

# **THREE APPROACHES TO EXPLORING TWIN CITIES PBS EDUCATIONAL GAME TELEMETRY**

Twin Cities PBS

WestEd

University of Wisconsin



# PROJECT GOAL



**Improve the school readiness and academic achievement of children in grades K-2 in science and literacy.**

## **Target Audiences**

- **Latino communities,**
- **English Language Learners,**
- **Children with disabilities, and**
- **Children from low-income households.**



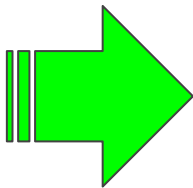
# HERO ELEMENTARY OVERVIEW

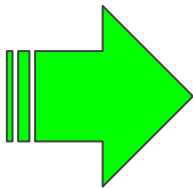
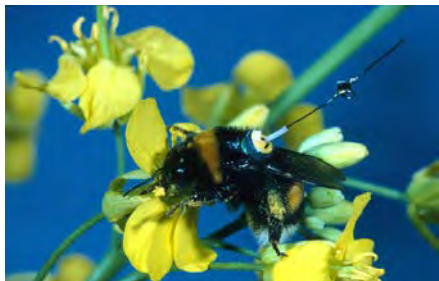


- 40 TV shows
- 16 digital games
- Science Power Notebook
- 8 Analog games
- 60 Hands-on Activities
- E-Books
- 30 Playlists

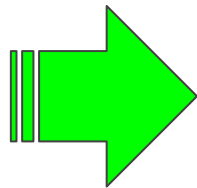
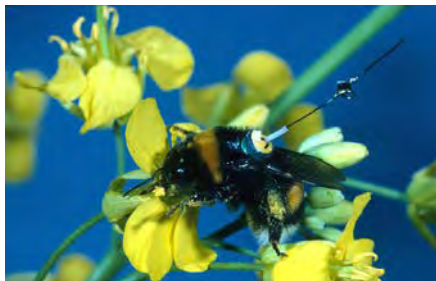


# WHAT IS Telemetry?











[illegible]

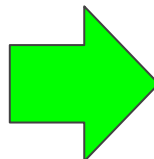


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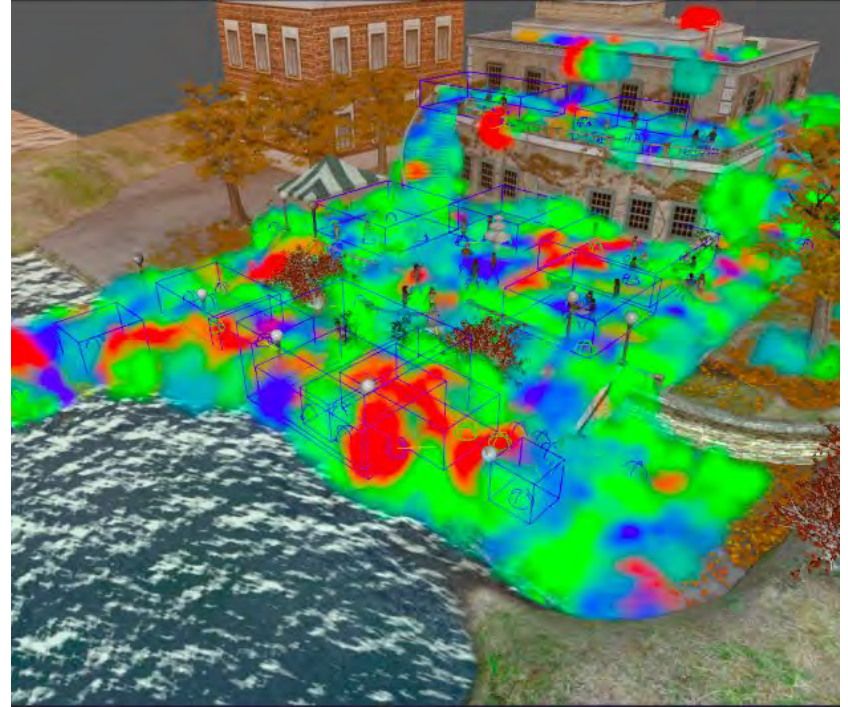
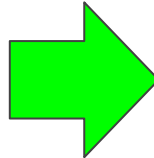


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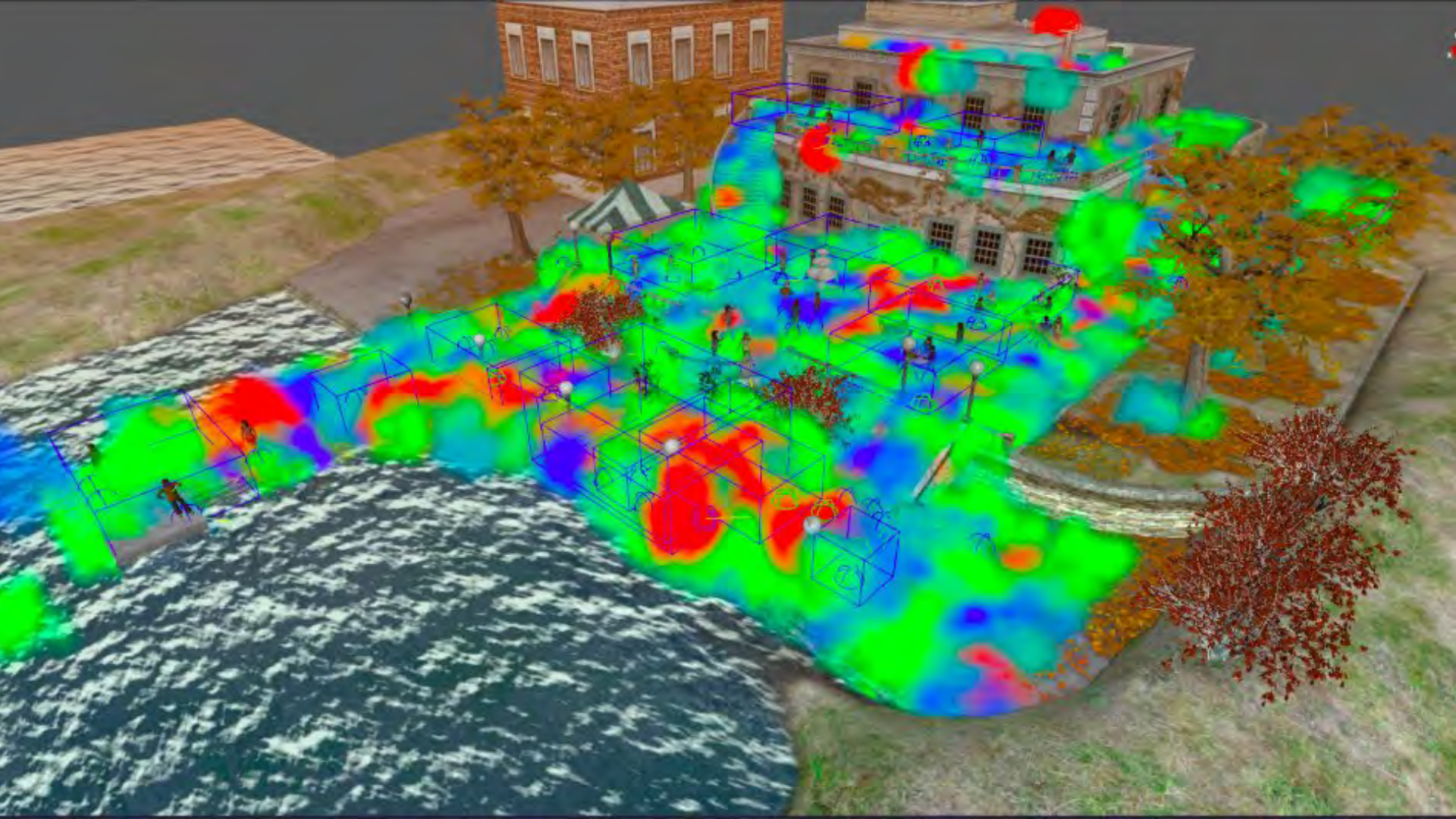




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# TODAY'S Session:



## ***Part 1: How and Why Twin Cities PBS Logs and Makes Sense of Telemetry***

Momo Hayakawa, Ph.D. & Dennis Ramirez, Ph.D., Twin Cities PBS

## ***Part 2: New Methodologies to Improve Digital Learning Games Using Observation and Log Data During Early Testing***

Betsy McCarthy, Ph.D. Melissa Cheung, M.A. & Mingyu Feng, Ph.D., WestEd

## ***Part 3: Visualizing Early Educational Game Telemetry***

Dennis Ramirez, Ph.D., Twin Cities PBS, & Matthew Berland, Ph.D., Univ. Wisconsin,  
Madison



# **PART 1:**

## **HOW AND WHY TWIN CITIES PBS LOGS AND MAKES SENSE OF TELEMETRY**

Momo Hayakawa, Ph.D &  
Dennis Ramirez, Ph.D.



# WHAT ARE WE COLLECTING?



User telemetry passed through our 14 Hero Elementary digital assets

- Digital games
- Science notebook
- Playlist - a bundle of our games and activities by topic
- Parent Playlist - dashboard for parents to view children's progress and notebook pages

# TYPES OF DATA WE COLLECT



- Time (start, stop, duration)
- Click location
- Number of clicks
- Help (when help marker implemented)
- Rates of success/failure
- Artifacts

**Standardize!**  
(to the extent possible)

# WHY ARE WE COLLECTING THIS INFO?



- They help us answer questions like...
  - Where do kids start to make errors?
  - When are kids disengaged?
  - When do kids start to struggle?
  - How long do they play?
  - Is it age appropriate?



# HOW DO WE USE THIS INFORMATION?



- To make refinements and recommendations
- Teacher dashboard
- Parent Playlist
- Science Notebook artifacts

# DASHBOARD



Twin Cities PBS

Dashboard

Assign & Approve

Manage Content

Groups

Users

Reports

Account

Create

## Pushes and Pulls

Group Overview

Group Game Progress

Group Notebook Entries

	1	2	3	4	5	6	7	8	

Each row represents a  
unique student



This student  
was absent





# TRIANGULATING DATA



We can combine telemetry, observational data, and survey data to understand how to interpret the data:

- Trends
- Struggles
- Successes
- Future modifications

# NOTEBOOK ARTIFACTS



kindergartener



first grader



second grader

# USABILITY OF SCIENCE NOTEBOOK



	Participant Grade Level & Gender	Save Page	Erase Page	Stickers	Edit Menu (General)	Adjust Size of Stickers	Move Stickers	Erase Stickers	Rotate Stickers	Background	Text	Drawing	Camera	Microphone	Help Button (General)
Grade K, M		red	green	green	green	green	green	red	yellow	green	green	green	green	green	red
Grade K, M		red	green	green	yellow	yellow	green	red	yellow	red	green	red	yellow	yellow	gray
Grade K, M		red	gray	green	red	red	green	red	red	yellow	yellow	red	red	red	red
Grade 1, F		green	green	green	green	green	green	green	green	green	green	green	green	green	gray
Grade 1, F		red	gray	green	yellow	green	green	red	green	red	green	red	yellow	yellow	gray
Grade 1, M		green	green	green	yellow	yellow	green	green	green	yellow	green	yellow	green	green	gray
Grade 2, F		green	green	green	green	green	yellow	yellow	green	green	green	red	green	green	green
Grade 2, F		green	green	green	yellow	yellow	green	yellow	green	green	green	red	green	yellow	green
Grade 2, F		red	green	green	yellow	yellow	green	red	yellow	green	green	yellow	yellow	yellow	green

red=could not do  
 yellow=could do with help  
 green=could do

# KEY FINDINGS



- Telemetry alone does not illustrate what exactly is happening
  - Telemetry implied kids were off-task and doodling
    - suggested inappropriateness for Kg
  - Observation showed that kids were on-task and completed prompt before doodling
- Critical, in early stages, to couple with observation!

# NEXT STEPS



- **Factor Analysis**
  - What components are driving the learning?
- **Subgroup effects**
  - LatinX, low-income, ELL, children with disabilities
- **Mediators**
  - What key component is impacting change in kids?
- **Data jam**



# **PART 3:**

## **VISUALIZING EARLY EDUCATIONAL Game Telemetry**

Dennis Ramirez, Ph.D. &  
Matthew Berland, Ph.D





# OVERVIEW OF PROGRAM



**The goal of the National Science Foundation-funded DCF project is to support researchers across the United States in developing the capacity to apply best practices in learning analytics and play.**

# DATA ANALYSIS



**Analyze the data shared today (gathered from one of our games) looking for patterns interesting events.**

**Expected outcome: Share pattern/suggestions for future collection.**

# AVERAGES



**Calculate the average metric, pay attention to deviations.**

**Example use: Demographic data**

SHARK INJURIES IN U.S.A.	12	14	12	6	13
Dog bites human	12,656	10,593	9,809	8,870	8,064
Human bites human	*	1,589	1,591	1,572	1,587
Cat bites human	826	*	879	*	802
Wild rat bites human	60	*	311	*	291
Squirrel bites human	81	*	*	*	95
Hamster bites human	52	*	*	*	*
Rabbit bites human	37	*	*	*	*
Raccoon bites human	18	*	*	*	11

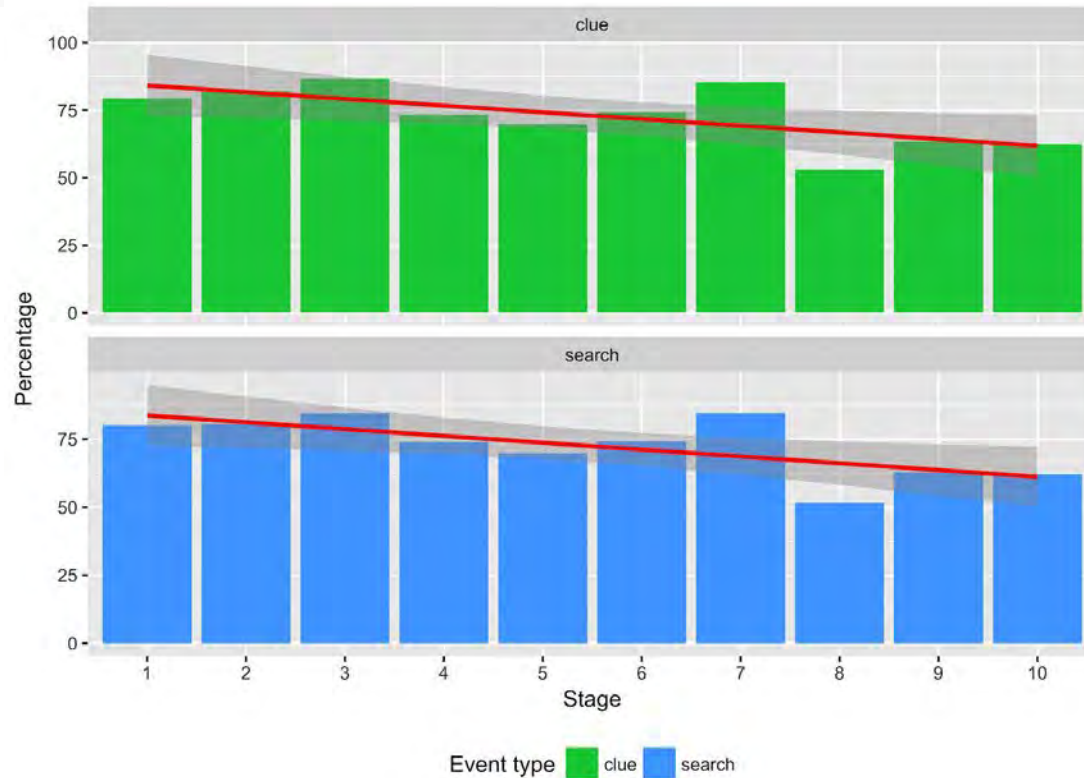
SHARK INJURIES IN U.S.A.	12	14	12	6	13
Dog bites human	12,656	10,593	9,809	8,870	8,064
Human bites human	*	1,589	1,591	1,572	1,587
Cat bites human	826	*	879	*	802
Wild rat bites human	60	*	311	*	291
Squirrel bites human	81	*	*	*	95
Hamster bites human	52	*	*	*	*
Rabbit bites human	37	*	*	*	*
Raccoon bites human	18	*	*	*	11

TIME 

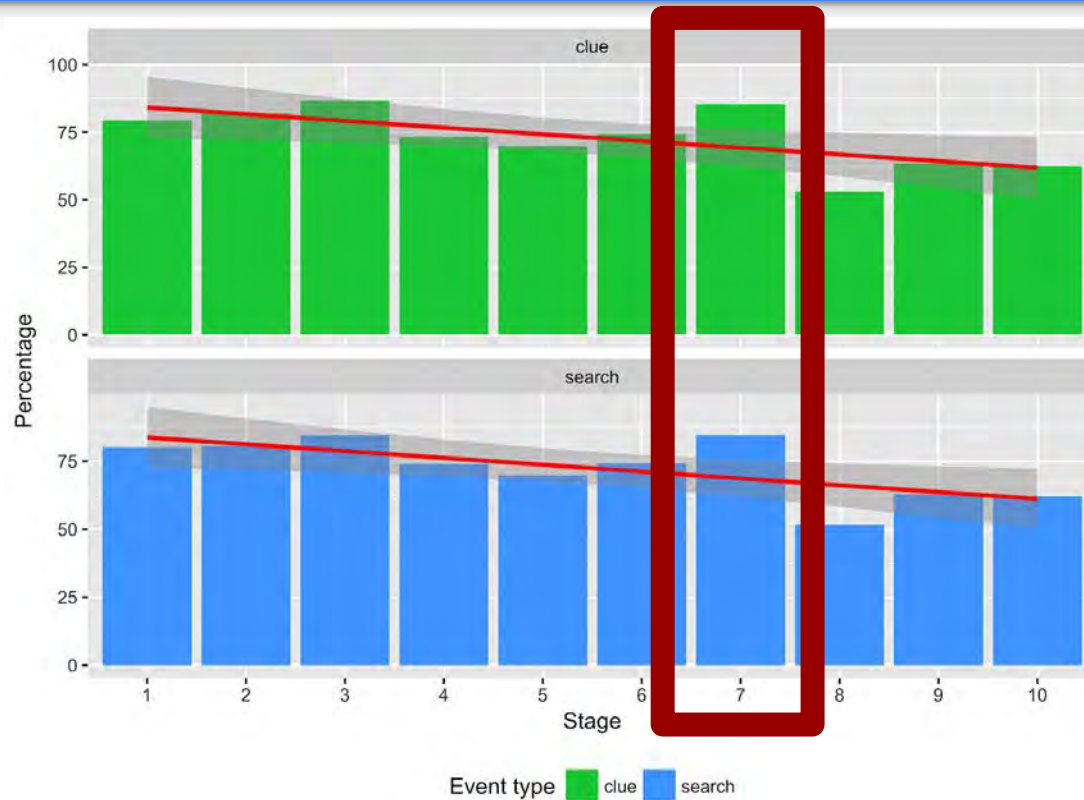
In New York alone, people are bitten 10 times more each year by other people than worldwide by sharks.



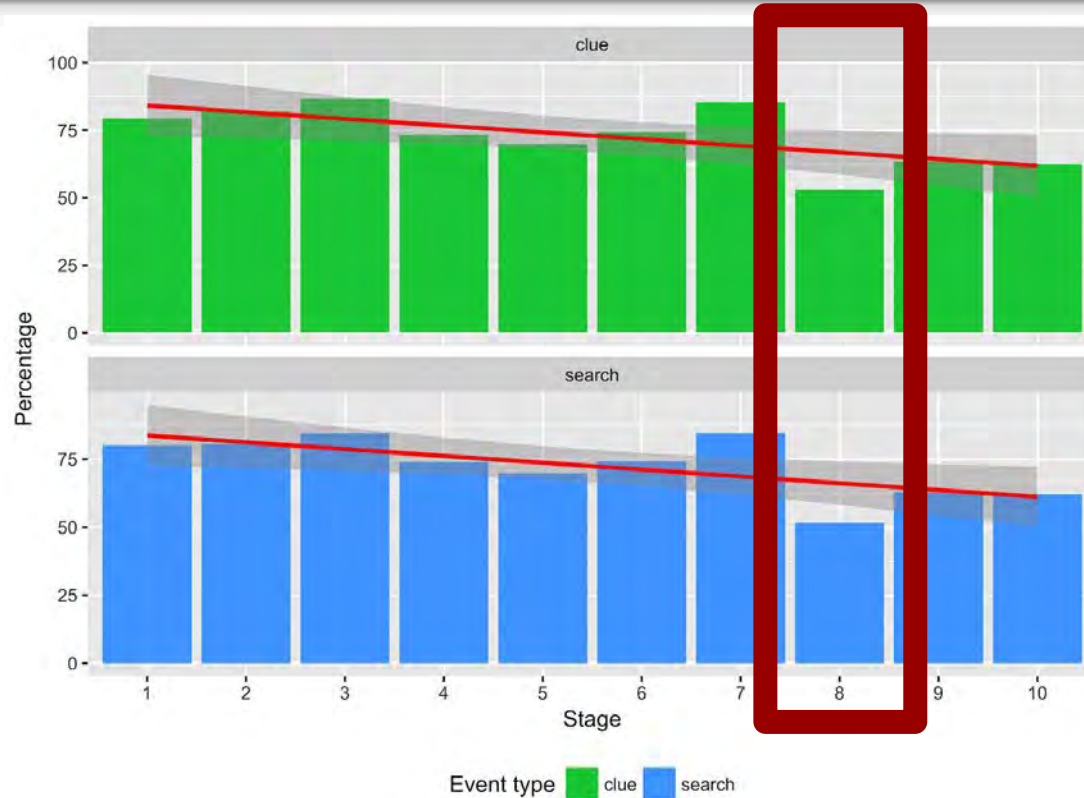
# RESULTS DATA VIS



# RESULTS DATA VIS



# RESULTS DATA VIS



# PATTERN RECOGNITION



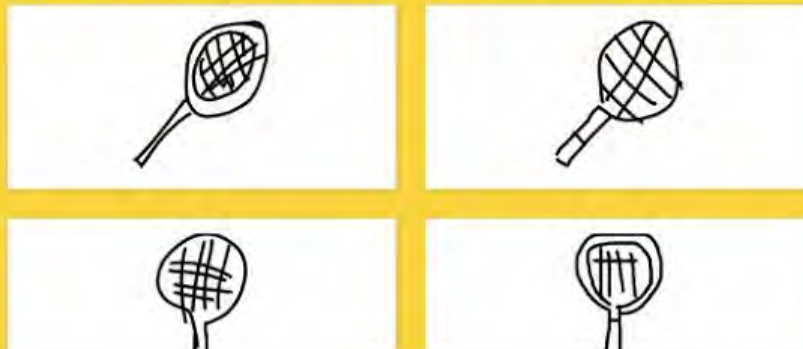
Using a data set, identify common patterns that can then be used to classify or predict new instances.

Example use: Snapchat filters

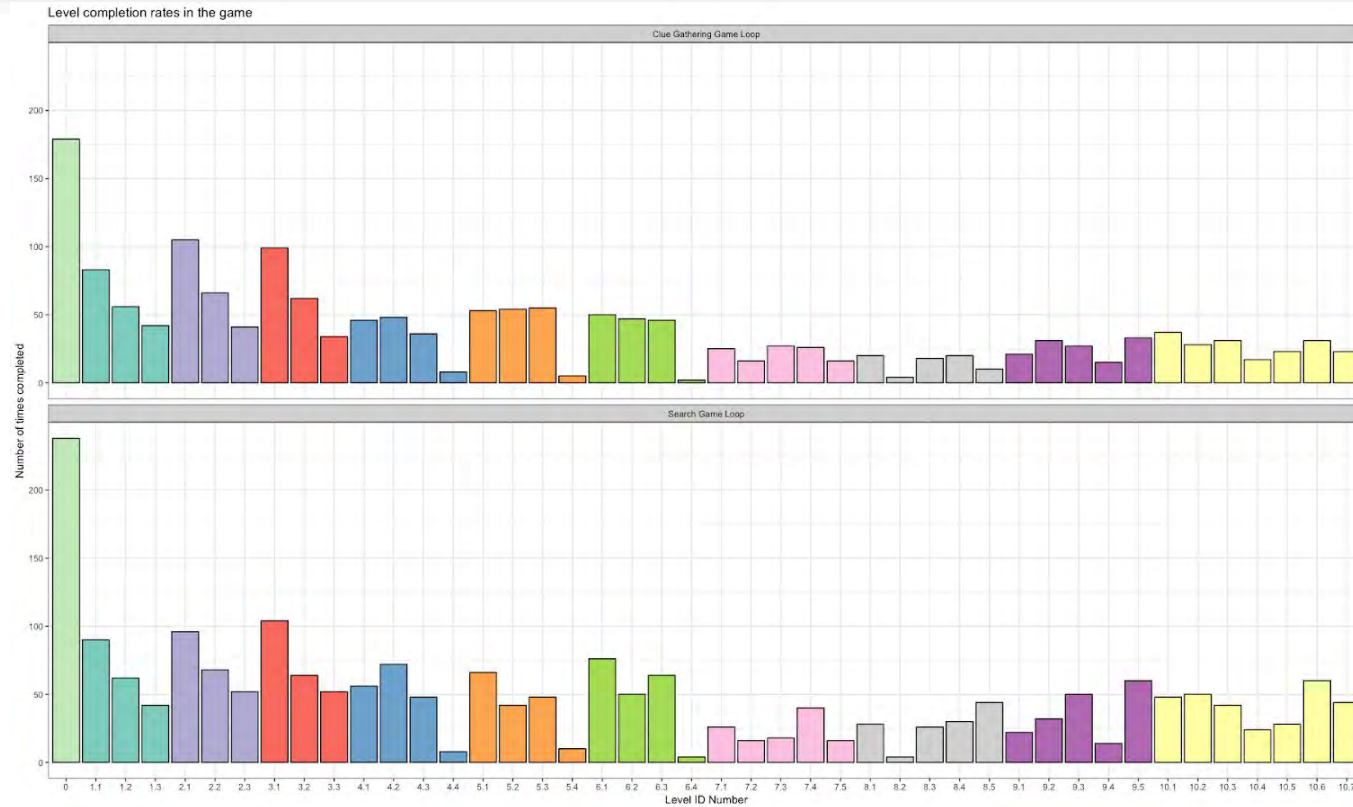
# Example of Pattern Recognition: Google Draw



How does it know what tennis racquet looks like?  
It learned by looking at these examples drawn by other people.



# RESULTS DATA VIS

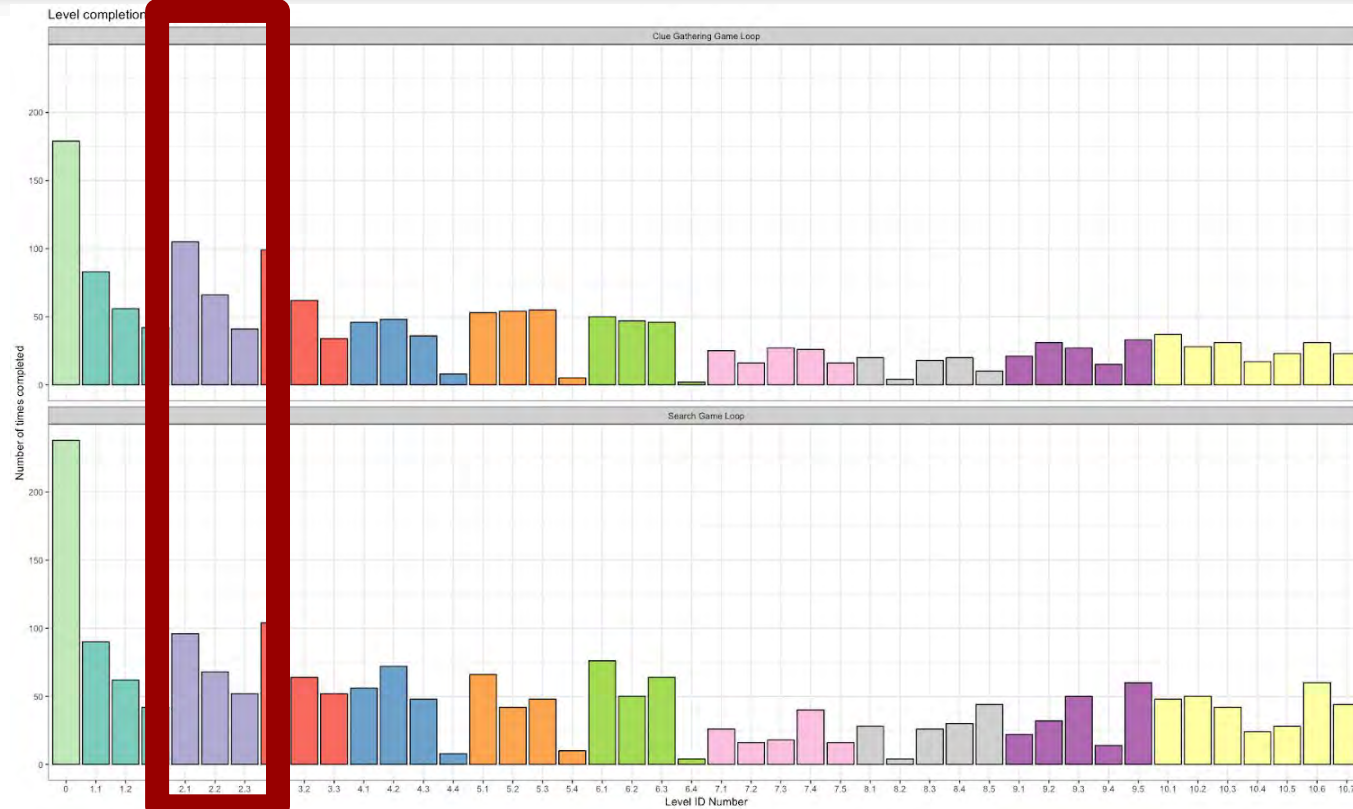


# RESULTS DATA VIS





# RESULTS DATA VIS

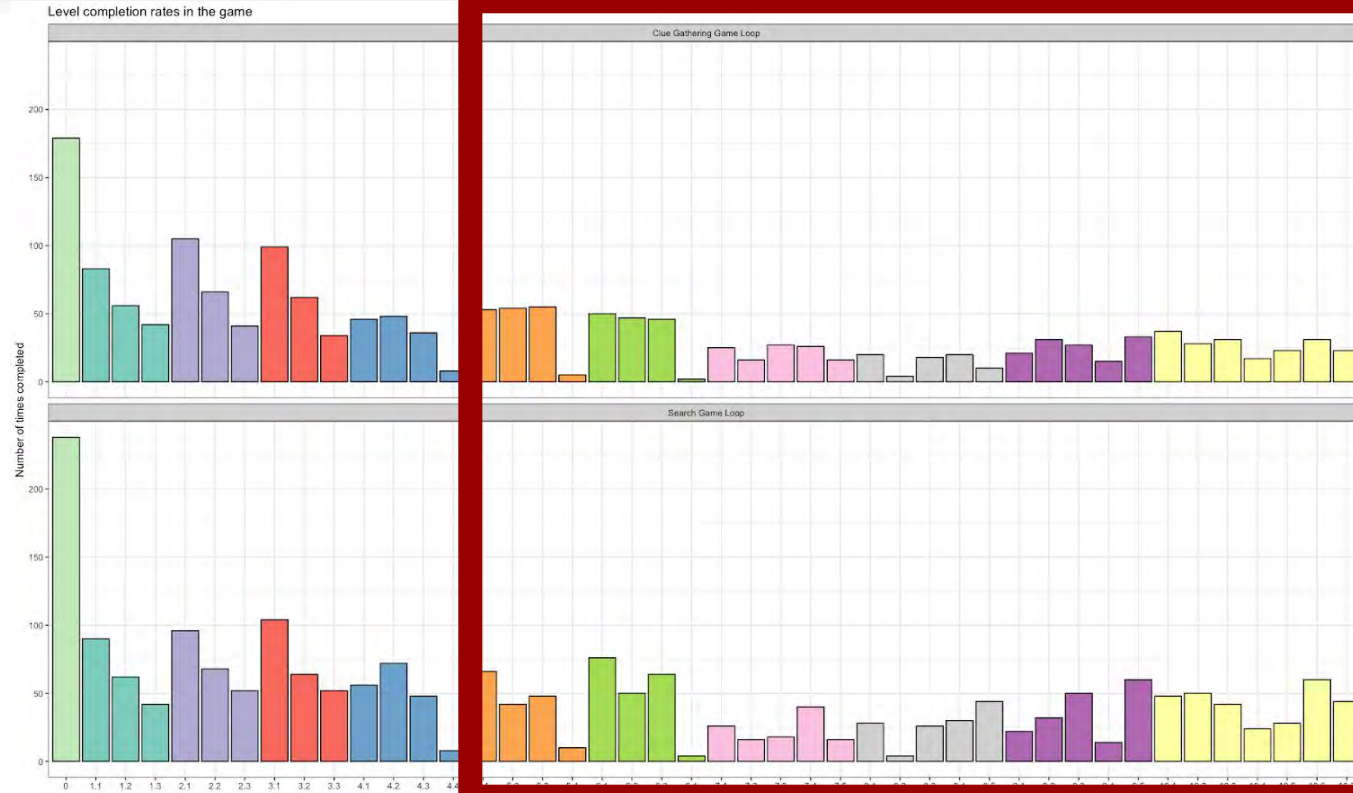




# RESULTS DATA VIS



# RESULTS DATA VIS



# HeATmAPs



**Visualizes intensity using colors.**

**Example use: Election Maps**

# The Walking Dead

★★★★★ 2010 TV-14 2 Seasons

## "Wildfire" (S1: E5)

Rick leads the group to the CDC after the attack. Jim must make a terrible decision.

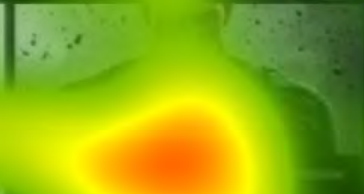
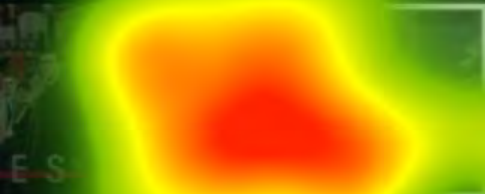


The global hit zombie show's 2012 season premiere became the most-watched basic cable episode ever.

NETFLIX



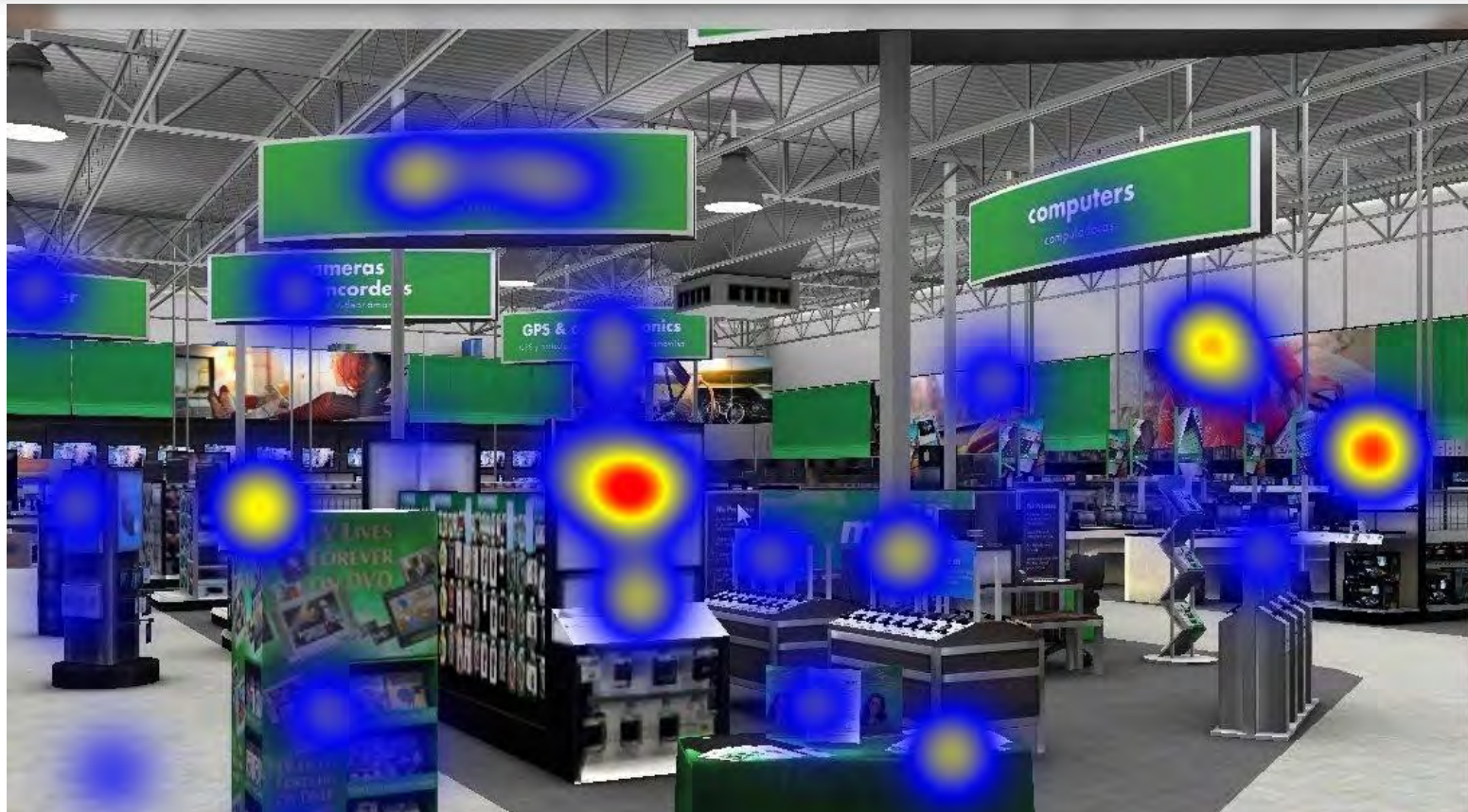
Continuing



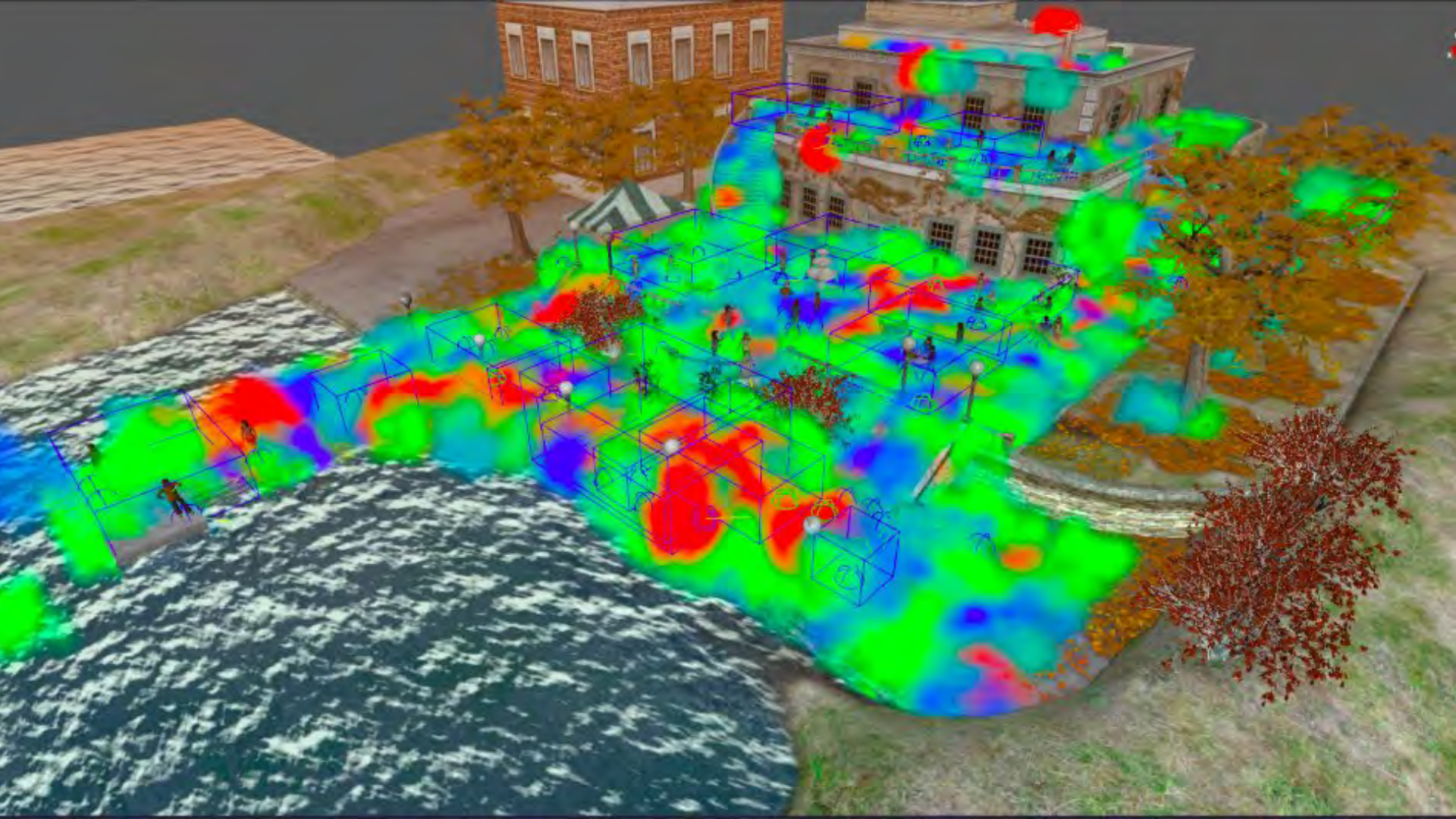
Kids Search

GIGAOM

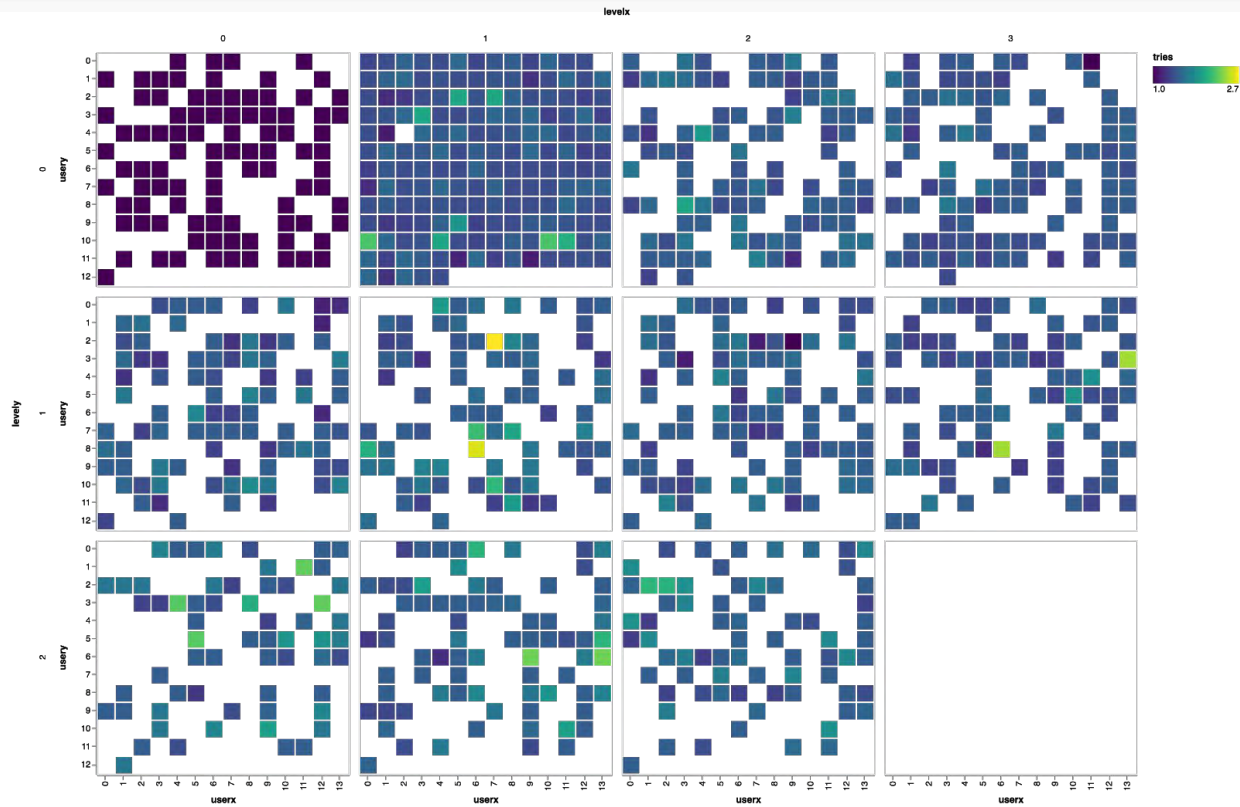




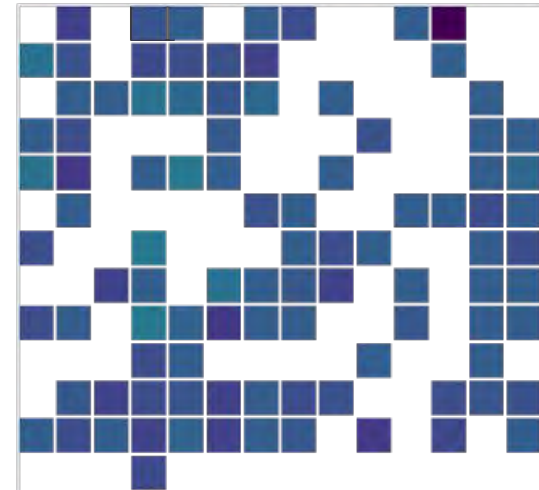
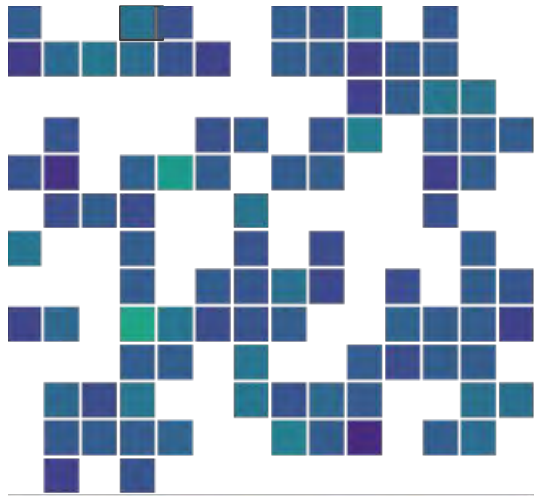




# RESULTS DATA VIS



# RESULTS DATA VIS

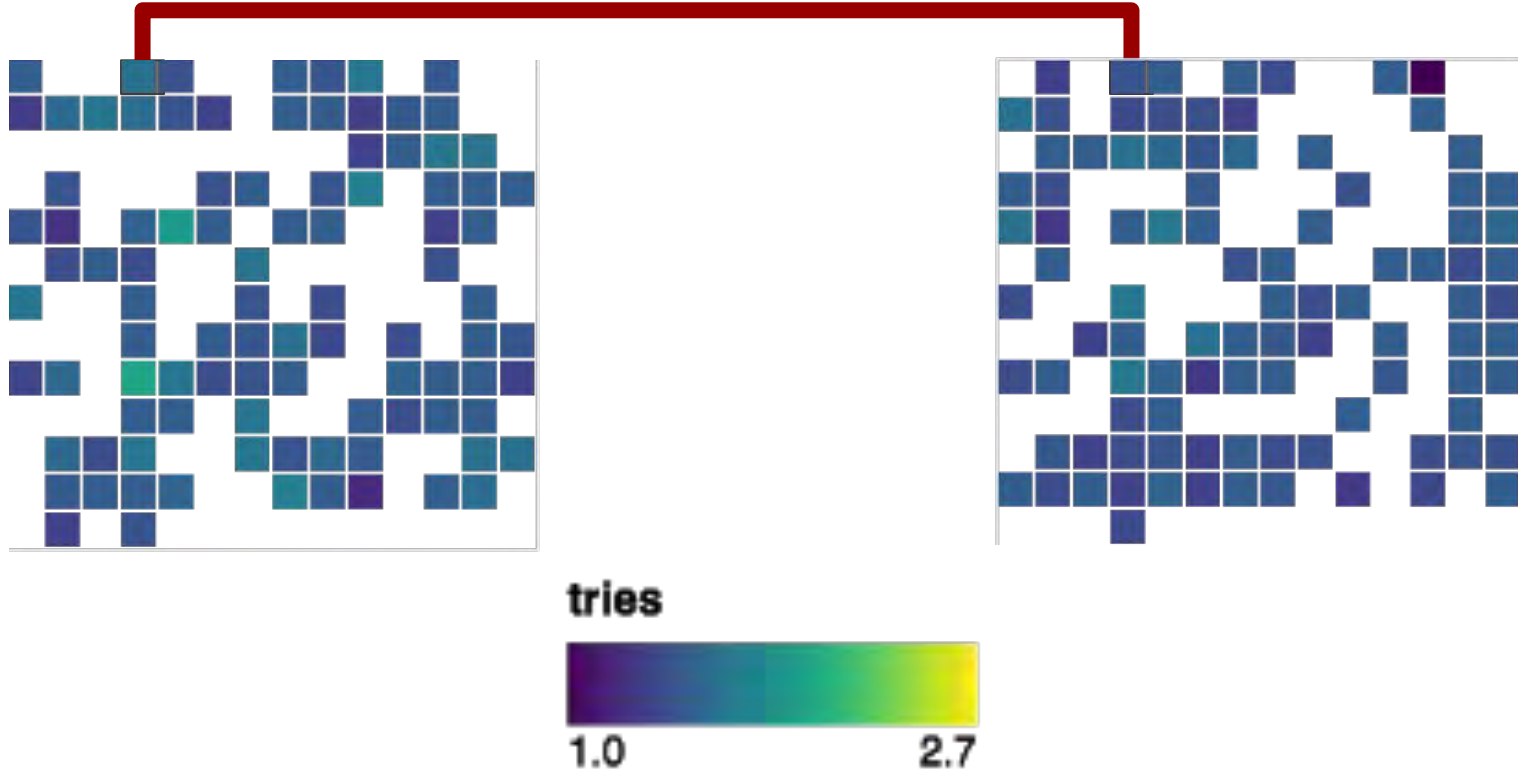


tries

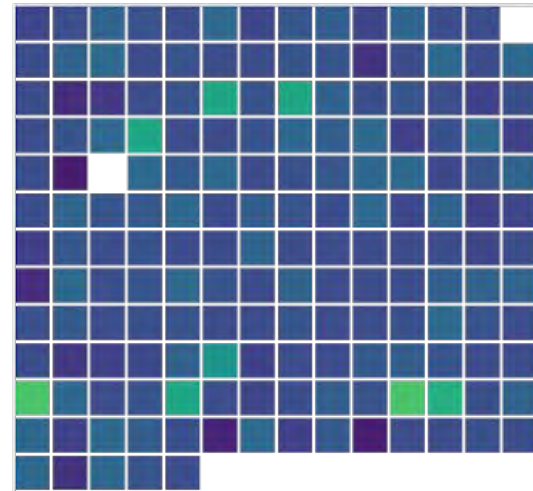
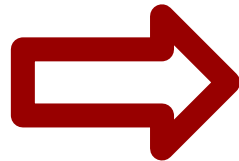
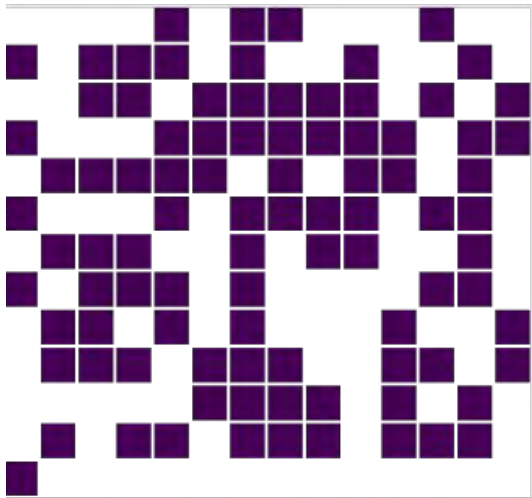




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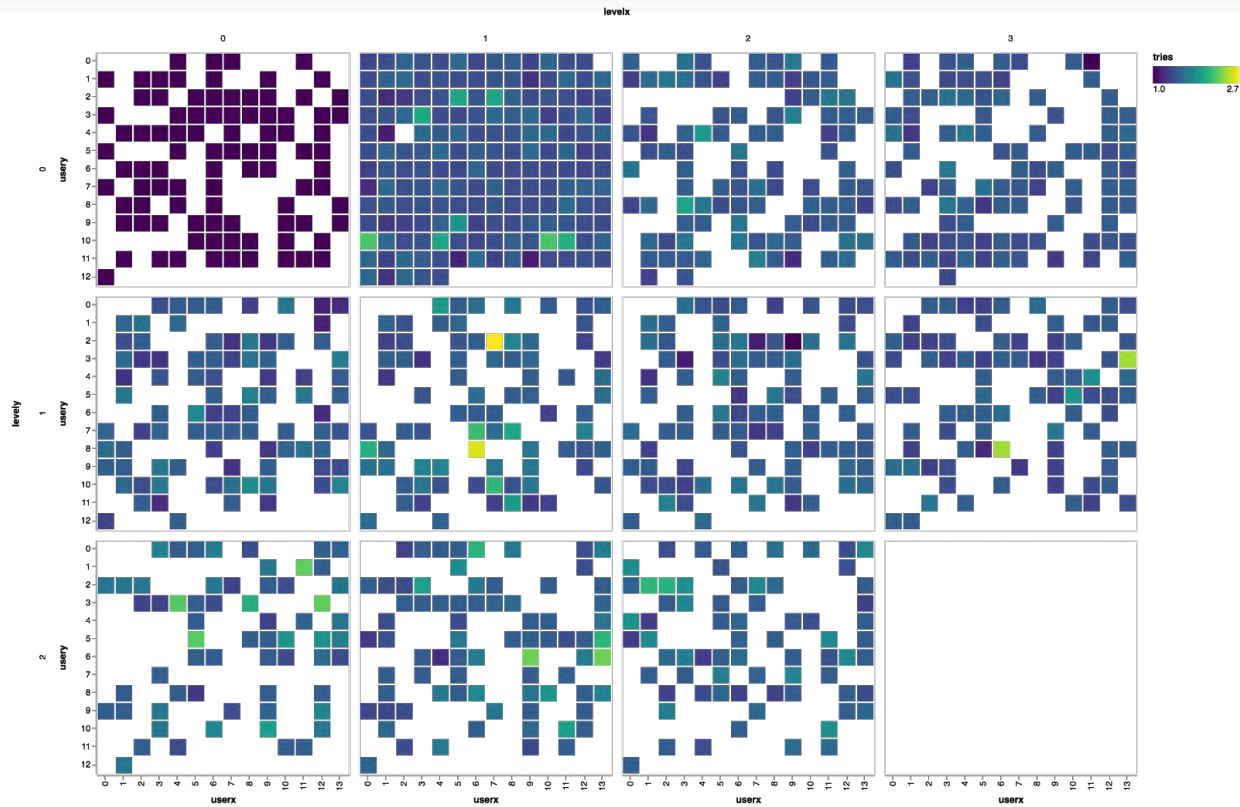
# RESULTS DATA VIS



tries



# RESULTS DATA VIS



# **SANKEY DIAGRAM / RIVER PLOTS**



**Can visualize choices / common paths.**

**Example use: Web traffic (Google analytics)**

# HOW DO YOU SPELL GYLen....HALL?

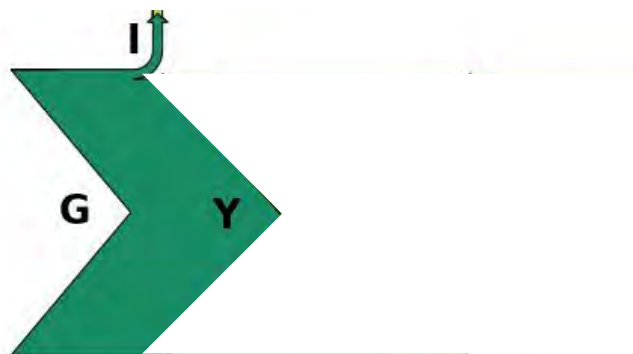


*It's pronounced Yillenhoolahay.*

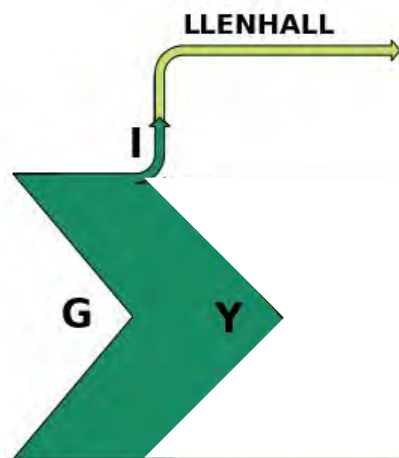


G

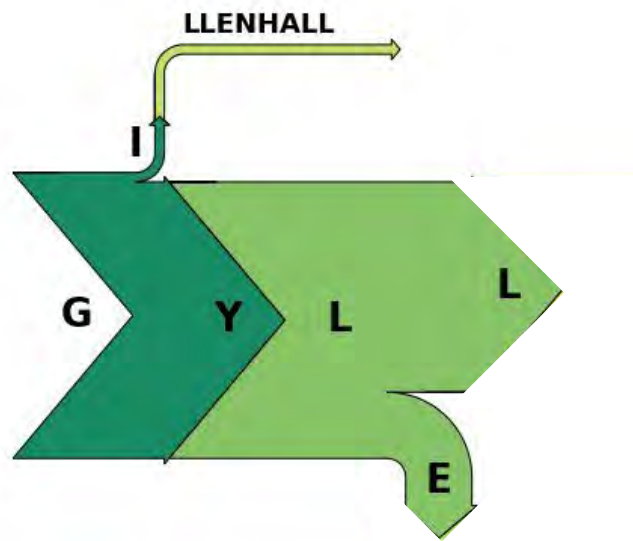
Read the

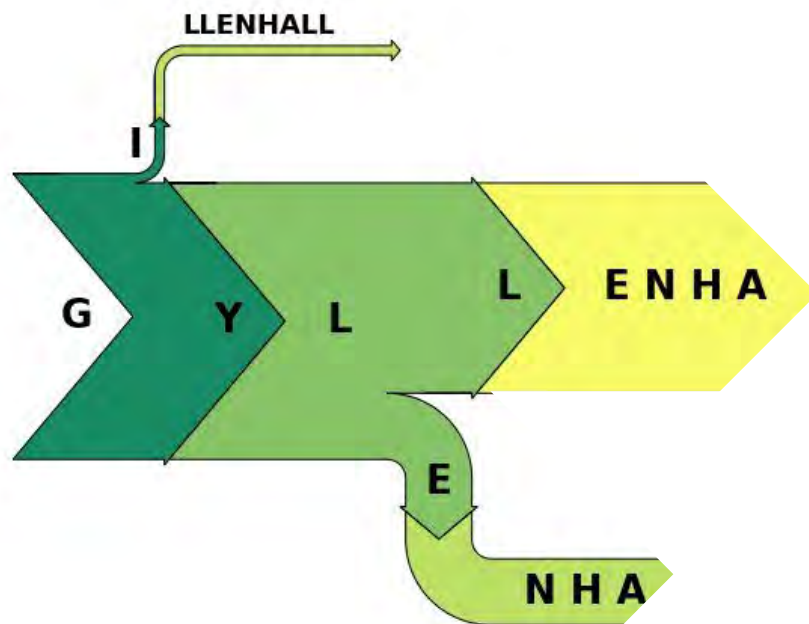


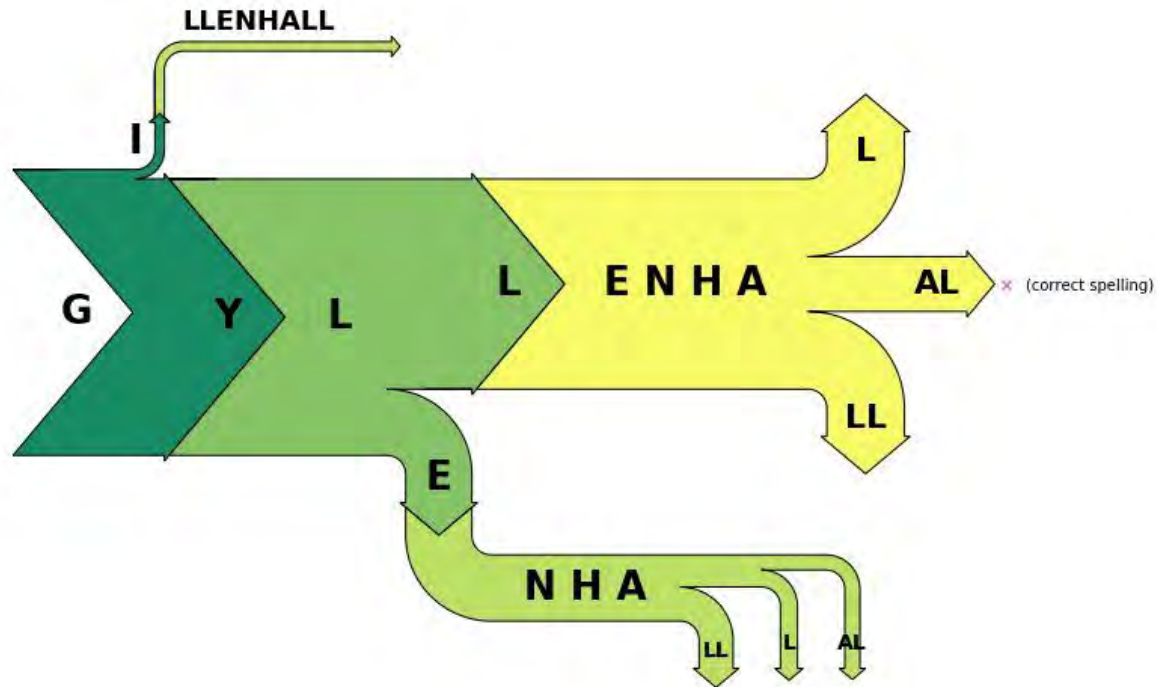
Write the

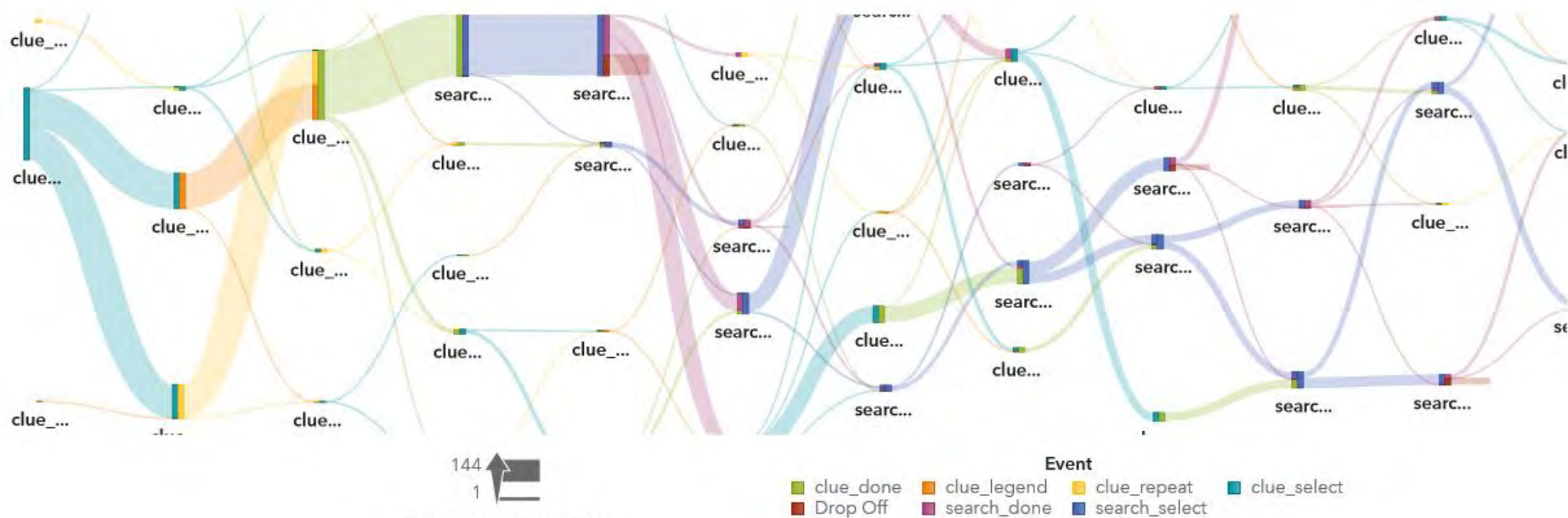




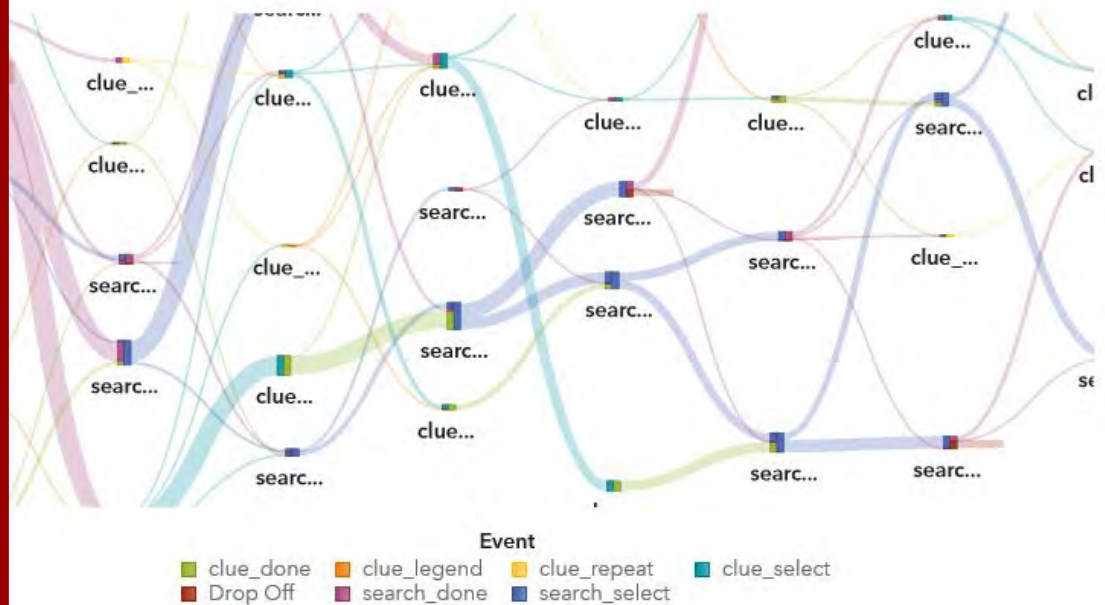






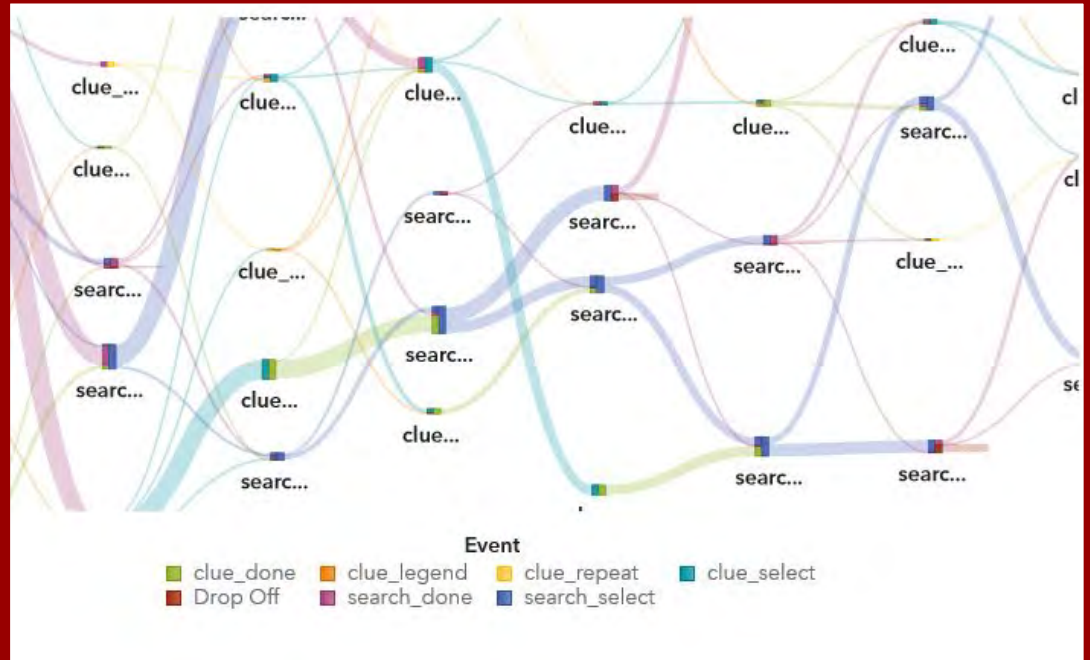


Path Frequency by Link

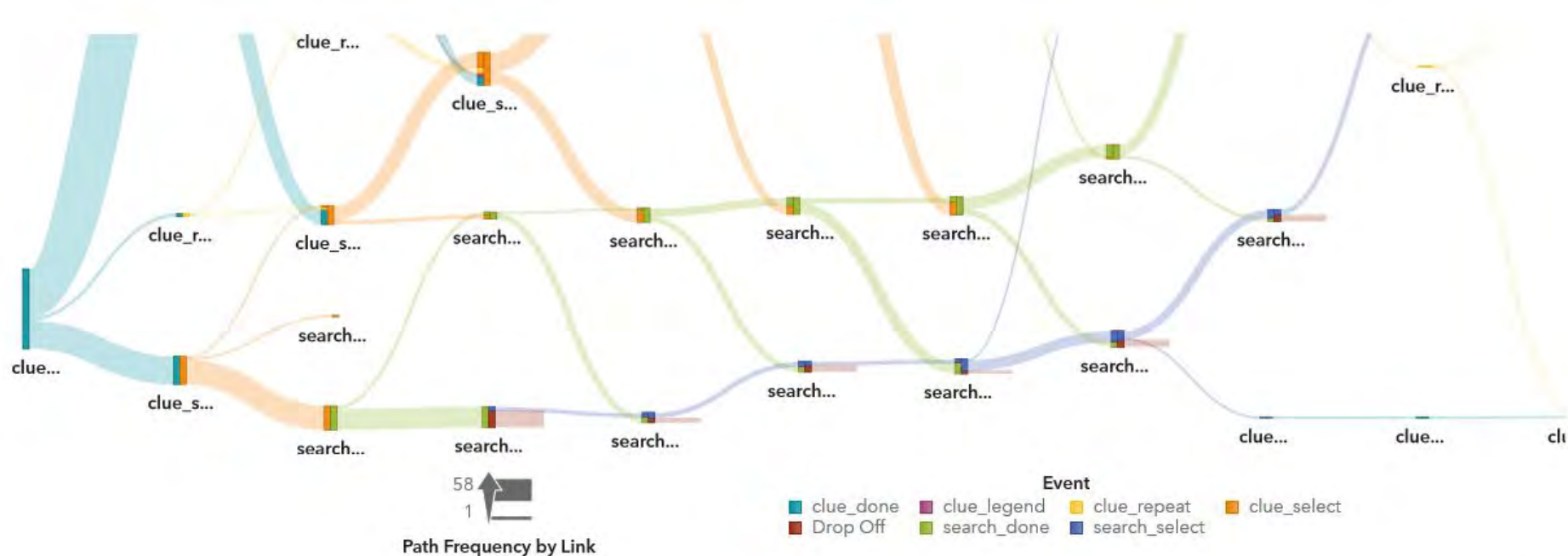


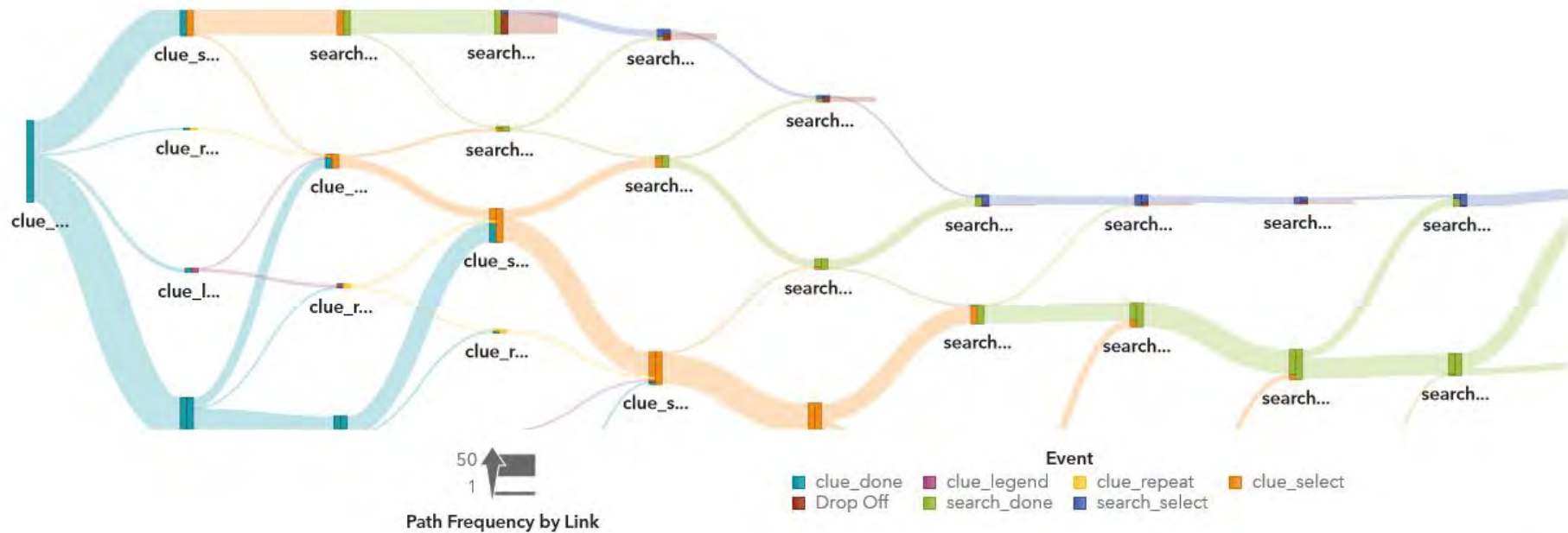
144  
1

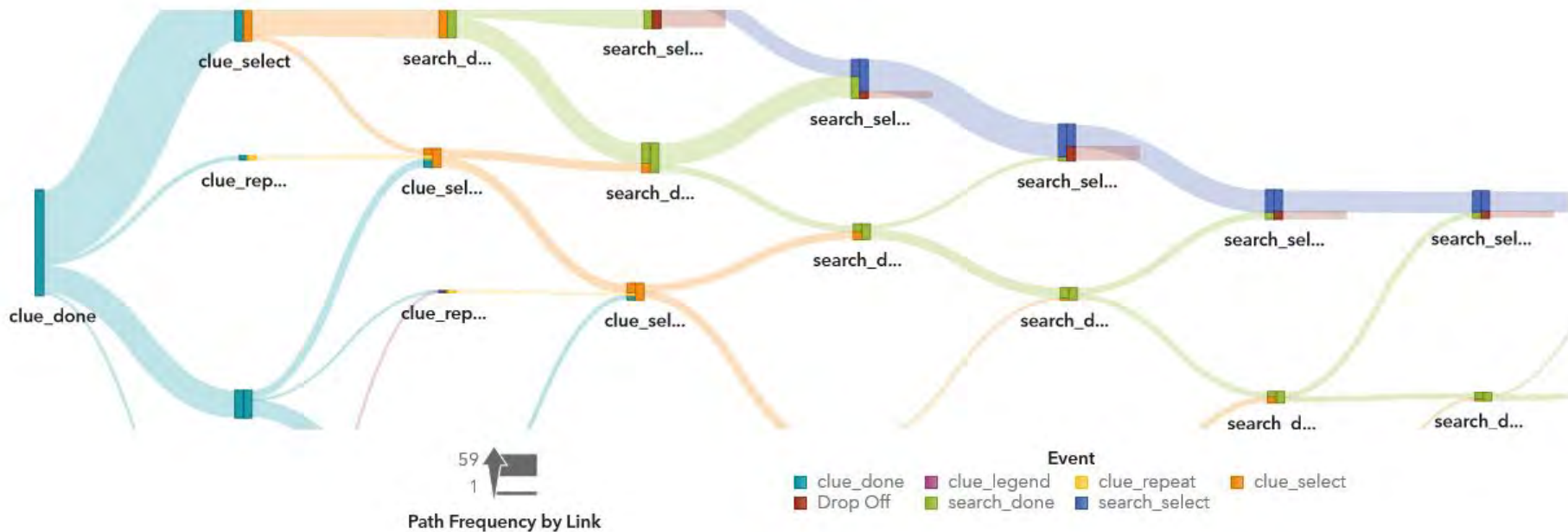
**Path Frequency by Link**













Questions?