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Barry McNamara
Camilo Fosco
Yun Bin Zhang

Introducing the TurkEyes Toolbox

UIs for crowdsourcing attention without an eye tracker

Pat Sukhum
Matthew Tancik
Nam Wook Kim
Zoya Bylinskii

Code, demos, and paper at
TurkEyes.mit.edu

The TurkEyes Tools

We present a toolbox of **four user interfaces** for **crowdsourcing attention data**.

These interfaces **do not use eye tracking**; they instead rely on **interactions** with a computer or mobile phone that correlate with visual attention.

ZoomMaps *(zoom-based)*

Participants use the pinch-zoom gesture on a phone to explore an image at multiple scales.

The UI | Generating an Attention Heatmap

CodeCharts *(self-report)*

Participants self-report where they gazed using a grid of three-letter codes.

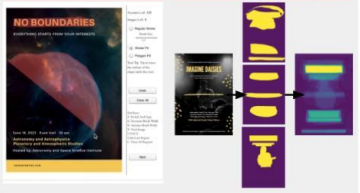
The UI

Generating an Attention Heatmap

ImportAnnots *(annotation)*

Participants paint over regions of a design that they consider important.

The UI | Generating a Heatmap



BubbleView *(cursor-based)*

Participants click to unblur small bubble regions of a blurred image.

The UI | Generating a Heatmap

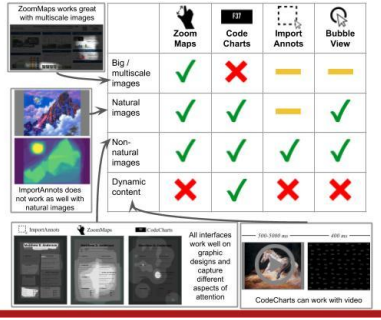
Which tool should I use?

We **ran experiments** with each of the interfaces in order to determine which **use cases** were appropriate for each.

	+	-
Zoom Maps	Works on multi-scale content, natural form of interaction	Coarse approximation of attention
Code Charts	Doesn't distort stimuli, approximates eye movements	Expensive, images must fit on screen
Import Annots	Produces clean segmentations, captures importance	Not ideal for natural images, importance > attention
Bubble View	Versatile, cheap	Distorts stimuli and timing

Image Type

Not all interfaces work with all image types.



	Zoom Maps	Code Charts	Import Annots	Bubble View
Big / multiscale images	✓	✗	—	—
Natural images	✓	✓	—	✓
Non-natural images	✓	✓	✓	✓
Dynamic content	✗	✓	✗	✗

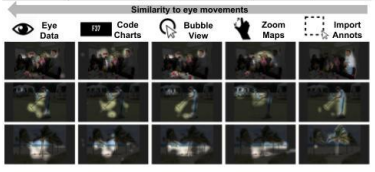
Cost

Cost depends on **how much data** we get per participant and **how much work** it is to use.

- **15+** clicks/ participant
- **15** participants/ image for consistent data
- **Multiple** zoomed viewports per viewer
- **20** participants/ image
- **1** gaze point/ participant
- **50** participants/ image
- **Multiple** annotations/ participant
- **30** participants/ image
- **Extra work required** to segment elements

Similarity to Eye Movements

	Human Consistency	Code Charts	Bubble View	Zoom Maps	Import Annots
Similarity to eye movements*	0.86	**0.76**	0.62	0.59	0.51
% of Human Consistency	100%	**88%**	72%	69%	59%

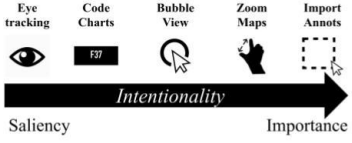


*Similarity measured using Pearson's Correlation Coefficient comparing ground-truth to generated heatmaps

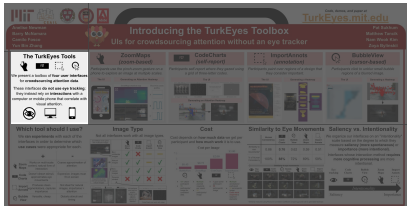
Saliency vs. Intentionality

We organize our interfaces on an "intentionality" scale based on the degree to which they measure **saliency (more spontaneous)** or **importance (more intentional).**

Interfaces whose interaction method **requires more cognitive processing** are more intentional.



The TurkEyes Tools



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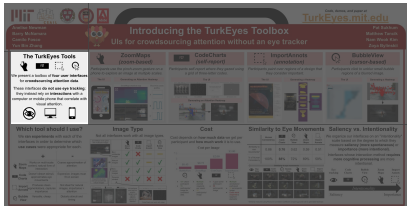

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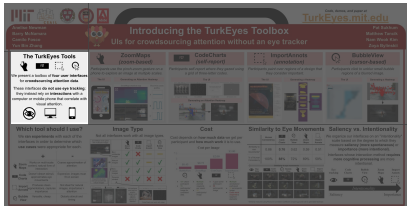

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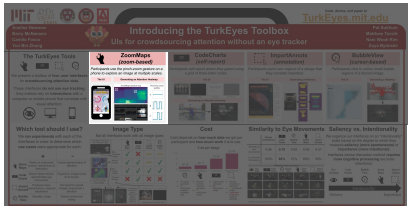

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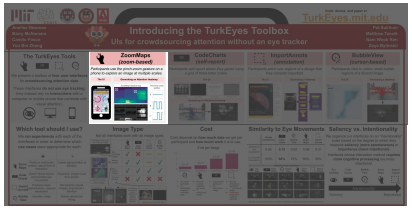

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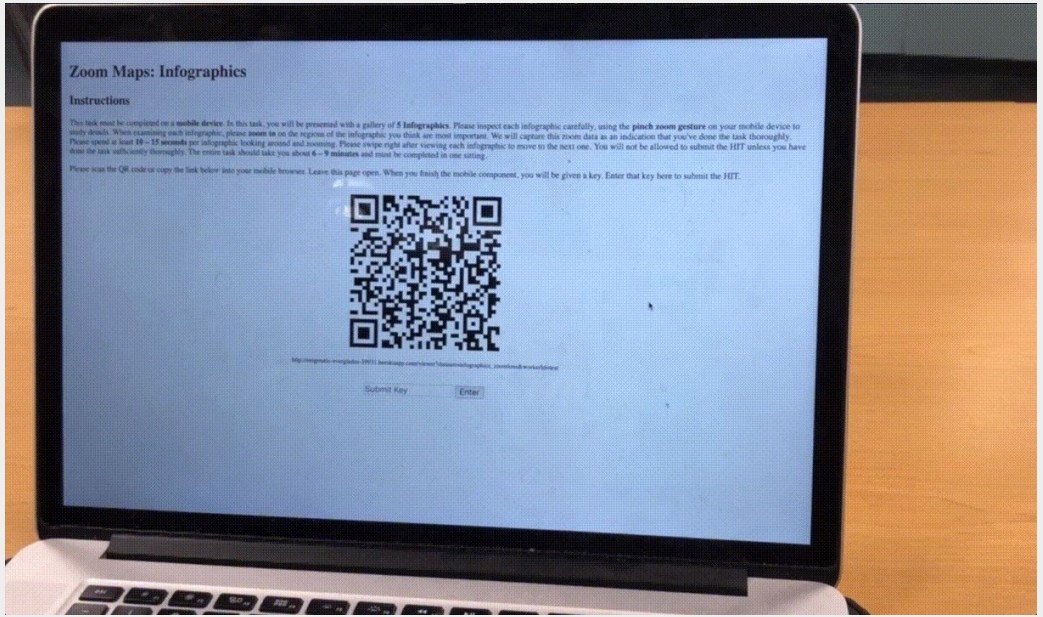

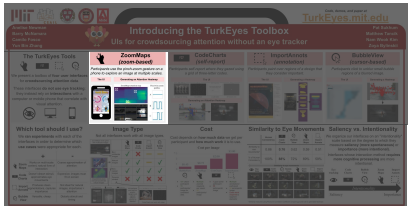

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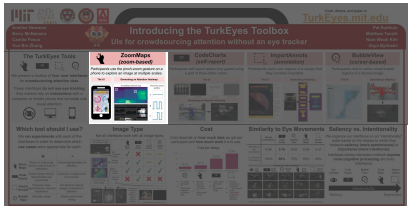

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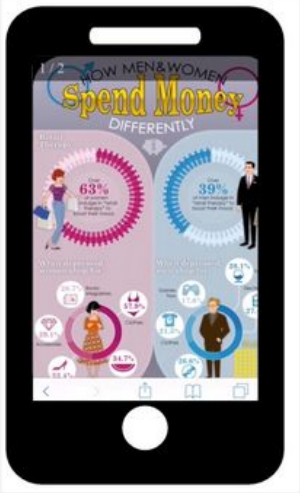

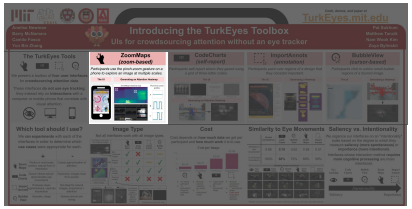

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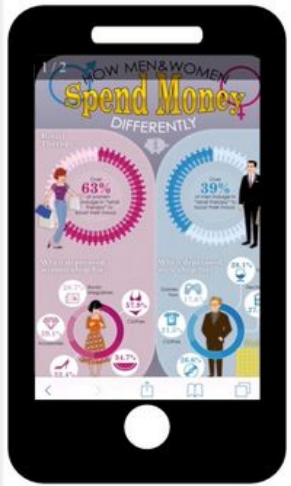

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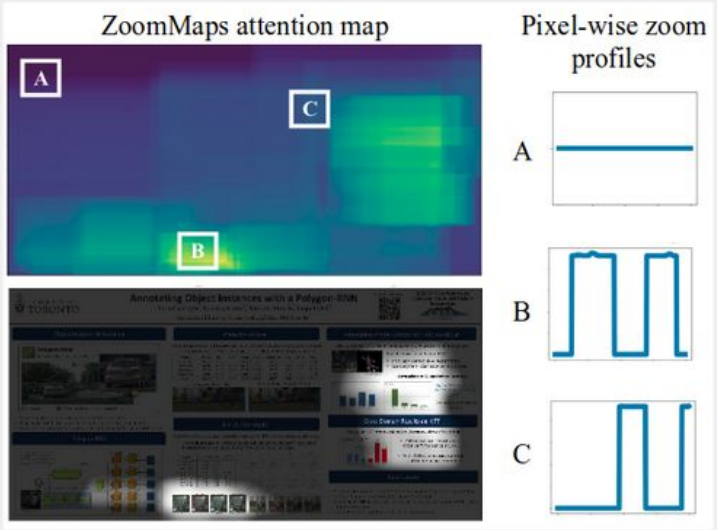

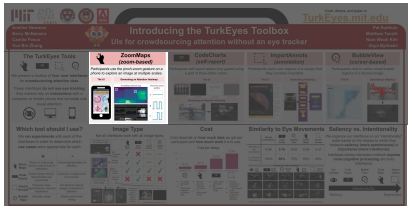

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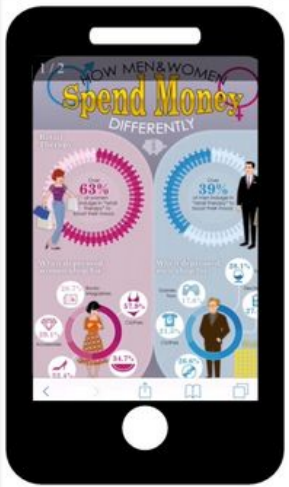

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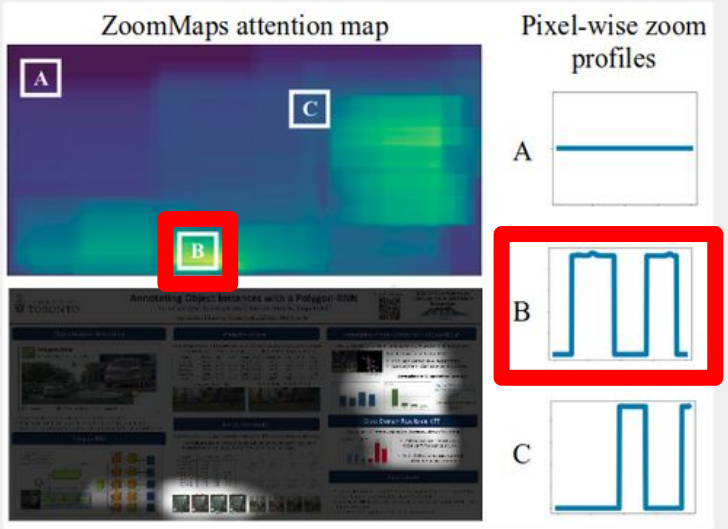

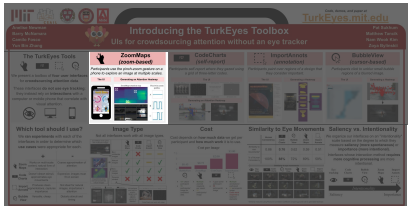

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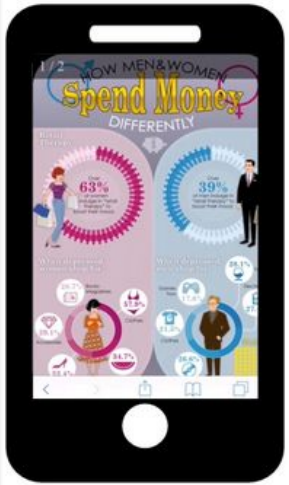

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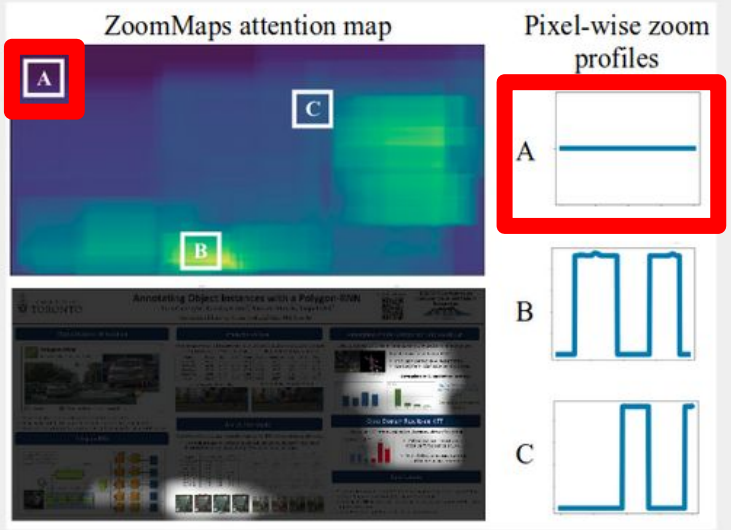

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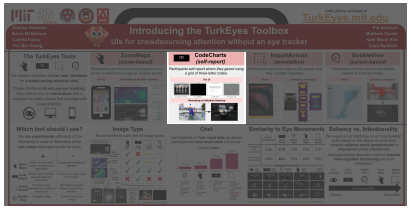

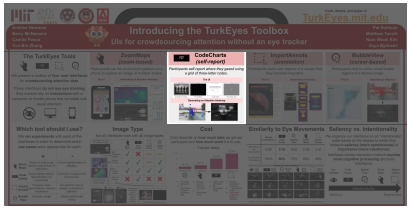

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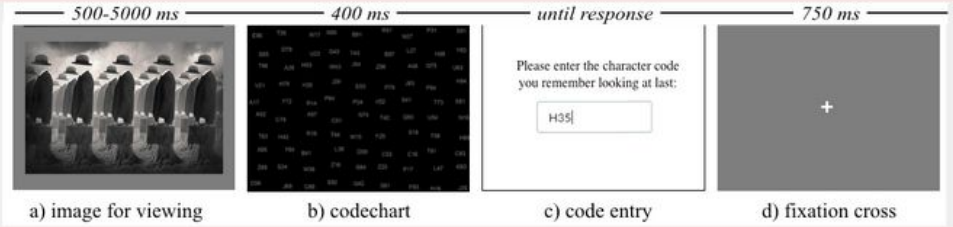

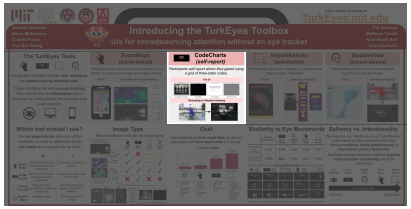

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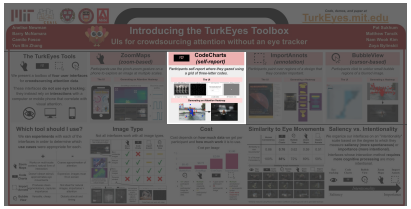

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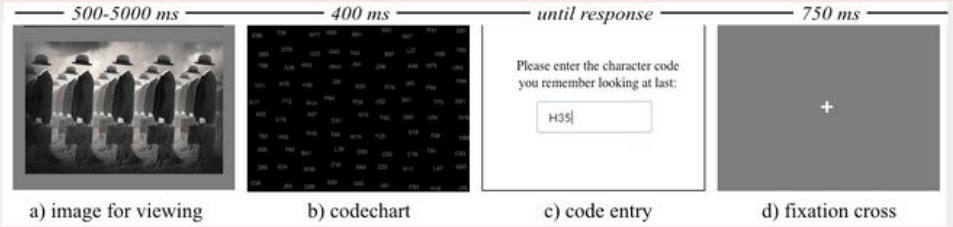

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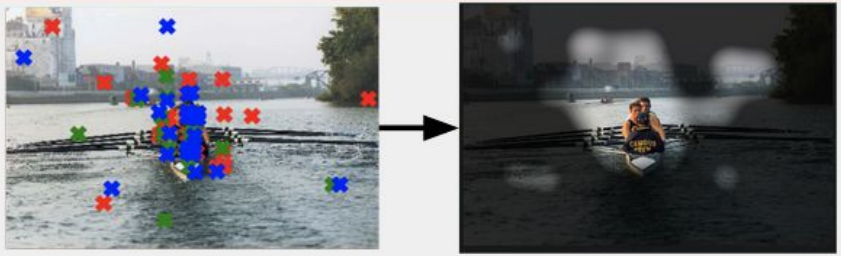

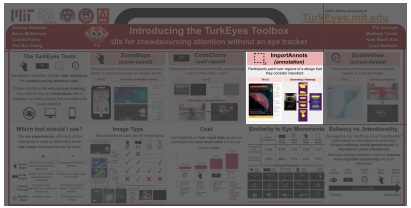

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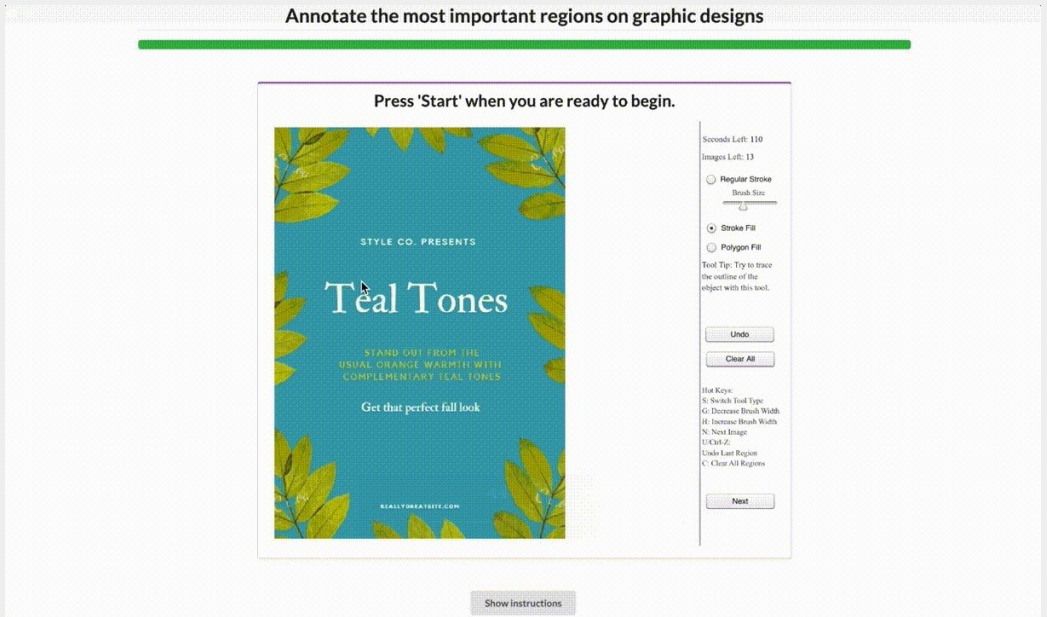

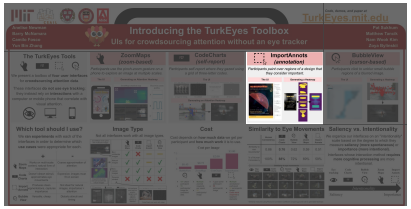

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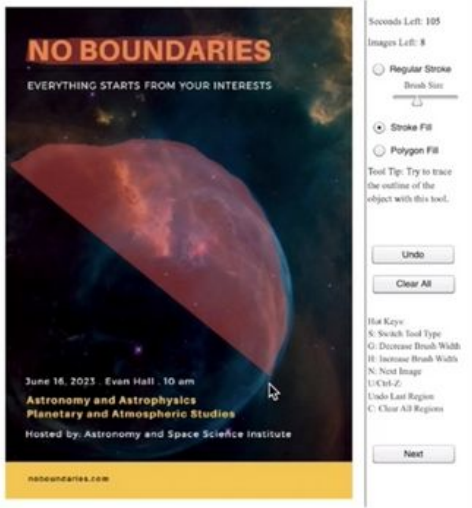

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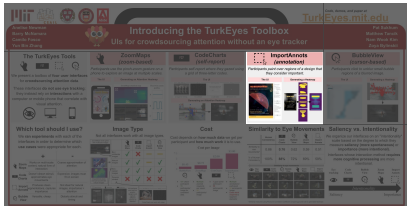

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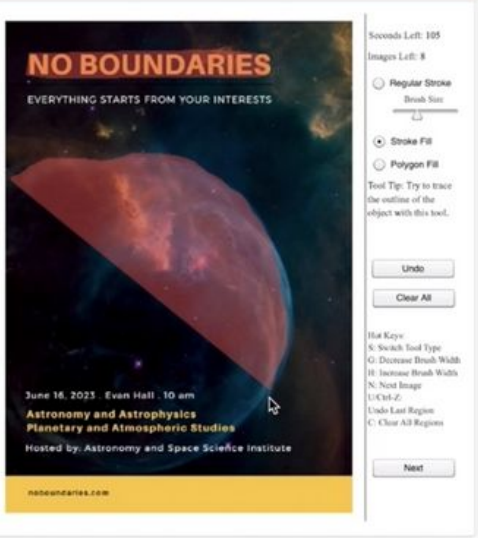

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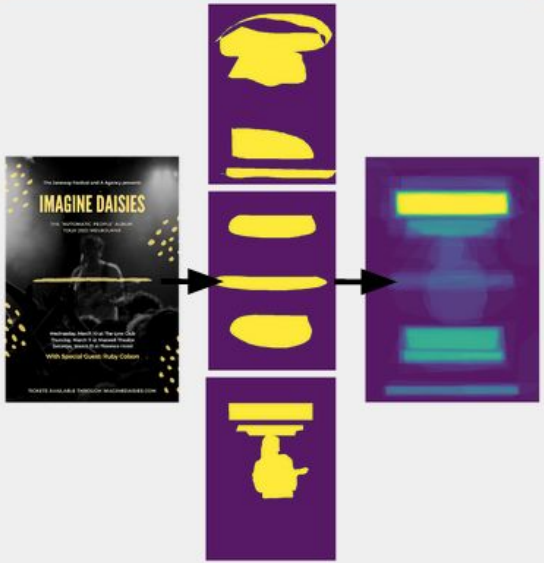

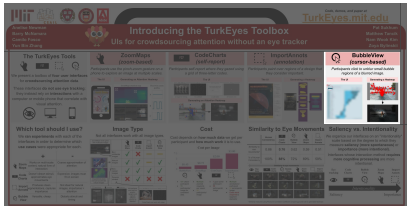

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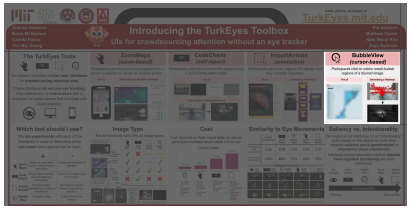

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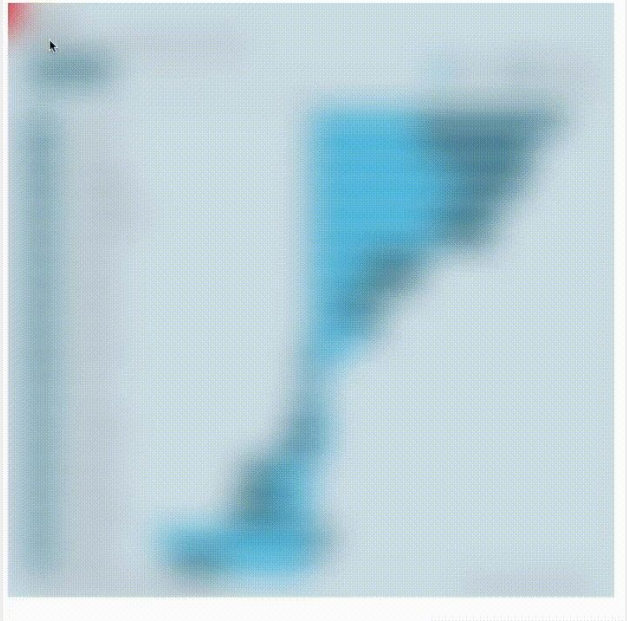

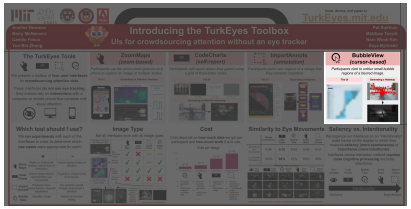

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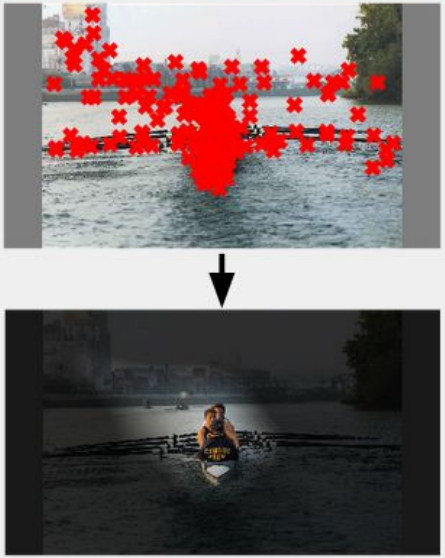

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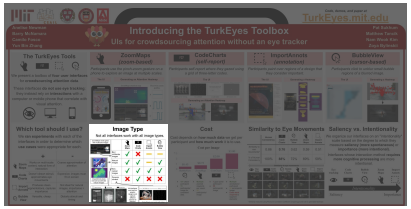

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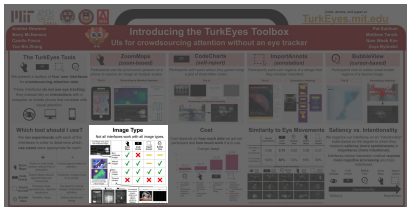

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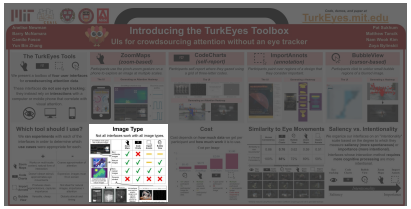

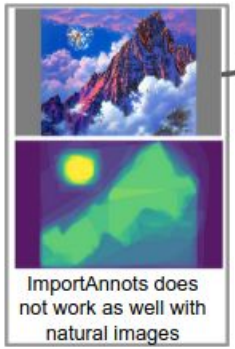

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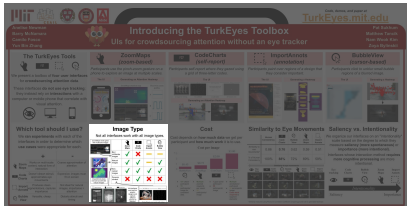
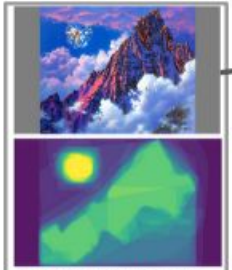
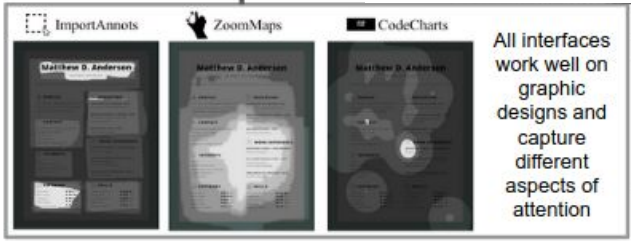


ZoomMaps works great with multiscale images



ImportAnnots does not work as well with natural images

	Zoom Maps	Code Charts	Import Annots	Bubble View
Big / multiscale images	✓	✗	–	–
Natural images	✓	✓	–	✓
Non-natural images	✓	✓	✓	✓
Dynamic content	✗	✓	✗	✗



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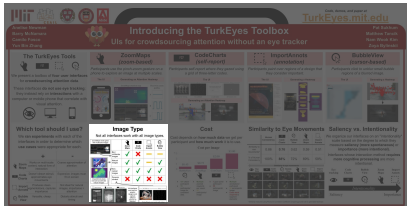

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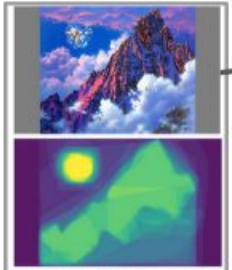

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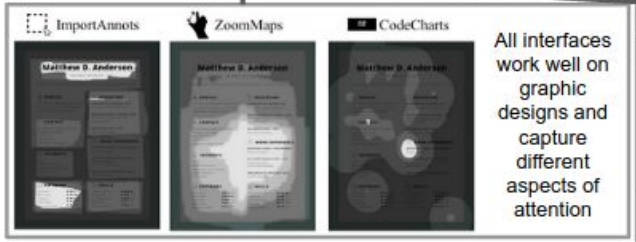
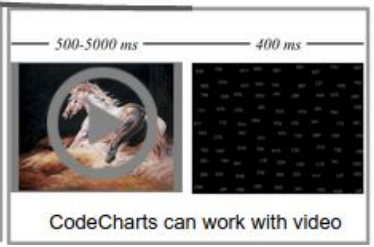
Dynamic content	✗	✓	✗	✗



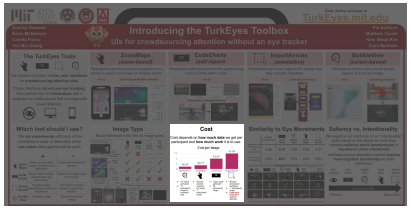
All interfaces work well on graphic designs and capture different aspects of attention



CodeCharts can work with video

Cost

Cost depends on **how much data** we get per participant and **how much work** it is to use.



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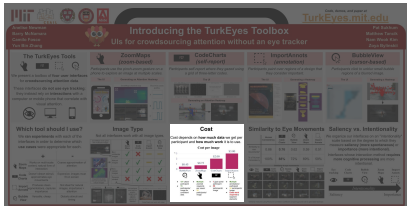

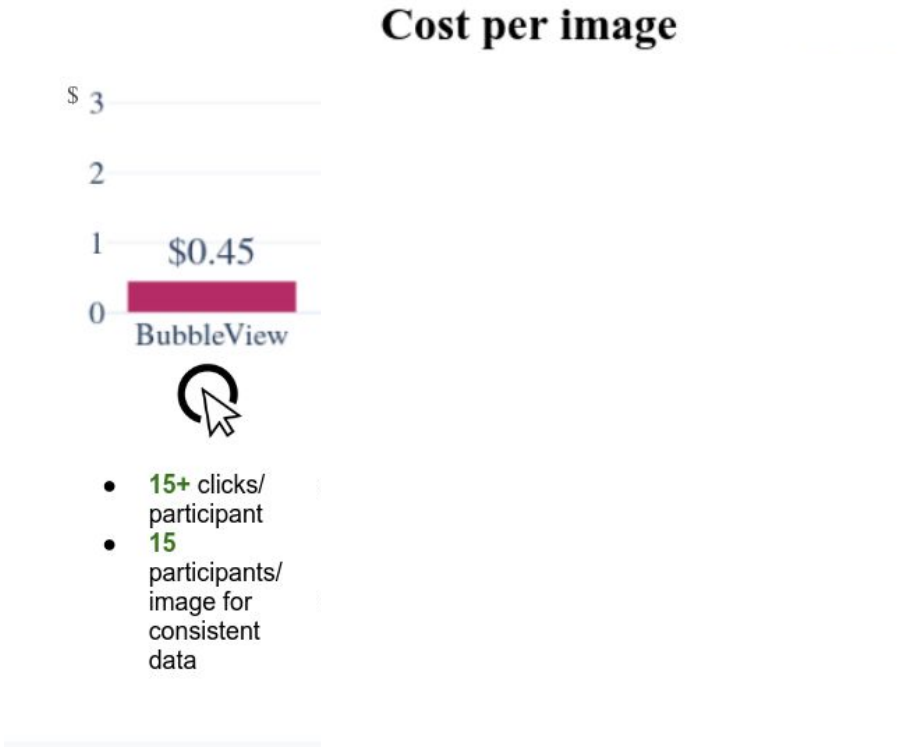

- **15+** clicks/ participant
- **15** participants/ image for consistent data

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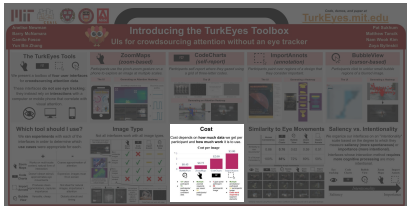

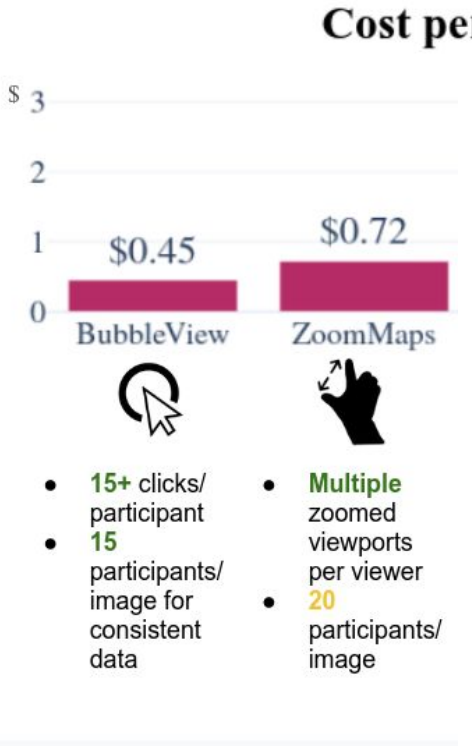

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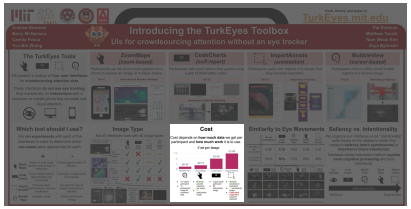

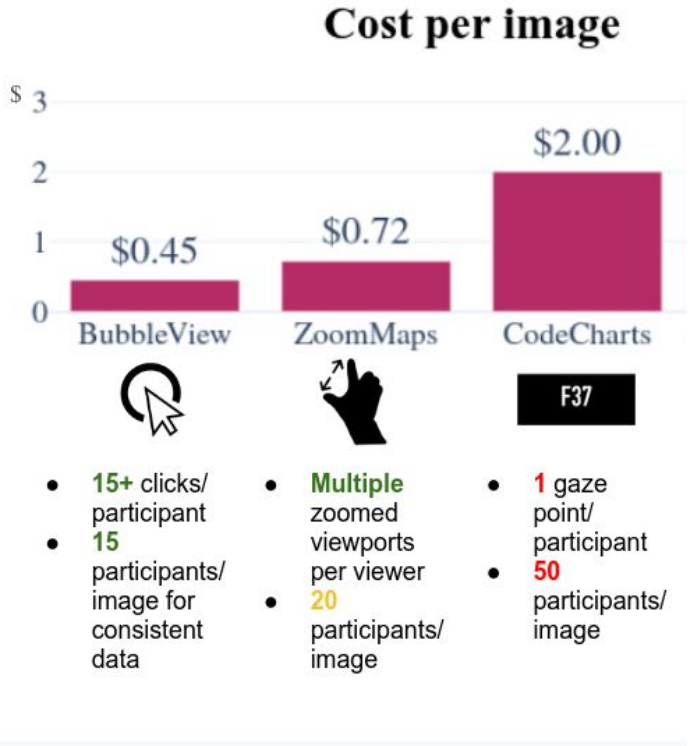

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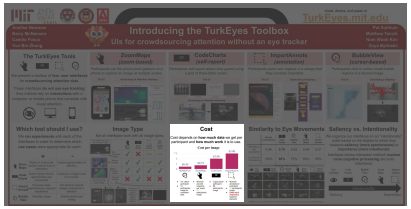

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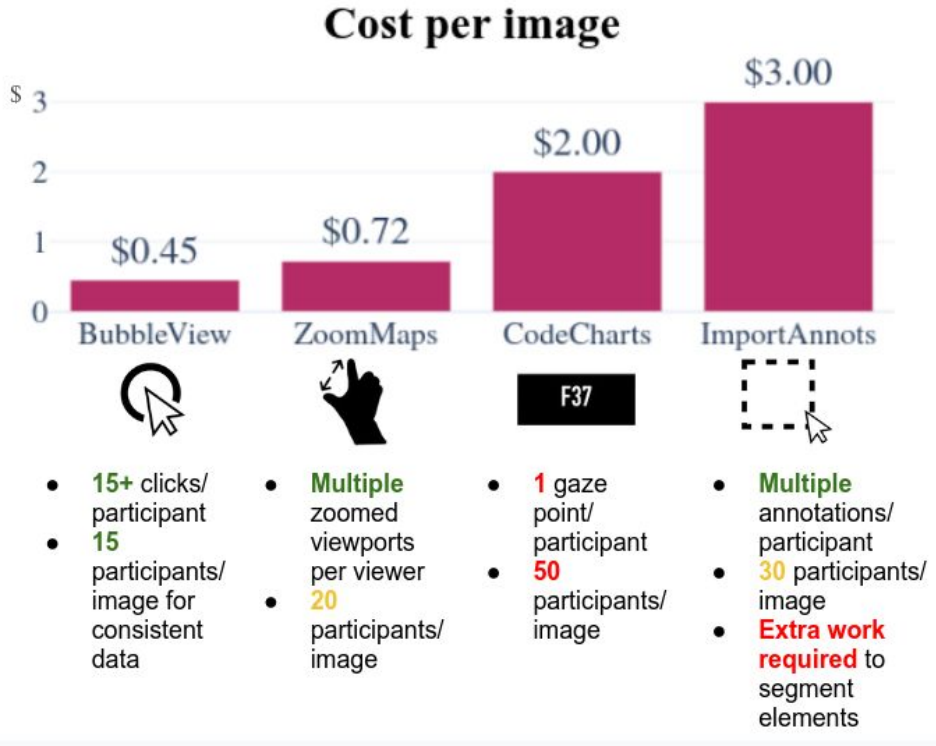
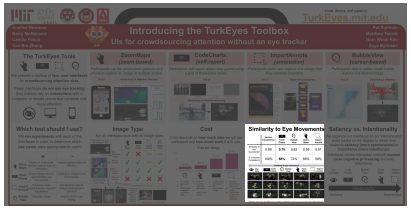


Similarity to Eye Movements



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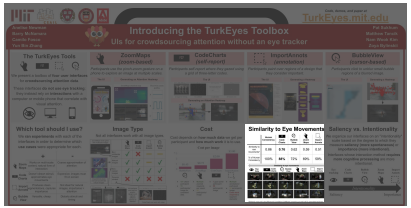

	Human Consistency
Similarity to eye movements*	0.86
% of Human Consistency	100%

Similarity to eye movements

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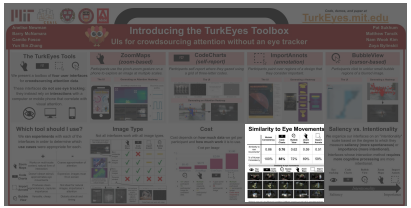


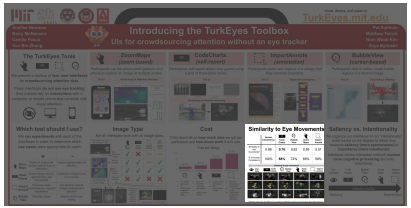
	Human Consistency	F37 Code Charts
Similarity to eye movements*	0.86	**0.76**
% of Human Consistency	100%	**88%**

Similarity to eye movements

Similarity to Eye Movements

	Human Consistency	F37 Code Charts	Bubble View	Zoom Maps	Import Annots
Similarity to eye movements*	0.86	**0.76**	0.62	0.59	0.51
% of Human Consistency	100%	**88%**	72%	69%	59%

Similarity to eye movements



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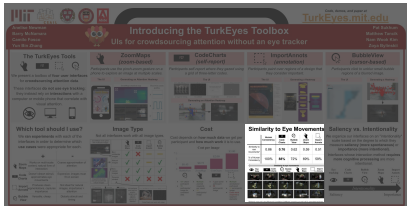

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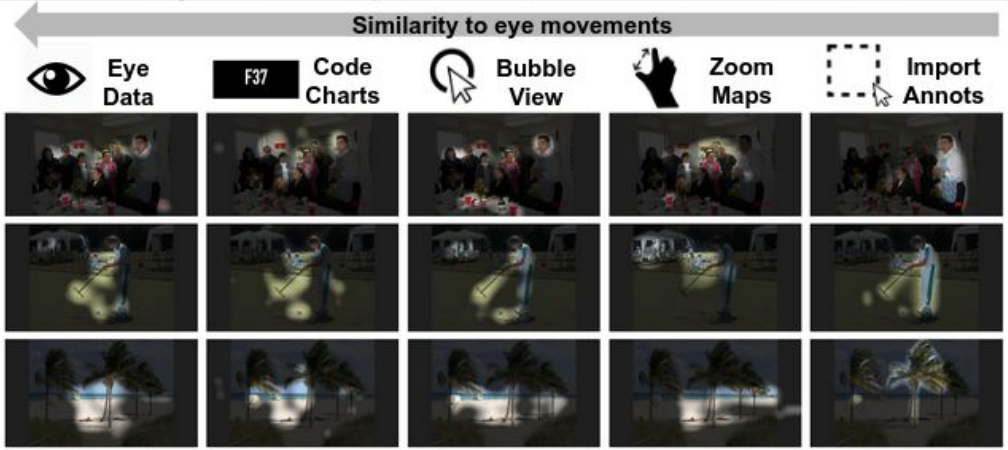
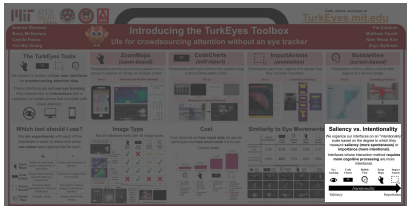


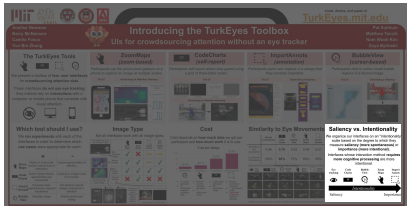
*Similarity measured using Pearson's Correlation Coefficient comparing ground-truth to generated heatmaps

Saliency vs. Intentionality



Saliency vs. Intentionality

We organize our interfaces on an "intentionality" scale based on the degree to which they measure **saliency (more spontaneous)** or **importance (more intentional).**



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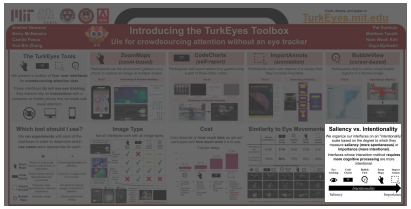

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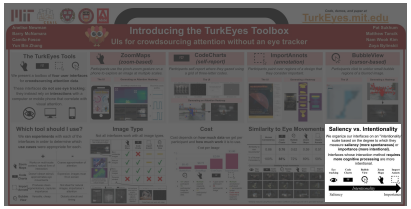

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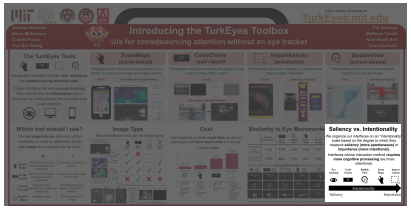

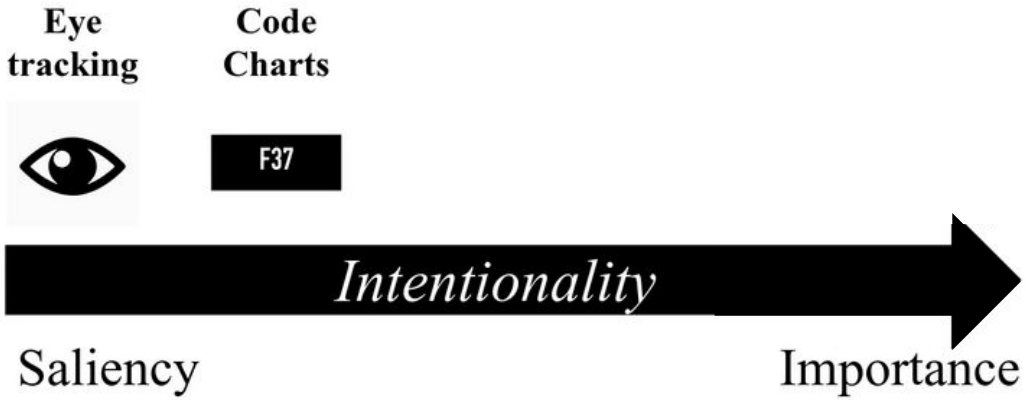

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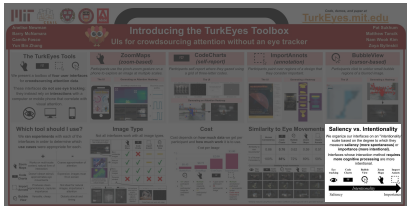

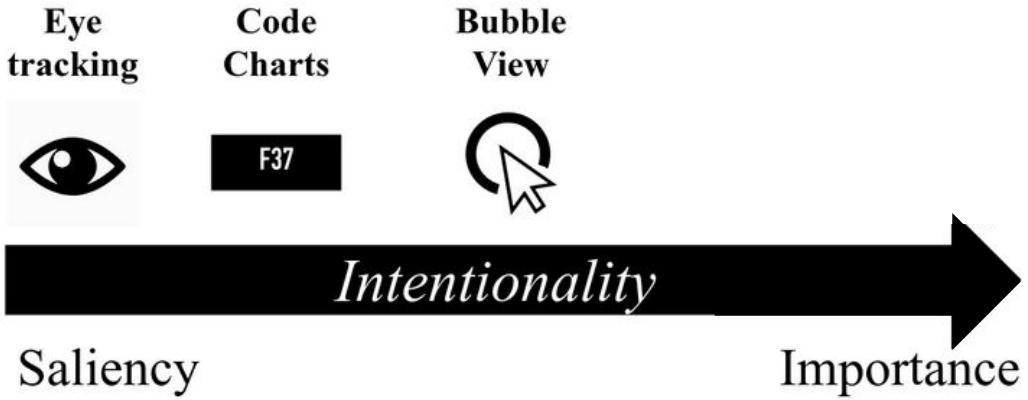

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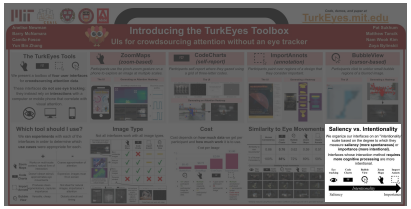

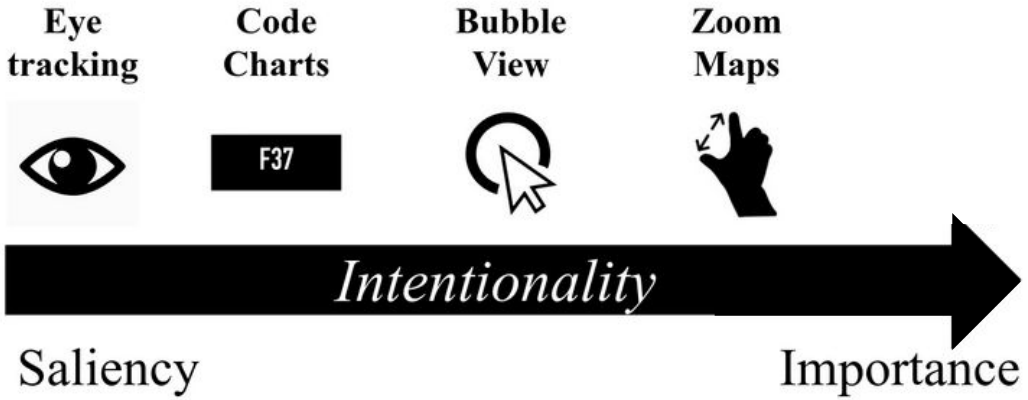

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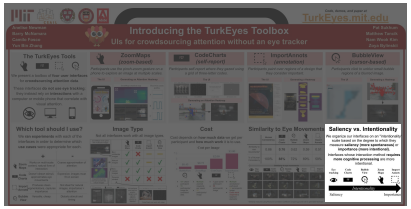
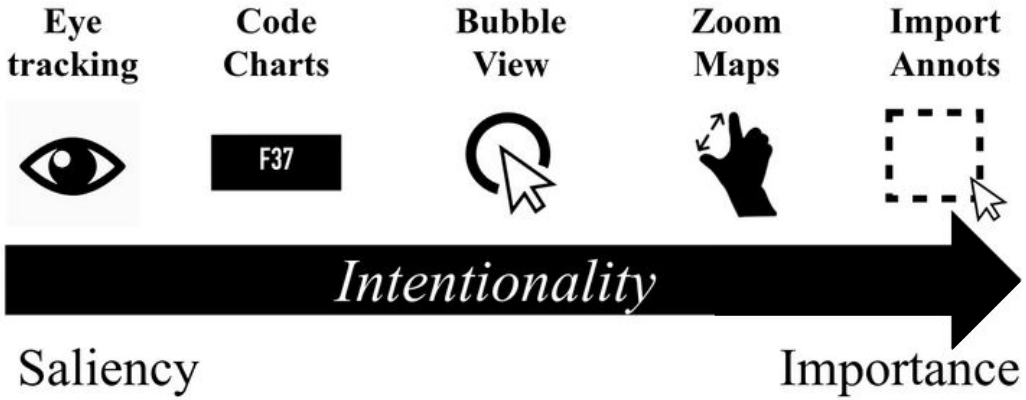
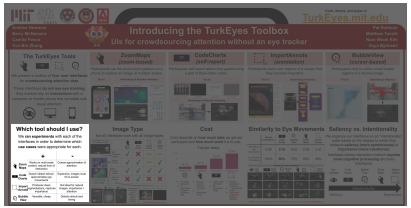




Which tool should I use?



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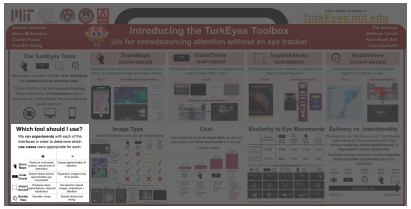

	+	-
Zoom Maps	Works on multi-scale content, natural form of interaction	Coarse approximation of attention

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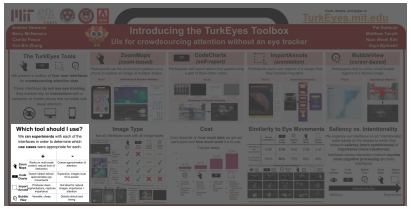

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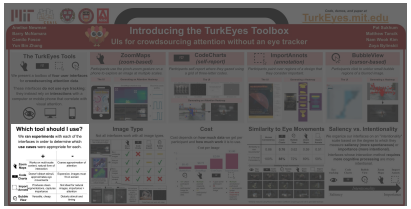

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Zoom Maps	Works on multi-scale content, natural form of interaction	Coarse approximation of attention
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Import Annots	Produces clean segmentations, captures importance	Not ideal for natural images, importance > attention

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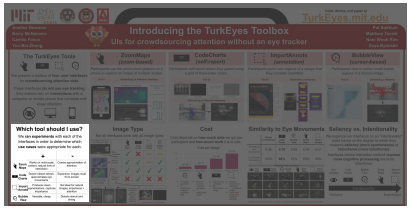

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Bubble View	Versatile, cheap	Distorts stimuli and timing

Code, demos, and paper at

TurkEyes.mit.edu

Anelise Newman
Barry McNamara
Camilo Fosco
Yun Bin Zhang

Introducing the TurkEyes Toolbox

UIs for crowdsourcing attention without an eye tracker

Pat Sukhum
Matthew Tancik
Nam Wook Kim
Zoya Bylinskii

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The TurkEyes Tools

We present a toolbox of **four user interfaces** for **crowdsourcing attention data**.

These interfaces **do not use eye tracking**; they instead rely on **interactions** with a computer or mobile phone that correlate with visual attention.

ZoomMaps *(zoom-based)*

Participants use the pinch-zoom gesture on a phone to explore an image at multiple scales.

The UI | Generating an Attention Heatmap

CodeCharts *(self-report)*

Participants self-report where they gazed using a grid of three-letter codes.

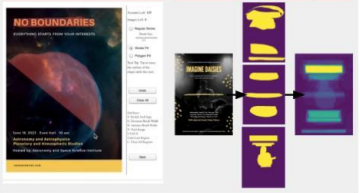
The UI

Generating an Attention Heatmap

ImportAnnots *(annotation)*

Participants paint over regions of a design that they consider important.

The UI | Generating a Heatmap



BubbleView *(cursor-based)*

Participants click to unblur small bubble regions of a blurred image.

The UI | Generating a Heatmap

Which tool should I use?

We **ran experiments** with each of the interfaces in order to determine which **use cases** were appropriate for each.

	+	-
Zoom Maps	Works on multi-scale content, natural form of interaction	Coarse approximation of attention
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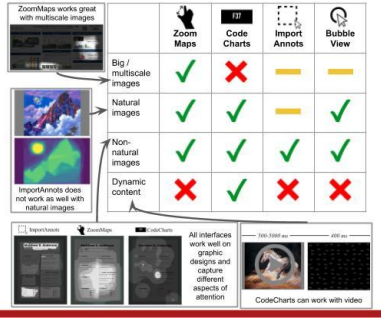
Image Type

Not all interfaces work with all image types.



	Zoom Maps	Code Charts	Import Annots	Bubble View
Big / multiscale images	✓	✗	—	—
Natural images	✓	✓	—	✓
Non-natural images	✓	✓	✓	✓
Dynamic content	✗	✓	✗	✗

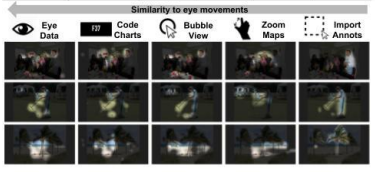
Cost

Cost depends on **how much data** we get per participant and **how much work** it is to use.

- **15+** clicks/ participant
- **15** participants/ image for consistent data
- **Multiple** zoomed viewports per viewer
- **20** participants/ image
- **1** gaze point/ participant
- **50** participants/ image
- **Multiple** annotations/ participant
- **30** participants/ image
- **Extra work required** to segment elements

Similarity to Eye Movements

	Human Consistency	Code Charts	Bubble View	Zoom Maps	Import Annots
Similarity to eye movements*	0.86	**0.76**	0.62	0.59	0.51
% of Human Consistency	100%	**88%**	72%	69%	59%



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