



REVISIT A TOOLKIT FOR DATA VISUALIZATION EXPERIMENTS

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AGENDA

30 Minute reVISit Overview

15 Minute Discussion

Then: Hands-On Tutorial (2h)

Goal: get revisit working for you

- Build a simple study
- Components and the reVISit Spec
- Data Analysis in reVISit
- Creating a React Component
- Provenance Tracking
- Randomization Strategies in reVISit
- Deployment
- reVISit-py -Python Bindings
- Recruiting participants
- Data Storage (Firebase)

PERILS OF ONLINE VISUALIZATION EXPERIMENTS

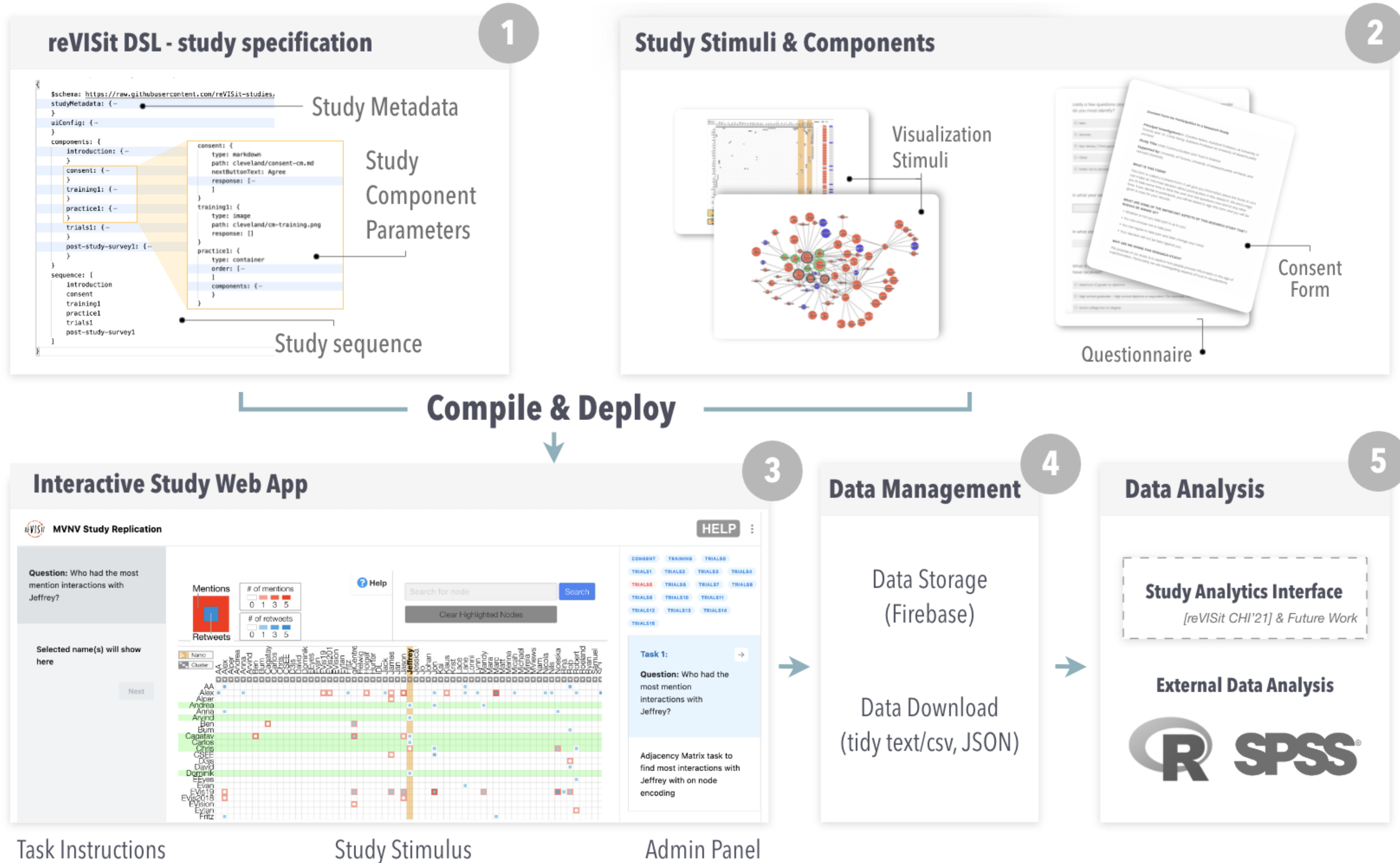
There is no **end-to-end platform** for building **interactive experiments**

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

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

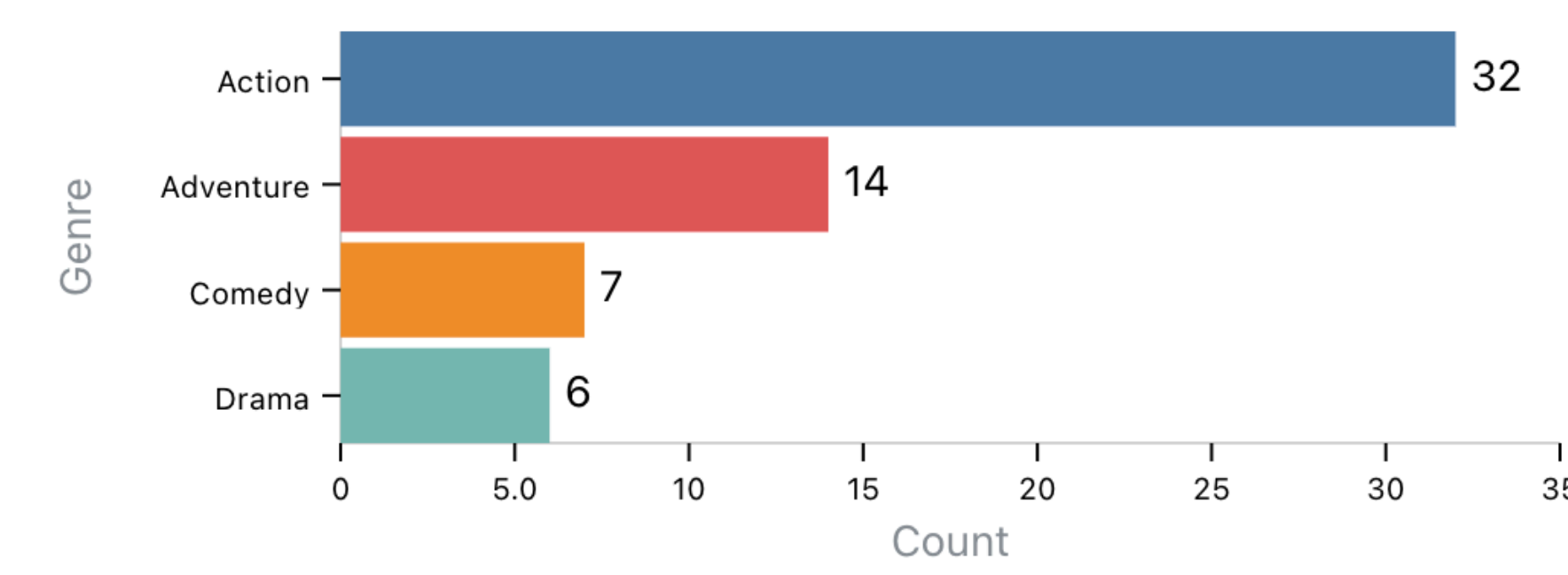
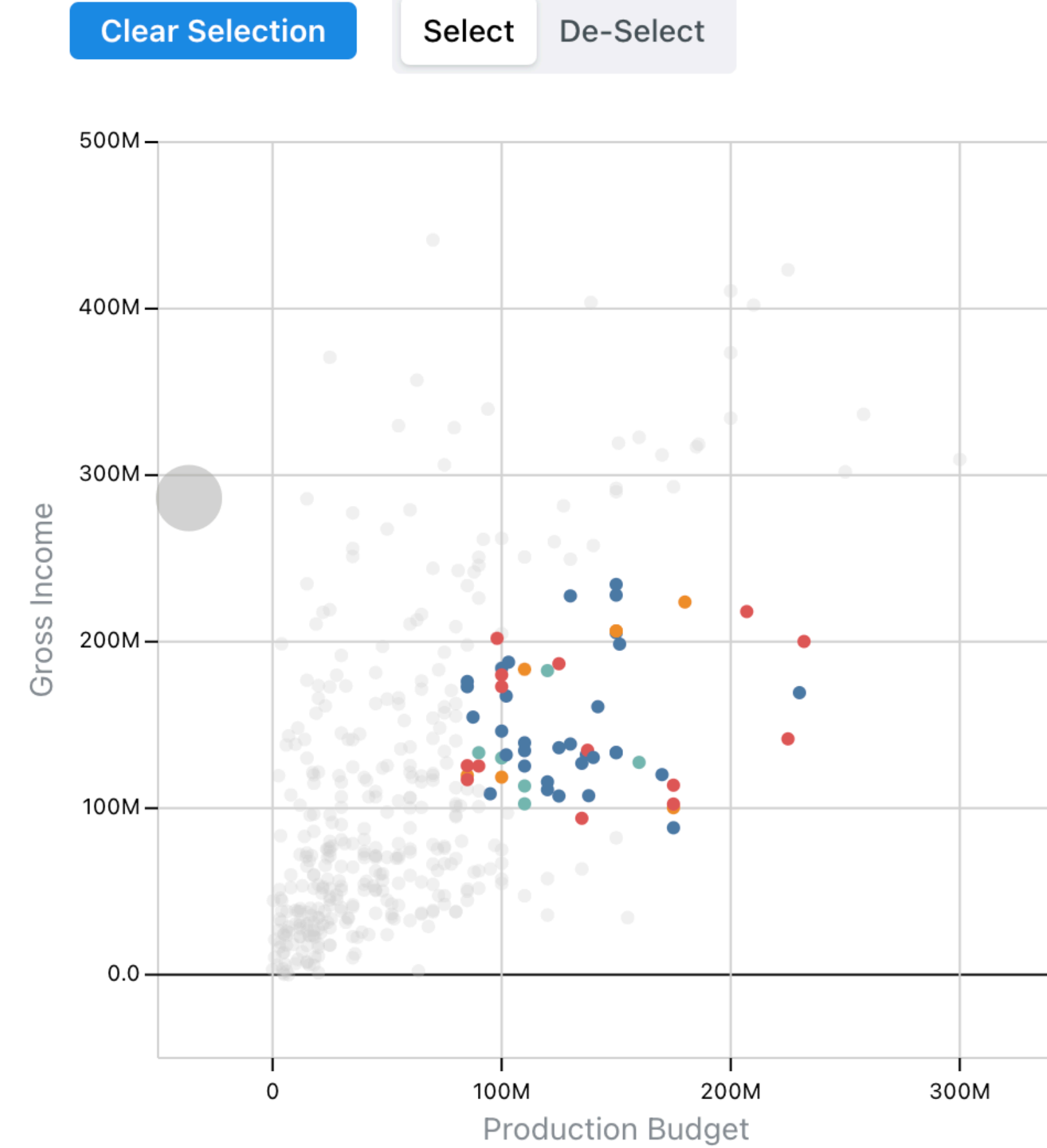


Task:

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

Answer: *

Next



Study Browser

Next Participant



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

VEGA DEMO

The screenshot displays a web interface for a study titled "Demo of use Vega-Lite as stimuli". The interface is divided into three main sections: a main content area, a top navigation bar, and a right-hand sidebar.

Top Navigation Bar: Features the "REVISIT" logo, the title "Demo of use Vega-Lite as stimuli", a "Help" button, and a menu icon.

Main Content Area: Contains the following sections:

- 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."

Right-Hand Sidebar (Study Browser): Includes a "Next Participant" button, a search icon, and two view options: "Participant View" (selected) and "All Trials View". Below these are a list of items: "introduction" (highlighted), "vegademo1", "vegademo2", and "end".

Bottom Right: A blue "Next" button.

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"
  ]
}
```

REVISIT-PY

Python Bindings for
reVISit

**Some things are annoying to do in
JSON**

Eg: generating 50 stimuli with slightly
different data

**reVISit-PY Python bindings allow you
to “program” a spec**

REVISIT-PY EXAMPLE

```
import revisit as rvt
import data.scatterjnd.metadata as metadata

study_metadata = rvt.studyMetadata(
    **metadata.study_metadata
)

newResponse = rvt.response(
    id='hello',
    type='matrix-radio',
    required=False,
    prompt='Test Prompt',
    test='hello',
    answerOptions='satisfaction5',
    questionOptions=['Test1', 'Test2']
)

base_comp = rvt.component(
    type='questionnaire',
    response=[],
    component_name__='Base_Test'
)

comp_one = rvt.component(
    base__=base_comp,
    component_name__='Test',
).responses([
    newResponse
])
```



```
import src.revisit as rvt

study_metadata = rvt.studyMetadata(
    **{
        "title": "HTML as a Stimulus",
        "version": "pilot",
        "authors": [
            "The reVISit Team"
        ],
        "date": "2023-04-14",
        "description": "A simple demo of using stimuli in an HTML file that renders a D3 visualization. Data is collected via a numeric response field.",
        "organizations": [
            "University of Utah",
            "WPI",
            "University of Toronto"
        ]
    }
)

ui_config = rvt.uiConfig(
    **{
        "contactEmail": "contact@revisit.dev",
        "helpTextPath": "./assets/help.md",
        "logoPath": "./assets/revisitLogoSquare.svg",
        "withProgressBar": True,
        "autoDownloadStudy": False,
        "sidebar": True,
        "windowEventDebounceTime": 200
    }
)

introduction = rvt.component(
    component_name__='introduction',
    type='markdown',
    path='./assets/introduction.md',
    response=[]
)

barChart = rvt.component(
    component_name__='barChart',
    type='d3',
    data=[
        {"category": "A", "value": 10},
        {"category": "B", "value": 20},
        {"category": "C", "value": 30},
        {"category": "D", "value": 40},
        {"category": "E", "value": 50}
    ]
)
```

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

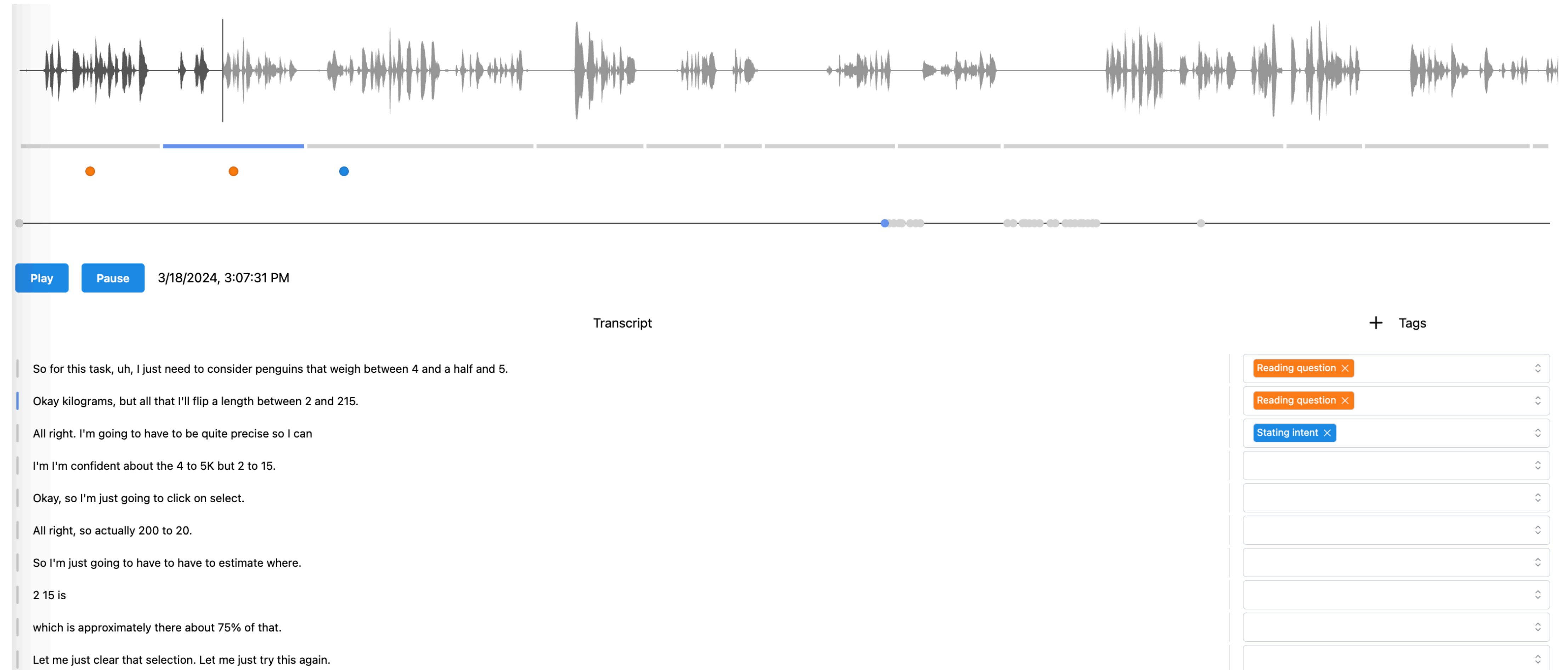


In Depth Analysis

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

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 is a sidebar with a '+ Tags' header and a list of tags, including 'Reading question' and 'Stating intent'.

Play Pause 3/18/2024, 3:07:31 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.

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

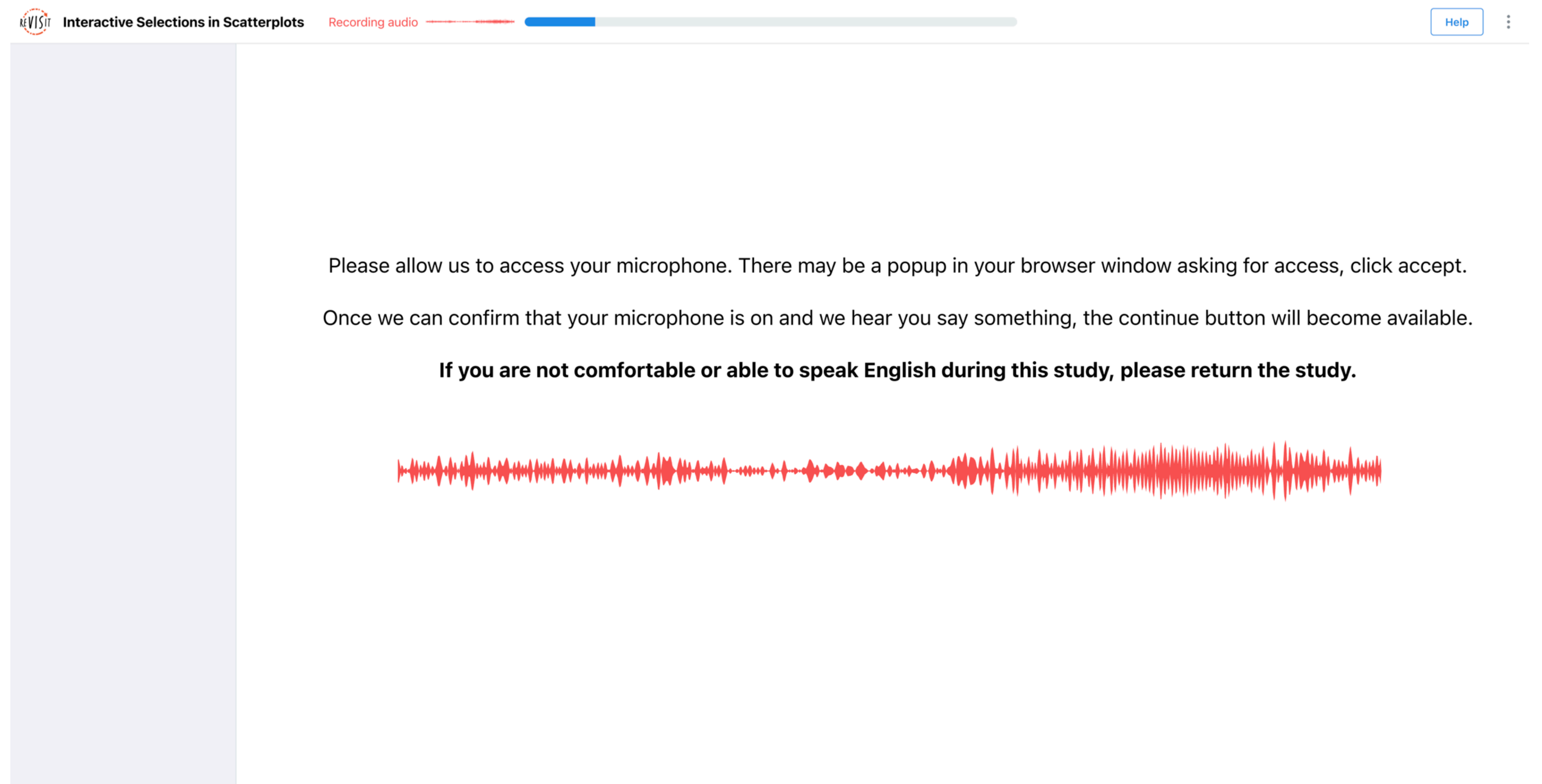
Usual trade-offs of lab vs crowdsourced

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 activity.

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?

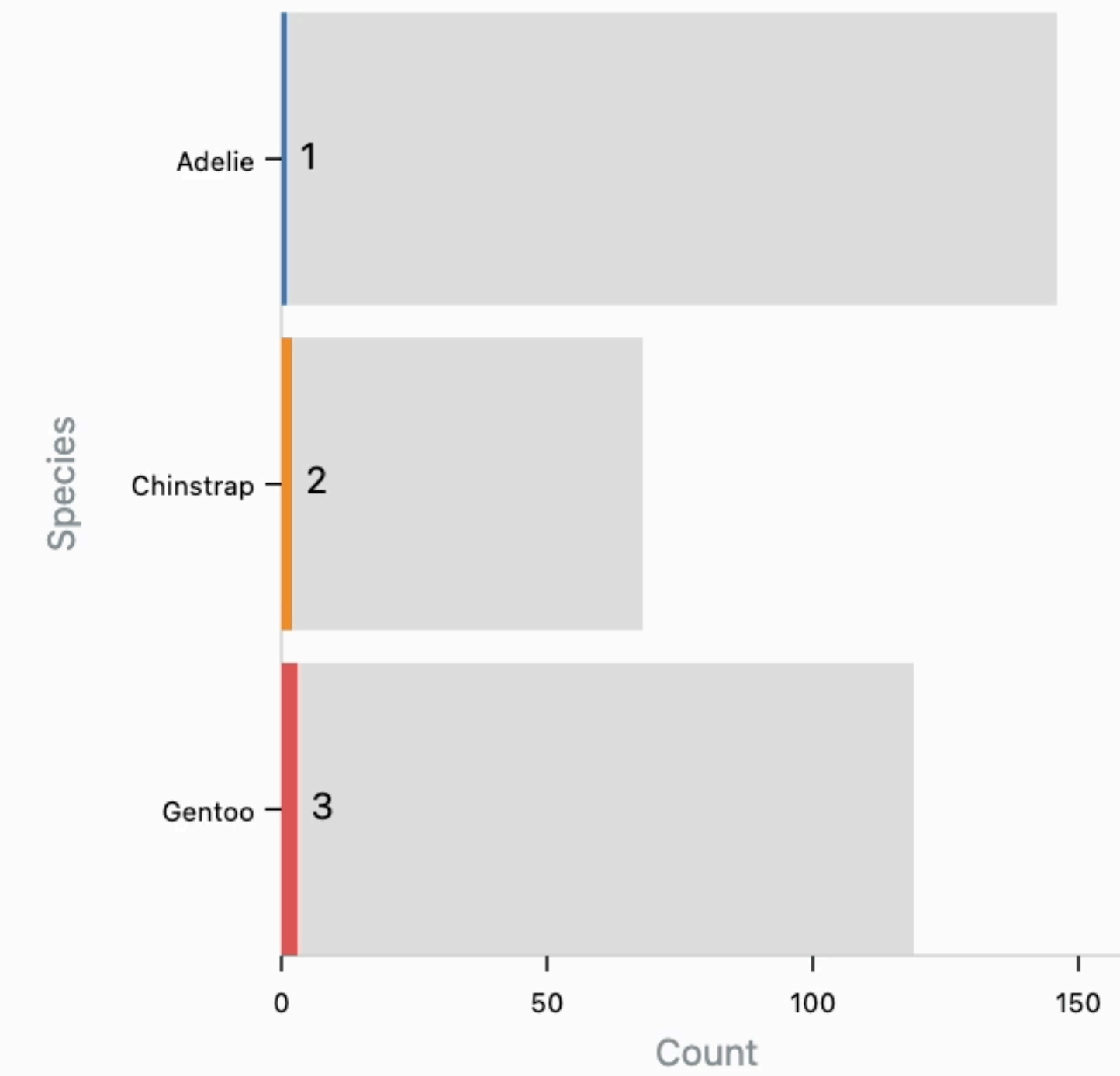
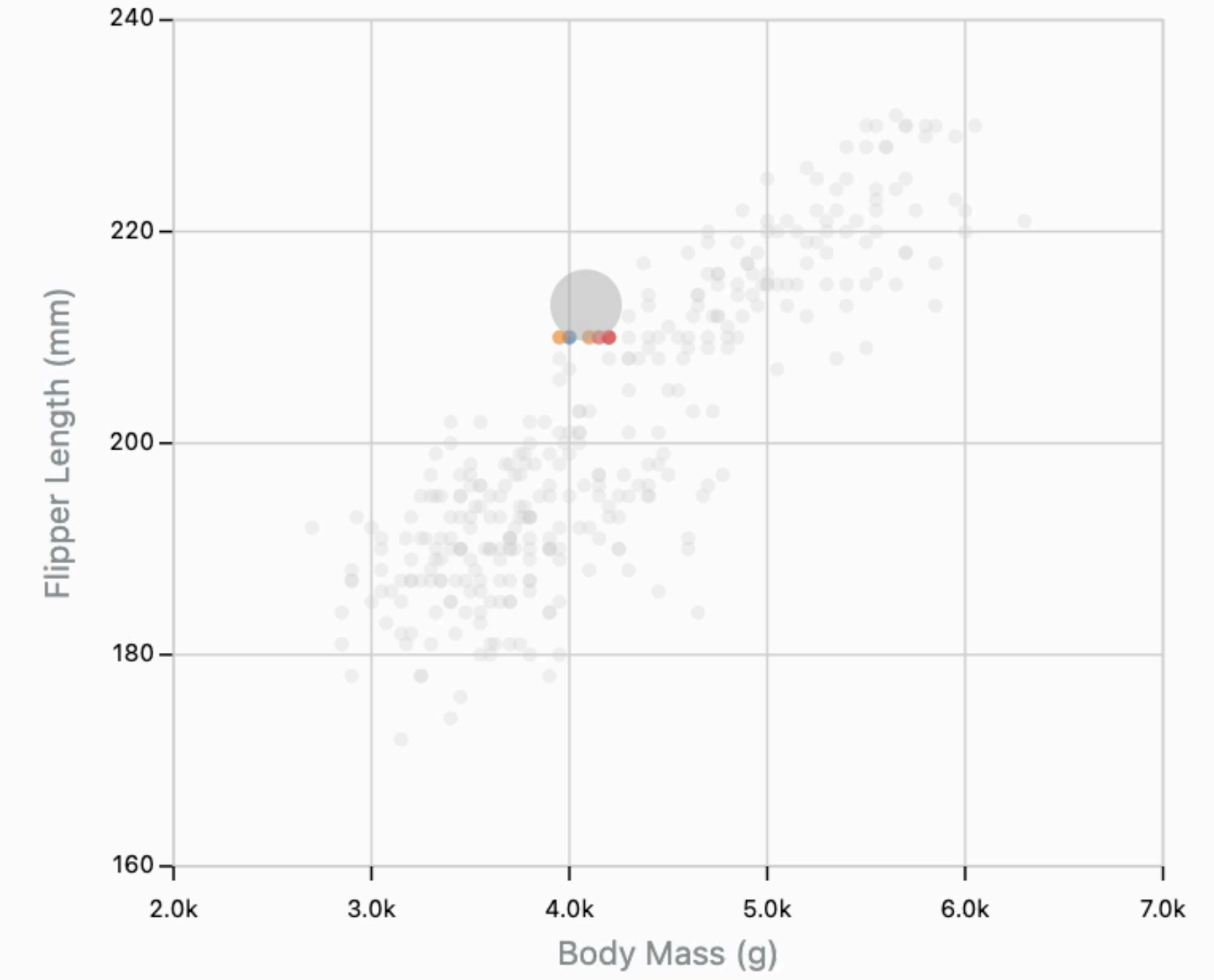
While answering this question, please verbalize your thoughts, especially any insights you have or problems you run into.

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

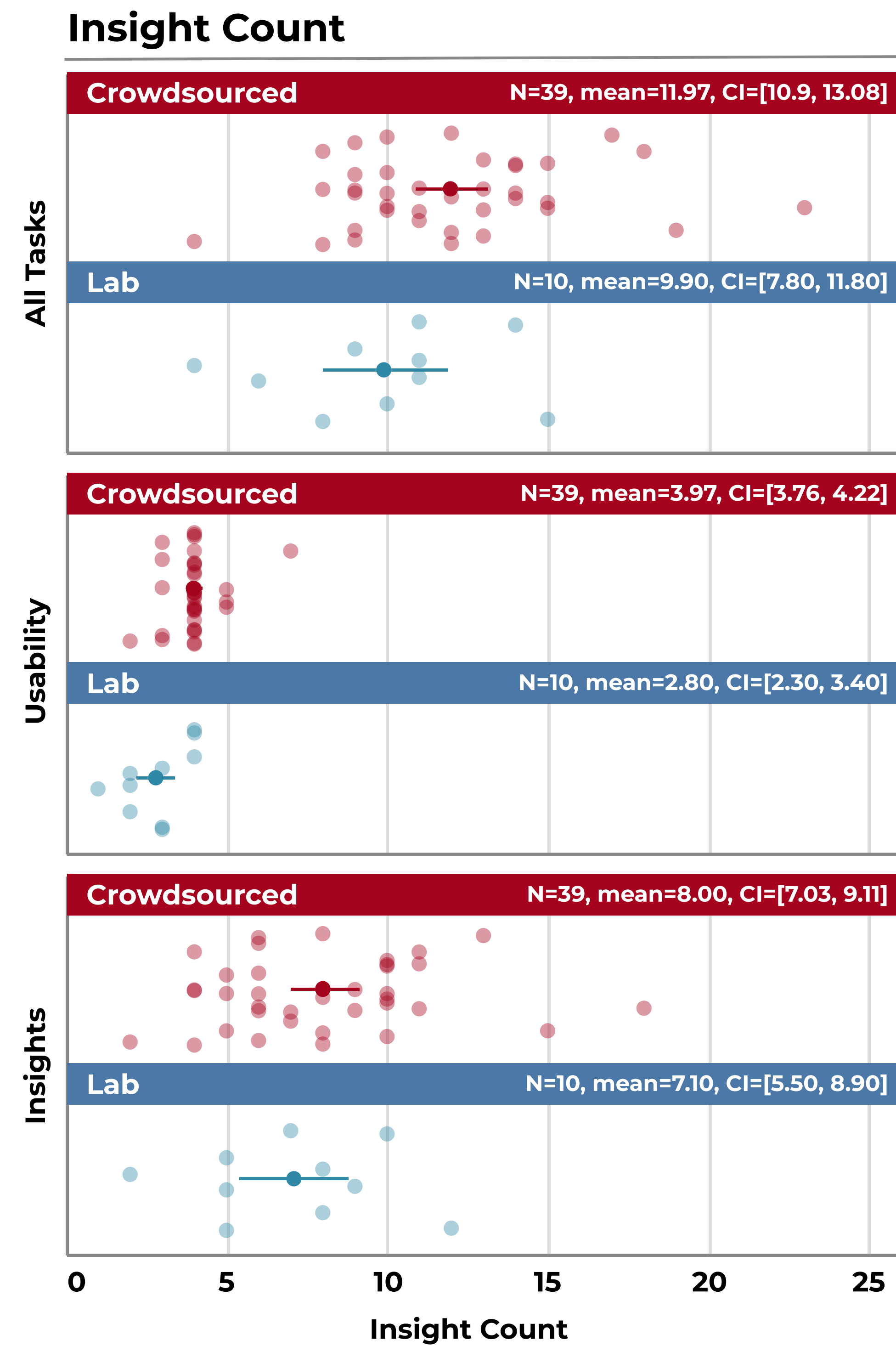
Coding:

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

Nr / quality of insights
similar to slightly higher

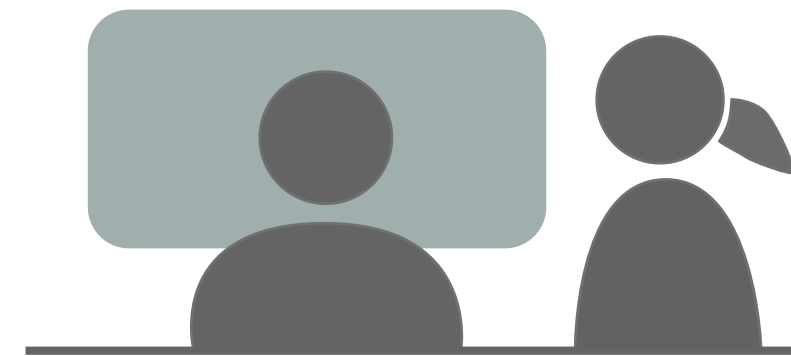
Do crowdsourced think-aloud studies work?

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!

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.

THOUGHTS?