The mobile screen provides a naturally restricted window frequently used to explore multi-scale content with the help of the zoom functionality. We show that the zoom patterns generated by participants viewing images on their mobile screens can be used as an approximation for visual attention.

**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 know that it was for a map of the United States it made it easier to find the state I was looking for."
- "Was OK. I don't think the style is the best for viewing."
- "It's clear without zooming in. All parts of the country are above/below the average."
- "Easy to follow and very exciting."
- "The one was 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."
- "It has a good color chart indicating if they are odds, pop, or code."
- "It is a very easy to understand design; it is also attractive to look at."

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

- **Eye fixations**
- **BubbleView**
- **ZoomMaps**
ZoomMaps: Using Zoom to Capture Areas of Interest on Images

Anelise Newman
Barry McNamara
Matt Tancik
Spandan Madan

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Converting zoom into attention heatmaps

Aggregating zoom patterns across observers

Stimulus
Observer 1
Observer 2
Observer 3
Average

Comparing zoom to eye fixations

Similarity to eye fixations (NSS)

# ZoomMaps observers

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

ZoomMaps with fixations overlaid for computing NSS

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Case Study 2: ZoomMaps for data visualizations

Zoya Bylinskii
Fredo Durand
Aude Oliva

TurkEyes.mit.edu

ZoomMaps
ImportAnnots
BubbleView
CodeCharts

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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"
- "It could be layed 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"
- "It has a good color chart indicating if they say soda, pop or coke"
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“It is a very easy to understand design. It is also attractive to look at”
How do we capture attention on multi-scale visualizations?
Capturing attention data

Accurate

Scalable
Capturing attention data

Accurate

 Scalable
Capturing attention data: BubbleView
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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

Zoom level over time

Pixel A
Pixel B
Pixel C
Eye movements

ZoomMaps

NSS = 1.37
(1.58 for BubbleView)
ZoomMaps for data visualization
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."
"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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### Converting zoom into attention heatmaps

### 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?

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**TurkEyes.mit.edu:** Scalable Interfaces for Crowdsourcing Attention