

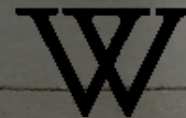
CURRENT AND FUTURE

Mobile and Wearable Device Use by People with Visual Impairments

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Leah Findlater²

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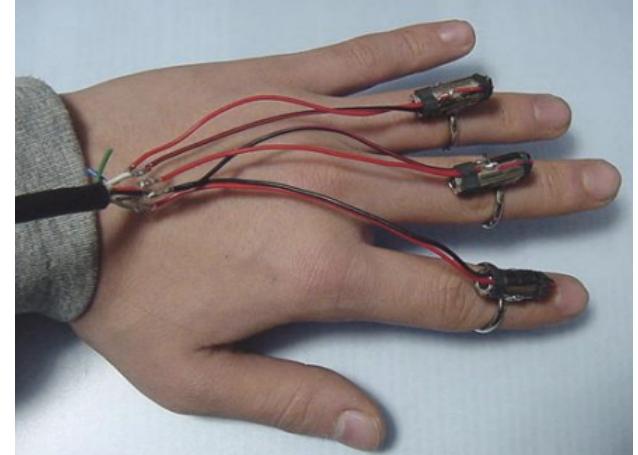




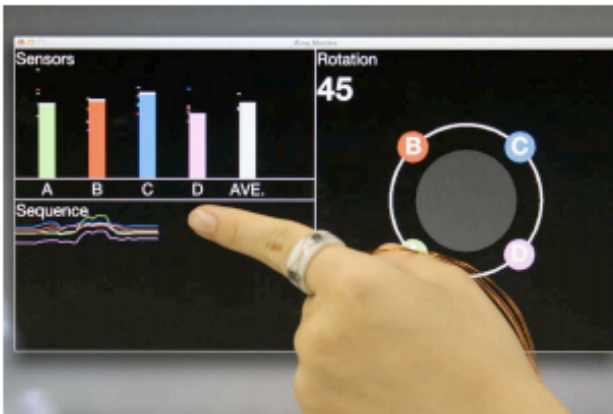




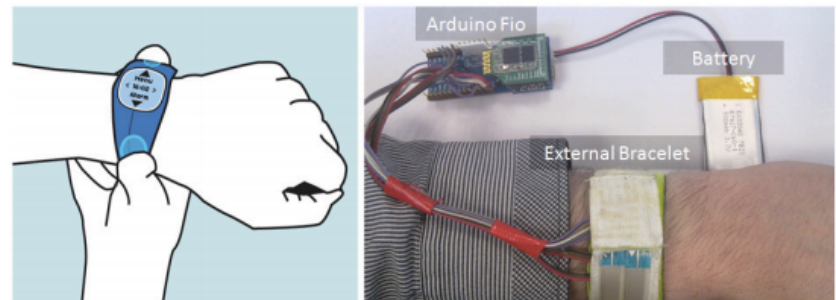
Rekimoto, ISWC 2001



Hirose et al., HCII 2003



Ogata et al., UIST 2012



Perrault et al., CHI 2013



Wayfinding



Obstacle
detection



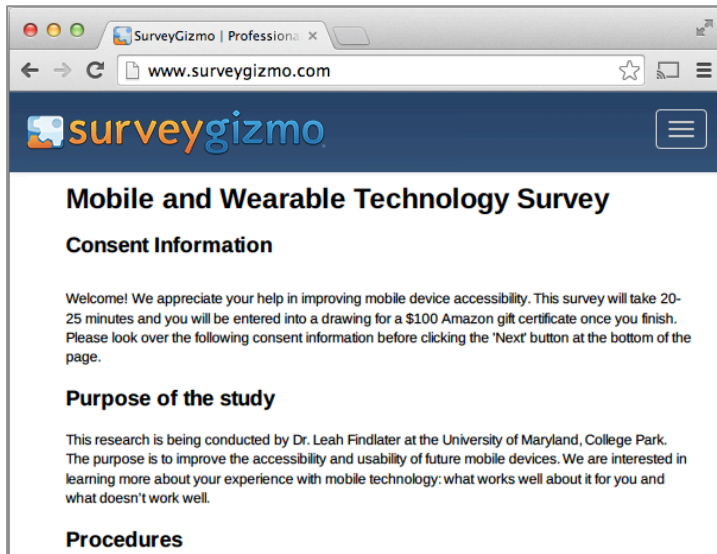
Facial
recognition

Wearable Technology for **Mobile Information Access**

Research Questions

- 1 How are users with visual impairments using mobile phones and wearables **compared to sighted users**?
- 2 What are the **projected benefits** and **drawbacks** of wearable input for users with visual impairments?

Survey



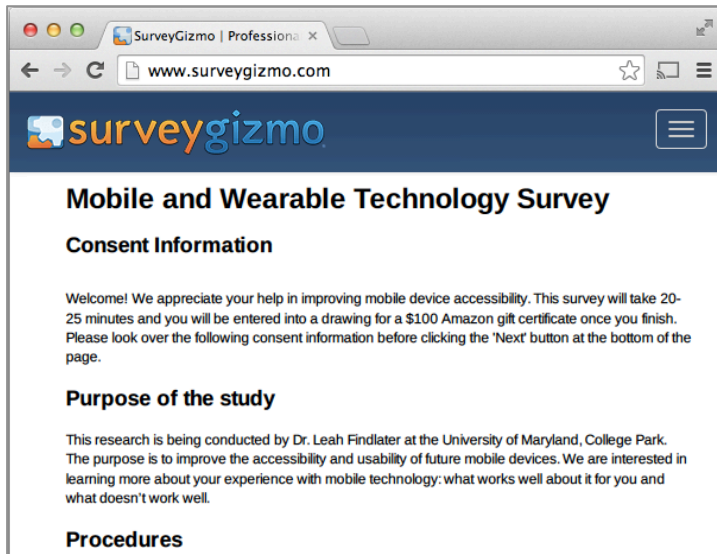
215 respondents
(**114** visually impaired)

Interviews & design probe



10 participants with
visual impairments

Survey



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Online survey

Online survey

20-25 minutes for people with visual impairments

Online survey

20-25 minutes for people with visual impairments

Screen reader



Online survey

20-25 minutes for people with visual impairments

Questions on:

Background

Online survey

20-25 minutes for people with visual impairments

Questions on:

Background

Attitudes about public use
(e.g. privacy and safety)

Online survey

20-25 minutes for people with visual impairments

Questions on:

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(e.g. privacy and safety)

Two wearable scenarios





Survey Results



Mobile devices used frequently by both groups for wide range of tasks

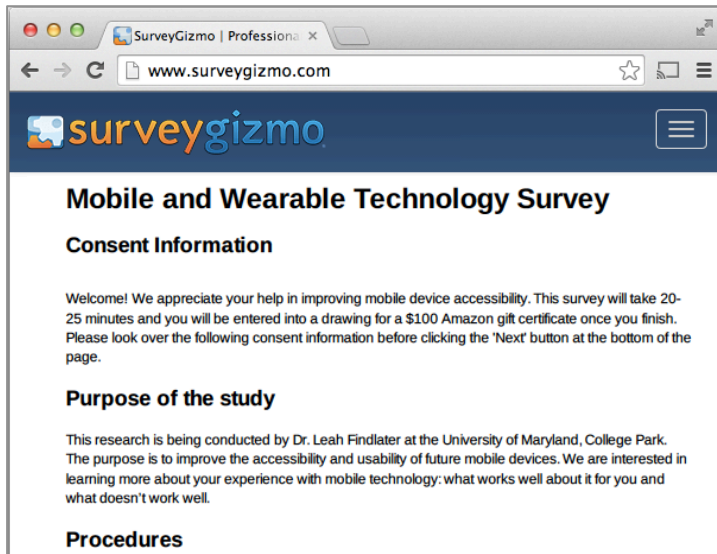


VI respondents more likely to use additional tools with phone



VI respondents reacted positively to the wearable scenarios

Survey



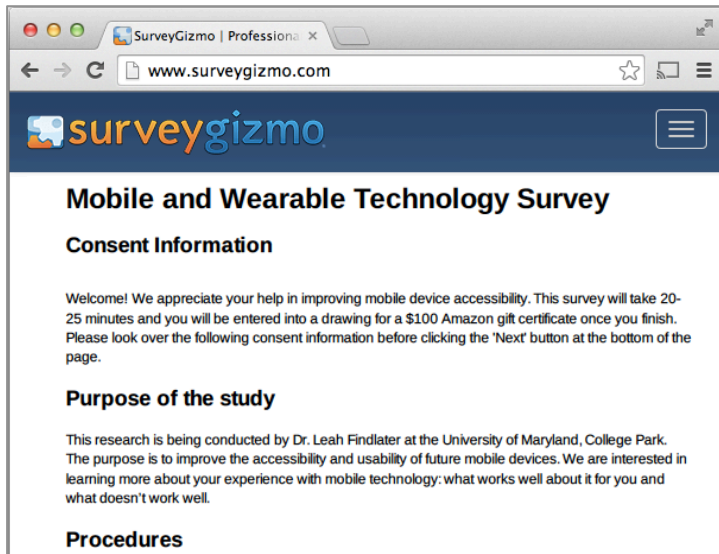
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Interviews with design probe

Interviews with design probe

60-minute sessions



Semi-structured interview:
Current device use



Use of design probe:
Wristband prototype



Semi-structured interview:
Projected impacts of a wearable

Interviews with design probe

60-minute sessions

10 participants

Gender

4 male
6 female

Vision Abilities

4 low vision
5 blind or light perception
1 peripheral vision

Mobile devices

7 iPhone
3 other (flip, feature)

Screenreader?

7 participants

Interviews with design probe

60-minute sessions

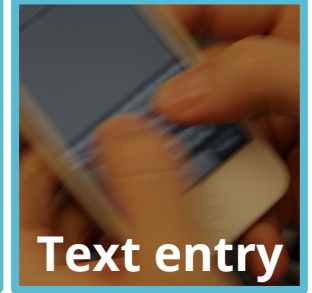
10 participants

Recorded (audio, video) and transcribed

Open and axial coding to identify emergent themes

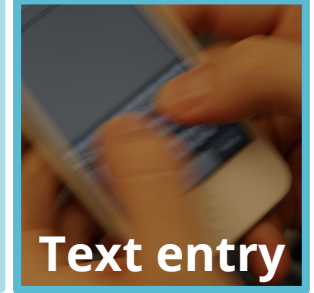
Interview Results

Current Mobile Use



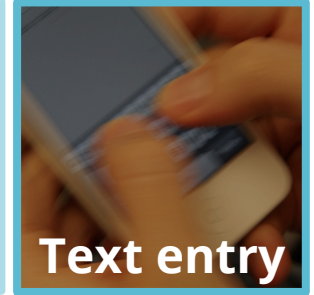
Interview Results

Current Mobile Use



Interview Results

Current Mobile Use





CURRENT MOBILE USE

Social Settings

Screenreader audio and gestures can make discreet use difficult

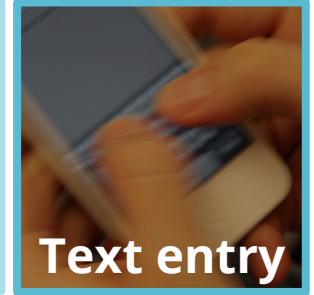


"...it seems like everybody else around the table has got their Blackberry out and I don't have an equivalent way to do it discreetly" (VI2)

"...it would be nice if the phone could convey more information through vibrations than auditory." (VI8)

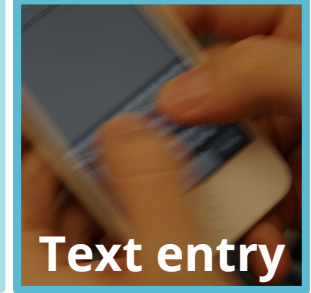
Interview Results

Current Mobile Use



Interview Results

Current Mobile Use





CURRENT MOBILE USE

Use On-the-go

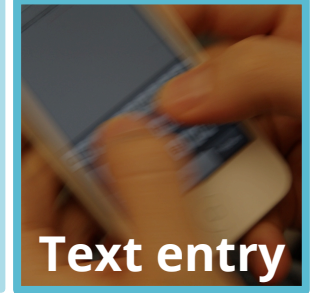
Difficulty due to one hand busy with cane or dog

Screenreader audio interferes with spatial perception

"I always have one hand with my cane, so, because I **can't do stuff one-handed with my phone**, that's very hard. I wish I could... **I can't just take it out and flip it and hold it up to my ear**. I have to take it out and double tap a few fingers and, you know, then put it up to my ear. **So I have to stop and use two hands.**" (VI7)

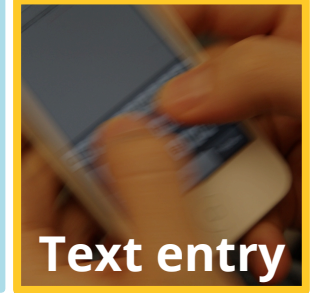
Interview Results

Current Mobile Use



Interview Results

Current Mobile Use





CURRENT MOBILE USE

Text and Speech Input

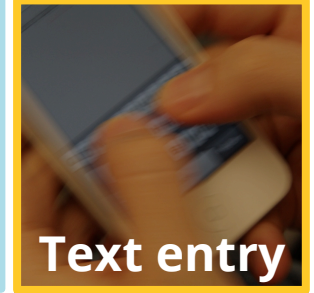
Text entry remains a challenge (Azenkot and Lee, 2013)

Bluetooth keyboards can be transformational (4 participants)

“If you email on the phone then it is just the same as if you were writing the email on a laptop” (V19)

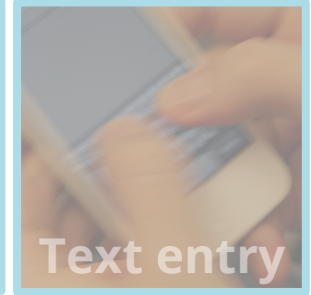
Interview Results

Current Mobile Use



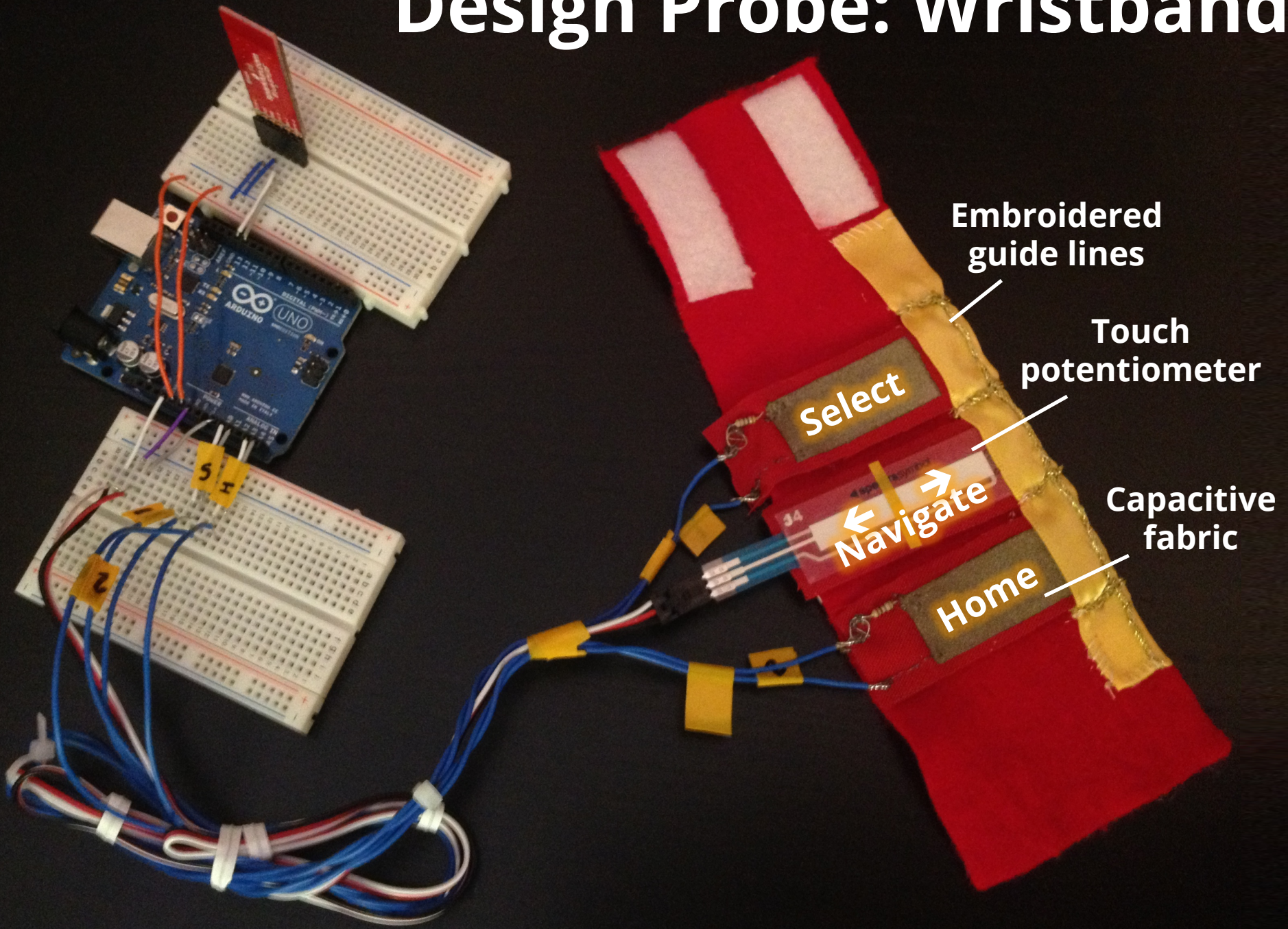
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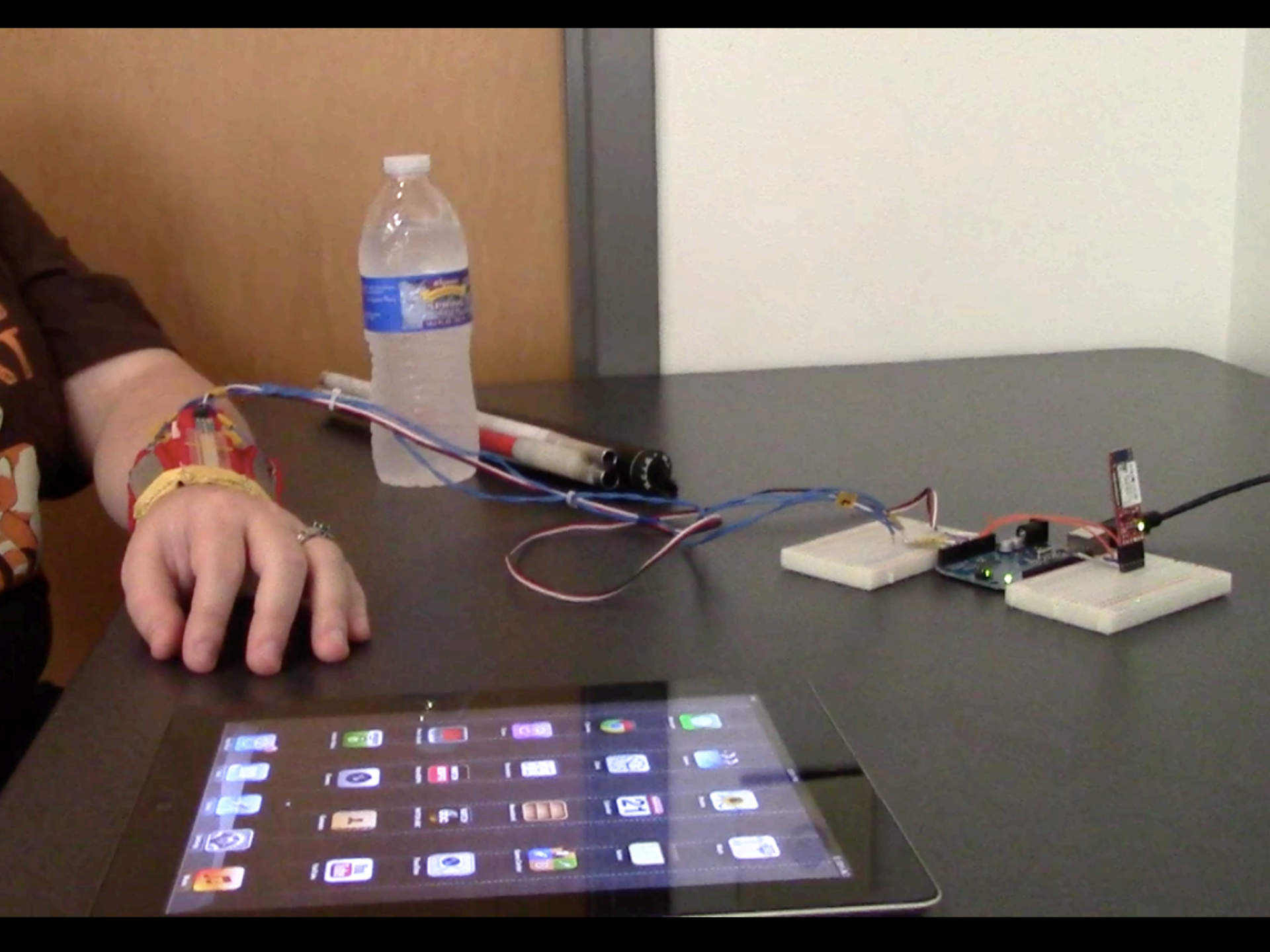
Current Mobile Use



→ **Design probe interaction**

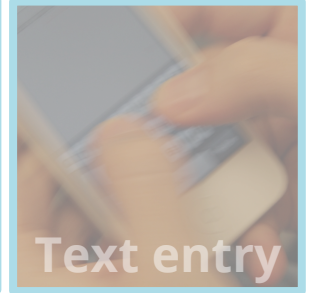
Design Probe: Wristband





Interview Results

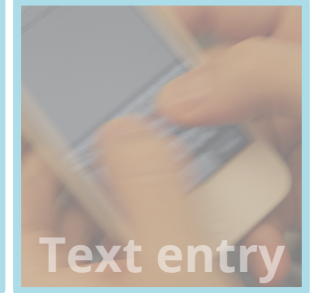
Current Mobile Use



→ **Design probe interaction**

Interview Results

Current Mobile Use



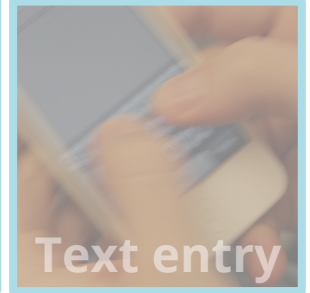
➔ **Design probe interaction**

Projected Wearable Use



Interview Results

Current Mobile Use



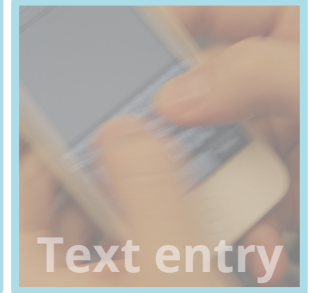
➔ **Design probe interaction**

Projected Wearable Use



Interview Results

Current Mobile Use



➔ **Design probe interaction**

Projected Wearable Use





PROJECTED WEARABLE USE

Social Settings

A wearable device would:

5 participants – Facilitate use in social situations

3 participants – But be just as *impolite* as a phone



PROJECTED WEARABLE USE

Social Settings

May enable new/different contributions to conversations

"I mean people do that now, you're talking to them and they're looking stuff up on the internet, and if there's a question that comes up they look it up on the internet, I'm getting used to that, so I might be able to do that, which I don't do that now." (VI1)



PROJECTED WEARABLE USE

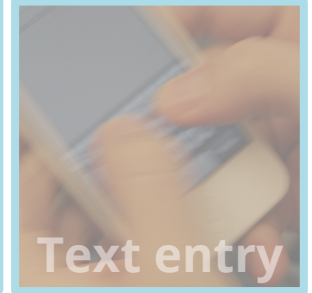
Social Settings

May increase sense of control over device

“Usually if I hand over my phone to someone I am turning VoiceOver off, because my friends who are sighted don’t know the gestures for the phone... Maybe I could feel like **I could control the phone and know what is happening instead of handing my phone over.**” (VI9)

Interview Results

Current Mobile Use



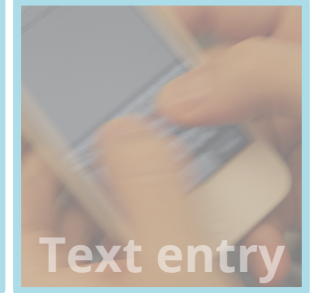
➔ **Design probe interaction**

Projected Wearable Use



Interview Results

Current Mobile Use



➔ **Design probe interaction**

Projected Wearable Use





PROJECTED WEARABLE USE

Personal Safety

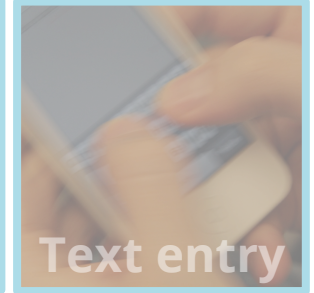
Tension in how the wearable may impact safety

Positive vs. negative impacts: 5 vs. 3 participants

"If I did need to call 911, for example, the person might not know until it was too late ... [whereas now I would need to] pull the phone out of my pocket and say, 'Siri, call 911,' or dial it myself, which would take even longer." (VI8)

Interview Results

Current Mobile Use

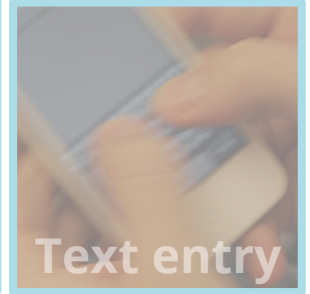


➔ **Design probe interaction**

Projected Wearable Use



Current Mobile Use



→ **Design probe interaction**

Projected Wearable Use





PROJECTED WEARABLE USE

Use on-the-go

Make it easier to use the phone on-the-go (4 participants)

"You could walk with a bag or something in your hand and use the other [hand]. With a touchscreen you can't do that while you are moving." (VI10)

Interview and Design Probe Summary

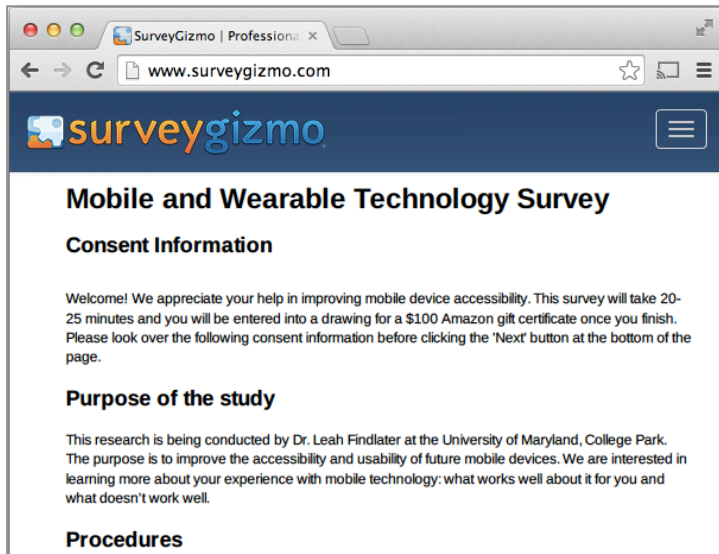


Alternatives to touchscreen input can be transformative



Wearable input may positively impact mobile access, particularly inclusion in social interactions and use on-the-go

Survey



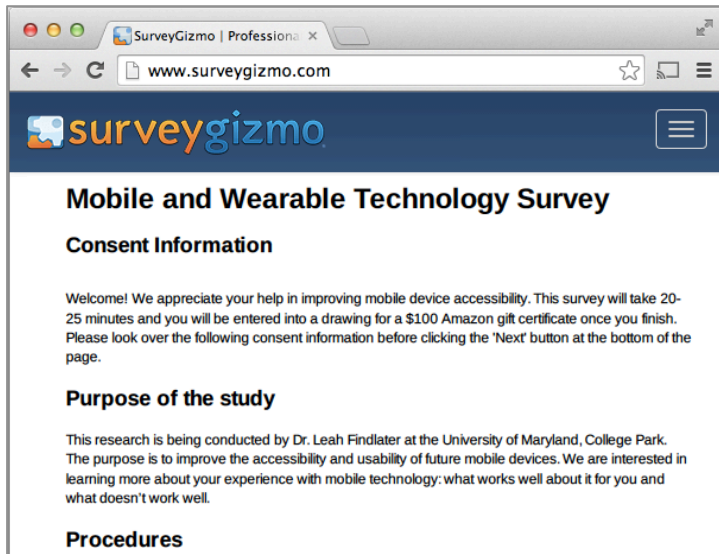
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Despite widespread mobile use by people with visual impairments, accessibility limitations persist

Wearable input devices may address some of these limitations, such as inclusion in social interactions and use on-the-go

CURRENT AND FUTURE

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Thank you to the Maryland State Library for the Blind and Physically Handicapped.

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Prof. Leah Findlater

Photo Credits

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ivyfield	stevendepolo
mollydot	yourdon

The Noun Project

Chat, Benny Forsberg
Compass, Alessandro Suraci
Graph, Matthew Hawdon

