# **Visual Narrative Flow:** Exploring Factors Shaping Data Visualization Story Reading Experiences

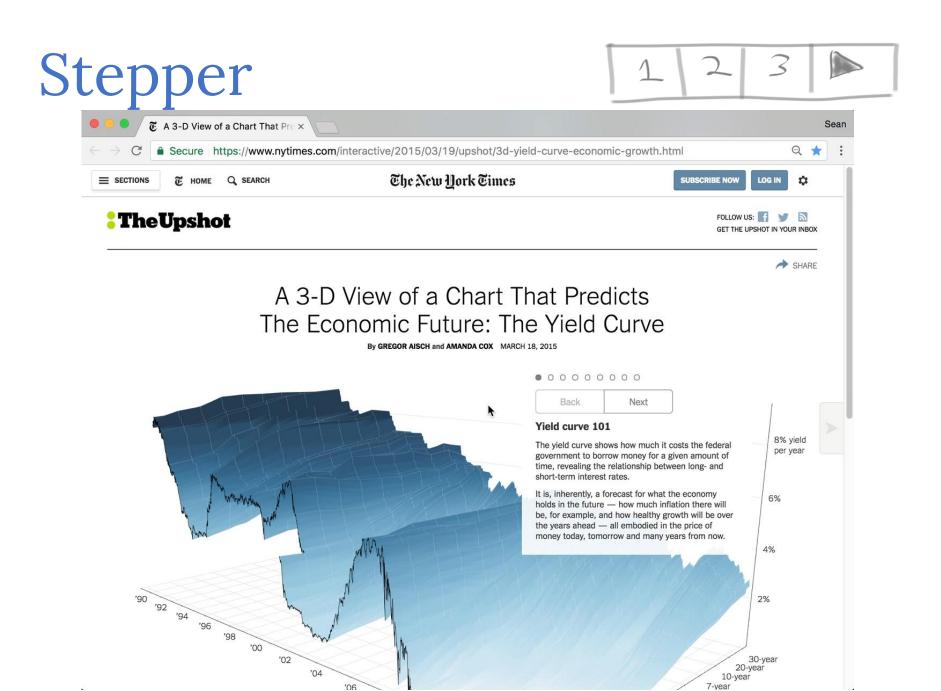
**Sean McKenna**<sup>1,2</sup>, Nathalie Henry Riche<sup>1</sup>, Bongshin Lee<sup>1</sup>, Jeremy Boy<sup>3</sup>, Miriah Meyer<sup>2</sup>

<sup>1</sup> Microsoft Research

<sup>2</sup> University of Utah

<sup>3</sup> United Nations Global Pulse

#### Visual Narrative Flow



#### Scroller A visual introduction to machin × Sean C () www.r2d3.us/visual-intro-to-machine-learning-part-1/ 🍖 ★ R2 D3 A visual introduction to k machine learning (A: English In machine learning, computers apply statistical learning techniques to automatically identify patterns in data. These techniques can be used to make highly accurate predictions.

### Discrete Scroller

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(A) The dark side of Guardian com ×

Sean

#### Secure https://www.theguardian.com/technology/2016/apr/12/the-dark-side-of-guardian-comments



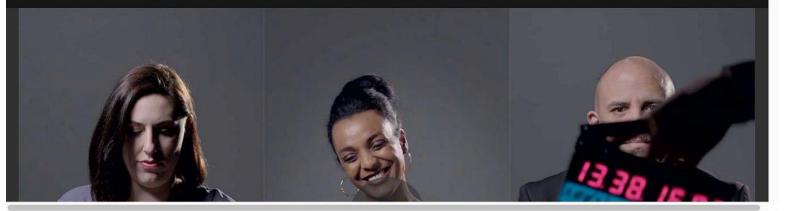
theguardian = all

#### The web we want

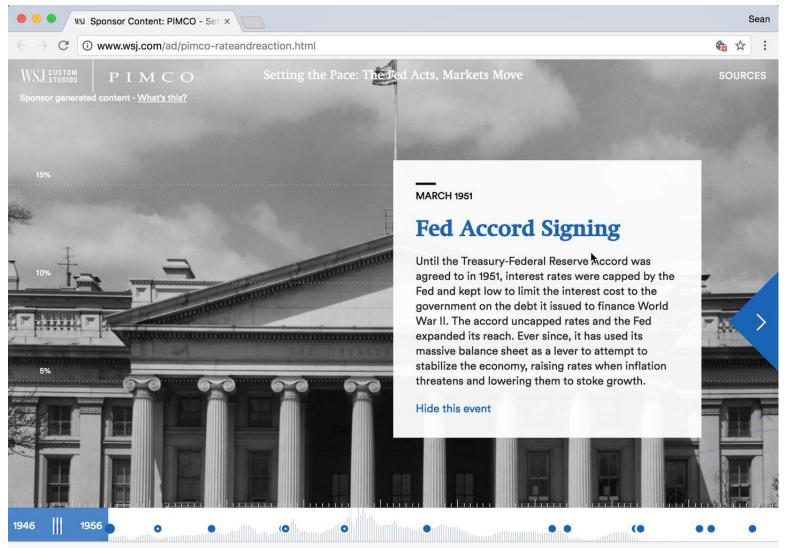
#### The dark side of Guardian comments

As part of a series on the rising global phenomenon of online harassment, the <sup>32</sup> Guardian commissioned research into the 70m comments left on its site since 2006 and discovered that of the 10 most abused writers eight are women, and the two men are black. Hear from three of those writers, explore the data and help us host better conversations online

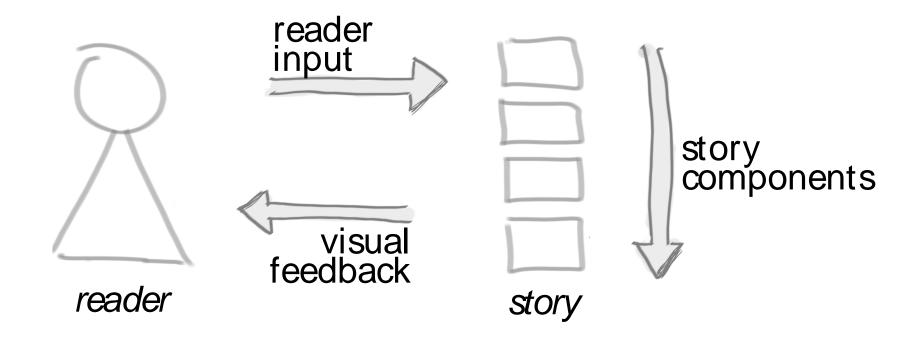
by Becky Gardiner, Mahana Mansfield, Ian Anderson, Josh Holder, Daan Louter and Monica Ulmanu



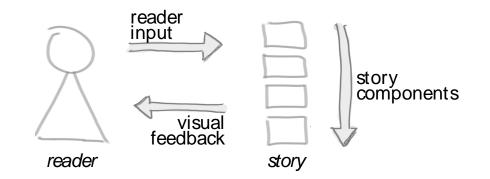
## Slider



#### Visual Narrative Flow

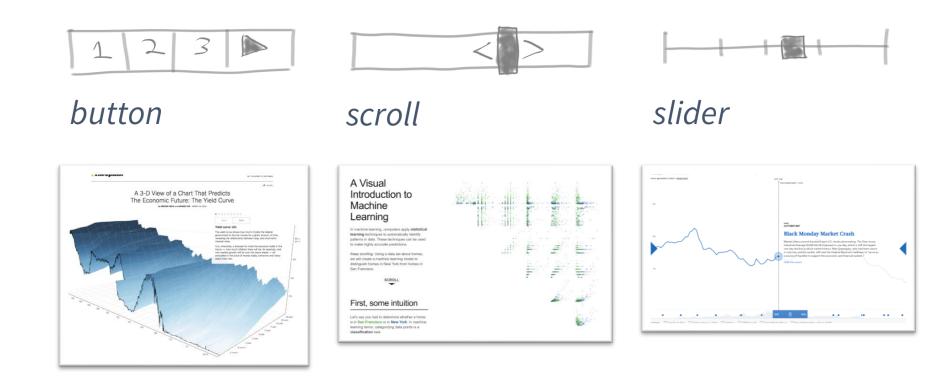


## Outline

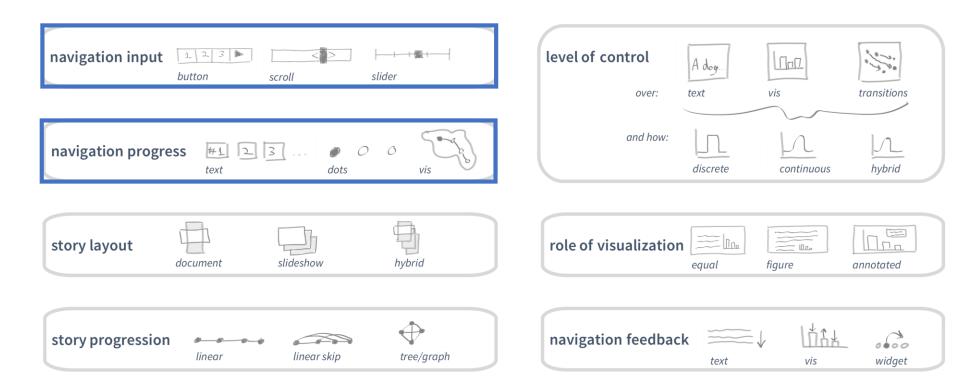


- 7 factors of visual narrative flow
- analysis of 80 stories & authoring prototype
- 3 studies on preference, usability, and engagement

# Navigation Input



# Design Space



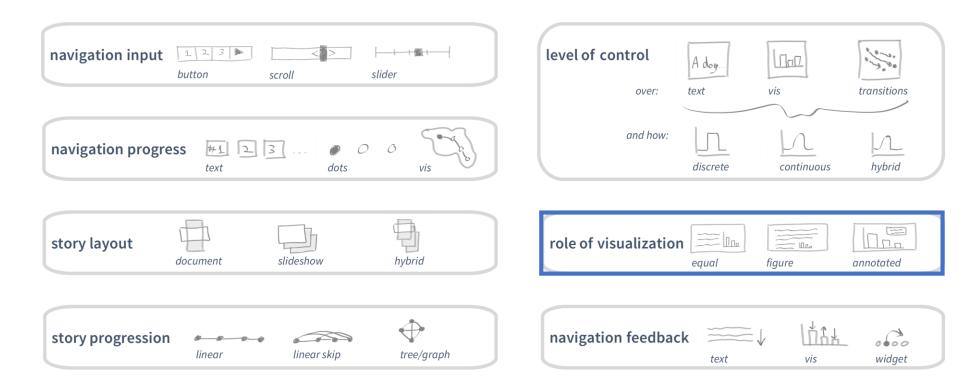
# **Corpus of Stories**

- 80 stories
- iterative coding
- mapped out 7 factors

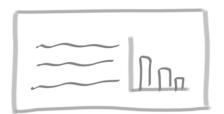
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# Design Space



## Role of Visualization



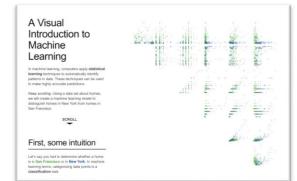
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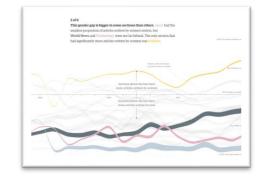


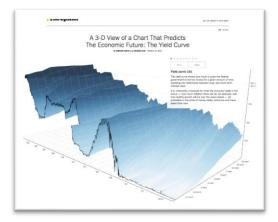
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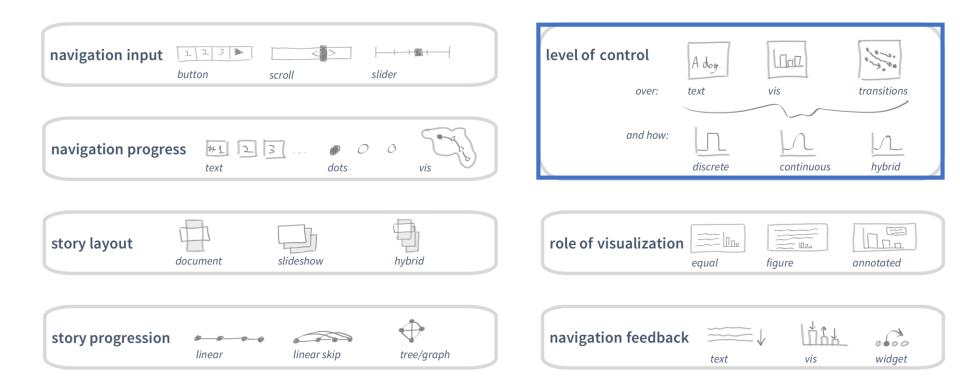
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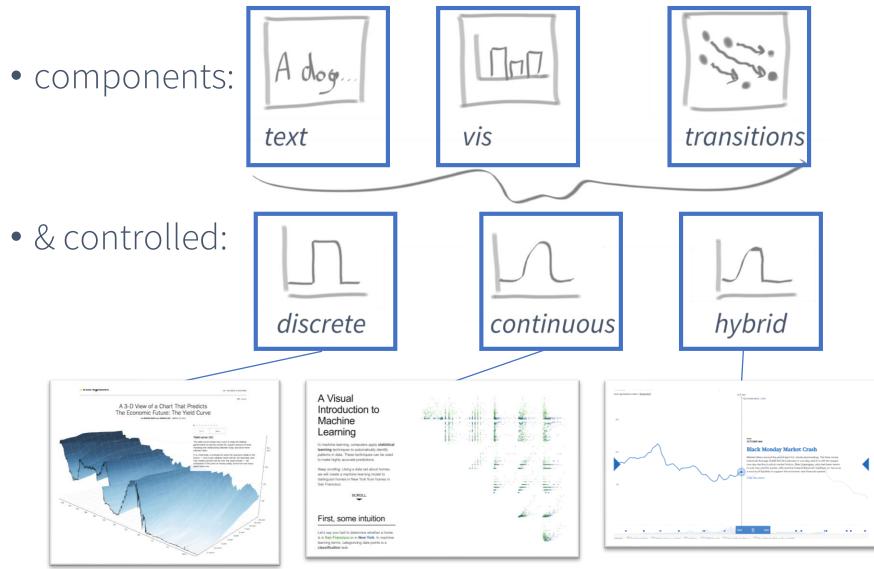




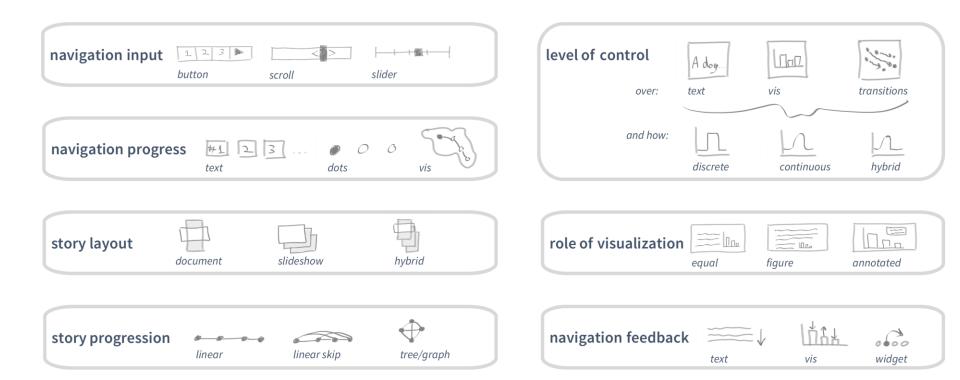
# Design Space



# Level of Control



# Design Space



# Authoring Prototype

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#### Teaching Bar Charts through Data Visualization

#### showing the raw data

Data enables us to better understand the world around us.

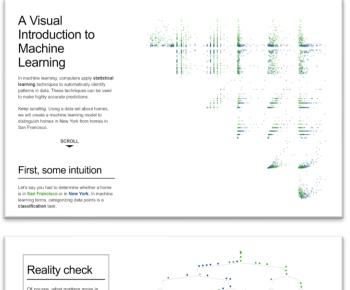
Take this list of a few characters from the TV show, The Simpsons. It includes their names, genders, and their ages.

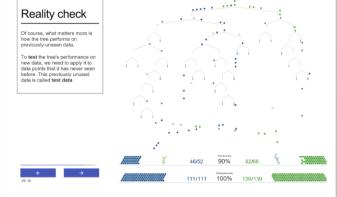
Let's start with just the 5 main Simpson family characters.

		Gender	Adult
	Lisa	F	N
-	Bart	м	Ν
	Homer	м	Y
	Marge	F	Y
3	Maggie	F	N

## **Overview of Studies**

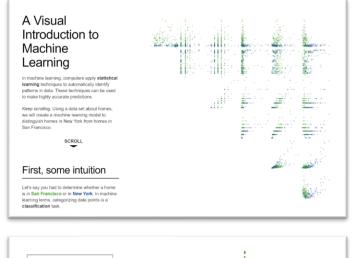
- mimic real-world stories
  - scrollers and steppers
  - machine learning story
- 3 studies to measure:
  - preference
  - usability [Brooke 1986]
  - engagement [O'Brien, Toms 2010]

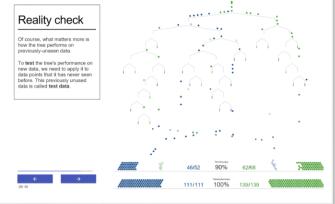




# Web Survey

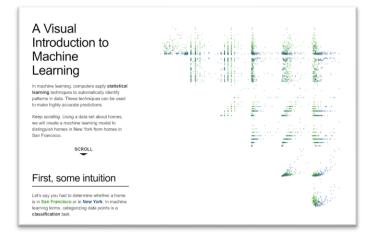
- methodology
  - 8 participants, free to explore
  - measured usability & preference
- mixed preferences
  - 3 stepper, 5 scroller
- similarly usable
- qualitatively
  - stepper: progress bar, arrow keys
  - scroller: less effort to scroll

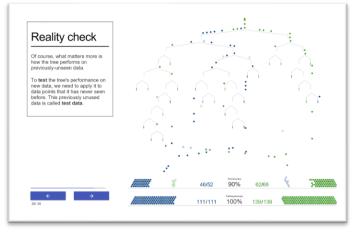




## **Observations & Interviews**

- methodology
  - 10 participants, 3 chapters, tablet
  - measured usability & preference
- results
  - above average usability [Sauro 2011]
  - 2/10 steppers
- "scrolling allowed me to see the transformations more fluidly"
- "scrolling is sexier in some ways, it is unique ... and just more fun"





# Crowdsourced Study

#### • 4 conditions:

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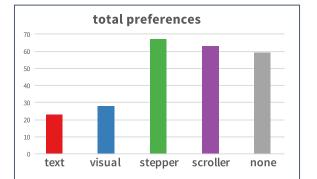
stepper

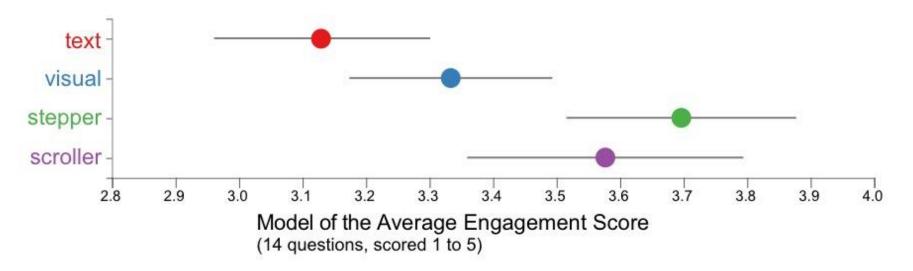
scroller

• which conditions are most engaging?

# Crowdsourced Study Results

- linear mixed effects analysis
- visualizations & animations engage
- no significance: steppers & scrollers



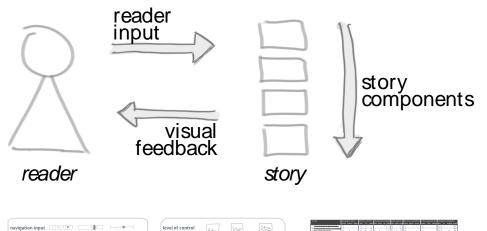


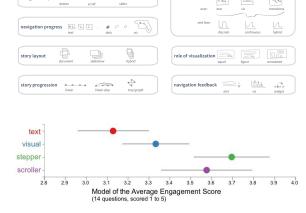
### Discussion & Future Work

- choice of flow factors may need to vary
- results of study may not generalize
- explore other metrics for engagement
- compare against comprehension, time, completion, or attention

## Visual Narrative Flow

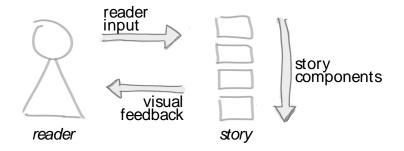
- reader input, story components, visual feedback
- design space of 7 flow-factors
- corpus of 80 stories & authoring prototype
- 3 studies on usability, preference, and engagement





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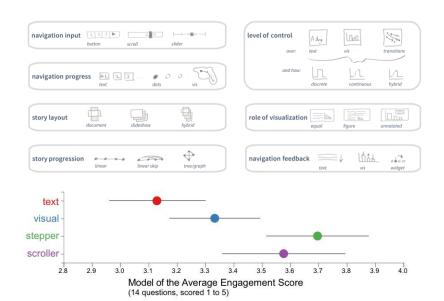


#### <u>http://narrative-flow.github.io</u> <u>sean@cs.utah.edu</u> @mckennapsean (.com)



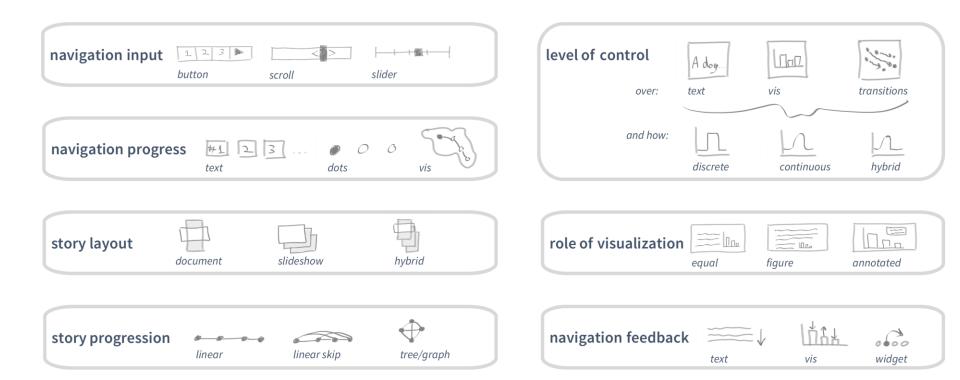


visualization design lab



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# Design Space



# Navigation Progress



Story Layout



document





# Story Progression



linear



linear skip



tree/graph

# Navigation Feedback

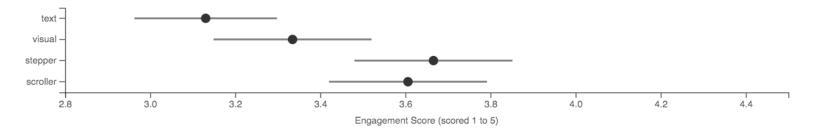


# Crowdsourced Study Analysis

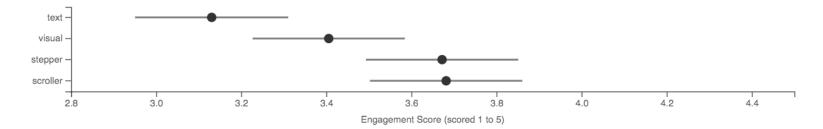
- linear mixed effects model
- fixed effects
  - four narrative flows
  - two chapters used
- random effects: intercepts and slopes
  - participants
  - engagement questions

# **Engagement Models**

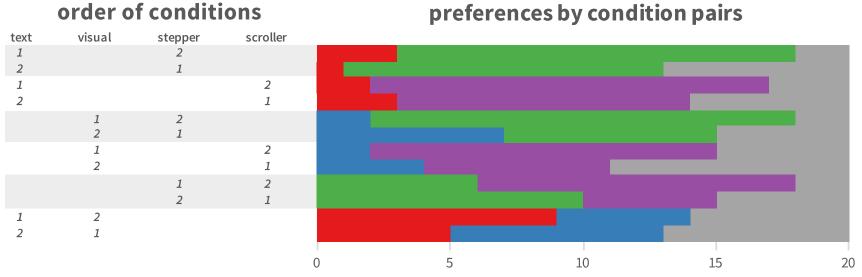
#### 1. I was absorbed in reading the story.



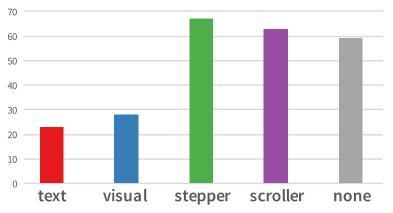
2. I forgot about my immediate surroundings while reading through this story.



## **Crowdsourced Preferences**







# Hybrid Example

(video)