

# Evaluating preliminary data visualization of an eye-tracking study

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## INTRODUCTION

### Background

- Fixation is a crucial eye-movement metric that provides valuable insights into gambling-related motivational mechanisms through serving as a direct measure of overt visual attention (Kim et al., 2021; Kwak et al., 2015; McGrath et al., 2018).
- However, systematic biases in raw eye-tracking data may induce inaccuracy in calculations and interpretations in future analyses.

### Study Aims

- To evaluate the performance of different choices of reference images on the quality of preliminary eye-tracking data visualization and determine the extent to which each reference image contributes to a better match with the computed scan paths through individual comparisons.
- To replicate a prior finding of Murch et al. (2020) in the overall pattern of fixation distribution among specific areas of interest (AOIs) on the slot machine screen.

### Hypotheses

- Individually created reference images would serve as better templates for plotting scan path graphs.
- More fixations would localize within the credit window where financial information was displayed in consideration of the size of each AOI.

## METHODS AND MATERIALS

- The subjective visual field and pupillary response of participants on a realistic slot machine task were captured by a wearable Pupil Labs eye tracker. A total number of n=32 recordings with an average length of 20 minutes were processed before analyses.
- We proposed two ways of extracting reference images from individual recordings, including:
  - a 'group' template, which was an exact reflection of the game interface,
  - three 'individual' templates, which were screenshots taken at flexible time points within a certain period from participants' subjective field of view.

## RESULTS

- We found ameliorated scan path graphs among 16 participants (50%) using at least one of the 'individual' templates.
  - Individual screenshots taken at the beginning of the recording improved visualization quality for 8 participants (25%);
  - Individual screenshots taken midway through the recording improved visualization quality for 3 participants (9%);
  - Individual screenshots taken at the end of the recording improved visualization quality for 5 participants (16%).
- The 'group' template showed a better fit with the computed scan paths for 6 participants (19%).
- No obvious difference between the quality of the visualized graphs using either reference images was found among the remaining 10 participants (31%).
- Although the greatest proportion of fixations were found on the spinning reels, an attentional bias towards the credit window can be inferred from the normalized data.

	# of Fixations	Fixations / Minute	Normalized Fixations
Reels	23489.66	1150.87	4.97
Credit window	898.72	41.97	6.08
Win window	619.14	29.88	0.46
Menu bar	217.55	29.88	-5.75
Game border	548.07	26.77	-5.76

Table 1. Fixations per area of interest

Note: Fixations/minute was calculated through dividing the total number of fixations within each AOI by the length of a single game session in minutes. Normalized fixations were calculated through standardizing the result of dividing the total number of fixations within each AOI by the percentage of the game screen occupied by the AOI.



Figure 1. Fixation scan paths on the game surface using the 'group' template

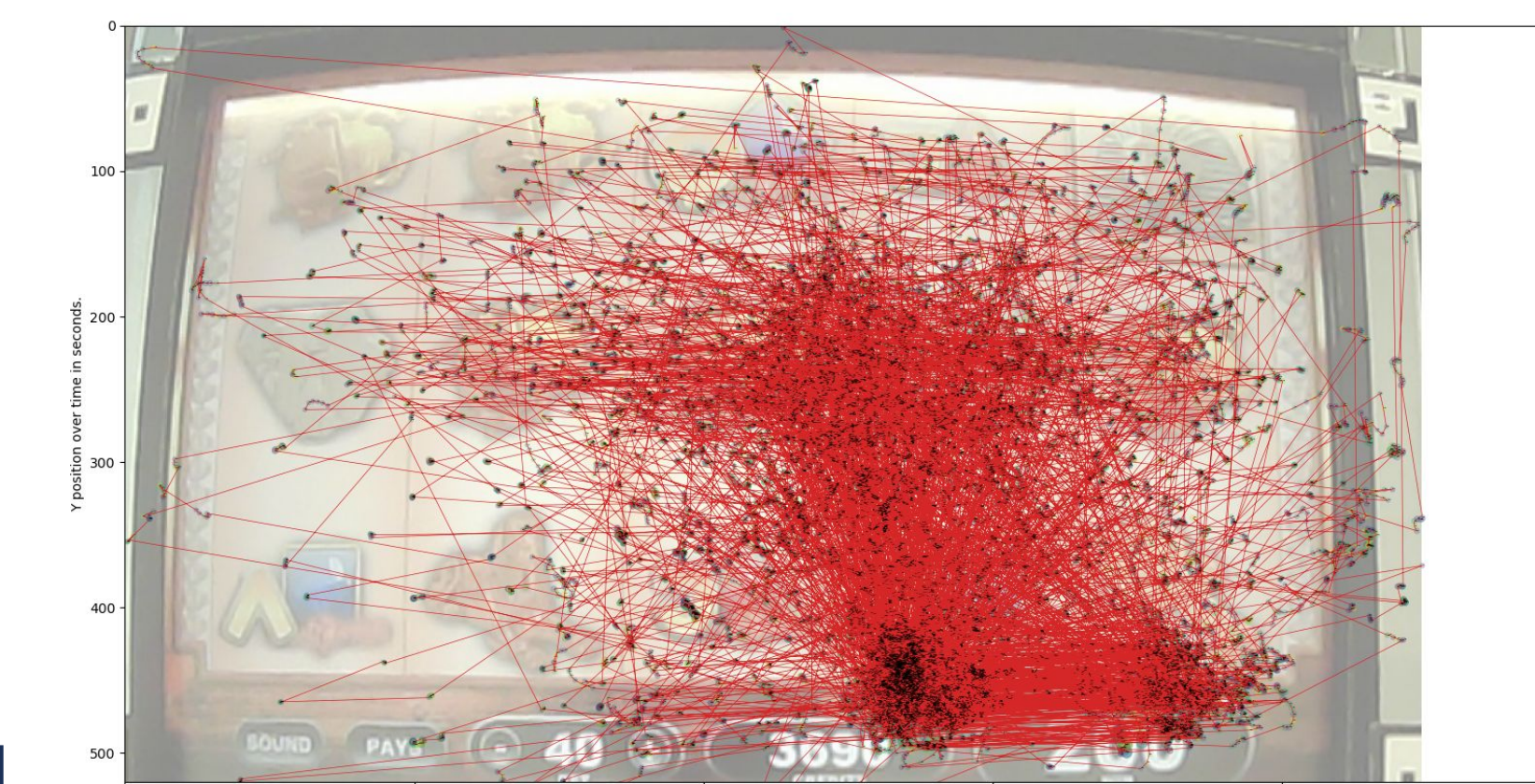


Figure 2. Fixation scan paths on the game surface using 'individual' template taken at the end of the recording

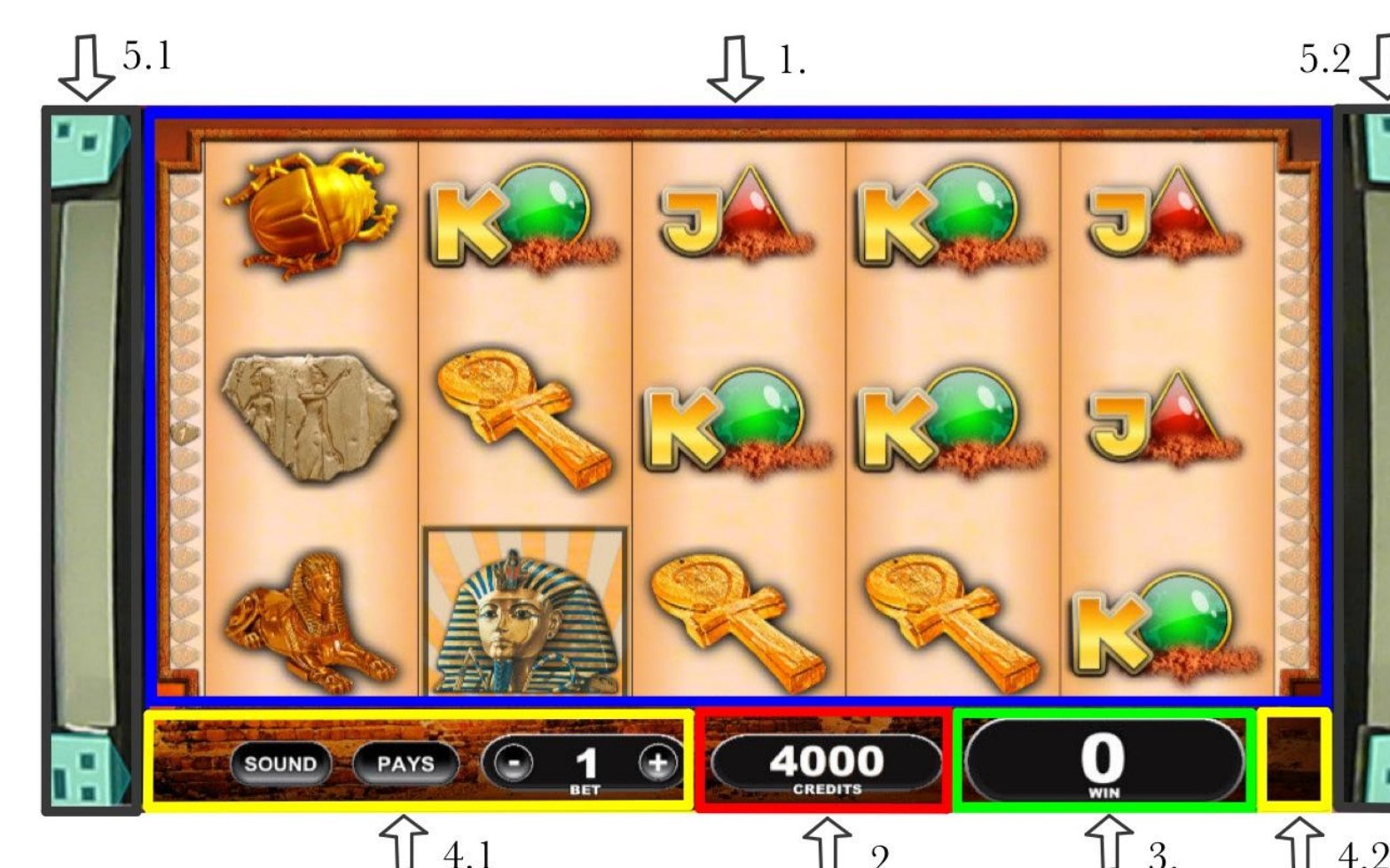


Figure 3. The 'group' template

Note: The game interface was segmented into 7 mutually exclusive pieces to represent a total number of 5 AOIs: (1) spinning reels, (2) credit window, (3) win window, (4.1&4.2) menu bar (which laid out information about sounds, pays, and bet sizes), and (5.1&5.2) game border.

Figure 4. Colorfully labelled fixations on each area of interest (Participant ID: 001)

## DISCUSSION

- As can be seen from the comparison (see Figure 1&2), the major advancement of 'individual' templates comes from readjusting the position of the screen display to better fit with the deflected scan paths.
- Therefore, we conclude that the effectiveness of individual reference images depends on the degree to which the scan paths deviate from the uniform 'group' template. In other words, the greater the systematic errors existed, the less the improvement will be.
- The present analysis successfully replicates the main feature of fixation distribution found by Murch et al. (2020), revealing the underlying attentional bias while gambling and further supporting the 'zone in' account for slot machine immersion.
- Some of the reference images inevitably failed to capture a complete game surface due to uncontrollable head movement and inappropriate sitting position.
- Notable improvements found in half of the scan path graphs supported individualizing reference images as a promising way of refining eye-tracking visualization. The same procedure should be applied to the rest of the data to test the reliability of the current findings with a larger sample size.

## REFERENCES

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