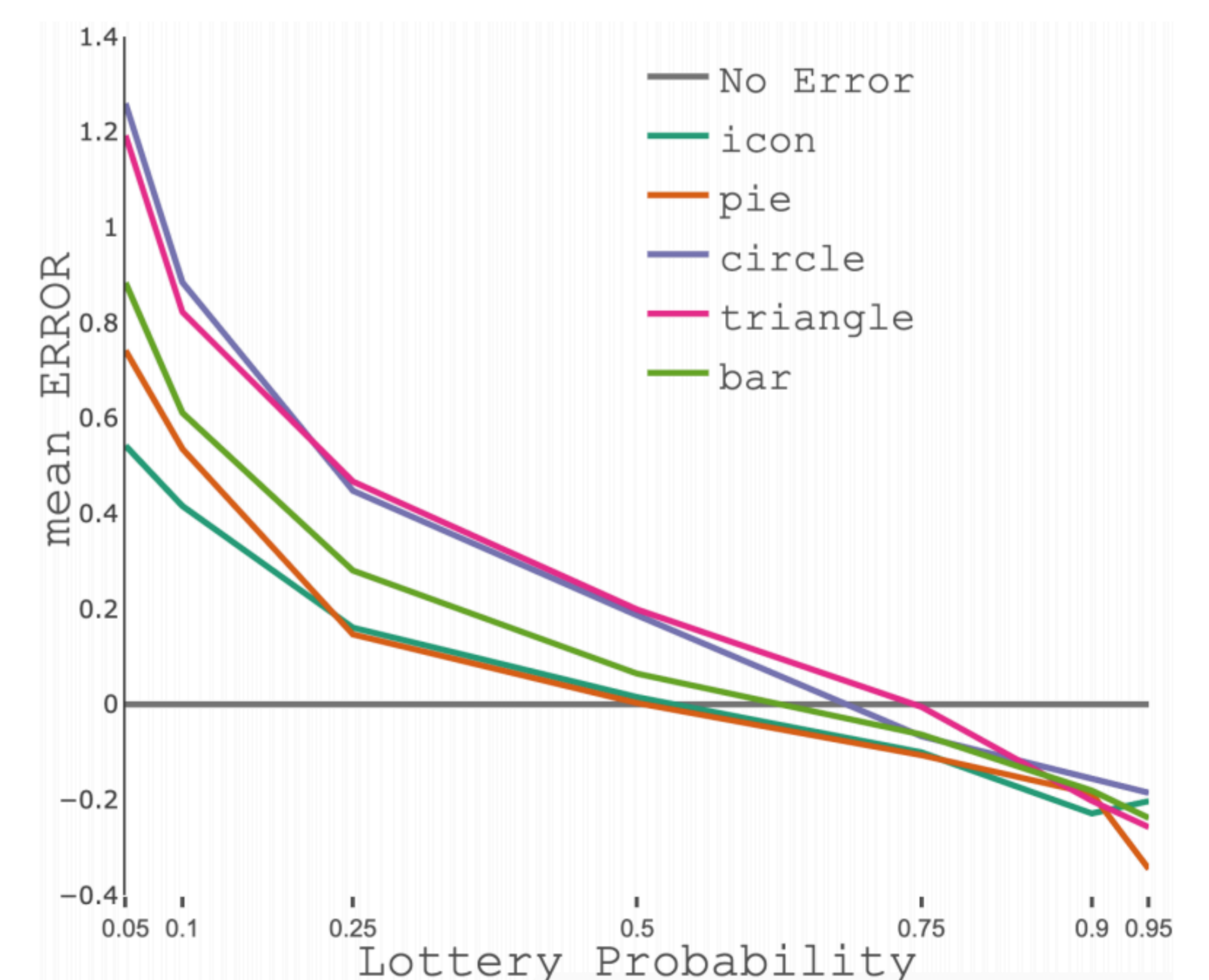


Figure 2.0. Mean error across probability values

