# Sweep-Shake: Finding Digital Resources in Physical Environments

**Simon Robinson**
**Parisa Eslambolchilar**
**Matt Jones**

**Future Interaction Technology Lab**
Swansea University, UK

EPSRC

# Overview

- Motivation
- Background → Our approach
- Sweep-Shake system
- Exploratory trial → User study
- Results
- Conclusions

# Motivation

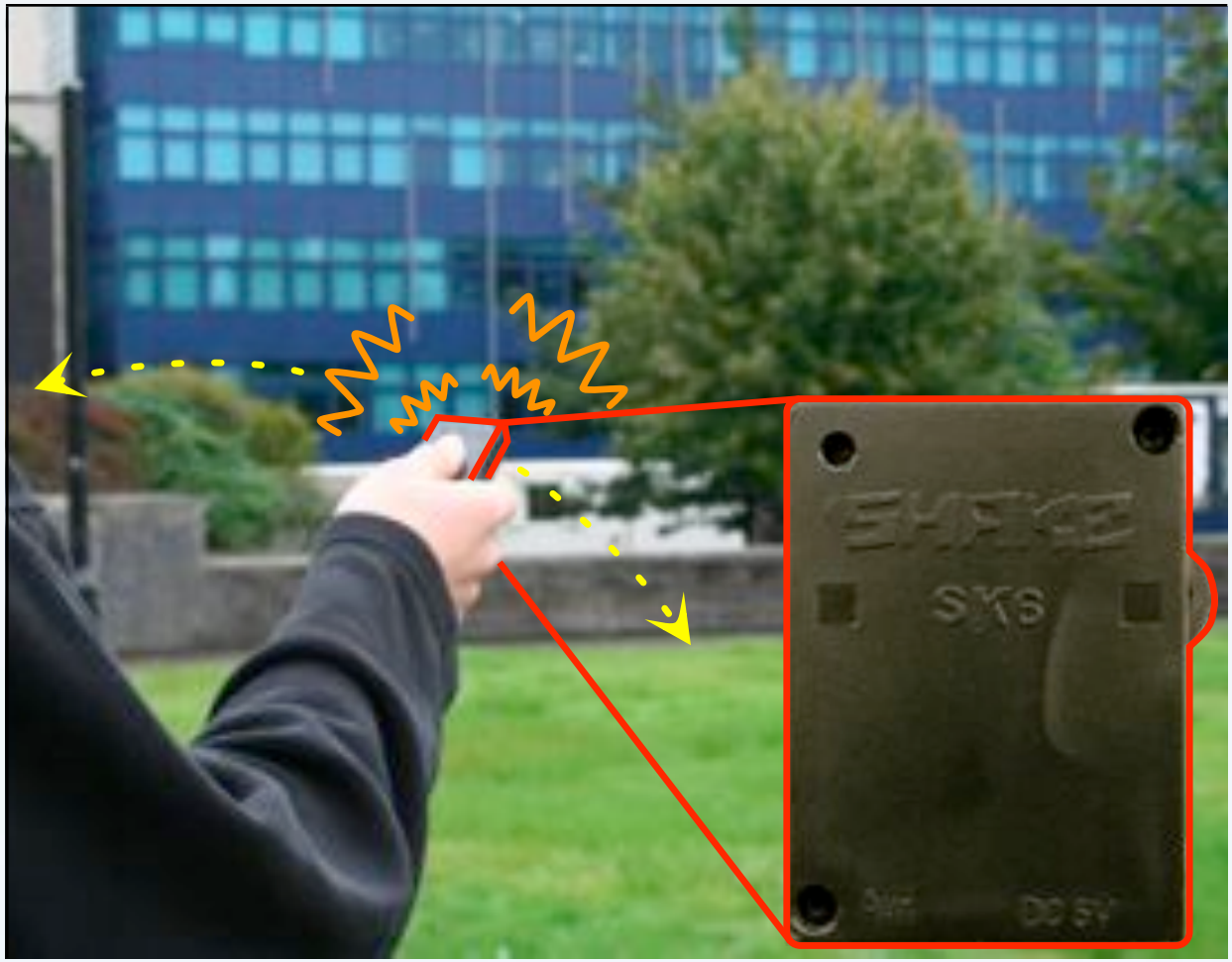

- Finding geo-tagged information about the places around you
- Engaging with surroundings: Often need to divide attention
- No reliance on screen for initial discovery
  - Lightweight, casual interaction
  - Filtering of information

# Background

- Spatial Information Appliances (Egenhofer [4])
- Point to Discover (Fröhlich *et al.* [5], Simon *et al.* [15])
- Bearing-based selection (Strachan, Murray-Smith [16])
- Vibrotactile waist belt (Van Erp *et al.* [18])
- Earcons (Brewster *et al.* [2])
- AudioGPS (Holland *et al.* [7])

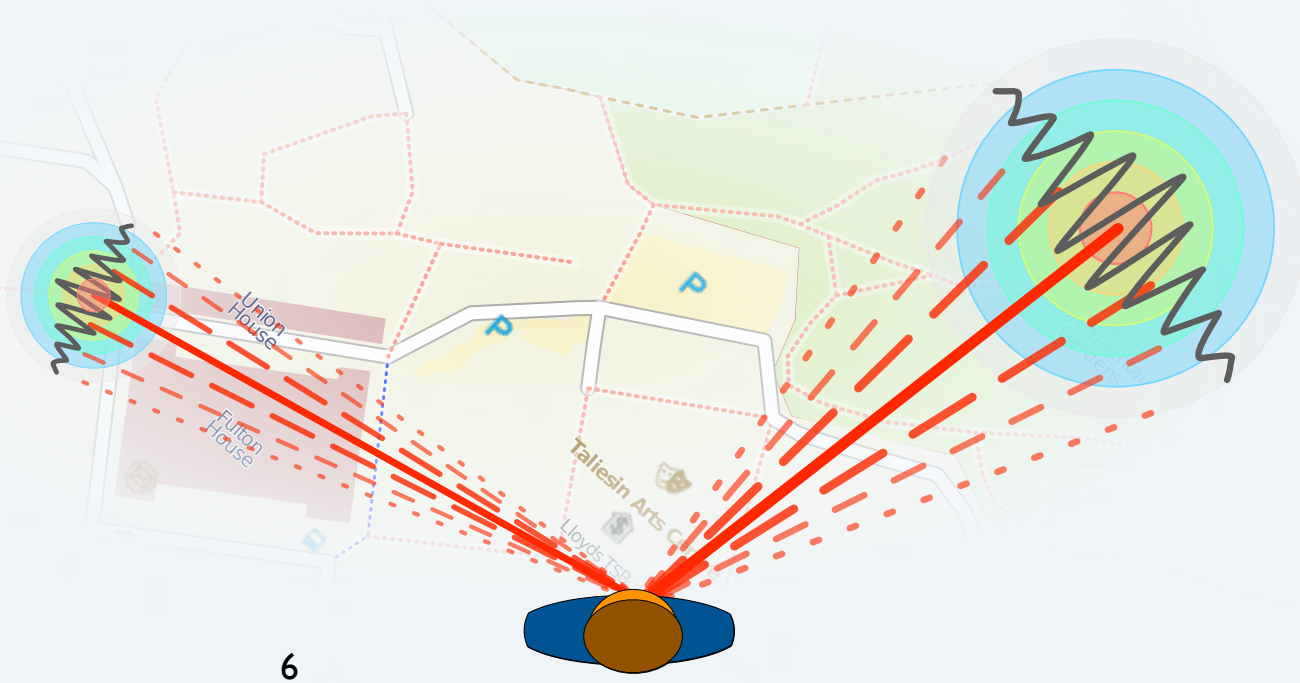
# Our approach: Sweep-Shake

- Haptic feedback for direction
- Gestures to refine selection
- Heads-up



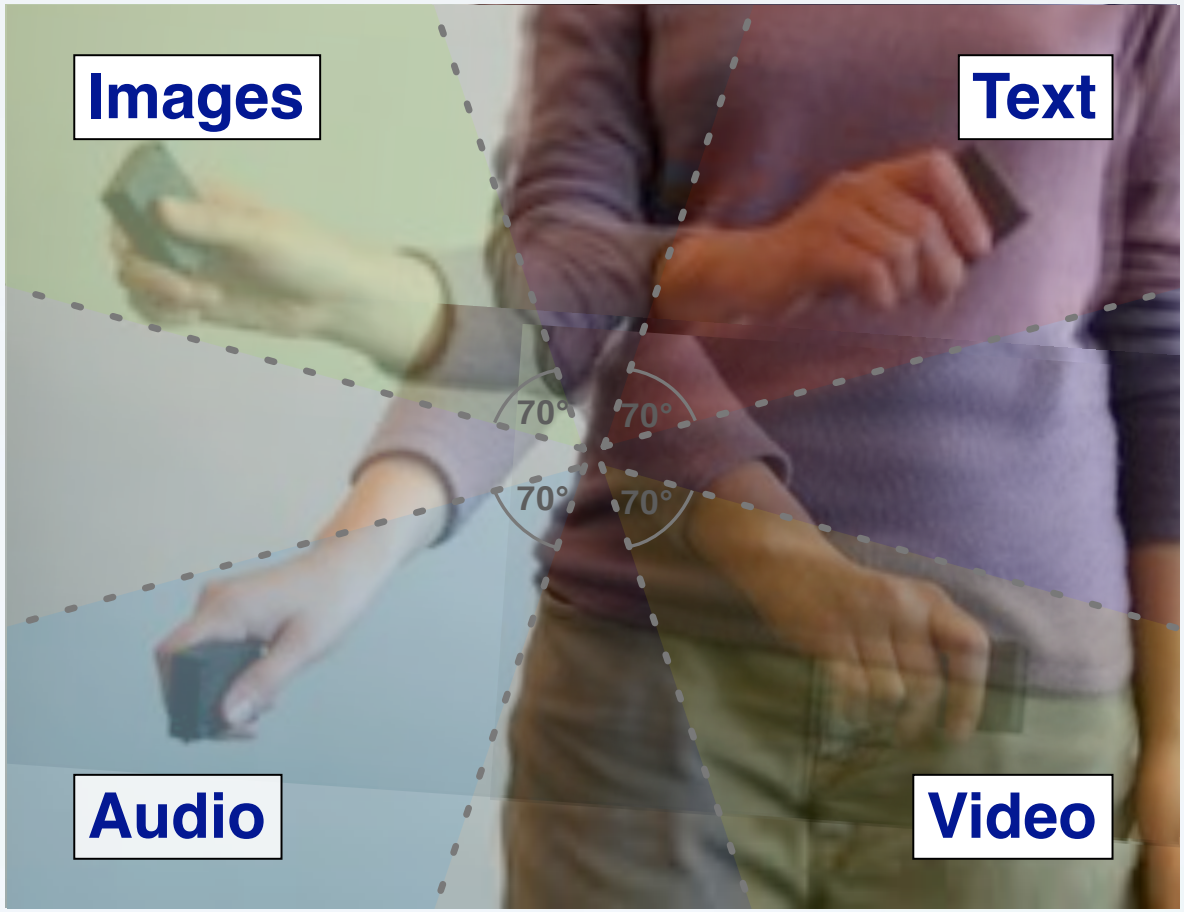
# Mode 1: Discovering places (browsing)

- Sweep the device to scan the area
- Feedback felt when pointing at a target
  - Direction
  - Size
- Press button to explore further



# Mode 2: Filtering information

- Simple gestures
  - 4 categories
  - Small pointing movements to filter
- Once found, press to view (on UMPC)



# Proposed benefits

- Seeking of real-world digital resources without looking at a screen

- Encourage interaction with the surroundings rather than the device

# Initial exploratory trial

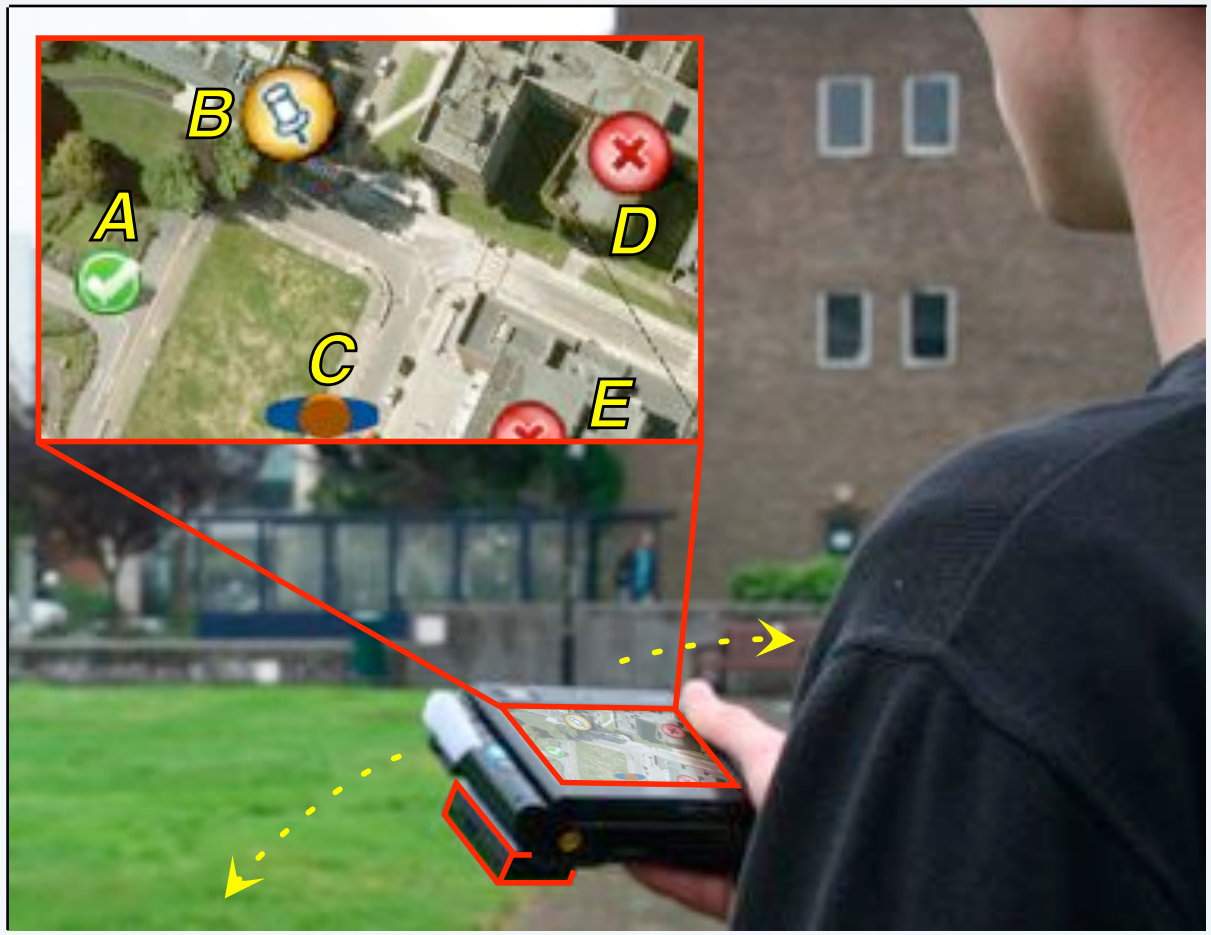
- 4 participants, explore campus at will
  - Verbal feedback
  - Observed behaviours
- Positive feedback
  - Enjoyed interaction method
  - Some used as background cue: Heads-up
  - Less interested in audio/video content
    - Save for later?

# User study

- Focus on discovery and selection process: simulated targets
  - Scan device to discover
    - Press button to select
  - Search for filtered information types
    - Find and select each one
  - Repeat
- Compare to visual system...

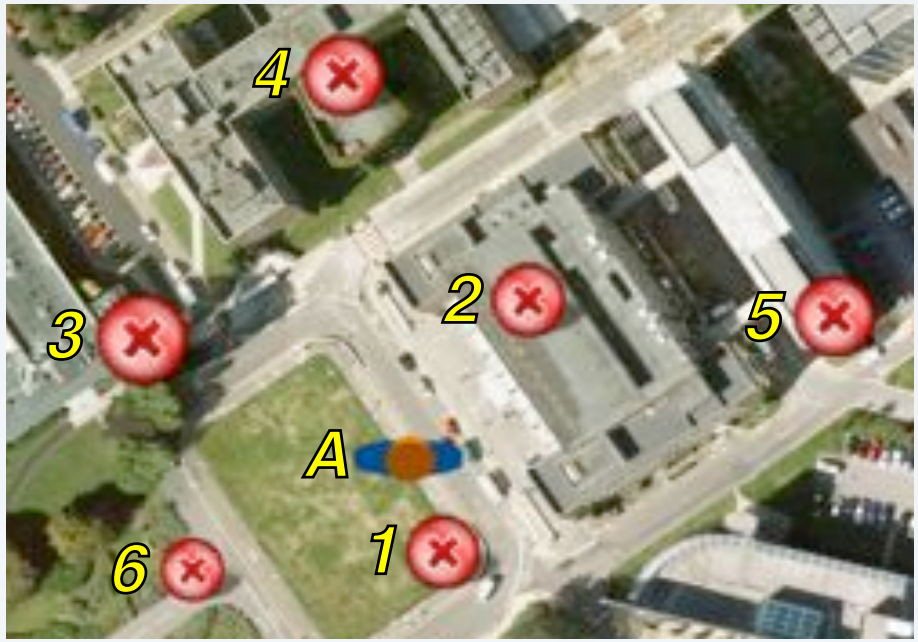
# Prototype 2: Visual

- Visual analog of haptic
  - Rotating aerial view
  - Same method for scanning
  - Touch for filtering
- Heads down



# User study: Method

- 32 participants
- 6 targets
- Fixed participant location




- Between groups, gather:
  - Success rate; time taken; false positives
  - Observed behaviours; verbal feedback

# Results: Discovering targets

| Measurement | Sweep-Shake | Visual |
|---|---|---|
| Targets found (of 6) | 75% | 97% |
| Time to select (secs, per target) | 16.5 (sd: 22.3) | 8.8 (sd: 5.6) |
| Overall time (secs) | 105.2 (sd: 32.3) | 81.7 (sd: 26.4) |
| False positives (per target) | 0.9 (sd: 1.1) | 0.9 (sd: 0.6) |

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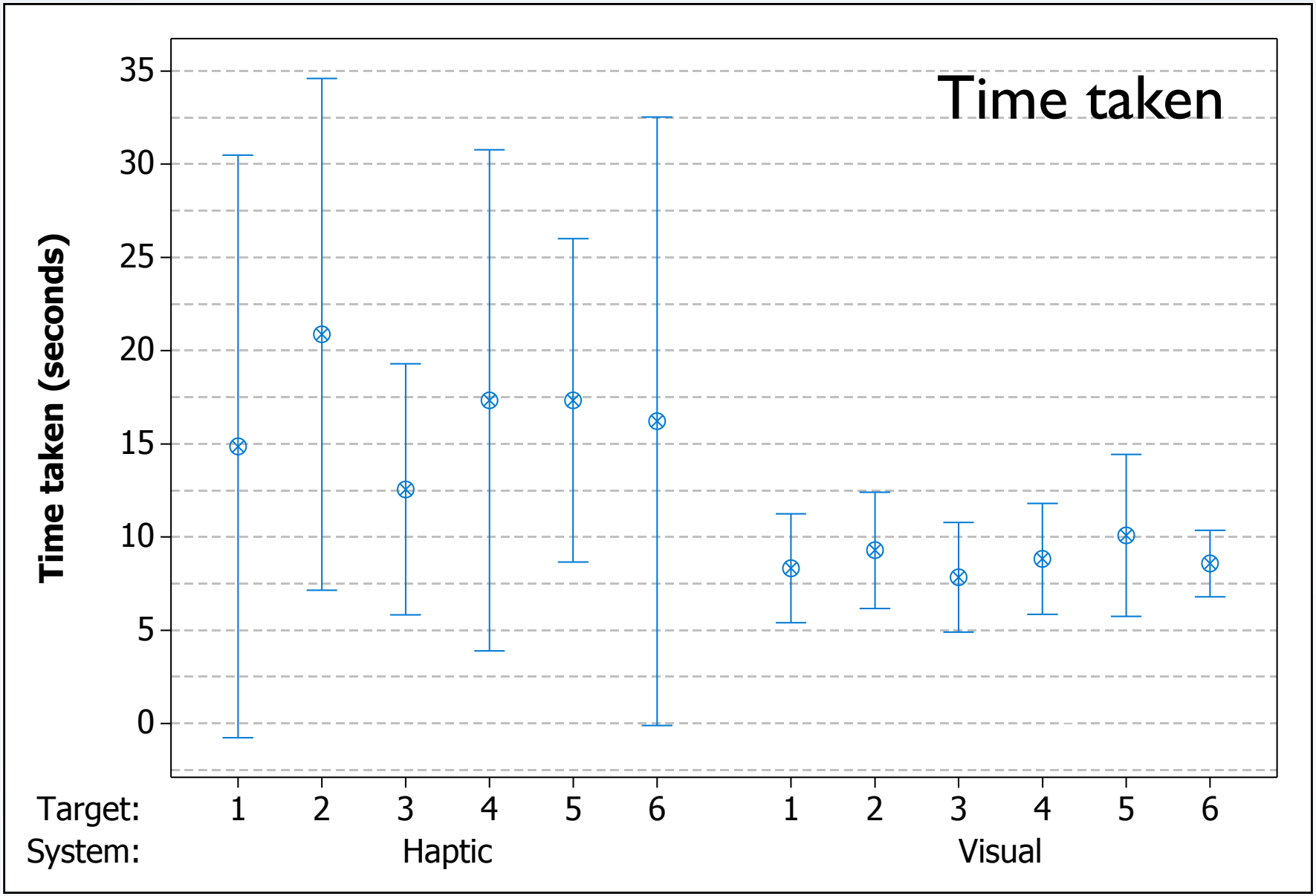

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# Verbal feedback

- Liked haptics
  - *'fun', 'easy'*
- Saw value in heads-up interaction
  - *'More helpful than my GPS'*
  - *'Guide me'* mode requested
- But: can be hard to interpret
  - Feedback and mode clarification needed

# Conclusions

- Haptic feedback can offer heads-up interaction
- Users appreciated haptic feedback

- Issues with usability
  - Work needed on modes

# Conclusions

- Haptic not yet on-par with visual
  - Lack of familiarity
  - Getting closer...
- Visual has its own issues
  - False positives similar to haptic

# Ongoing work

- Haptic feedback in other situations
  - Find objects instead of place information
    - Navigation instead of sat-nav
  - Multi-level hierarchy
- Completely on-phone
  - Low-cost applications - no specific hardware
- Projector for visual content

# Thank you

- Questions?

- cssimonr@swan.ac.uk
- http://cs.swan.ac.uk/negotiatedinteraction

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