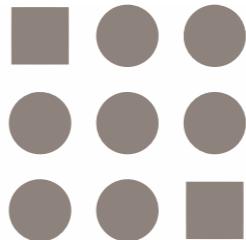
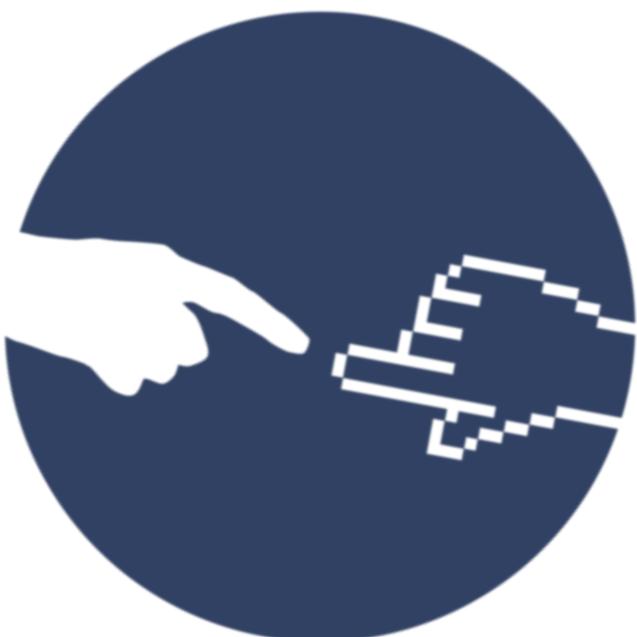


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# Interaction for Visualization

Hanspeter Pfister



**Obama has 431 ways to win**

84% of paths

**5 ties**

0.98% of paths

**Romney has 76 ways to win**

15% of paths

D Florida

If Obama wins Florida...

R Ohio



D North Carolina

and N.C.,

**Obama wins.**

Virginia

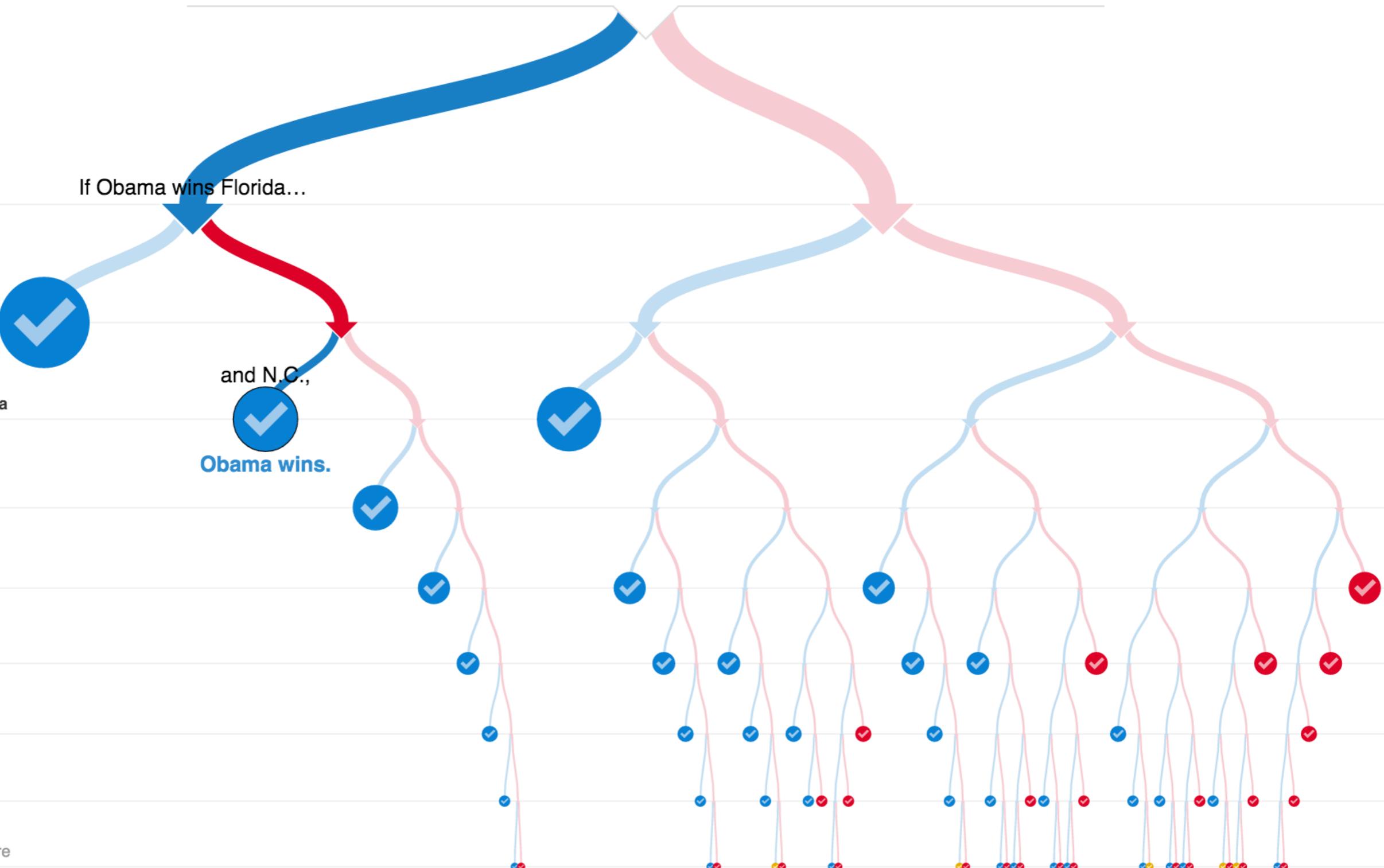
Wisconsin

Colorado

Iowa

Nevada

New Hampshire



# Feedback

- The difference between ordinal, quantitative, and nominal data
- Why do people use color as an indicator so often if it is the least effective encoding?
- How to integrate Bertin, Tufte, Gestalt, Ware into a coherent framework?

# Midterm Exam

- In class, 90 min, **March 8**
- Open book
- Design a visualization, including sketches
- Theoretical questions from the lectures: Tufte, Bertin, Gestalt, Ranking of Visual Channels, Interaction (today), Process (next week), ...

# Midterm Project

- Take home, **March 8-13**
- Effort should be equal to one homework
- D3/SVG/HTML/CSS implementation
- Preparation: Complete **ALL** labs (labs 1-6), review **ALL** lectures, including pre-readings
- Rules: all work must be your own, no communication with others, no Piazza

# Today

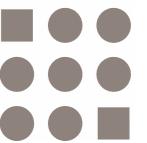
**Define** “Interaction for Visualization”

**Explore** the design space

**Create** your own interaction story board

# Define

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“The communication between user and the system” - Dix et al., 1998



Star Trek IV: The Voyage Home (1986)

# Activity

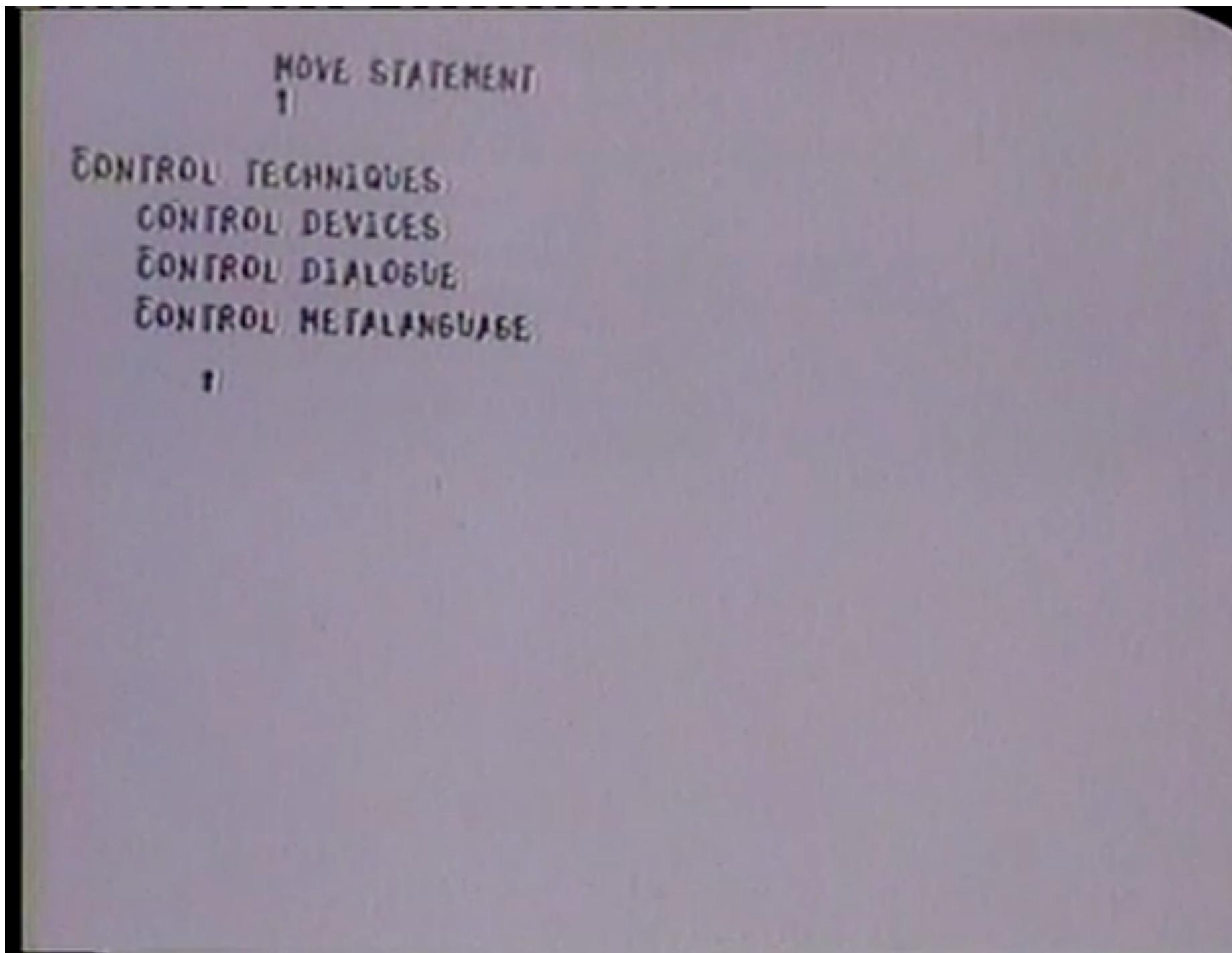
Think about how we interact with electronic devices. How do we provide input? (1 min)



# Modalities for Interaction

- WIMP: in this class  
**Windows, Icons, Menus and a Pointing device**
- AR / VR
- Touch
- Gesture
- Language (“Hello Siri”)

# The mother of all demos



Douglas Engelbart - December 9, 1968

# BUXTON COLLECTION

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## Explore

Browse devices by type (html)



chord keyboard



e-reader



game controller



gloves and rings



handheld



joystick



keyboard



mouse



pedal



pen computer



phone



reference object



stylus



tablet



touch pad



touch screen



trackball



watch



miscellaneous

# Activity

When is interaction useful in visualization? Think of at least two scenarios. (1 min)



# ... Visualization

- How can we create effective visualizations when we have **more information than visual space?**
- How can we address an audience with many **different questions?**
- How can we use the fact that we create visualizations for electronic devices with **many input modalities?**

# Activity

What do users intend to do using the following interaction techniques? Do not use the names of the techniques in your answers. (3 min)

- Select
- Sort
- Filter
- Navigate
- Coordinate

# User Intent

- Select - “Mark something as interesting”
- Sort - “Show me a different arrangement”
- Filter - “Show me something conditionally”
- Navigate - “Show me more or less detail”, “Show me something different”
- Coordinate - “Show me how A is related to B”

based on:

Toward a Deeper Understanding of the Role of  
Interaction in Information Visualization  
Ji Soo Yi, Youn ah Kang, John T. Stasko

# Explore the Design Space

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# Activity

For each of the following interaction categories, write down two examples that could be used in visualization. (3 min)

- Select
- Navigate
- Filter

# Activity

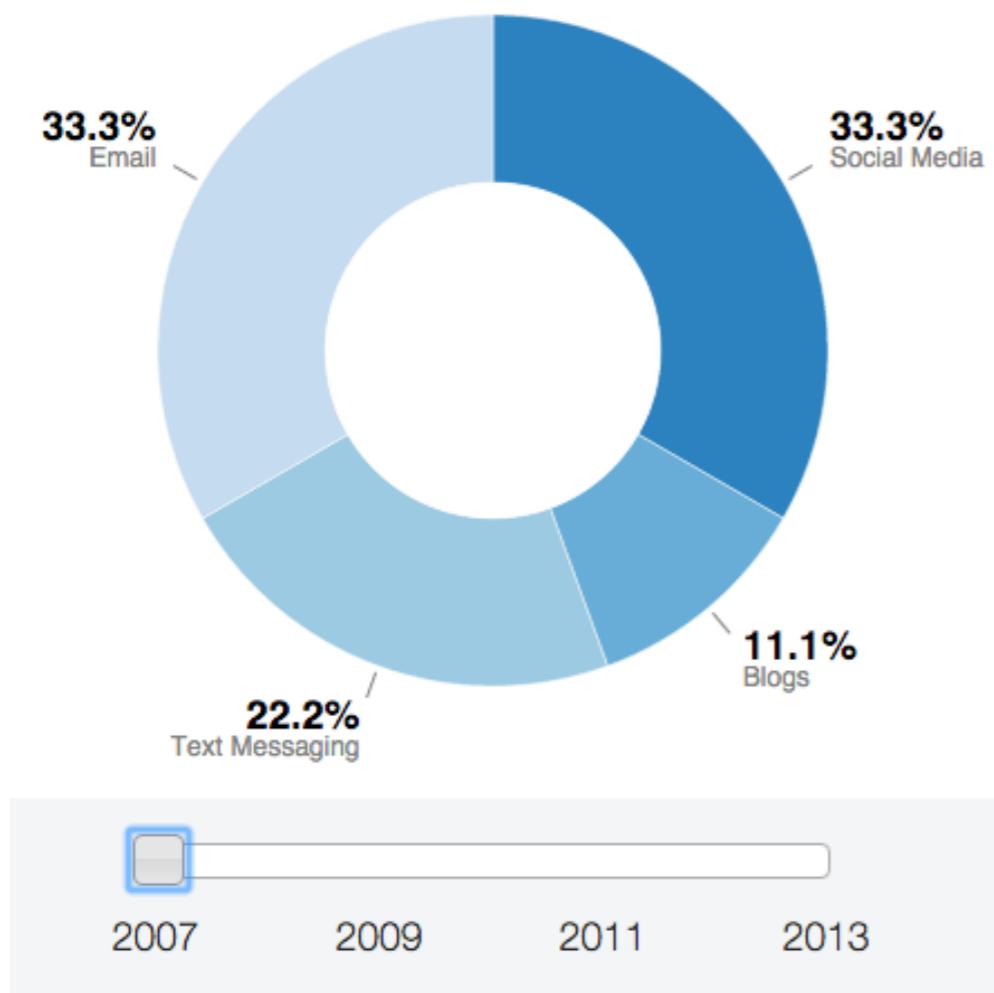
Discuss your findings with your neighbor. Identify the most interesting representative for each category. (3 min)

(Select, Navigate, Filter)



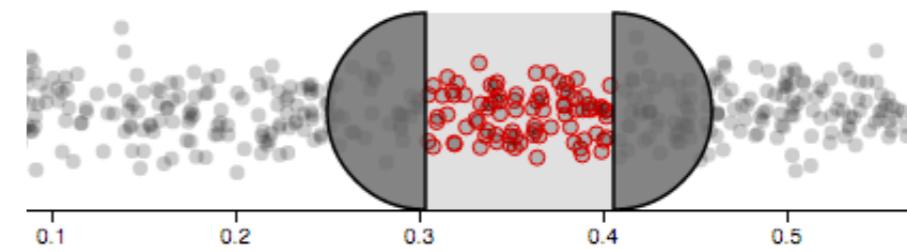
# Select: Slider

Alpha slider



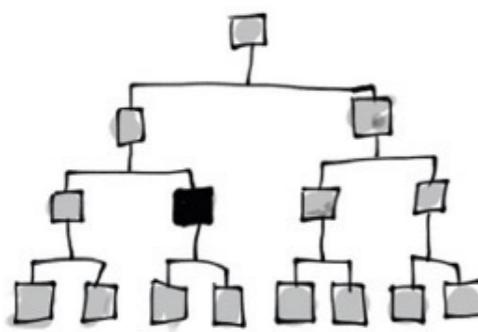
<http://jsfiddle.net/ksfph/>

Visualization slider

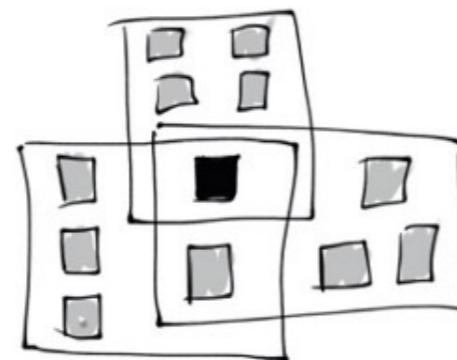


<http://bl.ocks.org/mbostock/4349545>

# Sort & Filter: Faceting



HIERARCHY



FACETS

Facets

The screenshot shows a flight search results page from kayak.com. At the top, it displays the search criteria: BOS ↔ ROM, Feb 23 → Feb 29, Tuesday → Monday, Economy cabin, 1 traveler, and a 'Change' button. Below this, a green line graph indicates flight availability. The sidebar on the left contains facet filters:

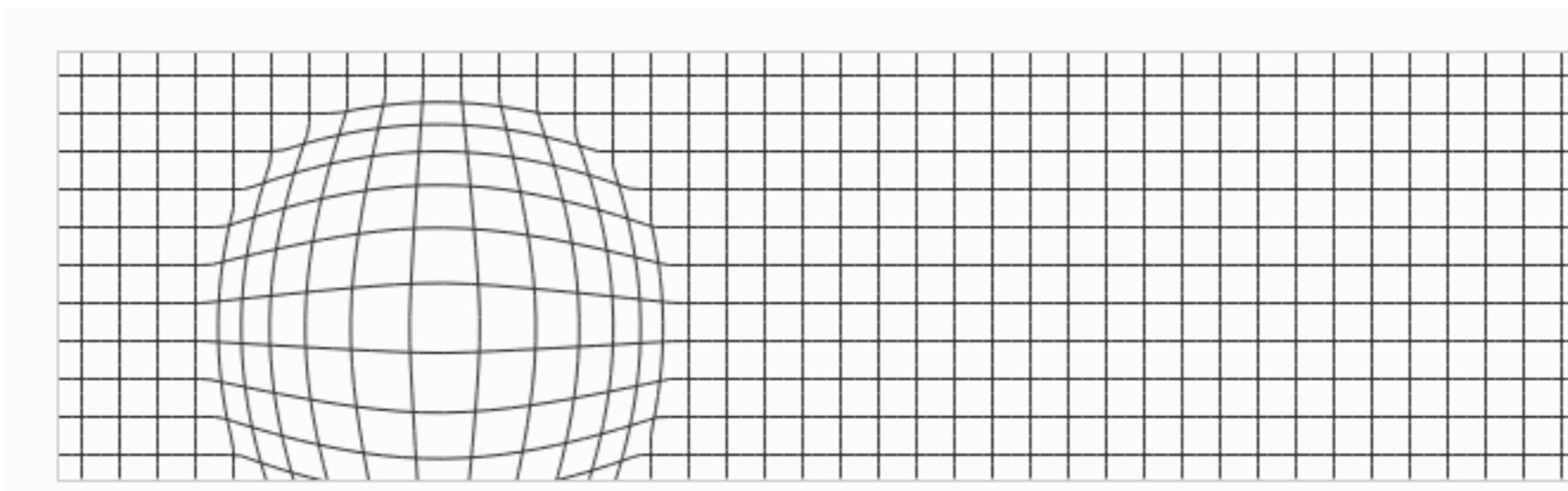
- Stops:** nonstop, 1 stop (checked), 2+ stops
- Times:** Take-off Boston (BOS) Tue 5:30a - 11:00p, Take-off Rome (ROM) Mon 5:30a - 10:00p, Show landing times
- Airports:** Depart/Return same (unchecked), Boston (checked), BOS: Logan Intern... \$577, Rome (checked), CIA: Ciampino \$1331, FCO: Fiumicino \$577
- Airlines:** Carrier | Alliance, Aer Lingus \$866, Air Canada \$1744, Air Europa \$1865

The main content area lists flight results with columns for departure and arrival times, duration, stops, and price. Some results are marked as 'Smart Flies' deals. The results are grouped by travel class: Student, Economy, and Economy.

<https://www.kayak.com/flights>

# Navigate: Overview & Detail

FishEye



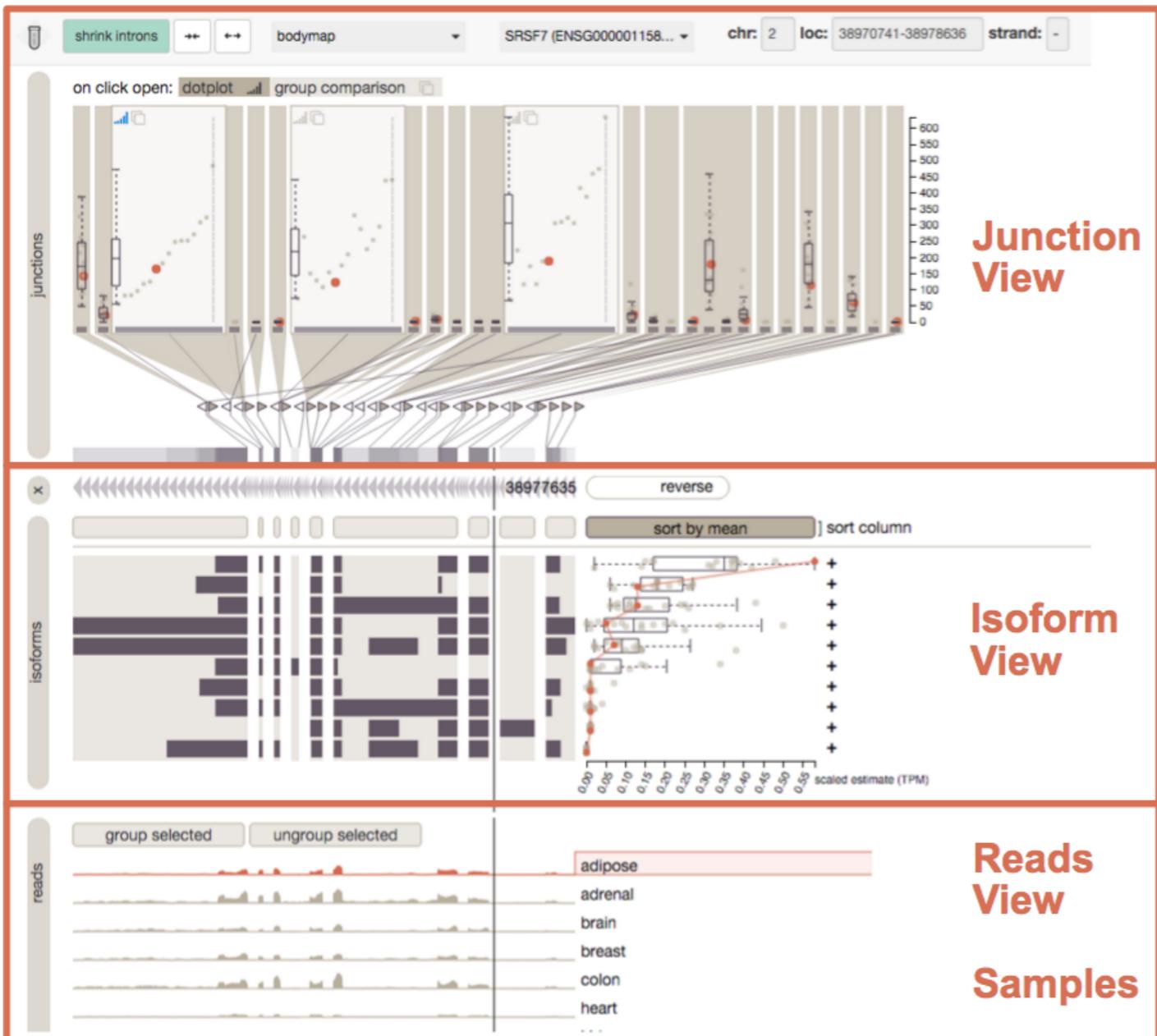
<https://bostocks.org/mike/fisheye/>

MiniMap



<http://codepen.io/billdwhite/pen/lCADi>

# Coordinate: Multiple Views



highlighting colors

red for samples



yellow for isoforms

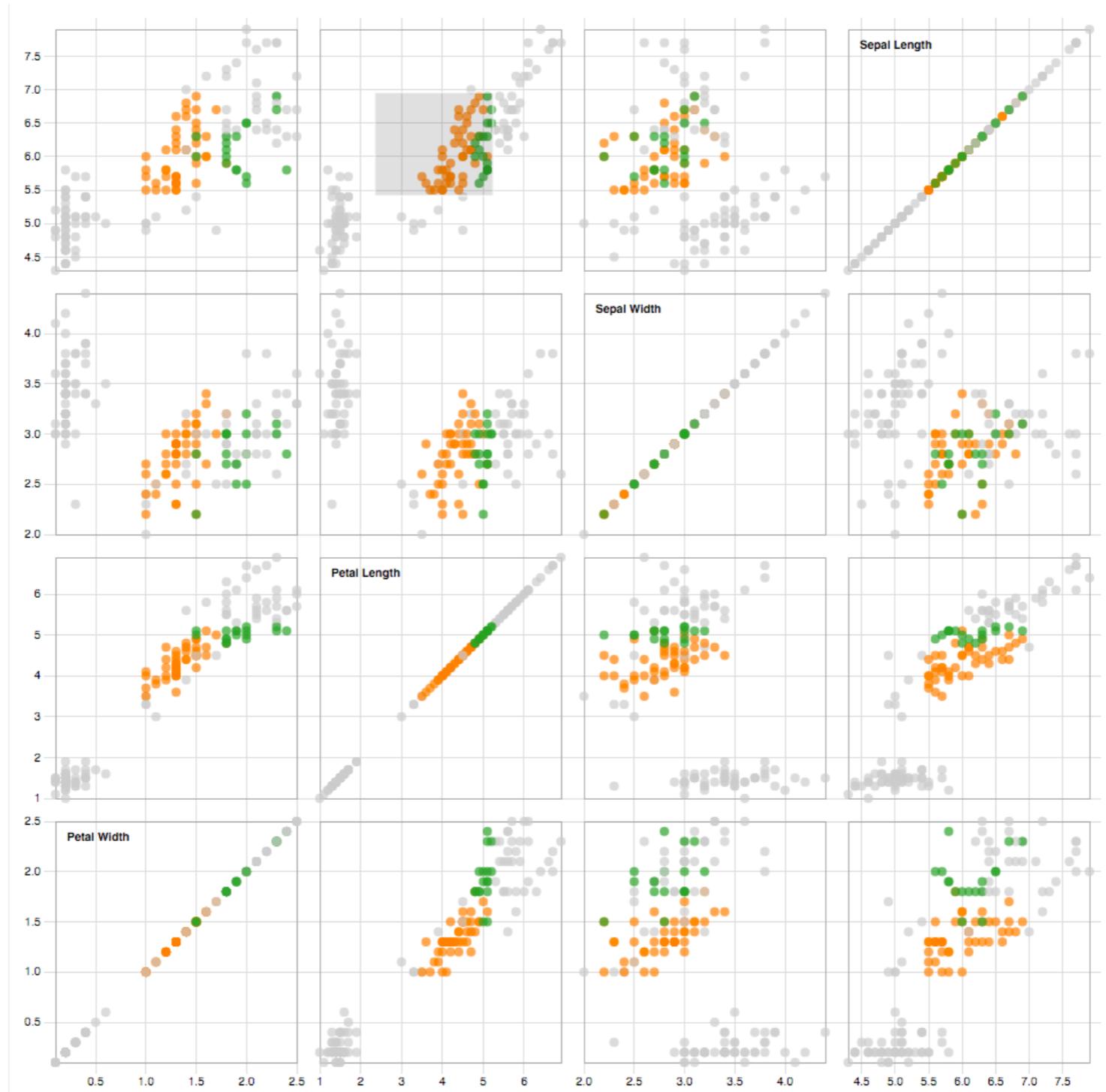


blue for junctions



vials.io

# Select: Brushing & Linking



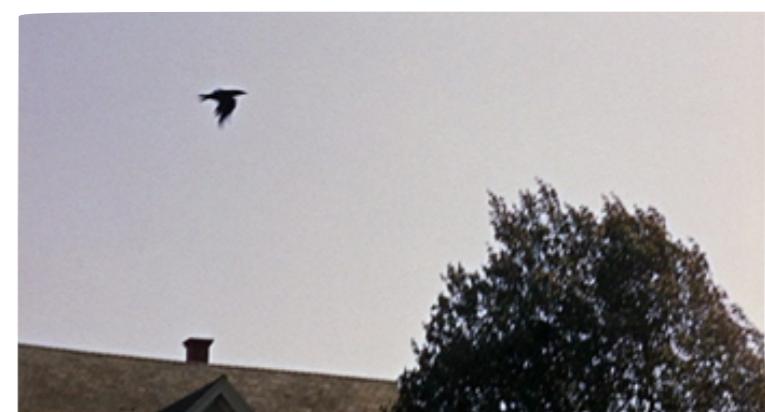
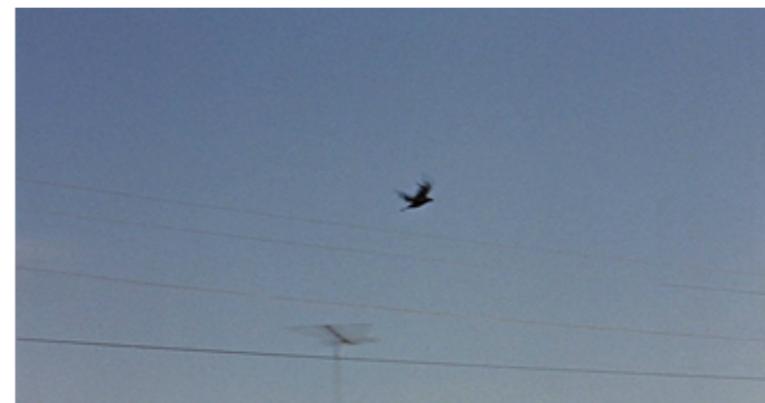
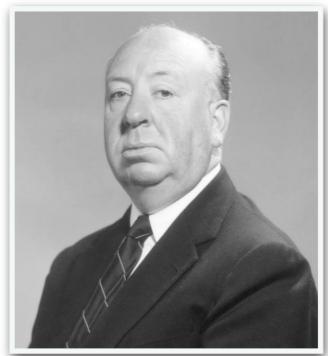
# Create a Storyboard

CS

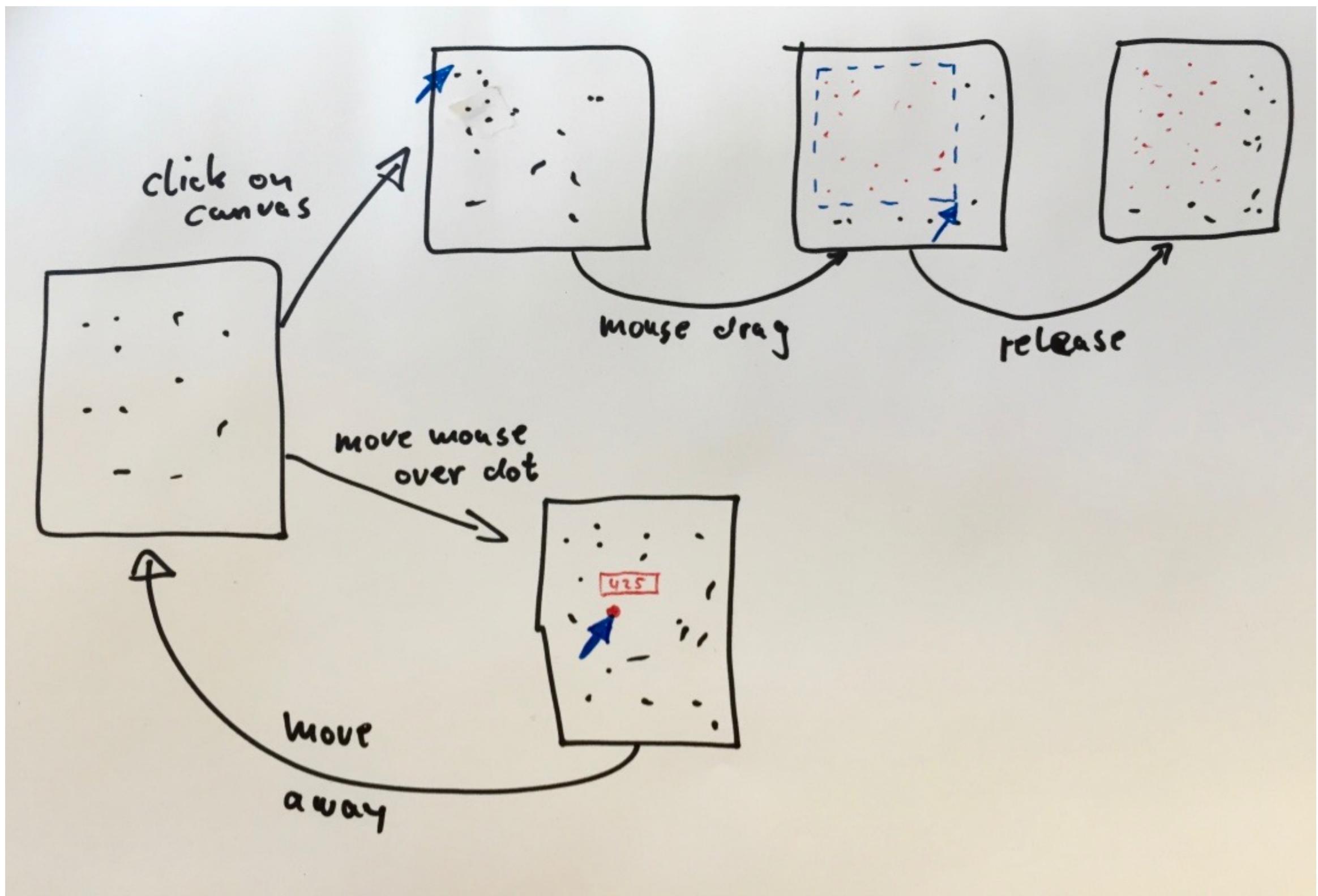
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# Storyboards

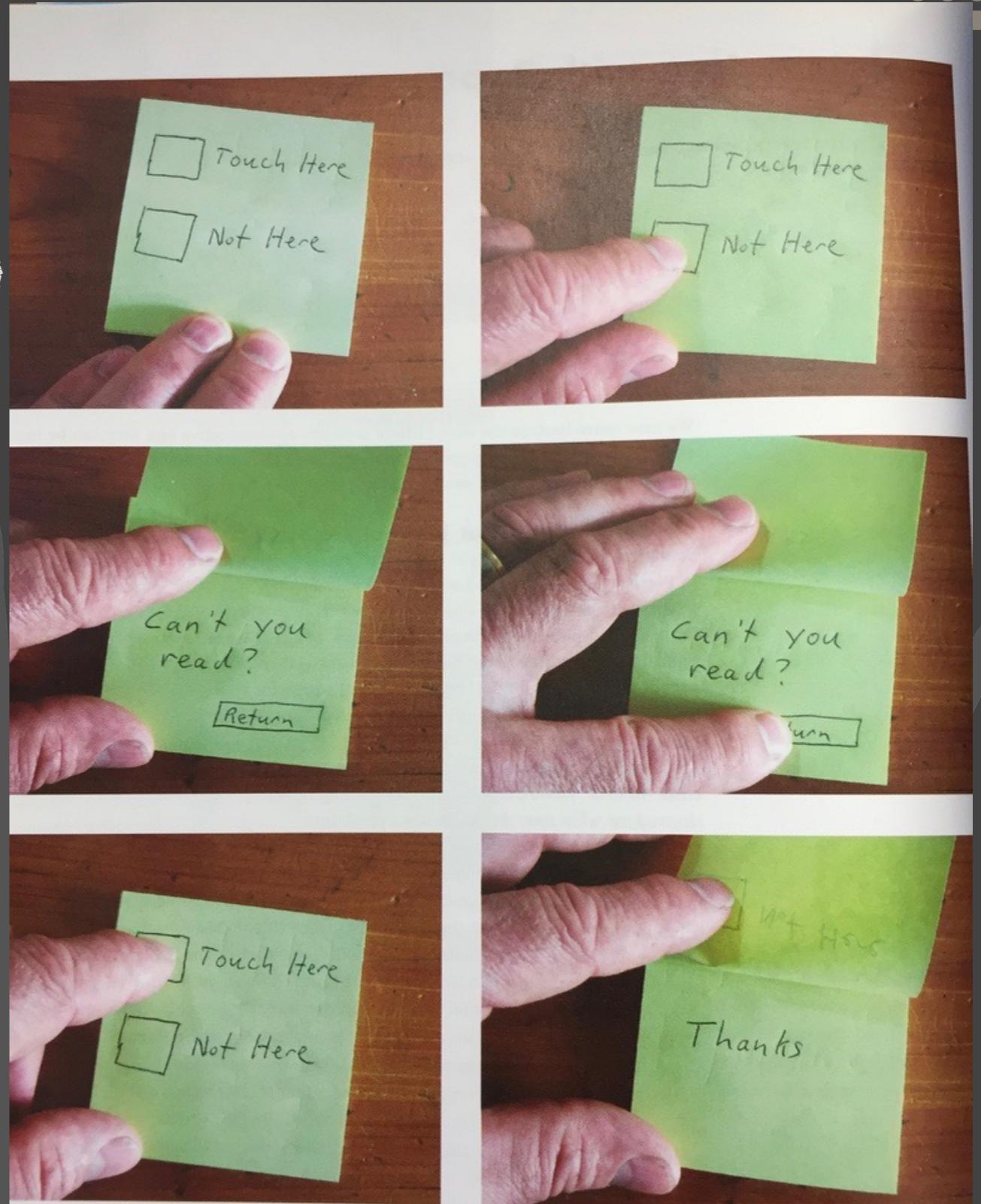


# Interaction Storyboards



# Activity

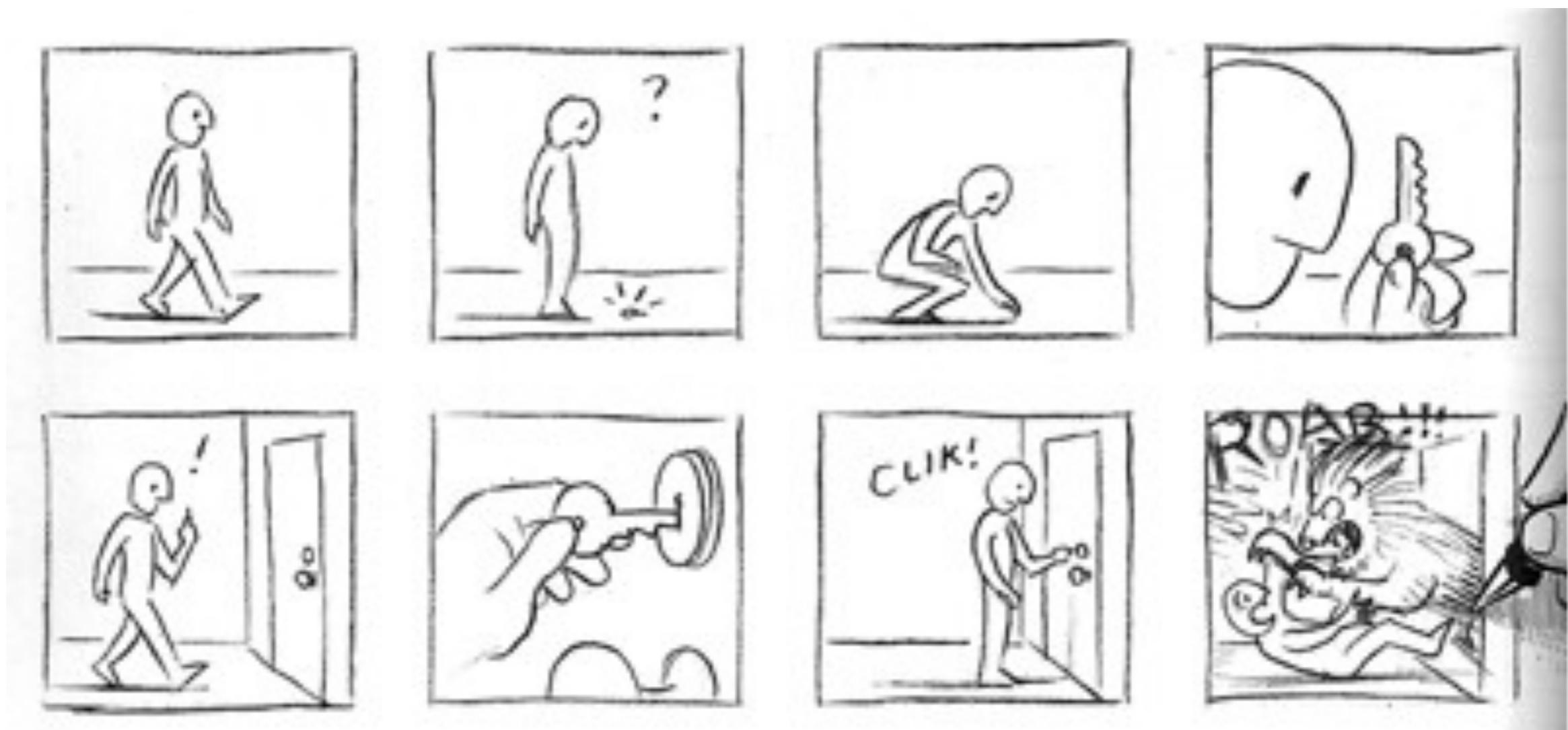
Convert this interaction into a storyboard. (5min)



3: A Simple Finger Exercise

Create and experience an interactive paper interface in two minutes... nothing more than Post-it notes and your finger!

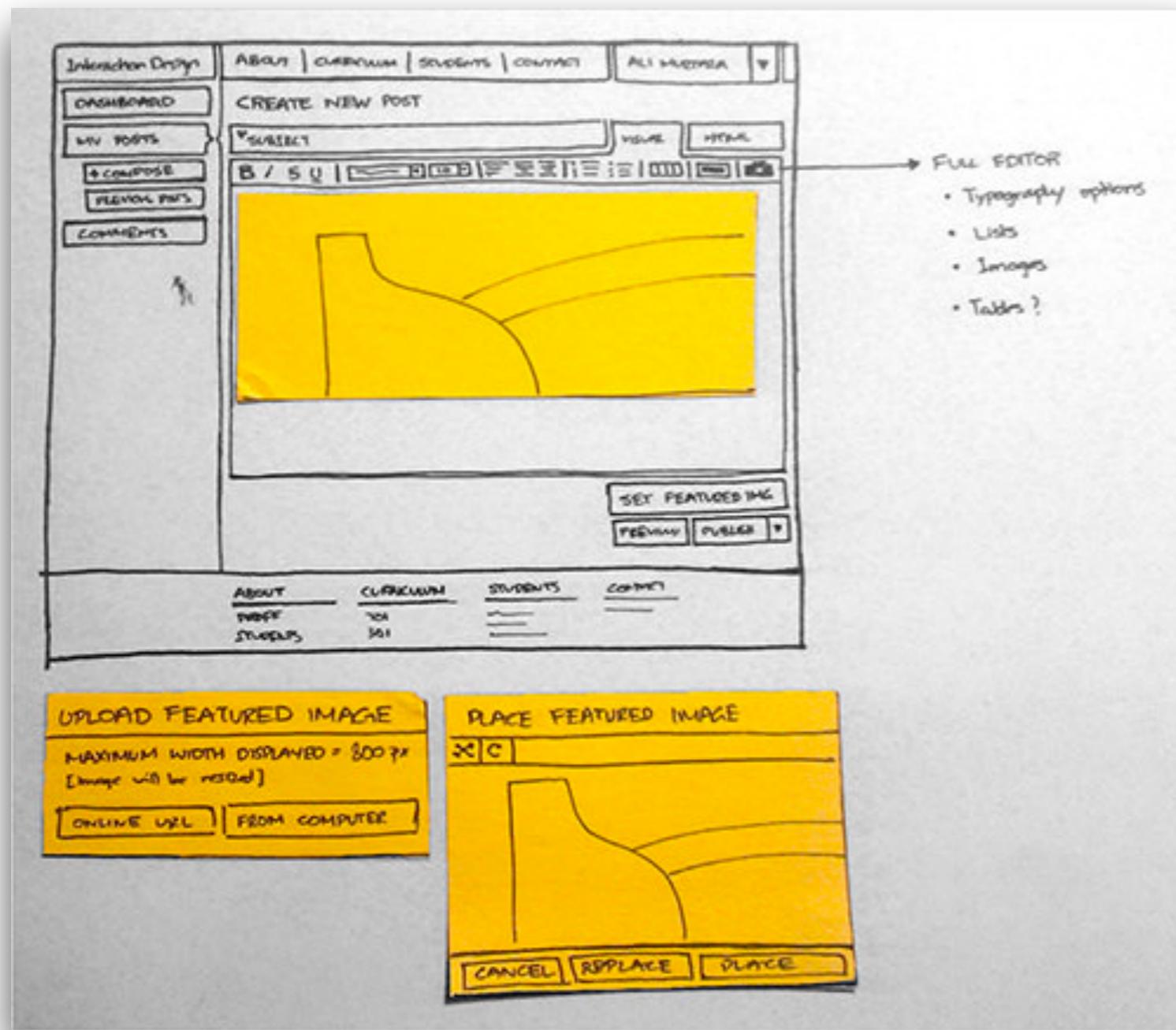
Each frame is substantial.  
Leaving it out alters the story.



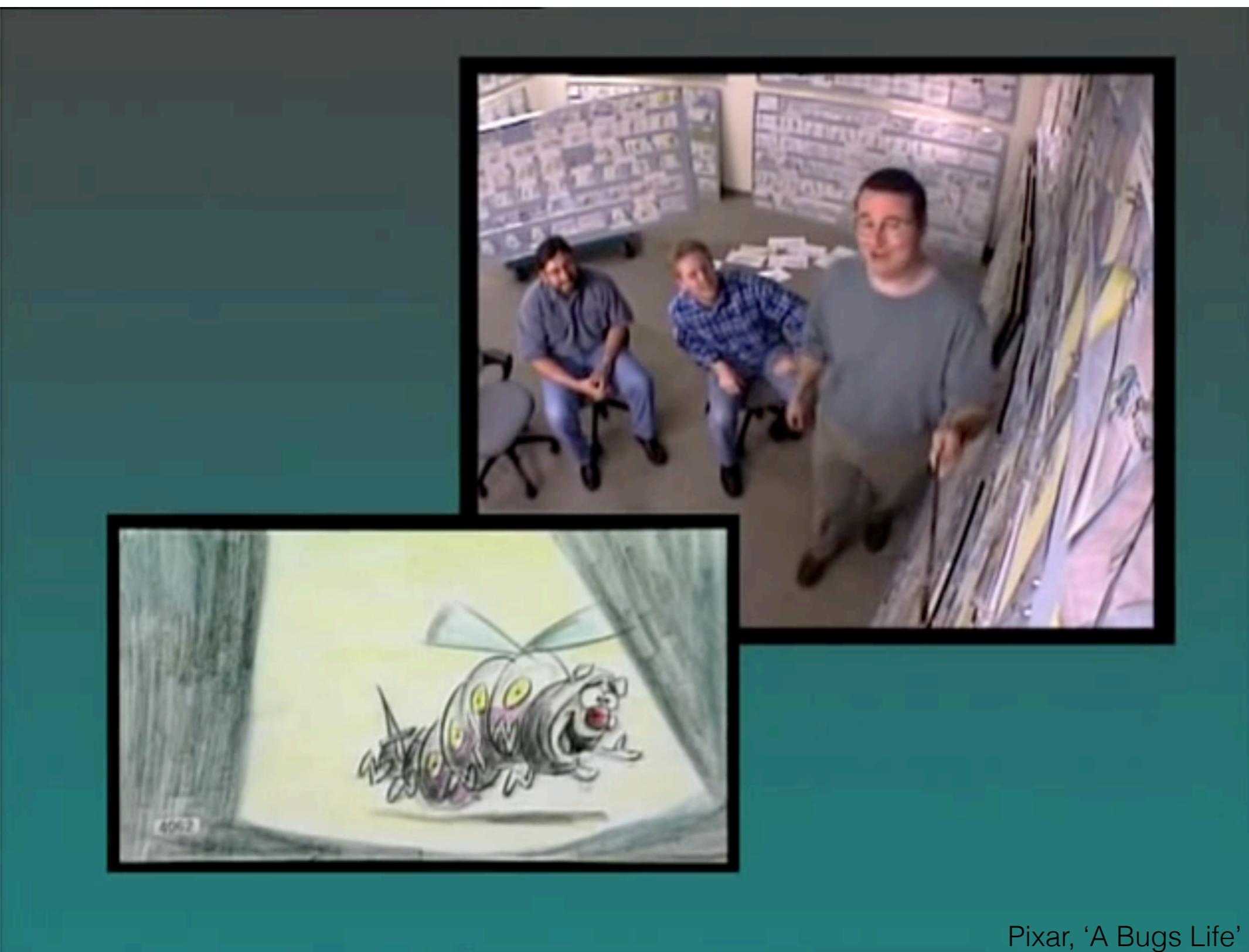
Scott McCloud, 'Understanding Comics'

# “My strategy has always been: be wrong as fast as we can.”

Andrew Stanton,  
Director of Finding Nemo  
and WALL-E



# Narrative Storyboards

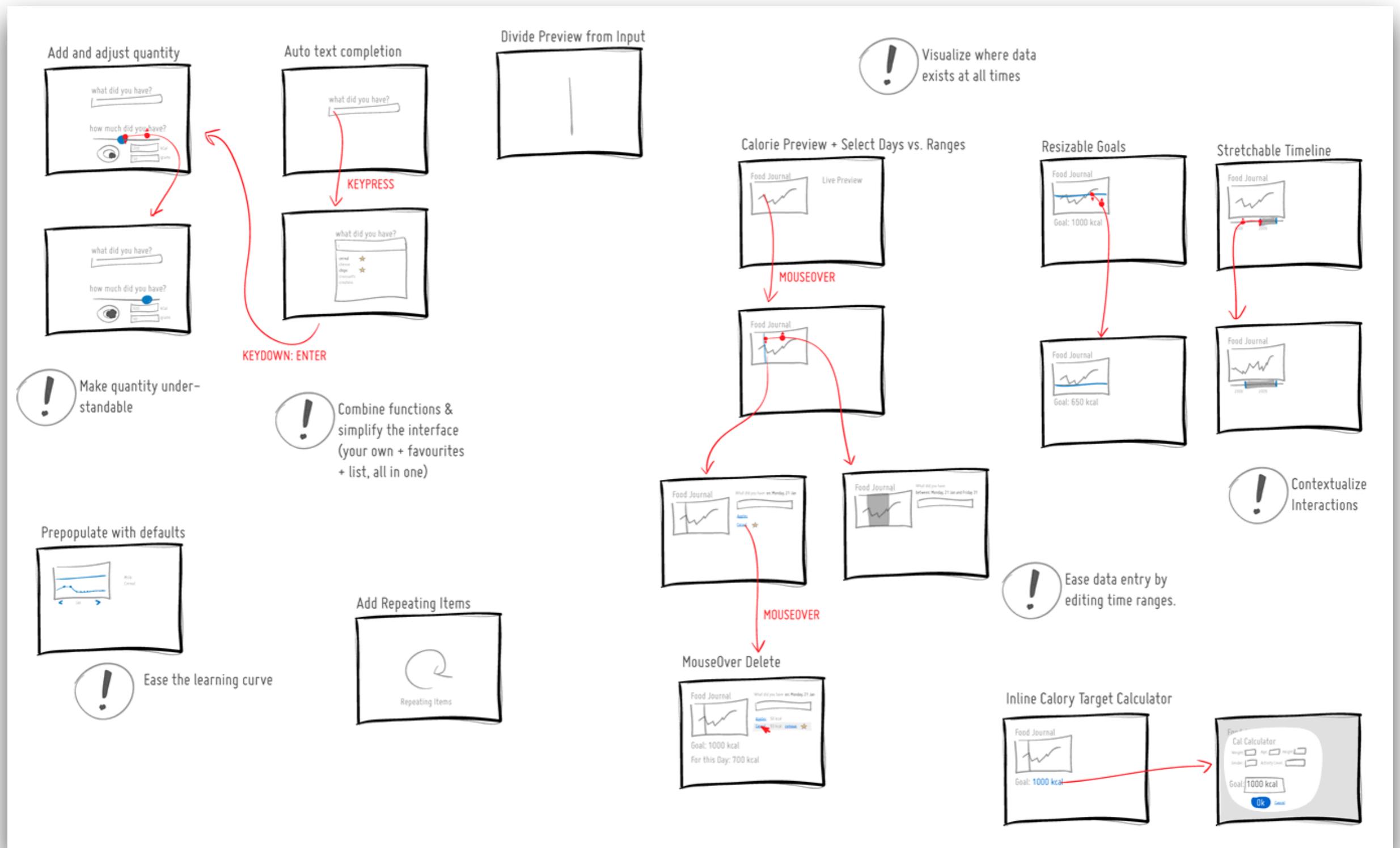


Pixar, 'A Bugs Life'

# Video Prototypes

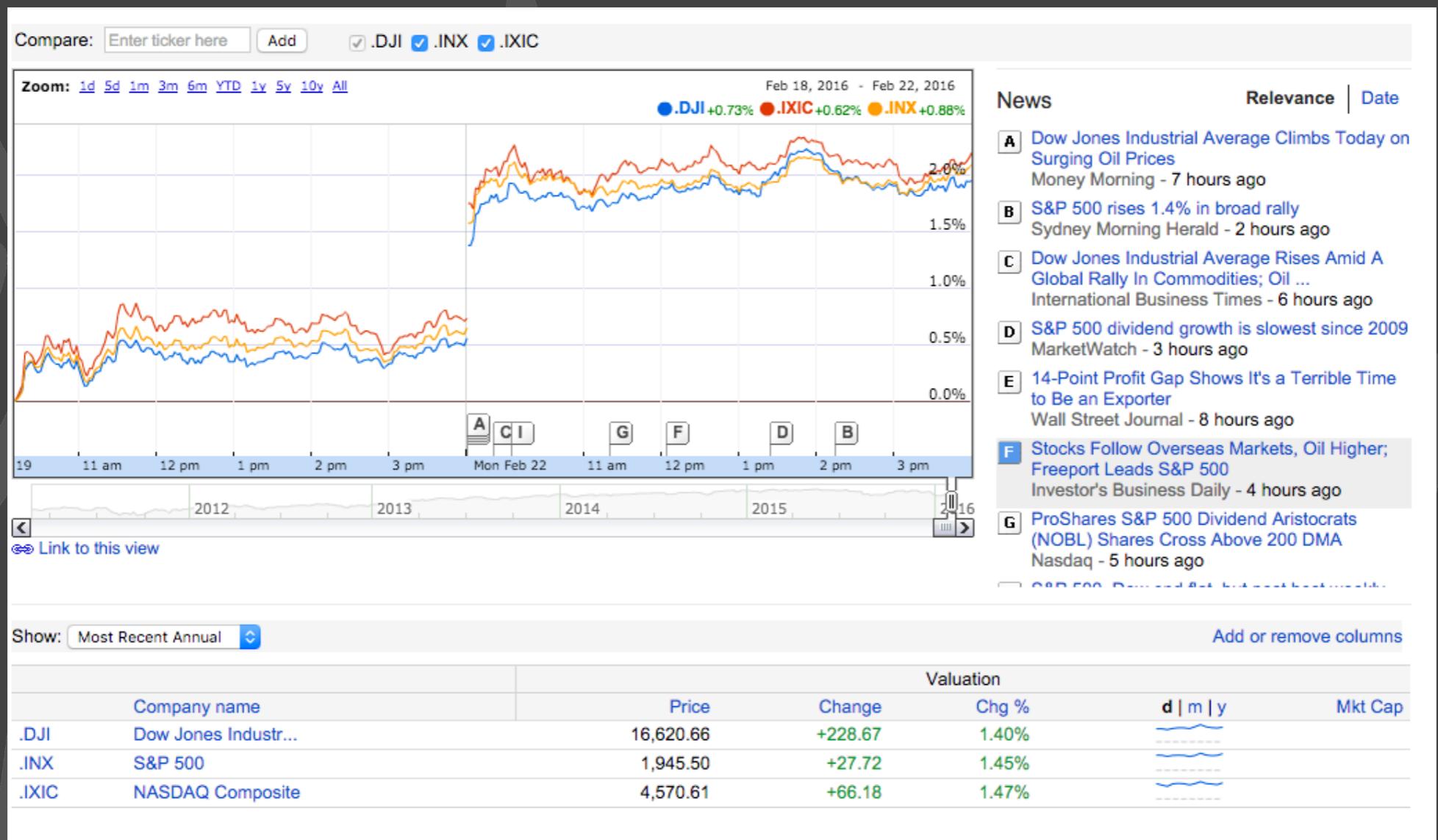
**Touch here  
not there :)**

# Branching Storyboards



# Activity

Convert this example into a branching storyboard. Capture at least two interactions. (10 min)



# [bit.ly/cs171-finance](http://bit.ly/cs171-finance)



Show: [Most Recent Annual](#) [▼](#) [Add or remove columns](#)

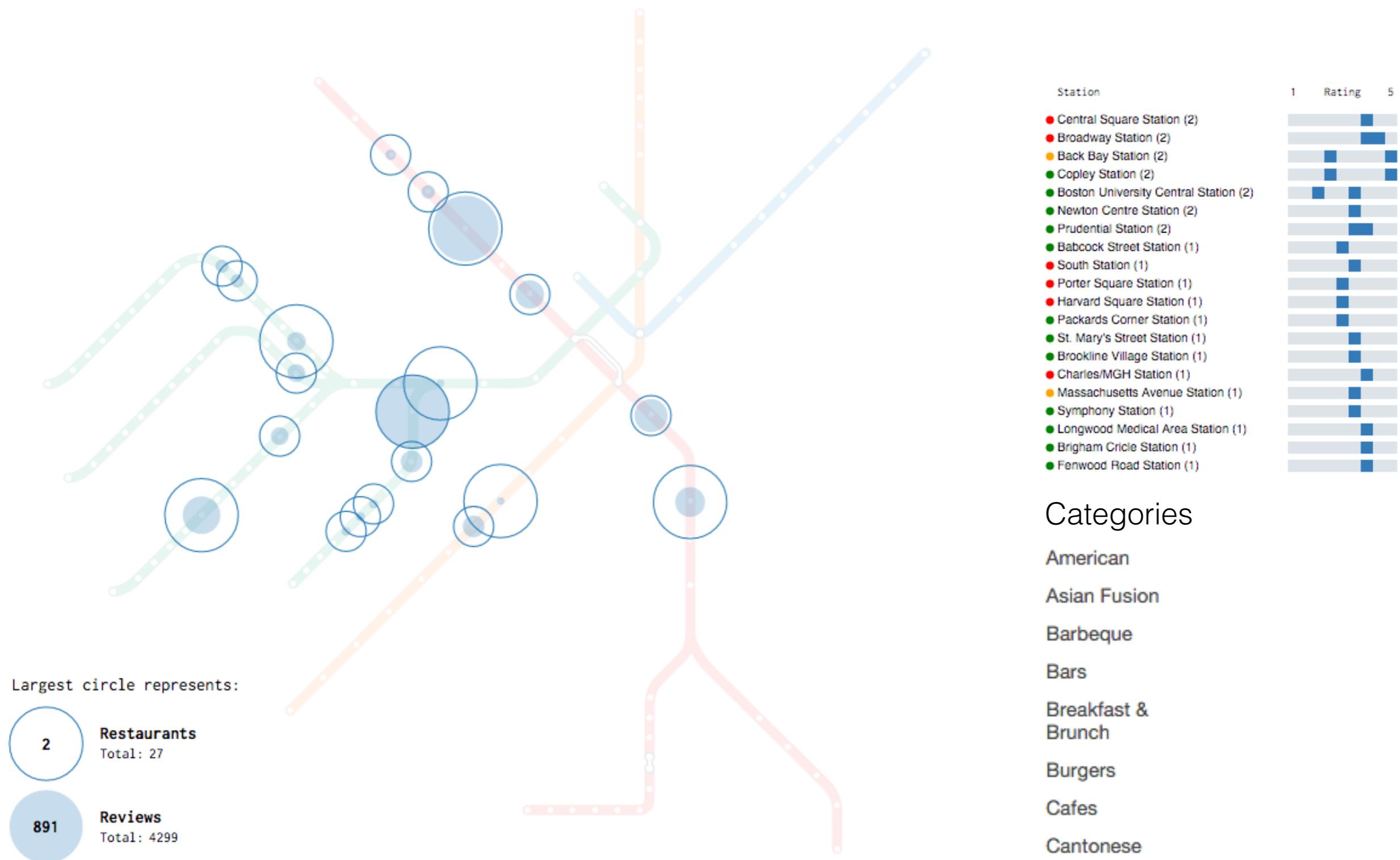
	Company name	Price	Change	Chg %	d   m   y	Mkt Cap
.DJI	Dow Jones Industri...	16,620.66	+228.67	1.40%		
.INX	S&P 500	1,945.50	+27.72	1.45%		
.IXIC	NASDAQ Composite	4,570.61	+66.18	1.47%		

# Activity

Swap your storyboard with your neighbor and give peer feedback on what you understood well and what needs clarification. (2 +2 min)

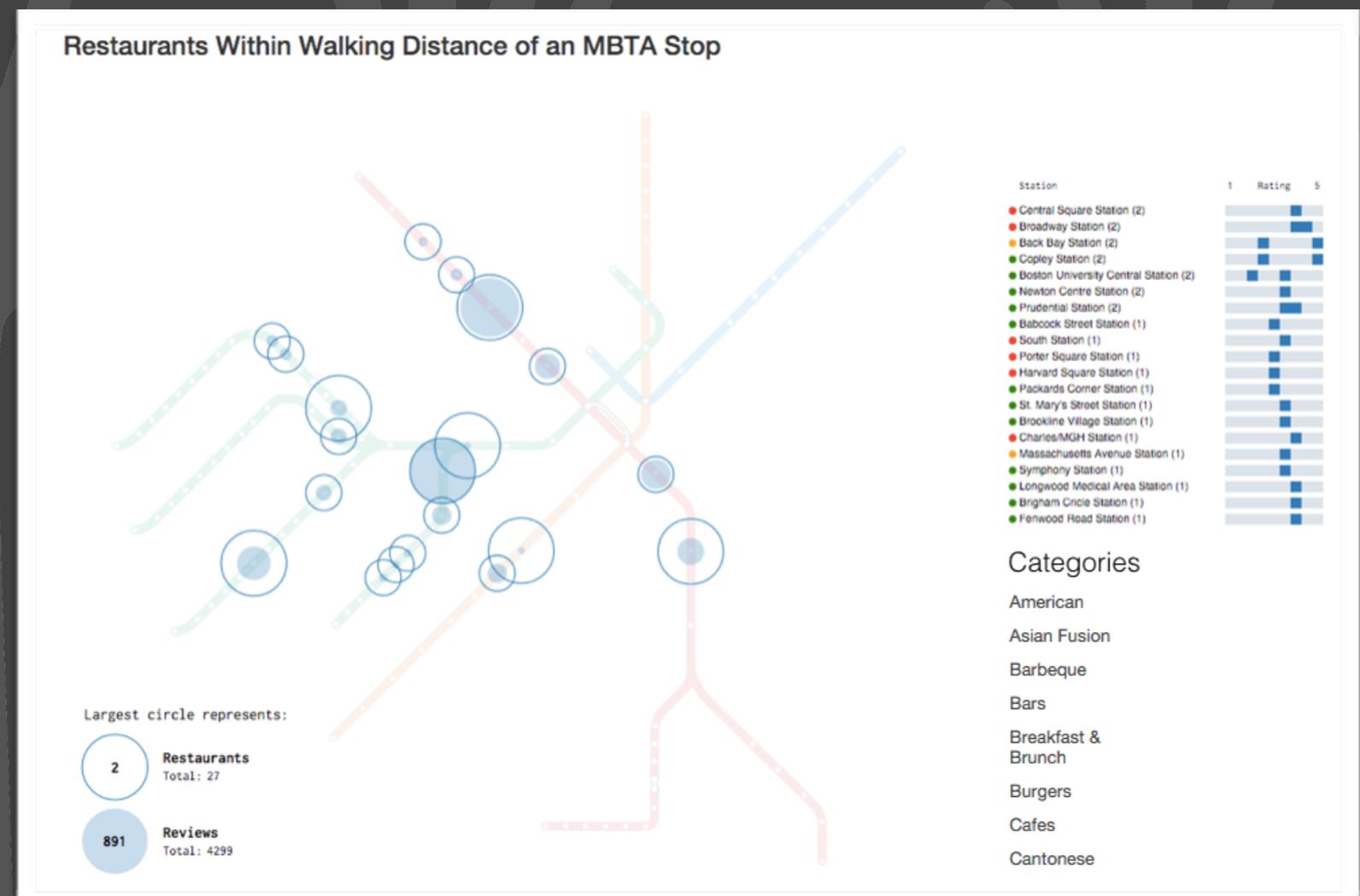


# Restaurants Within Walking Distance of an MBTA Stop

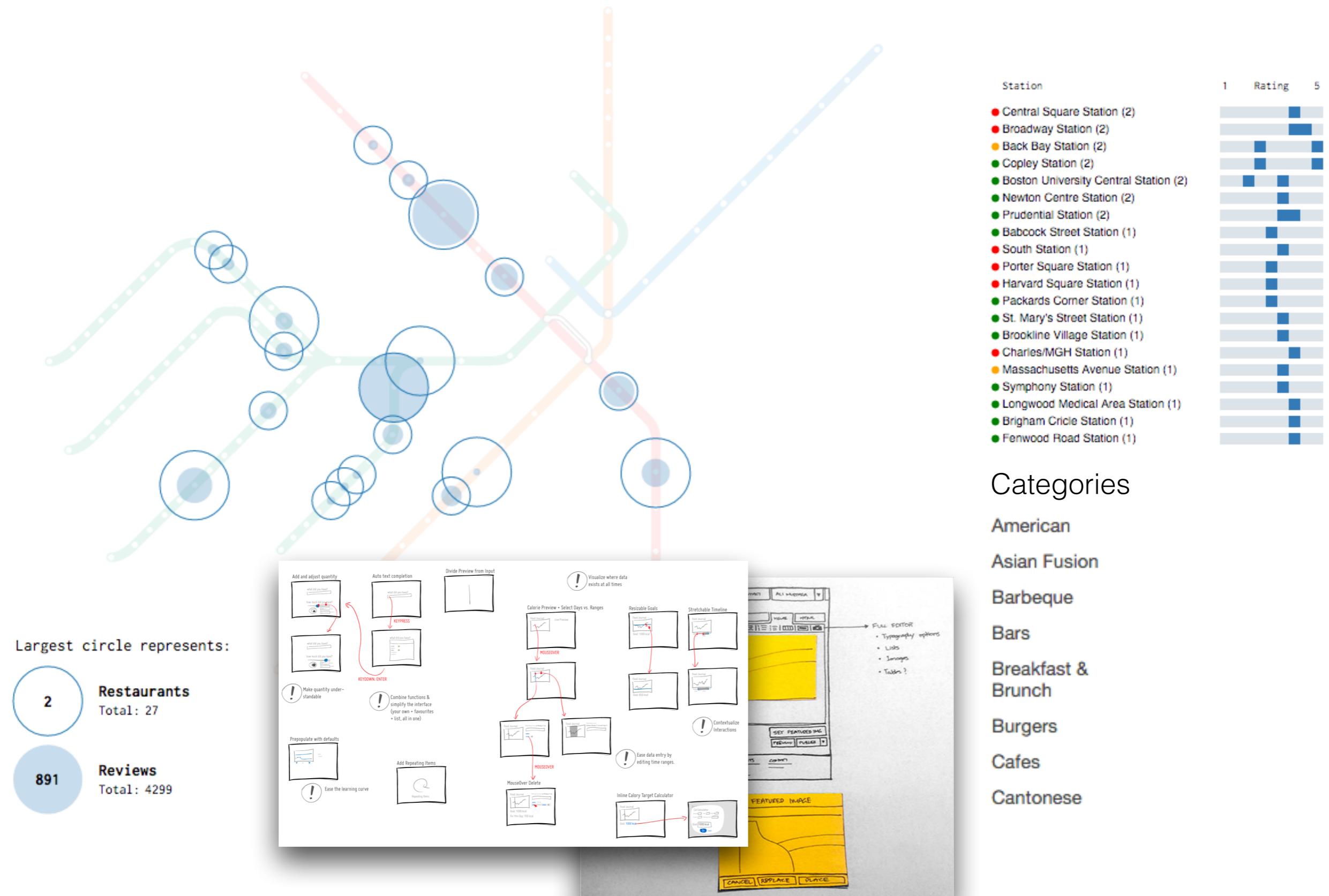


# Activity

What questions could you answer with this data and the visual encodings? For each question create a branch in an interaction storyboard. (10 min)



# Restaurants Within Walking Distance of an MBTA Stop



# Activity

Create groups of 4-5 students to discuss your ideas. Nominate the top storyboard and be ready to present it.  
(5 min)



# Today

## **Define** “Interaction for Visualization”

Interaction is necessary for visualization (especially for large and complex data)

## **Explore** the design space

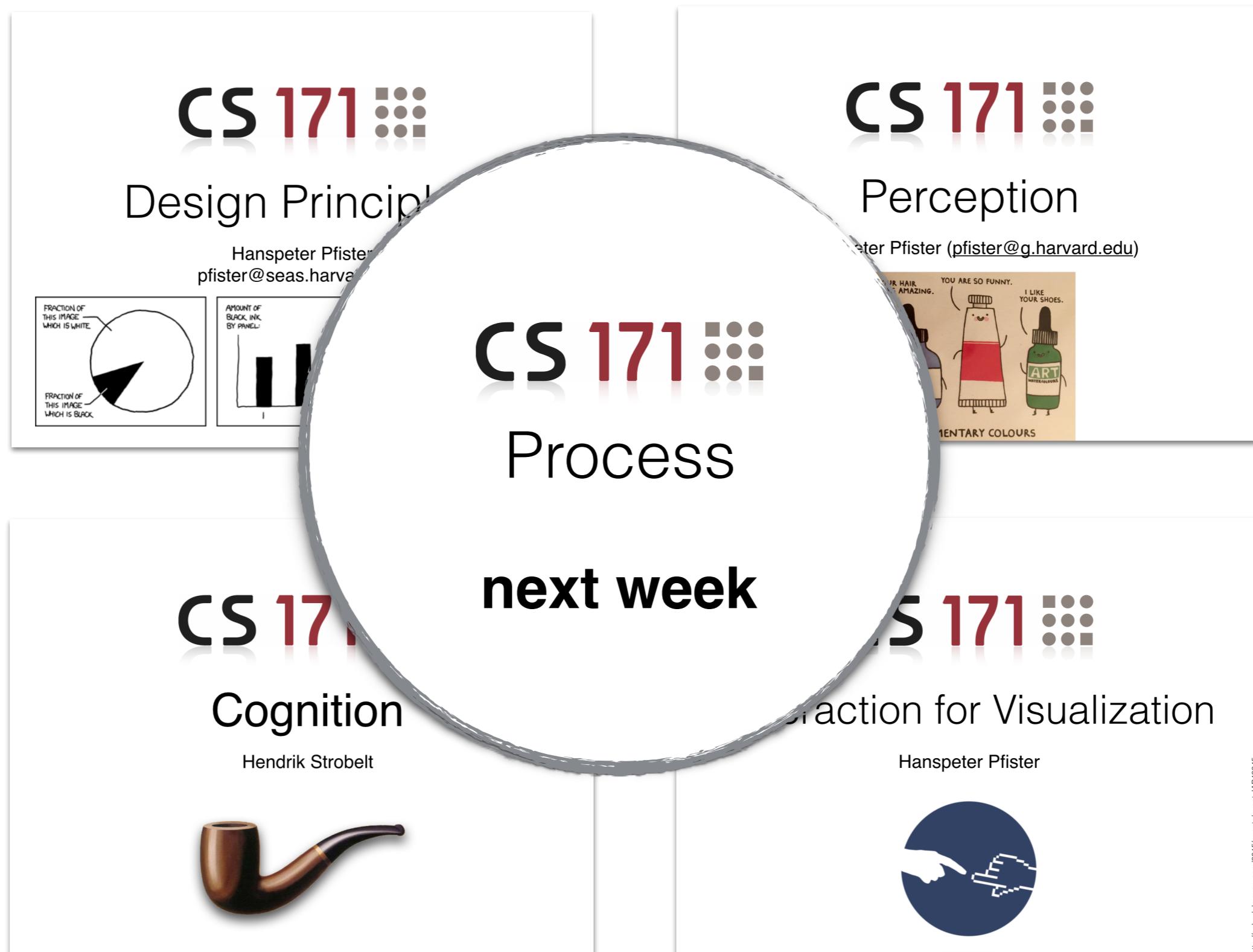
Filter, Sort, Select, Navigate, Coordinated Multiple Views, Brushing, Faceting

## **Create** your own interaction story board

Storyboards can communicate an interaction idea. They are a cheap method to iterate over interaction designs.

1 - min paper !

# Putting it all together...





## This Thursday...

- D3 enter-update-exit pattern.
- Reading: "Enter, Update, Exit" by Christian Behrens  
<http://bit.ly/1Ps7UZs>



## Next Tuesday...

- The Process
- Reading: "Narrative Visualization: Telling Stories with Data", Edward Segel and Jeffrey Heer



## Homework (due Monday)...

- HW 5