Enhanced Representation of Web Pages for Usability Analysis with Eye Tracking

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WeST People and Knowledge Networks
EYEVIDO cloud eye tracking
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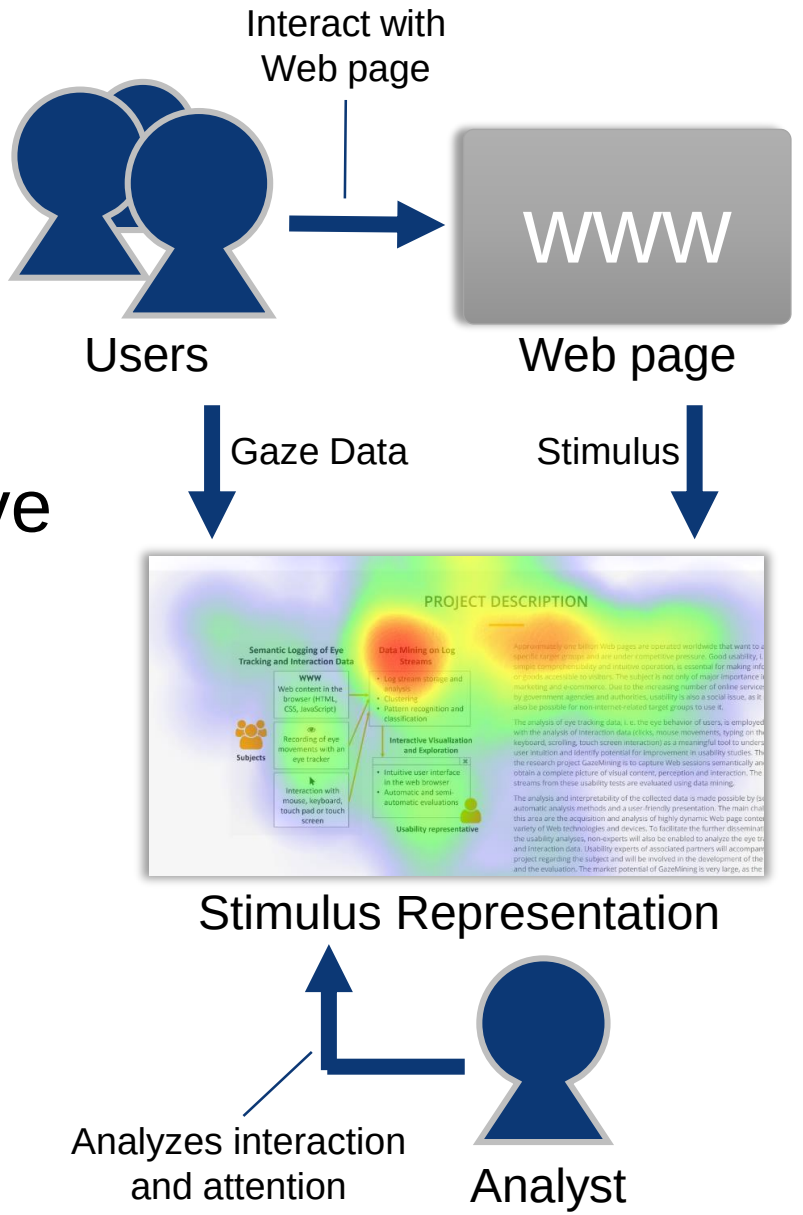
Motivation

- Analysts estimate interface usability with eye tracking
- Usually performed for static stimulus (screenshot, image)
- Web pages: Dynamic and active stimulus (Blascheck et al.)[1]
- How to enable efficient large-scale Web studies?



[1]Blascheck, T., Kurzhals, K. , Raschke, M. , Burch, M. , Weiskopf, D. and Ertl, T. (2017), Visualization of Eye Tracking Data: A Taxonomy and Survey

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State-of-the-Art Representations

Video Recording

- Viewport position of users diverges through scrolling

→ Analysis must be performed per video, which makes the Video Recording method *not scalable*

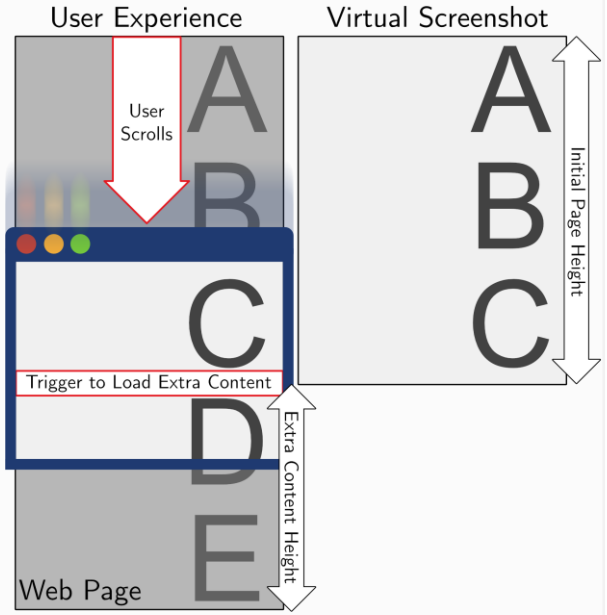
Virtual Screenshot*

- Virtually extends browser viewport to capture entire page
- Maps screen-space gaze data onto Virtual Screenshot

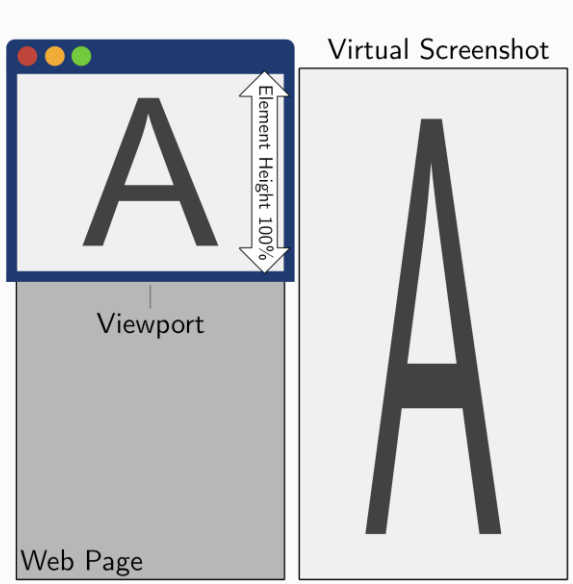
→ Virtual Screenshot method is *not accurate* for analysis on viewport-relative elements…

**as used by sticky.ai, eyezag.de, realeye.io or Tobii Studio Pro*

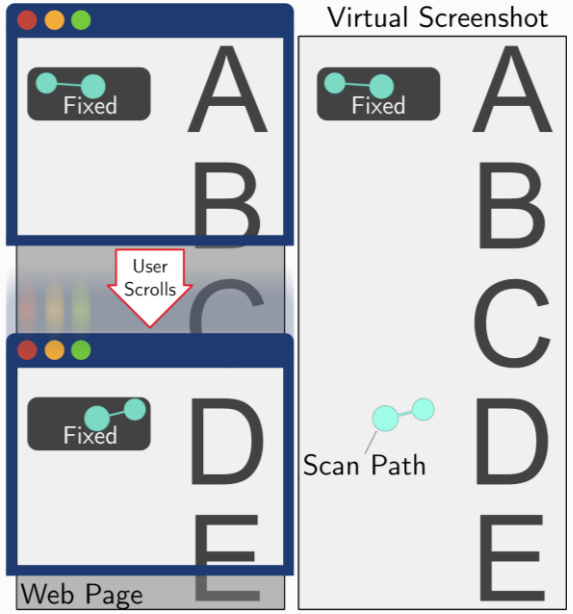
Problems of Virtual Screenshot Method



(P1) Infinite scrolling pages



(P2) Viewport-relative sized elements

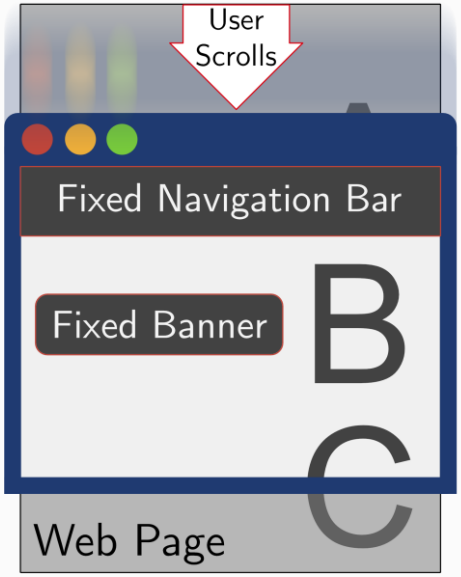


(P3) Viewport-relative positioned elements

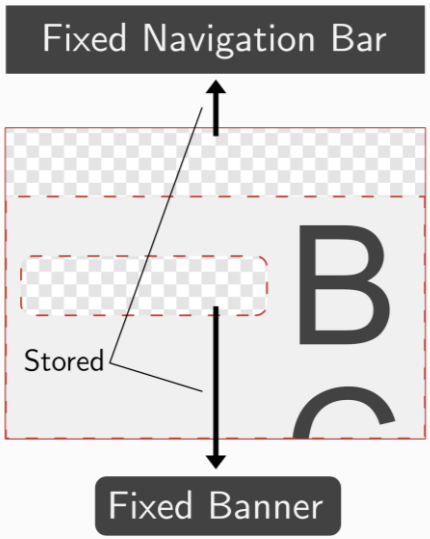
fixed

Idea: Combination of *structural information* and *pixel data*

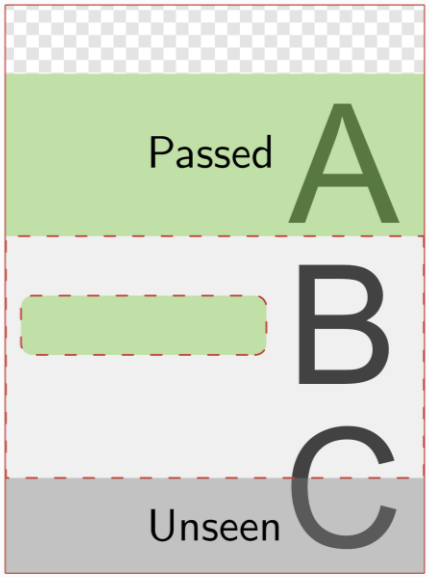
Our Enhanced Representation Method



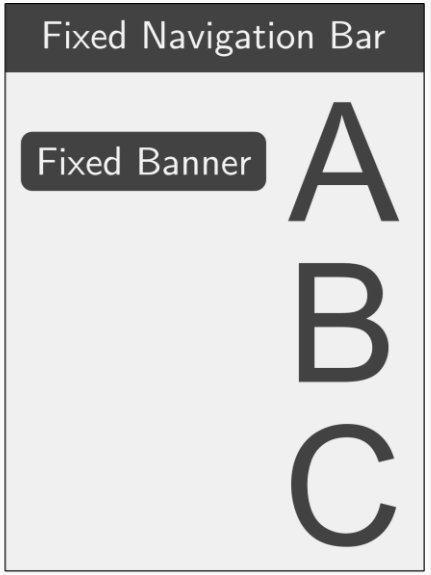
(a) Acquire information about fixed elements.



(b) Cropping of fixed elements from viewport screenshot.



(c) Integration into stitched screenshot.



(d) Combination of stitched screenshot and fixed elements.

Repeat over interaction with Web page

Final step

Our Enhanced Representation Method

The problems of the Virtual Screenshot are solved:

(P1) Infinite scrolling pages

→ Dynamic additions included

(P2) Viewport-relative sized elements

→ As displayed to the user

(P3) Viewport-relative positioned elements

→ Identified, cropped and correctly associated with gaze

Evaluation

Fixed elements and associated gaze data are **placed either** on **top** or **bottom** of stitched screenshot.

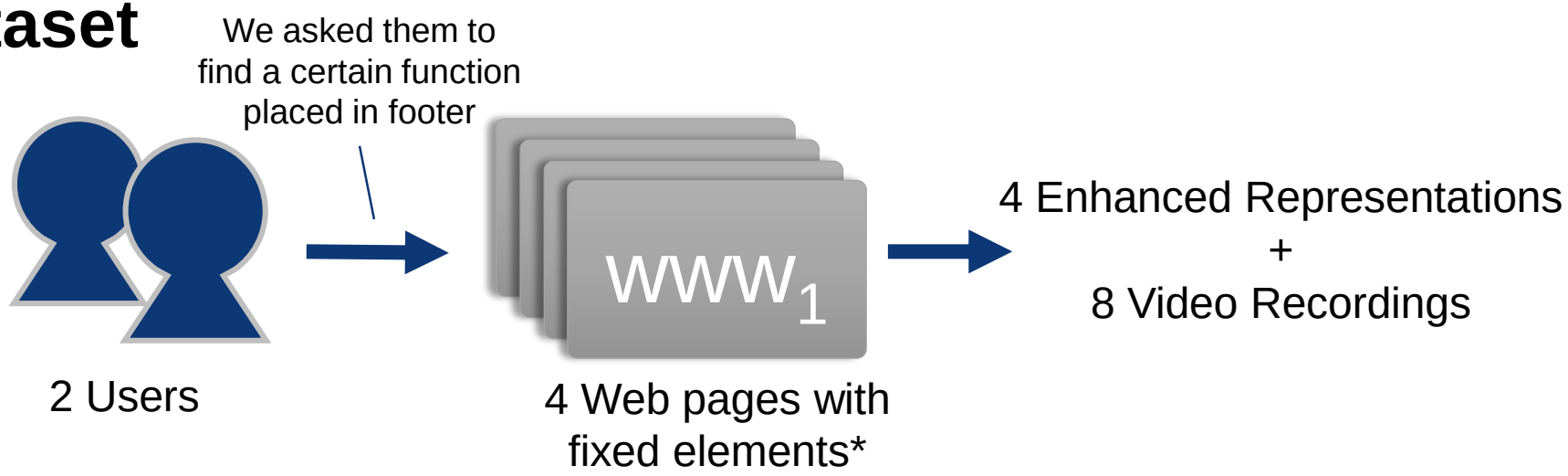
Evaluation of analysis of gaze data on fixed elements.

Hypotheses:

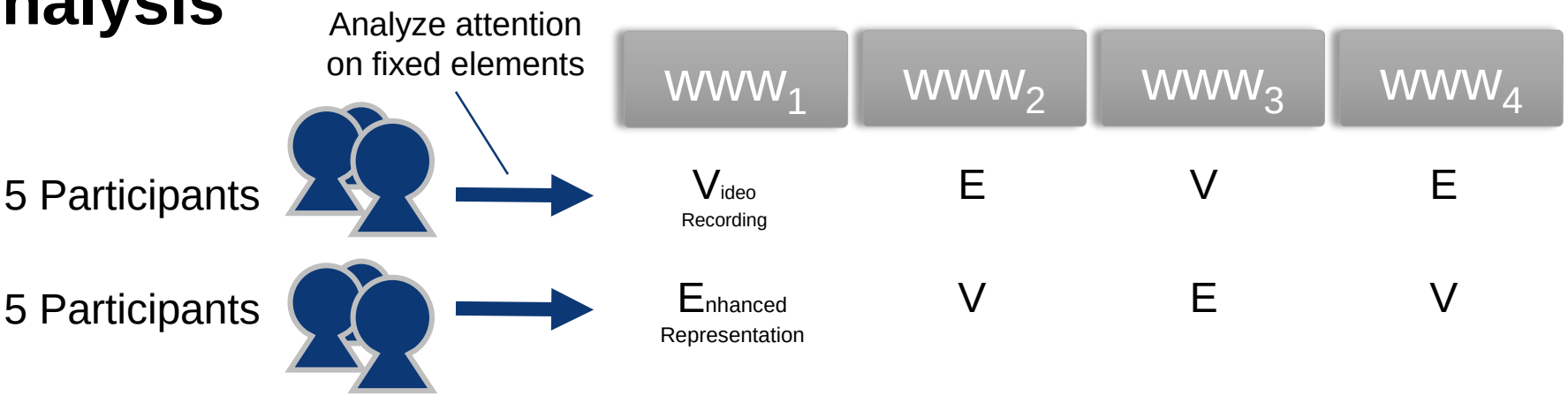
- **(H1) Accuracy**: The *Enhanced Representation* method supports the analysis of gaze data on fixed elements as accurate as the Video Recording.
- **(H2) Scalability**: For analyzing gaze data from multiple users, the *Enhanced Representation* method would be more efficient than a Video Recording.

Evaluation Setup

Dataset

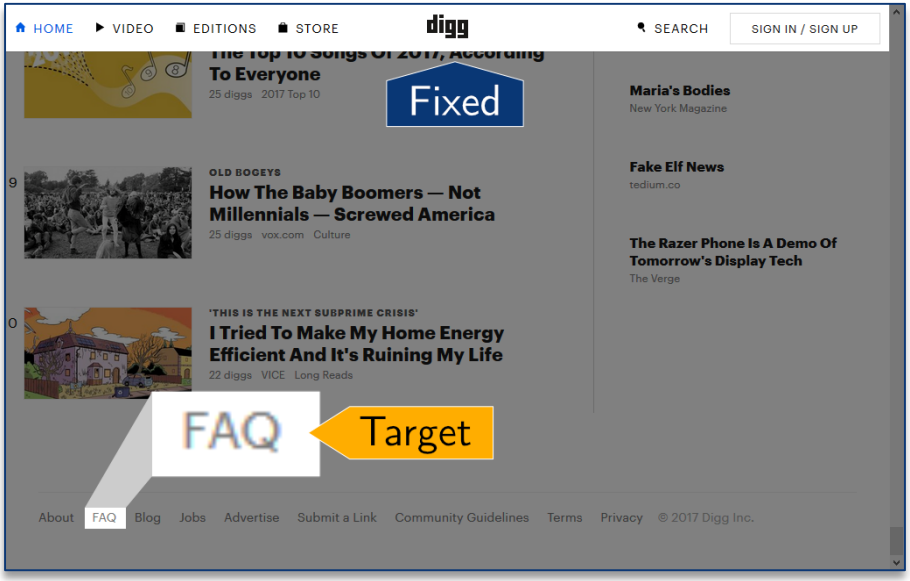


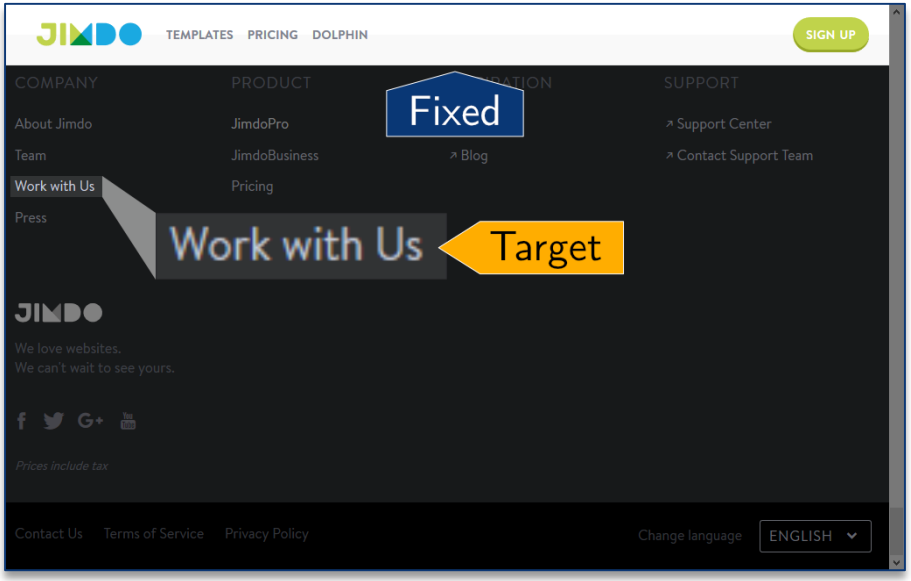
Analysis

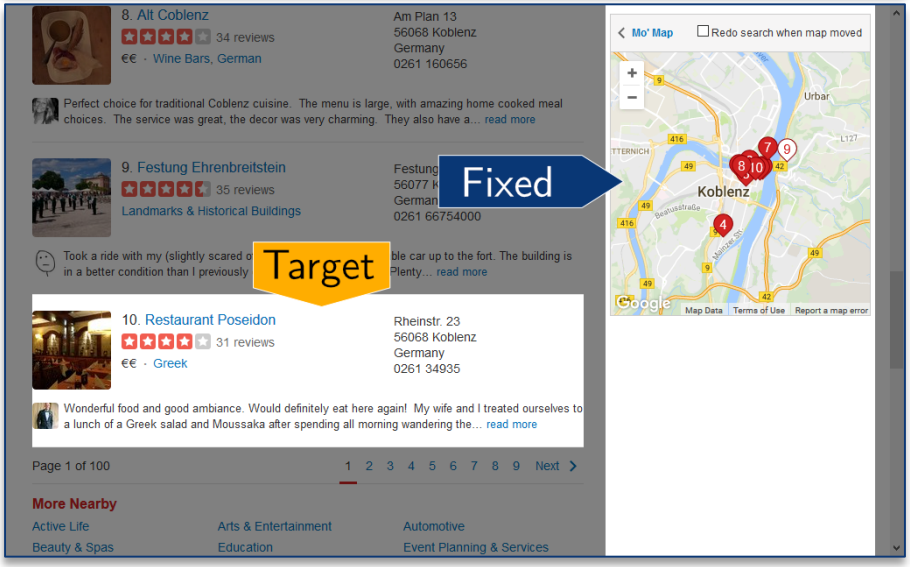


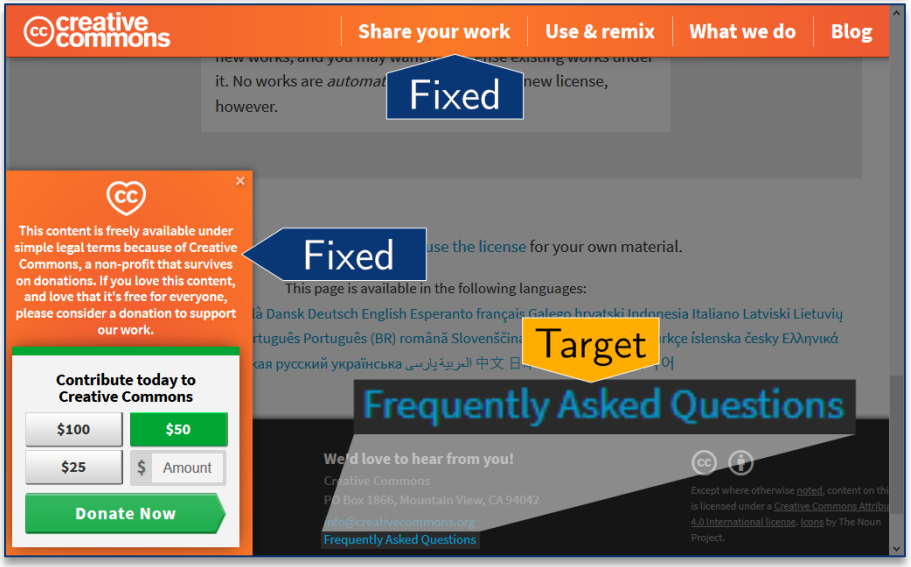
**digg.com, jimdo.com, yelp.com and creativecommons.org (CC)*

Evaluation Setup – Web Pages









Evaluation Results – Accuracy

Analysts report *Time to First Fixation* (TTFF) *and Total Fixations* (TF) within fixed element.

E = Enhanced Representation, V = Video Recording

Single outlier!

		Digg.com	*Jimdo.com*	*Yelp.com*	*CC*
E	*TTFF*	3.0 ± 6.2	0.0 ± 0.0	1.2 ± 3.8	0.0 ± 0.0
	TF	9.4 ± 17.8	31.3 ± 44.3	2.5 ± 7.9	1.0 ± 3.2
V	*TTFF*	15.3 ± 31.8	0.0 ± 0.0	1.2 ± 3.8	0.0 ± 0.0
	TF	15.3 ± 17.1	0.0 ± 0.0	2.5 ± 7.9	0.0 ± 0.0

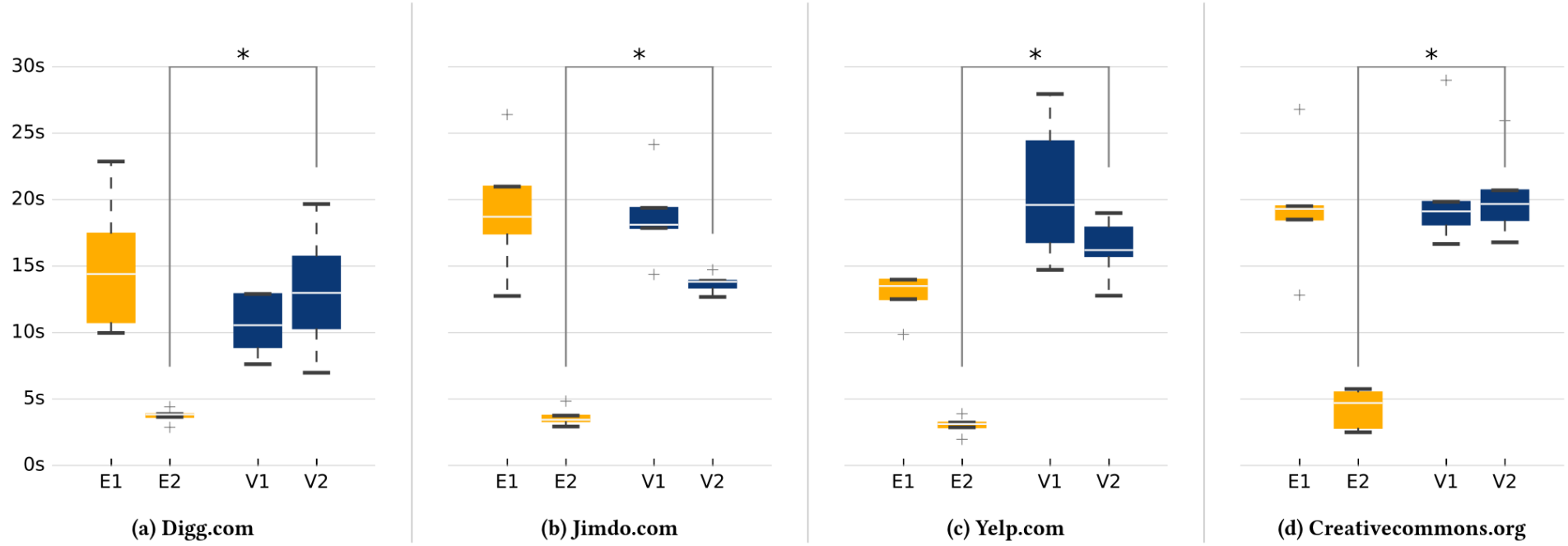
Average absolute percentage errors

→ Validates hypothesis about accuracy (H1)

Evaluation Results – Task Completion Time

Box plot of task completion time.

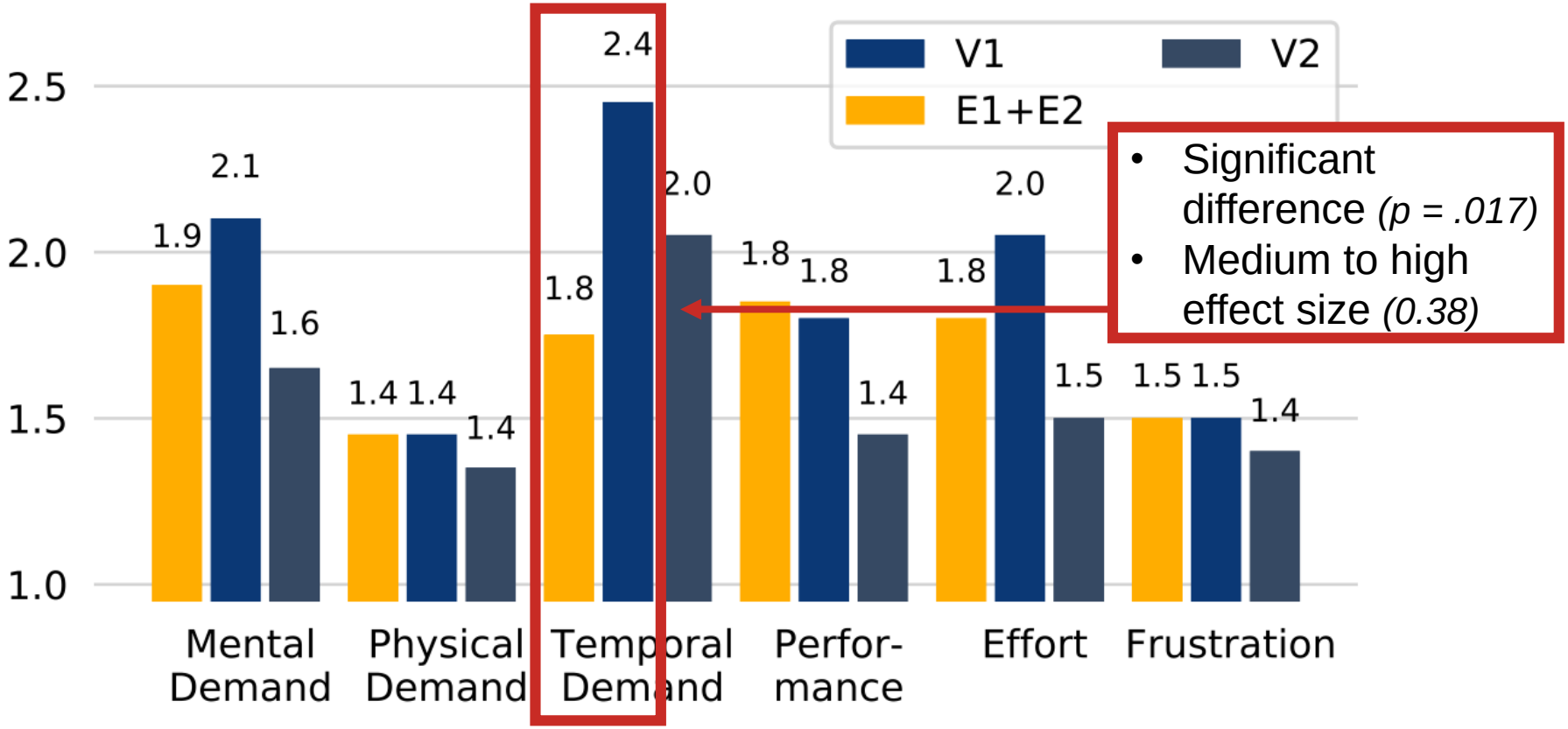
E = Enhanced Representation, V = Video Recording



→ Supports our hypothesis (H2) about scalability

Evaluation Results – Temporal Demand

NASA-TLX Raw values.



→ Supports our hypothesis (H2) about scalability, too

Contribution and Future Work

- Our method allows a *scalable* and *accurate* analysis of attention on Web pages
  - As good as Virtual Screenshot for page-relative content
  - As good as Video Recording for viewport-relative content

→ **Allows efficient analysis of high number of Web page users**

- Future Work
  - Improve precision of fixed element cropping (e.g., shadows)
  - Cover dynamics on Web pages, like carousels, etc.

Thank you for your attention!

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