

Alexander Lex

<http://vdl.sci.utah.edu>



The reVISit User Study Platform and Applications in Studying Misinformation



visualization
design lab





visualization
design lab

<http://vdl.sci.utah.edu/>



TECHNICAL CONTRIBUTIONS

**Novel Visualization
Techniques**

**Visualization Process
Innovations**

**Data Wrangling
Methods**

Accessibility

DOMAIN DRIVEN TECHNIQUES

**Tailored Methods
and Systems for High
Impact Science
Problems**

EMPIRICAL & THEORETICAL WORK

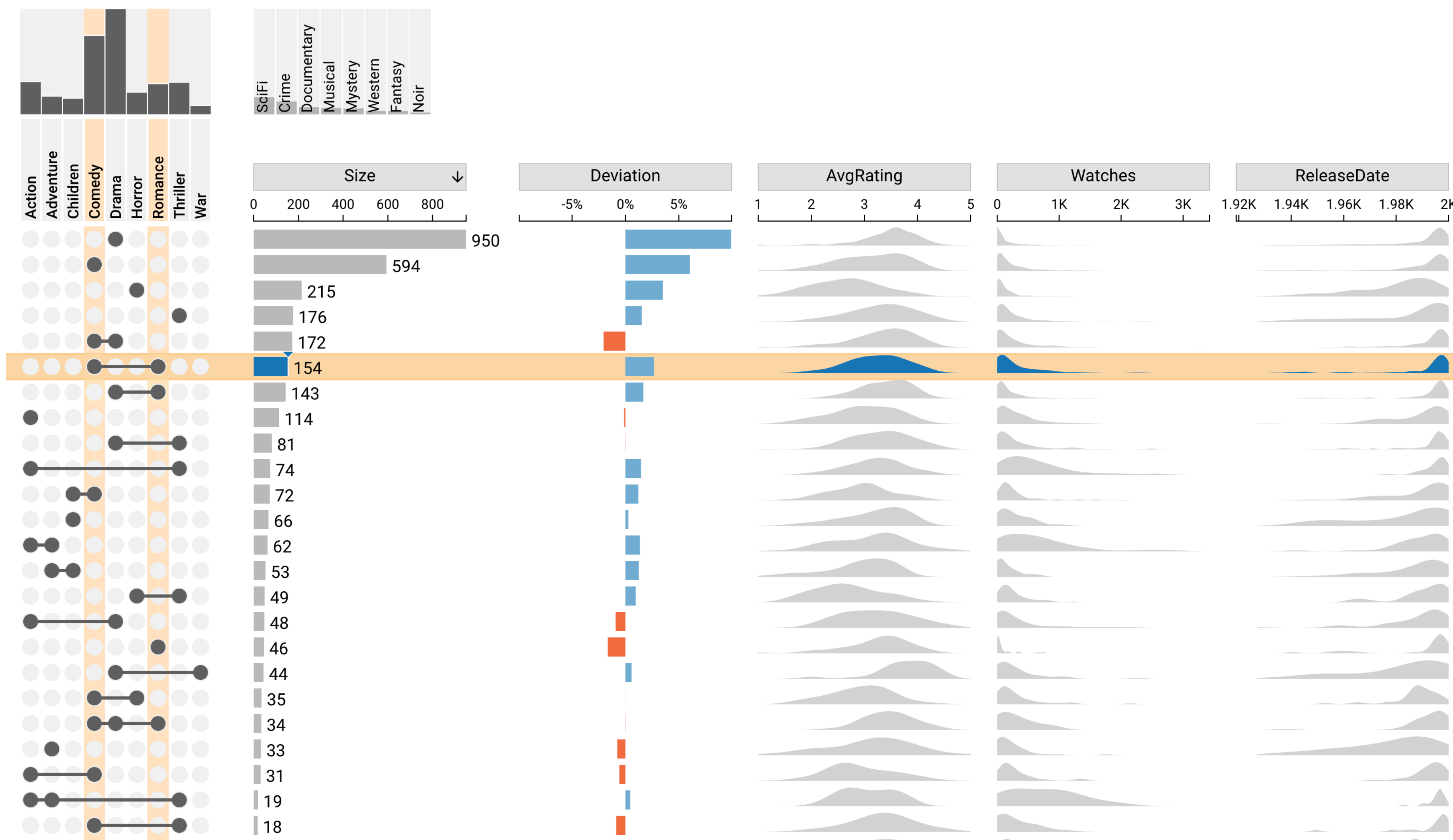
**Evaluation
Methodology**

Interview Studies

Visual Misinformation

Accessibility

Novel Visualization Techniques



TECHNICAL CONTRIBUTIONS

Visualization Process Innovations

Kiran Gadhave

Vis in Notebooks & Provenance

#	Date	Place	Trigger	Weak Layer	Depth_inches	Aspect	Elevation_feet
2338	3-23-2023	Dry Creek	Natural			West	8000
955	1-19-2014	Whitney Basin	Snowmobiler			East	10500
1028	2-21-2014	Chalk Creek	Natural			Northeast	10600
1024	2-17-2014	Upper Weber Canyon	Natural			Northeast	10400
998	2-12-2014	Upper Weber Canyon	Natural			Northeast	10400
938	1-14-2014	Upper Weber Canyon	Explosive			East	10300
1299	1-26-2016	Currant Creek Peak	Snowmobiler			Southwest	9500
1044	2-28-2014	Chalk Creek	Natural			Northeast	10600
2348	3-30-2023	Bunnels	Natural			Northeast	10800
1977	4-6-2021	Blue Ice	Natural			Northeast	10400

```
selector = alt.selection_interval("selector", encodings=["x"])  
  
scatterplot = alt.Chart().mark_point().encode(x="Elevation_feet:Q", y="Depth_inches:Q")  
chart = alt.Chart().mark_bar().encode(  
  x=alt.X("Month:O").sort([10]),  
  y="count()",  
  opacity=alt.condition(selector, alt.value(1), alt.value(0.3))  
)  
.add_params(selector).properties(width=400)  
  
PR.PersistChart(chart | scatterplot, data=df_outlier_removed, df_name="df_with_season")
```

Count of Records

Month

Depth_inches

Elevation_feet

Avalanche Season

- Middle
- No Assignment
- Start

Track Summary

- Root
- Add new category 'Avalan...
- Add new option 'Start' to ...
- Add new option 'Middle' t...
- Add new option 'End' to c...
- Selected Month (10 to 12)
- Assign Avalanche Season...
- Selected Month (1 to 3)
- Assign Avalanche Season...
- Selected Month (4 to 6)

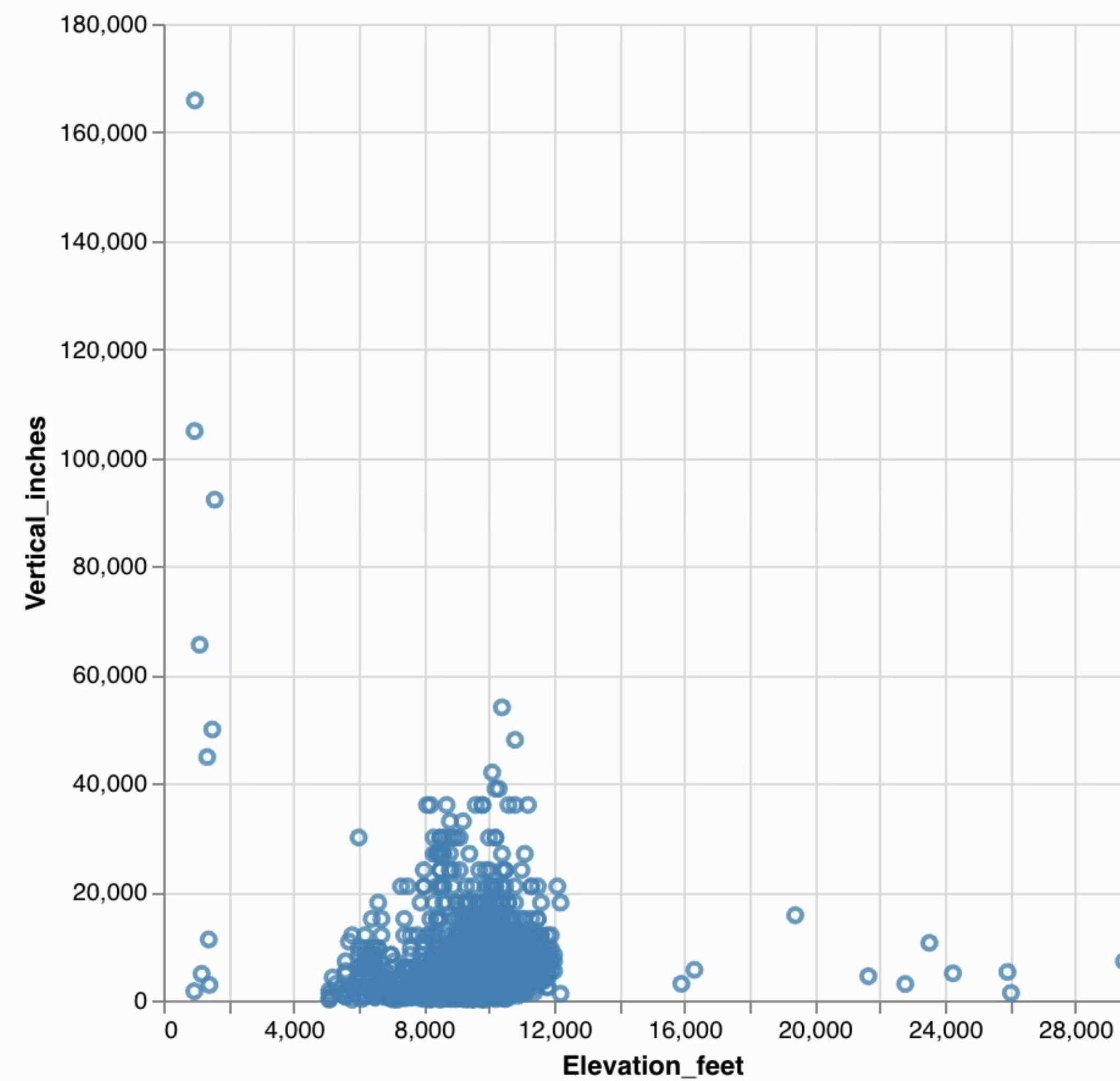
TECHNICAL CONTRIBUTIONS

Visualization Process Innovations

Kiran Gadhave

Vis in Notebooks & Provenance

```
[6]: PR.plot.scatterplot(avalanches, "Elevation_feet:Q", "Vertical_inches:Q", df_name="avalanches")
```



Ttrack Summary

● Root

Dataframe name...

avalanches

TECHNICAL CONTRIBUTIONS

**Data Wrangling
Methods**

DOMAIN DRIVEN TECHNIQUES

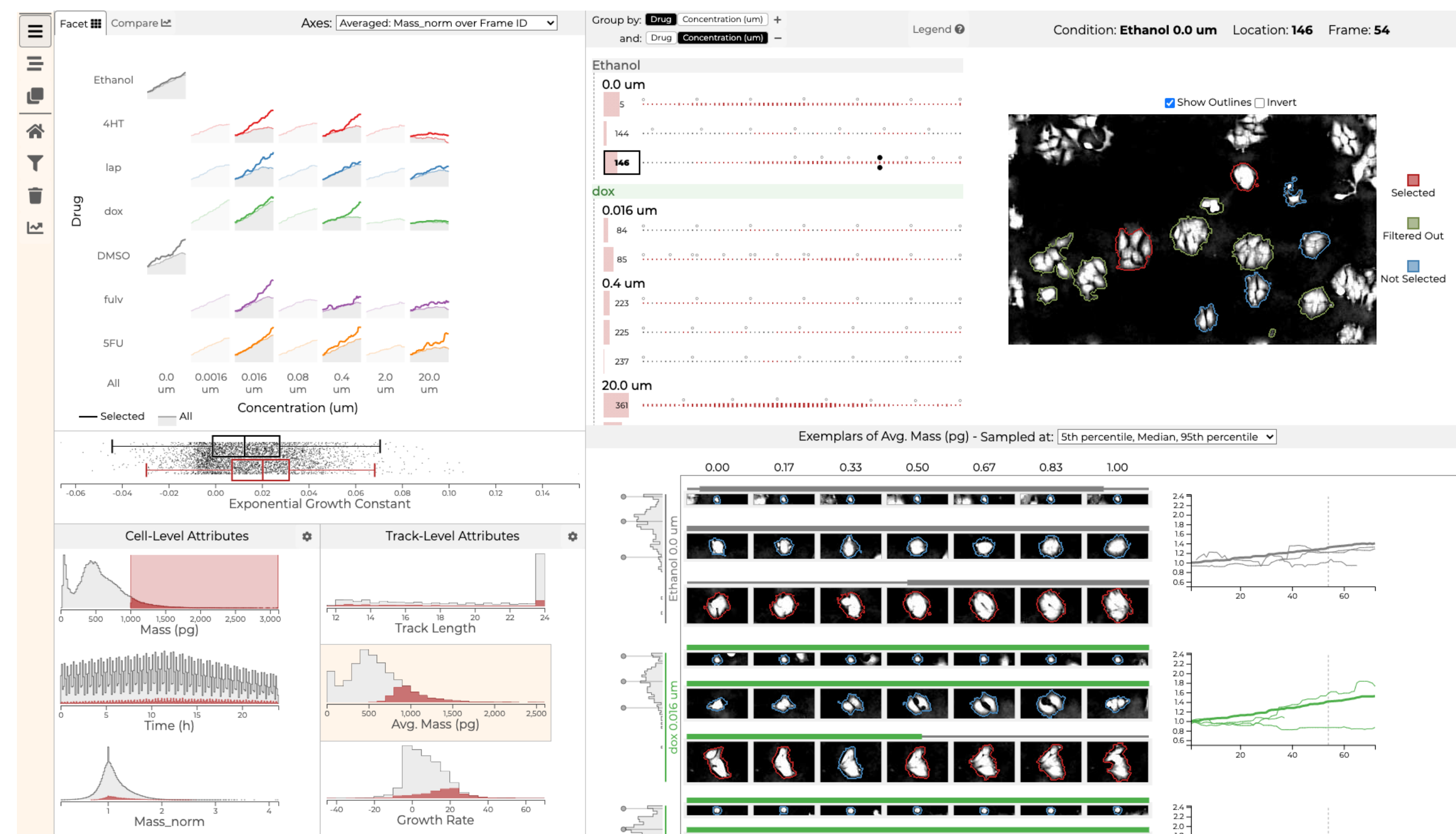
**Tailored Methods
and Systems for High
Impact Science
Problems**

DOMAIN DRIVEN TECHNIQUES

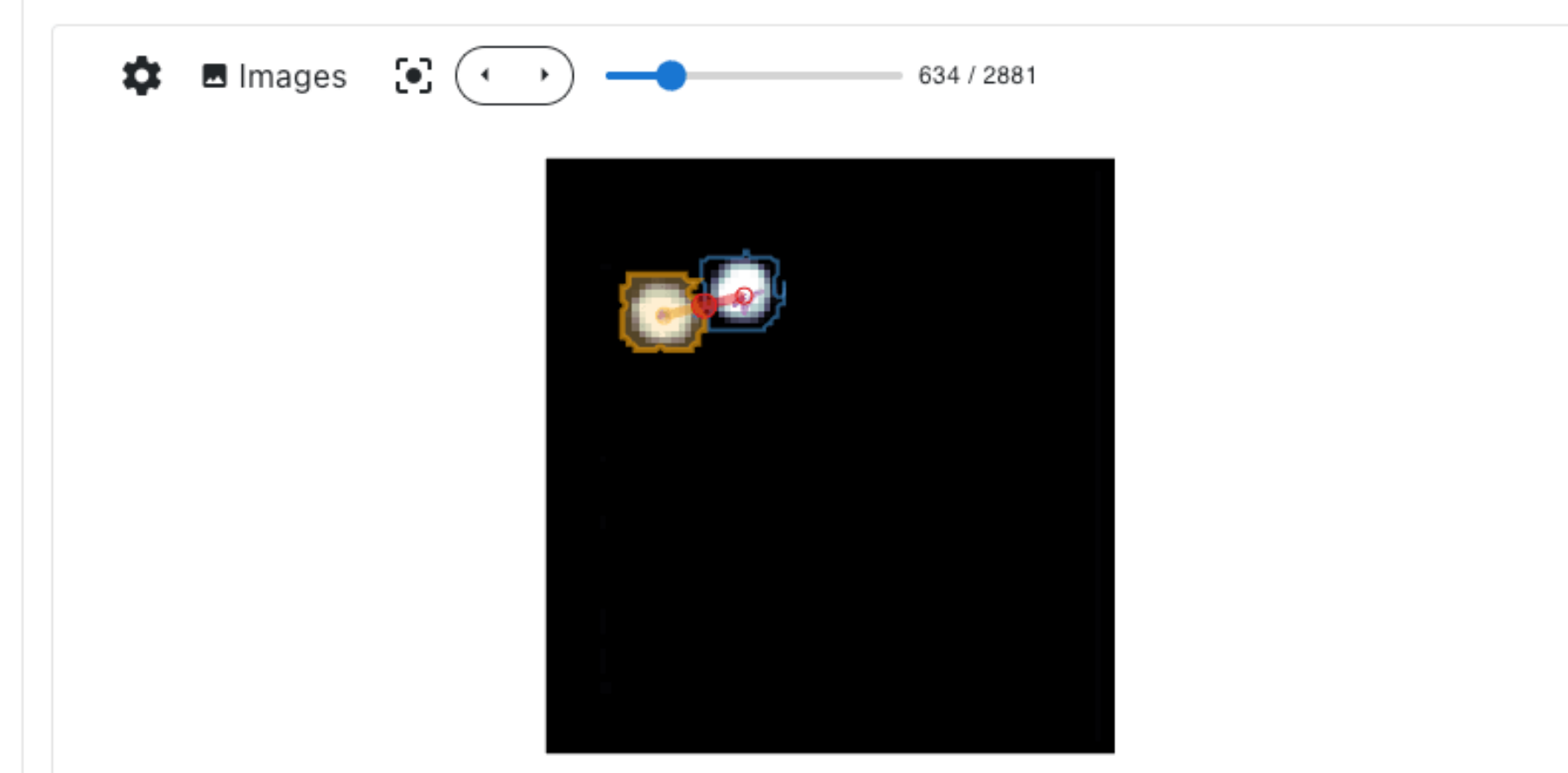
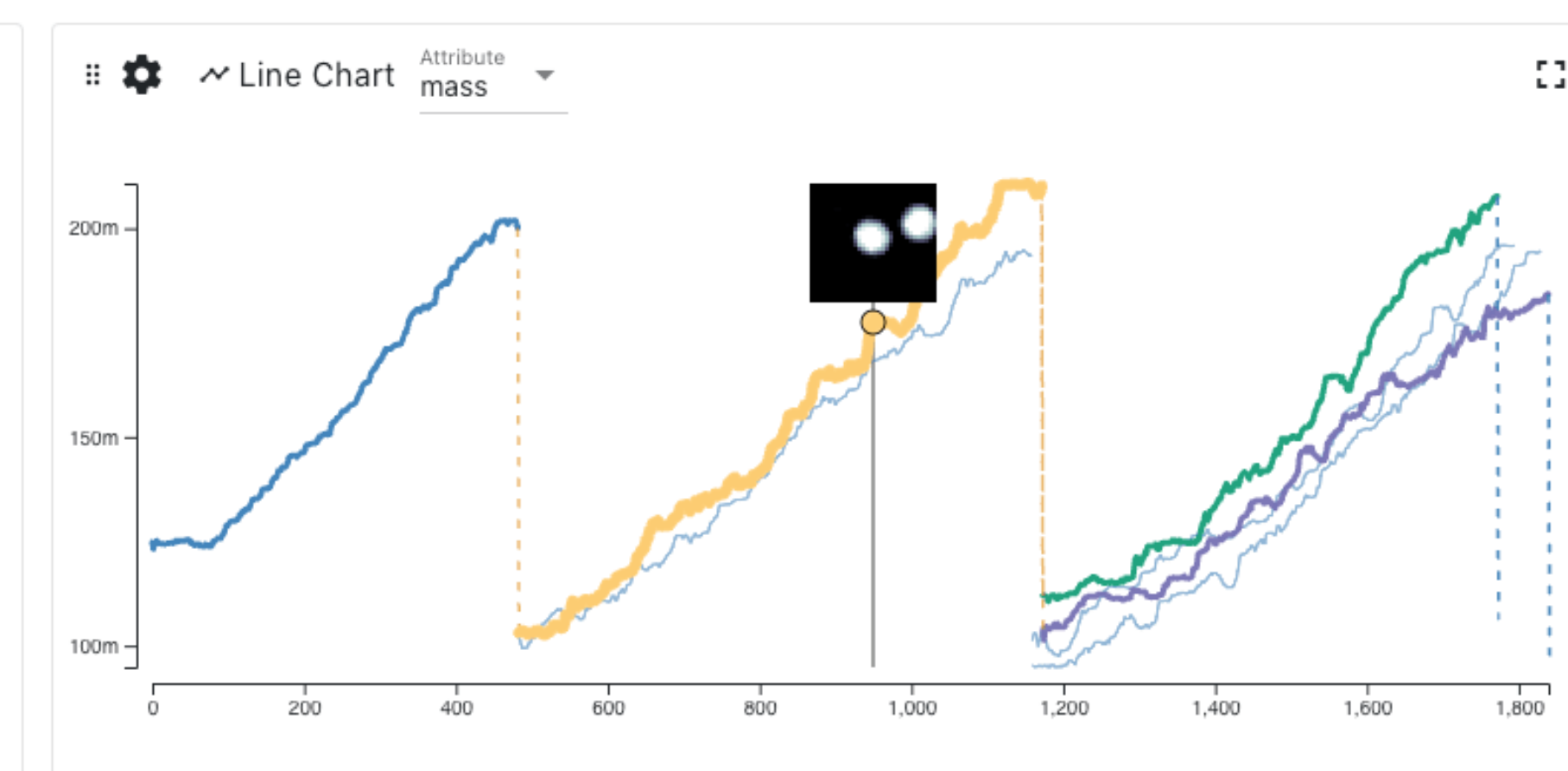
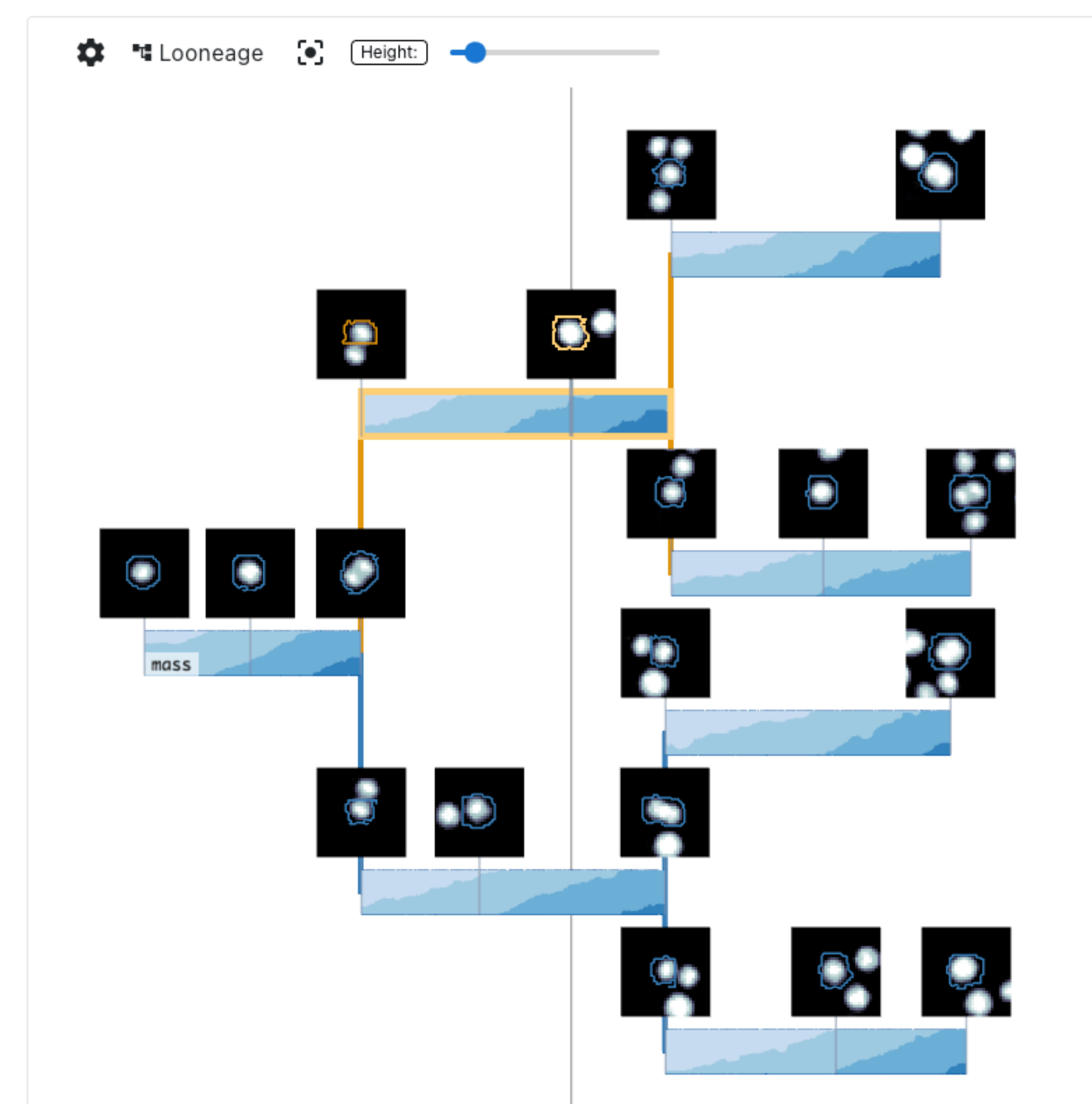
Cell Microscopy

Tailored Methods
and Systems for High
Impact Problems

Devin Lange



[Honorable Mention at VIS 21]



[Best Paper at VIS 25]

DOMAIN DRIVEN TECHNIQUES

**Tailored Methods
and Systems for High
Impact Science
Problems**

EMPIRICAL & THEORETICAL WORK

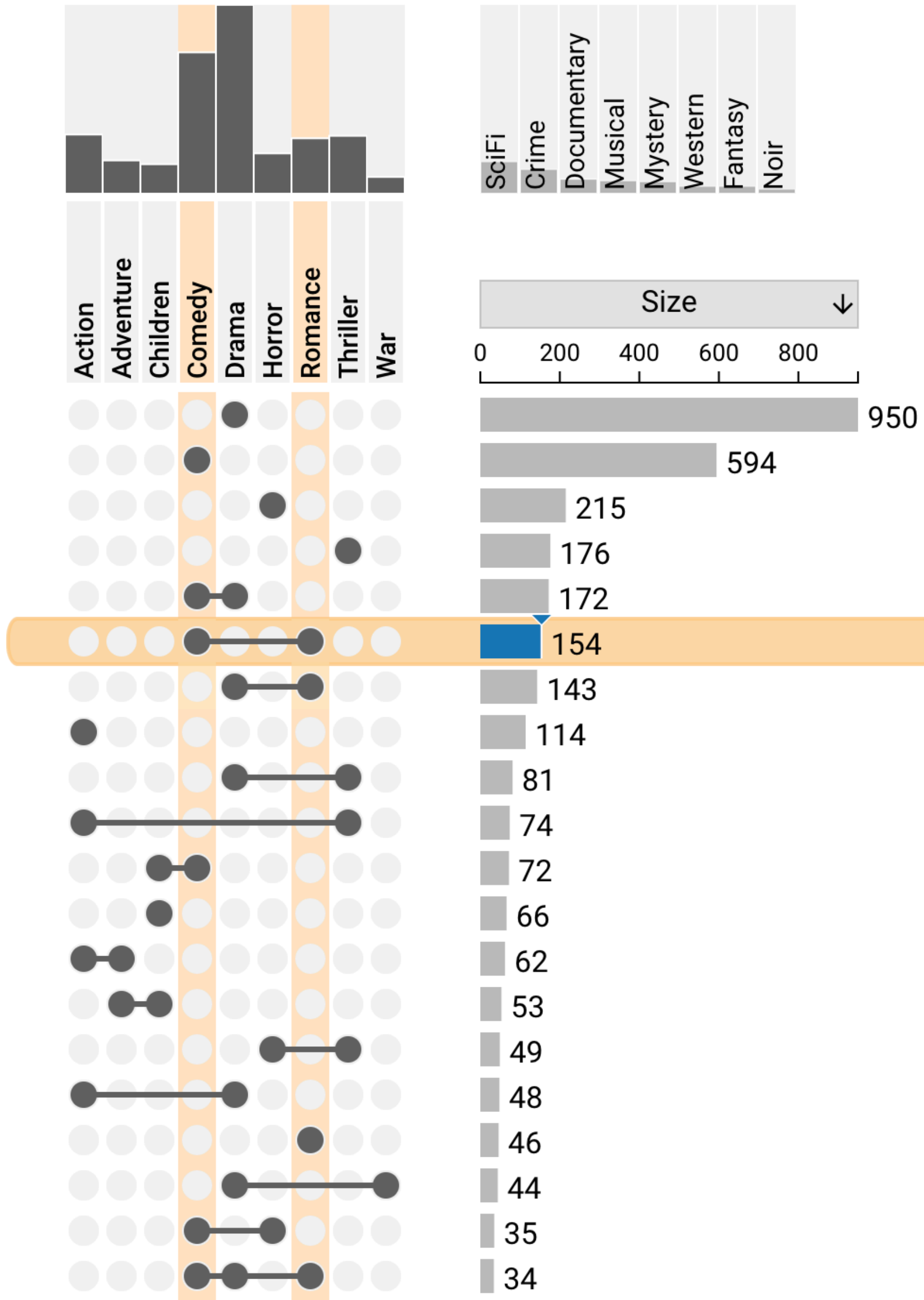
**Evaluation
Methodology**

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Visual Misinformation

Accessibility

Accessibility



Movies are Purists!

Most movies stick to one genre. The four largest intersection are for movies that are in just one genre. There are a lot of Comedy-Drama combinations, but more interestingly, there are also a lot of romantic comedies.

This UpSet plot shows movie genre overlap. The sets are movie genres. The items are movies.

Text Description

UpSet Introduction

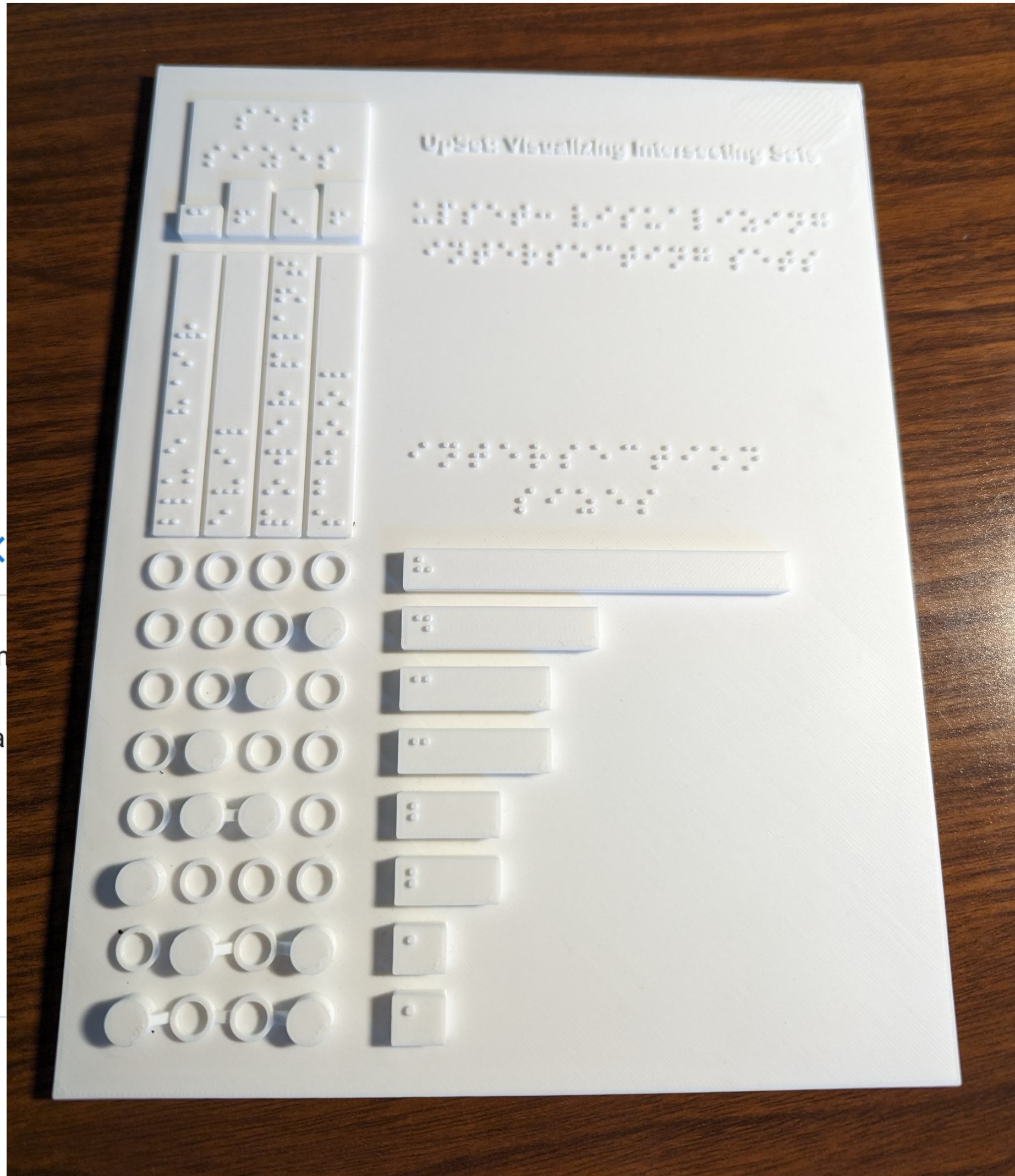
This is an UpSet plot that shows the intersections of 9 sets. To learn about UpSet plots, visit <https://upset.app>. The largest 2 intersections are just Drama (950) and just Comedy (594). The largest intersection of at least two sets is between Comedy and Drama, with 172 movies. Other large intersections also involve Comedy and Horror.

Dataset Properties

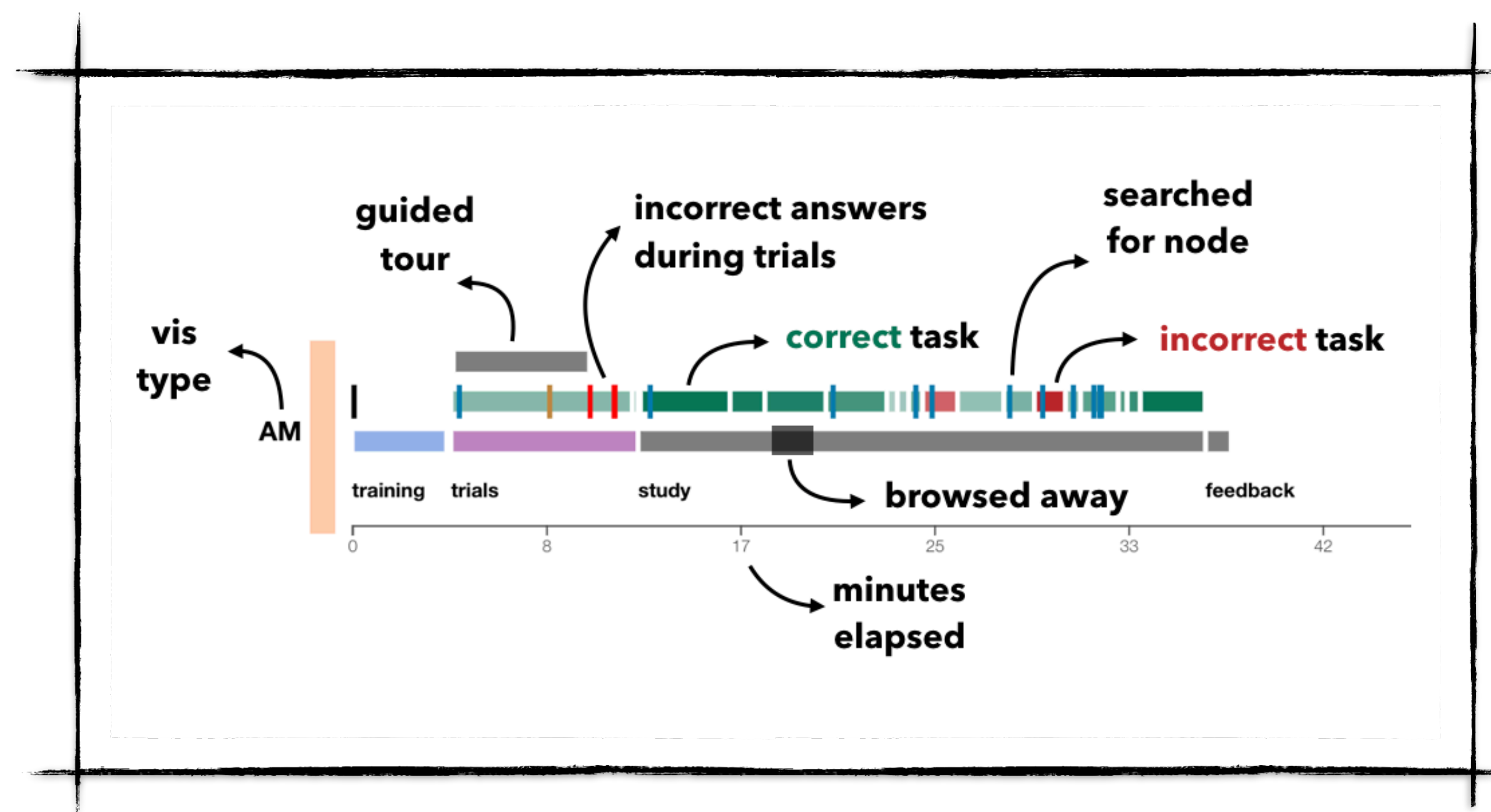
The dataset shows attributes of movie genre overlap. The dataset contains 17 sets and 6303 elements, of which 9 sets are shown in the plot.

Set Properties

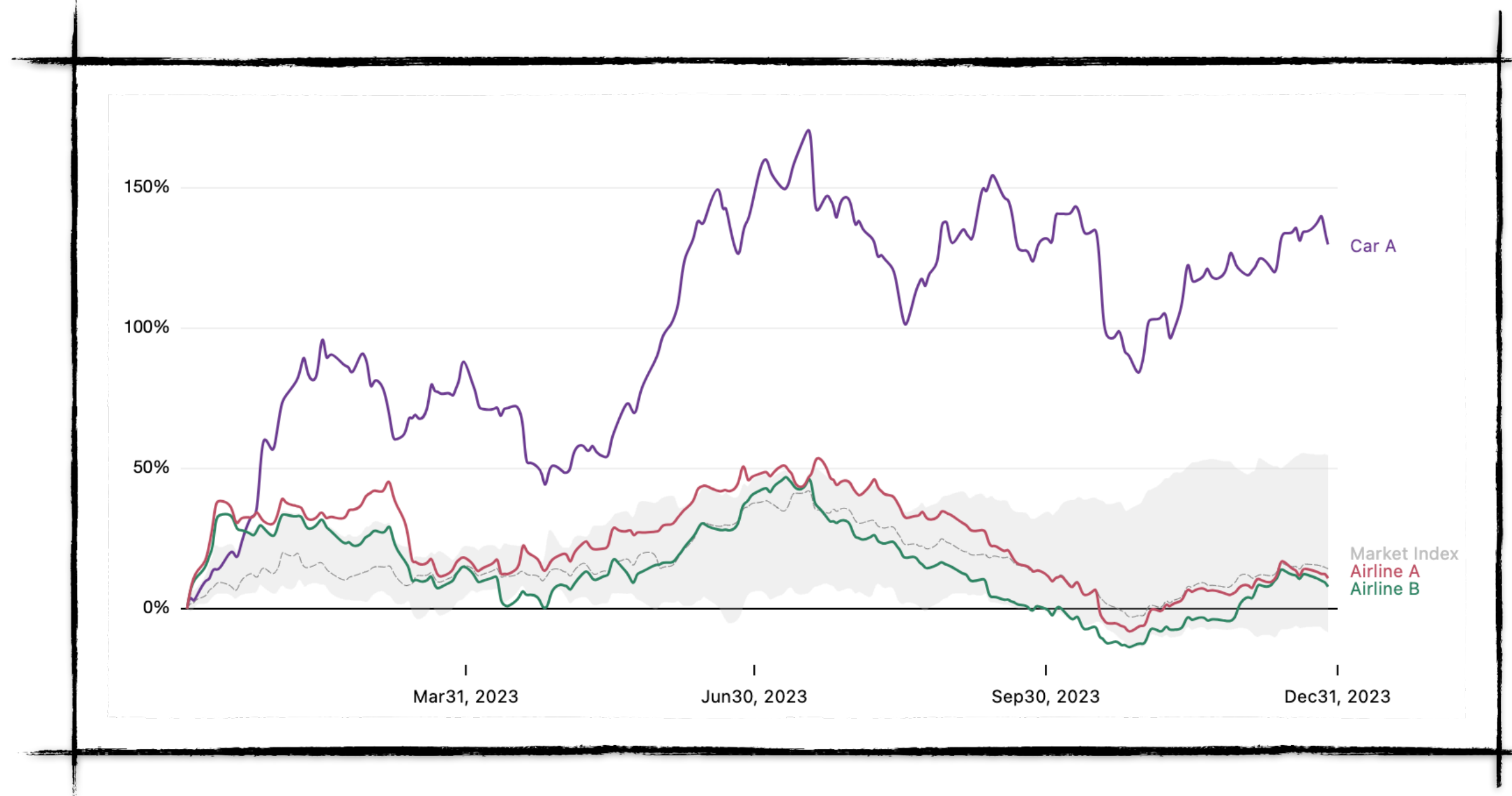
- The set sizes are diverging a lot, ranging from 143 to 1603.



Evaluating Interactive Visualizations



Visual Misinformation



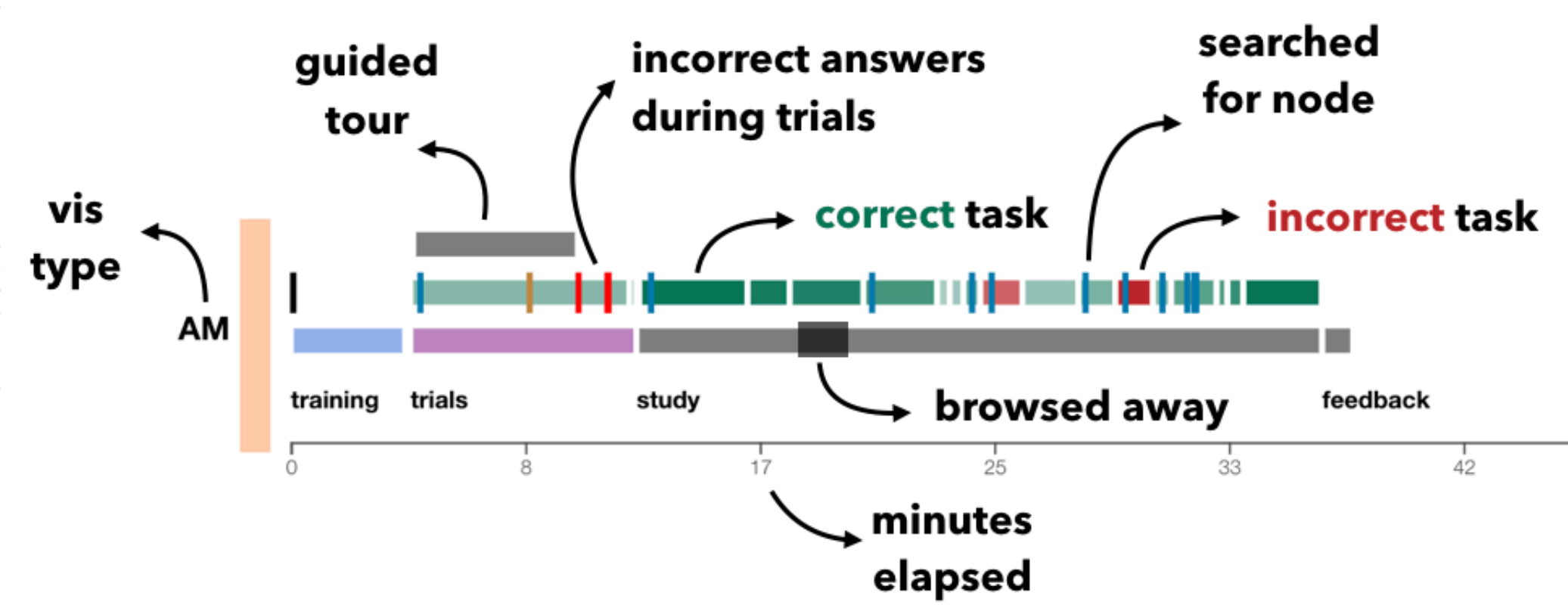
EMPIRICAL & THEORETICAL WORK

Evaluating Interactive Visualizations



Zach Cutler, Jack Wilburn, Carolina Nobre, Lane Harrison, Hilson Shresta, Yiren Ding et al.

reVISit: Empirically Evaluating Complex Interactive Visualization Techniques



PERILS OF ONLINE VISUALIZATION EXPERIMENTS

There is no **end-to-end platform** for building **interactive experiments**

The support for **types of stimuli** in survey tools are limited

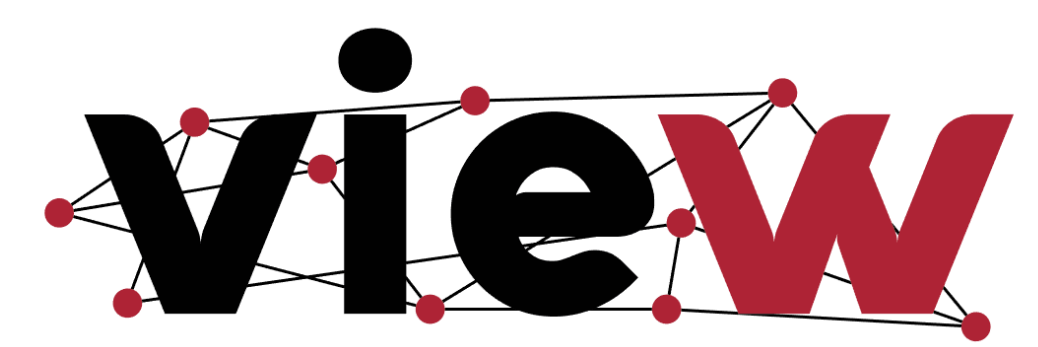
Lack of experiment **debugging** features

No built-in **data collection** and **provenance tracking** functions

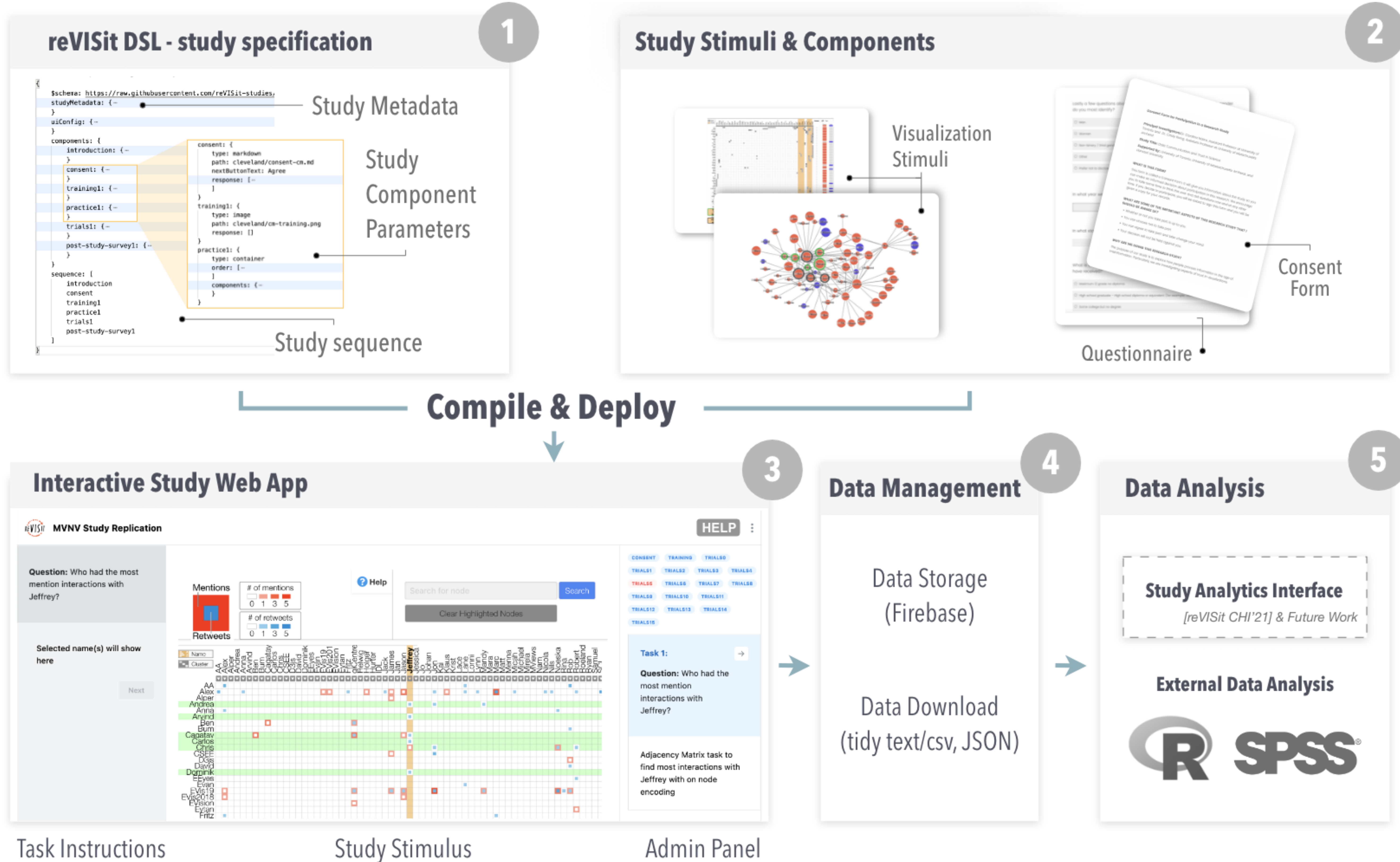


REVISIT

A TOOLKIT FOR DATA VISUALIZATION EXPERIMENTS



The Scope of reVISit



WHAT IS REVISIT: INFRASTRUCTURE FOR VIS STUDIES

Set up studies with all **components** (consent, training, trials, tasks, surveys, etc.) including sophisticated **study designs** (randomization)

Simple **data tracking and data export**

Simple to **deploy and run** studies

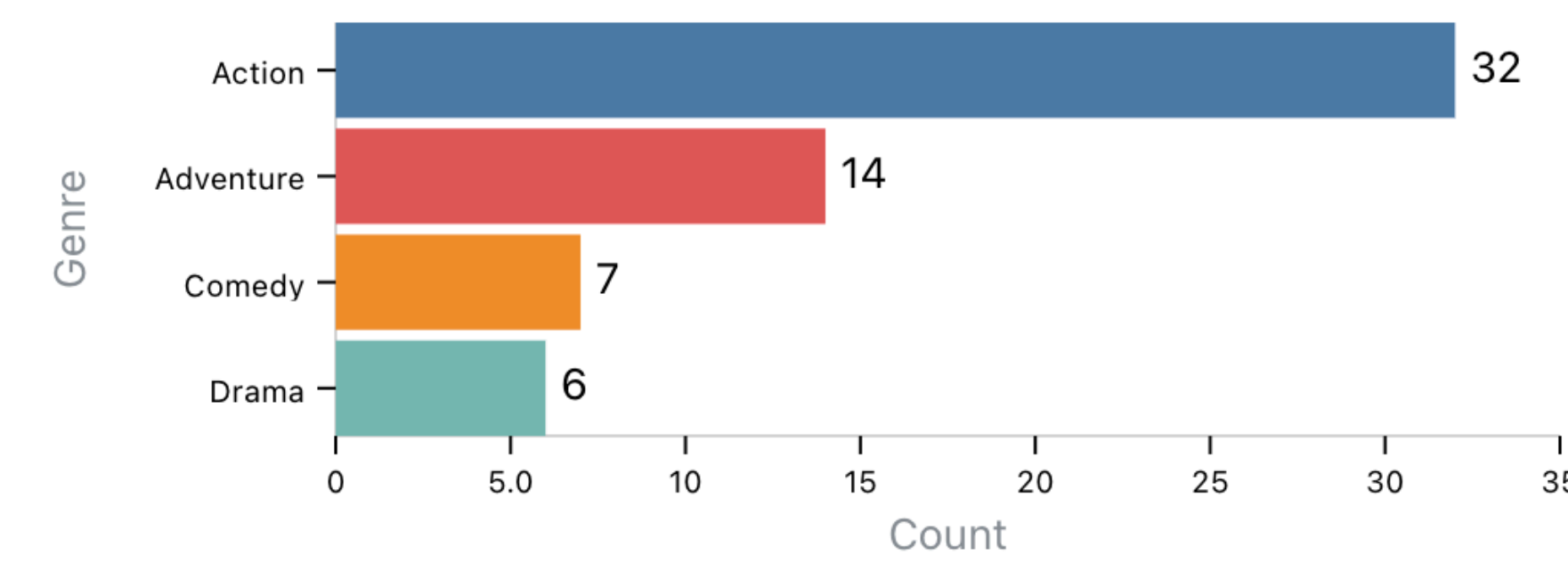
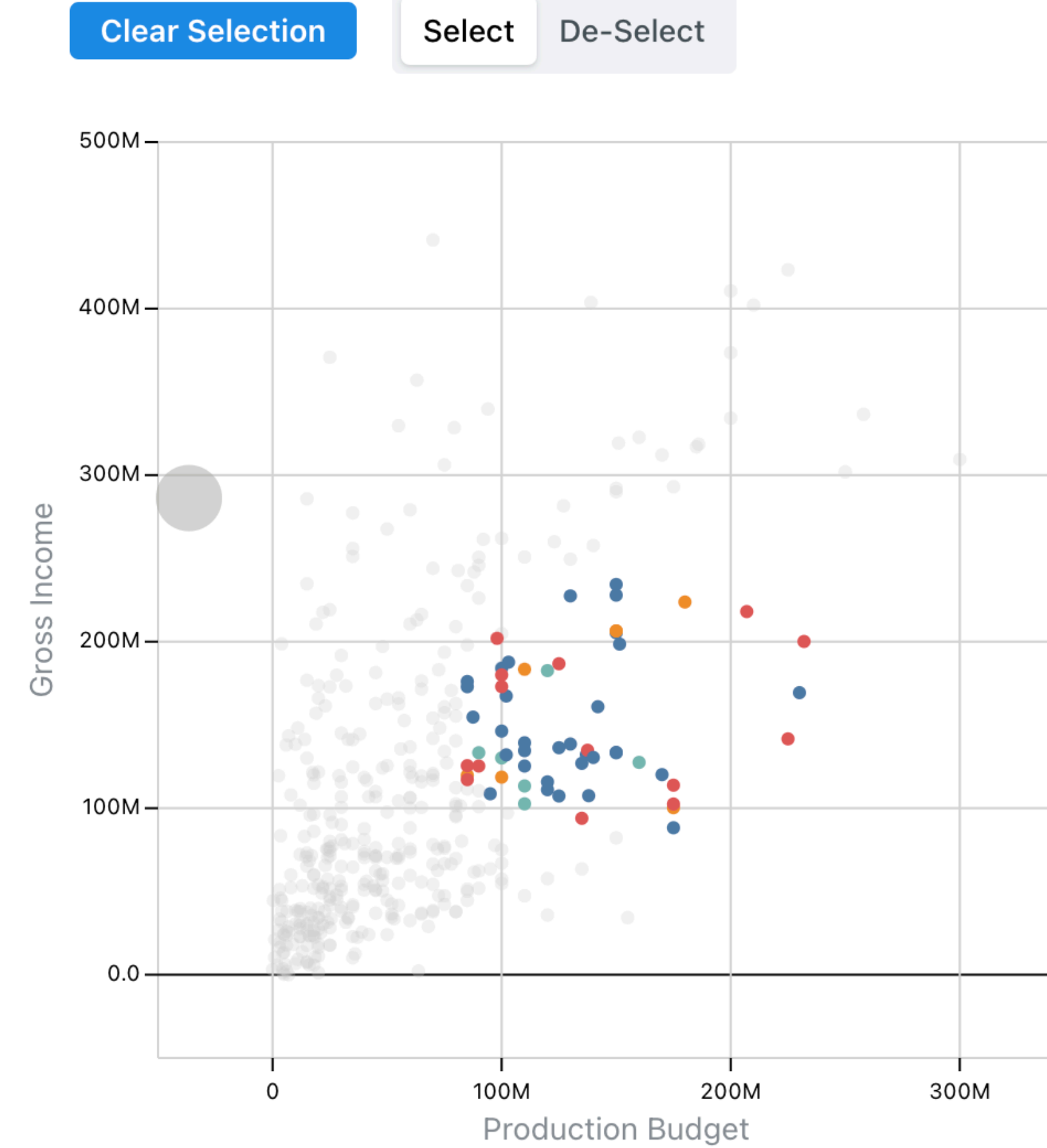
Fully **reproducible and open**. You can share your whole study setup for anyone to re-run, without having to have a license for software (qualtrics).

DEMO

Task:
How many Adventure Movies have a production budget value greater than 100 million?

Answer: *

Next



Study Browser

Participant View ⓘ All Trials View ⓘ

- introduction
- consent
- tutorial
- random ⌄ 8/8
- axisBrush_q2
- paintBrush_q1**
- sliderBrush_q1
- axisBrush_q1
- paintBrush_q2
- rectangleBrush_q2
- sliderBrush_q2
- rectangleBrush_q1
- post-study-survey
- survey
- end

WHY REVISIT?

Designed for **sophisticated studies**

randomization, complex stimuli, complex data tracking

Reproducible and Open Studies!

Non-commercial license lets you **share your study!**

Extensible – add on features you need

Code not GUI! (though there might be a GUI option in the future)

Support from us!

THE REVISIT SPEC

Define the details of your experiment as a JSON file.

Study Metadata — name of the study, authors, contact e-mails

UI Config — parameterizing the appearance of reVISit

Components and **BaseComponents** — setting up the content of the study

Sequence — choosing the order and the selection of tasks participants see.

REVISIT SPEC

Outline

```
{
  "$schema": "https://raw.githubusercontent.com/reVISit-studies/study/main/src/parser/StudyConfigSchema.json",
  "studyMetadata": {
    "title": "Basic Questionnaire Study",
    ...
  },
  "uiConfig": {
    "contactEmail": "contact@revisit.dev",
    ...
  },
  "components": {
    "introduction": {
      "type": "markdown",
      "path": "basic-questionnaire-study/assets/introduction.md",
      "response": []
    },
    "first-question-set": {
      "type": "questionnaire",
      "response": [
        {
          "id": "q1-name",
          "prompt": "What is your first name?",
          "type": "longText",
          "placeholder": "Please enter your first name"
        },
        ...
      ]
    },
    ...
  },
  "sequence": {
    "order": "fixed",
    "components": [
      "introduction",
      "first-question-set"
    ]
  }
}
```


REVISIT COMPONENTS – WHERE YOUR “STUDY CONTENT” GOES

Markdown Files – introductions, consent forms, help pages, etc.

Images – static (vis) stimuli

Web Pages – custom stimuli, made interactive with JavaScript

React Components – sophisticated interactive stimuli. Simplify the communication between reVISit and the stimulus

Survey Questions – structured responses

Vega Visualizations – directly put in interactive visualizations as stimulus (beta)

VEGA DEMO

Introduction

Welcome to our study. This is a replication of a study by Padilla et al., published in Frontiers in Psychology, 2021.

Instructions

The following instructions describe the tasks you will see and how to complete them. If you need to refer to these instructions during the experiment, please click on help at the top of the page.

Scenario: Alpacas may need blankets. Assume that you work at the Red Cross, and your job is to manage resources for farms in Peru. In previous years, alpacas have died in Peru from cold temperatures. Alpacas can typically withstand the cold unless the temperature drops below 32°F.

Budget: You are in charge of the Red Cross's blanket budget, and it is your job to issue blankets to the alpacas when temperatures fall below 32°F, which will help them withstand the cold.

Budget Constraints: You have a budget for 48 days of \$48,000. Purchasing and delivering blankets to farmers costs \$1,000 (per night). If you fail to issue blankets to the farmers and the temperature drops below 32°F, it will cost \$6,000 from your budget.

Task: In the experiment, you will be shown a nighttime temperature forecast like the one below. In the forecast, each dot represents a 1 out of 20 chance the nighttime low will be that temperature. You will be asked some questions about this forecast, including if you will issue blankets to the alpacas.

Compensation: Please respond to the best of your ability. You will receive an extra \$0.15 cents for every \$1,000 that you have in your budget at the end of 48 days.

Next

Study Browser

Next Participant

Participant View

All Trials View

introduction

vegademo1

vegademo2

end

Also auto-captures interaction!

REVISIT SPEC

Components & Inheritance

```
"baseComponents": {
  "bar-chart": {
    "type": "website",
    "response": [
      {
        "id": "barChart",
        "prompt": "Your selected answer:",
        "required": true,
        "location": "belowStimulus",
        "type": "iframe"
      }
    ],
    "path": "basic-questionnaire-study/assets/bar-chart.html",
    "instructionLocation": "aboveStimulus"
  }
}

"bar-chart-1":{
  "baseComponent": "bar-chart",
  "description": "A trial for the user to click the largest bar",
  "instruction": "Click on the largest bar",
  "parameters": {
    "barData": [0.32, 0.01, 1.2, 1.3, 0.82, 0.4, 0.3]
  }
},
"bar-chart-2":{
  "baseComponent": "bar-chart",
  "description": "A trial for the user to click the smallest bar",
  "instruction": "Click on the smallest bar",
  "parameters": {
    "barData": [1.2, 1.2, 1.2, 1.3, 0.82, 0.4, 0.3]
  }
}
```


COMPONENTS AND RESPONSES

Responses are a **primary data type** - **each component can have a response**

Form elements are "responses only"

```
Component  "first-question-set": {
            "type": "questionnaire",
            "response": [
                {
                    "id": "q1-name",
                    "prompt": "What is your first name?",
                    "required": true,
                    "location": "aboveStimulus",
                    "type": "longText",
                    "placeholder": "Please enter your first name"
                },
            ],
        }
```

Response

SEQUENCE

In what order do the components appear for which participant

- Can be made up of **nested blocks**
- **Fixed**
- **Random**
- **Latin Square**
- **Subsets** (show 2 out of 5)
- **Skips** (if wrong, go to next task)
- **Interrupts** (breaks, attention checks)

REVISIT SPEC

Sequence

```
"sequence": {  
  "order": "fixed",  
  "components": [  
    "introduction",  
    "consent",  
    "tutorial",  
    {  
      "order": "random",  
      "components": [  
        "paintBrush_q1",  
        "rectangleBrush_q1",  
        "axisBrush_q1",  
        "sliderBrush_q1"  
      ]  
    },  
    "post-study-survey",  
    "survey"  
  ]  
}
```


DATA COLLECTION

Responses – Participant responses to specified questions

Logs – a variety of things about participants and sessions

time information about responses

“Clean” time - minus “browsed away” time

Participant Metadata: Browser information, etc

Provenance Data – data you track in your stimulus via our provenance tracking library

Audio Data – you can run think aloud studies (more later)

PROVENANCE DATA

Instrument your interactive stimulus with provenance tracking!

E.g., using our **trrack library**

Works out **of the box for Vega!**

<https://apps.vdl.sci.utah.edu/trrack>

Provenance **data is stored as JSON** with the rest of your data

PROVENANCE DATA

New analysis possibilities!

Analyze **logs**

Analyze **interaction strategies**

Review individual user actions

Debug your study setup

See where things go **wrong**

Review Demo

DATA STORAGE: LOCAL OR FIREBASE

Local

Works out of the box

Download from local storage of your browser

Doesn't work for online studies

Firestore

A bit of a pain to set up (but better than running your own server)

Reliable cloud storage option

Available with servers in many countries

STUDY MODES – EXPERIMENT LIFECYCLE

Study Design & Debugging

Jump around a study, see all data, see run-throughs of pilots

Collecting Participant Data

Hide all debug features

Study & Data Dissemination

Share study w. navigation

Share data

Study Browser [Next Participant](#) ✕

Participant View ⓘ All Trials View ⓘ

- introduction
- consent
- tutorial
- random ⌘ 8/8 ▼
 - paintBrush_q1
 - sliderBrush_q1
 - rectangleBrush_q2
 - paintBrush_q2
 - axisBrush_q1
 - rectangleBrush_q1
 - axisBrush_q2
 - sliderBrush_q2
 - next_study_survey

reVISit ✕ +

← → ↻ <https://revisit.dev/study/analysis/stats/demo-html/manage>

reVISIT ReVISit Analytics Platform

demo-html ✓ 0 ⚠ 0 ✗ 0

Table View Trial Stats Participant Replay Manage

ReVISit Modes

- Data Collection Enabled
- Study Navigator Enabled
- Analytics Interface Publicly Accessible

Data Management

DOCUMENTATION & COMMUNITY

Documentation & Tutorials on Website
Community participation via slack etc.
<https://revisit.dev>



A study creation platform allowing you to quickly create, publish, and disseminate your customized visualization study.

About ReVISit Try The Demo Get Started



Flexible And Powerful

ReVISit is designed with researchers from all disciplines in mind. It is simple enough



Focus on What Matters

ReVISit allows researchers to focus on the visual stimuli without the hassle of setting



In Depth Analysis

With the Analysis Dashboard, you can investigate the results from your study with

FUTURE DIRECTIONS

Looking for community input!

Improve Analysis Interface

Sequencing: step-functions

Integration with prolific: balancing latin squares

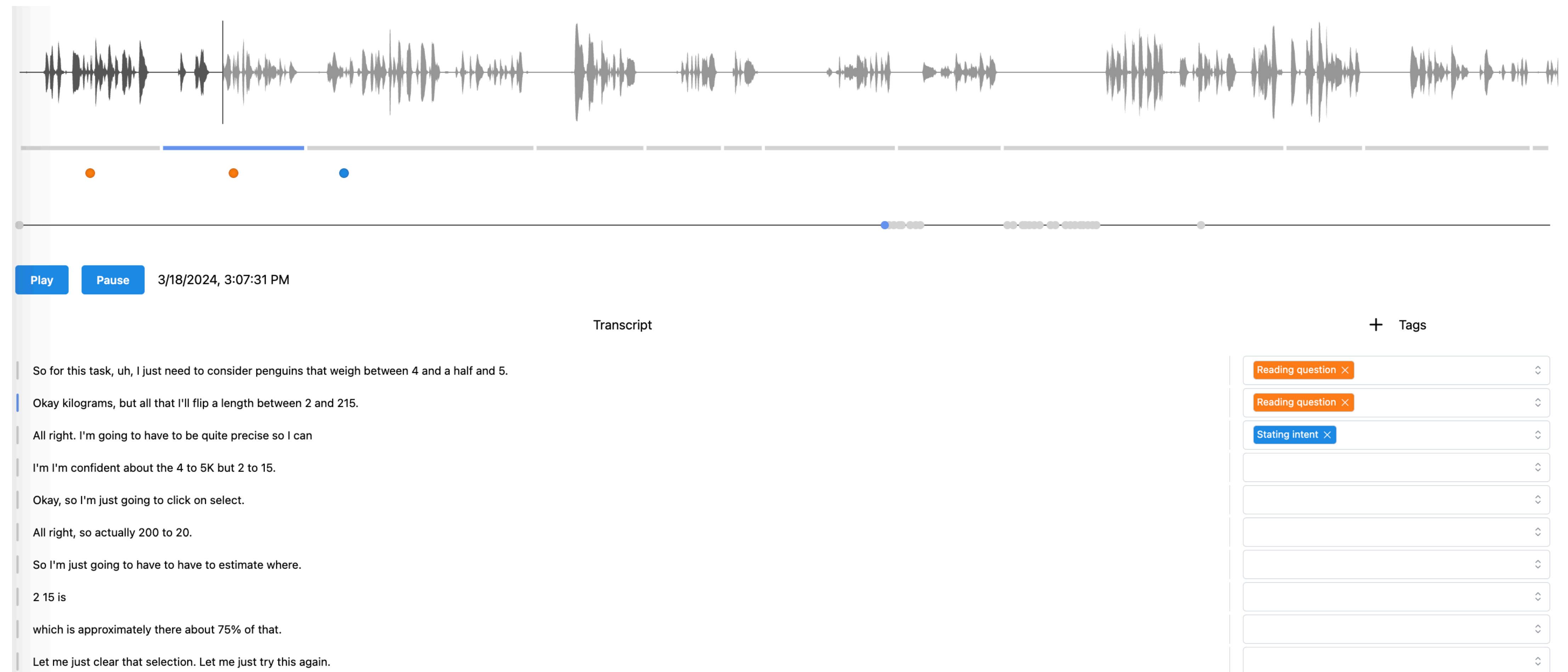
Libraries of common surveys / tasks

Python Bindings

Higher-level language features

CAN WE DO
QUALITATIVE
EVALUATION
ONLINE?

Yes! Think Aloud & Provenance



The screenshot shows an audio player interface. At the top is a waveform of the audio. Below it is a progress bar with a play/pause button and a timestamp of 3/18/2024, 3:07:31 PM. The main area contains a transcript of the audio. To the right of the transcript is a sidebar with a '+ Tags' header and a list of tags, each with a close button and a dropdown arrow.

Transcript

So for this task, uh, I just need to consider penguins that weigh between 4 and a half and 5.
Okay kilograms, but all that I'll flip a length between 2 and 215.
All right. I'm going to have to be quite precise so I can
I'm I'm confident about the 4 to 5K but 2 to 15.
Okay, so I'm just going to click on select.
All right, so actually 200 to 20.
So I'm just going to have to have to estimate where.
2 15 is
which is approximately there about 75% of that.
Let me just clear that selection. Let me just try this again.

+ Tags

- Reading question ×
- Reading question ×
- Stating intent ×
-
-
-
-
-
-

Pushing the boundary of what can be
evaluated using crowdsourcing

THINK ALOUD PROTOCOL

A UI/UX Method for finding usability issues in software

Participants sit in a **lab**

Instructed to "**speak their thoughts**" as
they use an interface

Audio is recorded

Screen is recorded

Logs may be recorded

Experimenter is **present**

PURPOSE

Traditional focus on “**Defects**” and UI Issues

Vis community also uses it to analyze **Insight Formation** with visualizations

**REVIEWED 67 TA
STUDIES IN VIS**

66 were synchronous (lab or zoom)

27 evaluated insights

Participants:

experts - evaluating a domain-specific system (small n)

novices & skilled participants (large n, 20-50)

RESEARCH QUESTIONS

Can we build a **system** that makes **recording and analyzing TA studies** online easy?

Do **crowdsourced TA studies** actually **work**?

WHY?

Logistics are easier

Crowdsourcing

Expert-studies at their schedule

Potentially more **diverse participant pools**

Time-saving for experimenter

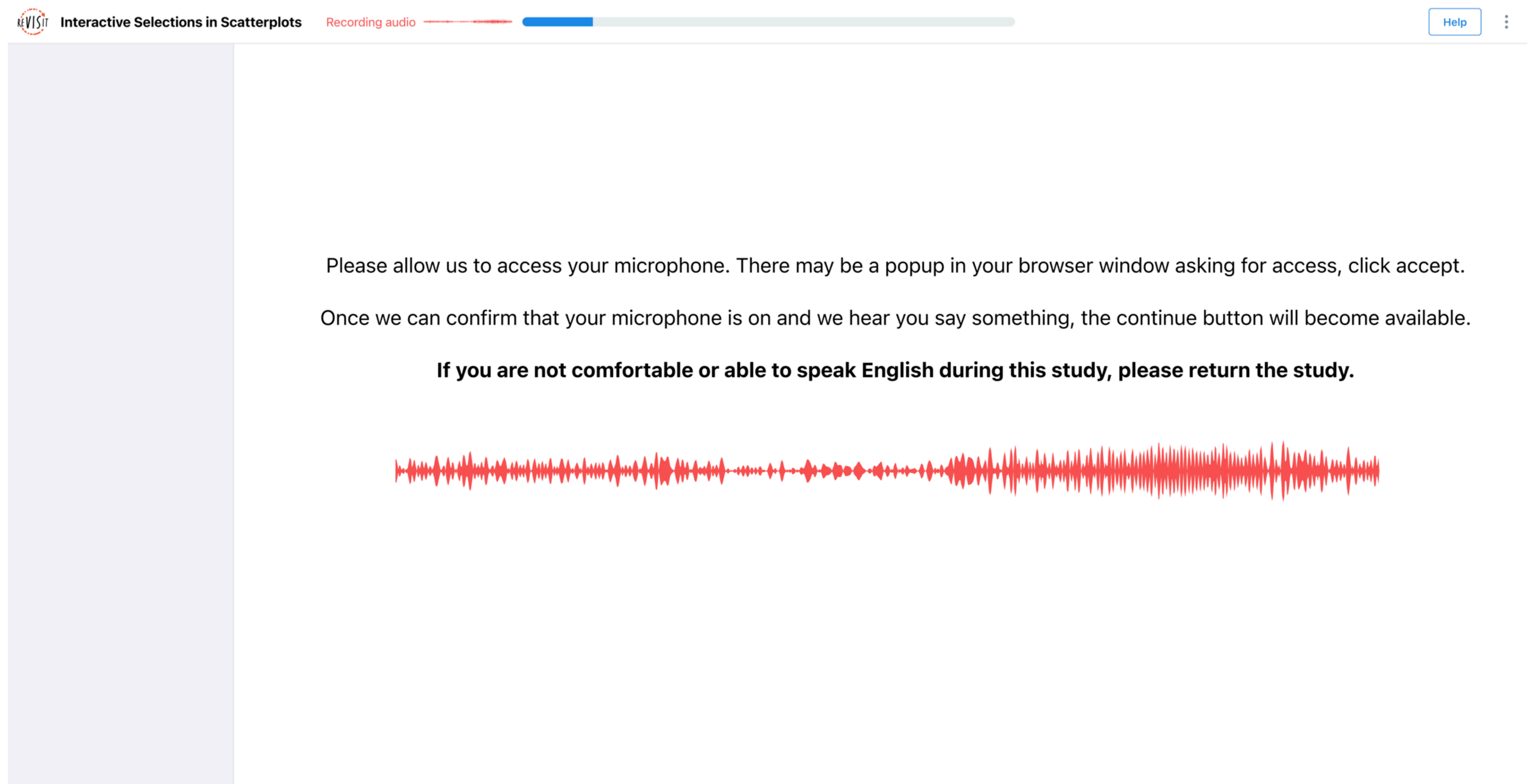
Usual trade-offs of lab vs crowdsourced

RECORDING

Single flag

Waveform vis to show recording is on

Automatic **transcription**



The screenshot shows a web application interface. At the top, there is a header with the text "Interactive Selections in Scatterplots" and "Recording audio" next to a progress bar. A "Help" button is visible in the top right corner. The main content area contains the following text:

Please allow us to access your microphone. There may be a popup in your browser window asking for access, click accept.

Once we can confirm that your microphone is on and we hear you say something, the continue button will become available.

If you are not comfortable or able to speak English during this study, please return the study.

Below the text is a red waveform visualization representing audio recording.

ANALYSIS

Synched with Application State / Events

Easy **editing** of transcripts

Ability to **code** per participant / task / trial



← 5e5521580ee1b951df544c3c paintBrush_q4 × →



[Play](#) [Pause](#) 3/18/2024, 3:08:05 PM

Transcript

+ Tags

So for this task, uh, I just need to consider penguins that weigh between 4 and a half and 5.

Okay kilograms, but all that I'll flip a length between 2 and 215.

All right. I'm going to have to be quite precise so I can

I'm I'm confident about the 4 to 5K but 2 to 15.

Okay, so I'm just going to click on select.

All right, so actually 200 to 20.

So I'm just going to have to have to estimate where.

2 15 is

which is approximately there about 75% of that.

Let me just clear that selection. Let me just try this again.

Okay. Alright, so that's the 4 to 5K body mass. And then the 2002215.

So that's giving me those results.

so the most common penguin There Is the Gen 2

and the least common penguin with 5 is the a deli if I've pronounced that correctly.

Okay clicking.

- Reading question ×
- Reading question ×
-
-
- Stating Intent ×
-
-
-
-
- Answering question ×
-
-



Task:

Consider only penguins that weigh between 4k and 5k grams (g) and have flipper lengths between 200 and 215mm. What is the most and least common type of penguin in this subset?

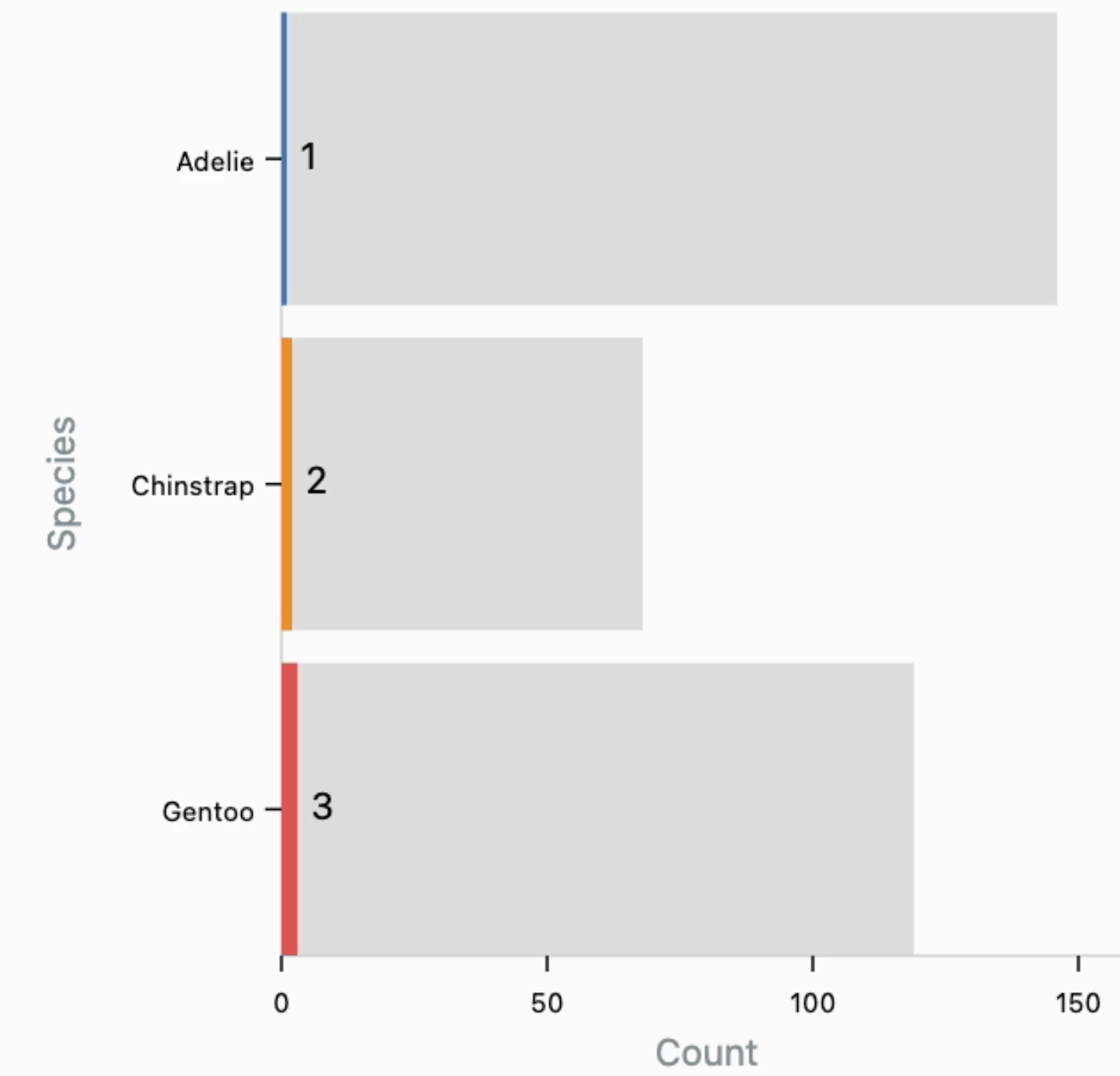
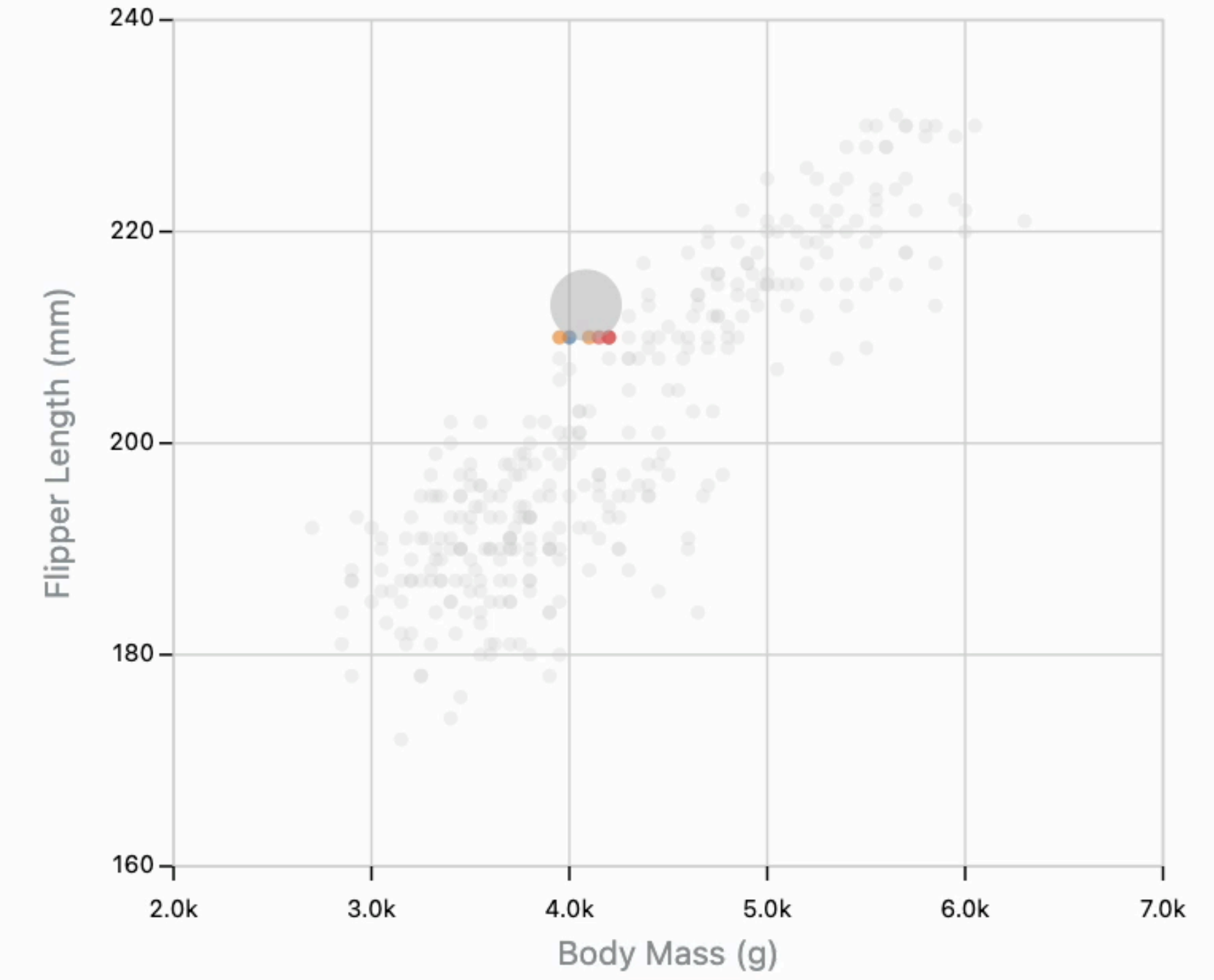
While answering this question, please verbalize your thoughts, especially any insights you have or problems you run into.

Most common Penguin: *

Least common Penguin: *

[Next](#)

[Clear Selection](#) [Select](#) [De-Select](#)



VALIDATION

Do crowdsourced think-aloud studies work?

Study 1: Crowdsourced vs Lab Think-Aloud

Crowdsourced



Lab



Study 2: Online Think-Aloud vs Text Response

Think-Aloud



RECORD RESPONSE

Text Response

Lorem ipsum dolor sit amet,
consectetur adipiscing elit, sed
do eiusmod tempor incididunt
ut ero labore et dolore

SUBMIT RESPONSE

Do crowdsourced think-aloud studies work?

Study 1: Crowdsourced vs Lab Think-Aloud

Crowdsourced



Lab



40 online participants

10 lab participants

Stimulus:

interactive vis tool

two views

required interactions to solve tasks

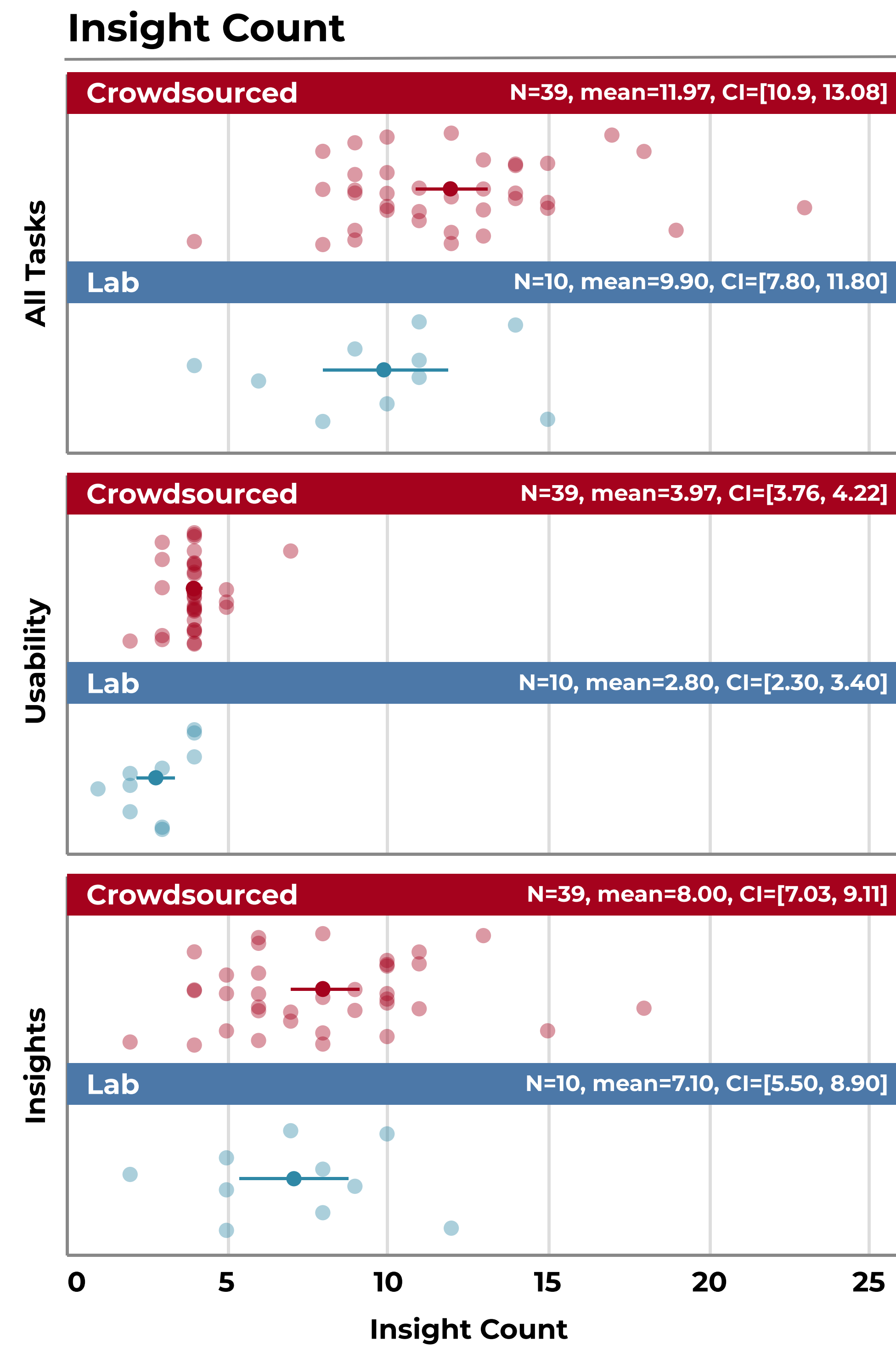
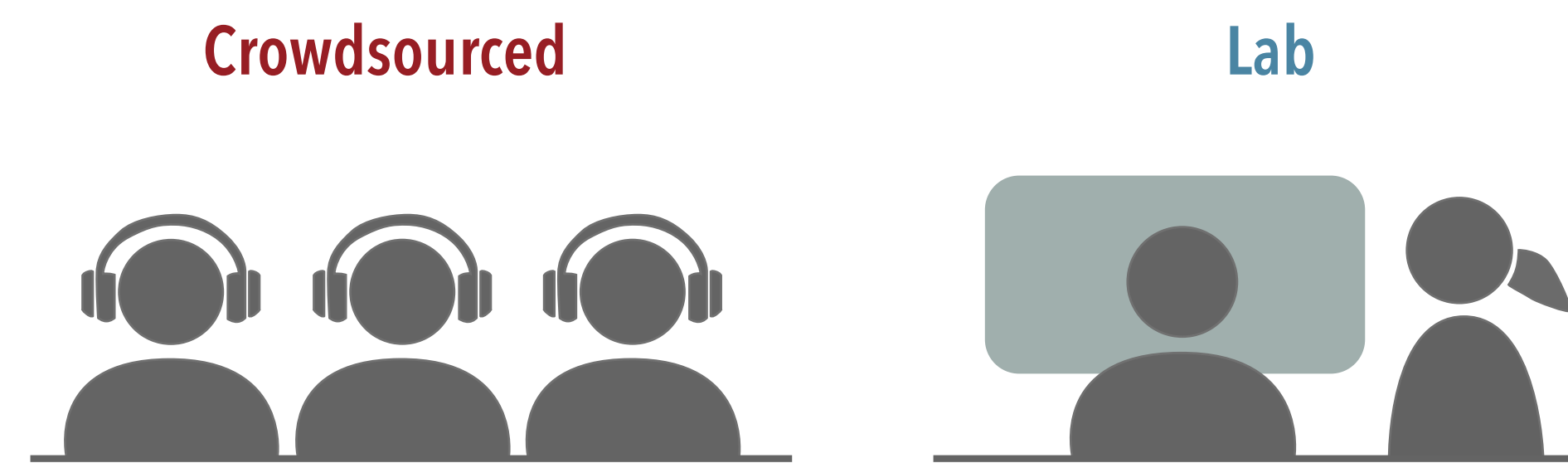
Coding:

Usability

Insights (correct, directed / open, hypothesis, elaborated)...

Do crowdsourced think-aloud studies work?

Study 1: Crowdsourced vs Lab Think-Aloud



Yes, ppl speak!

1 audio recording unusable

2 required heavy editing
recruiting slightly slower

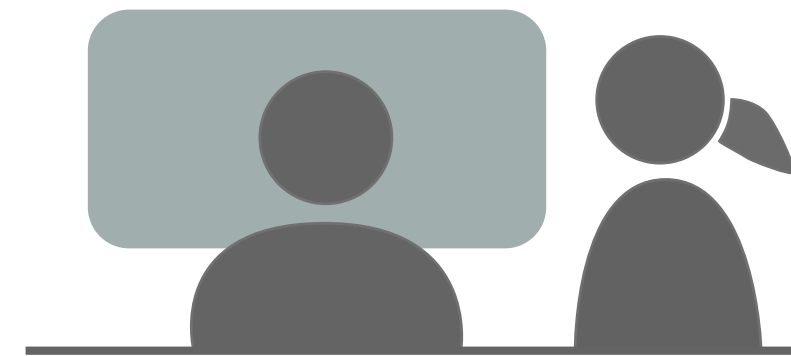
Do crowdsourced think-aloud studies work?

Study 1: Crowdsourced vs Lab Think-Aloud

Crowdsourced



Lab



Crowdsourced comments were more negative

Bias because of experimenter present in lab setting?

Role of experimenter

Better introduction

Clarifying questions

Need to carefully prepare crowdsourced study!

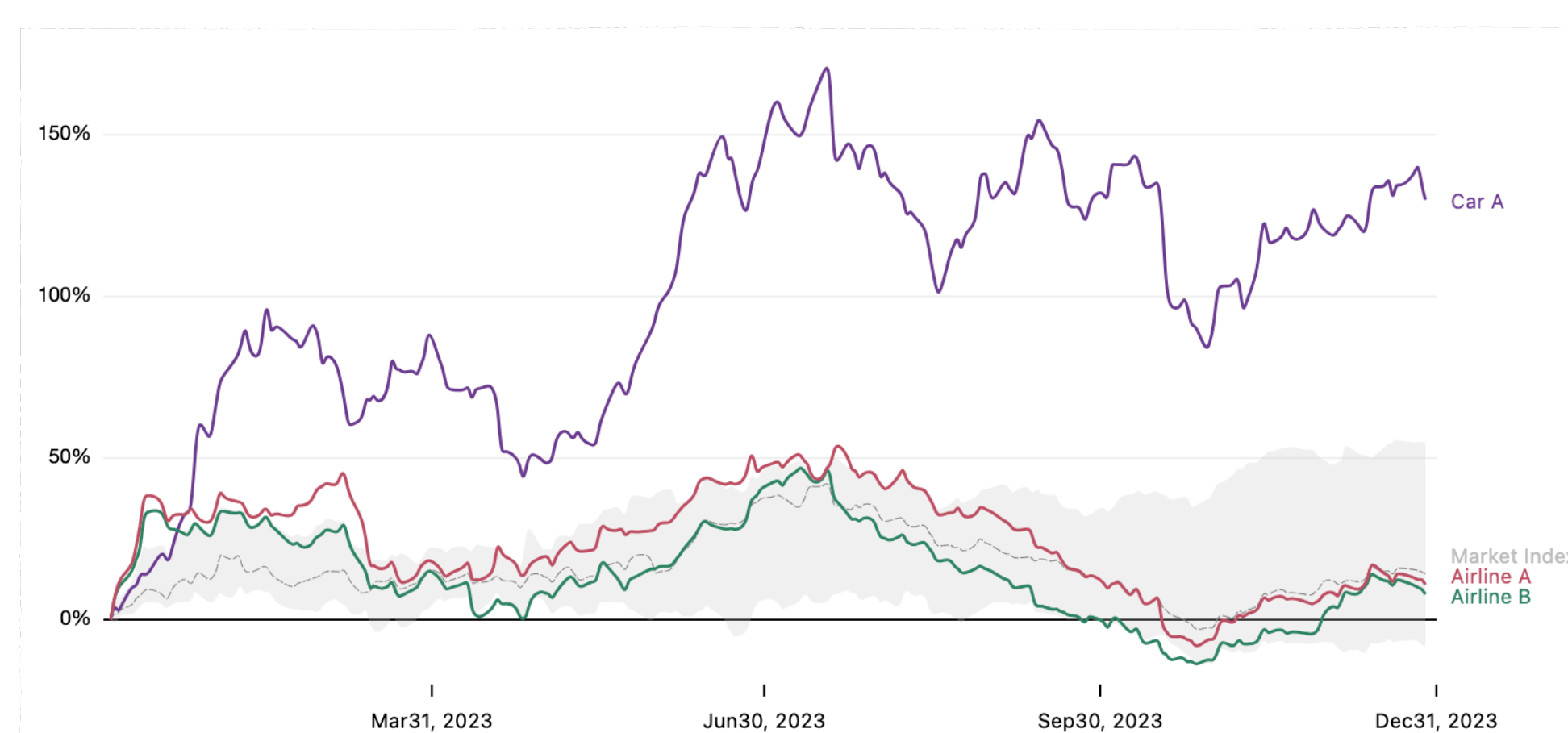
EMPIRICAL & THEORETICAL WORK



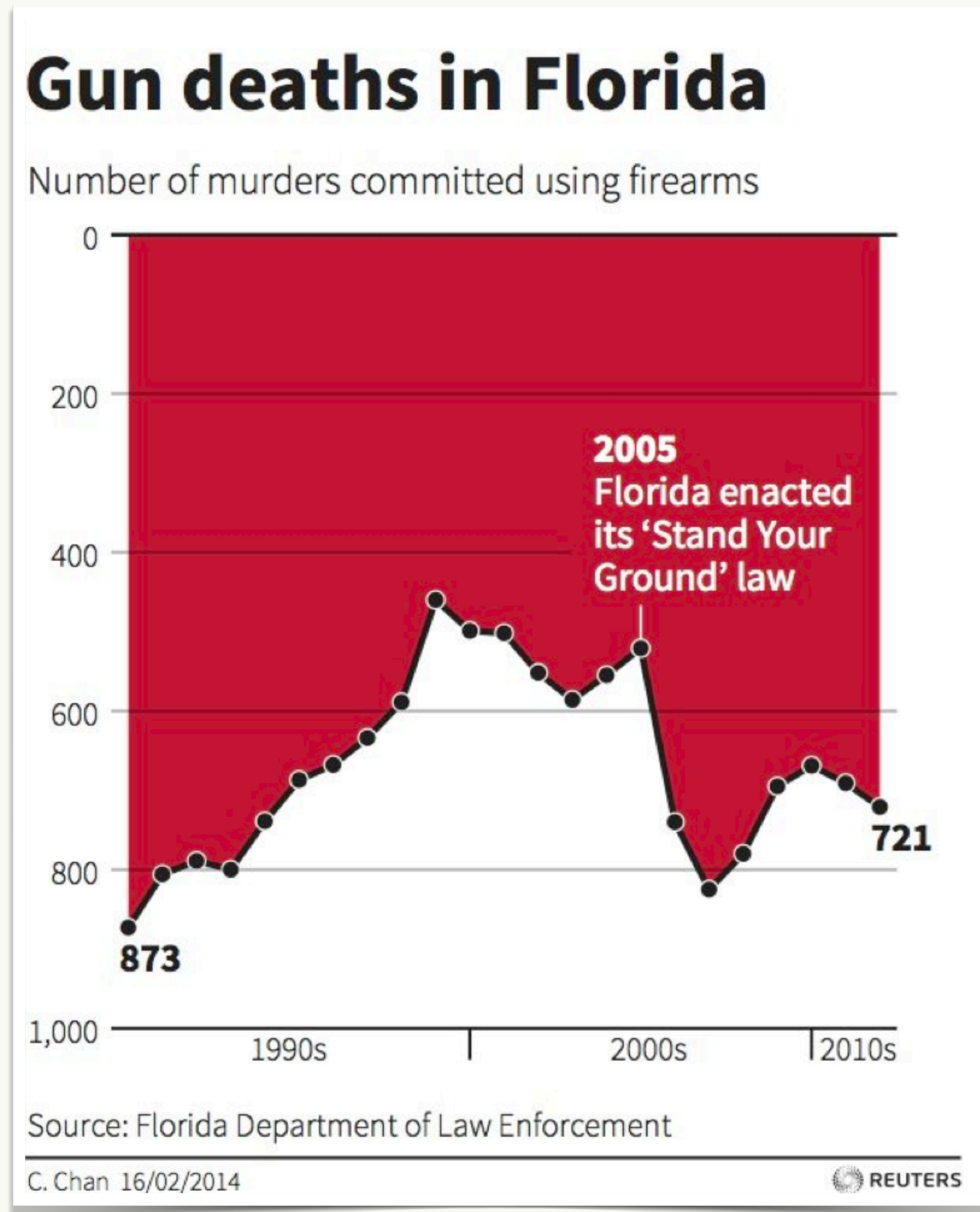
Max Lisnic, Marina Kogan

HOW PEOPLE ACTUALLY LIE WITH CHARTS...

... AND WHAT WE CAN DO ABOUT IT



HOW WE THINK PPL LIE WITH CHARTS: VIOLATIONS OF VISUALIZATION DESIGN GUIDELINES



Inverted y axis

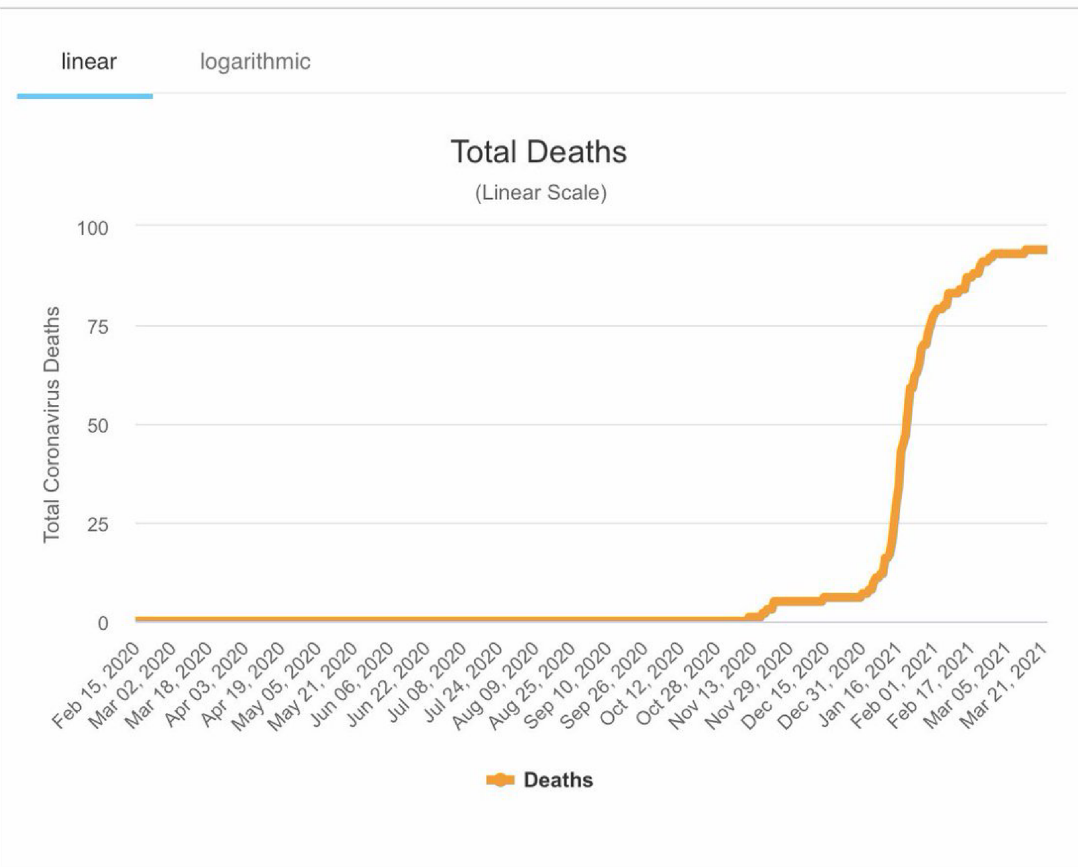


Truncated y axis

**BUT IS THAT REALLY HOW
PEOPLE LIE WITH CHARS?**

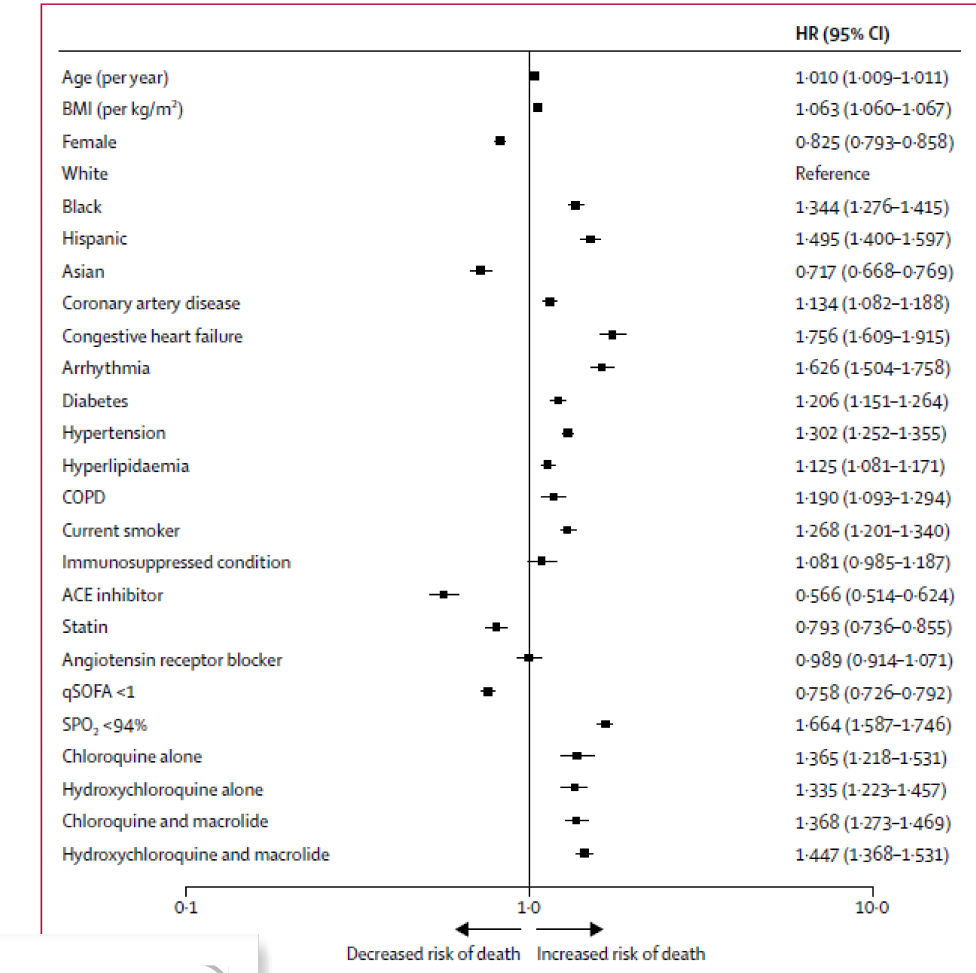
As of 10th January when they started vaccinations there had only been 16 cases.

Total Coronavirus Deaths in Gibraltar

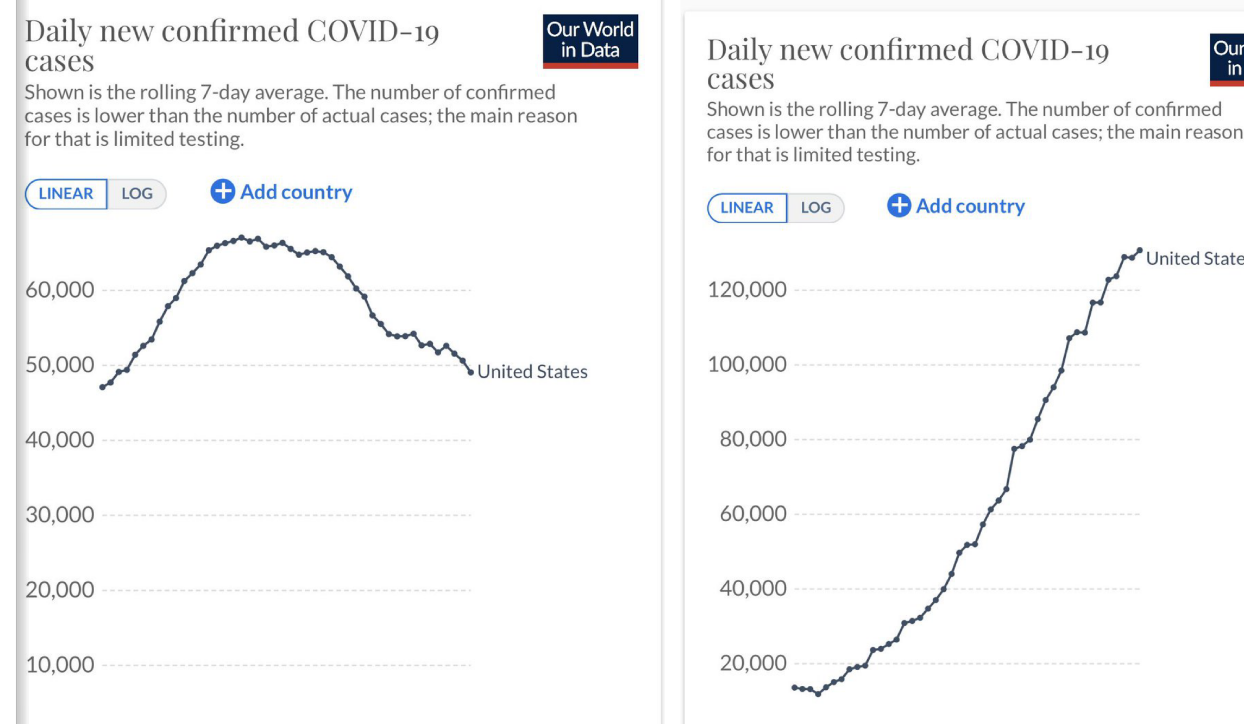


Taking HCQ is as strongly associated with increased coronavirus death risk as DIABETES.

thelancet.com/journals/lance...



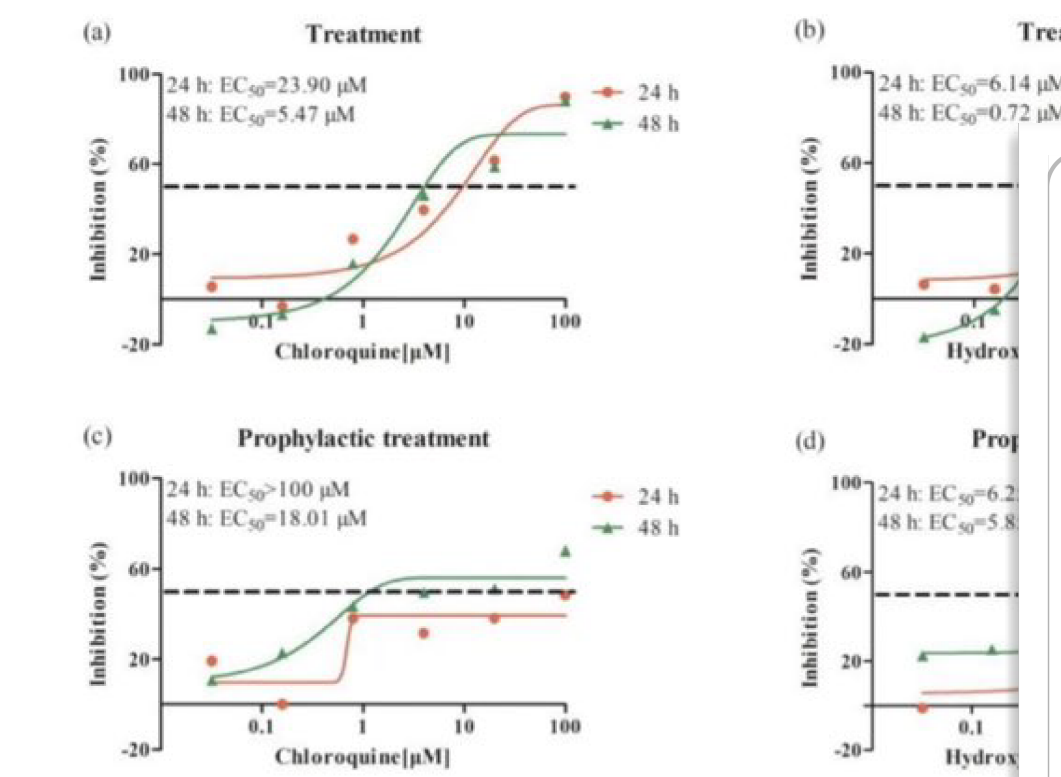
New daily covid cases this time last year (pre-vaccination) vs this year (post-vaccination)



Hydroxychloroquine probably better

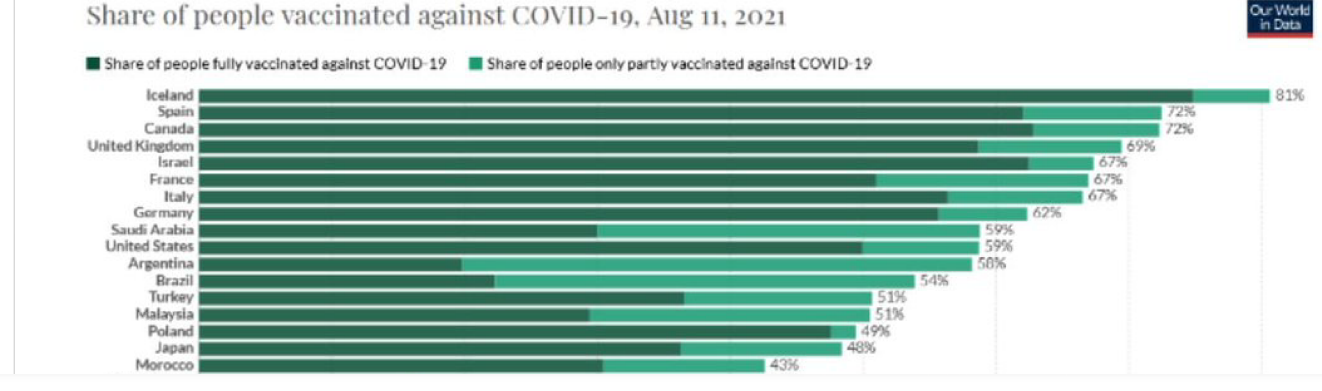
m.youtube.com/watch?feature=...

Figure 1



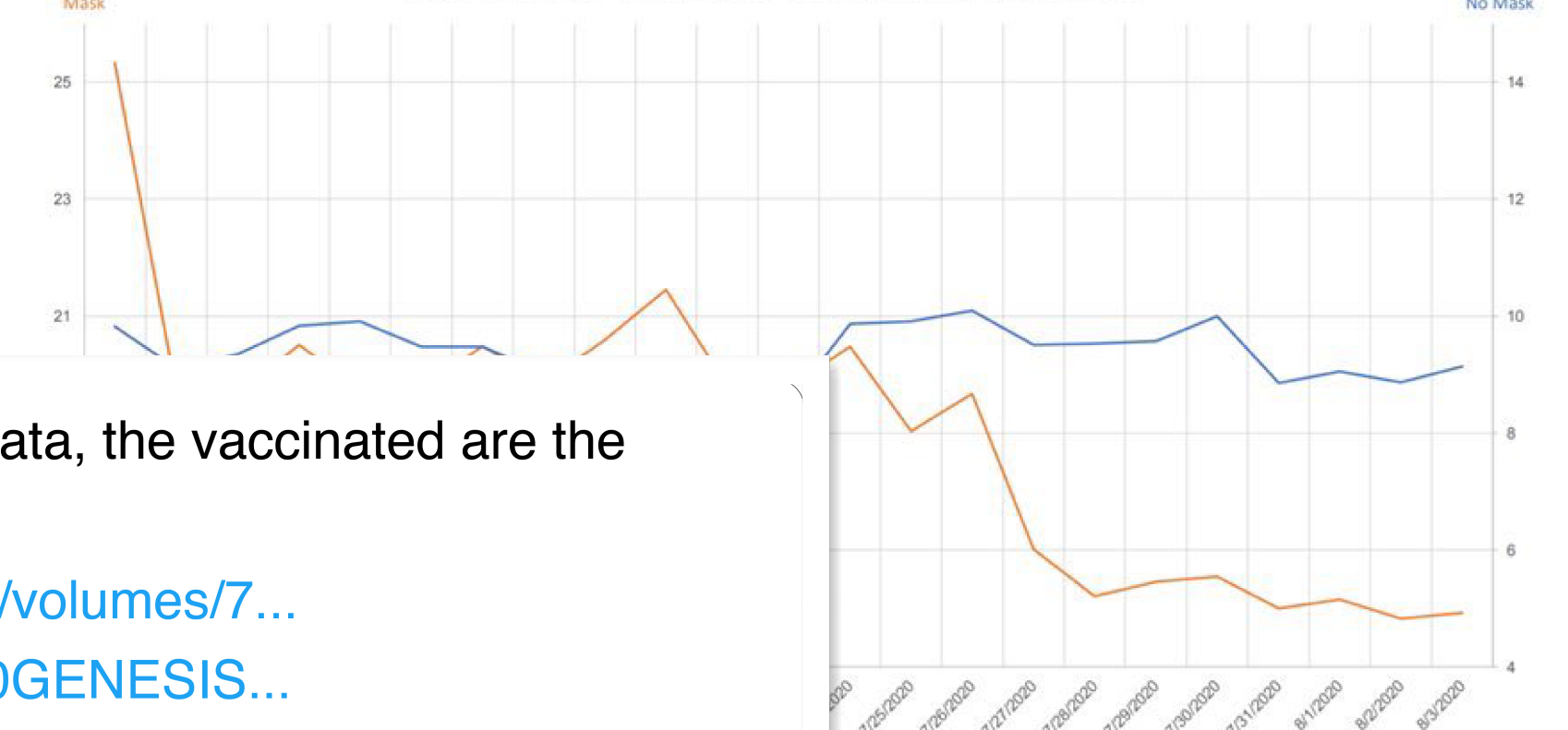
Most vaccinated: Iceland 81%
Least vaccinated: Nigeria 1.2%

Iceland has 119 times more Covid cases



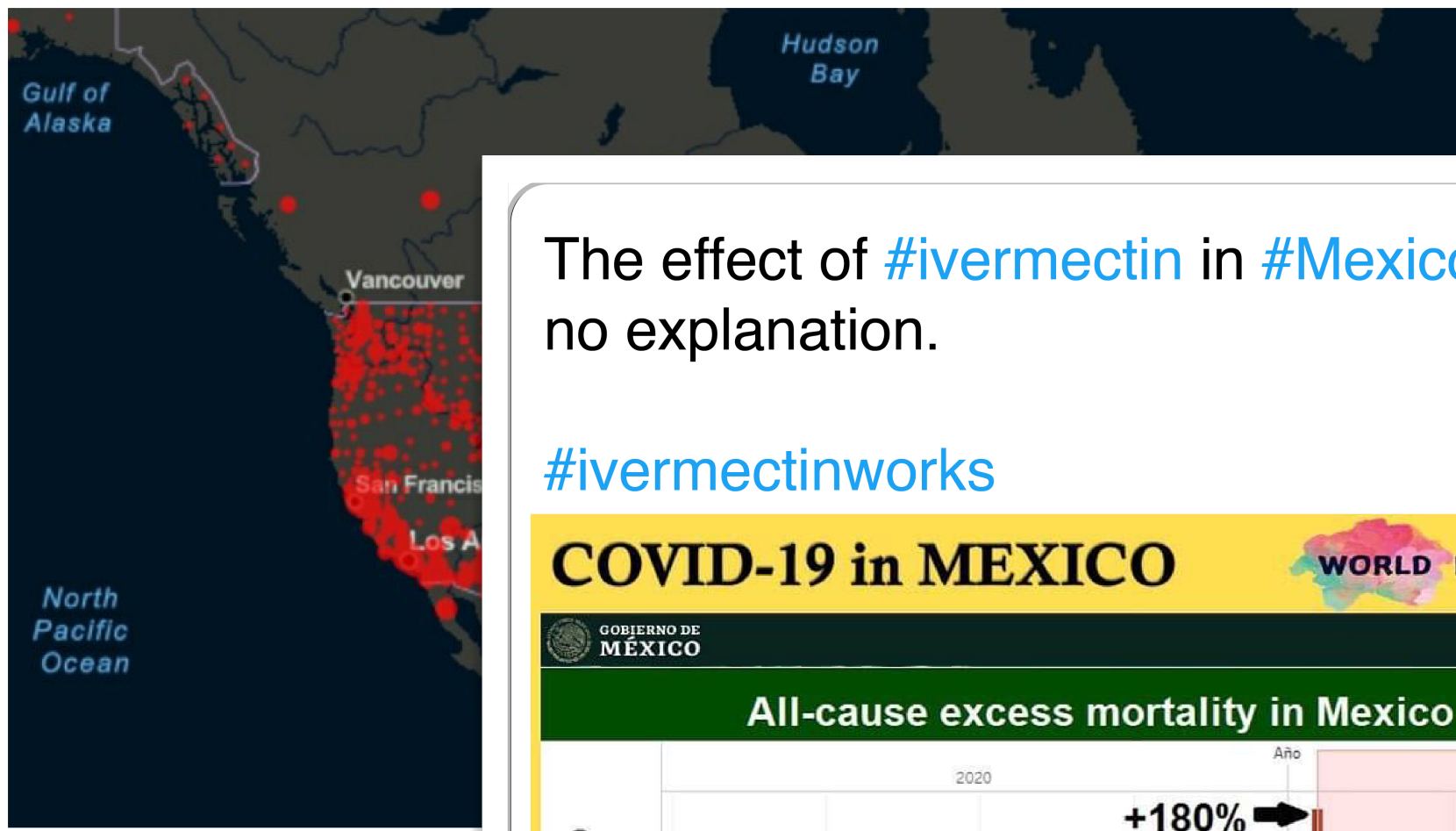
More proof that masks work....

Kansas COVID-19 7-Day Rolling Average of Daily Cases/Per 100K Population
Mask Counties Vs. No-Mask Mandate Counties



We need national leadership...like Canada.

Covid is coded in red.



The effect of #ivermectin in #Mexico needs no explanation.

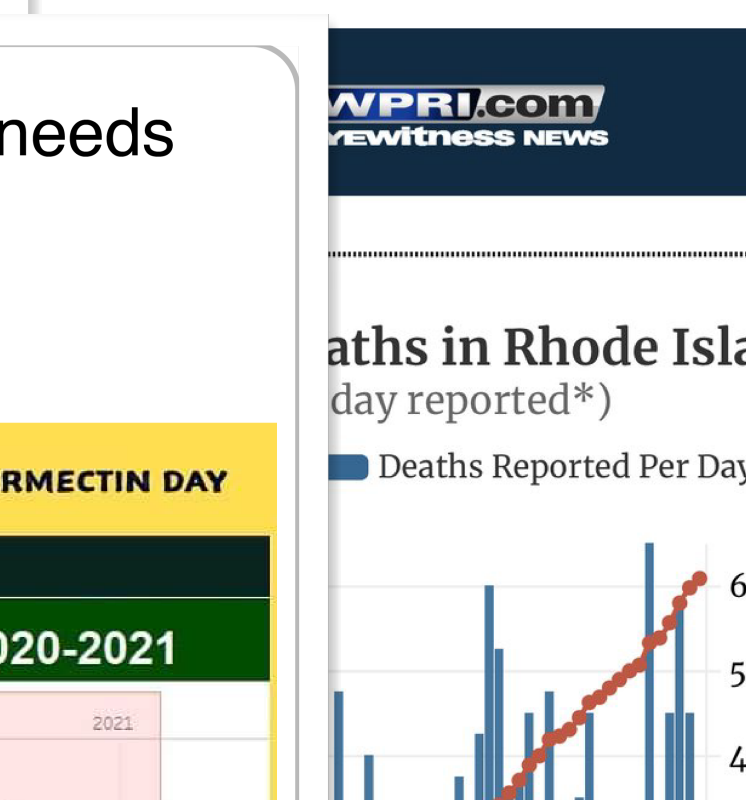
#ivermectinworks



We need national leadership...like Canada.

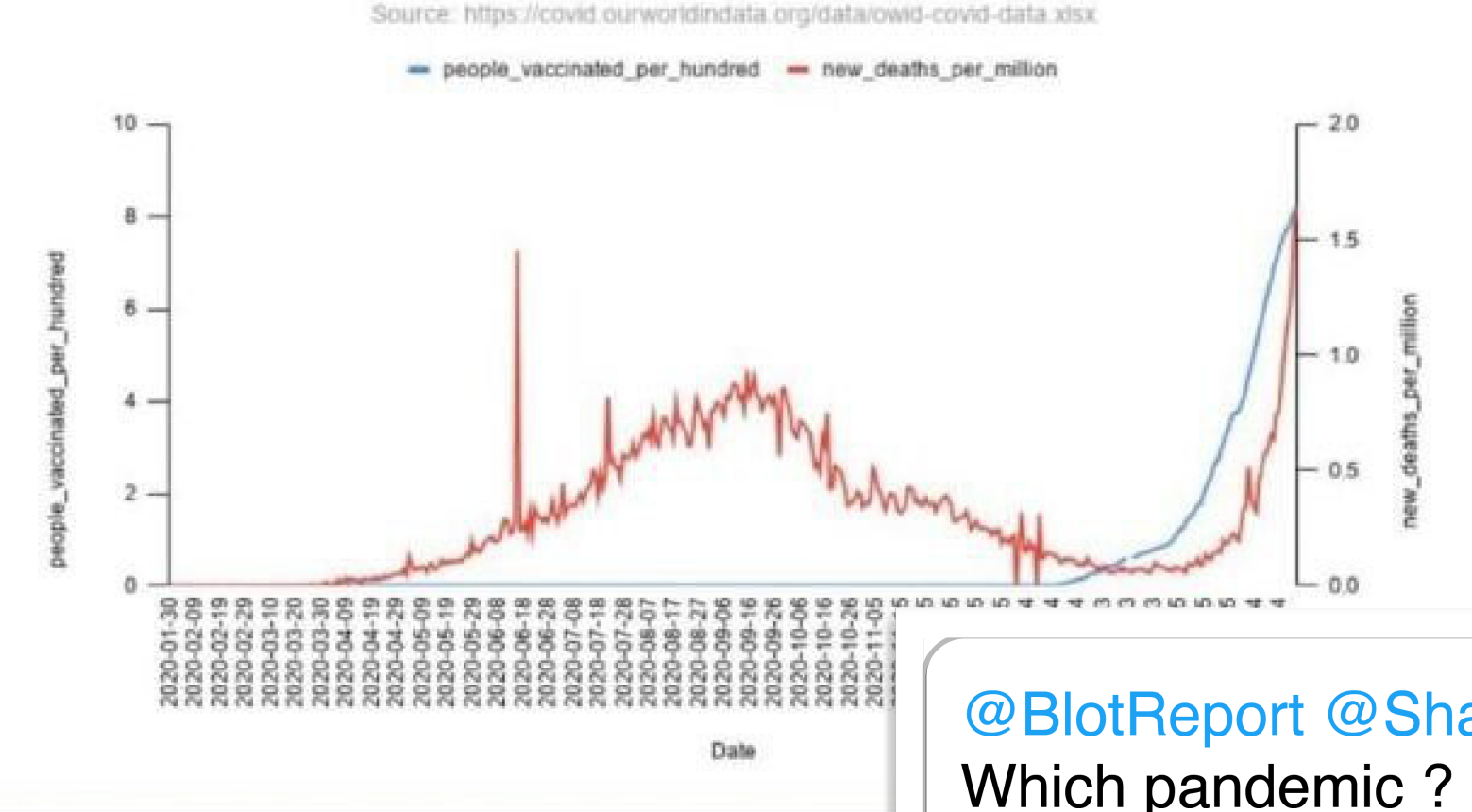
Covid is coded in red.

milestone: today Rhode Island's avirus death toll passed 600 people

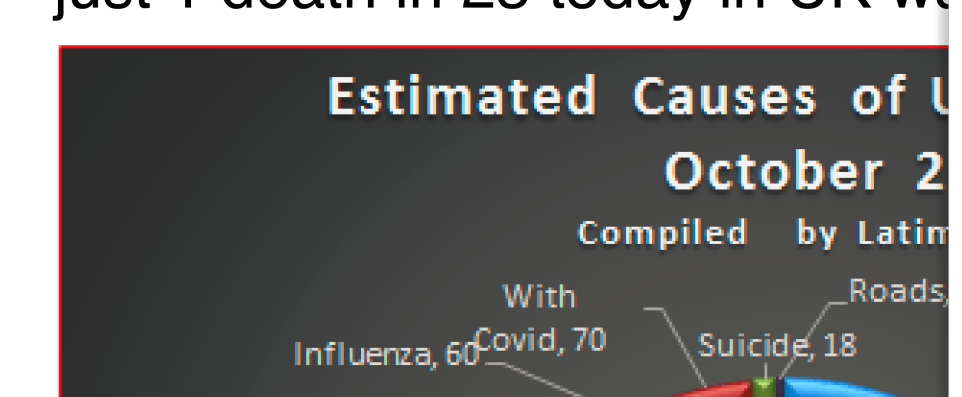


Whoa look what I found, death rates rising in line with vaccination numbers in India.

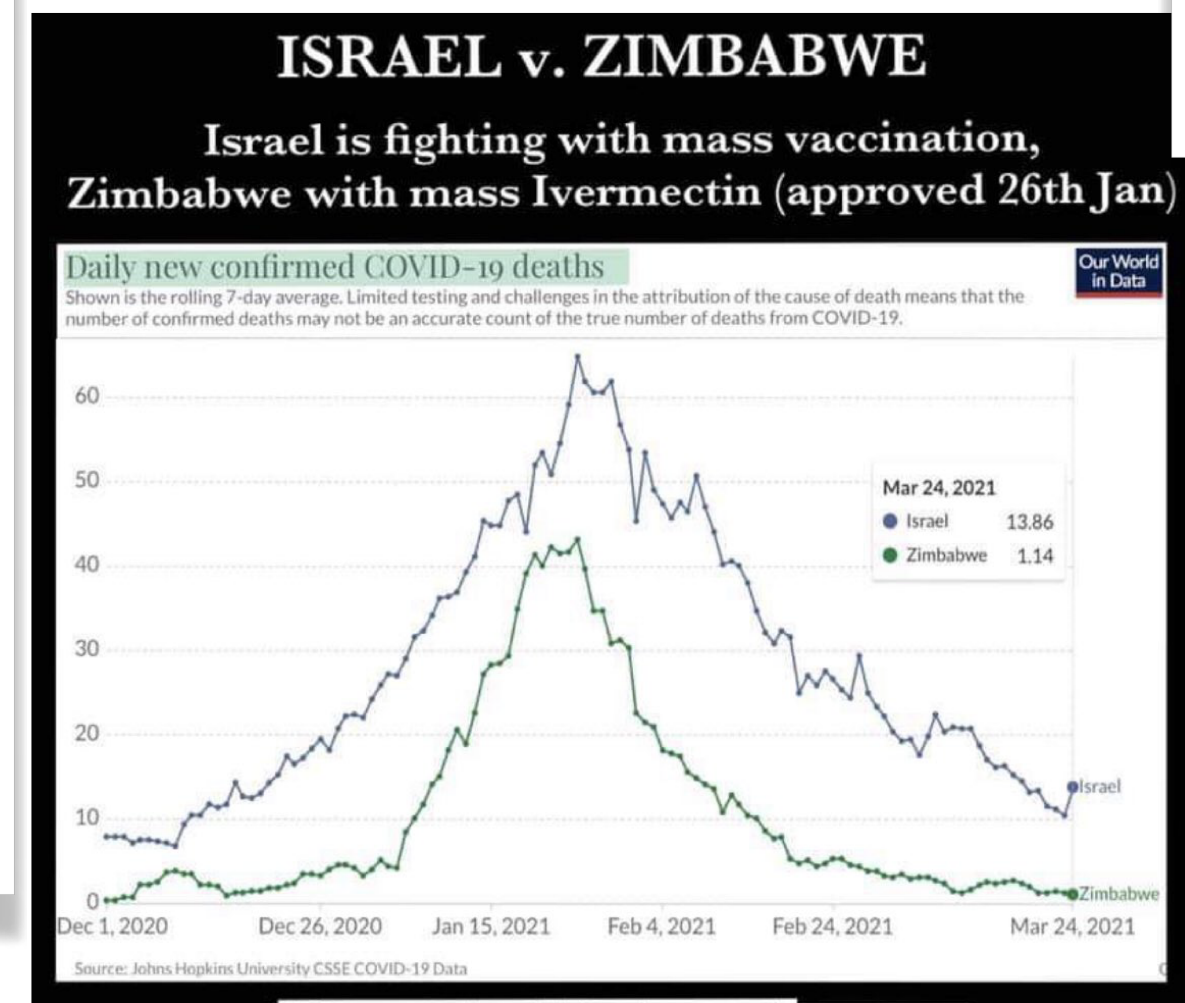
India - people_vaccinated_per_hundred vs new_deaths_per_million



Hot off the press: just 1 death in 23 today in UK with



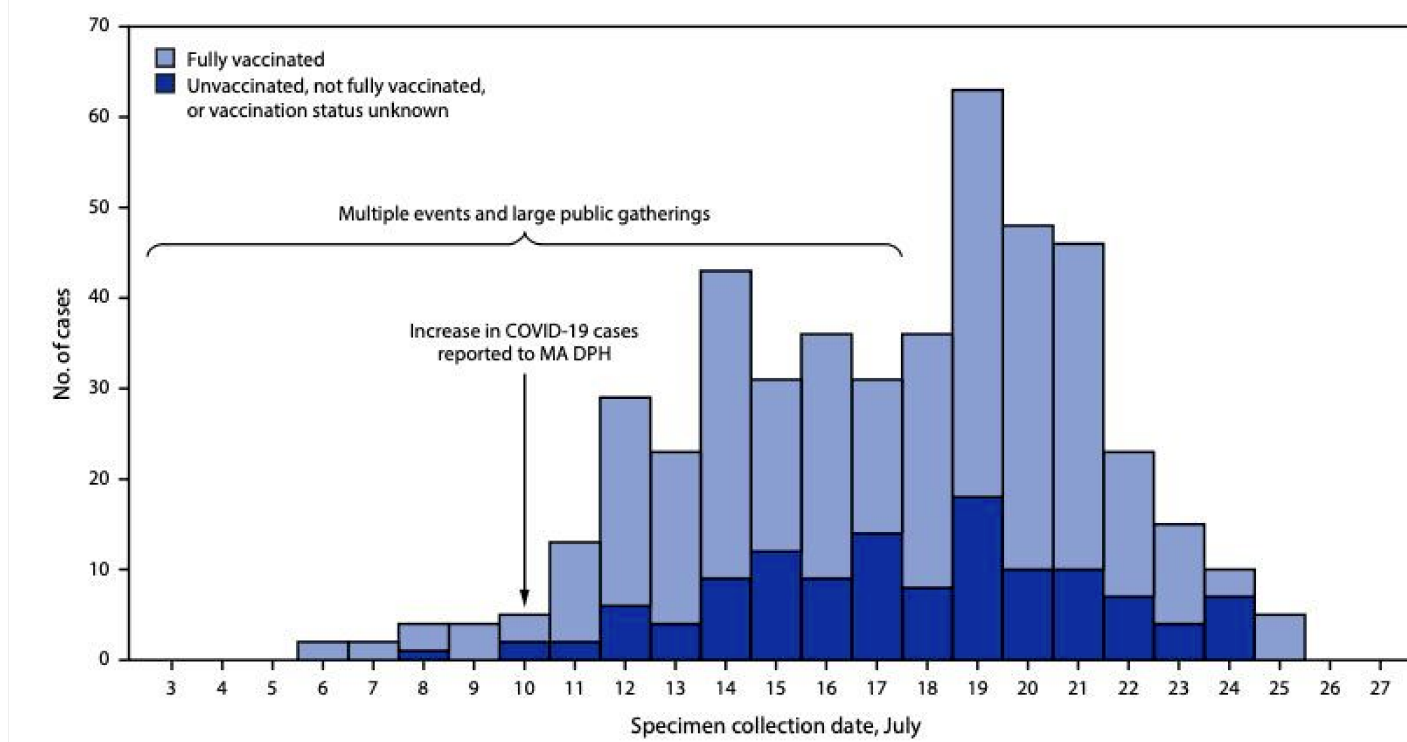
Two words Ivermectin works #ivermectinworks



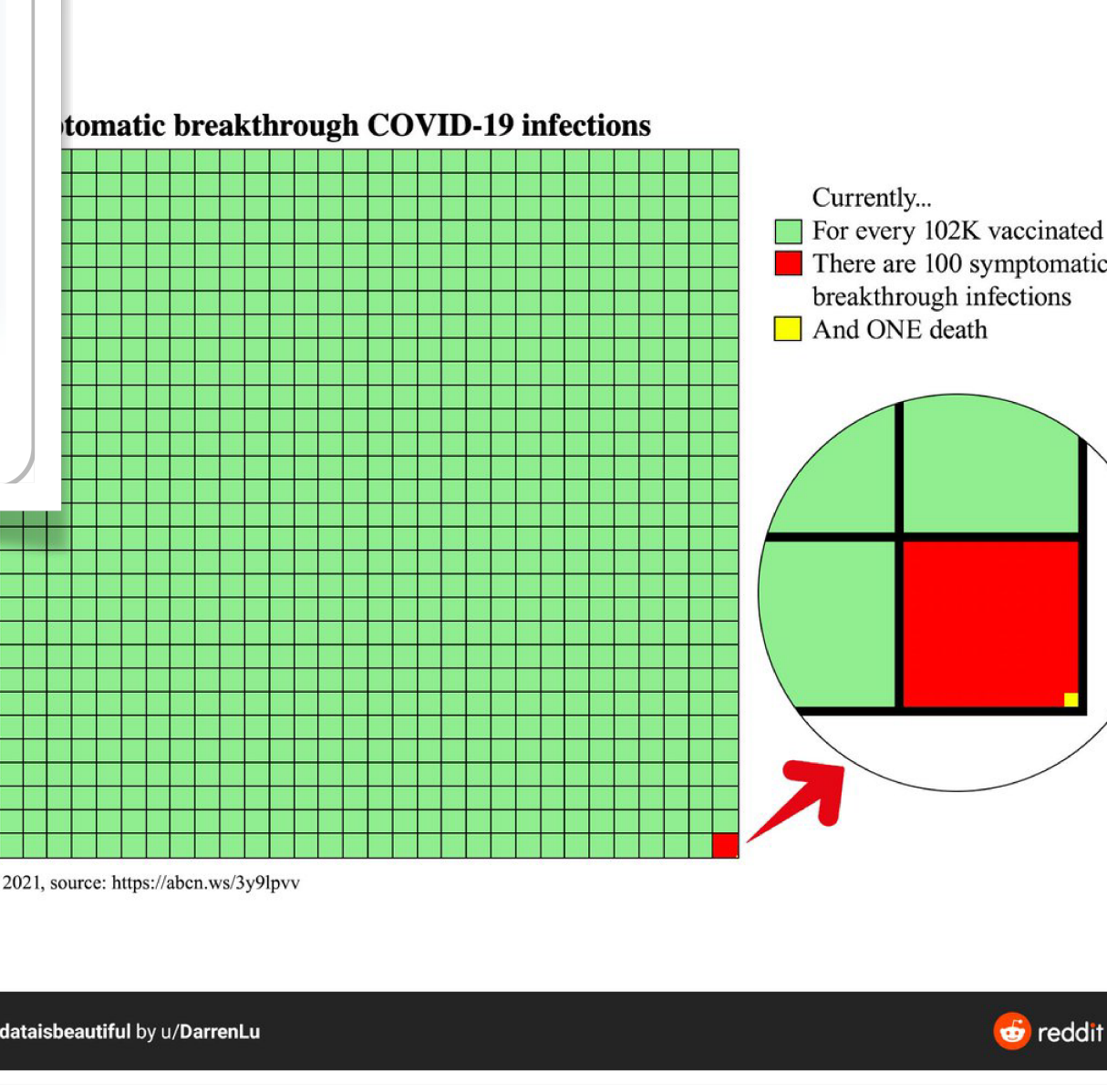
According to official data, the vaccinated are the super-spreaders.

https://cdc.gov/mmwr/volumes/7...
https://t.me/EARTH20GENESIS...

FIGURE 1. SARS-CoV-2 infections (N = 469) associated with large public gatherings, by date of specimen collection and vaccination status* — Barnstable County, Massachusetts, July 2021

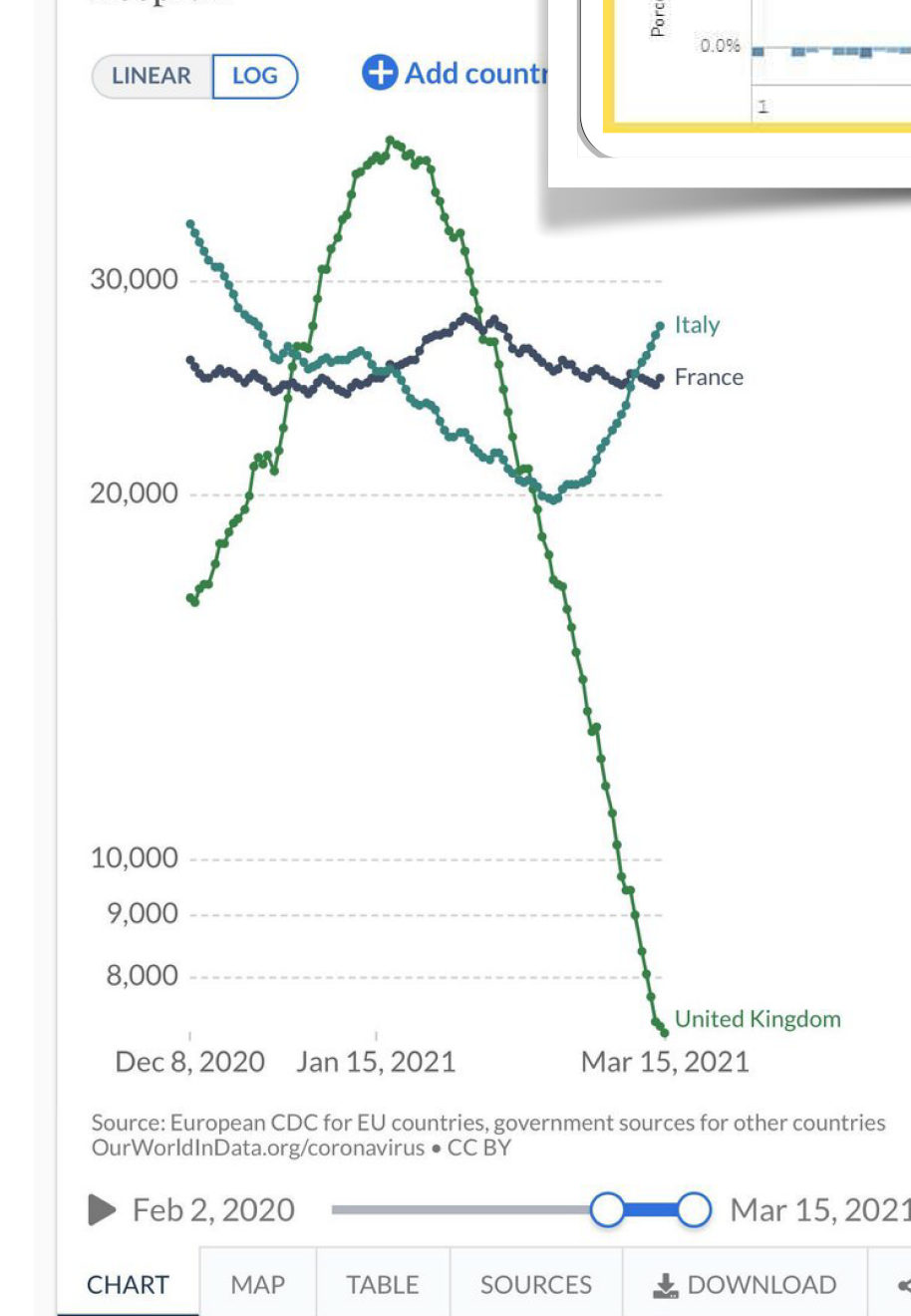


Automatic breakthrough COVID-19 infections

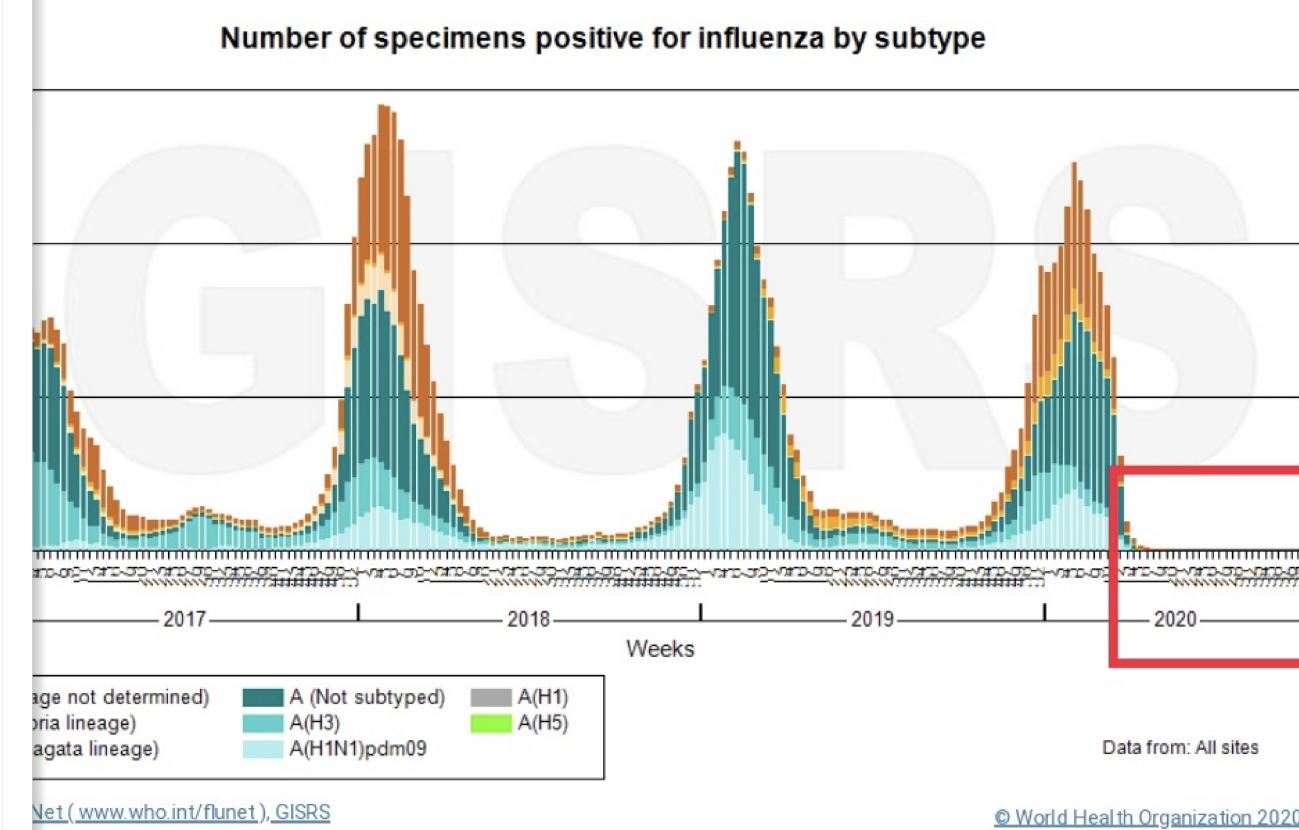


Vaccines work.

Number of COVID-19 patients in hospital

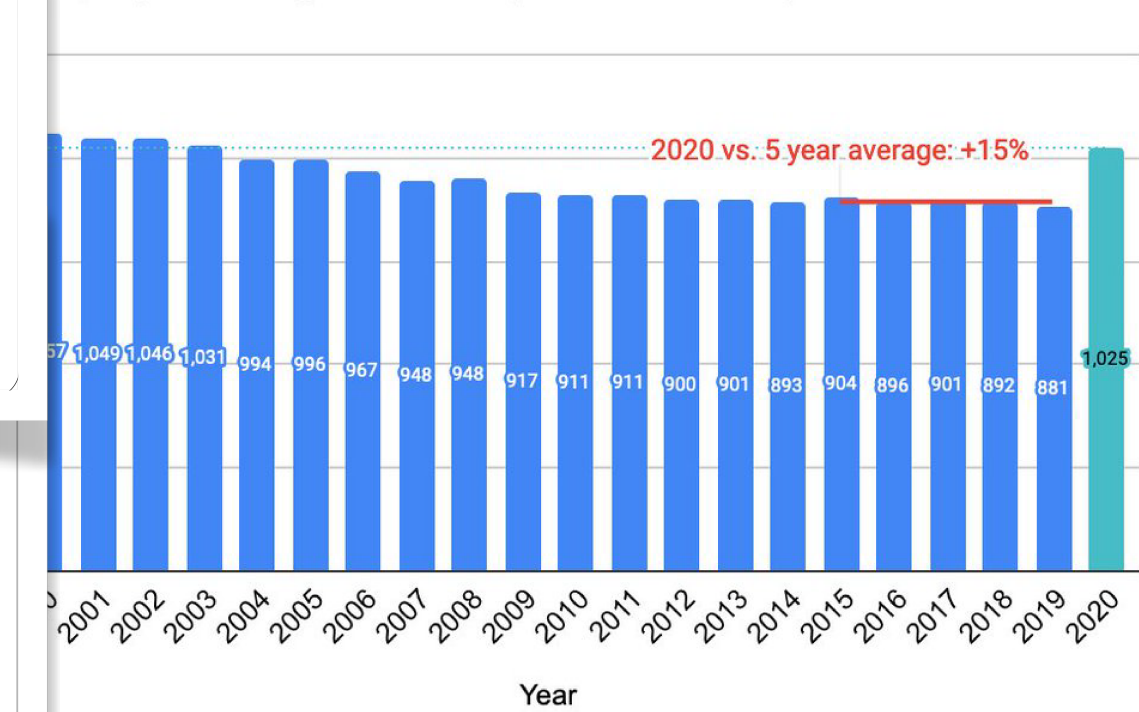


laboratory Surveillance Information System (GISRS)

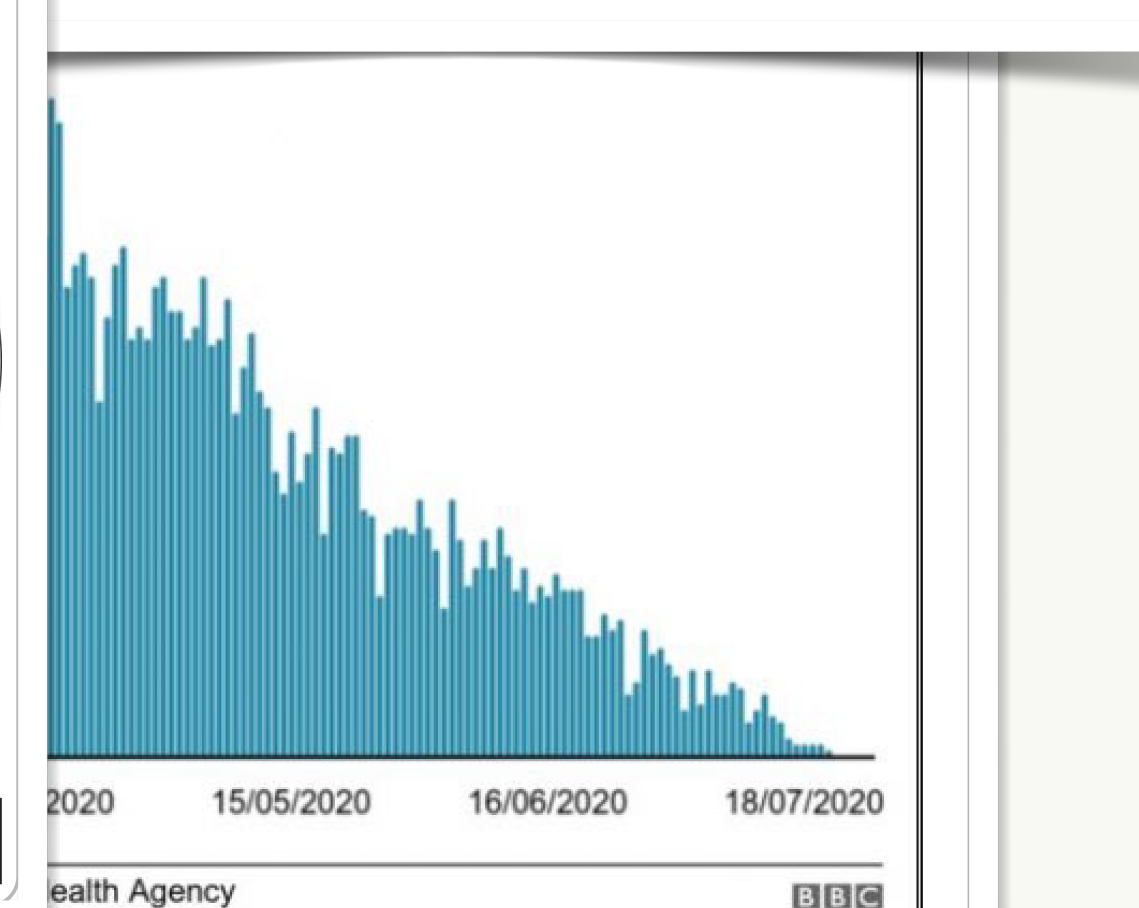


#Covid #Corona #Coronavirus

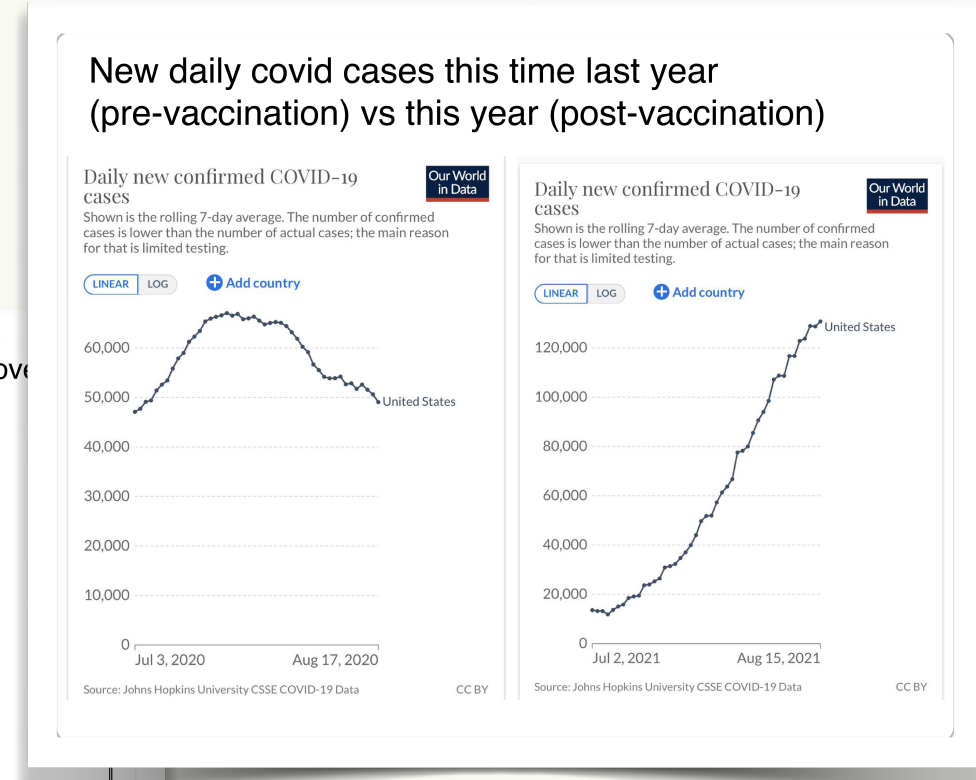
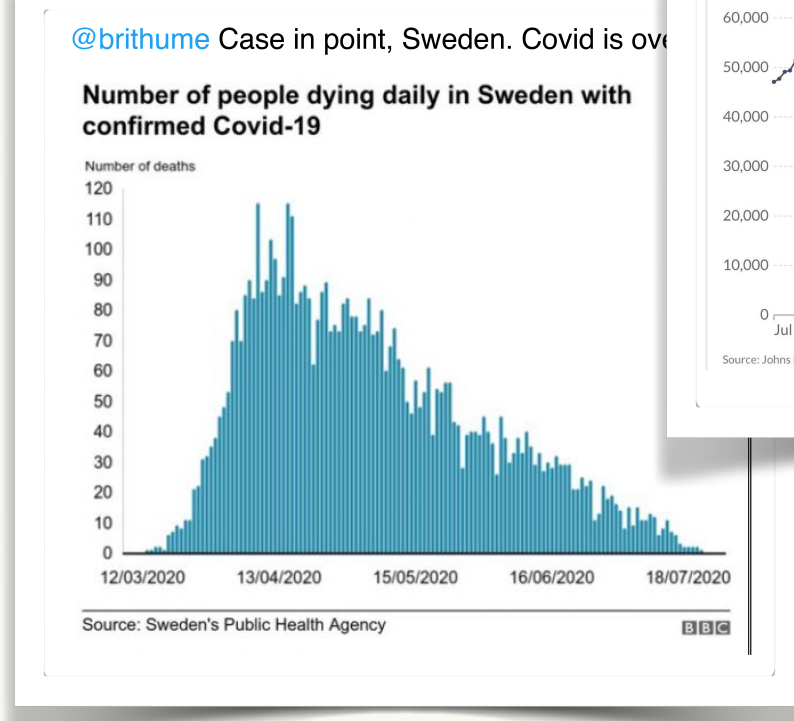
Adjusted Mortality Rate [United States]



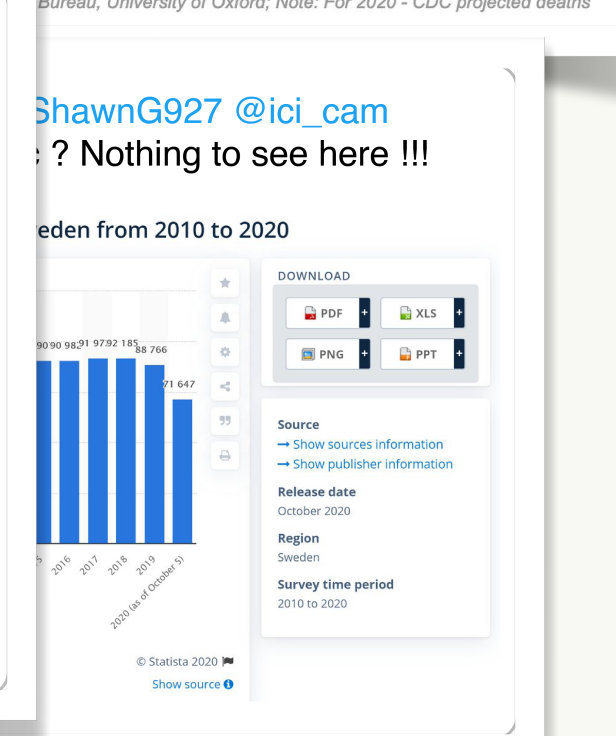
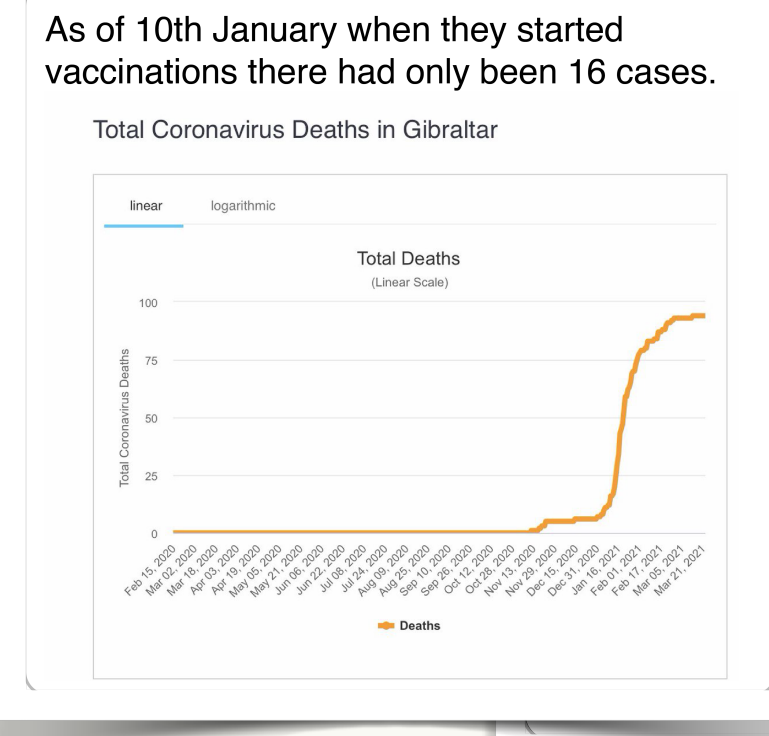
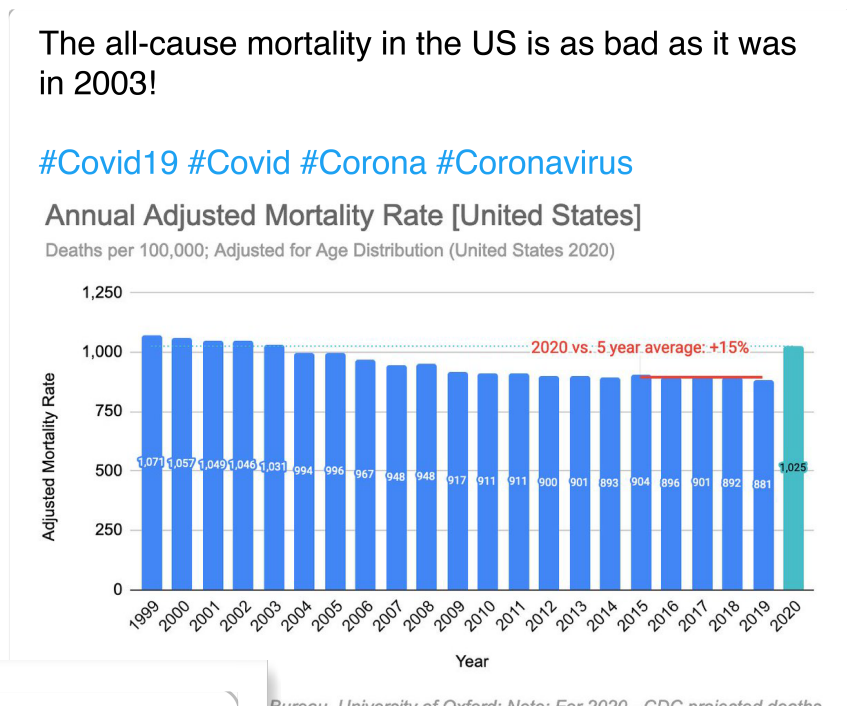
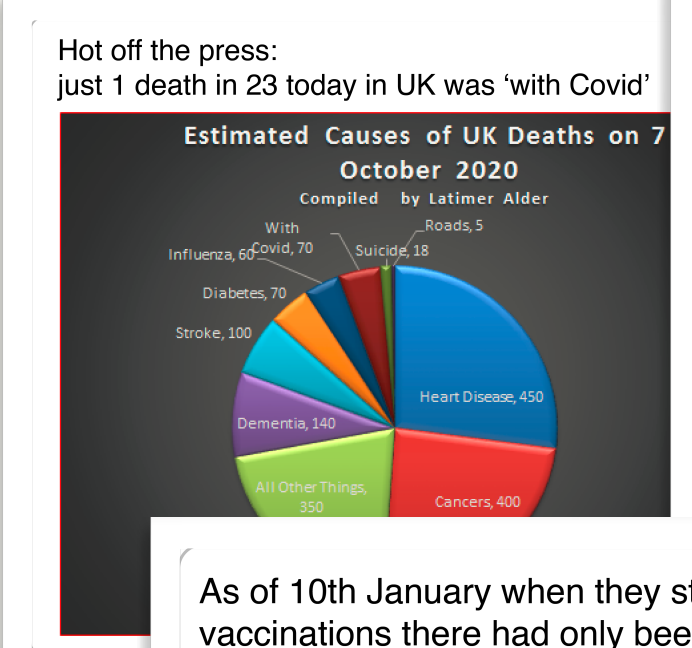
U.S. Census Bureau, University of Oxford; Note: For 2020 - CDC projected deaths



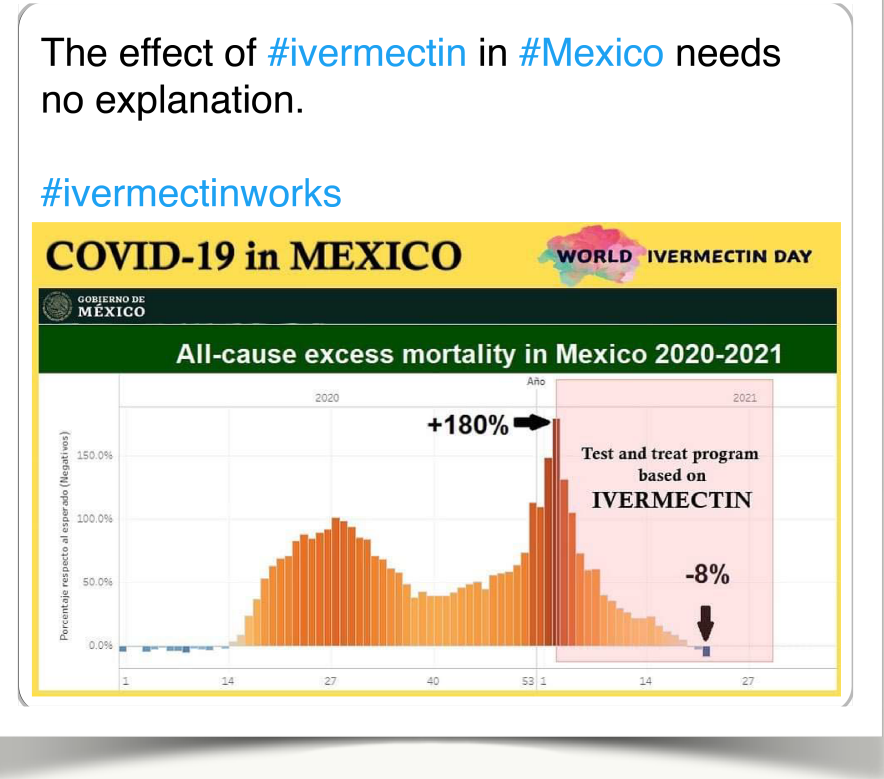
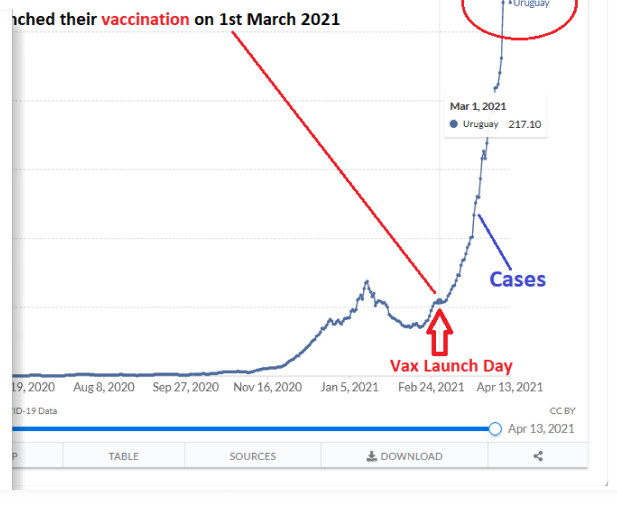
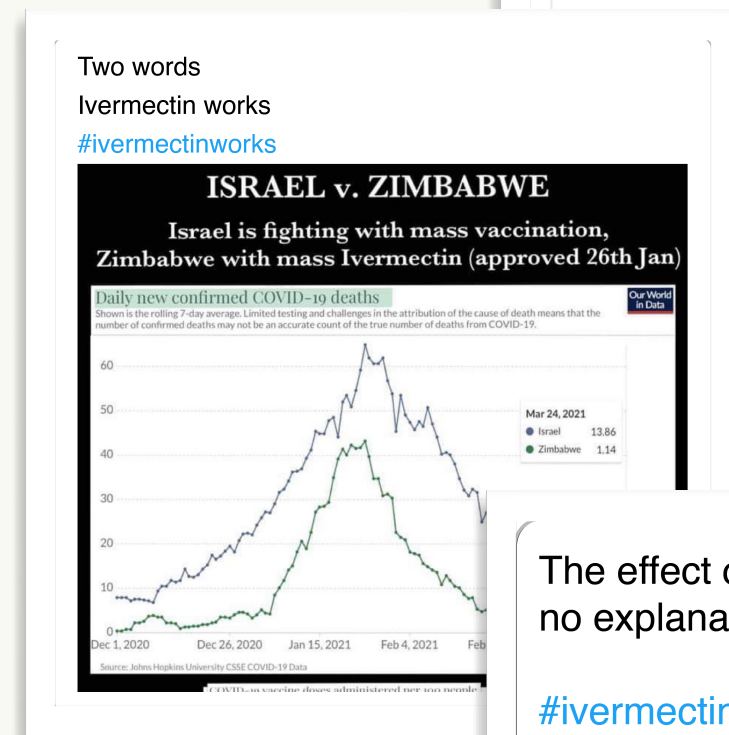
Cherry-picking



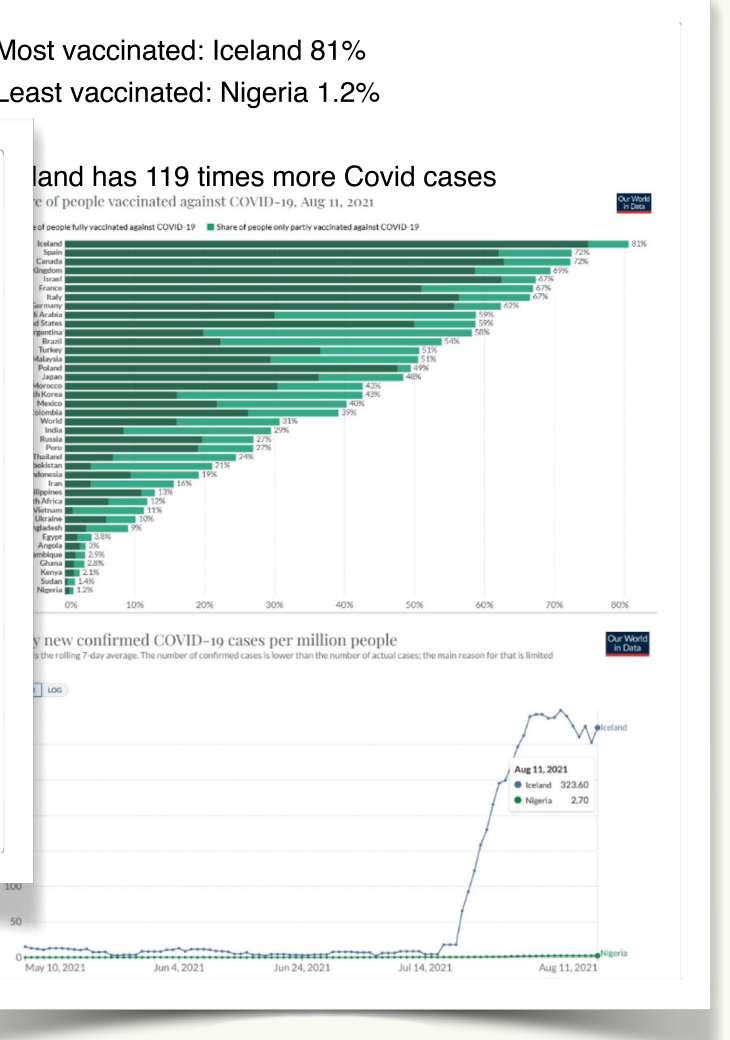
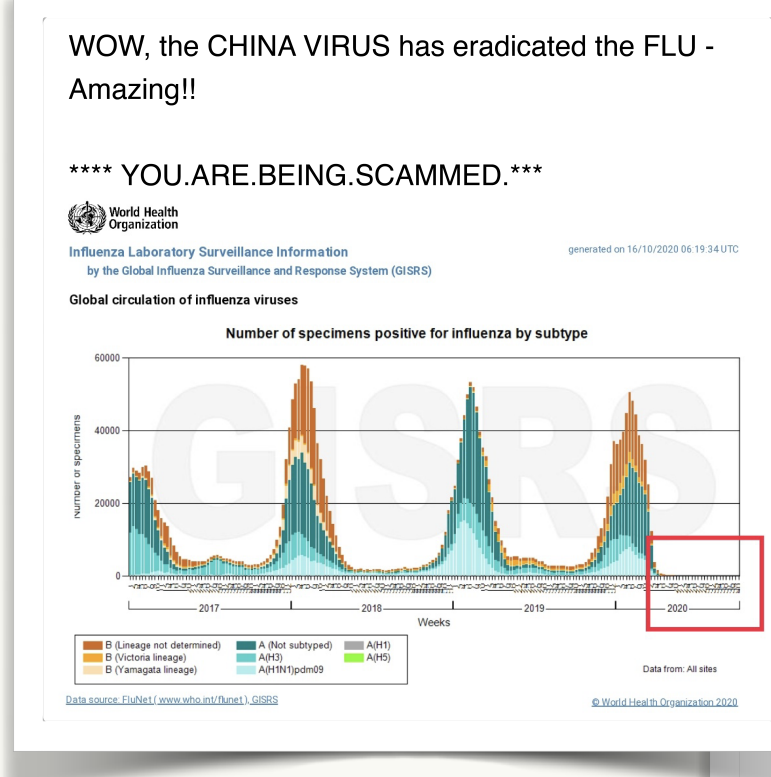
Arbitrary threshold



Causal inference



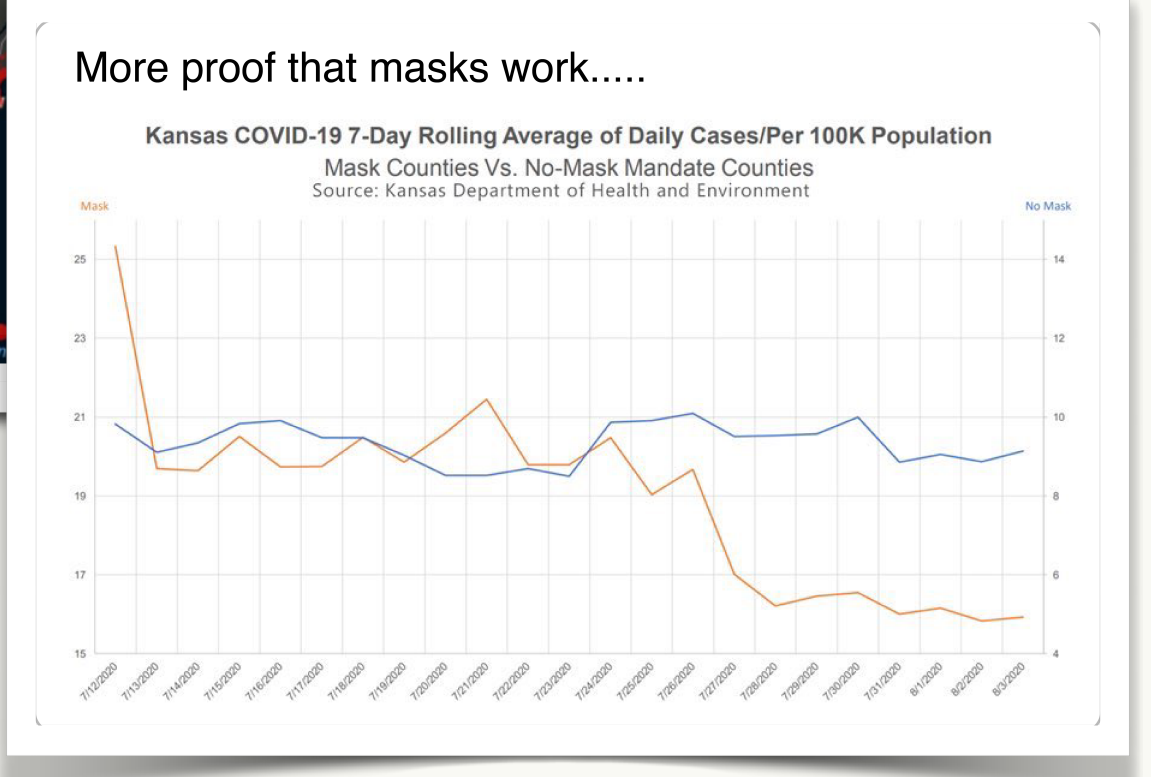
Issues with data validity



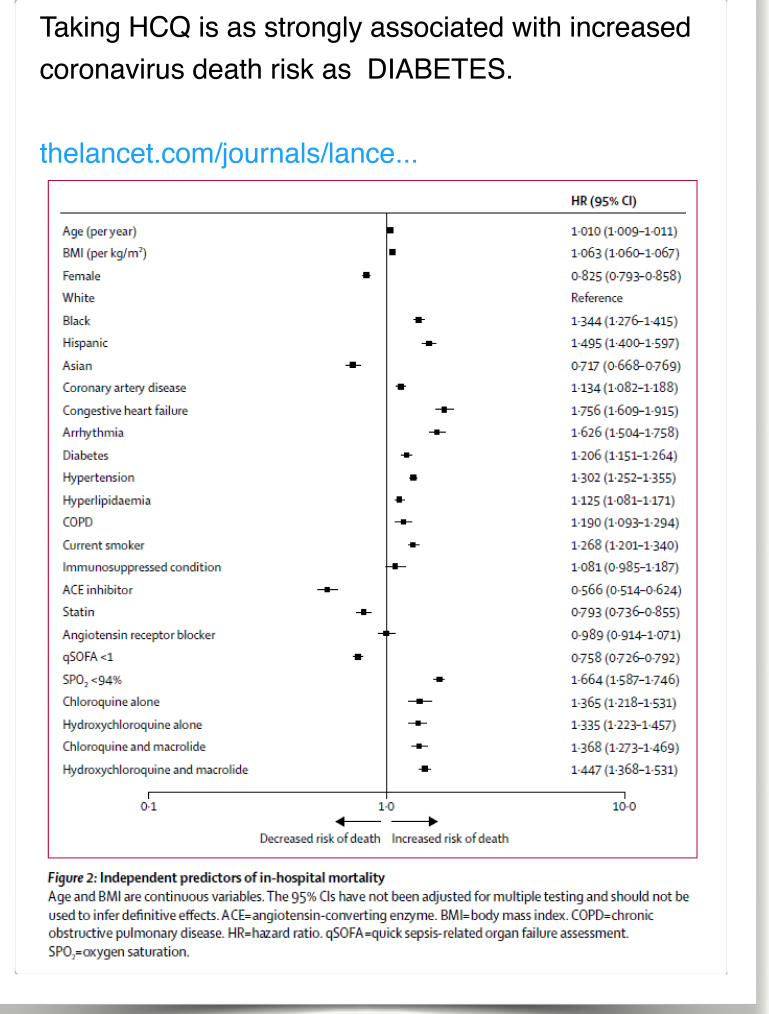
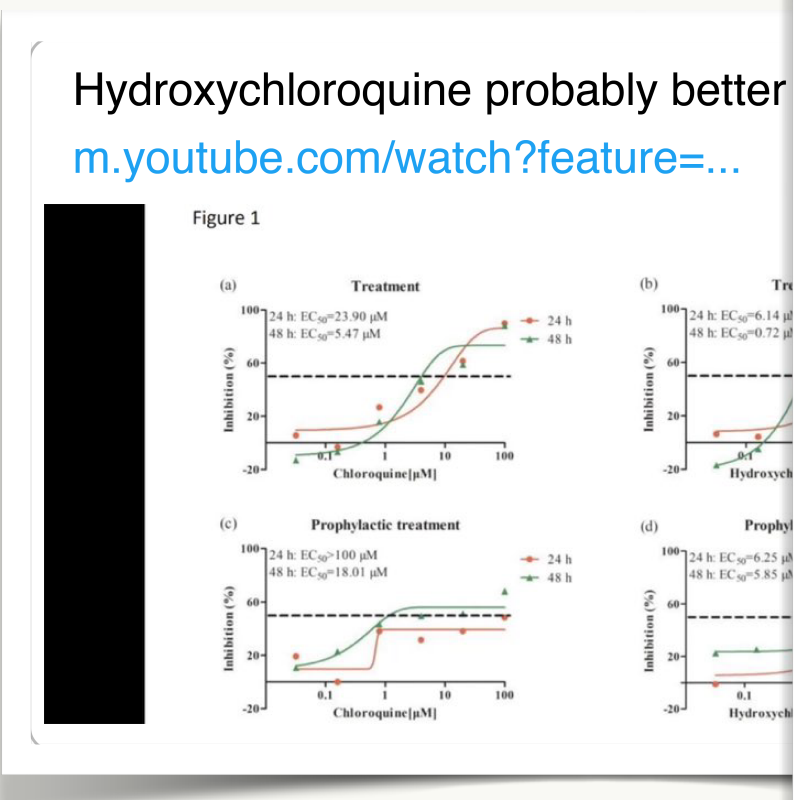
We need national leadership...like Canada. Covid is coded in red.



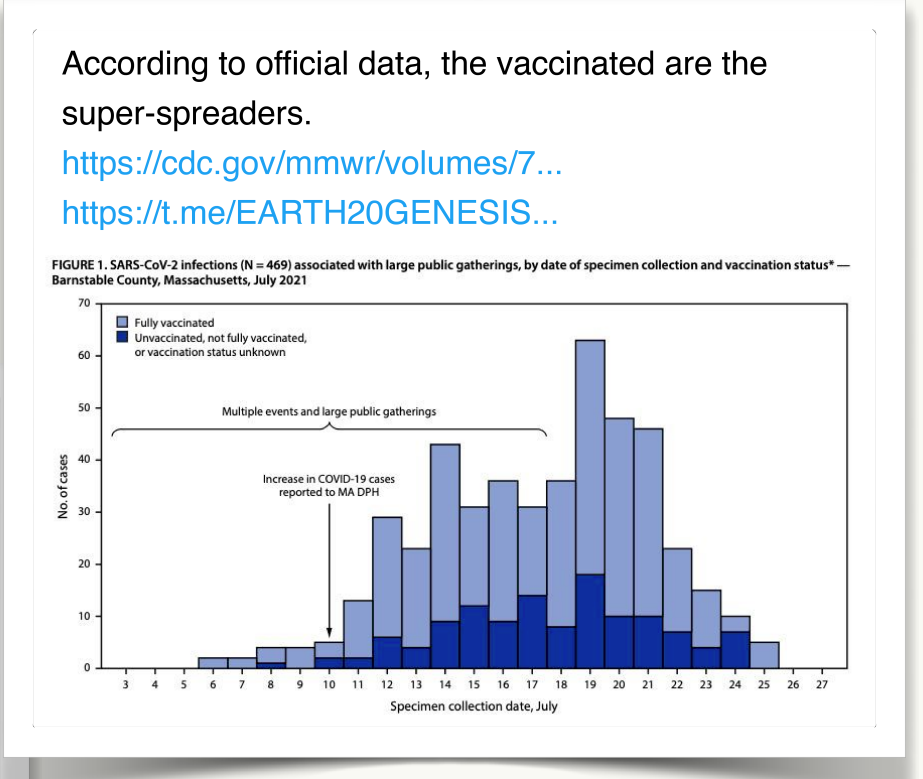
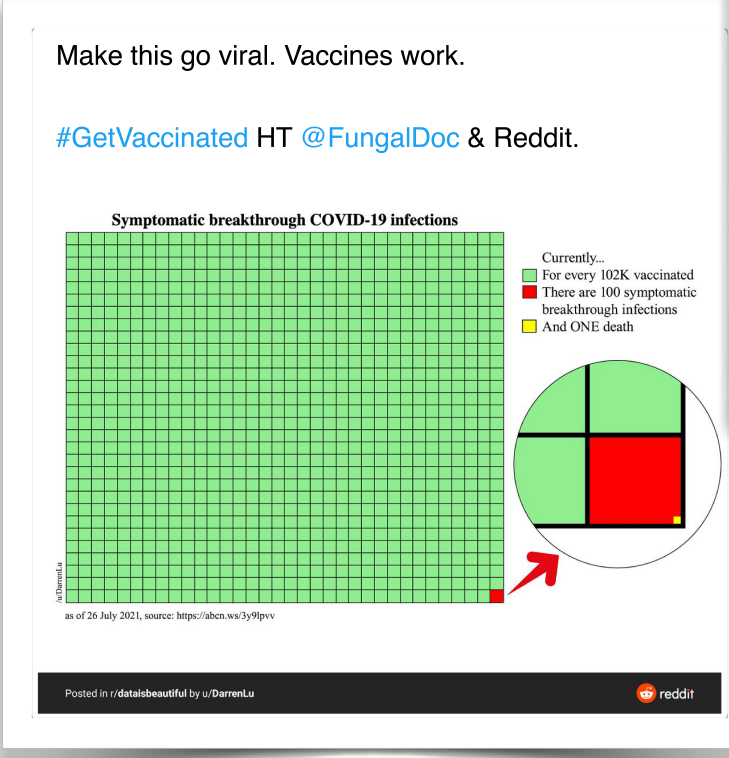
Incorrect reading



Misrepresentation of scientific results



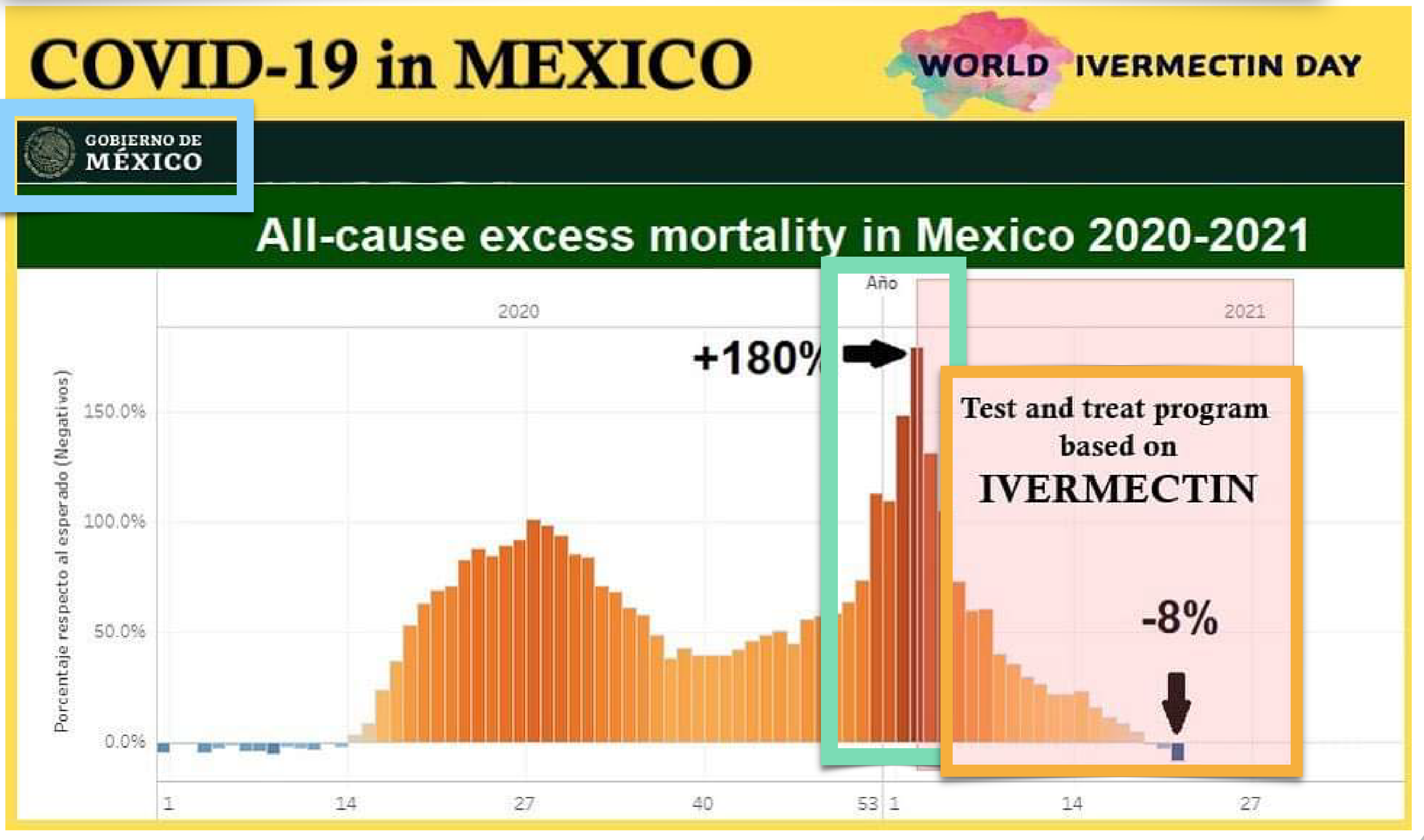
Statistical nuance



The effect of #ivermectin in #Mexico needs no explanation.

#ivermectinworks

Causal inference



Screenshot of a government dashboard

Sharp mortality drop is a salient visual feature

Added annotation assigns a cause-and-effect

Tweet text further explains the argument

TAKEAWAYS

89% of charts
with reasoning errors
**do not violate any
visualization guidelines**

The majority of **misleading
charts** are screenshots
from **reputable sources**

Sources of Deceptive Visualizations

WOW, the CHINA VIRUS has eradicated Amazing!!

**** YOU.ARE.BEING.SCAMMED.***

World Health Organization
Influenza Laboratory Surveillance Information
by the Global Influenza Surveillance and Response System (GISRS)

Global circulation of influenza viruses

Number of specimens positive for influenza by subtype

World Health Organization 2021

The effect of #ivermectin in #Mexico needs no explanation.

#ivermectinworks

COVID-19 in MEXICO WORLD IVERMECTIN DAY

All-cause excess mortality in Mexico 2020-2021

+180%

According to official data, the vaccinated are the super-spreaders.

<https://cdc.gov/mmwr/volumes/7...>

<https://t.me/EARTH20GENESIS...>

FIGURE 1. SARS-CoV-2 infections (N = 469) associated with large public gatherings, by date of specimen collection and vaccination status* - Barnstable County, Massachusetts, July 2021

Government reports

New daily covid cases this time last year (pre-vaccination) vs this year (post-vaccination)

Daily new confirmed COVID-19 cases

Shows the rolling 7-day average. The number of confirmed cases is lower than the number of actual cases; the main reason for that is limited testing.

Least vaccinated: Nigeria 1.2%

Most vaccinated: Iceland 81%

Iceland has 119 times more Covid cases

Share of people vaccinated against COVID-19, Aug 15, 2021

Vaccines work.

Number of COVID-19 patients in hospital

Data exploration websites

@HaroldofWorld Rise in cases?

Daily new confirmed COVID-19 cases per million people

Shows the rolling 7-day average. The number of confirmed cases is lower than the number of actual cases; the main reason for that is limited testing.

Uruguay launched their vaccination on 1st March 2021

Mar 1, 2021

Uruguay 217.50

Vax Launch Day

ZIMBABWE mass vaccination, ivermectin (approved 26th Jan)

Distribution of the cause of death means that the number of deaths from COVID-19

A sad milestone: today Rhode Island's coronavirus death toll passed 600 people

65° WPRI.com

COVID-19 Deaths in Rhode Island

Total Deaths

News media

@brithume Case in point, Sweden. Covid is over! 🙌

Number of people dying daily in Sweden with confirmed Covid-19

Number of deaths

Source: Sweden's Public Health Agency

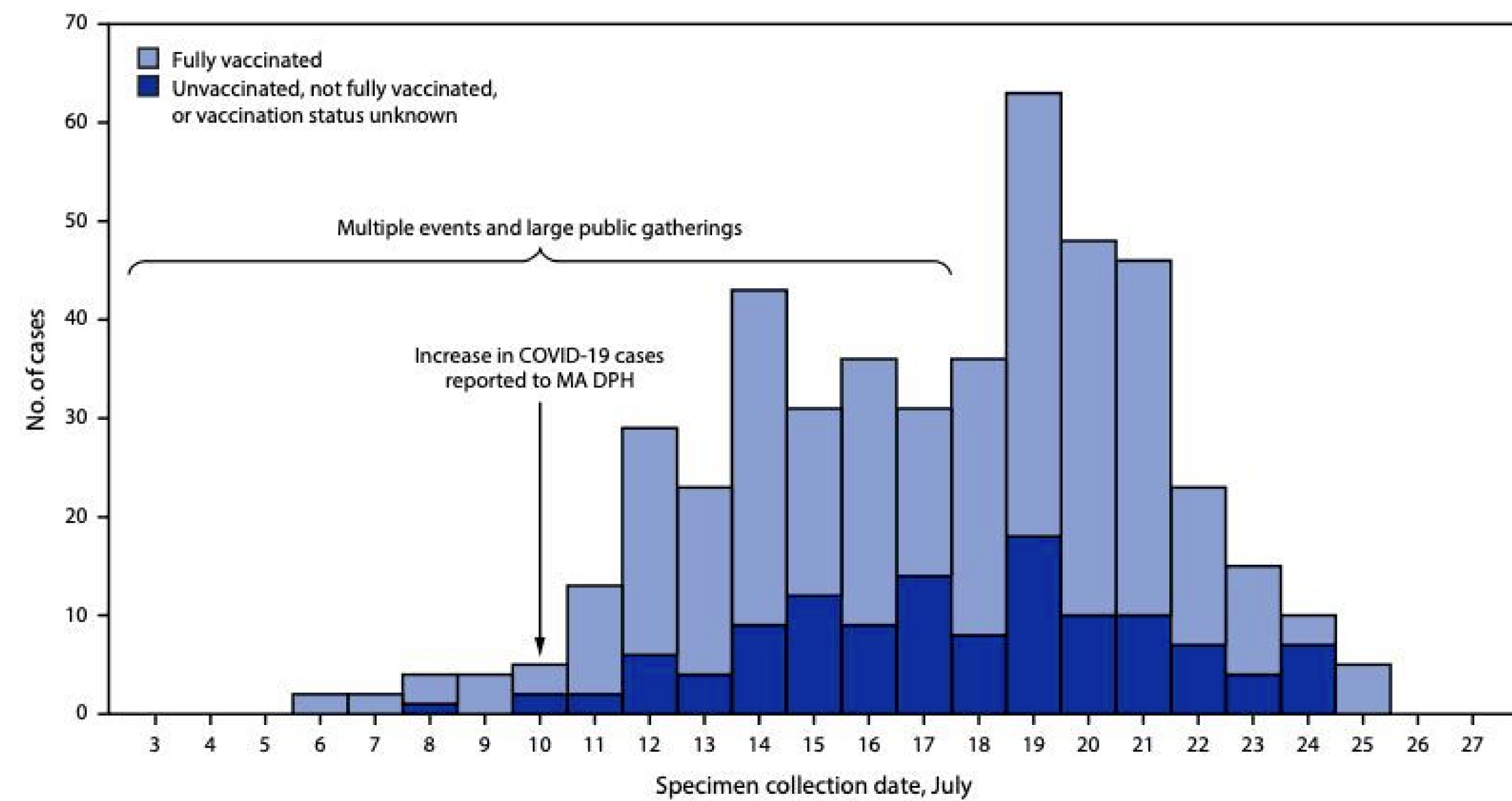
VULNERABLE VISUALIZATIONS

According to official data, the vaccinated are the super-spreaders.

<https://cdc.gov/mmwr/volumes/7...>

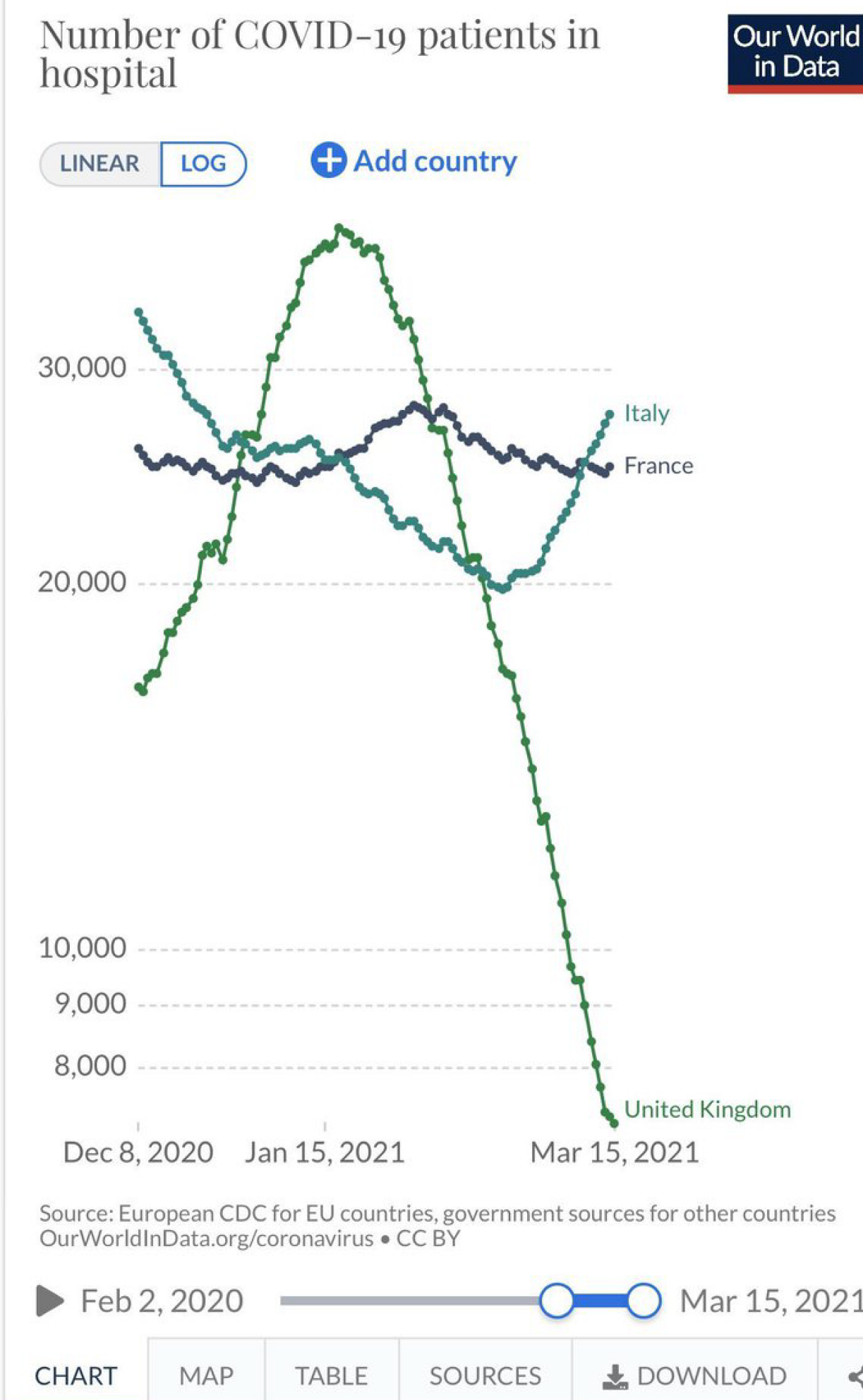
<https://t.me/EARTH20GENESIS...>

FIGURE 1. SARS-CoV-2 infections (N = 469) associated with large public gatherings, by date of specimen collection and vaccination status* — Barnstable County, Massachusetts, July 2021



Notes outside the chart

Vaccines work.



Unrestricted interaction

The effect of #ivermectin in #Mexico needs no explanation.

[#ivermectinworks](#)



Added annotations

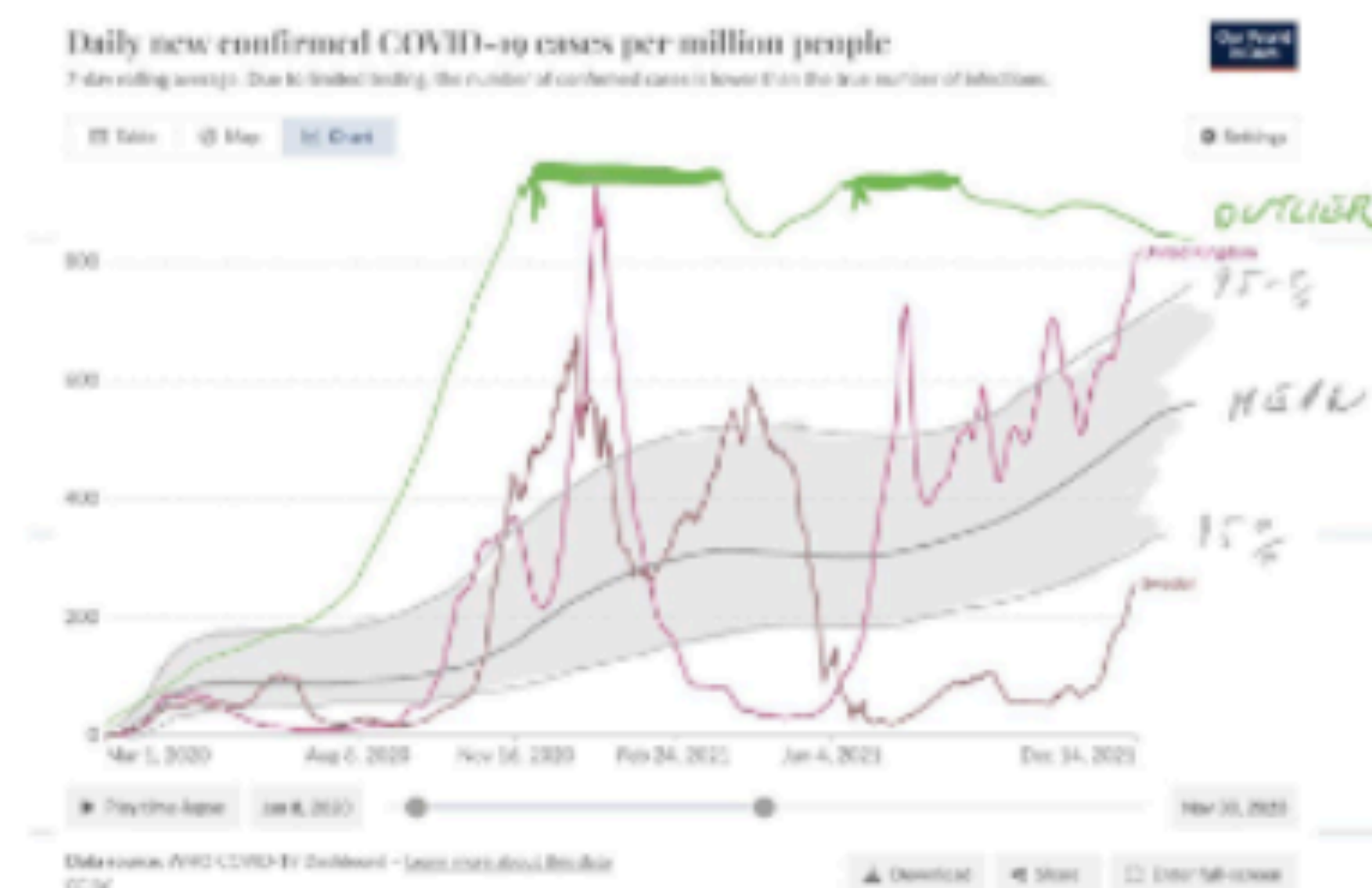
PROTECTING VISUALIZATIONS

Can we design data exploration tools that prevent cherry-picking while maintaining freedom of exploration?



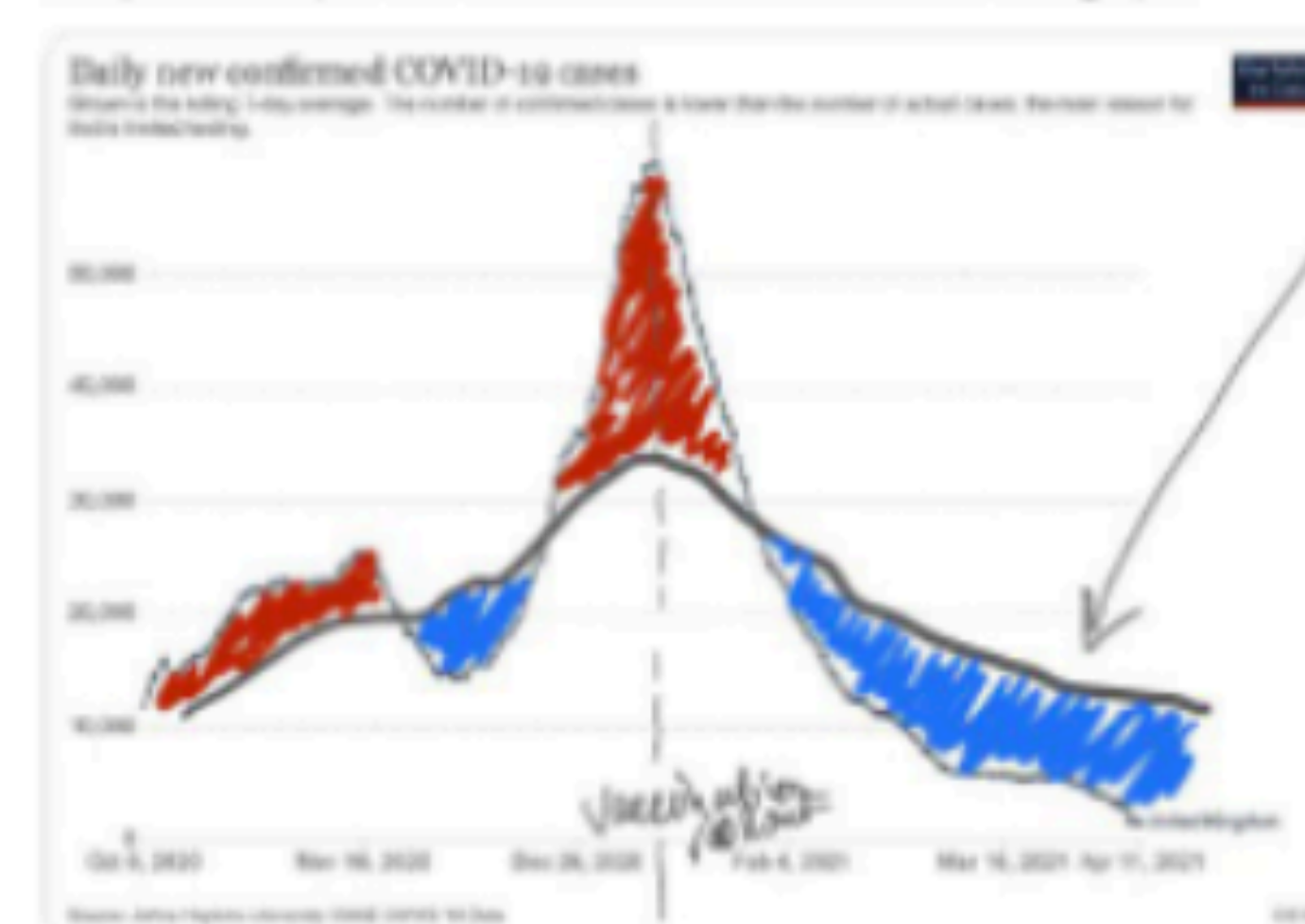
DESIGNING GUARDRAILS

Parallel Design by 4 Authors Cheery-Picking in Temporal Charts (Stocks, COVID)



- plot (almost) all other available data but blurred into a heatmap in the background (point density?)
- Denseliner (Moritz & Fisher) preprint

The positive impact of the UK's vaccination efforts in one graph:



some sort of weighted avg for similar population countries, all aligned around their vaccination rollout date (to model UK's in relative terms)

the avg is also very problematic (countries, apples & oranges) maybe several lines instead, forming some sort of an envelope?

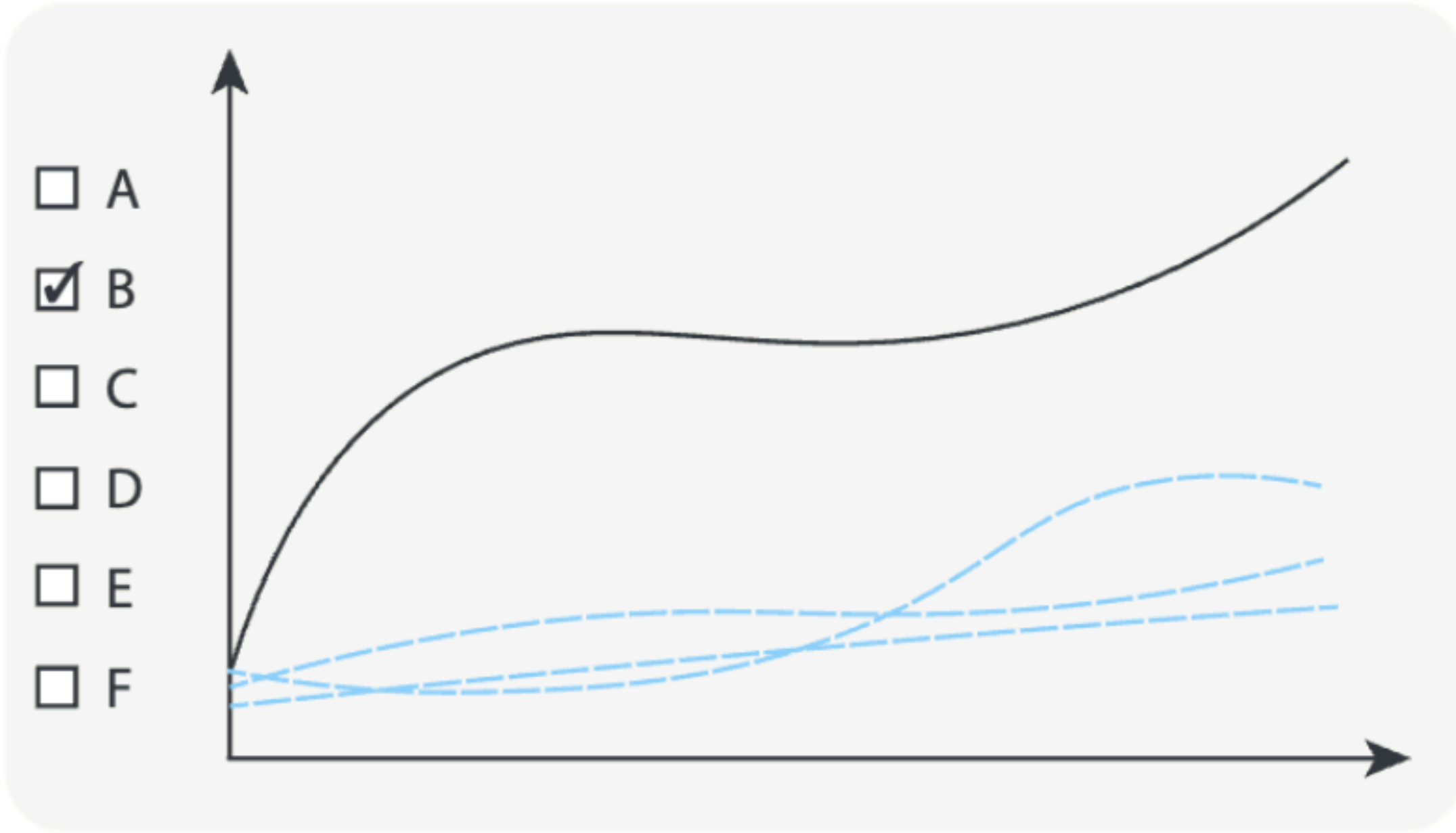
- Calculate a rolling variance over some domain-appropriate period of the past
- I think some stock charts do that

DESIGN SPACE

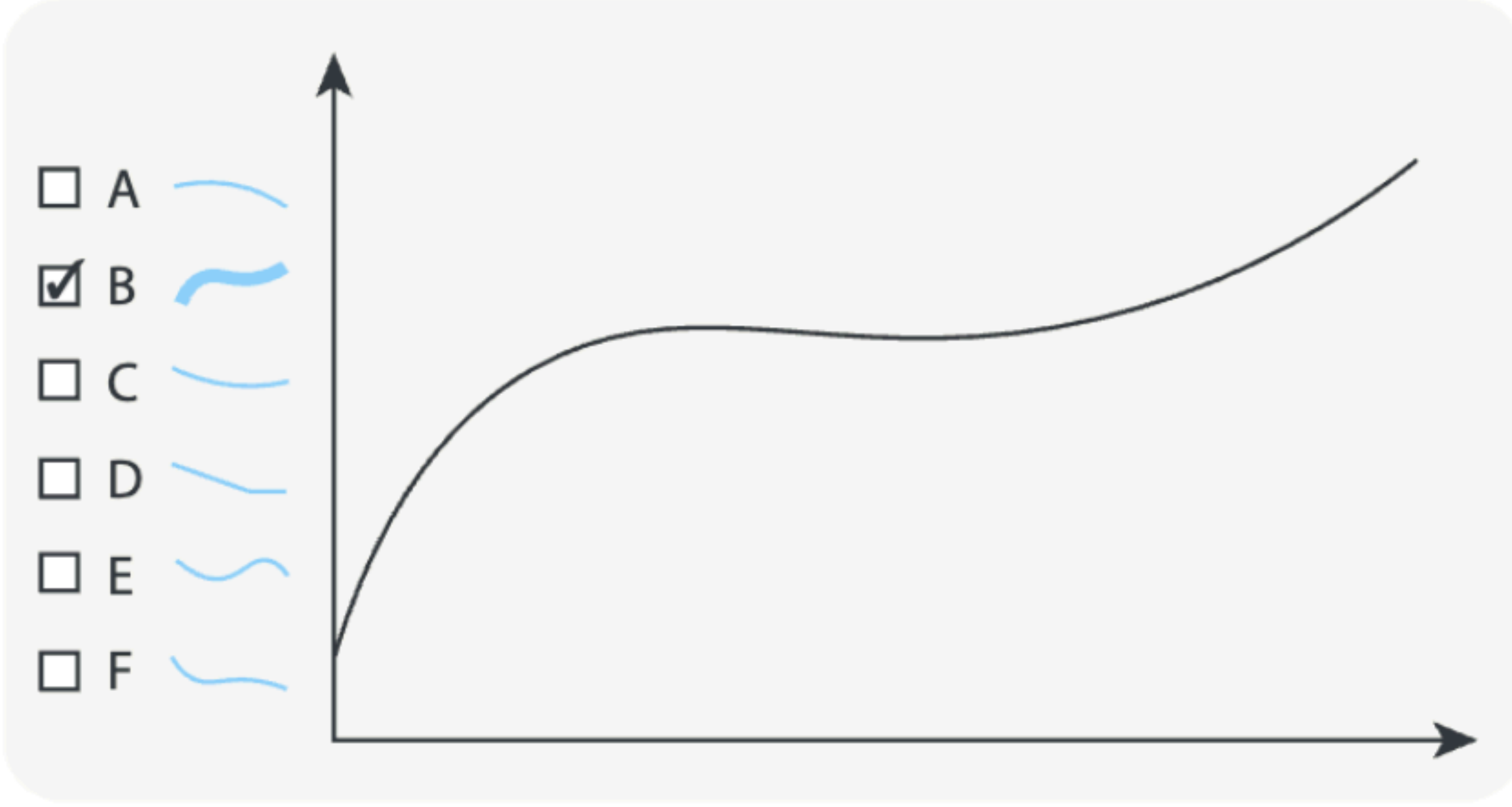
Layout

Context

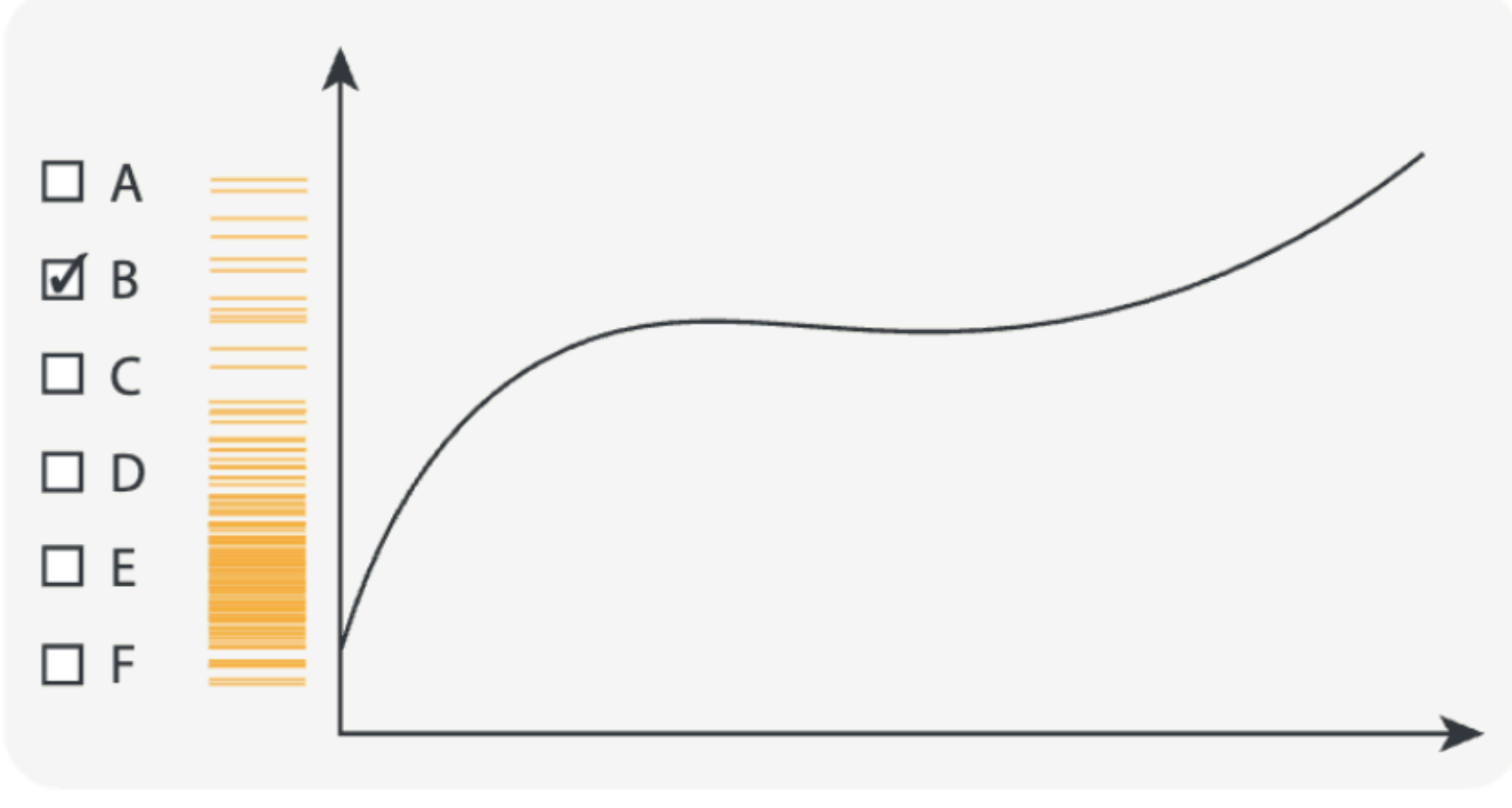
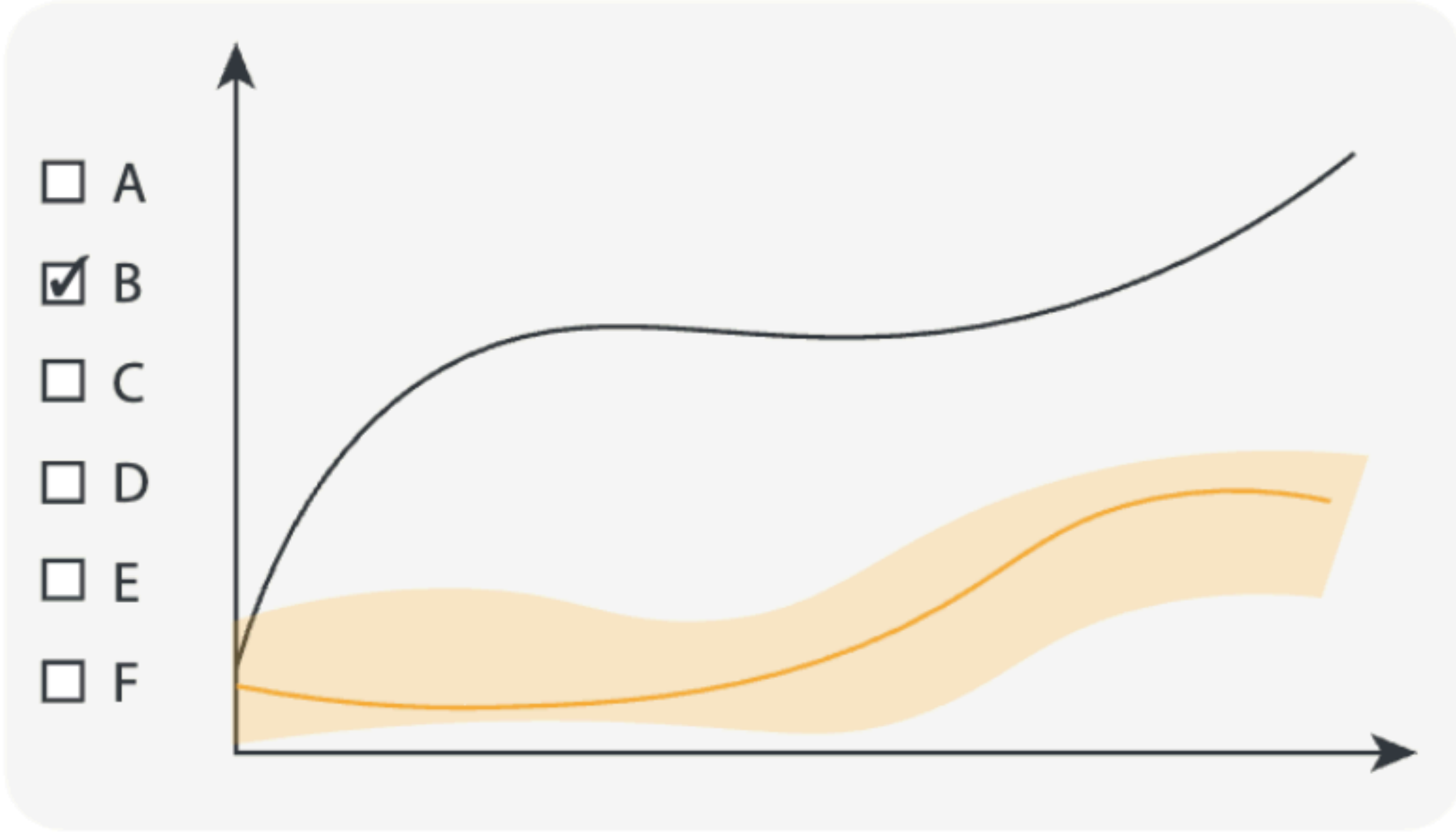
Primary Data



Juxtaposition



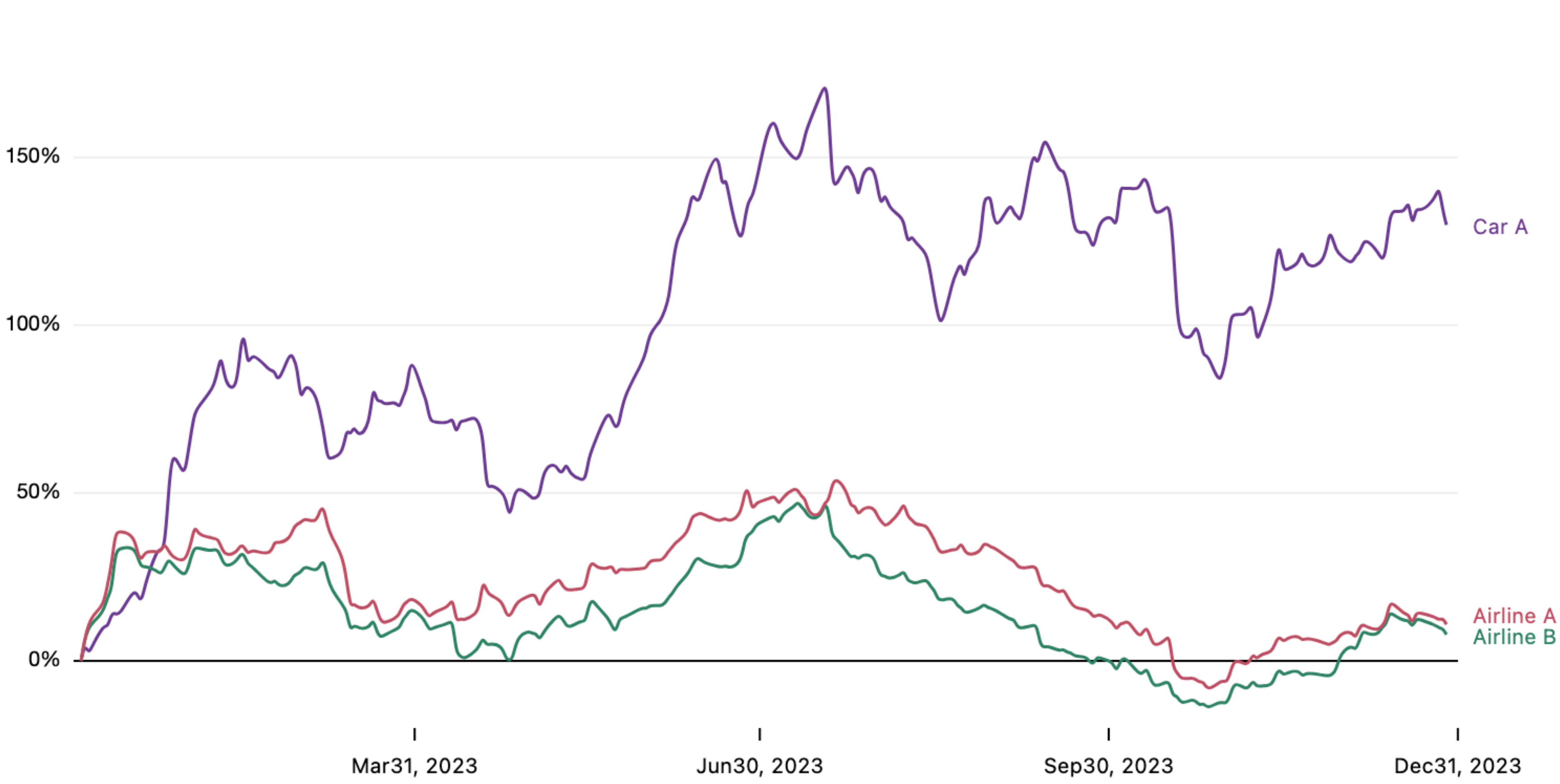
Summary



CHERRY-PICKING: NO GUARDRAILS

- Airline A
- Airline B
- Airline C
- Car A
- Car B
- Car C
- Gas A
- Gas B
- Gas C
- Tech A
- Tech B
- Tech C

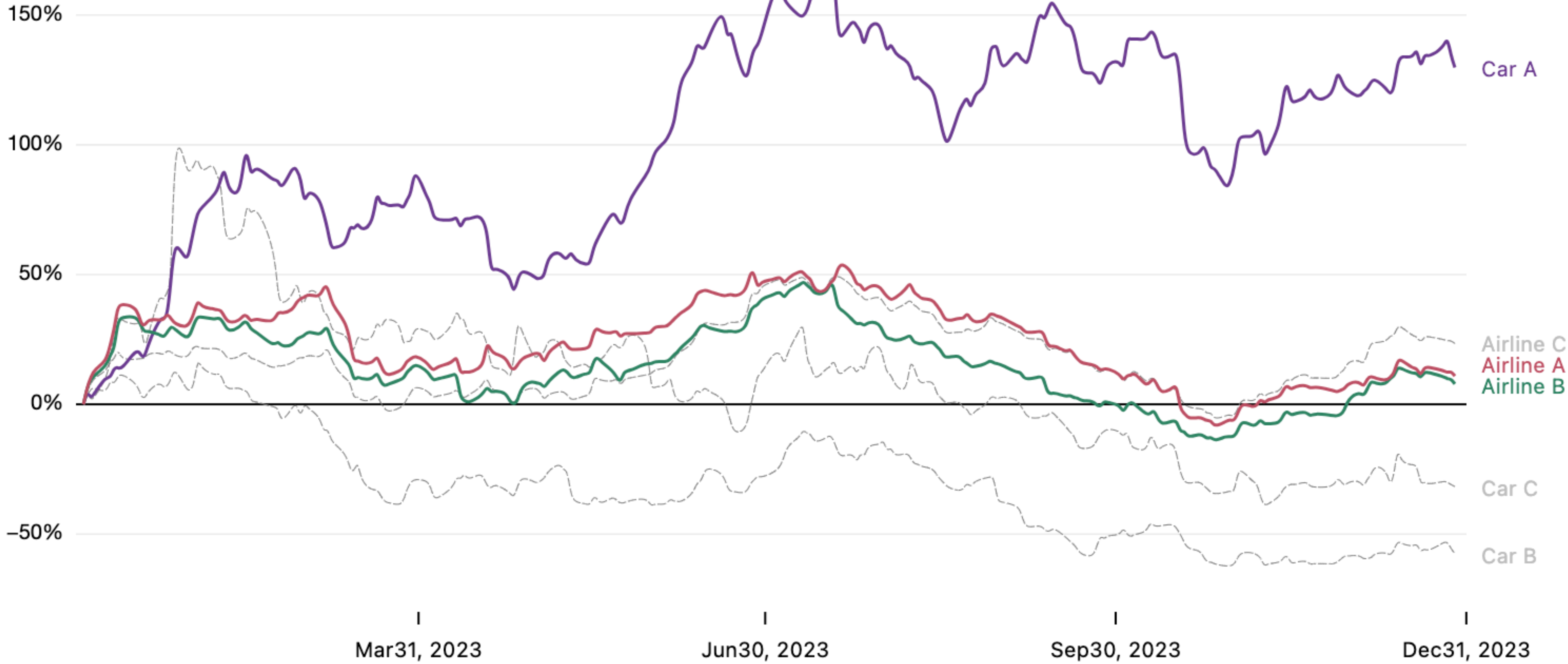
Percent change in stock price



ENFORCING CONTEXT – SUPERIMPOSITION / PRIMARY DATA

- Airline A
- Airline B
- Airline C
- Car A
- Car B
- Car C
- Gas A
- Gas B
- Gas C
- Tech A
- Tech B
- Tech C

Percent change in stock price

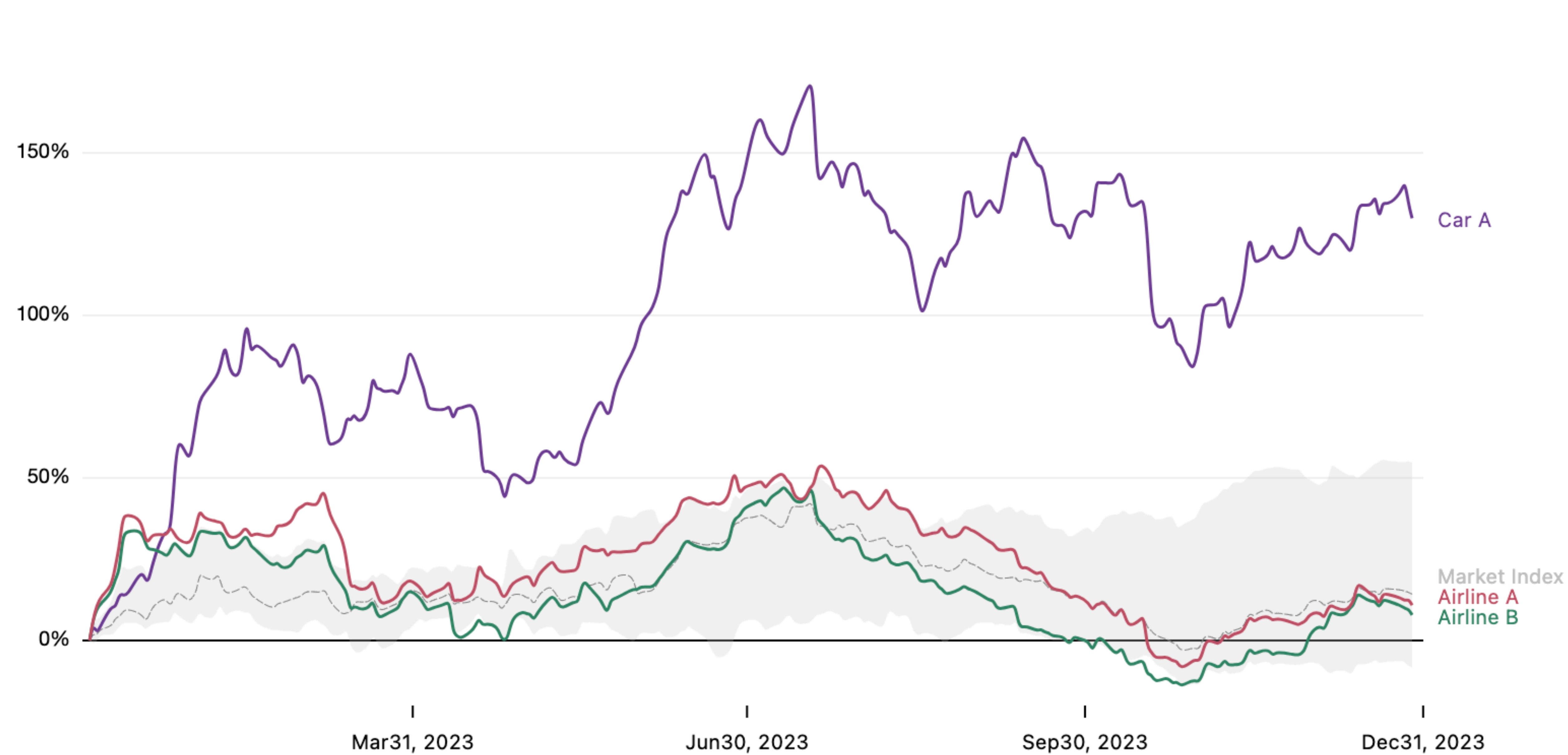


SHOWING STATISTICAL CONTEXT – SUPERIMPOSITION / SUMMARY

- Airline A
- Airline B
- Airline C
- Car A
- Car B
- Car C
- Gas A
- Gas B
- Gas C
- Tech A
- Tech B
- Tech C

Percent change in stock price

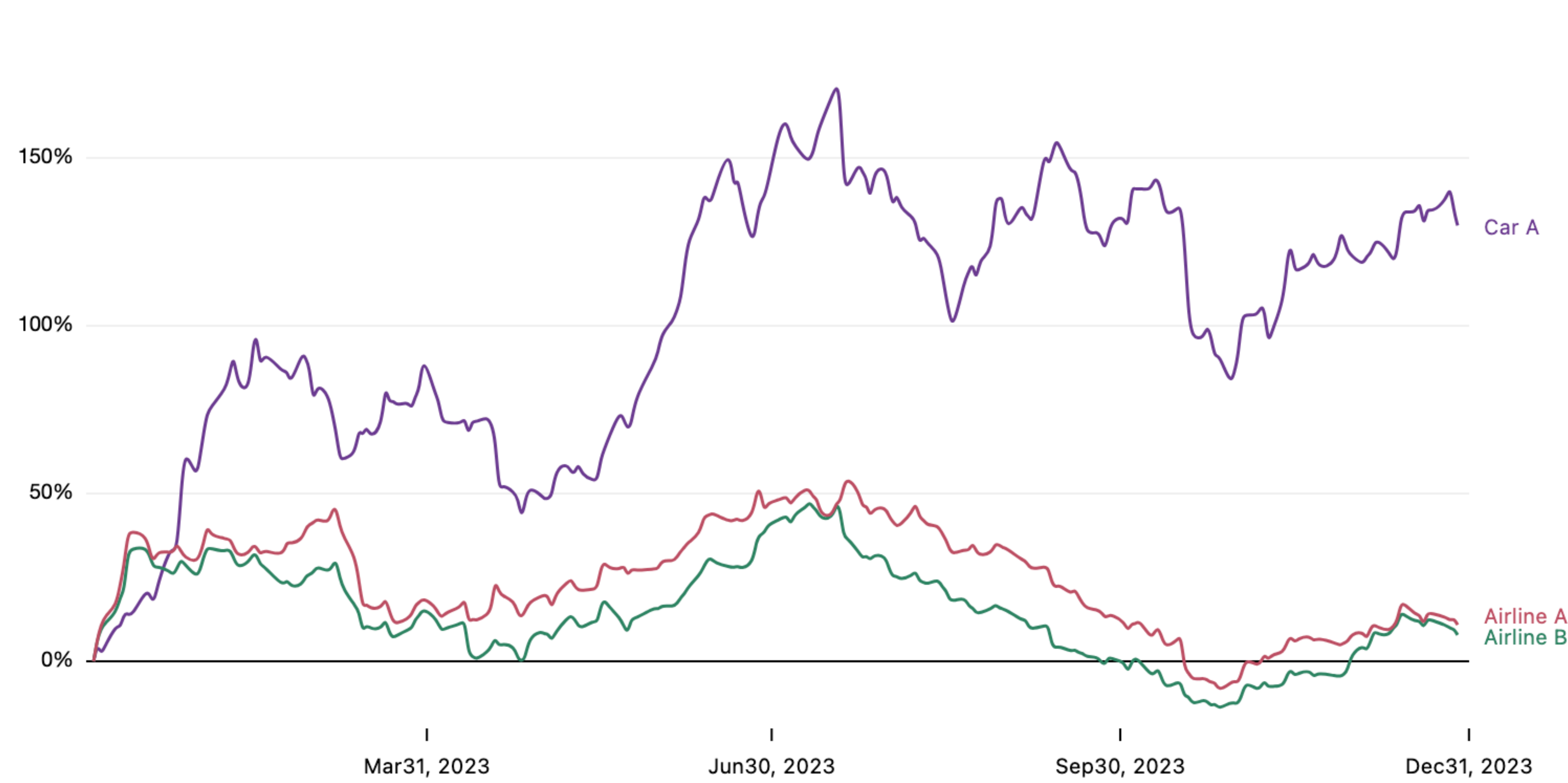
Shaded area represents the middle 50% of all values.



CONTEXT OUTSIDE – JUXTAPOSITION / PRIMARY DATA

- Airline A
- Airline B
- Airline C
- Car A
- Car B
- Car C
- Gas A
- Gas B
- Gas C
- Tech A
- Tech B
- Tech C

Percent change in stock price

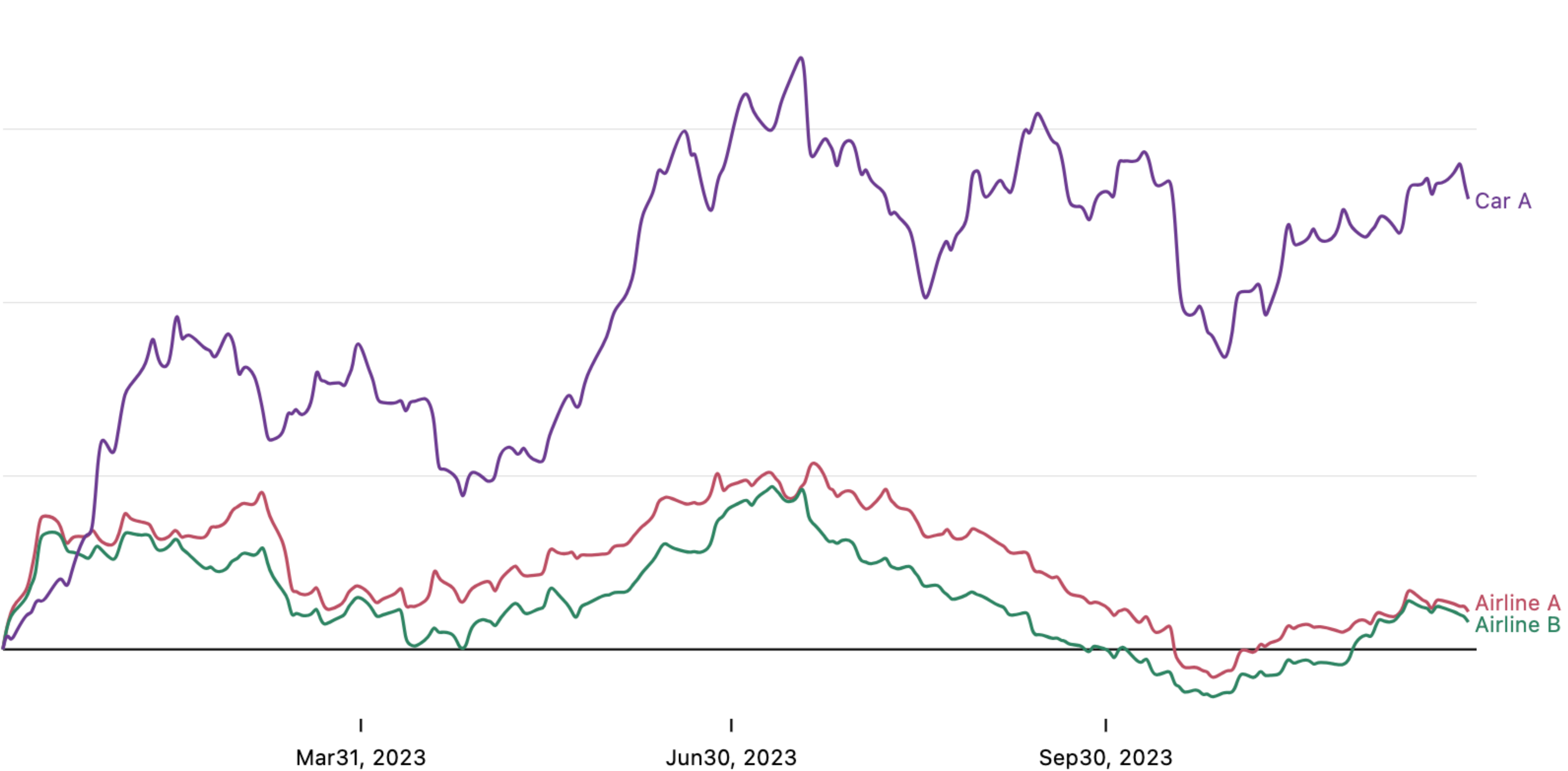
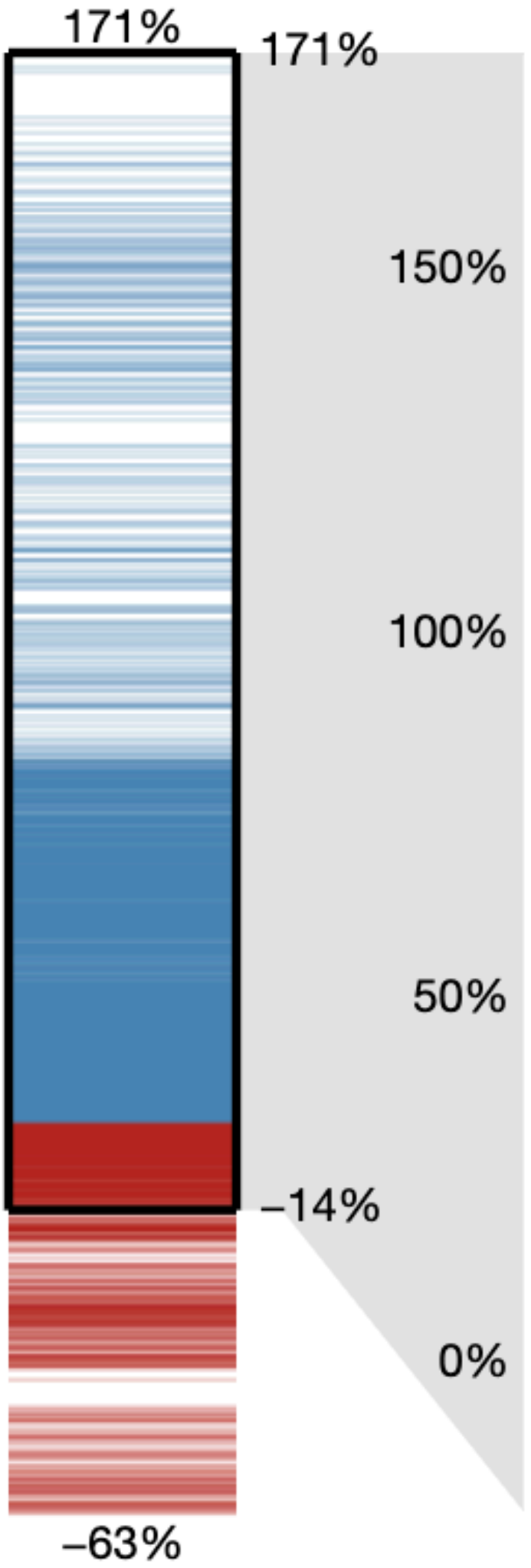


SUMMARY CONTEXT – JUXTAPOSITION / SUMMARY

Percent change in stock price

Bar on the left highlights the range of selection among all data.

- Airline A
- Airline B
- Airline C
- Car A
- Car B
- Car C
- Gas A
- Gas B
- Gas C
- Tech A
- Tech B
- Tech C



Jan 3, 2023

Dec 31, 2023



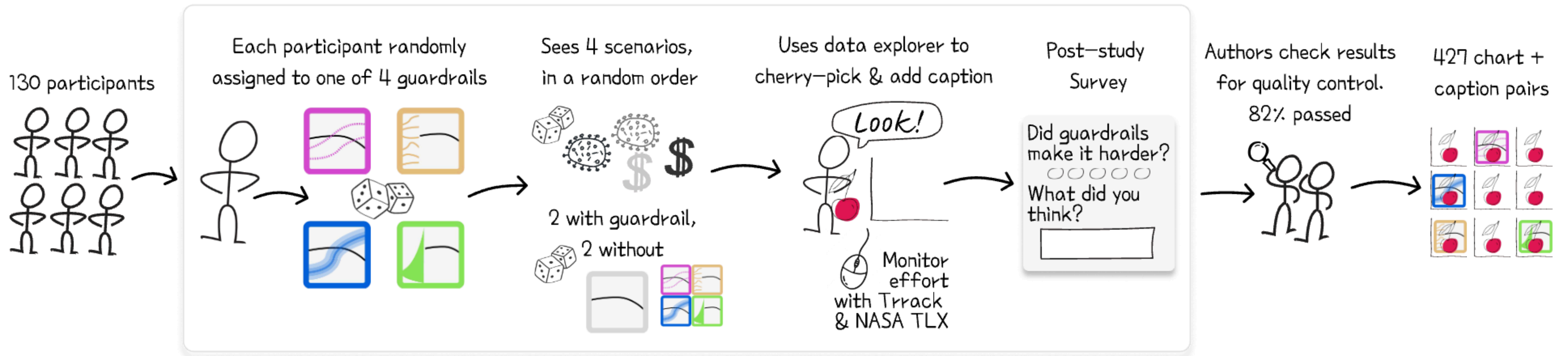
3 STUDIES

Producer Study: do guardrails make it more difficult to cherry-pick data?

Consumer Study: Do guardrails make cherry-picked data less convincing?

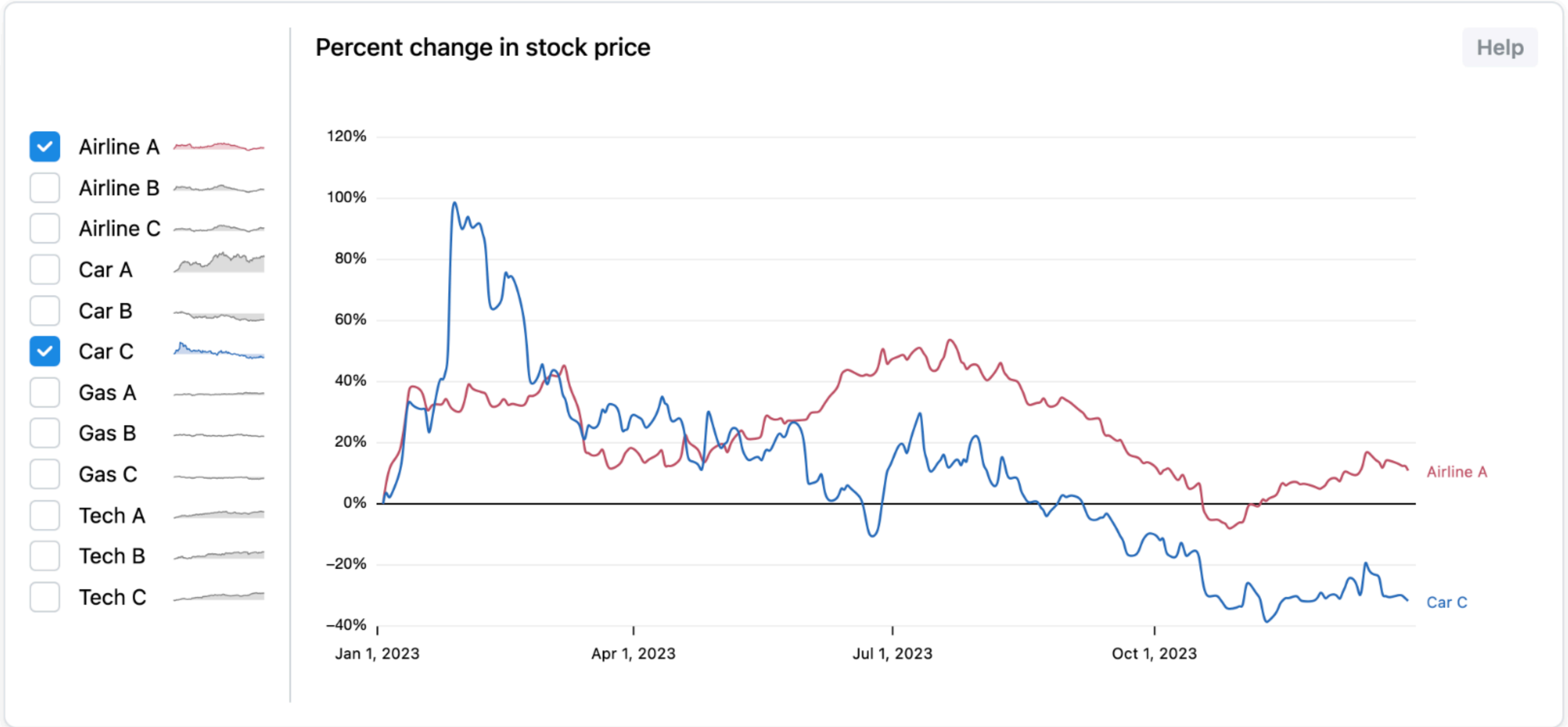
Controlled Consumer Study: Do guardrails work at different levels of egregiousness?

PRODUCER STUDY: SETUP



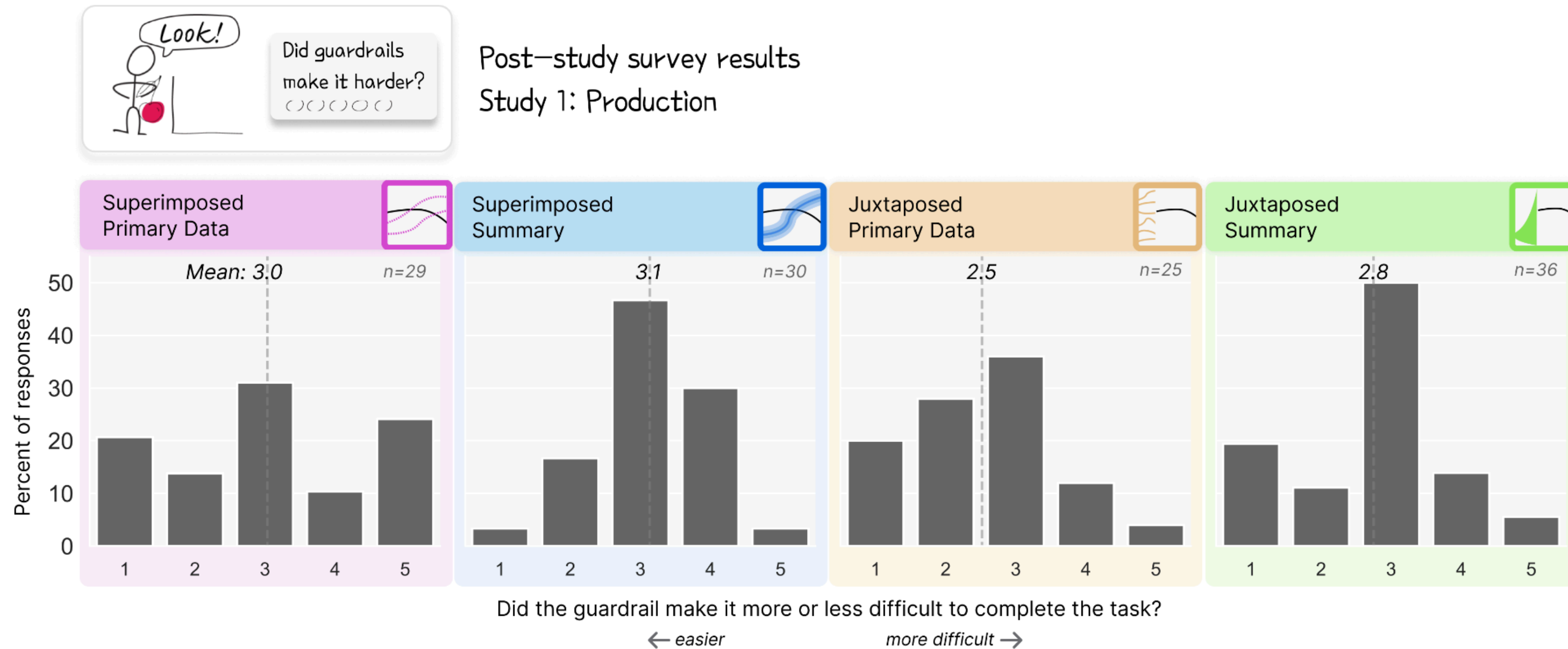
PRODUCER STUDY: SETUP

Select a view that best shows (and convinces your client) that **the airline industry fund is the best investment.**



Add a short text caption that will go along with your visualization: *

PRODUCER STUDY: RESULTS

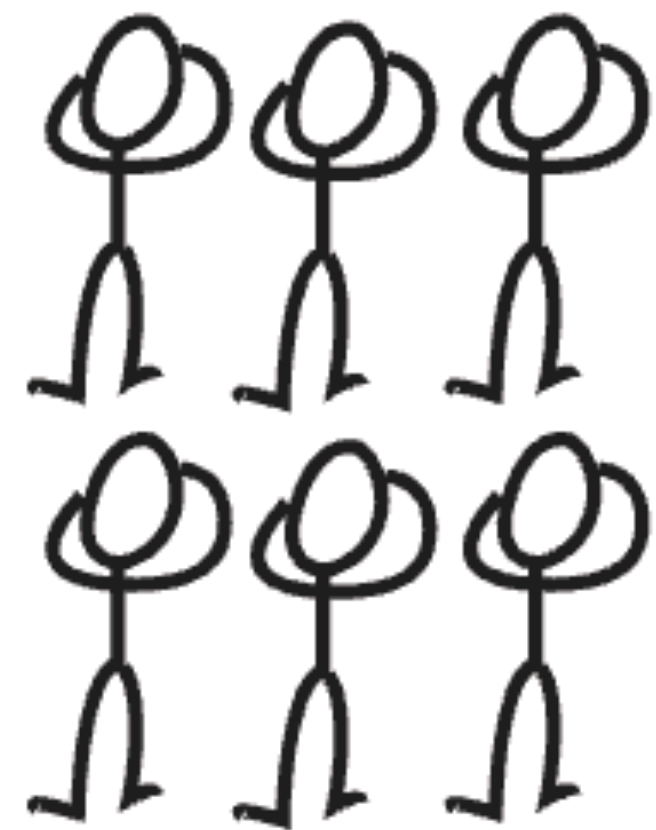


Superimposed primary: **bimodal**

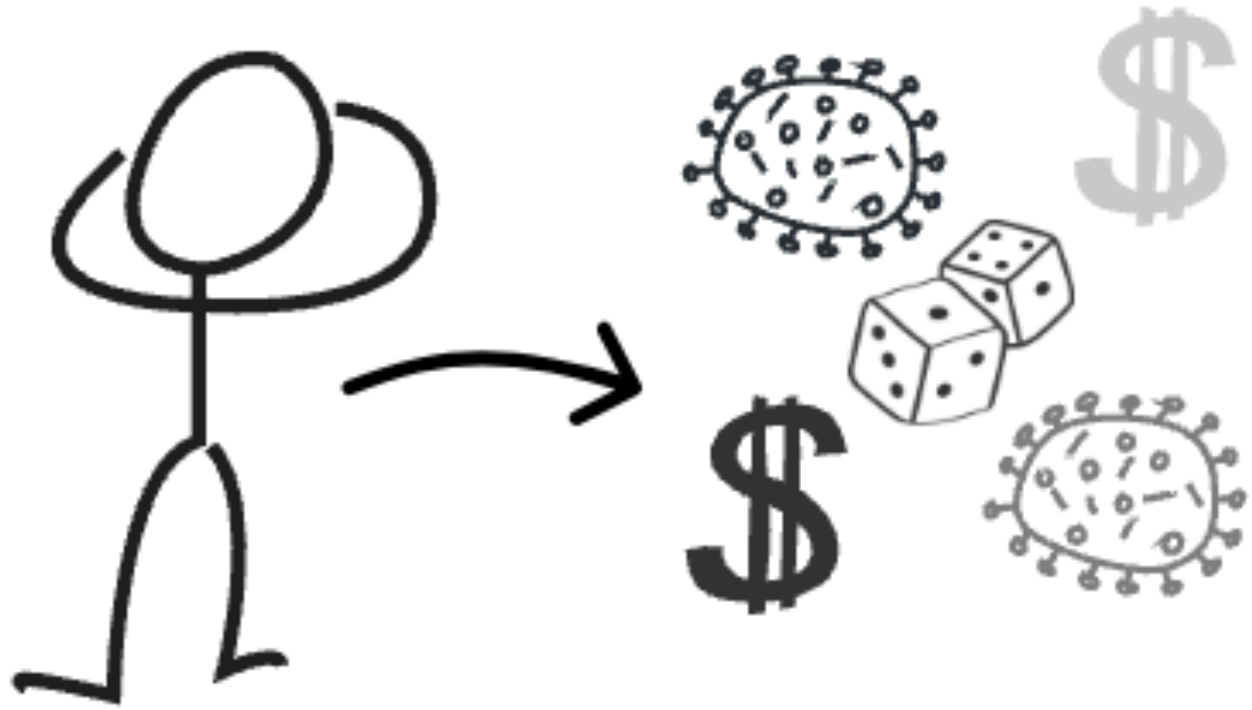
Juxtaposed primary: **makes cherry picking easier**

CONSUMER STUDY SETUP

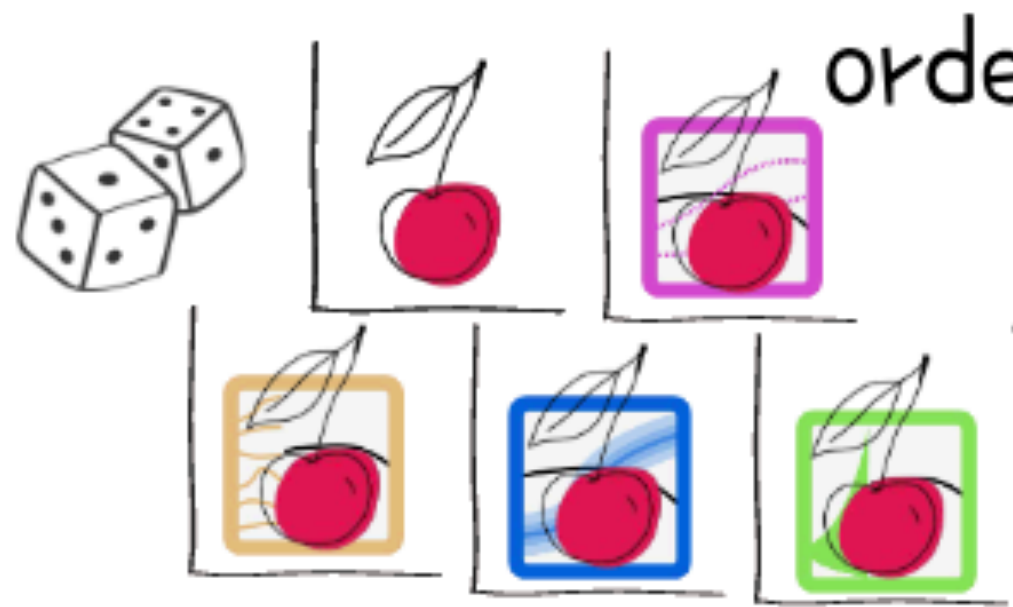
160 participants



Each participant randomly assigned to one of 4 scenarios

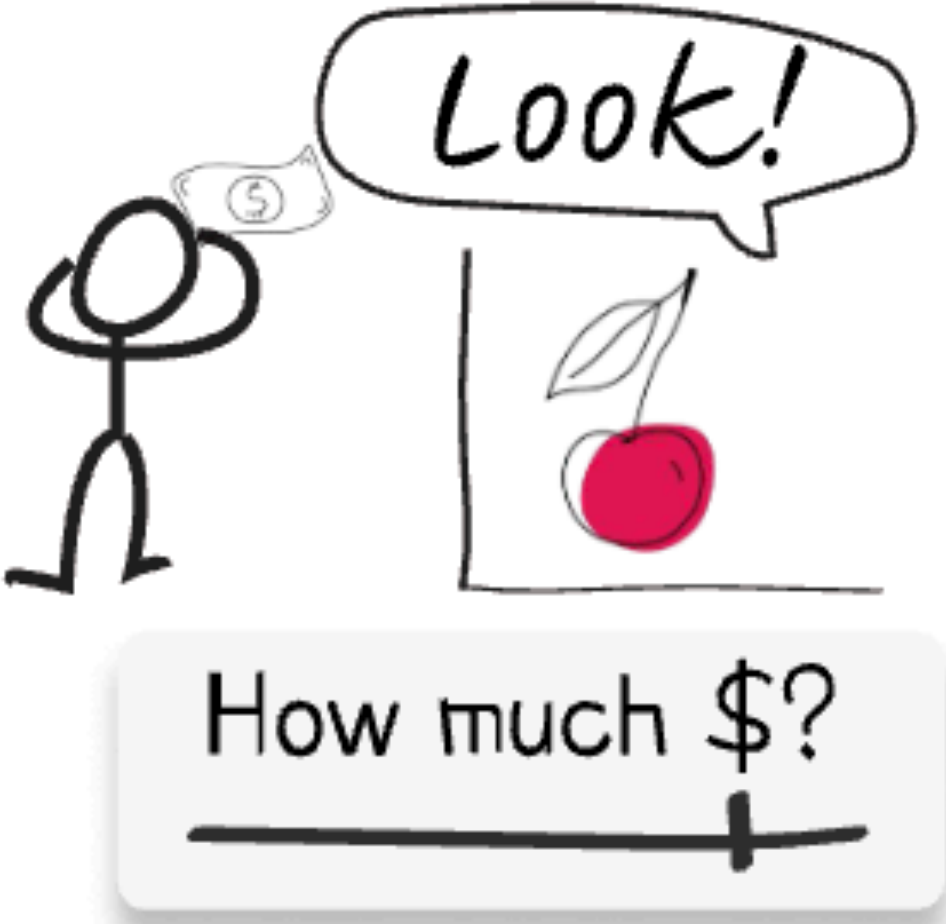


Sees 5 random charts from Study 1 in random order



1 with no guardrail
+ 4 with guardrails

Estimates how convincing it is



Post-study Survey



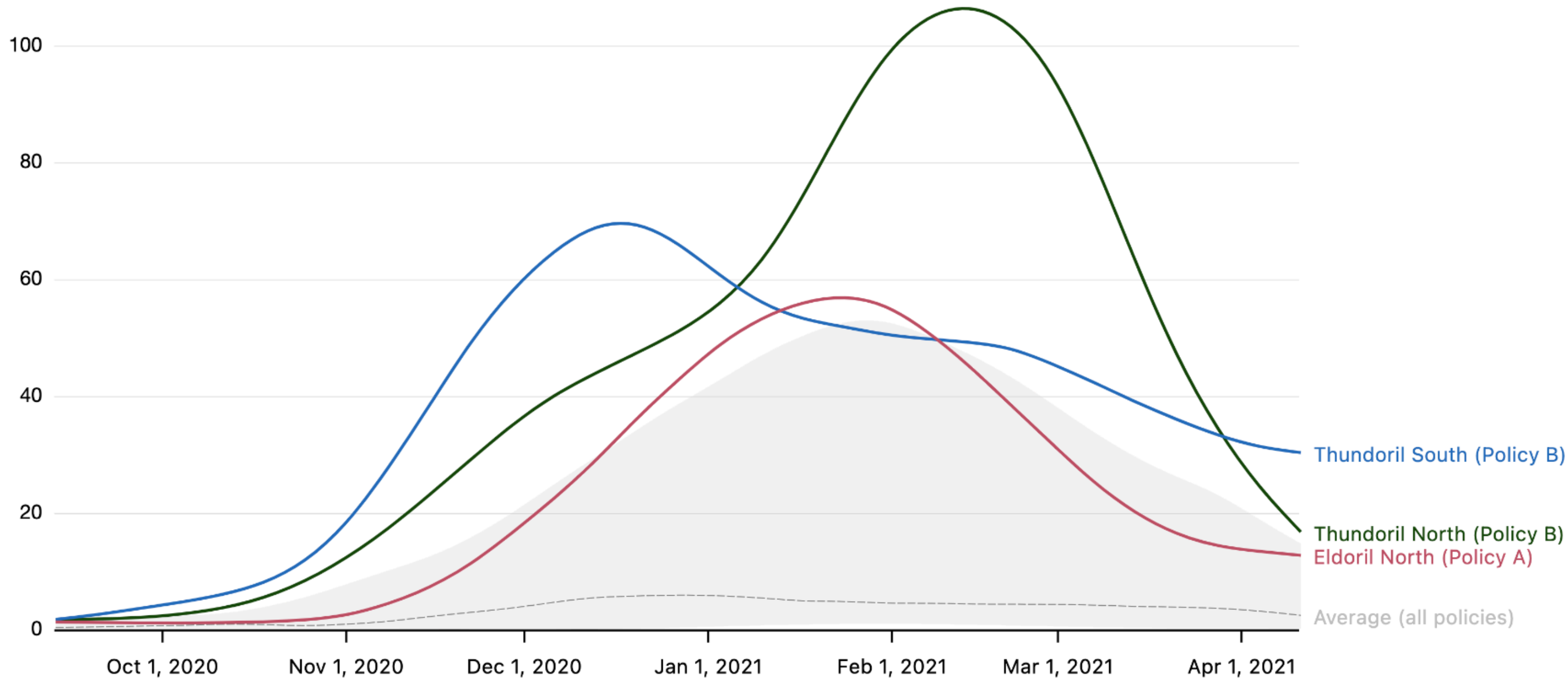
CONSUMER STUDY SETUP

“ Policy A (red) is the superb policy to manage a sudden boom in infections

Infections per million people

Shaded area represents the middle 50% of all values.

Help

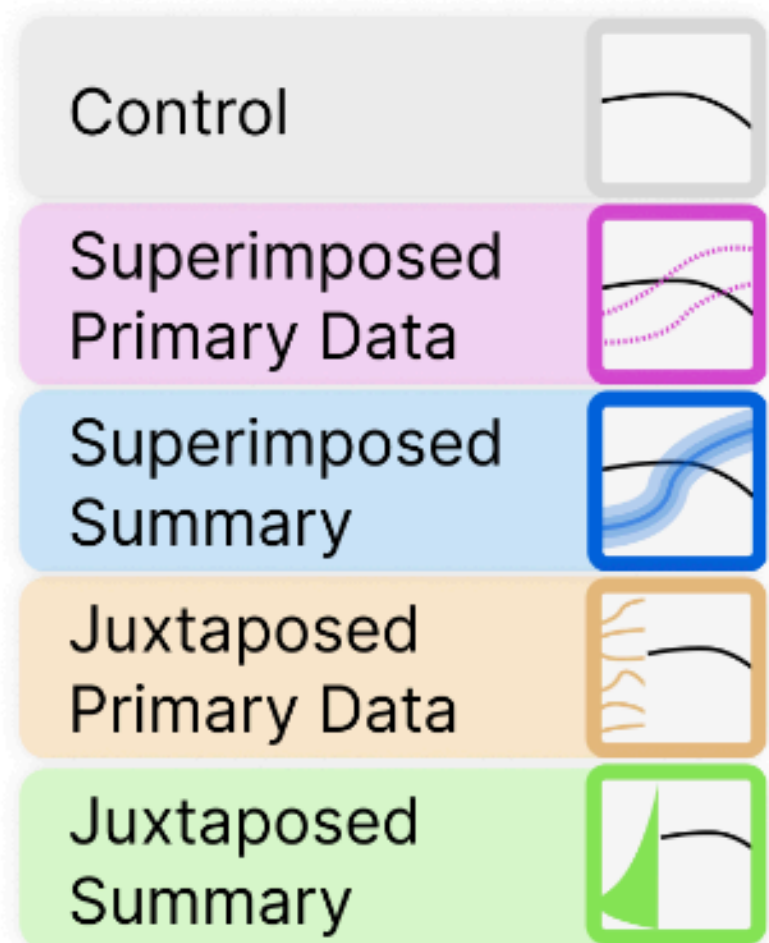
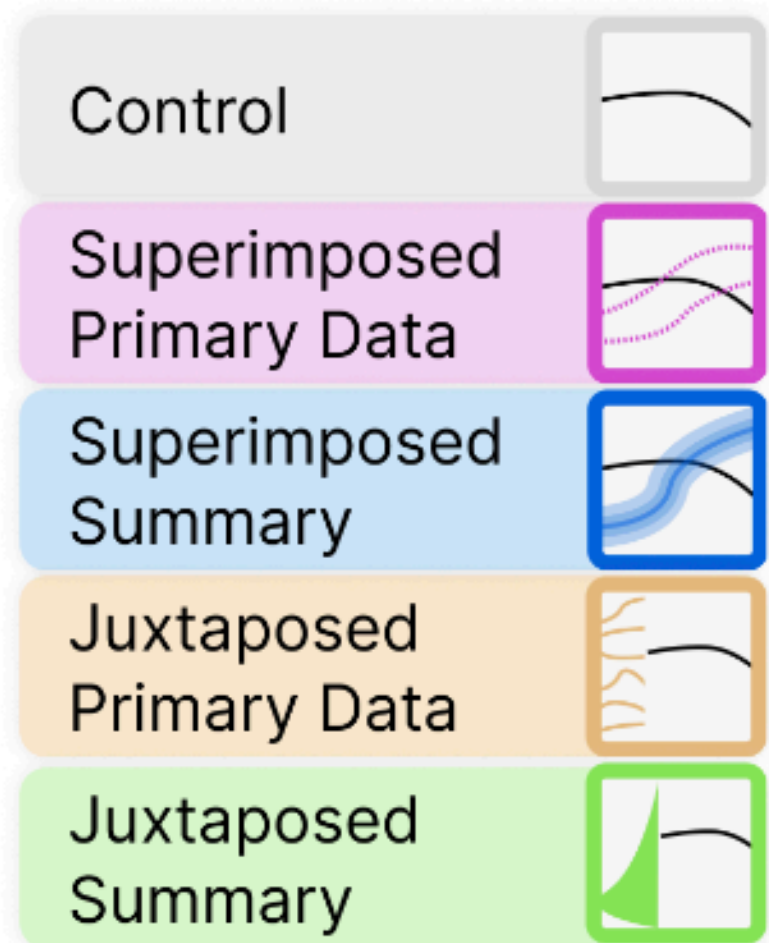
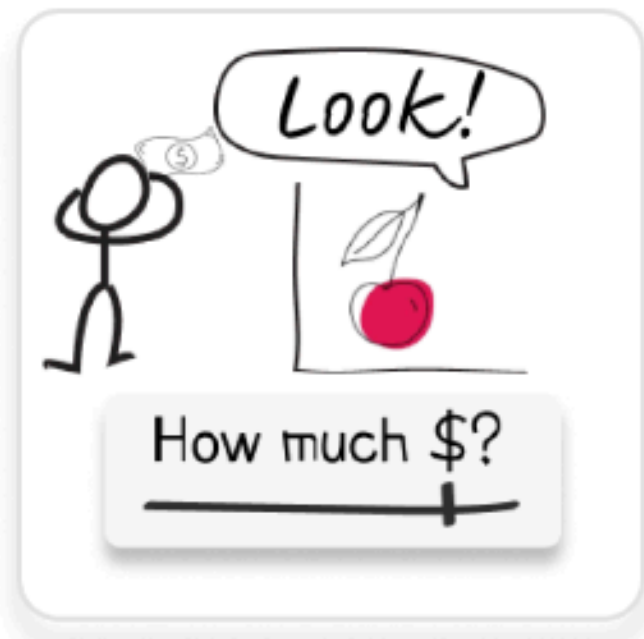


Based on this information, before traveling to Eldoril North (Policy A) I would buy this much insurance:
(\$0 = no risk of getting sick, \$100 = very high risk of getting sick)

\$0 \$25 \$50 \$75 \$100

CONSUMER STUDY: RESULTS

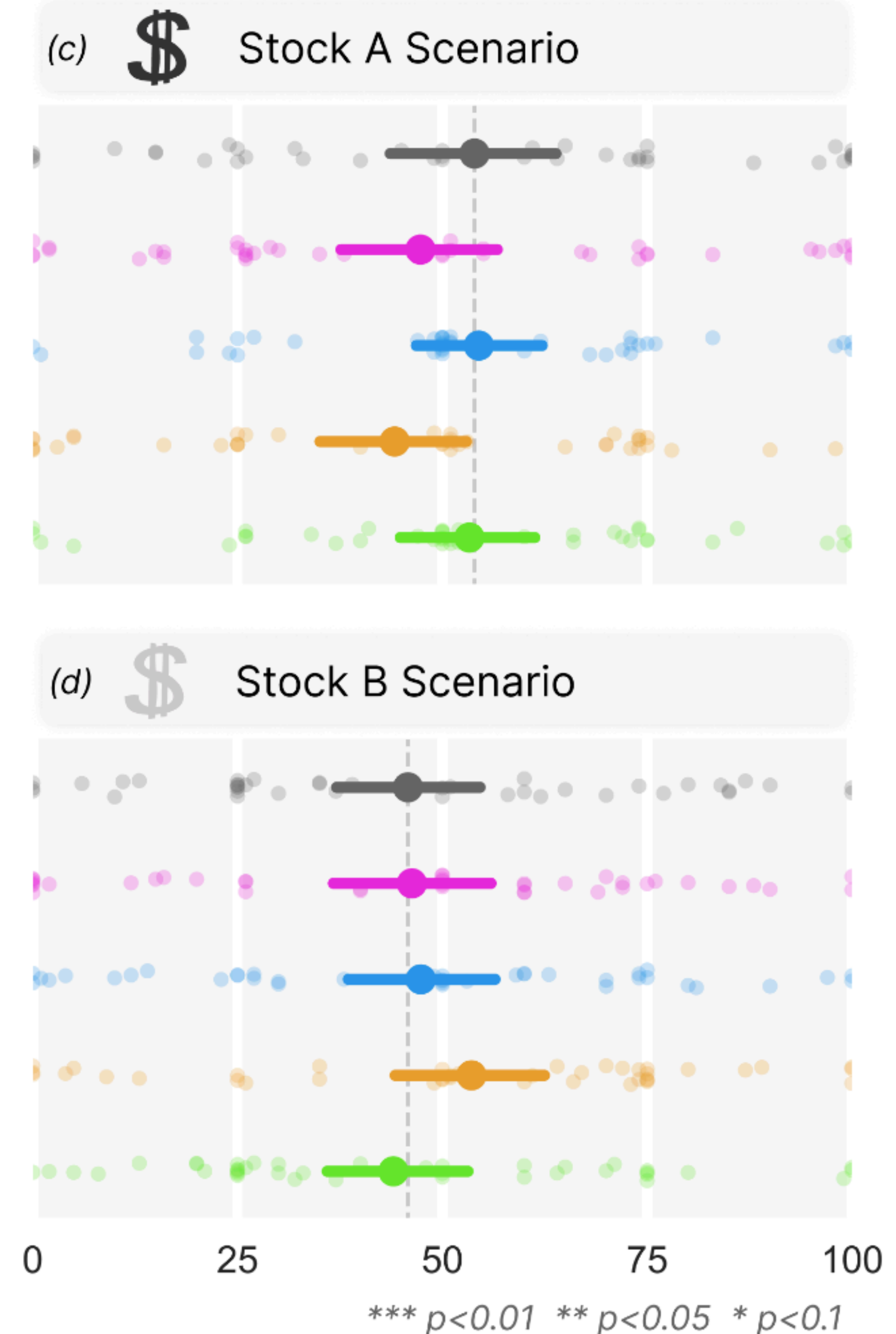
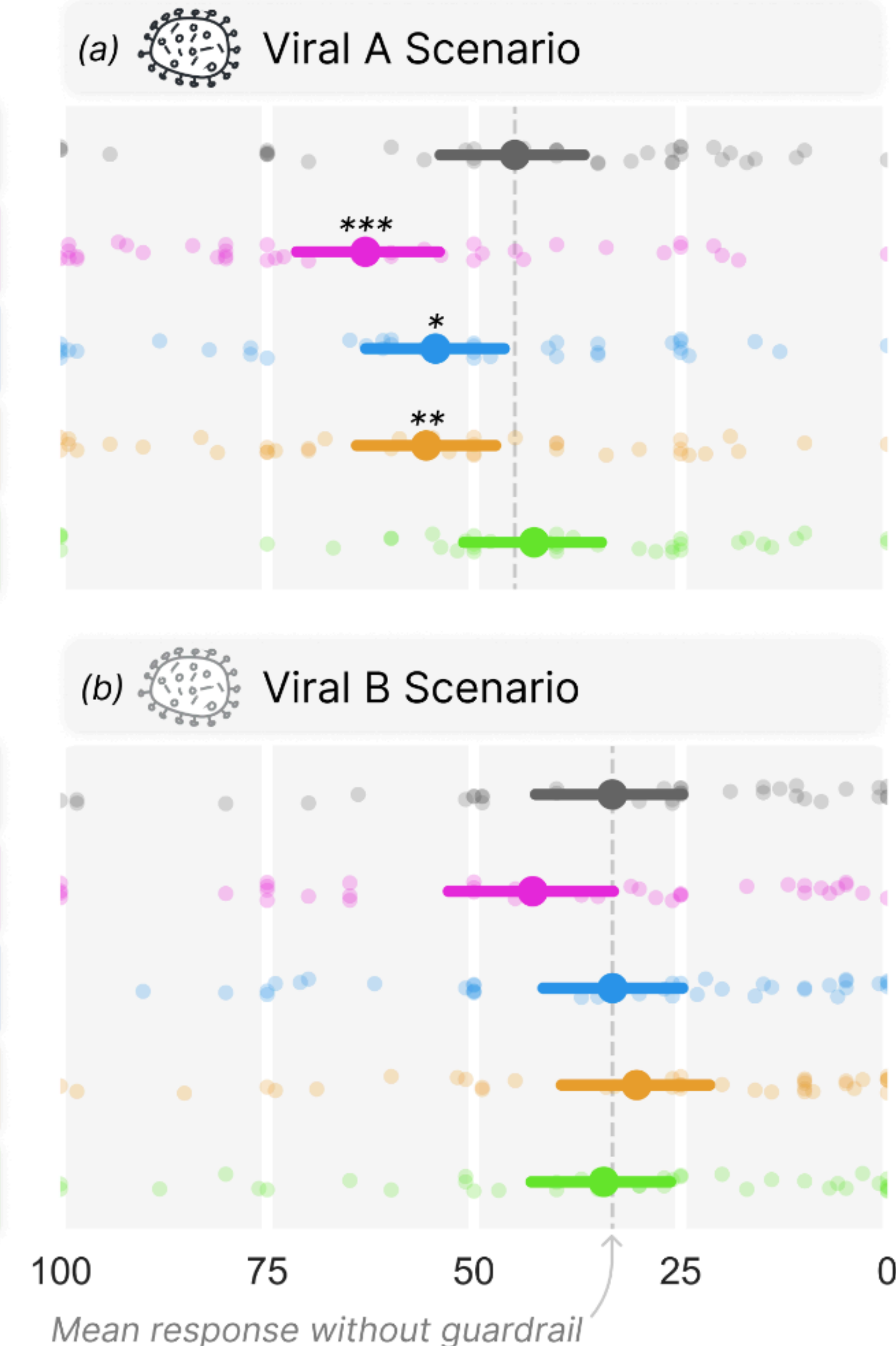
Superimposed Primary works in some scenarios



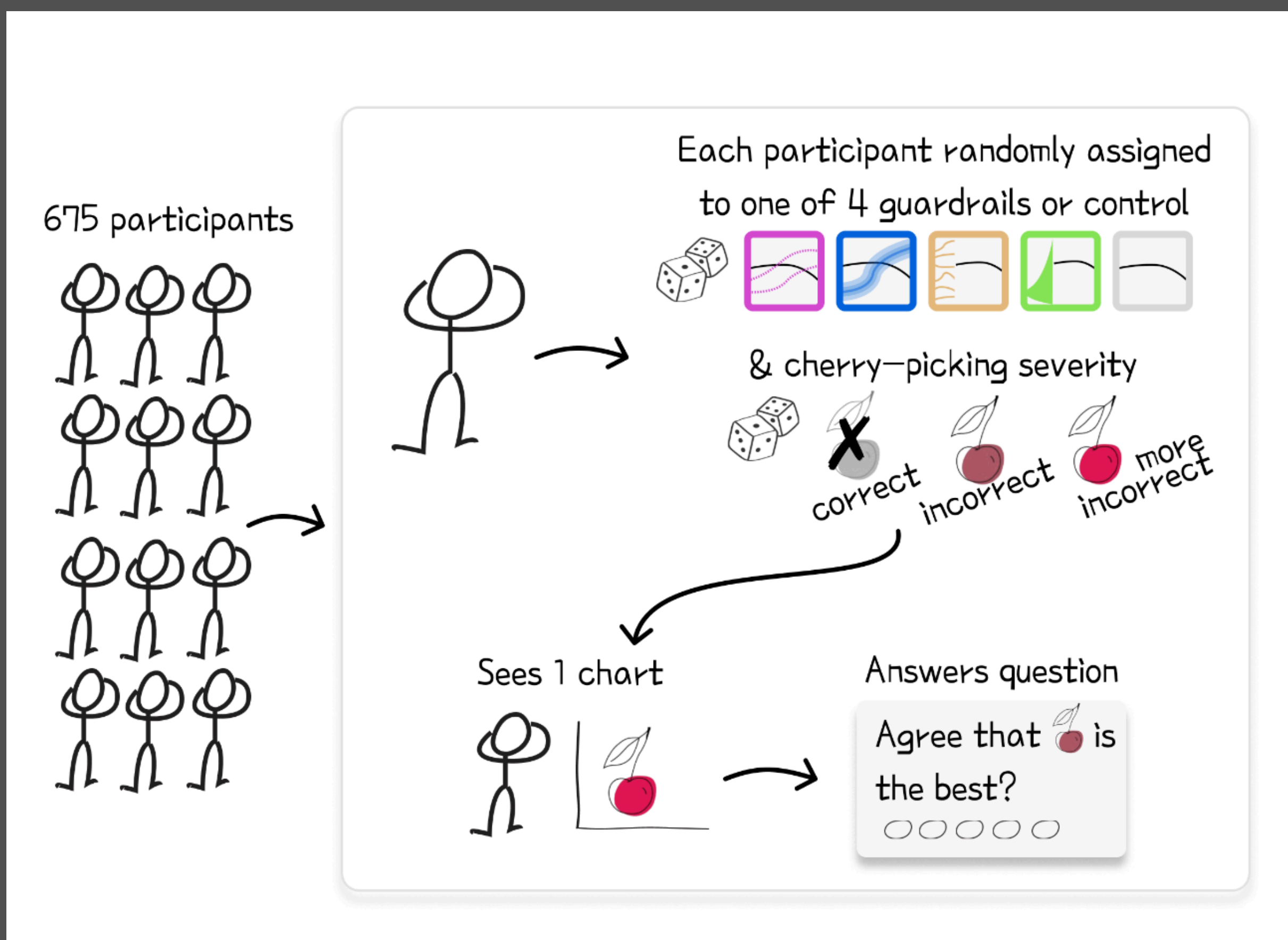
Results from Study 2: Reaction

How much insurance would you buy in promoted country?
← more skeptical → more convinced →

How much would you invest in promoted stock?
← more skeptical → more convinced →



CONTROLLED CONSUMER STUDY

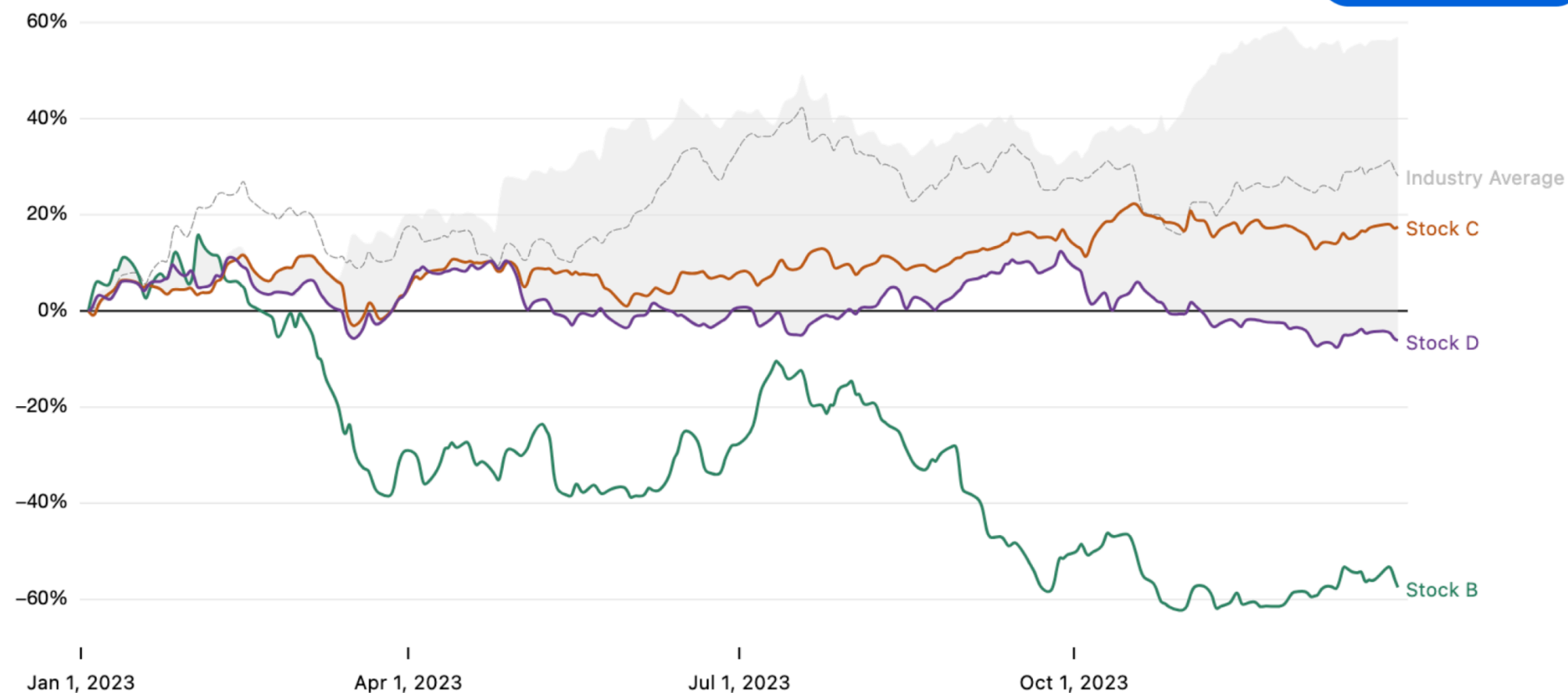
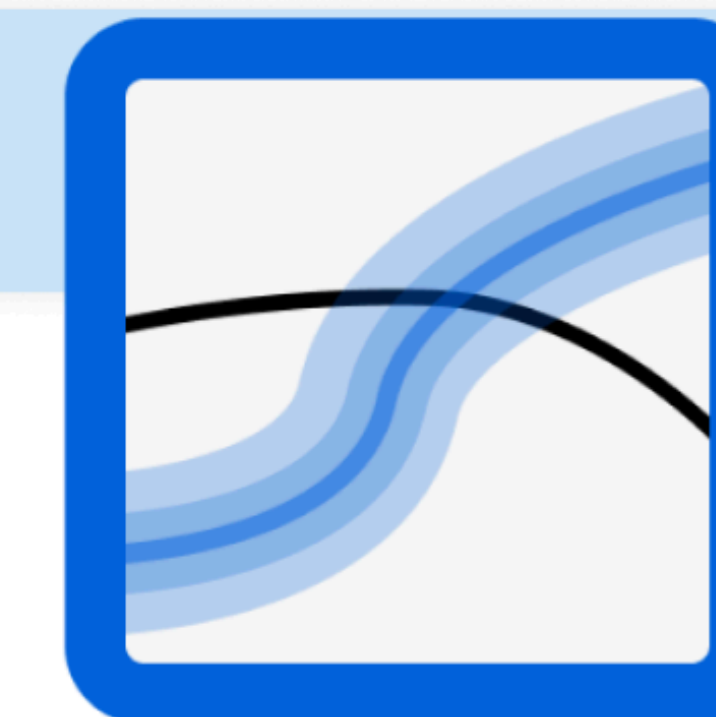


The visualization supports the idea that stock C yielded the highest returns

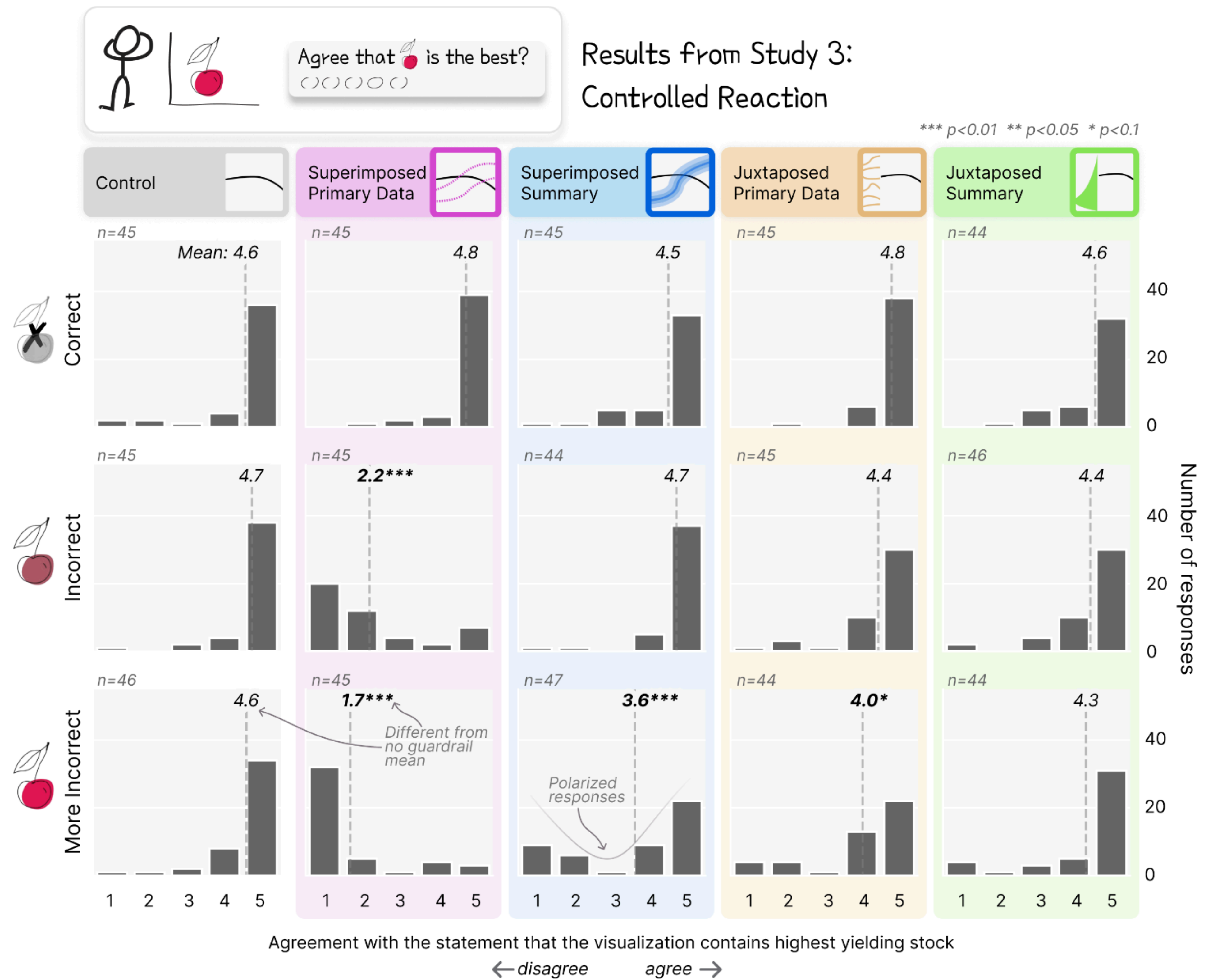
Superimposed Summary

Percent change in stock price

Shaded area contains the industry average and shows the middle 50% of all values in the industry.



RESULTS



Superimposed primary works

Superimposed summary is bimodal

Juxtaposed doesn't work

DISCUSSION

Superimposed Primary seems like a promising design against cherry-picking

easy to implement

easy to understand

Juxtaposed Primary design useful as a way to make data explorers more usable

Interventions may be useful, but not a Panacea

SUMMARY



A TOOLKIT FOR DATA
VISUALIZATION EXPERIMENTS

ReVISit takes care of the annoying parts of a study

Gives you the **ability to share your study with** reviewers and community!

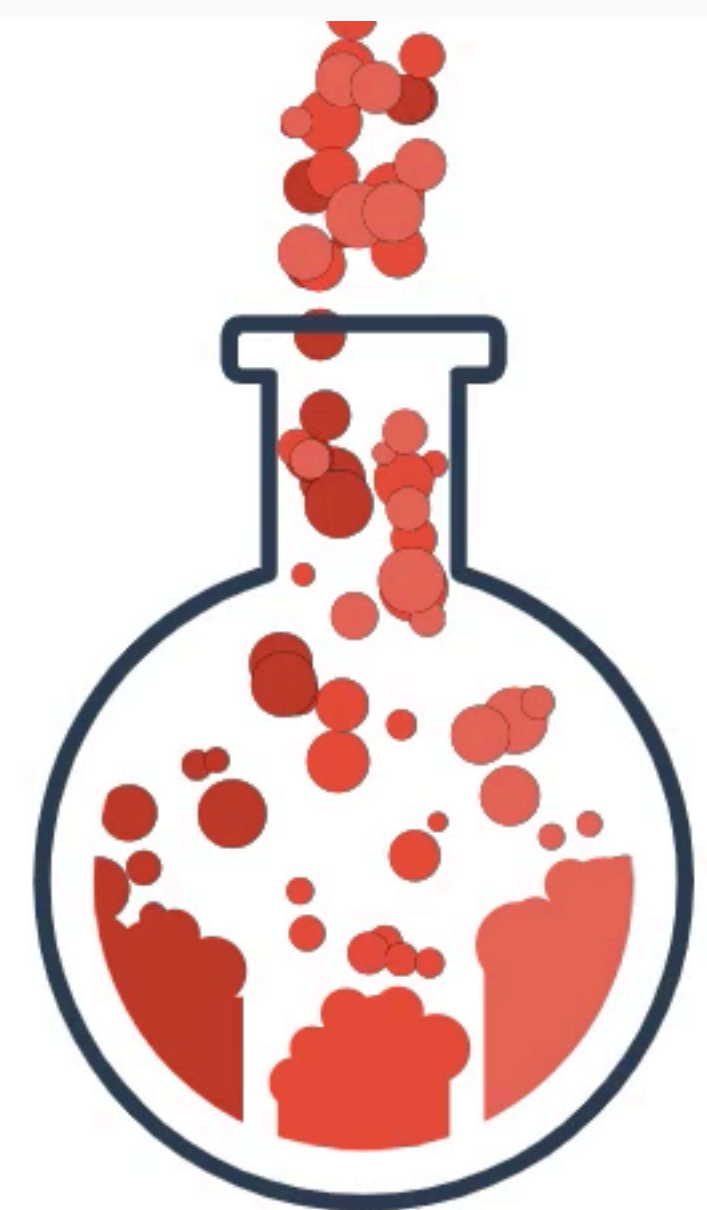
Hope you give it a try.

Alexander Lex

<http://vdl.sci.utah.edu>



The reVISit User Study Platform and Applications in Studying Misinformation



visualization
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