



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

*ASSETS 2018, Galway, Ireland / October 22-24*

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

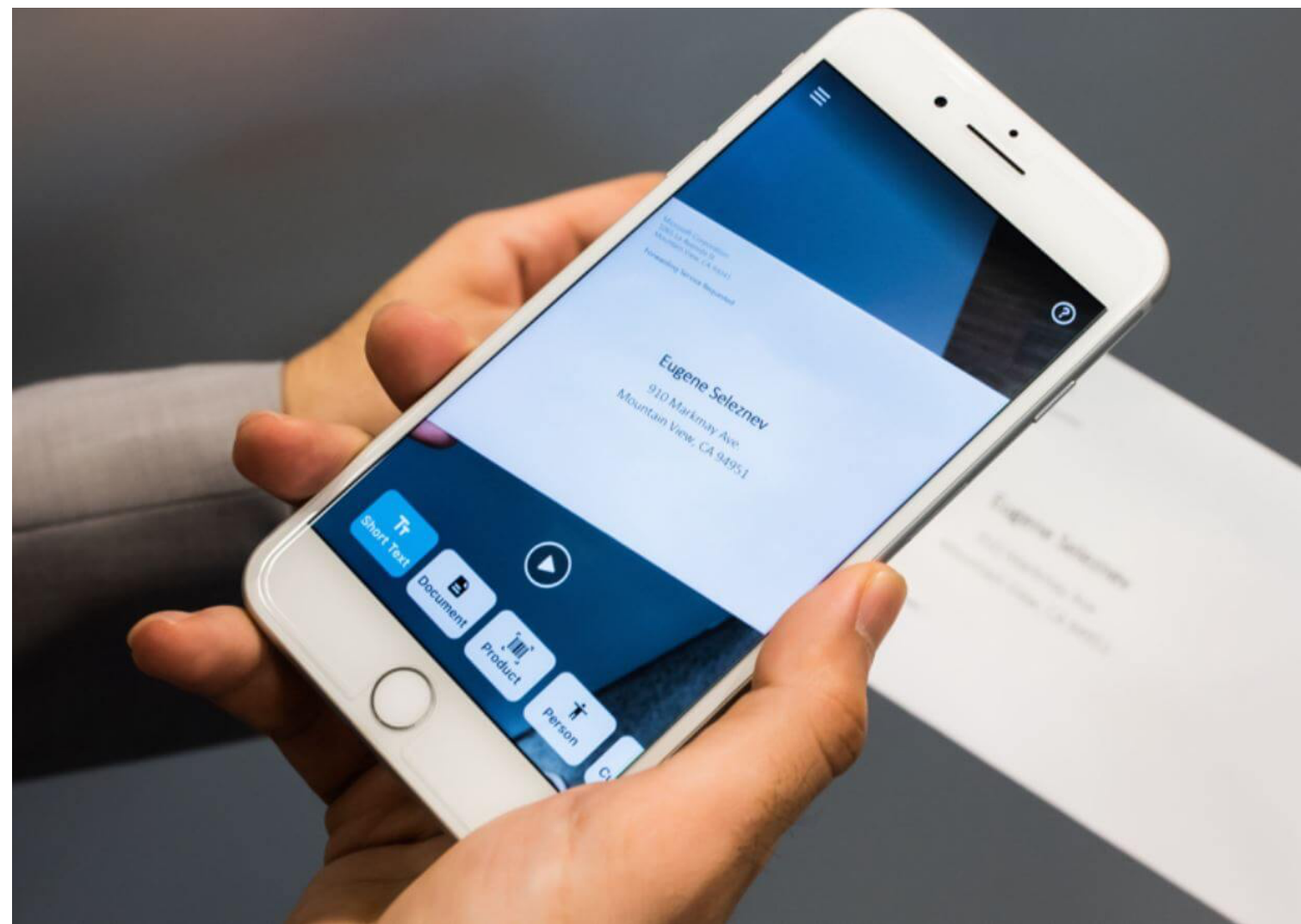
Google

Carnegie Mellon





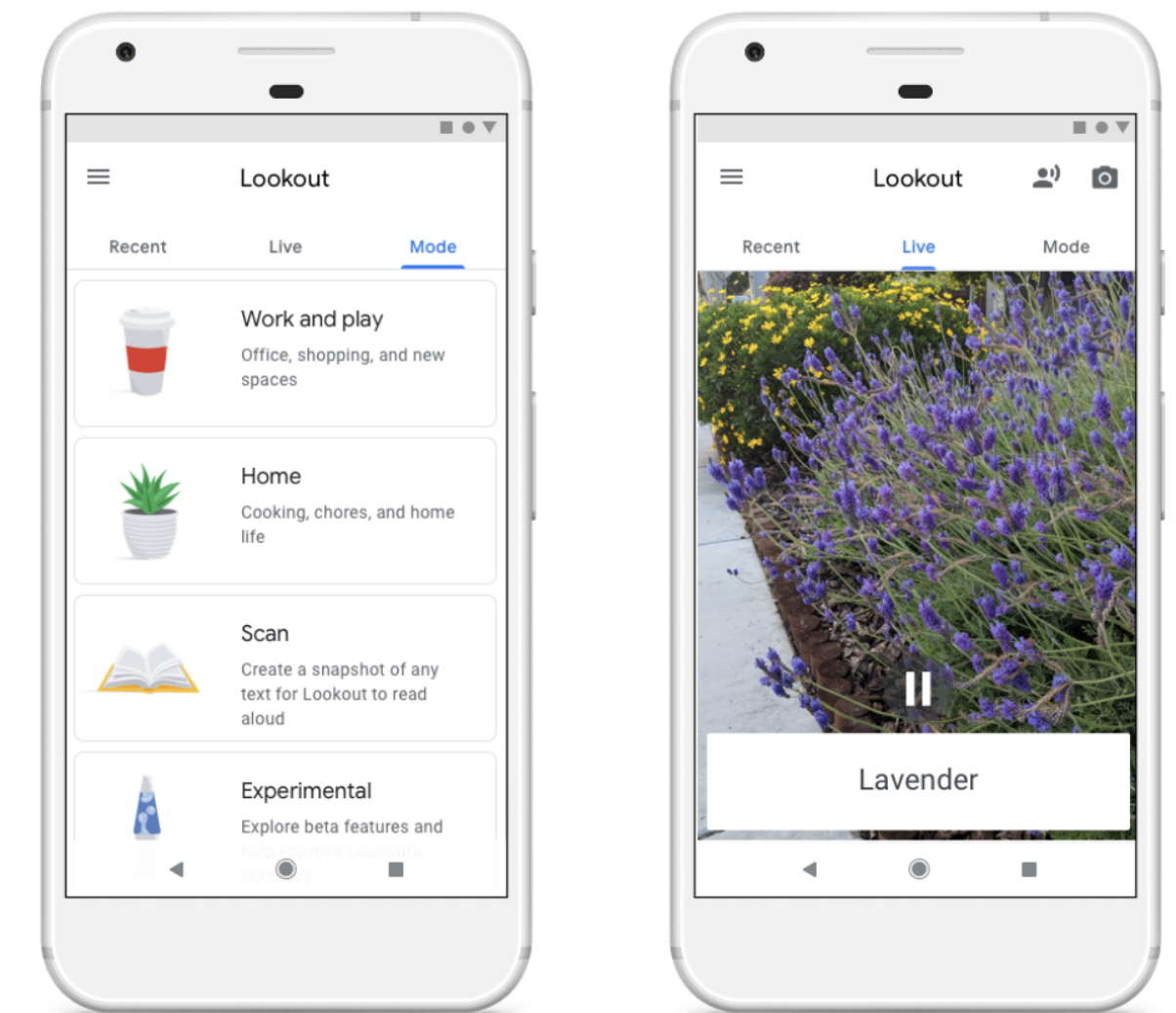
# Computer Vision Systems



Seeing AI



OrCam



Lookout







**TATTOO & Piercing**  
380 Water St.  
743-3888

Are you a **Teacher**?  
Training

**WORK?**  
Working with a social/IT?

**Fruit Tree Workshops**  
GreenUP PARK

**KARAOKE EVERY WEDNESDAY PIGS EAR TAVERN 10P**

**BECAUSE IT'S BUZZ**  
A BANDY PUB BALL TONIGHT

**ANIME NIGHT COSPLAY CONTEST**

**LEE HARVEY OSWALD TOM WILSON**  
FRIDAY OCT 16  
8 PM THE VENUE

**RON JAMES PEDAL TO THE METAL**  
OCTOBER 25 & 26, 2015 • 8 PM

**COMIC STRIPPERS**

**YOGA FOR KIDS & SHOULDERS**

**DANDELION WINE VIDEO PREMIER**

**CLASS OF '59**  
The Early Years of Rock n' Roll - In Concert

**BLACK HORSE**  
October 11th  
3pm-6pm

**PETERBOROUGH 2nd UN-CONCERT**

**Live Your Yoga**

**TUTORING**

**ACME PRESENTS NEW COPPER DRAWINGS**

**THACAP**

**YOGA FOR KIDS & SHOULDERS**

**PULP FLOOR FITNESS WORKSHOP**

**DO YOU LIKE MAKING A DIFFERENCE?**

**balance**

**CHILDREN & YOUTH SERVICES**

**Bellydance**

**GIR STE**

**BEST FRIE**

**Drawing with Line**

**ACME PRESENTS NEW COPPER DRAWINGS**

**DOUGLAS STENTON**  
Archaeology of the 1845 Franklin Expedition:  
Evidence and Questions

**Natas Cafe**  
Weekend Breakfast Special \$3.95  
Bacon, Eggs, Toast

**WHO AM I?**

**COMIC STRIPPERS**

**LIVE AT THE SPILL**  
Saturday, October 24

**WRITERS**

**ACME PRESENTS NEW COPPER DRAWINGS**

**ACME PRESENTS NEW COPPER DRAWINGS**

**ACME PRESENTS NEW COPPER DRAWINGS**

**DOUGLAS STENTON**  
Archaeology of the 1845 Franklin Expedition:  
Evidence and Questions



A brick wall is covered with a dense array of posters and notices. The posters include advertisements for 'Tattoo & Piercing', 'Teacher Training', 'Fruit Tree Workshops', 'Karaoke Every Wednesday Pigs Ear Tavern 10P', 'Because It's Buzz', 'Anime Night Cosplay Contest', 'Lee Harvey Oswald Tom Wilson', 'Ron James Pedal to the Metal', 'Class of '59', 'Dandelion Wine Video Premier', 'Mazzini Swingin' Steezin'', 'Do You Like Making a Difference?', 'Natas Cafe', and 'Weekend Breakfast Special \$3.95'. The wall is cluttered, with many posters overlapping and partially obscured by others.

# 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.



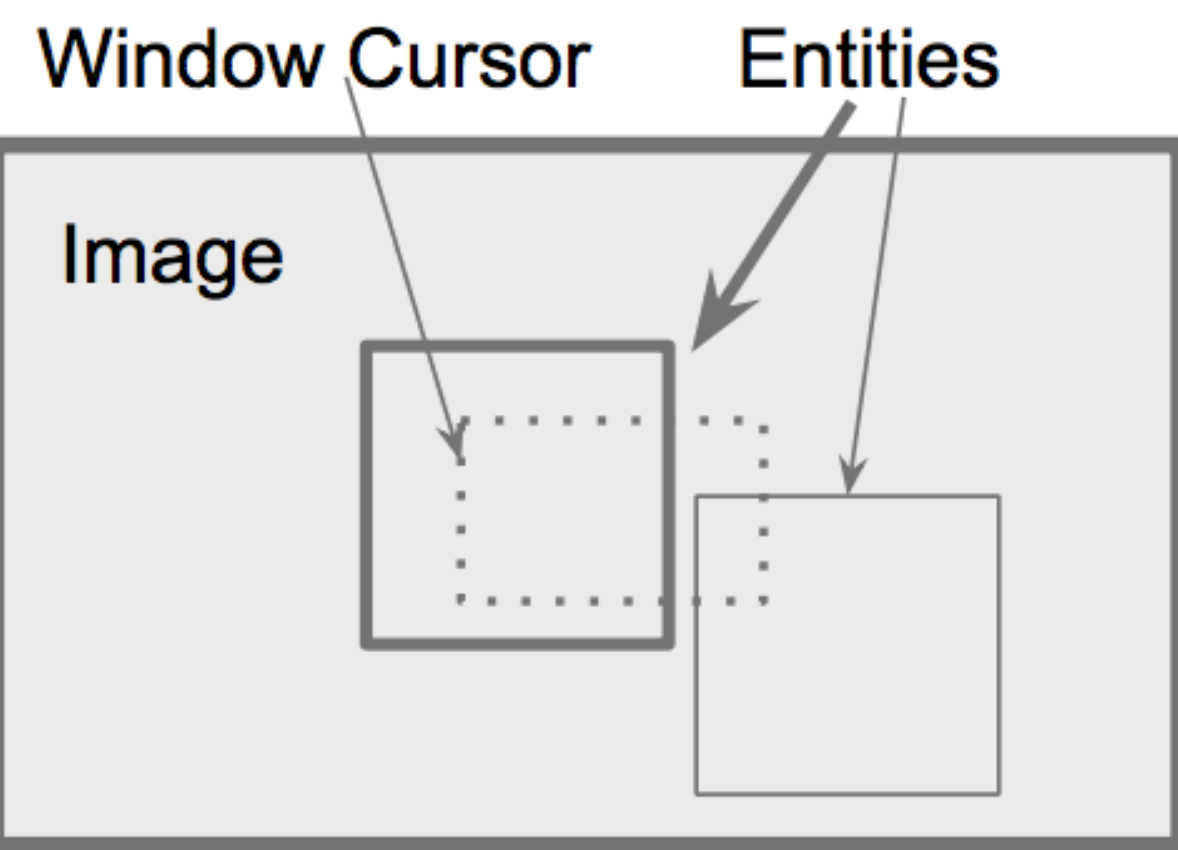
# Cursor-based Interactions

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

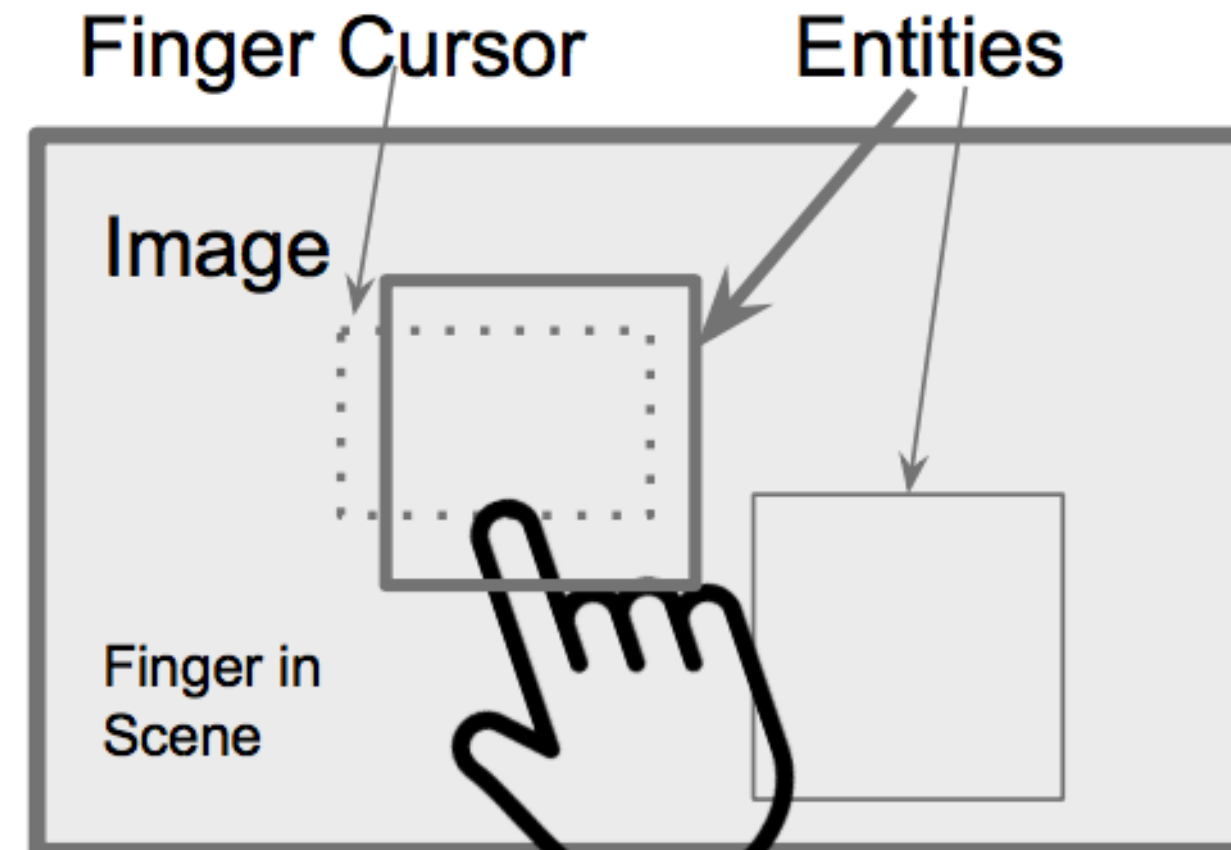
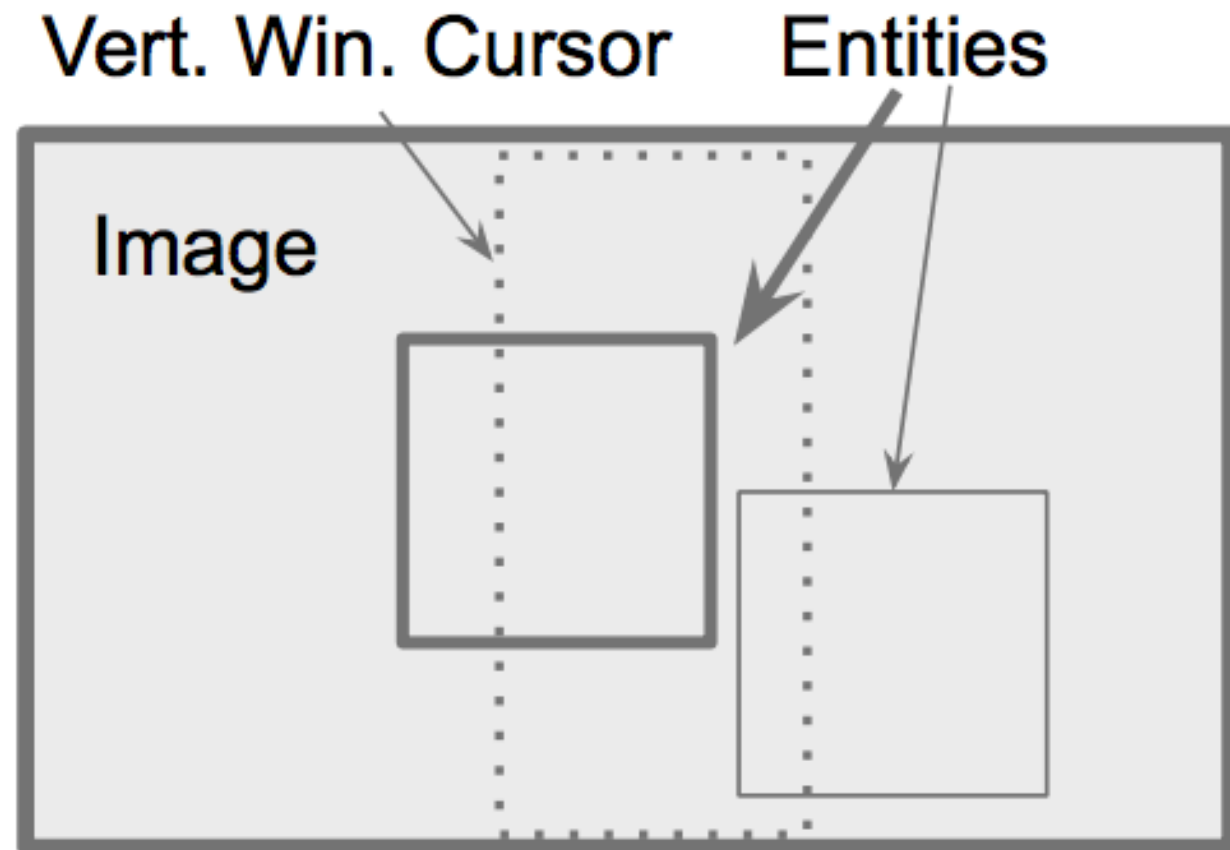
**Cursor affects how easily users can query for certain types of information and within which types of visual scenes**



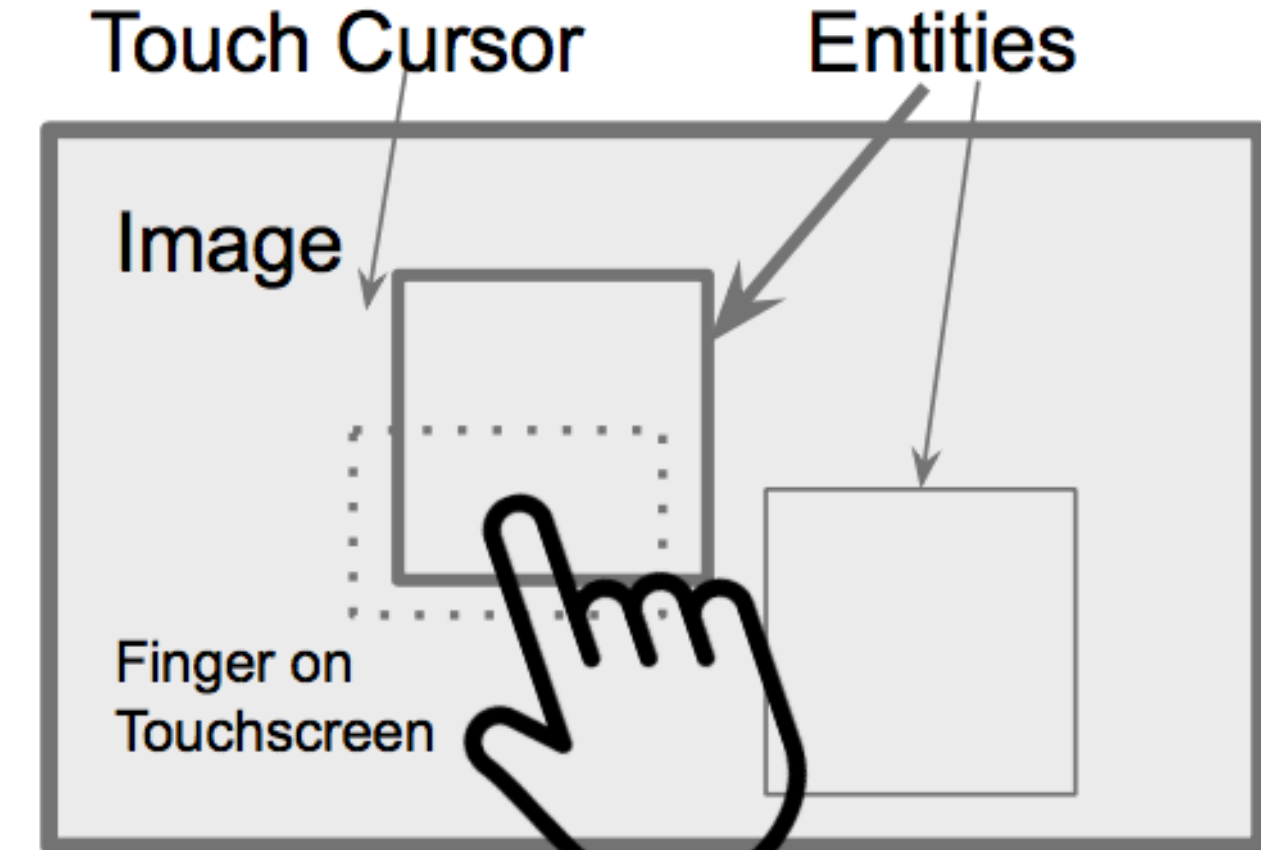
# Cursor-based Interactions



Window Cursor



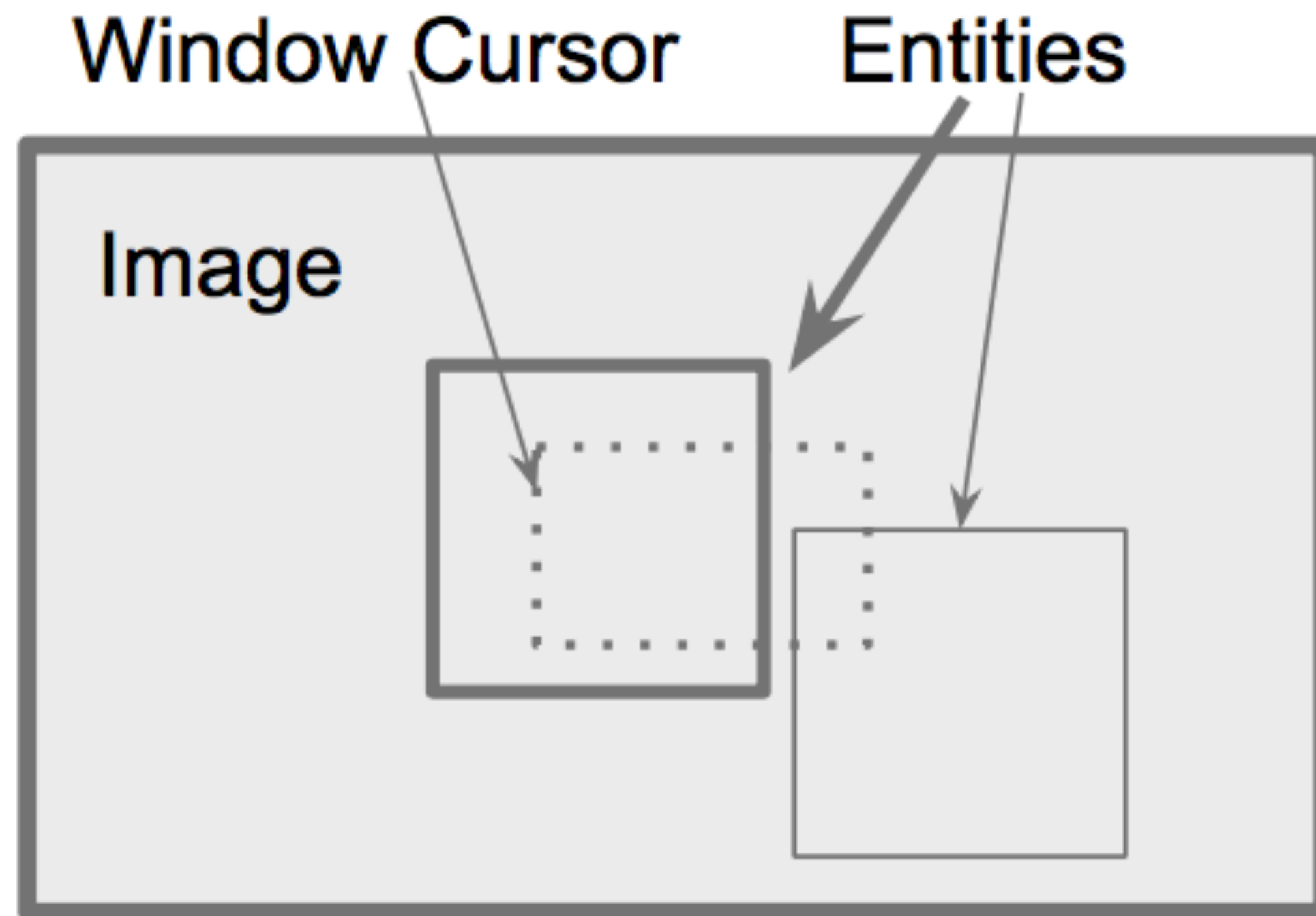
Finger Cursor



Touch Cursor



# Window Cursor



## Blind photography

- VizWiz::LocateIt (CVPRW'10)
- EasySnap (ASSETS'11)
- Scan Search (ASSETS'13)
- Assistive Photography (ASSETS'12, TOCHI'2014)

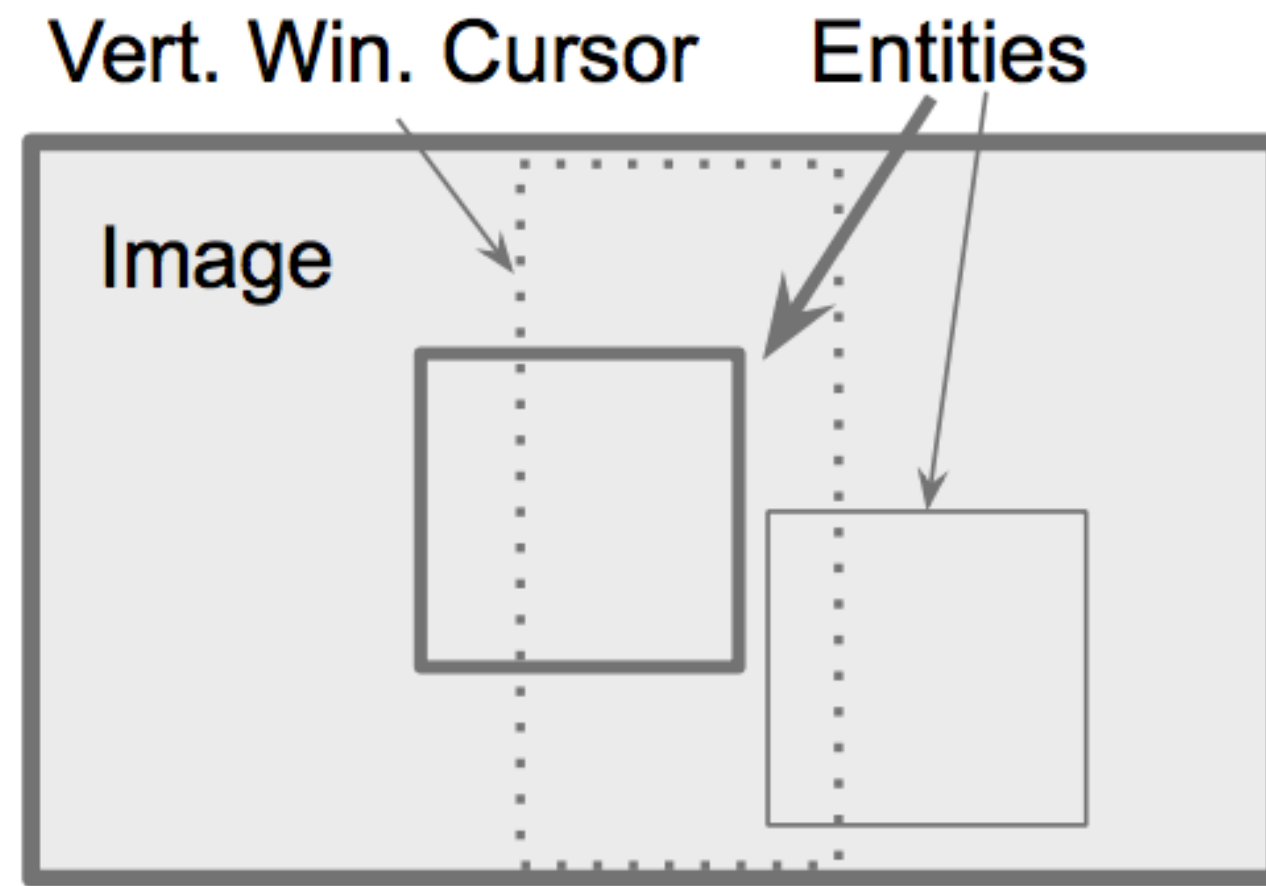


# Window Cursor



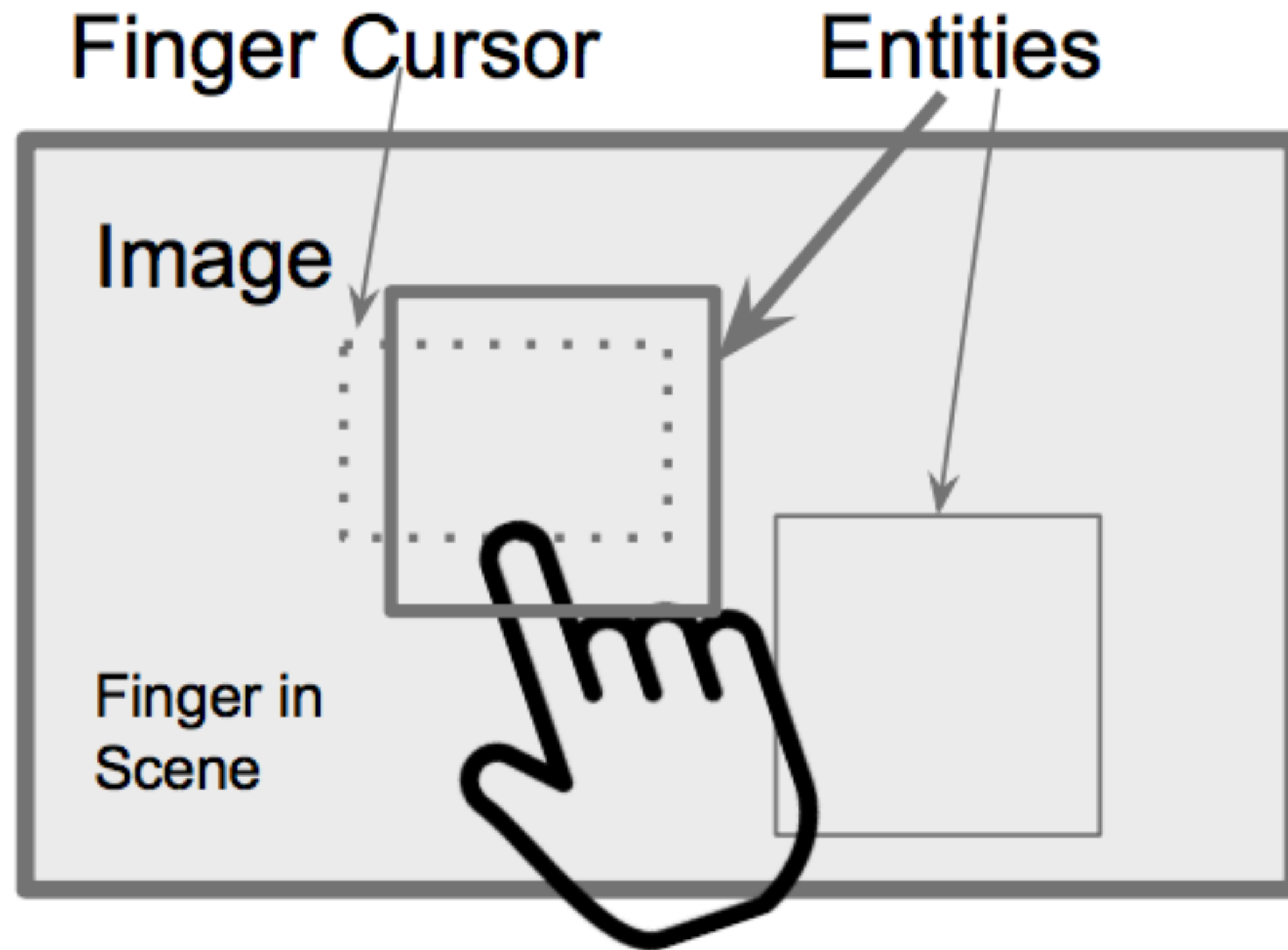


# Vertical Window Cursor





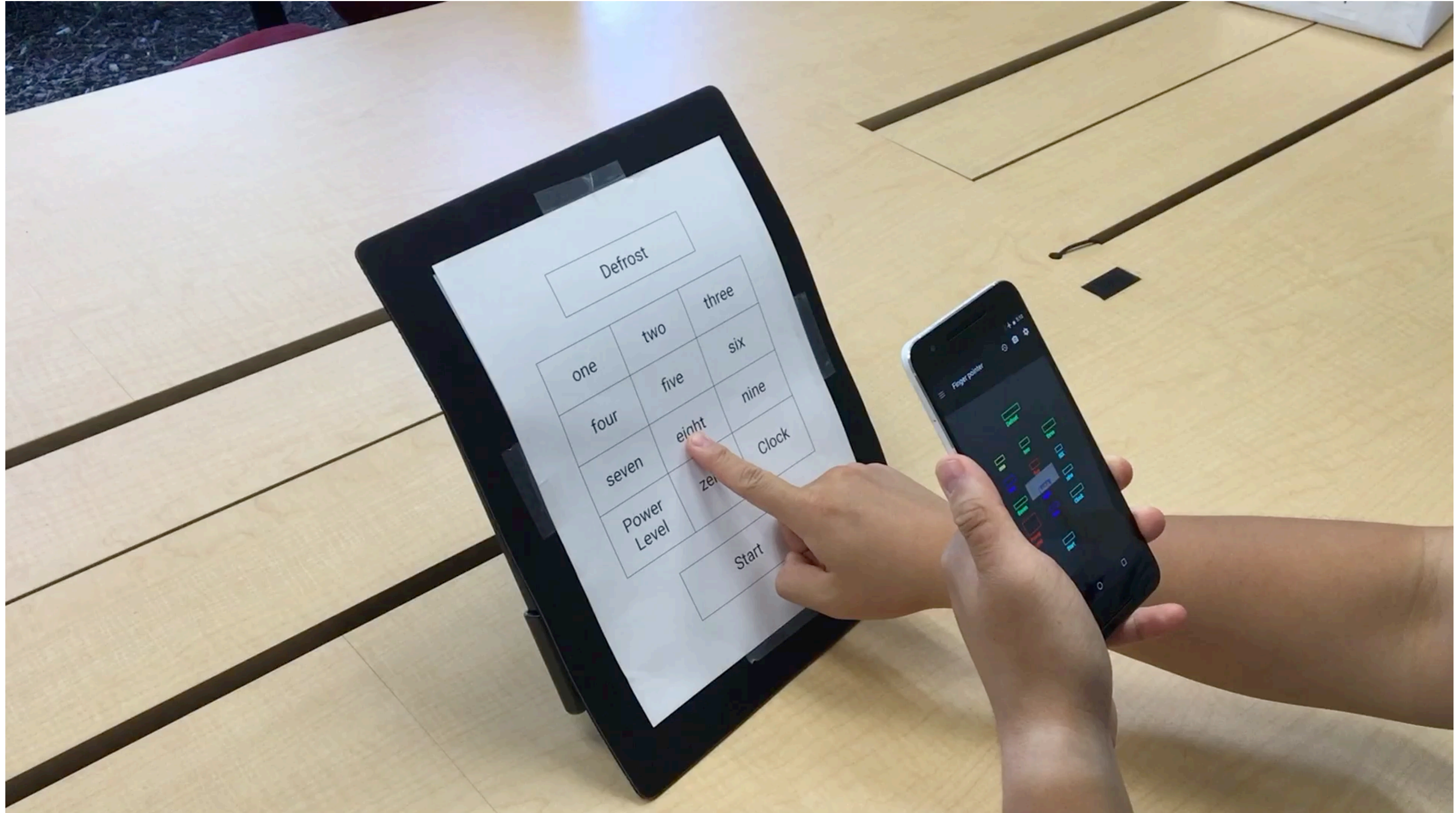
# Finger Cursor



- 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

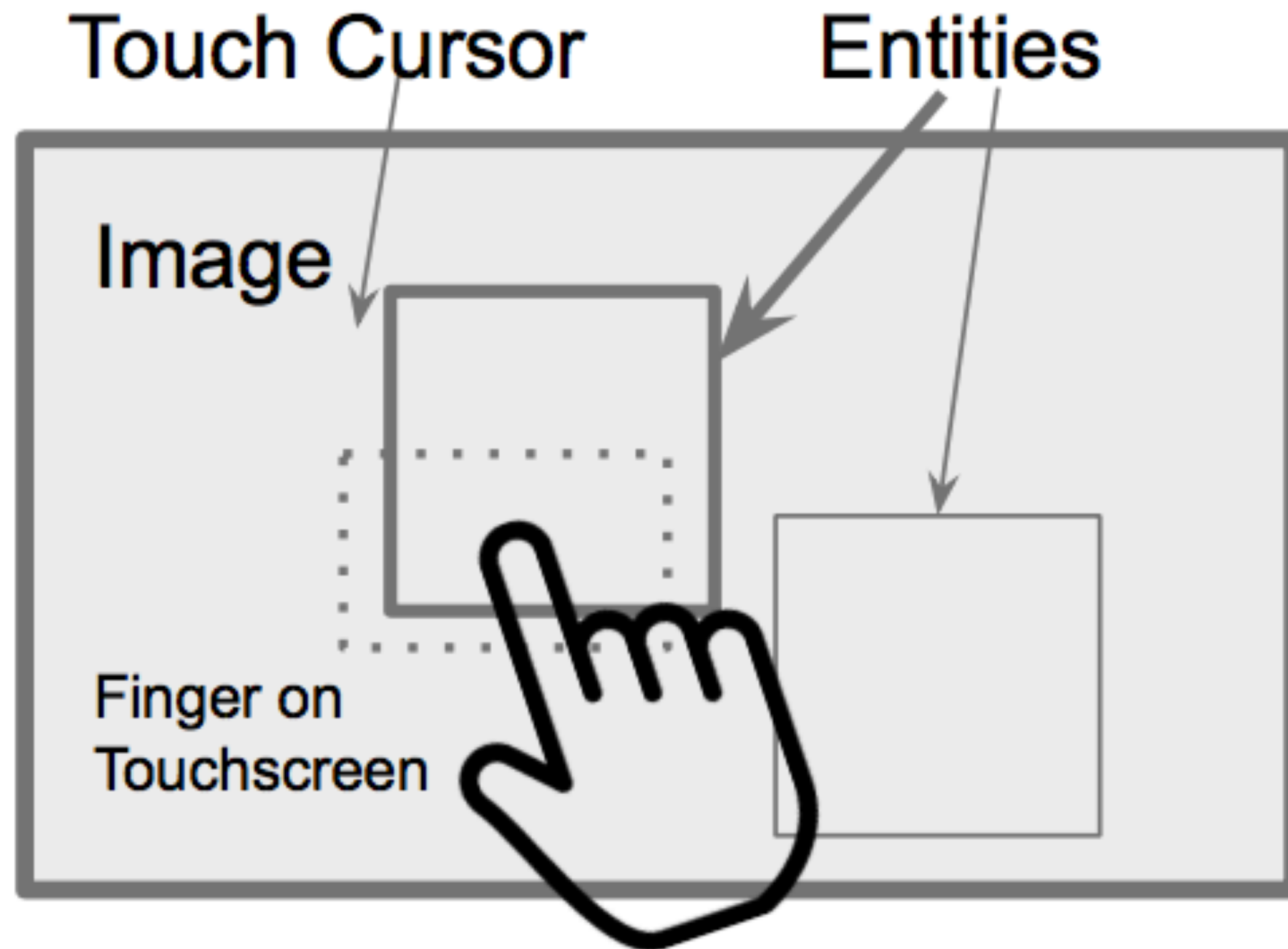


# Finger Cursor





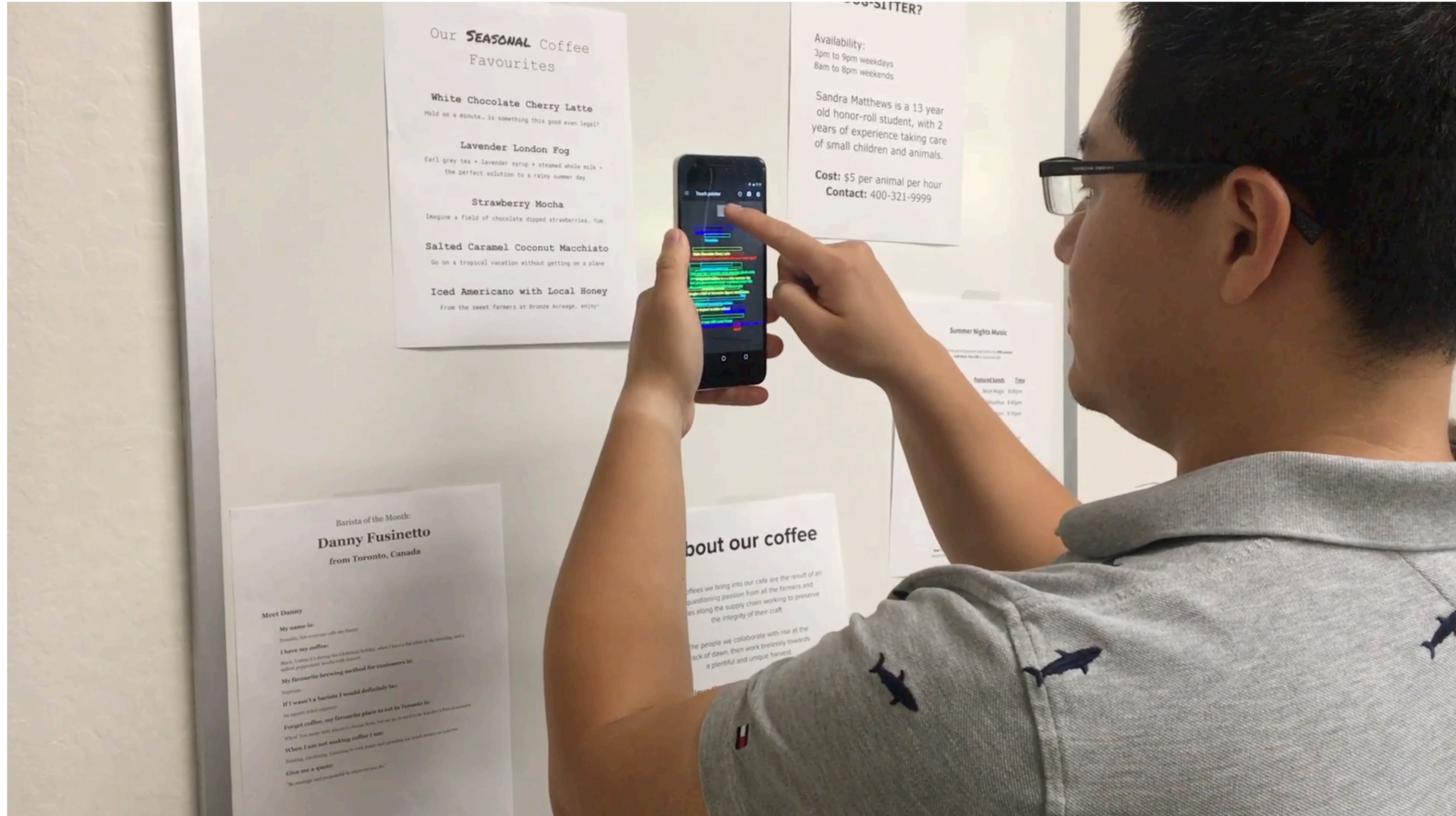
# Touch Cursor



- Slide Rule (ASSETS'08)
- iOS VoiceOver
- Android TalkBack
- RegionSpeak (CHI'15)



# Touch Cursor







# Cursor-based Interactions

How do different kinds of cursors affect **information access** in the physical world in various **contexts**?

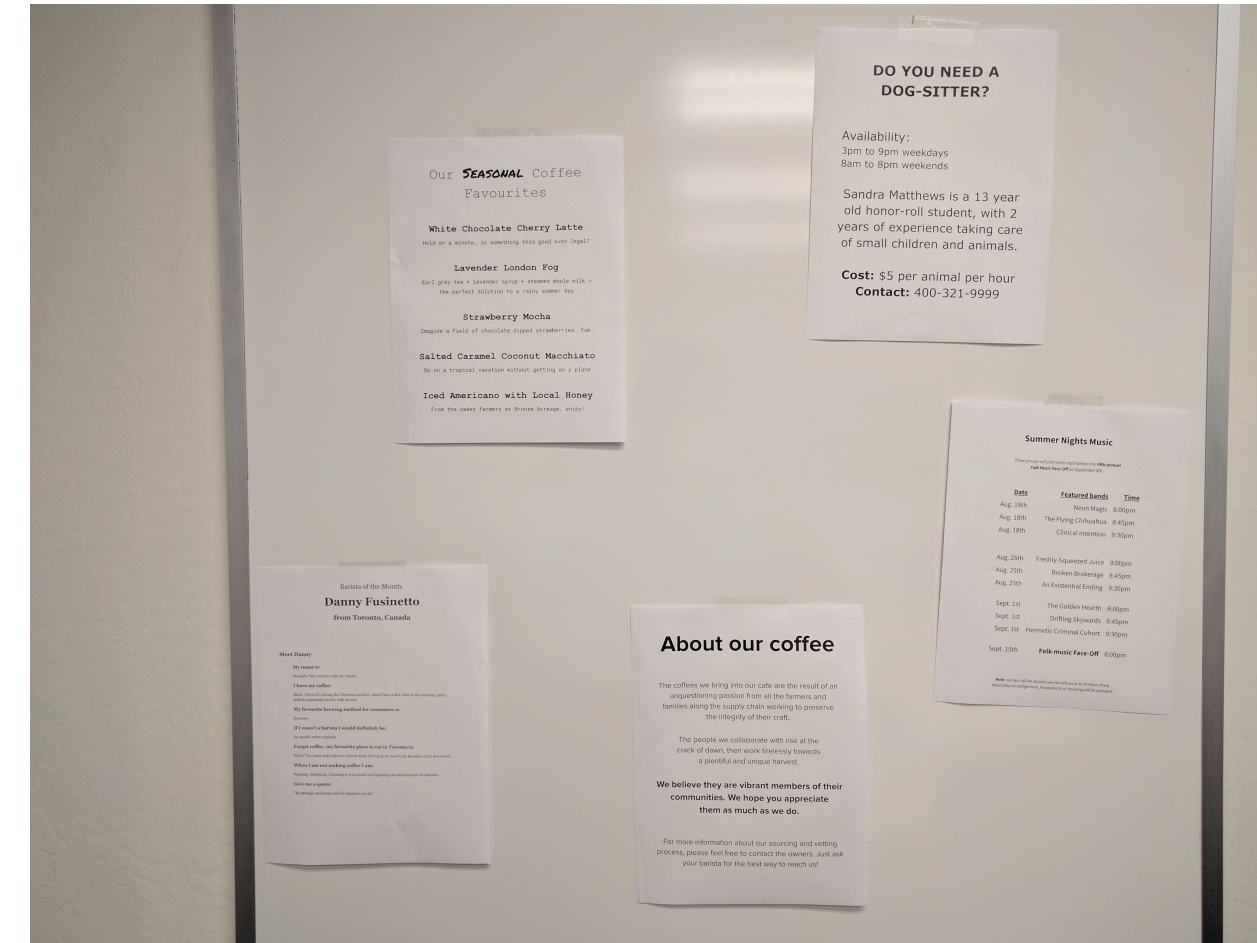
What are the **strengths** and **limitations** of each cursor?



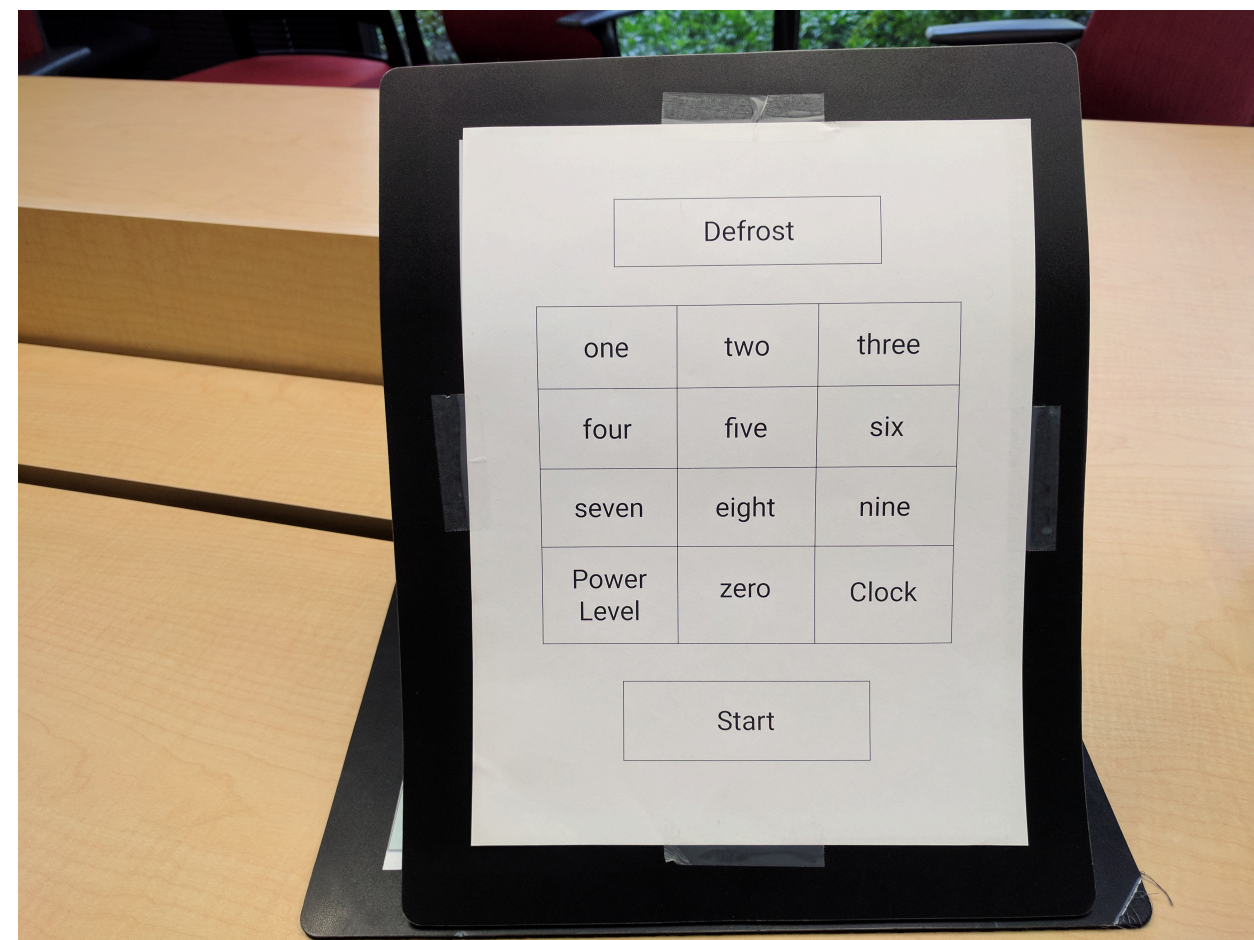
# User Study Tasks



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

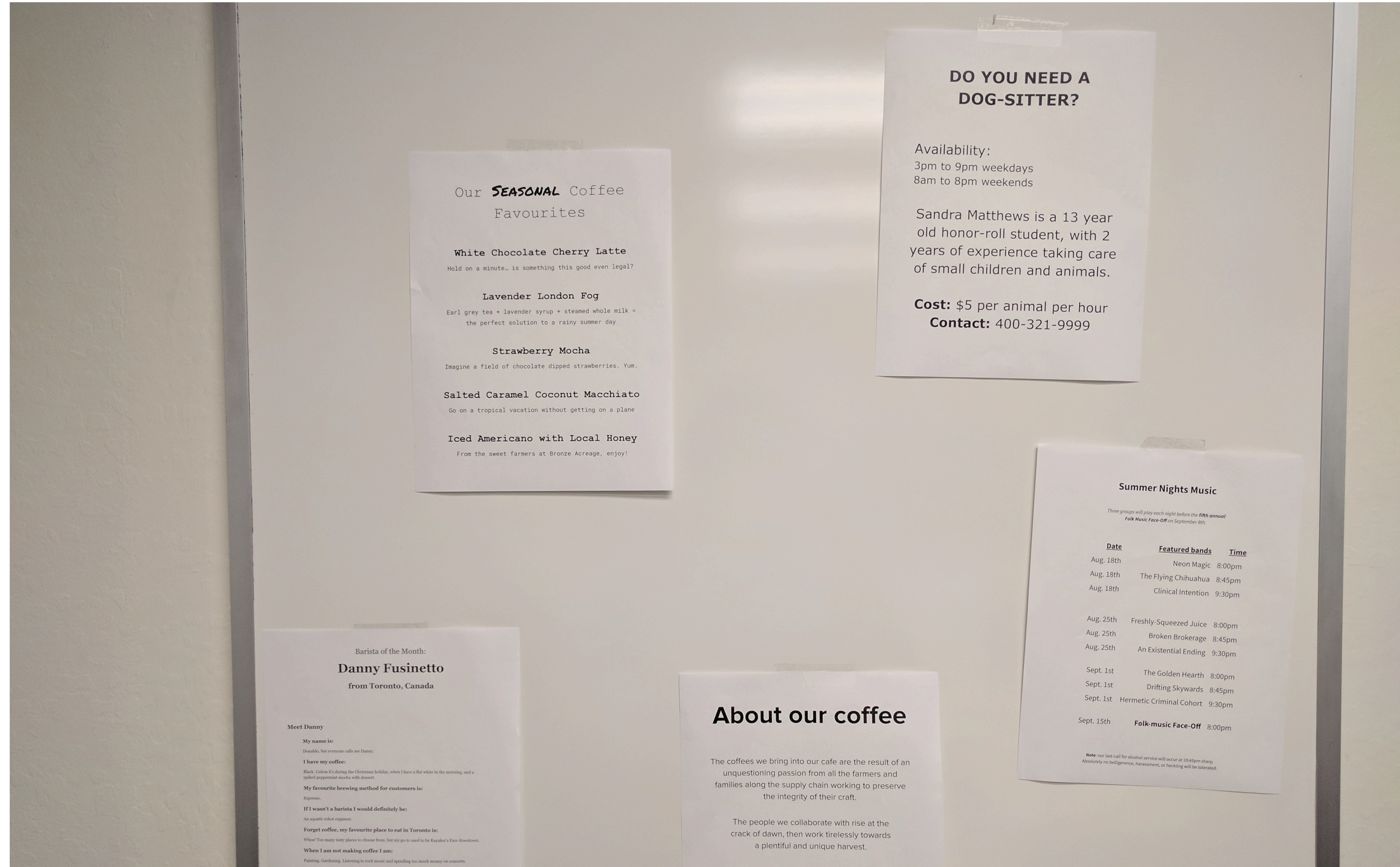
*It's tougher because getting my finger in the camera view is what I'm finding to be hard... I would have to move both simultaneously. (P4)*

## Touch Cursor

Users struggled to keep the device steady to locate even after discovery



# Task 2 - Interpret Document and Signs



## Our **SEASONAL** Coffee Favourites

**White Chocolate Cherry Latte**  
Hold on a minute... is something this good even legal?

**Lavender London Fog**  
Earl grey tea + lavender syrup + steamed whole milk = the perfect solution to a rainy summer day

**Strawberry Mocha**  
Imagine a field of chocolate dipped strawberries. Yum.

**Salted Caramel Coconut Macchiato**  
Go on a tropical vacation without getting on a plane

**Iced Americano with Local Honey**  
From the sweet farmers at Bronze Acreage, enjoy!

## DO YOU NEED A DOG-SITTER?

Availability:  
3pm to 9pm weekdays  
8am to 8pm weekends

Sandra Matthews is a 13 year old honor-roll student, with 2 years of experience taking care of small children and animals.

**Cost:** \$5 per animal per hour  
**Contact:** 400-321-9999

Barista of the Month:

**Danny Fusinetta**  
from Toronto, Canada

Meet Danny

My name is:

Donald, but everyone calls me Danny.

I have my coffee:

Black. Unless it's during the Christmas holidays, when I have a fat white in the morning, and a spiked peppermint mocha with dessert.

My favourite brewing method for customers is:

Espresso.

If I wasn't a barista I would definitely be:

An aquatic robot engineer.

Forget coffee, my favourite place to eat in Toronto is:

Whoa! Too many tasty places to choose from, but my go-to used to be Kayaker's Fare downtown.

When I am not making coffee I am:

Painting, Gardening, Listening to rock music and spending too much money on concerts.

## About our coffee

The coffees we bring into our cafe are the result of an unquestioning passion from all the farmers and families along the supply chain working to preserve the integrity of their craft.

The people we collaborate with rise at the crack of dawn, then work tirelessly towards a plentiful and unique harvest.

## Summer Nights Music

Three groups will play each night before the 5th annual Folk Music Face-Off on September 8th.

Date	Featured bands	Time
Aug. 18th	Neon Magic	8:00pm
Aug. 18th	The Flying Chihuahua	8:45pm
Aug. 18th	Clinical Intention	9:30pm
Aug. 25th	Freshly-Squeezed Juice	8:00pm
Aug. 25th	Broken Brokerage	8:45pm
Aug. 25th	An Existential Ending	9:30pm
Sept. 1st	The Golden Hearth	8:00pm
Sept. 1st	Drifting Skywards	8:45pm
Sept. 1st	Hermetic Criminal Cohort	9:30pm
Sept. 15th	Folk-music Face-Off	8:00pm

Note: our last-call for alcohol service will occur at 10:45pm sharp. Absolutely no belligerence, harassment, or heckling will be tolerated.



# 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

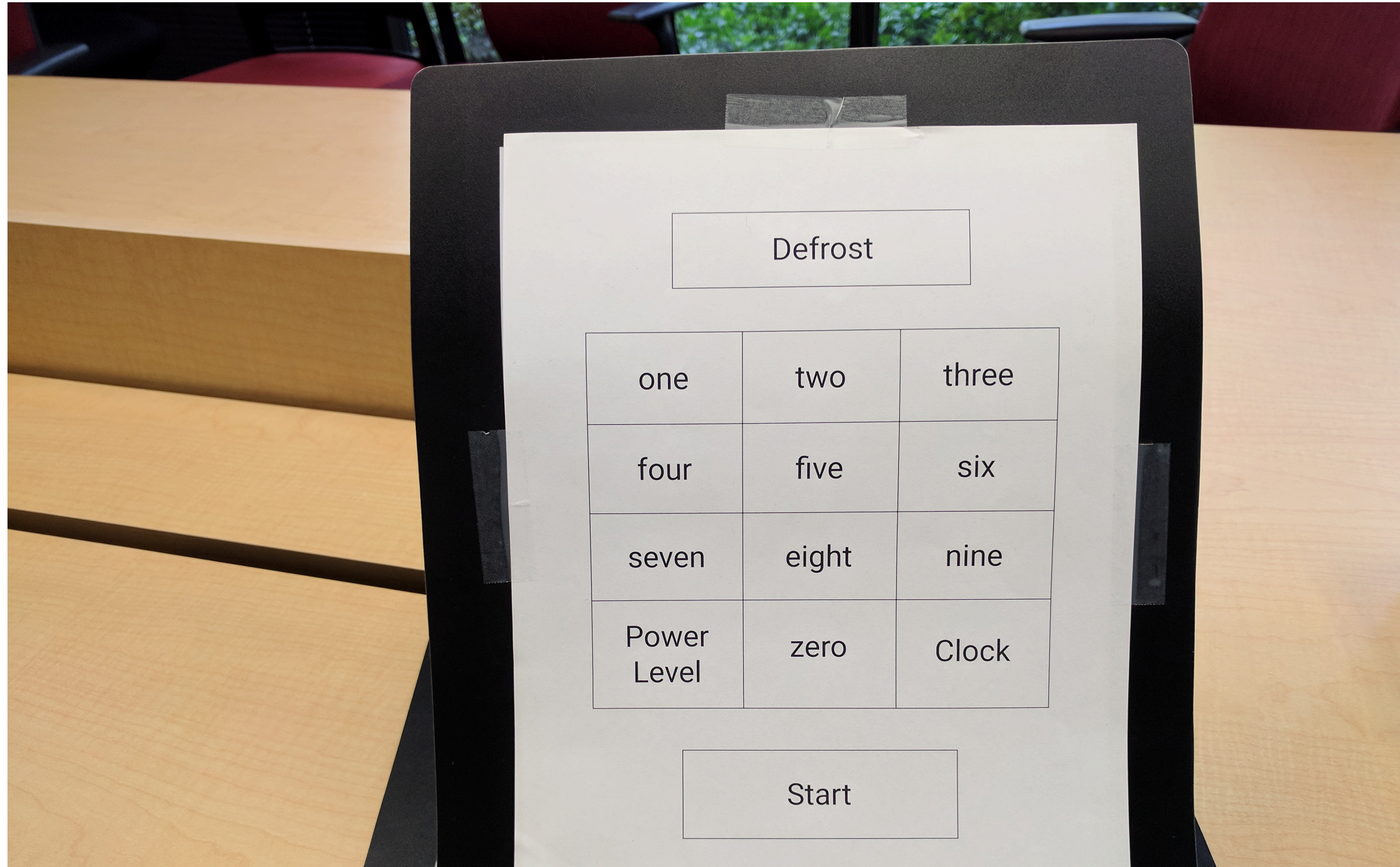
*You have to balance between density and truncating the text with the edge of the window, then you have to figure out how to scan it. (P3)*

## Finger Cursor

Users found it unnecessary to point at the poster since layout is not important



# Task 3 - Manipulate an Appliance





# 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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