Mobile Accessibility

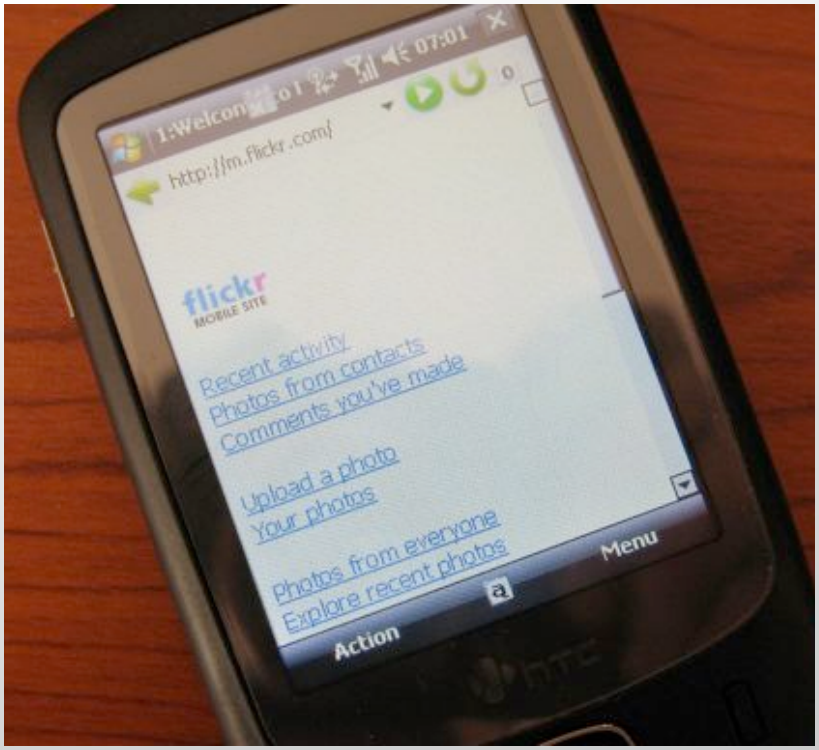
Shaun K. Kane
PhD Candidate
The Information School
DUB Group

Today

- Why mobile accessibility is important
- Challenges of mobile accessibility
- Our mobile accessibility research

The Mobile Miracle

- Mobile devices are becoming ubiquitous
- Increasing variety of applications
- Always-on connection to family, friends, and information



Benefits of mobile access

- Stay in contact with friends and family
- Access information via the web
- Access local information (e.g. weather, bus schedules)

Google Mobile App
Category: Reference
Released Nov 14, 2008
Free GET APP

Flick Fishing
Category: Games
Released Nov 06, 2008
$0.99 BUY APP

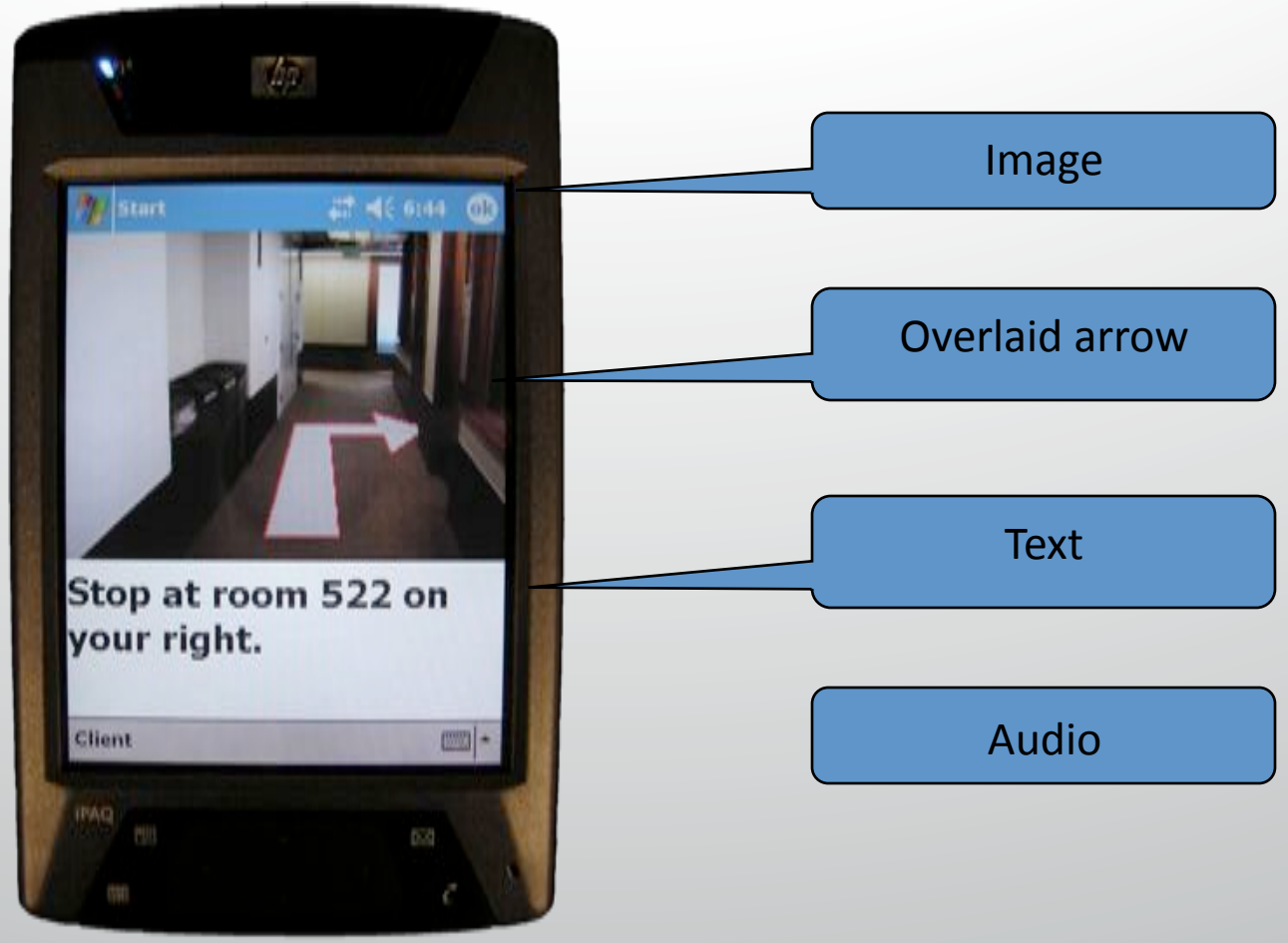
Facebook
Category: Social Networking
Released Jul 10, 2008
Free GET APP

Seattle Bus
Category: Travel
Released Jul 09, 2008
$4.99 BUY APP

Assistive technologies

- Mobile devices enable new assistive technologies
  - Navigation assistance
  - Augmentative and alternative communication (AAC)
  - Task management and prompting

Indoor wayfinding (Liu et al., 2006)



Trinetra (Lanigan et al., 2007)

Mobile accessibility

- Before users can benefit these tools, they must be accessible
  - Across available applications
  - Across available devices
  - Across different situations

Mobile accessibility challenges

Mobile accessibility challenges

- Small devices
- Touch screens
- Lack of standardized UIs
- Lack of device expandability
- Using devices out “in the wild”

Mobile devices in the wild

- Movement
- Obstacles
- Weather
- Noise and distractions
- User fatigue

Improving mobile accessibility

- Specialized devices for people with disabilities
- Accessibility add-ons for existing devices
- New accessible interaction techniques for mainstream devices

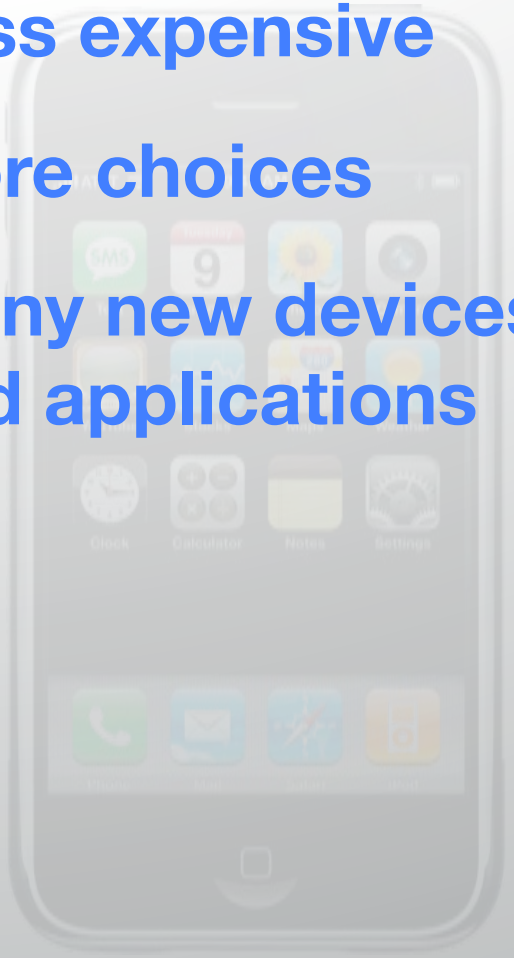
Specialized accessible mobile devices

Specialized vs. mainstream devices

Specialized vs. mainstream devices

- Expensive
- Fewer choices
- Slow to add features

- **Less expensive**
- **More choices**
- **Many new devices and applications**



Accessibility add-ons (software)

Accessibility add-ons (hardware)

Limitations of add-ons

- May tie user to a specific device
- Often difficult to use
- May not fully support the device

- But these can be helpful, too

Mobile Speak Pocket

Accessibility solutions

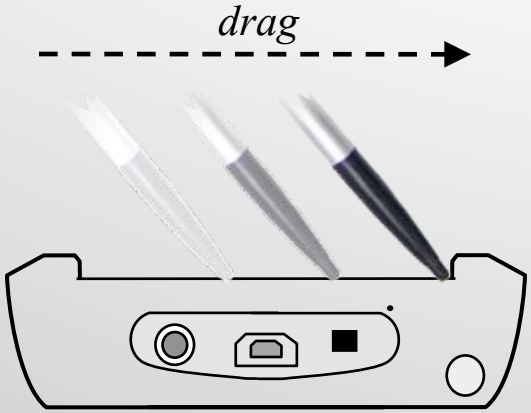
- Specialized devices for people with disabilities
- Accessibility extensions for existing devices
- New accessible interaction techniques for mainstream devices

Some projects

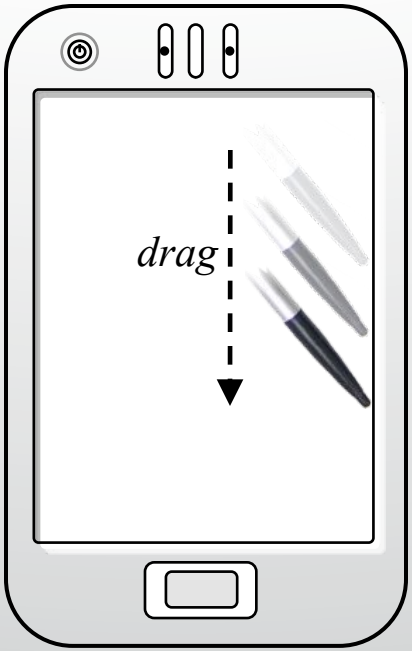
- EdgeWrite → text entry
- Barrier pointing → targeting on touch screens
- Slide Rule → interaction with touch screens
- Walking User Interfaces → accessibility for everyone

EdgeWrite (Wobbrock et al., 2003)

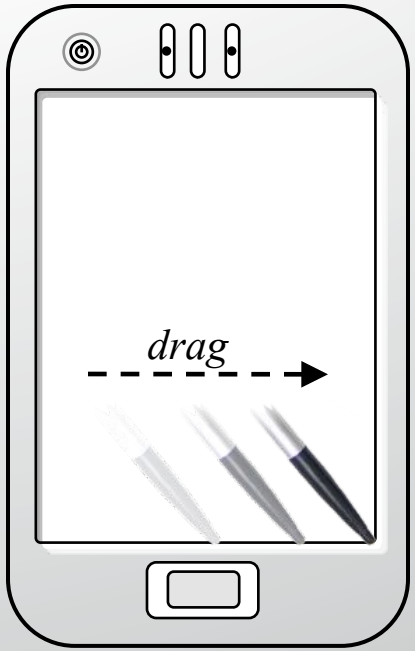
Barrier pointing (Froehlich et al., 2007)



Allow user to rely on screen surface to assist movement.



Use screen edge to guide movement.



Use screen corner to trap movement.

Projects

- EdgeWrite → text entry
- Barrier pointing → targeting on touch screens
- Slide Rule → interaction with touch screens
- Walking User Interfaces → accessibility for everyone

Slide Rule (Kane et al., 2008)

- Touch screens are everywhere, including phones
- Most do not provide sufficient audio or tactile feedback
- Therefore inaccessible to blind and visually impaired users

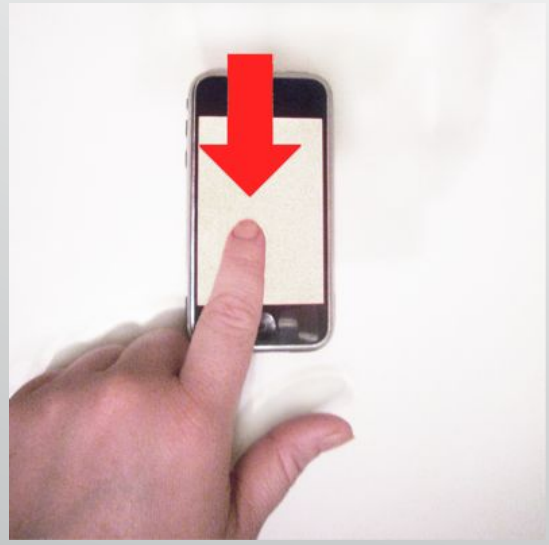

U-SCAN
Welcome
Lane Open
vitamin
Change Out

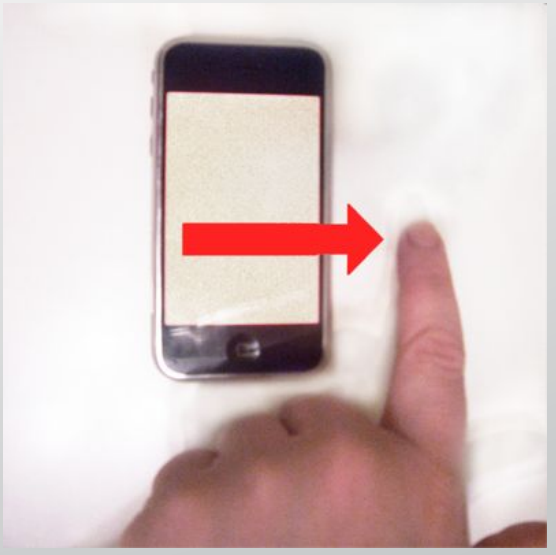

When you help, they win.
Donate today!

Existing solutions

Slide Rule

- **Idea:** Use gestures to increase accessibility of mobile touch screens





Design process

- Interviewed blind informants about how they currently use touch screens
- Developed a set of design guidelines for accessible touch screen interactions
- Designed 4 gestural interaction techniques for interacting with mobile touch screens

Interaction principles

- Allow risk-free exploration
- Reduce demand for selection accuracy
- Intuitive gestural mappings

- Operate at finger resolution, not screen resolution
- Allow quick browsing and navigation
- Enable users to query location and return home at any time

Implementation

- Developed for Apple iPhone
- Touch input, speech and audio output
- Items arrayed in linear lists
- User slides her finger across screen to activate items

Video available at
http://students.washington.edu/skane/sliderule/

Evaluation

- 10 blind computer users (8m, 2f)
- Compared Slide Rule with a button-based Pocket PC with screen reader
  - 4-way control, plus 4 regions on touch screen

Mobile Speak Pocket

Results

- 7 out of 10 participants preferred Slide Rule
- Slide Rule was significantly faster than the Pocket PC
- However, Slide Rule was more error prone

Reactions from users

- “Flat screens without a grid—a real tangible grid—are difficult for blind people … I think that flat screens are not really accessible.”

- “I’ve never seen a touch screen that accessible before, and that was pretty cool.”

Future work

- Additional applications and interaction techniques
- Slide Rule on other (bigger) touch screens
- Demo on iPhone App Store
- Evaluation with sighted users

Projects

- EdgeWrite → text entry
- Barrier pointing → targeting on touch screens
- Slide Rule → interaction with touch screens
- Walking User Interfaces → accessibility for everyone

Accessibility for everyone

- Mobile accessibility benefits people without disabilities too
- Environmental factors can reduce user's ability
- **Situationally-induced impairments and disabilities** (or situational impairments)

  (Sears and Young, 2002)


Divided attention


Reduced dexterity


Occupied hands
User in motion
Obstacles

Situational impairments

- **Environmental factors:** low light, glare, ambient noise, vibration tremor, extreme temperatures, rainwater, uneven terrain
- **Attentional factors:** Physical obstacles, social interactions, divided attention, abrupt distraction, device out-of-sight
- **Physical factors:** Impeding clothing, baggage, occupied hands, user or device movement, posture or grip, user fatigue

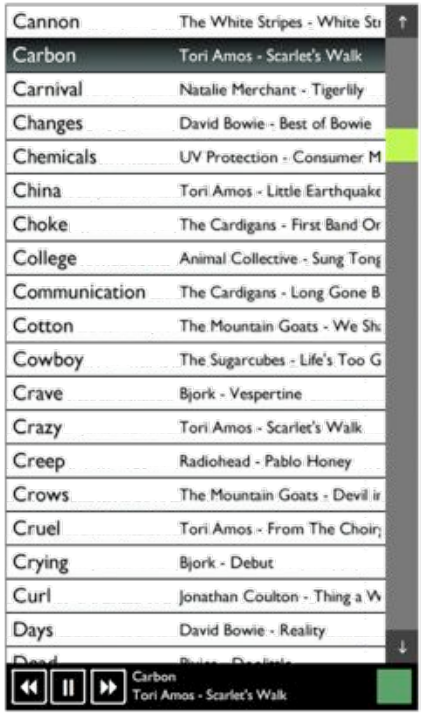
Walking User Interfaces (Kane et al, 2008)

User interfaces designed to compensate for the effects of walking on mobile device usability

WUIs use context to adapt to user activity (e.g. increase text and button sizes as the user walks)

Accessible technology that benefits people without disabilities, too

Adaptive WUI prototype

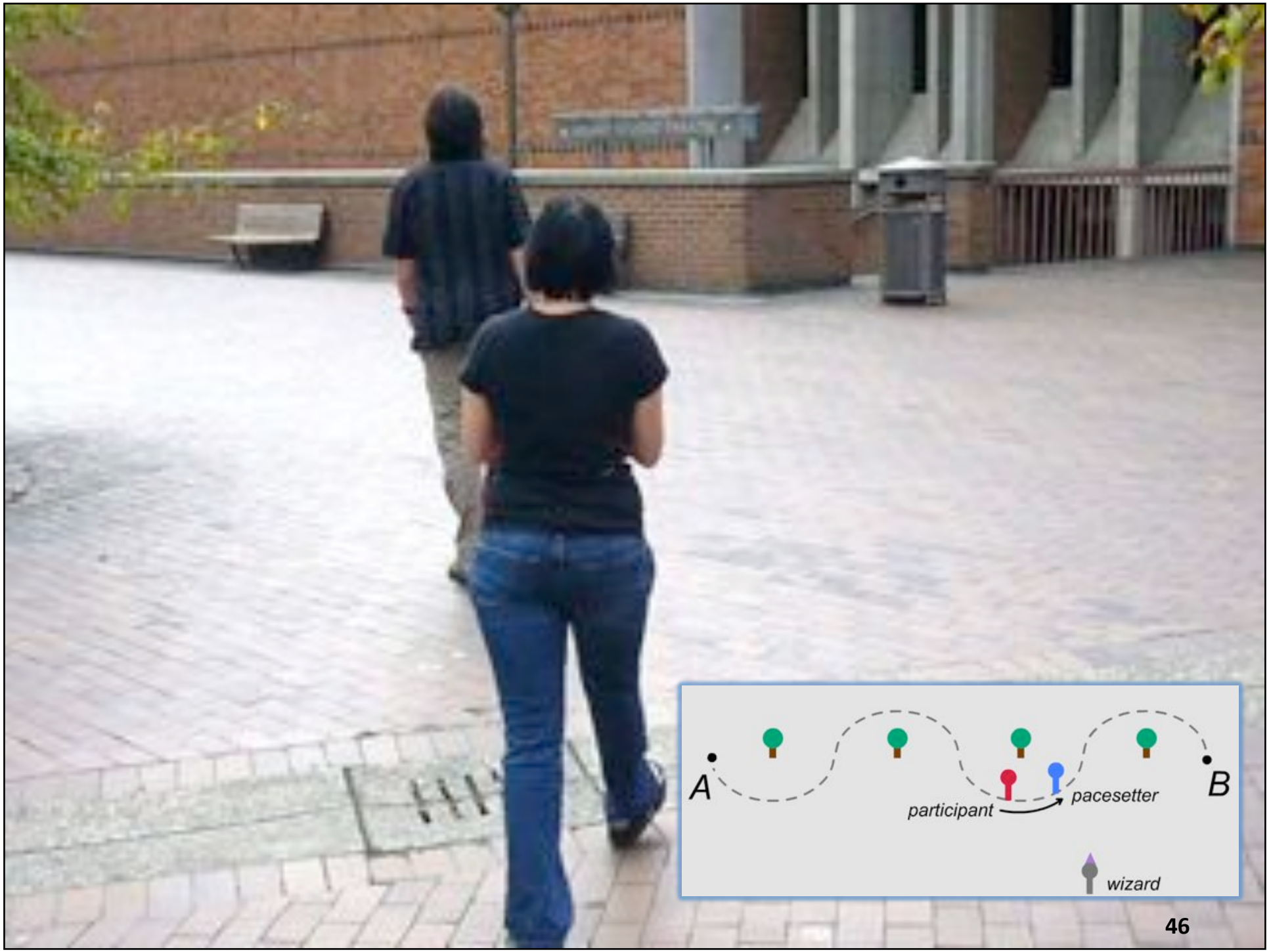


User begins walking:
UI element size increases

User stops walking:
More items appear on screen

Evaluation

- Evaluated adaptive WUI prototype with 29 participants (10m, 19f)
- Participants used WUI prototype while standing and walking along an outdoor course


A
B
participant
pacesetter
wizard

Results

- WUI performed comparably to non-adaptive interfaces (no adaptive penalty)
- However, performance was not substantially better with WUI
- Users were generally open to the idea, but more work is needed

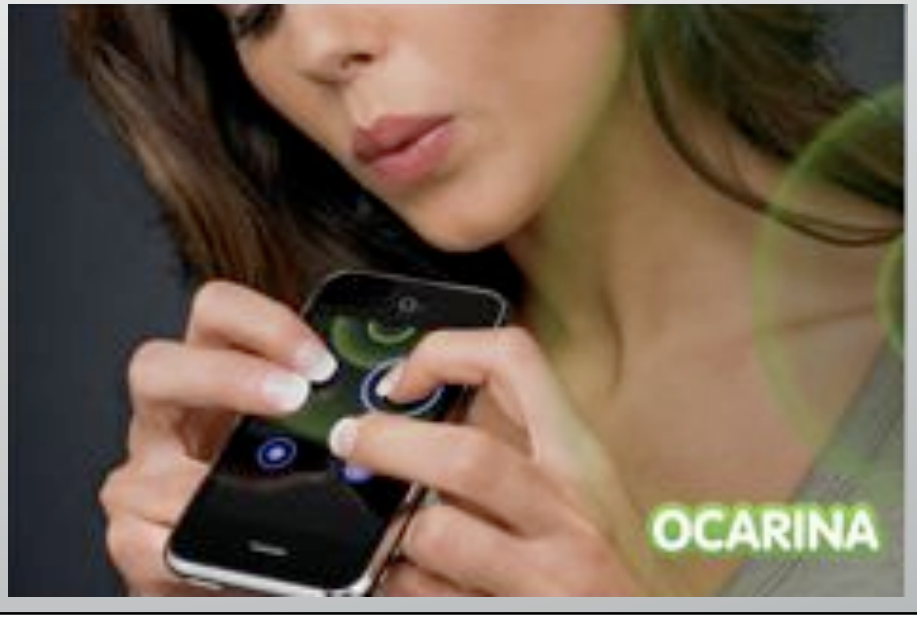
What’s next

Ongoing work: Accessible Mobile Widgets

- Mobile devices are becoming a mainstream computing platform
- **10,000 applications** on the iPhone App Store
- Many applications use novel interaction techniques


Dice
Roll
Settings


ROG...
6:12 PM
Facebook
http://iphone.facebook.com/#h...
Status
facebook
Search
Home
Profile
Friends
Inbox
News Feed
Events
Requests (1)
Mike Tusche is an army of one.
Kevin Psaila is waiting to hear from Allessio that he's taken out yet another opponent in WEC tonight.
Jen Fitterer is thankful that she can always count on Nick to save the day!
Cameron D is attending InAffinity Live at the Balmoral.
Jennifer Burkmar left the group Arabian


OCARINA

Accessible mobile widgets

- How do we ensure that these applications are accessible?
- Look at how applications are developed

iPhone user interface widgets

- List box
- Button
- Soft keyboard

Accessible mobile widgets

- How do we ensure that these applications are accessible?
- Look at how applications are developed
- Develop a toolkit of **context-sensitive, accessible user interface components** (widgets)

List control →
talking list

Button →
barrier widget

Keyboard →
expanding keyboard

Using context

- Adapt the user interface for people with disabilities as well as people on the go
  - Resize user interface when the user is walking
  - Turn on video captions when the environment is noisy
  - Use speech feedback when the device is in a pocket

Conclusions

- Mobile devices have tremendous potential for people with disabilities
- But present accessibility challenges (size, environmental factors)
- Improved interaction techniques can improve accessibility of common devices

Design goals

- Use mainstream hardware when possible
  - Use full capabilities of device
- Support use by people without disabilities
- Develop generalizable, learnable interaction techniques

Thanks

Shaun K. Kane
skane@u.washington.edu
http://students.washington.edu/skane/

AIM Research Lab
http://depts.washington.edu/aimgroup/

Discussion

- How do mobile accessibility issues differ from other issues you've encountered?
- How can everyday users benefit from accessible technologies?
- How can we use context to improve mobile accessibility?