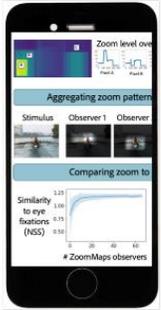
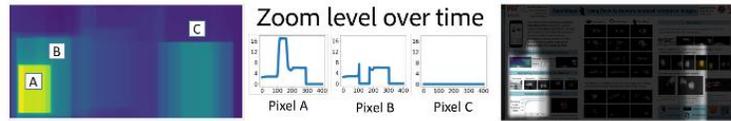


# ZoomMaps Using Zoom to Capture Areas of Interest on Images



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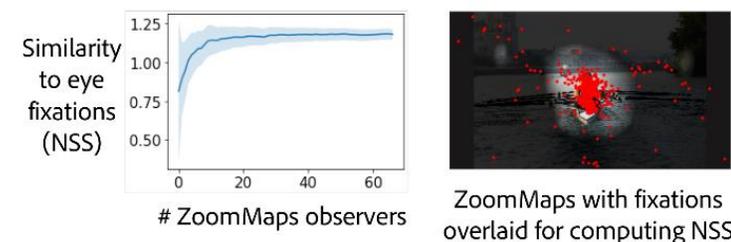
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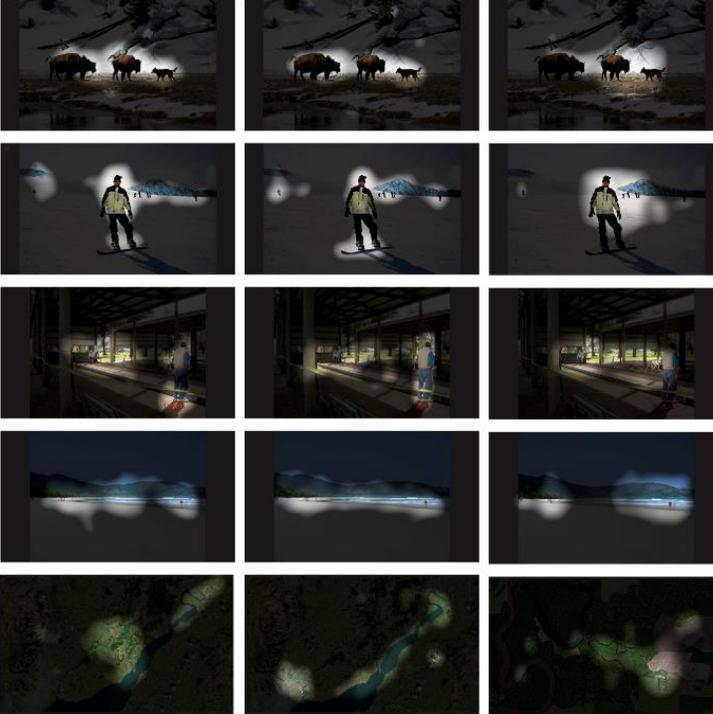
## Aggregating zoom patterns across observers



## Comparing zoom to eye fixations



## Eye fixations    BubbleView    ZoomMaps



How do people read a document or browse a design?  
What is interesting and attention-capturing?



## Case Study 1: ZoomMaps for academic posters

Individuals' zoom patterns can be used to generate customized thumbnails for better information recall.



## Case Study 2: ZoomMaps for data visualizations

“I like that it was like a map of the United States it made it easier to find the state I was looking for”

“It was OK. I don't think the style is the best for viewing.”

“It is clear without zooming in which areas of the country are above/below the average.”

“Easy to follow and very detailed”

“This one was completely confusing”

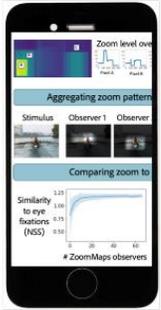
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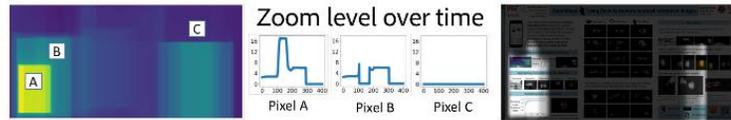
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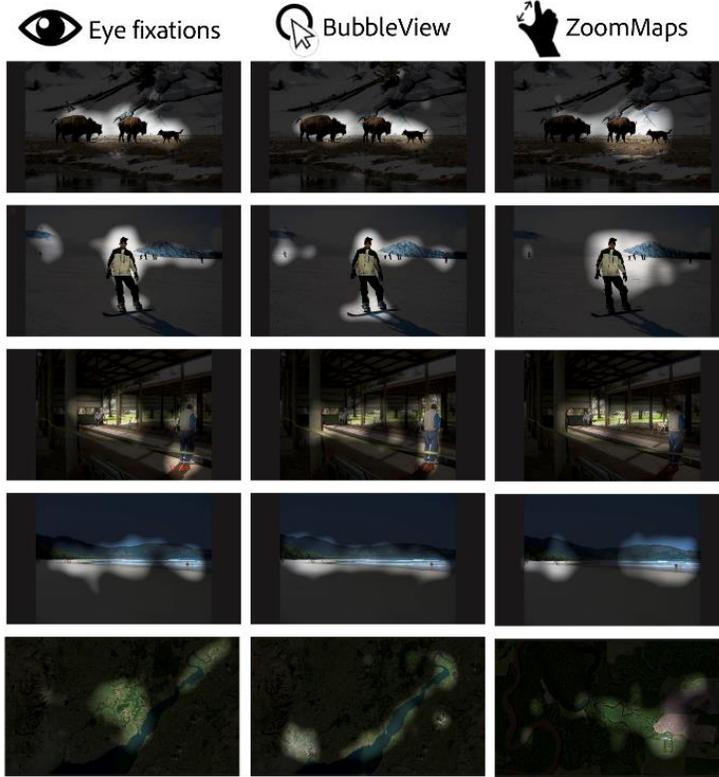
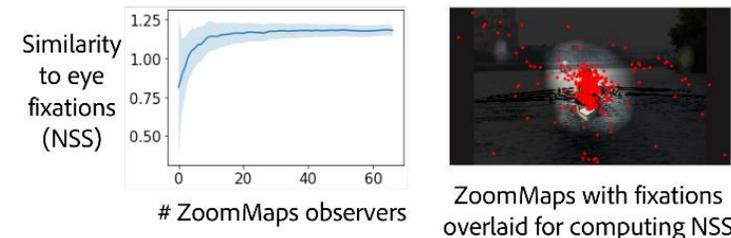
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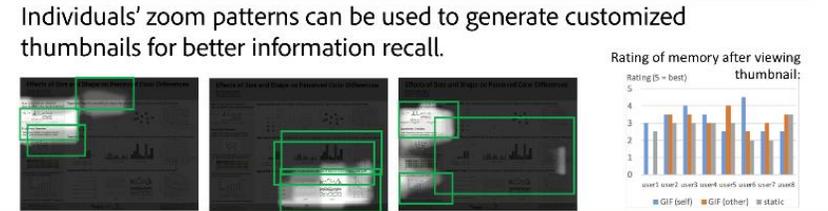
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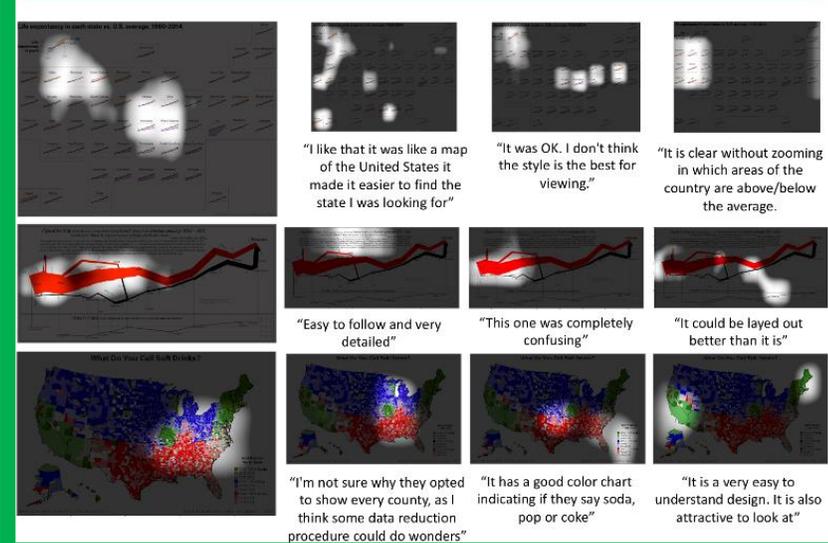
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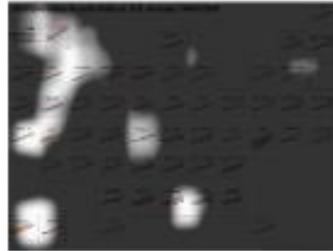
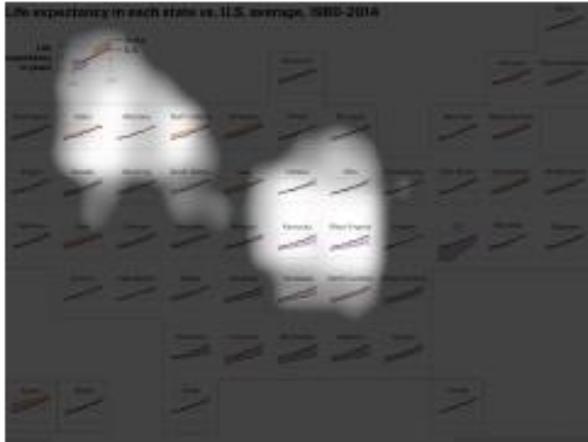
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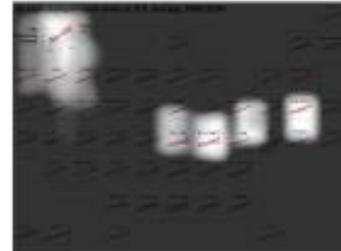
## Case Study 2: ZoomMaps for data visualizations



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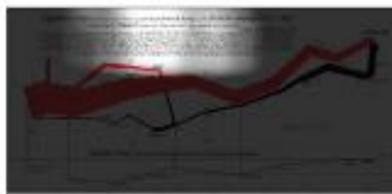
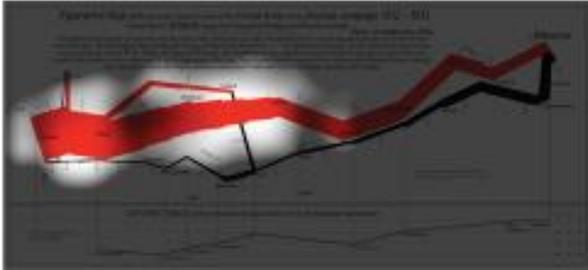
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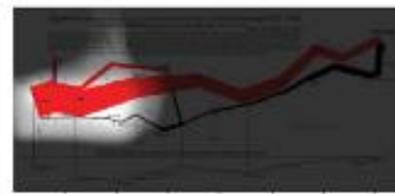
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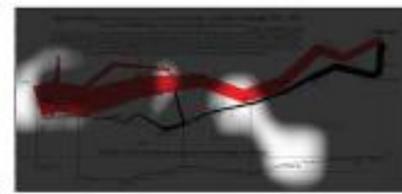
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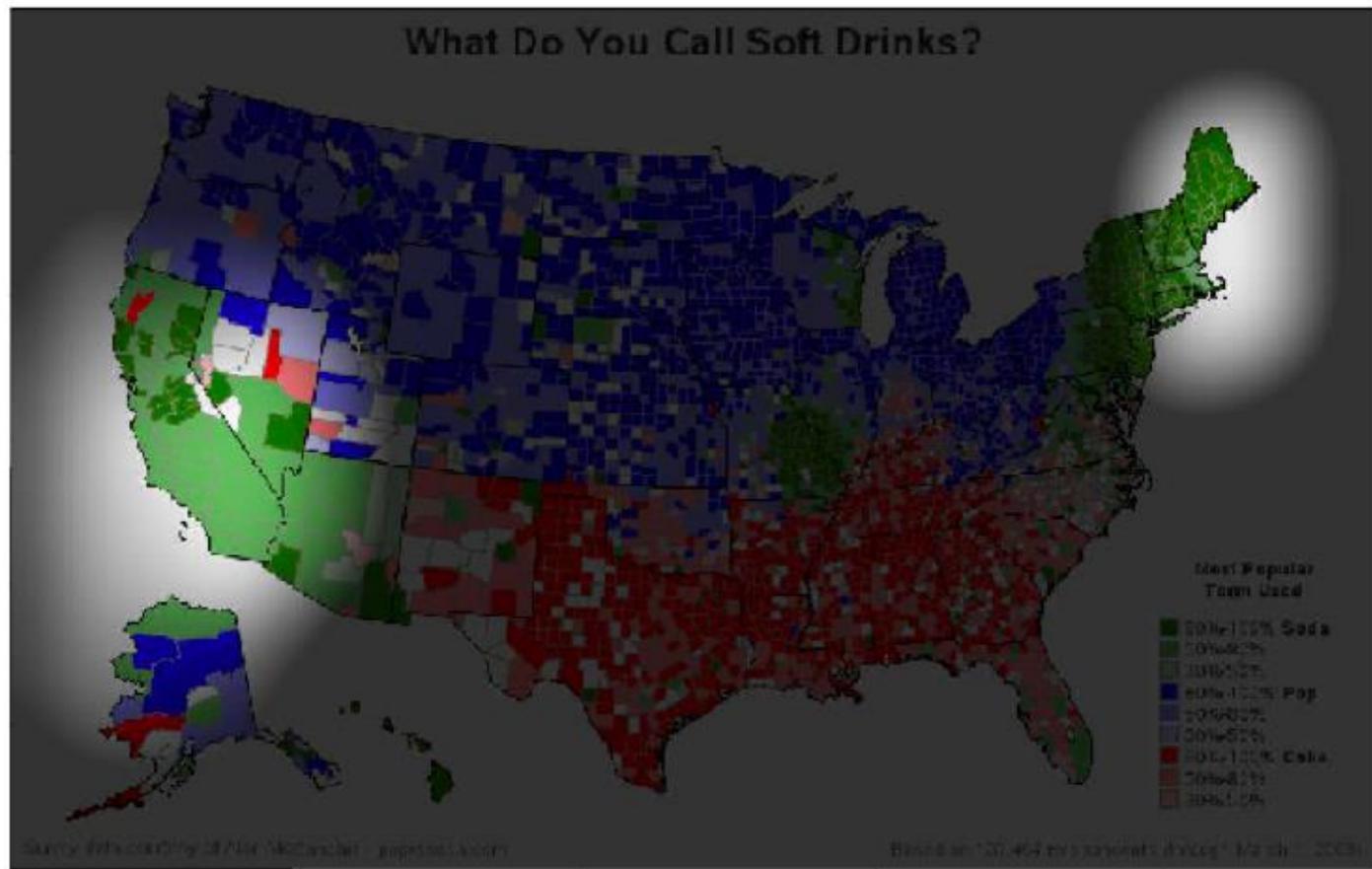
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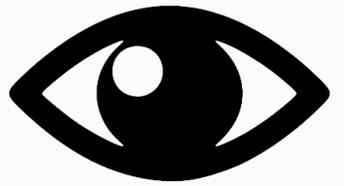
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**How do we capture attention on multi-scale visualizations?**

# Capturing attention data

**Accurate**

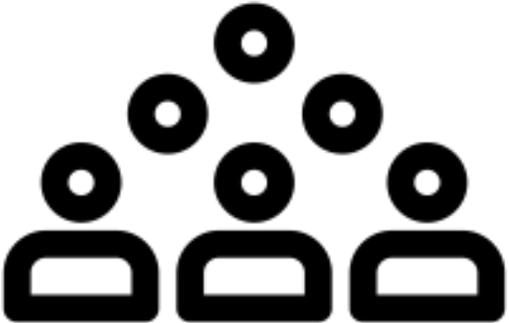
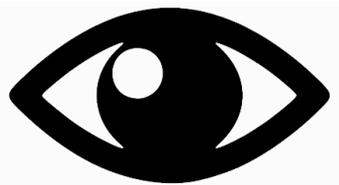
**Scalable**



# Capturing attention data

**Accurate**

**Scalable**



# Capturing attention data: BubbleView



0 clicks

0 characters

Describe the image in as much detail as possible...

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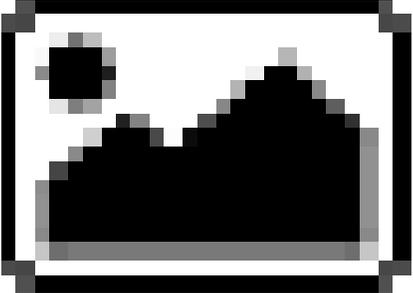
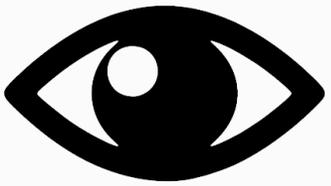
NEXT

# Capturing attention data

**Accurate**

**Scalable**

**Natural**



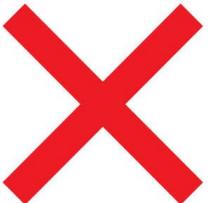
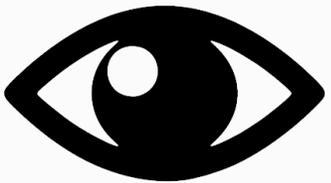
# Capturing attention data

**Accurate**

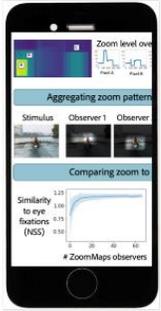
**Scalable**

**Natural**

**Multi-Scale**

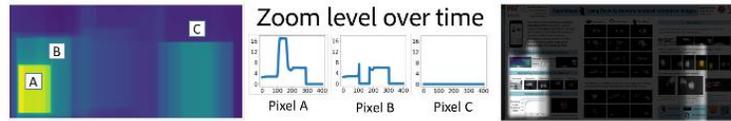


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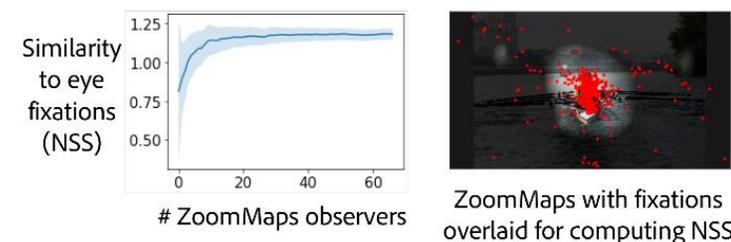
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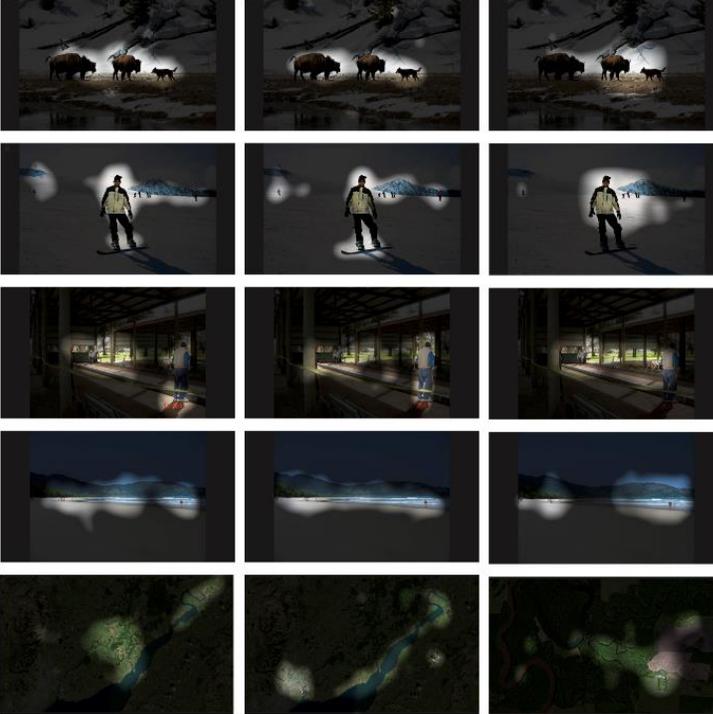
## Aggregating zoom patterns across observers



## Comparing zoom to eye fixations



### Eye fixations BubbleView ZoomMaps



How do people read a document or browse a design?  
What is interesting and attention-capturing?



## Case Study 1: ZoomMaps for academic posters

Individuals' zoom patterns can be used to generate customized thumbnails for better information recall.

Rating of memory after viewing thumbnail:

Rating (5 = best)

user1 user2 user3 user4 user5 user6 user7 user8

■ GIF (self) ■ GIF (other) ■ static

## Case Study 2: ZoomMaps for data visualizations

"It was OK, I don't think style is best for..."

"It is clear without zooming in which areas of the country are above/below the average."

"Easy to follow and very detailed"

"...completely confusing"

"It could be laid out better than it is"

"I'm not sure why they opted to show every county, as I think some data reduction procedure could do wonders"

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"It is a very easy to understand design. It is also attractive to look at"

**A natural restricted window that operates  
at multiple scales...**



**A natural** restricted window that operates  
at **multiple scales...**





# ZoomMaps

## A Zoomable Crowdsourced Interface for Exploring Attention on Large-scale Visualizations

Anelise Newman, Barry McNamara, Aude Oliva, Zoya Bylinskii

# From zoom to maps

**ZoomMaps** Using Zoom to Capture Areas of Interest on Images

Anelise Newman, Barry McNamara, Matt Tancik, Spandan Madan (MIT, Berkeley)

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Applications:

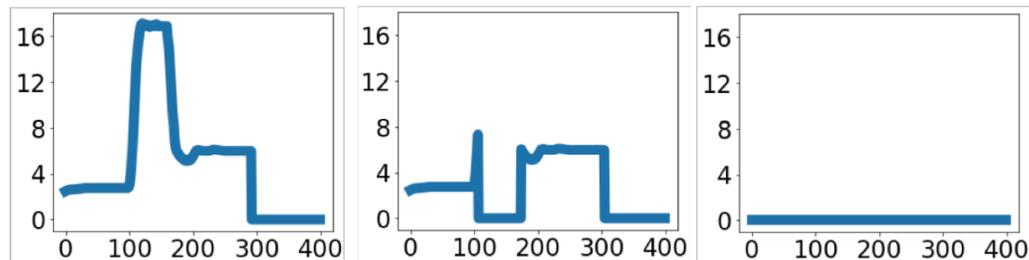
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How do people read a document or browse a design? What is interesting and attention-capturing?

ZoomMaps with fixations overlaid for computing NSS

ZoomMaps observers overlaid for computing NSS

## Zoom level over time



Pixel A

Pixel B

Pixel C



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Eye movements



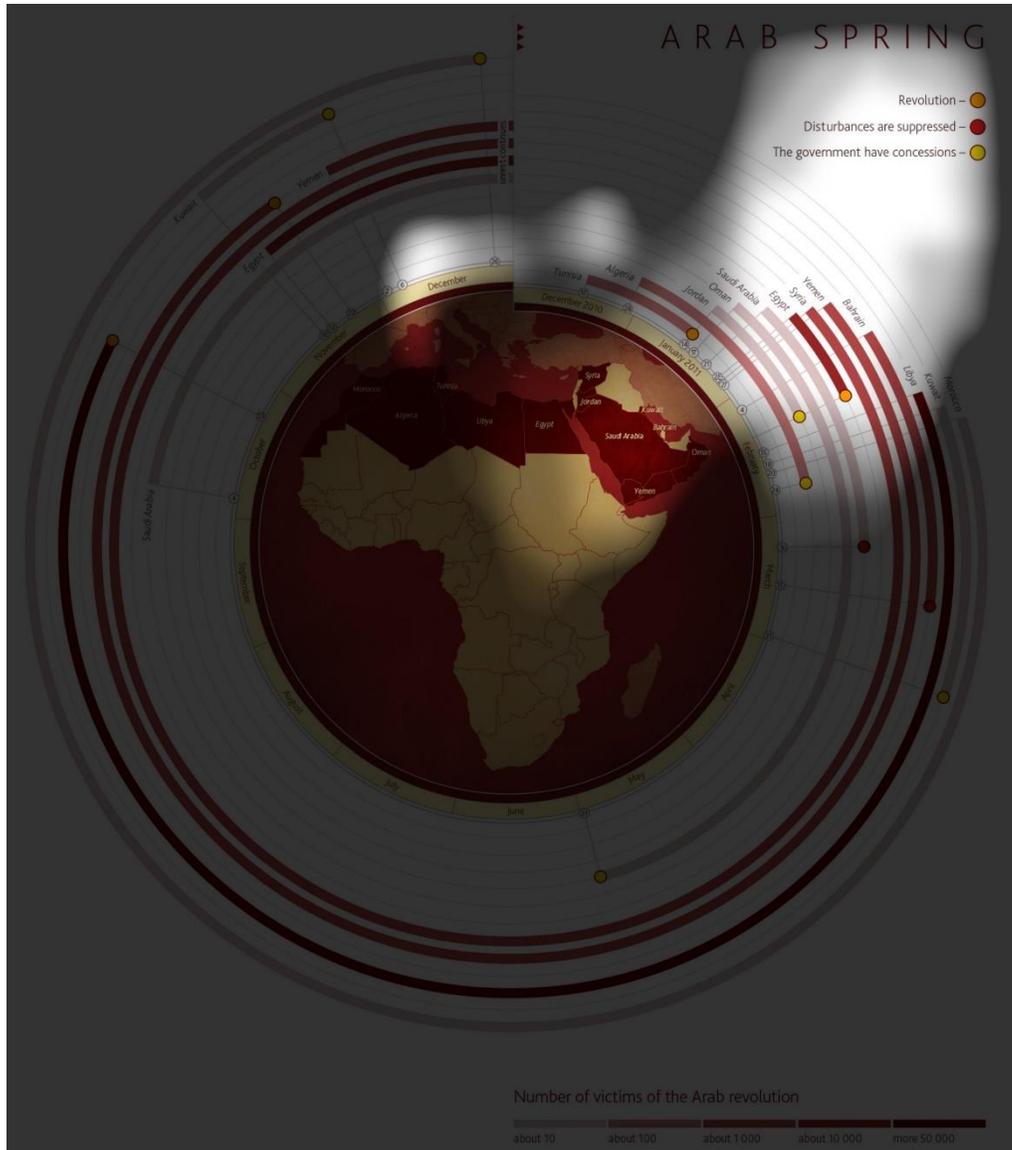
ZoomMaps



NSS = 1.37  
(1.58 for BubbleView)



# Average Attention Patterns



"It was **hard to read** the information at times because it was in a circle."

"I like the way the dates wrap around the continent of Africa and the Middle East. It does a good job of showing **where each took place.**"

"It was very confusing. I **didn't understand** the curved lines on the side."

All commercial transport aircraft are fitted with underwater locator beacons to assist in the relocation of black box flight data recorders and cockpit voice recorders. These beacons are free-running pingers that transmit signals at an acoustic frequency of 37.5 kilohertz and have an expected battery life of 30 days. The scale of the challenge in locating the black boxes is immense.

**200 feet** - the width of a Boeing 777-200.



**22 feet** - the draft of the Australian

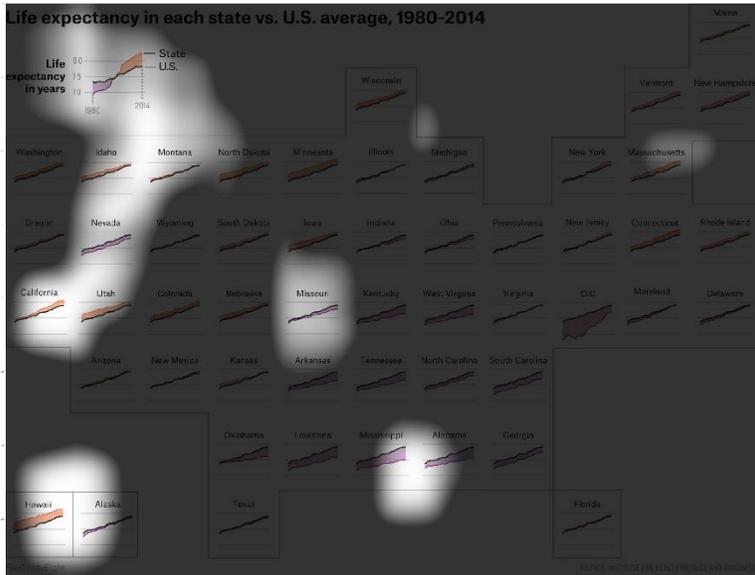
"I think this design is awesome. It really shows how difficult this search is. Also, continuously having to scroll down is a great way of **getting the message across.**"

"I like the design. I really like the sea creatures on the design. It makes it fun to **imagine how deep** the beacons can go and be recovered. I like that design can be swiped up and down."

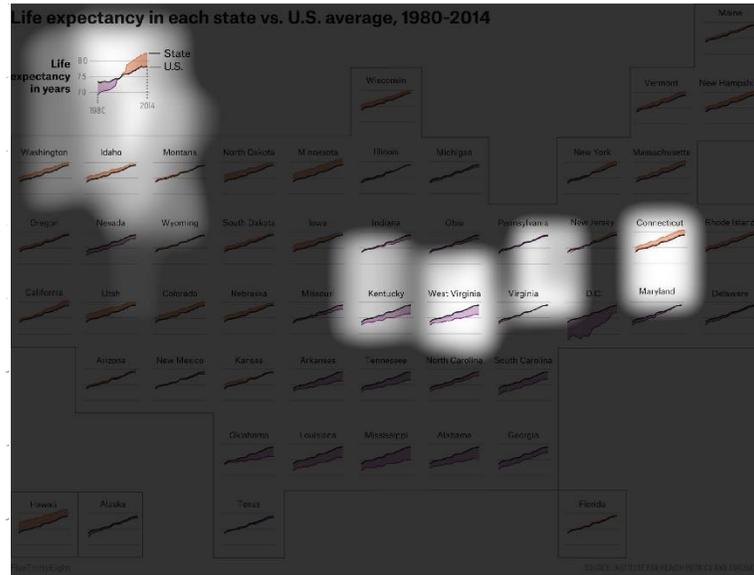
"It is **too vertically long** and the colors are drab."

# Individual Differences

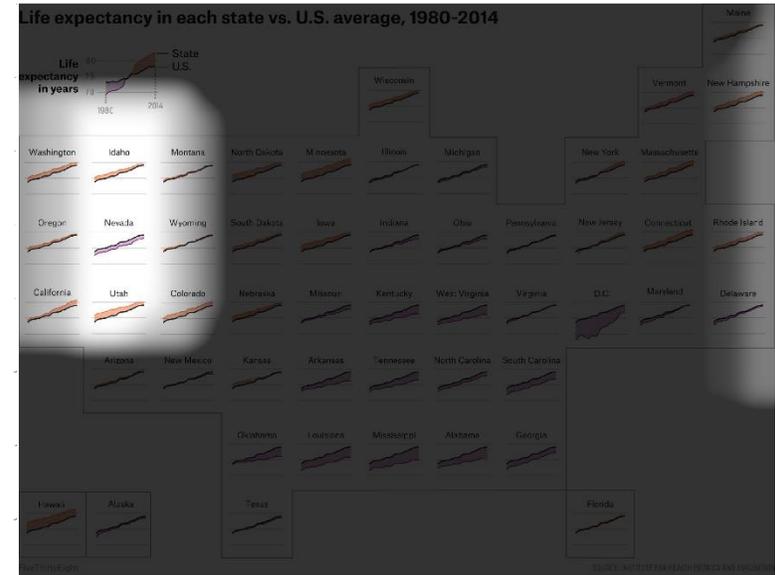
# What do you think of the **design** of the visualization?



“I like that it was like a map of the United States it made it easier to **find the state I was looking for**”



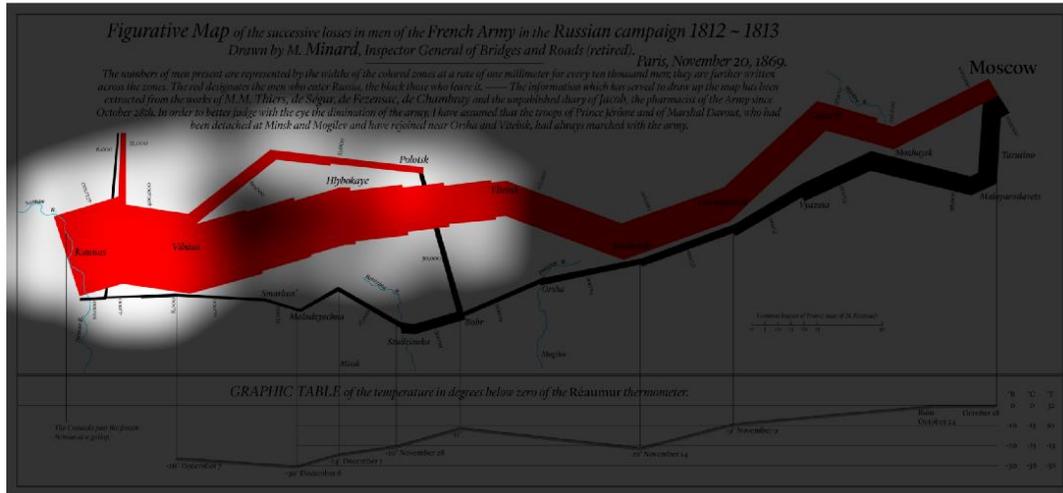
“It was OK. I don't think the style is the best for viewing.”



“it allows you to **see any patterns** that are visible. It is clear **without zooming in** which areas of the country are above/below

# Was the visualization well-designed?

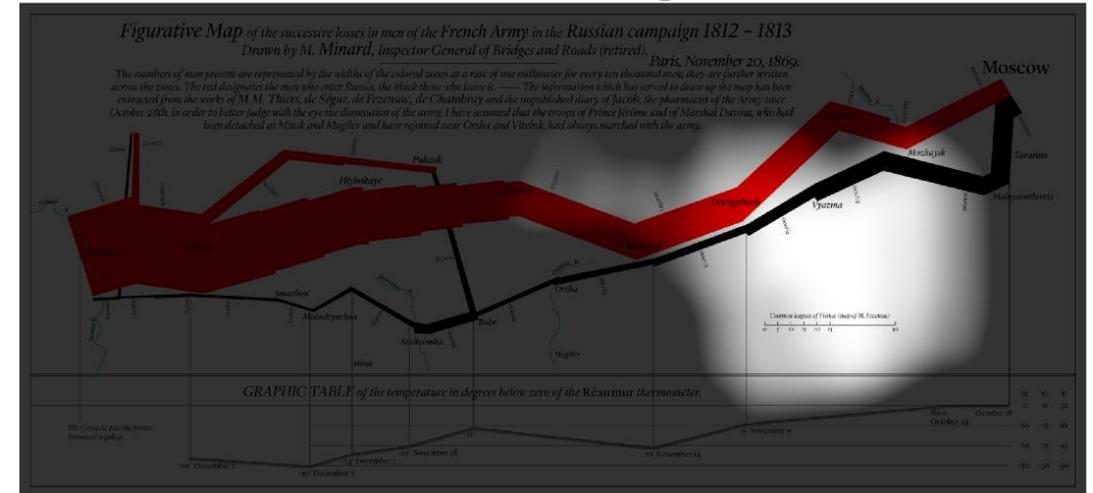
## Higher ratings



"It was Ok, the only problem is it was a little hard to judge the width of **the red line.**"

"I like the correlation between the two graphs. After you take the time to read through the explanation, the visualization does a good job of visually **taking you on the journey.**"

## Lower ratings



"The design was very weird. It seemed to be **all over the place**"

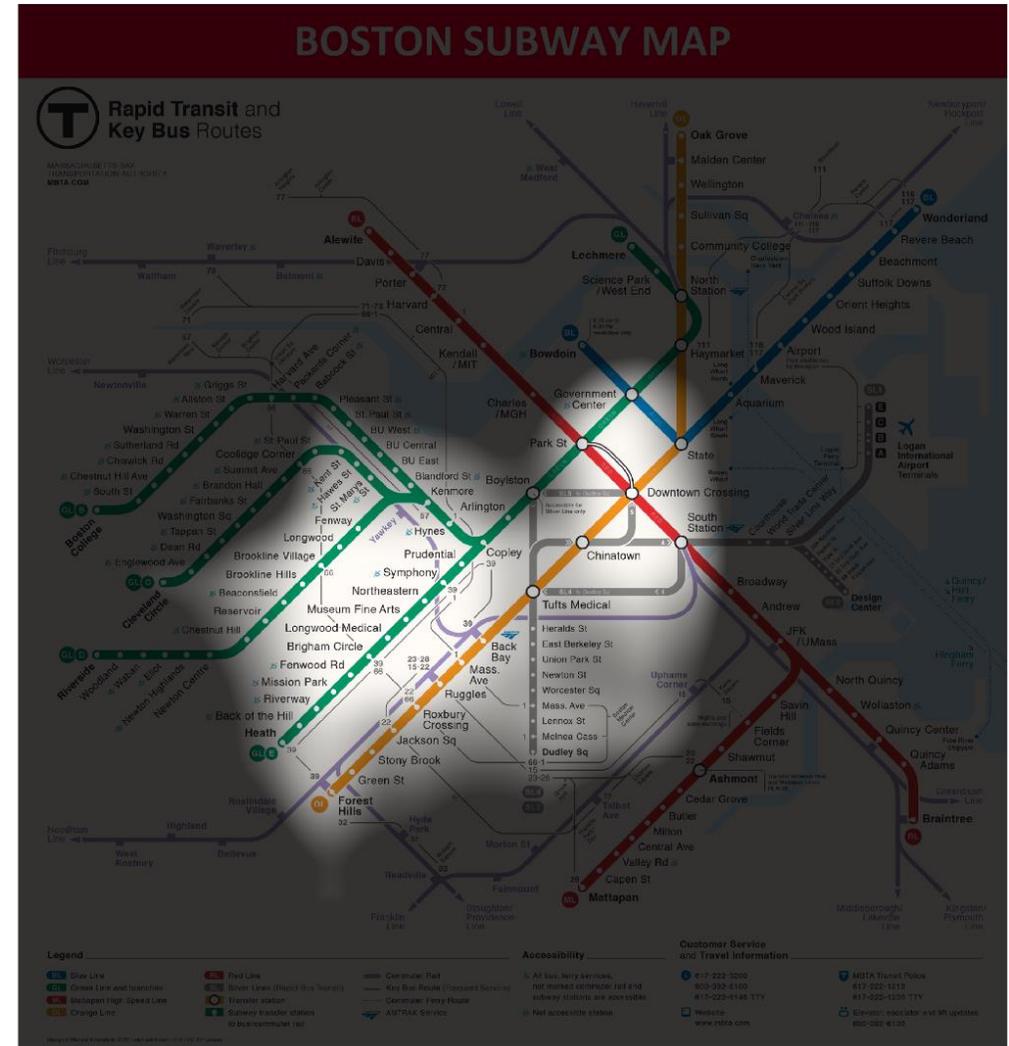
"This was a **jumbled mess**...the thick red line and the black lines it was hard to follow what each line meant."

# Was the content interesting?

Higher ratings



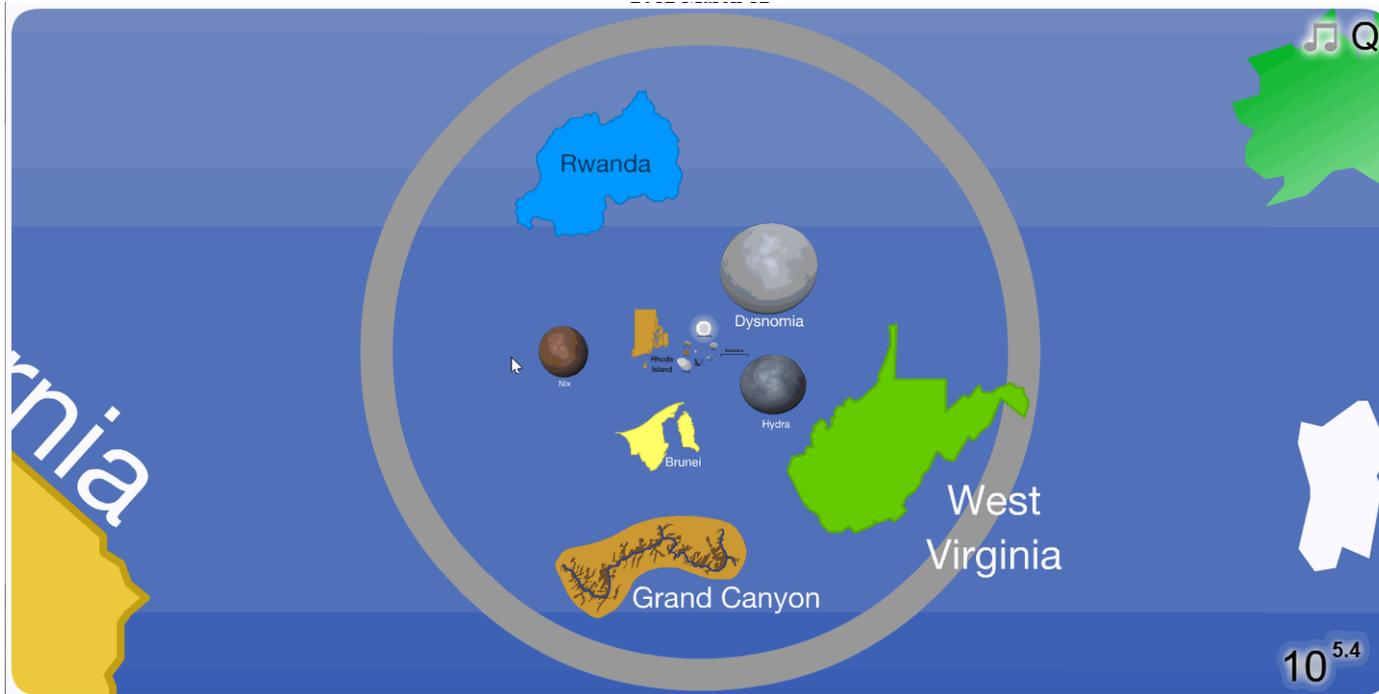
Lower ratings



# Takeaways

- Approximates attention on natural images
- Suitable for multi-scale content
- Drill down into individual differences
  - Customized applications

# Future Work

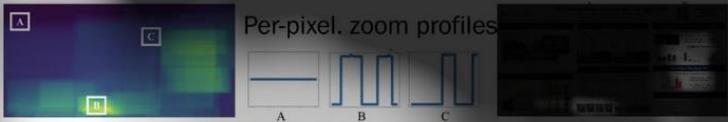


- Interactive visualizations
- Directed tasks
- Applications
  - Modeling
  - Personalized thumbnails



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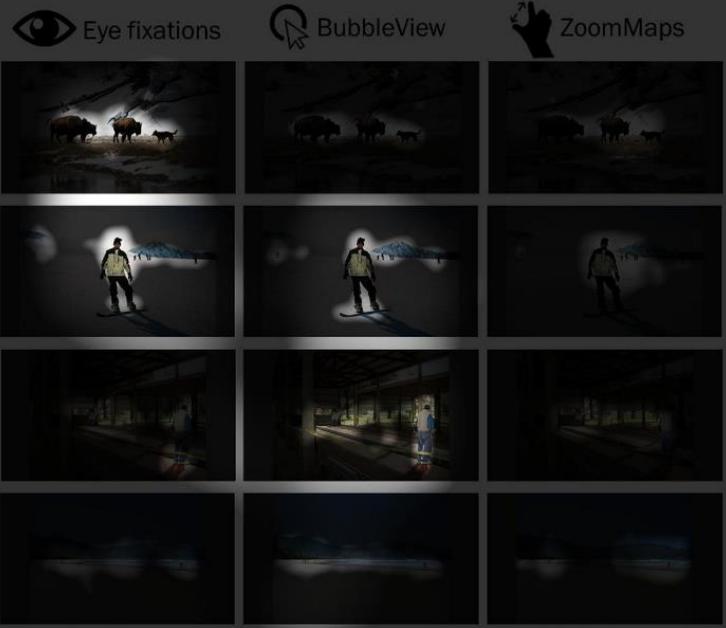
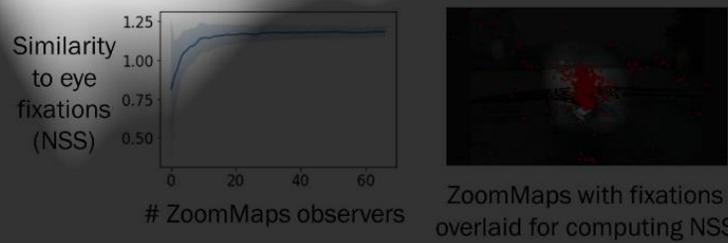
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## Aggregating zoom patterns across observers



## Comparing zoom to eye fixations



ZoomMaps are perfectly designed for multi-scale visual content, and can be used as an attention proxy within search tasks:



## Applications

Individuals' zoom patterns can be used to generate customized thumbnails for better information recall.



How do people read a document or browse a design? What is interesting and attention-capturing?



How do people parse complex content?



"The design was difficult to read"  
 "It is visually pleasing and very clever"

"I like that it was like a map...it made it easier to find the state I was looking for"  
 "I realized it allows you to see any patterns...without zooming"

"Easy to follow and very detailed"  
 "This one was completely confusing"  
 "The design was very weird. It seemed to be all over the place"

ZoomMaps F37 CodeCharts  
 ImportAnnots BubbleView  
[TurkEyes.mit.edu](http://TurkEyes.mit.edu)

