



How can we help everyday people better interpret data visualizations?



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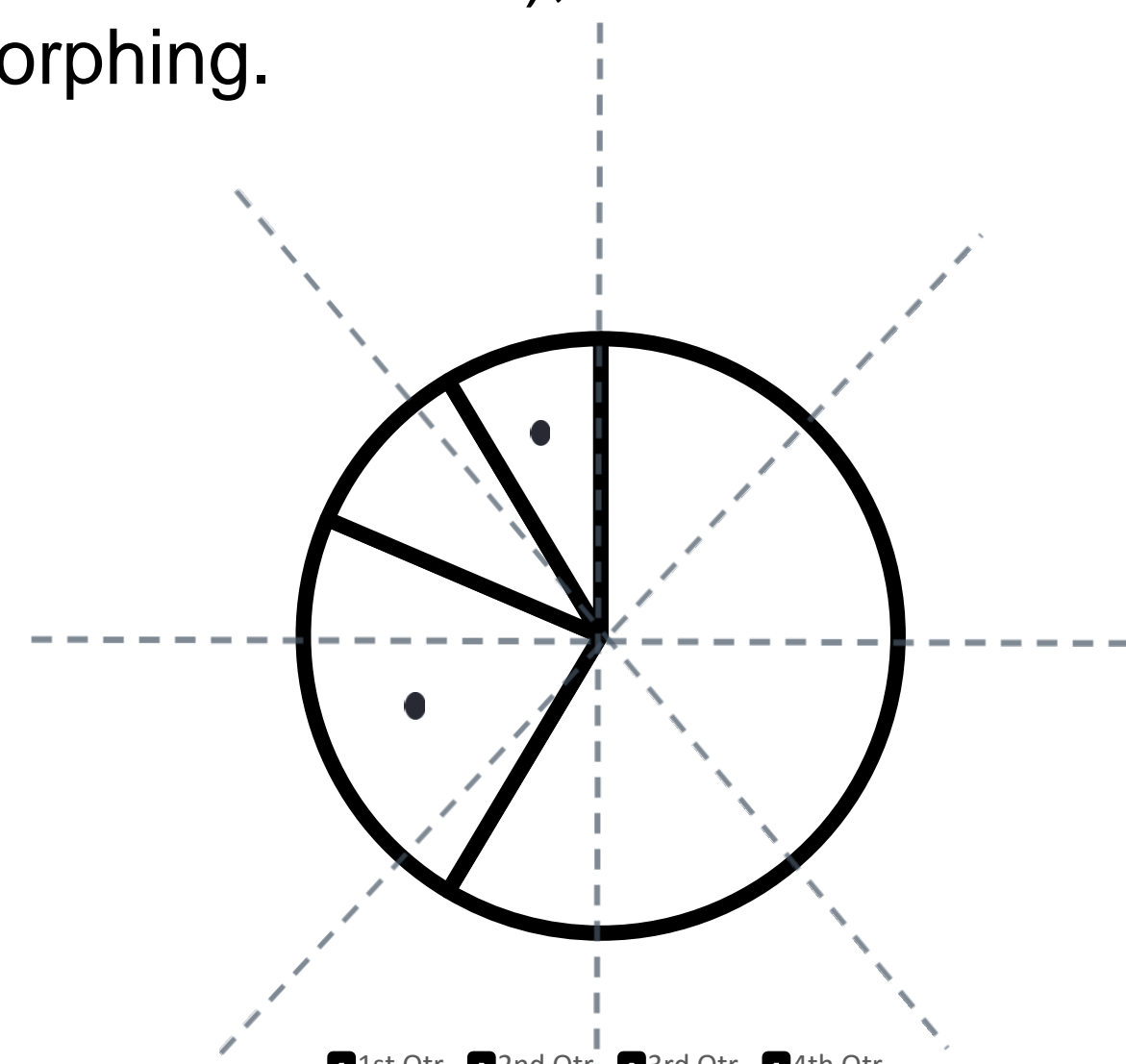
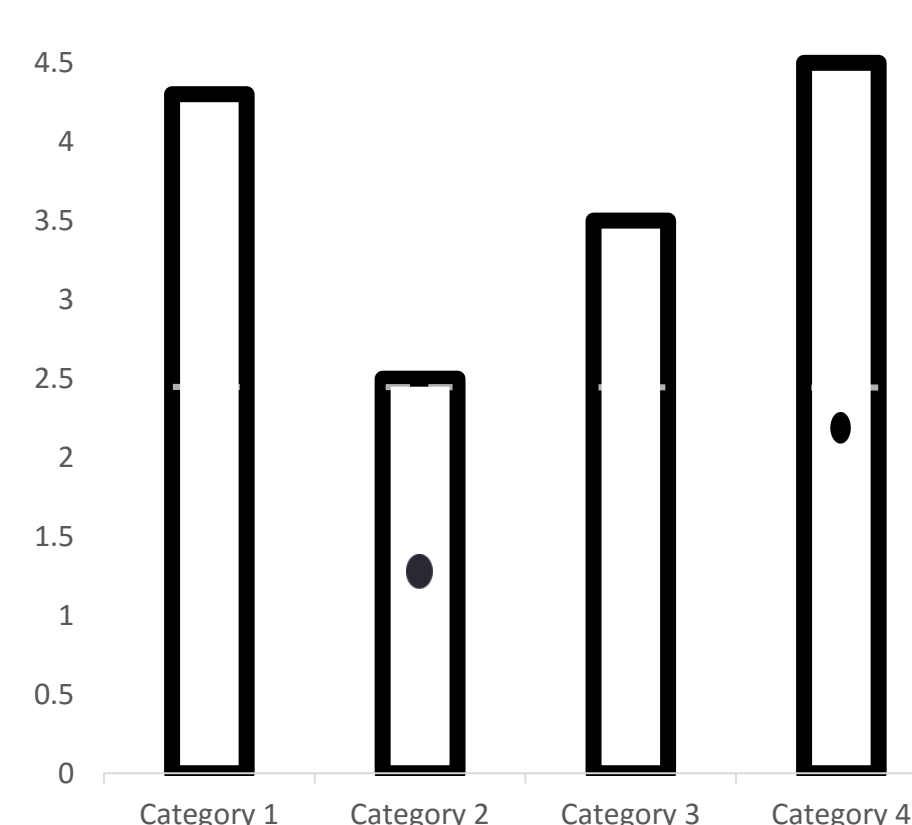
ABSTRACT

The average person cannot accurately interpret even the most common charts. As data becomes more pervasive in the lives of everyday people, research needs to move beyond quantifying how accurately we read charts and develop techniques that can assist us in effectively interpreting charts. To tackle this issue, we designed feedback mechanisms intended to help our pilot study participants interpret the visualizations. With repeated exposure to feedback, we hypothesize that everyday people will indeed improve on data literacy.

DESIGN SPACE

There are many possible ways to deliver feedback to participants as they make comparison judgements in charts. Through a design exercise, we generated several possible feedback designs and categorized them into groups: Basic (Dashed lines/color/focus bubble), Mathematics and Calculations, Interactive, and Morphing.

Basic Examples:

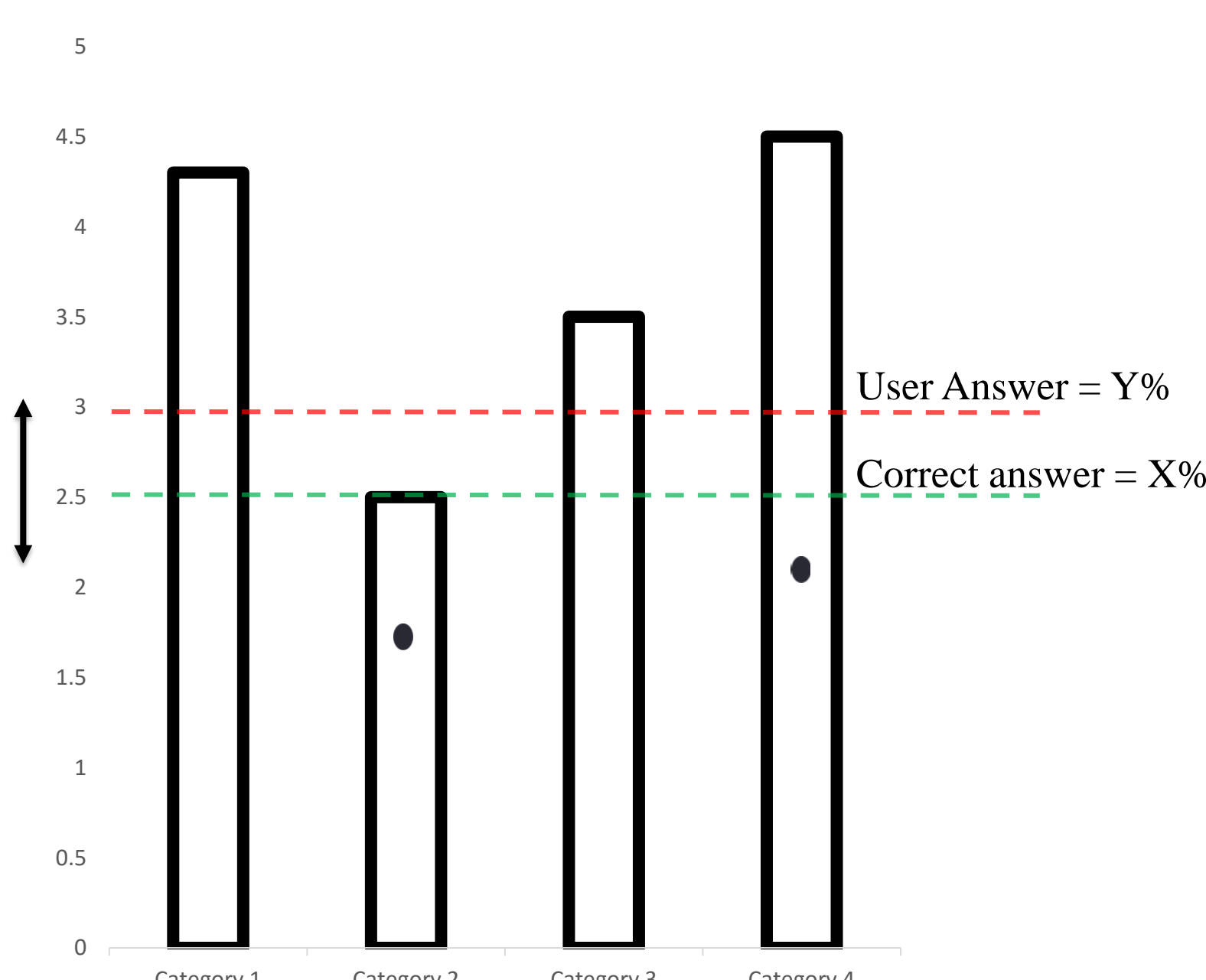


Mathematics & Calculations: Teach participants to make a mathematical estimate

1. Determine each indicated slice/bar's individual % of the whole chart.
2. Determine the % the smaller is of the larger.

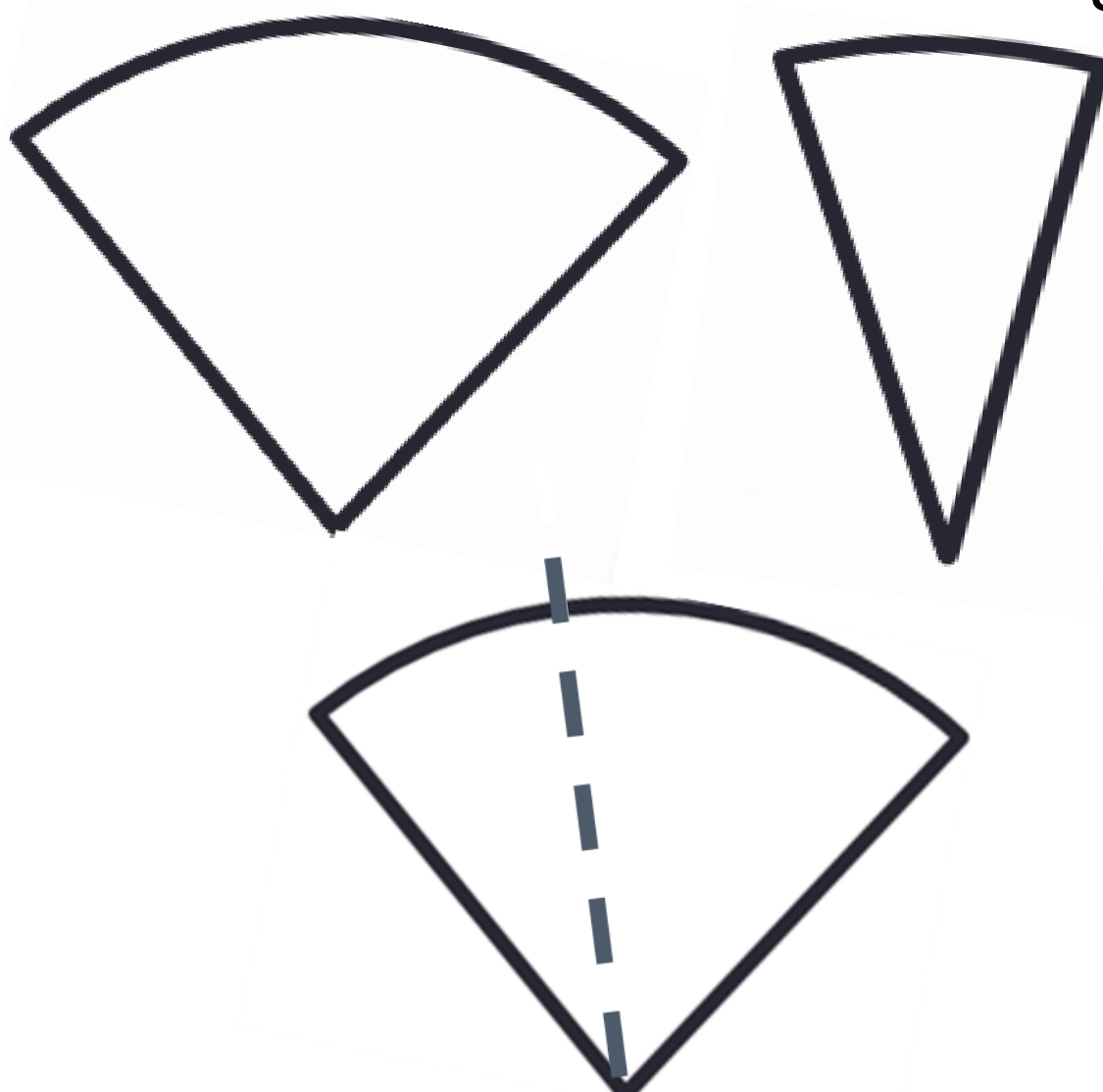
Interactive Examples:

Y-Toggle



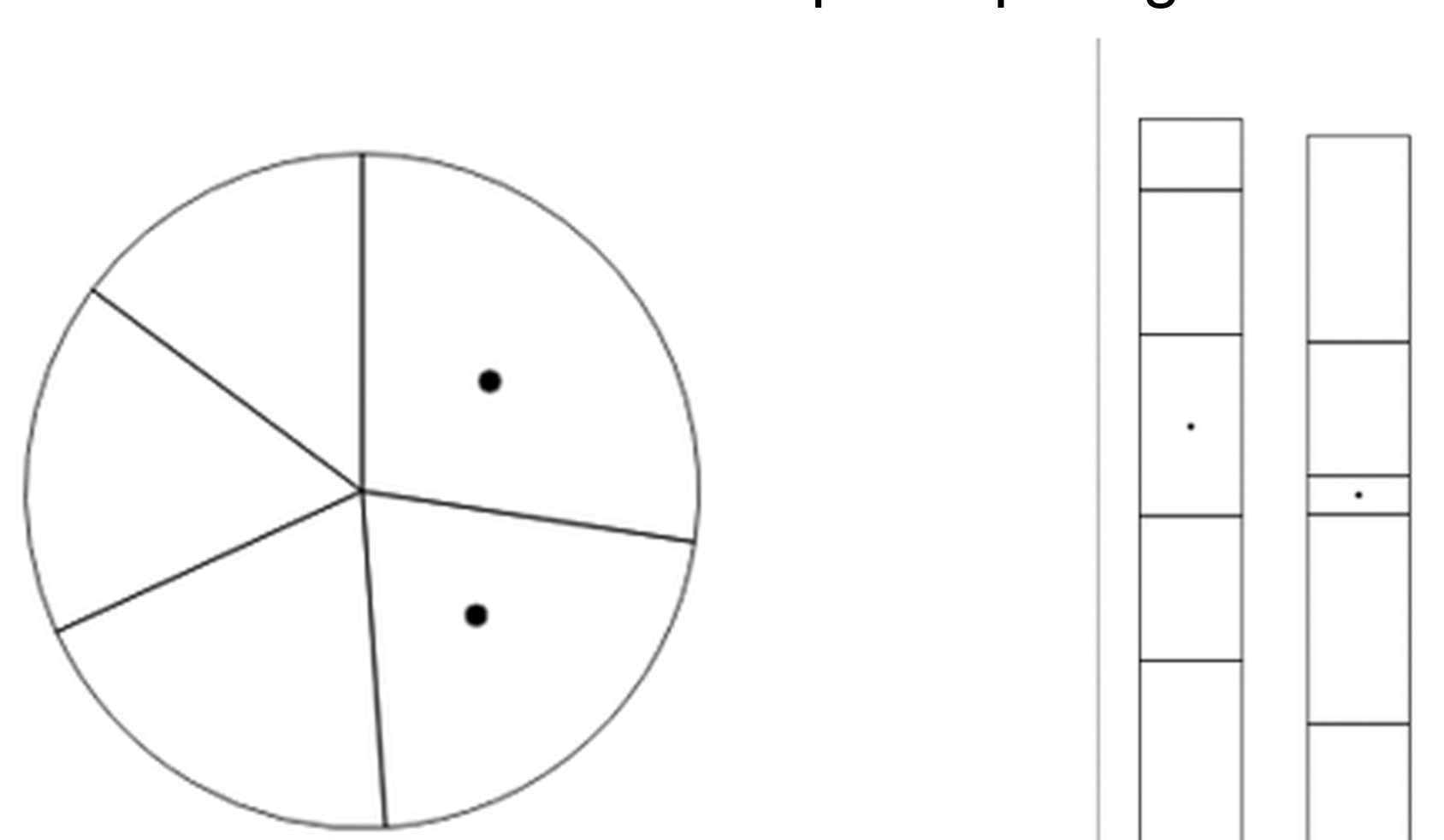
Overlap: the actual % and user % are shown below, then we show the overlap/difference in the two answers

X% -- actual Y% -- user guess



EXPERIMENT DESIGN

To test our hypothesis that feedback helps improve performance in judging data visualizations, we adapt a previously-established experiment methodology to incorporate one of our feedback designs^{[1][2]}. The images below are examples of the charts the participants could have seen while participating in our experiment.

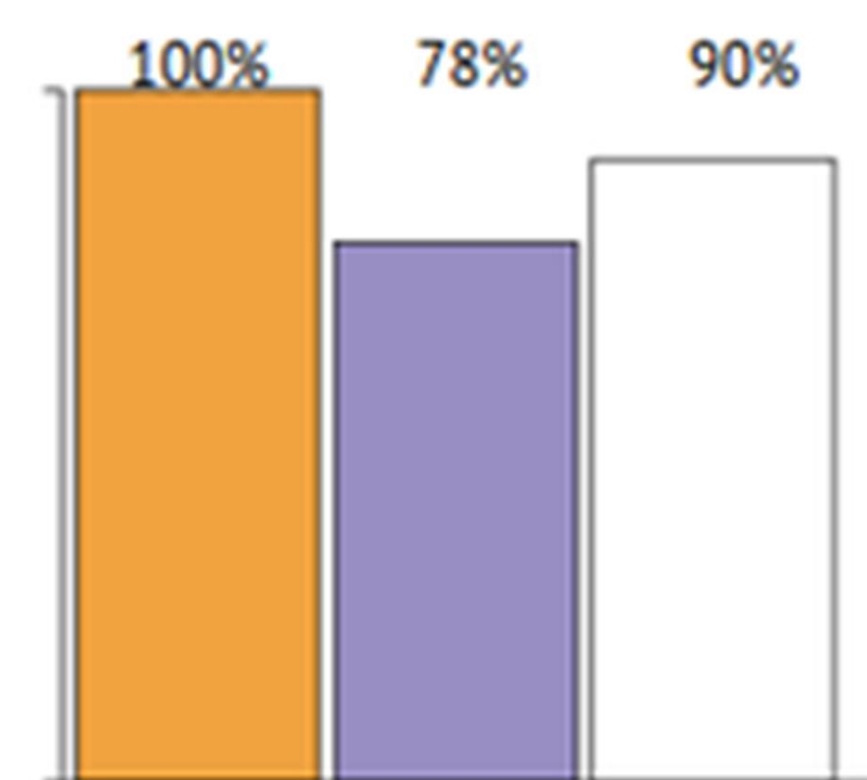
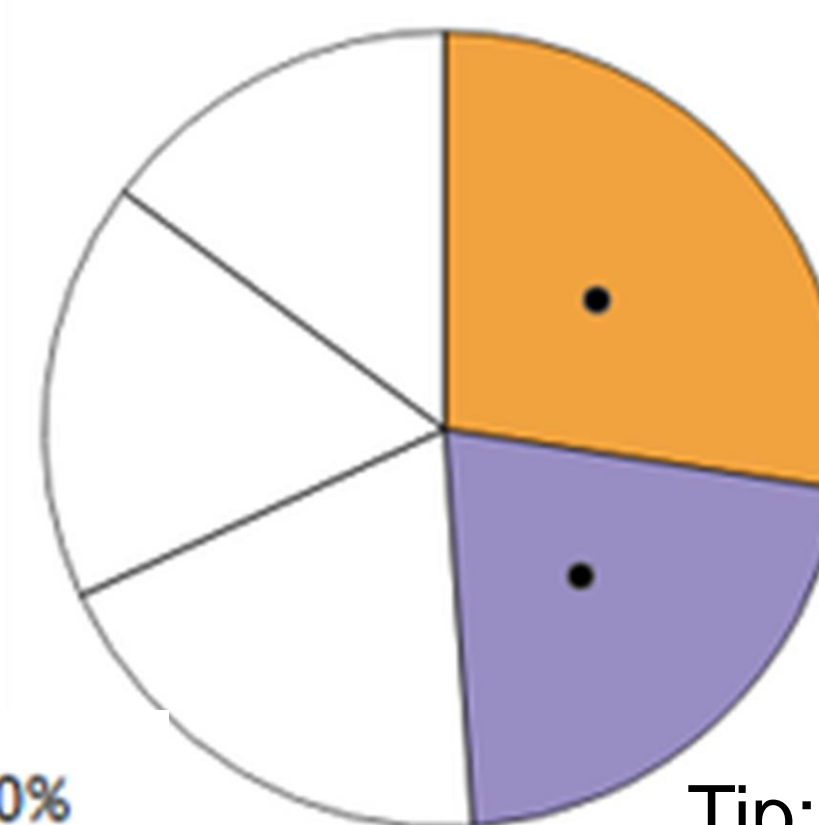


- Participants were asked to explore two common visualizations: a pie chart and a stacked bar chart.
- They had to compare the two sections marked with a black dot.
- We asked: "What percentage is the smaller of the larger?"
- Total of 48 comparison trials per participant, with a short break after the 24th trial.
- This experiment used "between subject" design. Some participants saw no feedback; those who received feedback, only saw it during the first half of the experiment (for pie charts only).
- Throughout the experiment, there were 12 trials involving stacked bar charts ("control"—no feedback for stacked bar charts), and 36 trials involving pie charts (some participants saw feedback for pie charts, while others did not)

IMPLIMENTED FEEDBACK MECHANISM

Morphing Feedback Design: Pie chart → Bar Chart

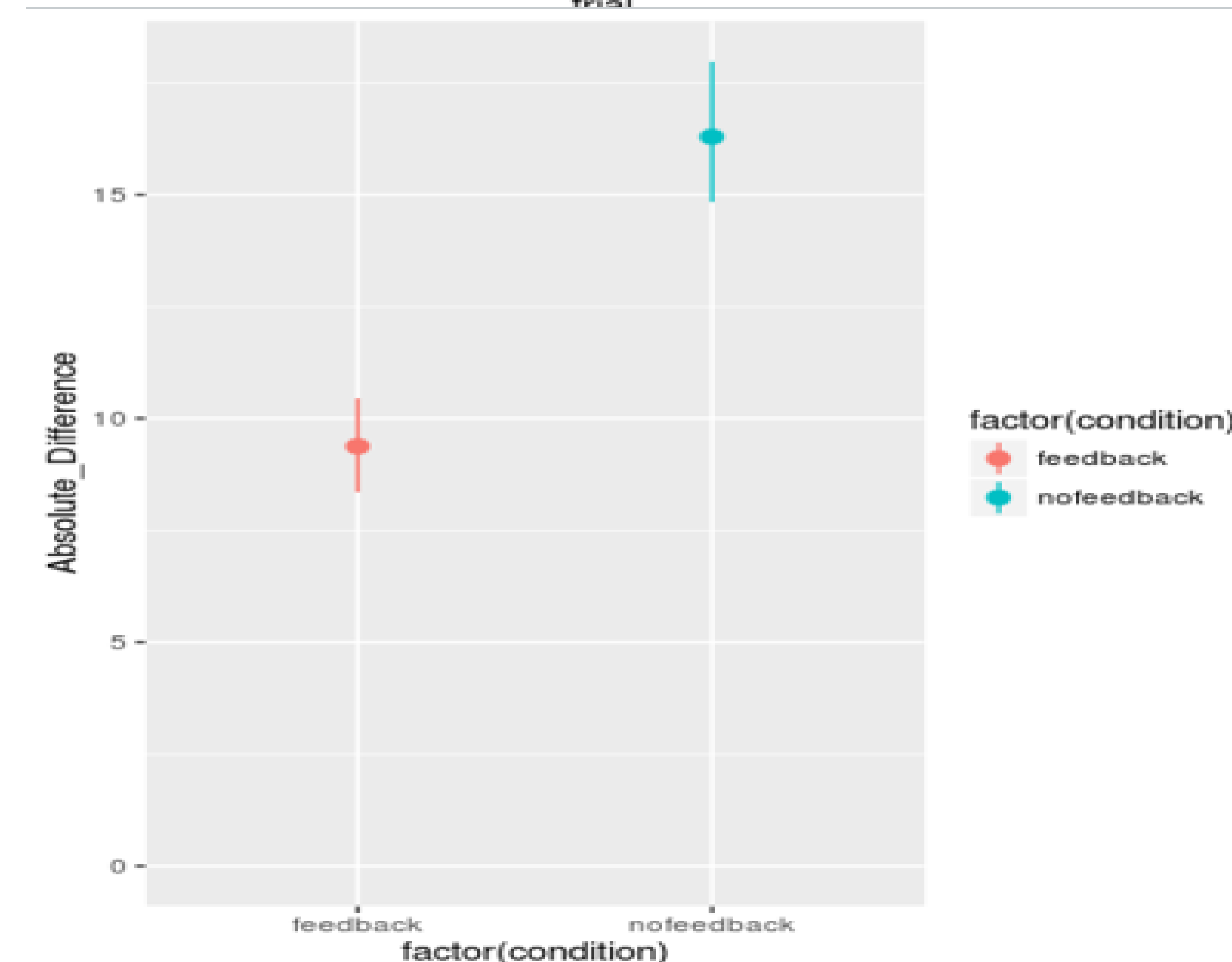
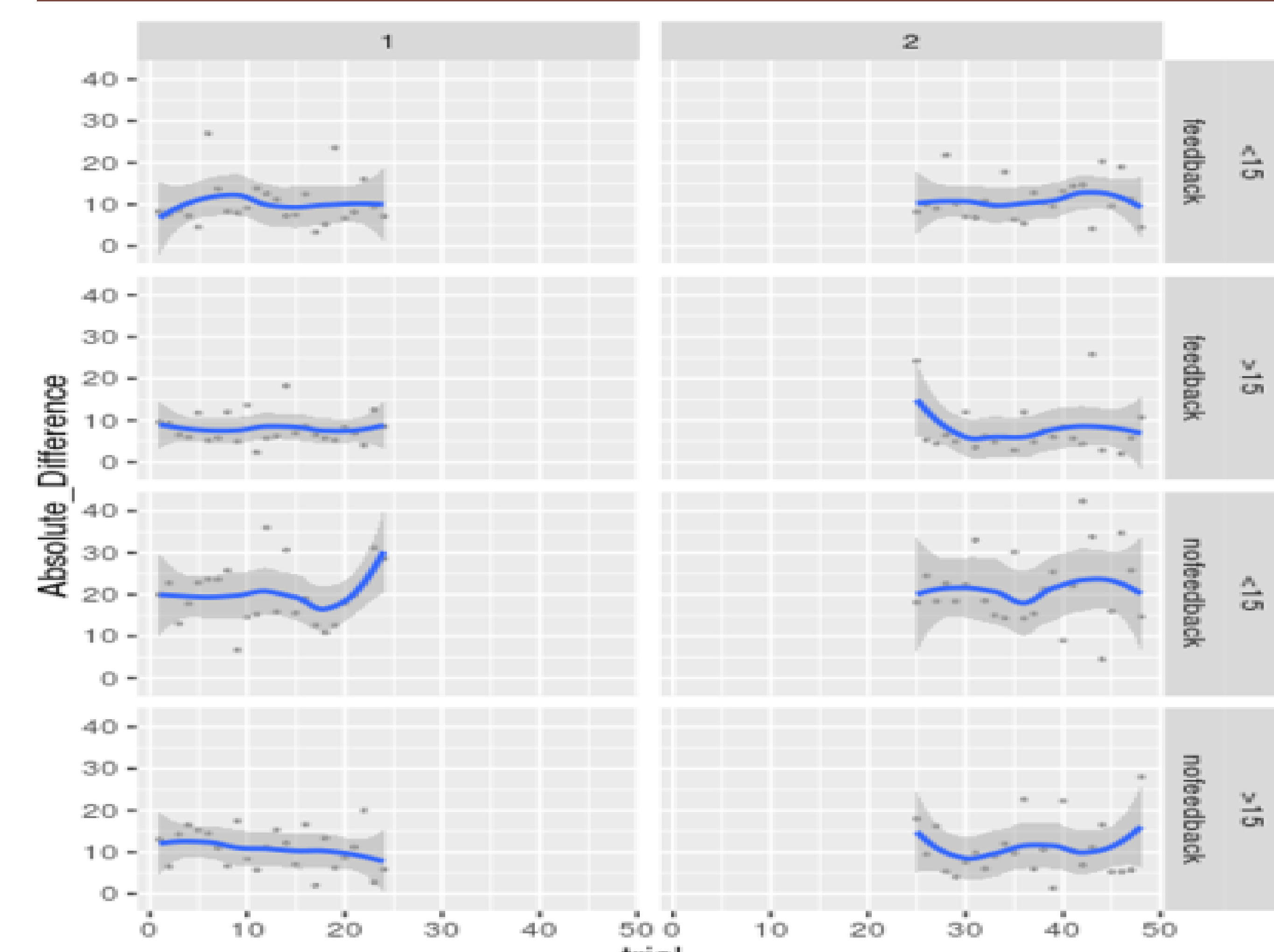
- The morphing feedback design concept transforms unfamiliar or difficult to read graphs into more common and easy to read graphs.



Tip: Above is the pie chart you analyzed during the previous question. The larger slice is orange, the smaller is purple. To the left, we show a bar chart that displays the relative size of the purple and orange slices, along with your guess.

You answered 90% -- the exact difference is 78%. Better luck next time!

Results



Acknowledgments/Citations

- Kartik Vasu [Undergraduate at Worcester Polytechnic Institute, Major: Computer Science]
- NSF - 1560229 REU SITE: Data science research for safe, sustainable and healthy communities
- Puripant Ruchikachorn, Klaus Mueller, Senior Member: Learning Visualizations by Analogy: Promoting visual Literacy through Visualization Morphing, 2015
- ^[1] Jeffrey Heer, Michael Bostock. Crowdsourcing Graphical Perception: Using Mechanical Turk to Assess Visualization Design. *ACM Human Factors in Computing Systems (CHI)*, 203–212, 2010
- ^[2] William S. Cleveland, Robert McGill. Graphical Perception: Theory, Experimentation, and Application to the Development of Graphical Methods. *Journal of the American Statistical Association*, Vol. 79, No. 387 (Sep., 1984), 531–554