Investigating Cursor-based Interactions to Support Non-Visual Exploration in the Real World

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Anhong Guo, Saige McVea, Xu Wang, Patrick Clary, Ken Goldman, Yang Li, Yu Zhong, Jeffrey Bigham
Computer Vision Systems

Seeing AI

OrCam

Lookout
Focusing is not straightforward

Blind people use a combination of contextual information, knowledge of the spatial layout of their environment, as well as interactive scanning to find and attend to specific items.
Cursor-based Interactions

- Indication of a **cursor region**
- More **focused** information and feedback relative to the cursor
- Further user **exploration** based on the feedback

Cursor affects how easily users can query for certain types of information and within which types of visual scenes
Cursor-based Interactions

Window Cursor

Vert. Win. Cursor

Finger Cursor

Touch Cursor
Window Cursor

Blind photography

- VizWiz::LocateIt (CVPRW’10)
- EasySnap (ASSETS’11)
- Scan Search (ASSETS’13)
- Assistive Photography (ASSETS’12, TOCHI’2014)
Window Cursor
Vertical Window Cursor
Finger Cursor

- EyeRing (AH’13)
- AccessLens (CHI’13)
- Fingerreader (CHI’15); Fingerreader 2.0 (Ubicomp’18)
- VizLens (UIST’16)
- Markit and Talkit (UIST’17)
- OrCam MyEye, MyReader
Finger Cursor
Touch Cursor

- Slide Rule (ASSETS’08)
- iOS VoiceOver
- Android TalkBack
- RegionSpeak (CHI’15)
Cursor-based Interactions

How do different kinds of cursors affect information access in the physical word in various contexts? What are the strengths and limitations of each cursor?
User Study Tasks

Locate an object

Interpret documents and signs

Manipulate an appliance control panel

Learn about surroundings
Qualitative User Study

- 12 participants: 9 blind users, 3 low vision users
- Completed four tasks in the same order
- Completed each task with counterbalanced cursor modes
- Asked participants to rank the cursor modes on each task
- Semi-structured interviews to learn about their experience
Task 1 - Locate an Object
Task 1 - Locate an Object

Window Cursor

Only required one hand, the most comfortable

Users generally had a poor sense of angular alignment

*It’s hard to tell if I’m actually tilting it or not... So technically speaking, holding it flat is tough.* (P4)

Finger Cursor

Users had a tough time aligning both the objects and their finger in the FOV

*It’s tougher because getting my finger in the camera view is what I’m finding to be hard... I would have to move both simultaneously.* (P4)

Touch Cursor

Users struggled to keep the device steady to locate even after discovery
Task 2 - Interpret Document and Signs
Task 2 - Interpret Document and Signs

Touch Cursor

Although preferred, users suggested to capture a photo then explore offline

*Is there a way to freeze the image? Then you could sit down and quietly explore... I would like to just take a screenshot and not take other people’s time.* (P5)

Window Cursor

Small movement of the phone will result in large movement on the document

*You have to balance between density and truncating the text with the edge of the window, then you have to figure out how to scan it.* (P3)

Finger Cursor

Users found it unnecessary to point at the poster since layout is not important
Task 3 - Manipulate an Appliance

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<tr>
<th>Power Level</th>
<th>one</th>
<th>two</th>
<th>three</th>
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<td>nine</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Defrost</th>
<th>Start</th>
</tr>
</thead>
</table>
Task 3 - Manipulate an Appliance

Finger Cursor

Users were most confident & satisfied with finger cursor for appliance usage

*It’s more tactile... but if you’re actually touching it, and it’s telling you what you’re interacting with, it’s immediately much more useful.* (P3)

Window Cursor

Users were not confident with translating the movement from phone to finger

Touch Cursor

Users found it helpful in creating a mental blueprint of the panel

Mapping between screen and panel was not intuitive
Task 4 - Learn about Surroundings
Key Takeaways

• **Window cursor**: large surfaces > small areas

• **Finger cursor**: direct touch > remote pointing

• **Touch cursor**: understanding layout > taking action

• **Combining cursors**: a single task could benefit from a combination of multiple cursors
Social Acceptability

Not to mention, you’re going to look weird to other people. If a blind person randomly starts pointing their finger, people are going to think, ‘Oh, what is this guy doing?’... You don’t want to stand out from the crowd for making strange gestures. (P5)

It’s also a safety issue. I would be concerned if I were a blind person, and I was walking down the street, that someone would just grab [my phone] and steal it. (P9)
Future Work

• **Combination of multiple cursors**
  Overview first, zoom and filter, then details on-demand
  Window cursor to locate area, touch cursor to learn layout, finger cursor to interact

• **Automatically switching between cursors**
  Turn on window cursor when holding device in hand
  Switch to finger cursor when showing their hand
  Activate touch cursor when dragging on screen

• **Deployment in the wild**
  Parts of the cursors integrated in Google’s Lookout to deploy to real users
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anhongg@cs.cmu.edu    guoananhong.com