Supporting Object-level Exploration of Artworks by Touch for People with Visual Impairments

Nahyun Kwon, Youngji Koh, Uran Oh
{skgus2624, youngji0201}@gmail.com, uran.oh@ewha.ac.kr
Department of Computer Science and Engineering, Ewha Womans University

INTRODUCTION

Goal:
• To enable people with visual impairments to explore and understand artworks independently

Our Approach:
• A touchscreen-based mobile application which plays object-level verbal descriptions upon users’ touch

RELATED WORKS

• Location-based audio guidance [1-4, 6]
  • Requires users to visit the exhibition sites in person
• Multimodal exploration with 2.5D tactile representation [5, 7]
  • Requires a custom device per painting

PROTOTYPE

Figure 1. The original and its visualization of segmented painting examples with ‘The Starry Night’ by Vincent van Gogh which was used in our study.

• Main feature: Provides object-level information upon touch (e.g., “A cypress tree, painted black, located on the left side of the painting”)
• Supported VoiceOver gestures
• Implementation
  • Manual object segmentation and descriptions
  • Developed as a web application using HTML, CSS, JavaScript, and D3.js

USER STUDY

• Semi-structured interview study using our prototype

Participants

• Eight participants with visual impairments
• All participants were male, age = 41.8 on average (SD = 10.7)

<table>
<thead>
<tr>
<th>PID</th>
<th>Age</th>
<th>Visual Impairment (best eye)</th>
<th>Onset Years</th>
<th>Screen Reader Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>44</td>
<td>light perception</td>
<td>2</td>
<td>N</td>
</tr>
<tr>
<td>2</td>
<td>53</td>
<td>low vision</td>
<td>6</td>
<td>Y</td>
</tr>
<tr>
<td>3</td>
<td>59</td>
<td>low vision</td>
<td>3</td>
<td>N</td>
</tr>
<tr>
<td>4</td>
<td>30</td>
<td>light perception</td>
<td>7</td>
<td>Y</td>
</tr>
<tr>
<td>5</td>
<td>32</td>
<td>totally blind</td>
<td>30</td>
<td>Y</td>
</tr>
<tr>
<td>6</td>
<td>47</td>
<td>low vision</td>
<td>8</td>
<td>Y</td>
</tr>
<tr>
<td>7</td>
<td>35</td>
<td>light perception</td>
<td>1</td>
<td>N</td>
</tr>
<tr>
<td>8</td>
<td>34</td>
<td>low vision</td>
<td>32</td>
<td>N</td>
</tr>
</tbody>
</table>

Procedure

Figure 2. Four paintings used in our study with varying genres (landscape, portrait, still life, and abstract)

• Participants were asked to:
  1. freely explore different genres of paintings using our prototype
  2. describe each painting and provide their personal opinions

FINDINGS

Exploring Objects in Paintings by Touch

• Exploring paintings by touch while listening to verbal feedback was highly appreciated (P2 & 5-8), and enabled participants to understand the shape (P4 & 7) and location of objects (P6 & 7)
  "It is hard to imagine what it (painting) looks like just by listening to descriptions. [But with this] I can grasp where things are by touching them with my finger." (P7)

Painting Encyclopedia

• Participants felt like they have gained knowledge of the painting as if reading an encyclopedia (P3 & 5)

Greater Access to Paintings

Participants valued our prototype as it enables them to:
• Save time and money since visiting a museum is not necessary (N = 5 and 4, respectively)
• Imagine what each painting looks like without sighted person’s help (P4-8)
• Access paintings at any time they want and as much time as they need at their own pace (P3, 5 & 6)

Suggestions for Improvements

Participants wished our prototype to provide:
• Relative attributes of each object such as position and size (N = 5)
• Distinguishing features, painting styles and textures, overall mood (N = 2), and experts’ opinion (N = 1) of paintings
• Links to relevant artworks (N = 2)

CONCLUSION

Our prototype can help people with visual impairments to freely explore and learn various paintings more in detail with object-level descriptions as well as spatial information such as position and size.

Future Work

- Multimodal interaction
- Collective intelligence by crowdsourcing
- Automation of segmentation through machine learning

References