Cognitive Biases caused by skewed visual data

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Abstract: Various studies in the past have looked at the role of different cognitive biases in economic decision-making in order to find a better estimation of the value function. With the rise in the use of data visualisations in advertisements and social media posts that aim to compress the most amount of information in a concise way, There is a need to study cognitive biases that can be generated by inaccurate data visualisation. We aim to follow and build upon the work of .In this study, we designed an experiment to test the same.

Keywords—Cognitive Biases, Data Visualisation, Bar Graphs, Economics.

Introduction

Decision-making is a complex process, and humans tend to take shortcuts leading to cognitive biases. These biases can be misused to exploit consumers without their knowledge. Thus we need to explore and beware of such practices. We will look at data visualisation as an advertisement technique and test the hypothesis that people making snap decisions prioritise the visual aspects over calculating numeric values of data. Kahneman and Traveskey applied. Tested the differences in choice behaviour when people are presented with the same data framed in different ways. We look at the same thing, except we change the framing in terms of visual representation instead of linguistics.

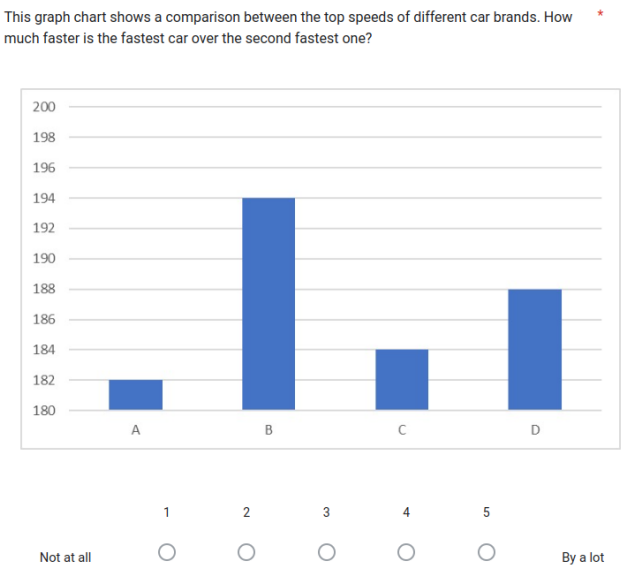
Literature Review

When data is presented as a graph or a chart instead of a numeric table, Values aren't the only factor that affect the perception. The scale chosen for the X and Y axis, 3-Dimensional distortions, selection of data points, and even context is important to evaluate data completely. Each of these can be manipulated. Some examples are Truncating the X or Y axis on Bar charts, Tilting Pie Charts and using percentages that sum up to more than 100, or Obfuscation(making it obscure to extract data values). , or inverting axis.
Eye Tracking studies have looked at Claire Lauer and Shaun Obrien have worked on persuasive visualisations and paired them with control versus exaggerated statements.

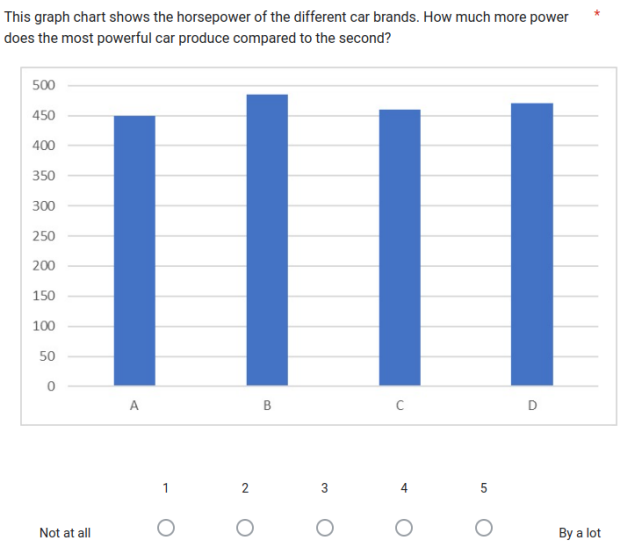
Experiment Design

We conducted a mixed-group design survey. Participants were randomly assigned one of two surveys, each containing eight questions to judge visual data, with four control and four Skewed Data Charts. 1) Bar chart with Turncated Y axis. 2) Pie chart with distorted 3D representation. 3) Line Chart with Flipped Y-axis, 4) Line Chart with distorted Y-Axis. Each of these had a Control Visualisation with the same data presented without exaggeration.

Example:



Truncated Bar chart



Control Bar chart.

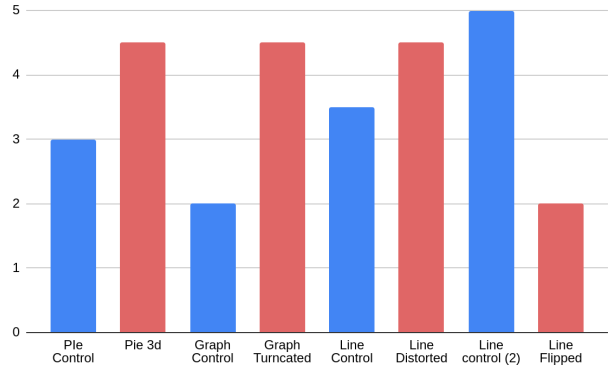
The Two surveys were used to alternate between the linguistic context given along with the data to avoid its effect on the results. (Each statement was presented with a control graph to one set of participants and with deceptive visualisations to another set of participants) This was chosen in random order. (Survey linked in the appendix).

Participants were informed about the time required to fill out the survey and that their participation was voluntary, also that they were allowed to stop the survey at any point in time in the consent form. They were instructed to avoid any distractions while completing the survey. After this, general

personal background details were collected, and participants were informed that their data is collected anonymously and will not be used outside the scope of this study.

Results

We collected 20 responses (15M, 5F). from the age group of 19 to 22. mostly high school and undergraduate-educated students.



The responses show ratings based on how convincing the narrative given was in each situation. Every Visualisation method shows a higher response on average than in the control situation. The bar graph showed the highest difference in the control versus the truncated case.

Conclusion

Some of the limitations of this study were the low number of participants and the inability to explain the reversal of the hypothesis in the line chart(2) case. Yet we see that the results indicate a correlation. Based on the above analysis we can conclude that this has real world implications such as effective marketing to establish opinions, political agendas as well as spread of misinformation. As we saw the influence of many big companies on important choices. Since data analysis is taking up more important roles day by day we think that research like this is very important in the marketing context.

References

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