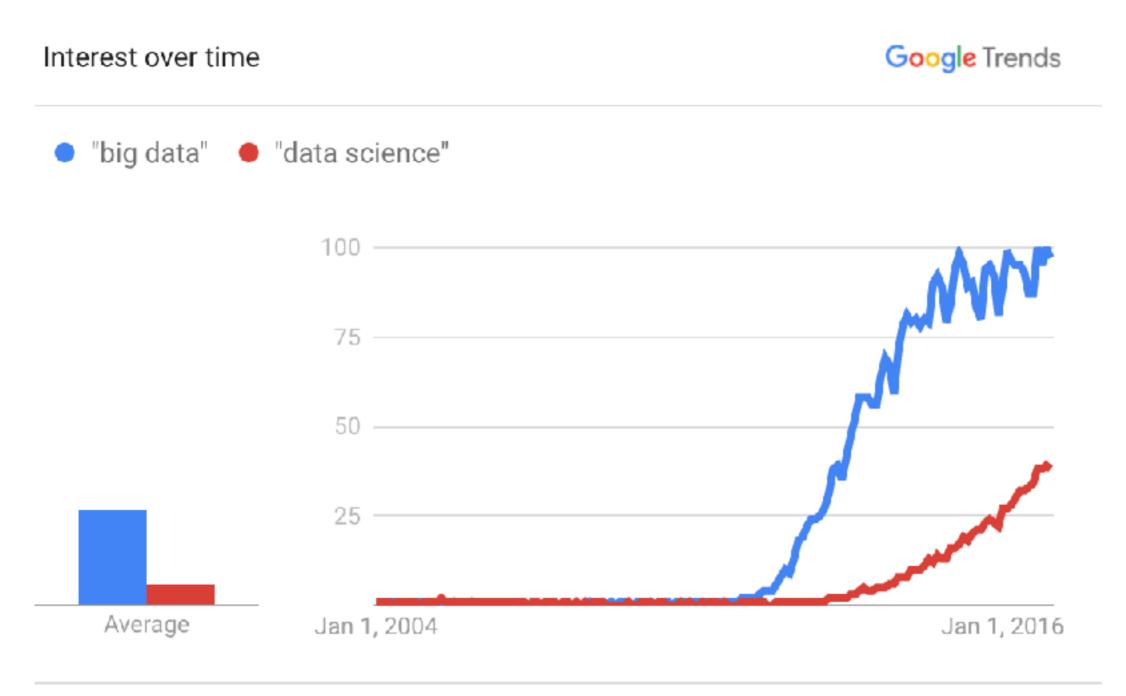
Examining Whether Approximate Visualizations Impact Perception of Corrected Visualizations

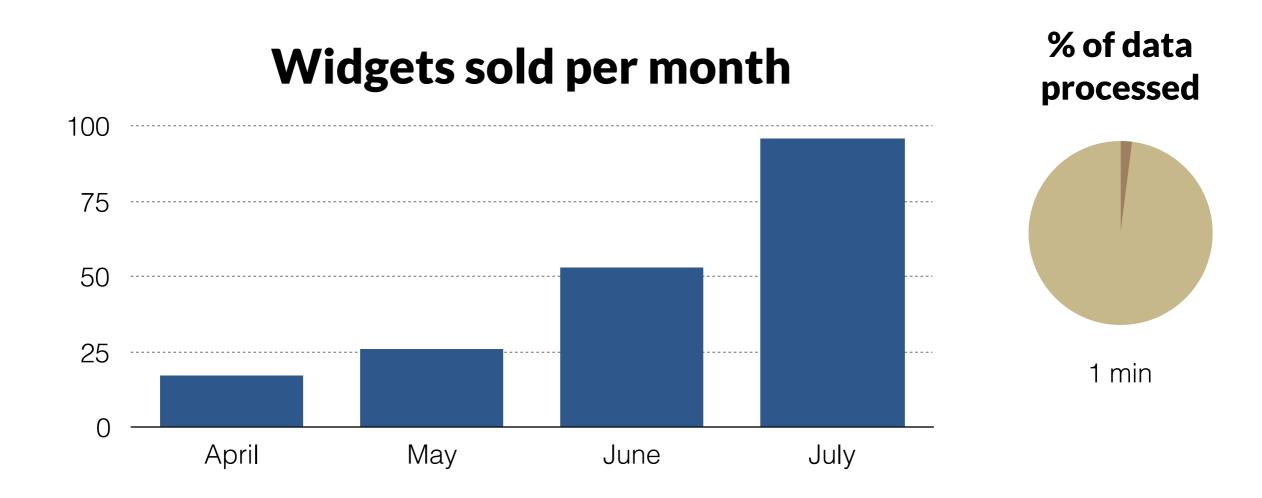
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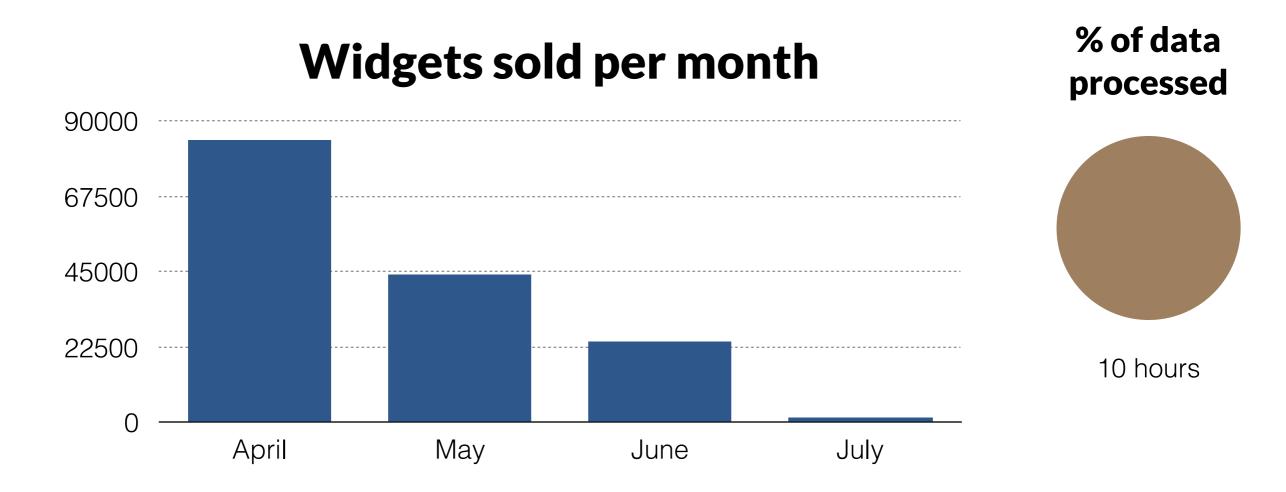




Worldwide. 2004 - present.







Research Questions

- 1. Does seeing an imprecise visualization generated from sampled data prior to a precise visualization impact people's recollection of the data viewed? (e.g., is there a bias?)
- 2. Is this impacted by highlighting the change from the imprecise visualization in the precise visualization? (e.g., can we prevent the bias?)

Talk Overview

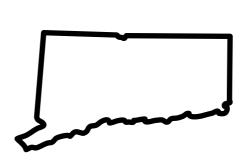
- Study Design
- Measurements
- Participants
- Results
- Discussion

Talk Overview

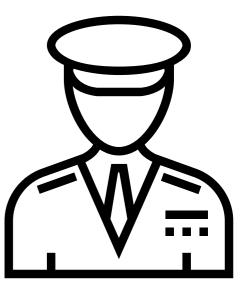
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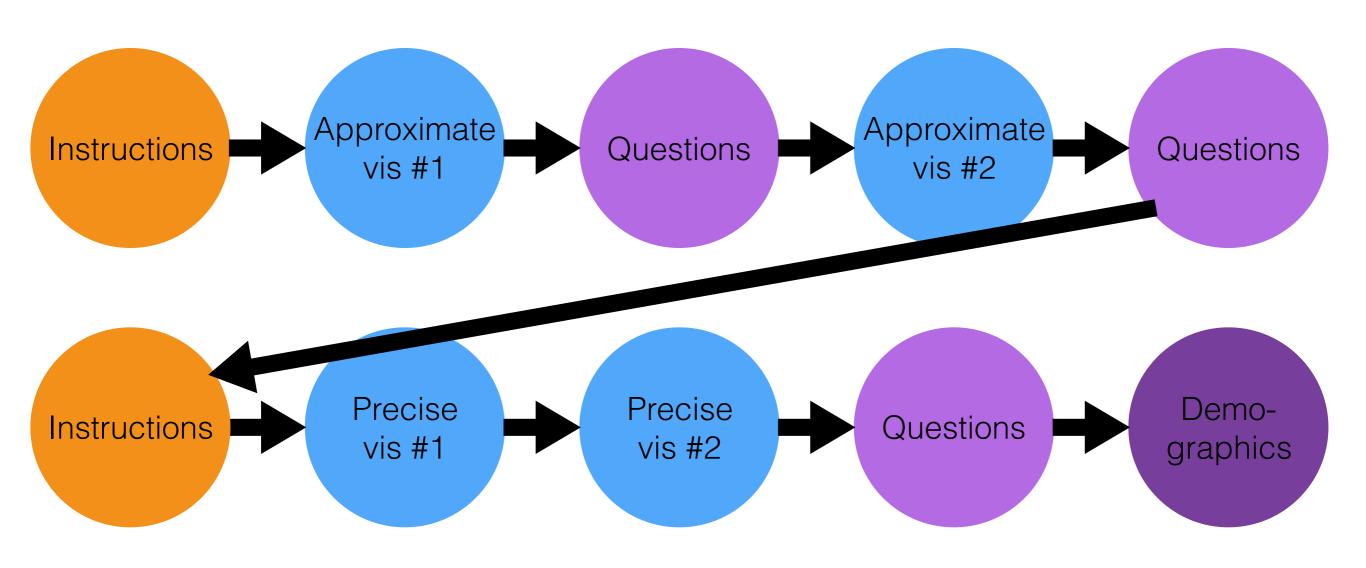
Flights dataset



States



Airlines





In this study, you will look at visualizations from a large dataset about recent flights across the United States. The dataset is quite large, and takes a while for a computer to analyze. You will first view sets of visualizations which will approximate the overall results. Later in the study, once the computation is complete, these visualizations will then be corrected to show the precise results. You will answer some questions at each stage.

The study consists of three major parts:

- 1. Viewing 2 approximate visualizations and answering a few questions about them.
- 2. Viewing 2 updated, precise visualizations.
- 3. Answer a few questions about the dataset.

When completing this task, please imagine that you are an analyst interested in flights on **American Airlines** and flights originating out of **New York**.

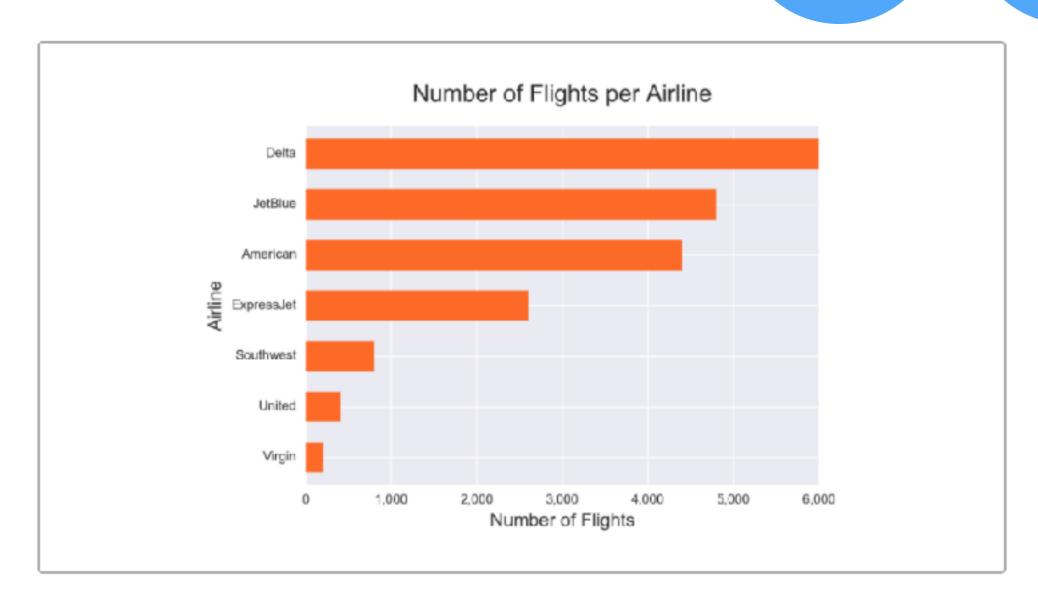
The questions in the study relate to the data associated with American Airlines and New York, and how it compares to other airlines and states in the dataset.

Upon answering the questions about the dataset, we will provide you with a code to enter into Amazon Mechanical Turk to denote that you have successfully completed the study.

Please don't take notes on the data. We want your answers to reflect what you noticed in the visualizations, not what you wrote down.

Approximate vis #1

Approximate vis #2

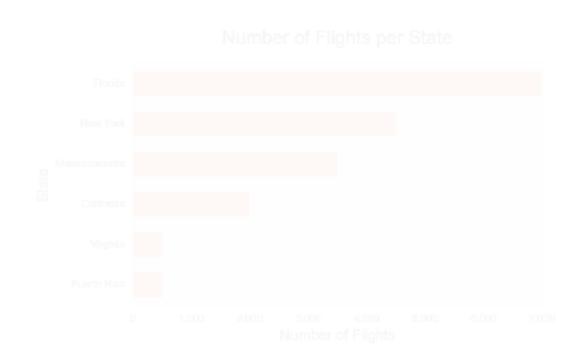


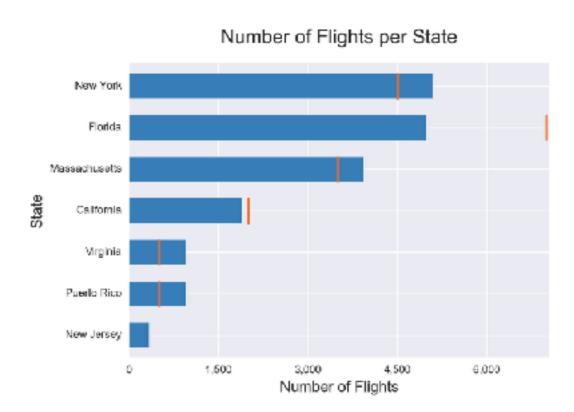
As a reminder, you are interested in flights on **Delta Air Lines** and flights originating out of **Massachusetts**.

You will be able to look at the questions after 10 seconds. However, you will not be able to look at this visualization again once you clicked "Continue"!

I have carefully looked at the visualization.







Profese morely

Questions

- About how many flights were there on...?
 (e.g., HowMany)
- About how many <u>more</u> flights were there on... than...? (e.g., Compare)
 - Saw multiple (1 for approximate, 3 for precise)
- Which airlines/states are in the dataset?
 (e.g., Recall)

Talk Overview

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- Focus state/airline
- Visualization number (e.g., first, second)
- Visualization order (e.g., state first, airline first)
- Sample for approximate (e.g., 1%, 10%, 100%)
- Precise visualization type

- Focus state/airline
- Visualization number (e.g., first, second)
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- Precise visualization type

correct_answer-answer_given

correct_answer-approximate_answer

correct_answer

correct_answer

Expected bias

Measured bias

- Dependent variable: Measured bias
- Independent variables: Expected bias, precise visualization type

Talk Overview

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Participants

- Recruited 40 participants from Amazon Mechanical Turk
- One did not complete the study, five said they wrote down data from visualizations
- Statistics report on remaining 34 participants

Participants

- Average age 33.7
- 26 male, 8 female
- Generally familiar with visualizations
 - 89% were not familiar with heatmaps, bar charts, and scatter plots

Talk Overview

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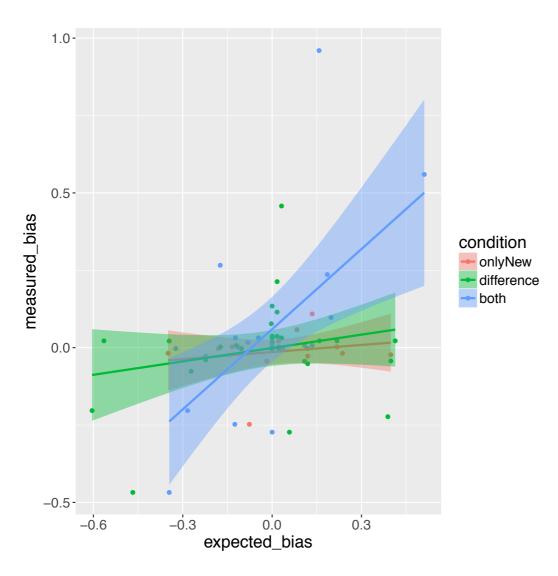
Descriptive Statistics

Question Type	Visualization Type	Mean error	Standard deviation
HowMany	Expected	-0.011	0.215
HowMany	Measured	0.010	0.195
Compare	Expected	-0.145	0.691
Compare	Measured	-1.542	5.244

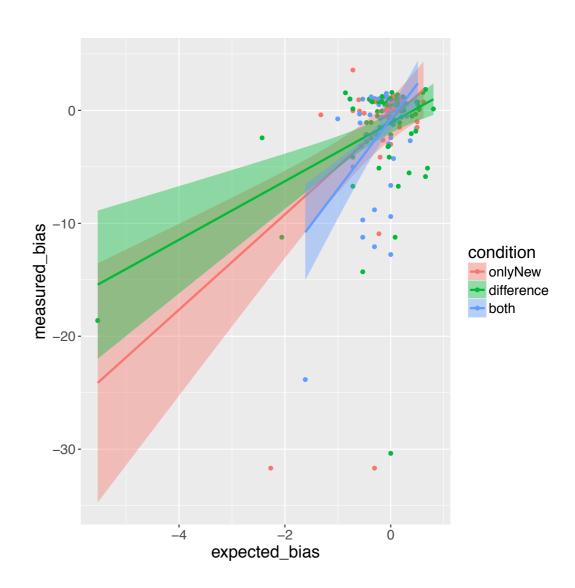
Inferential statistics

- Linear regression
- Test for interaction effects between Expected bias and Visualization Type

Answering research questions



HowMany



Compare

Answering research questions

- RQ1: Reject hypothesis that there is no bias
 - (Our data suggests there is a bias)
- RQ2: Fail to reject hypothesis that visualization matters
 - (Our data does not suggest that visualization matters)

Talk Overview

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Threats to Validity

- Really high error rates
 - Particularly for Compare questions
 - Suggests need to change experiment, rather than remove outliers
- Regression type particularly susceptible to values with varying orders of magnitude
 - Will revisit after above is resolved

Next Steps

- Rethink experiment
 - Focus airline/state might have over-emphasized HowMany at the expense of Compare
- Rethink statistics
- More piloting!

Examining Whether Approximate Visualizations Impact Perception of Corrected Visualizations

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The authors would like to thank Michael D. Ernst for his feedback on the experimental design and writing. They would also like to thank Jessica Hullman and Danyel Fisher for their feedback on the study design and research questions.