ABBI
Audio Bracelet for Blind Interaction

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Multimodal human-computer interaction

Interaction and user experience crucial aspects of technology success

HCI research

Research and innovation into how users can interact with their devices, applications and information in new and compelling ways

Key area of work is Multimodality

Using our human senses and control capabilities

More human way to work

Engaging interactive experiences use multiple senses
Modalities

Non-speech audio

Earcons, 3D sound, sonification

Haptics

Force-feedback, pressure input, temperature output
Tactile (vibrotactile and pin arrays)
Ultrasound haptics

Gestural interaction

On-screen, in-air, multi-touch, capacitive sensing

Smell
Wearable technology

Great potential for providing information about the environment and social context

Discreet and unobtrusive

  Mobile phones, smart watches, headsets
  Many commercially available

Gestural input

  Rich control of technology using body
  Take care of social acceptability

Haptic and audio output
The aim of ABBI is the development of a new technology based on sensory-motor rehabilitation for visually impaired children

www.abbiproject.eu
ABBI

Audio Bracelet for Blind Interaction

Primary function is to inform child about his/her own movements to aid spatial cognition

- Audio and haptic feedback for body movements
- Natural audio-motor and tactile-motor associations

A rehabilitation technology that exploits the neural mechanisms that are naturally used by our sensory and motor systems

- Audio feedback about body movements can help to build a sense of space and spatial relations
**Mobile phone**

Control of ABBI is via a mobile phone
Can control several ABBIIs
Parents / rehabilitators
Project activities

Workshops with blind and visually impaired kids
  Sound design, materials

Focus groups with blind teenagers
Focus groups with teachers
  Reflections on needs and requirements

User studies of prototypes
Games workshops
ABBI workshops
**Social cues**

Feedback to show attentional focus of others in social settings

Used Microsoft Kinect
- Detect nearby people and emotion from face

Communicated discreetly in real time
- Tactile feedback from smartwatch if person is looking at you
- Thermal feedback
  - Warm if smiling
  - Cold if frowning
Environment scanning

Using wearable technology to support scanning of environment

Find people, objects, doors, ...

Smart watch

- Touch input
- Tactile feedback

Everyday device appropriated

Move finger around edge of display

- Tactile feedback indicates location of target
Graham Wilson

SPATIAL AUDITORY PERCEPTION: PERIPERSONAL & EXTRAPERSONAL
Spaces

Peripersonal

Extrapersonal
Extrapersonal Space
Extrapersonal Space
Extrapersonal Space
Extrapersonal Space
Extrapersonal Space
Extrapersonal Space
Extrapersonal Space

Before

Experimenter

Subject

After

Experimenter

Subject

150 cm

200 cm
Extrapersonal Space

Sighted

Acquired Blind

Born Blind

N=4

AB1

CB1
Sound Design

• Workshop with blind and visually impaired children
• Played abstract and real sounds and asked which they liked/disliked
• Also got preferences for different materials (soft, hard, furry, rubber)

• Most liked sounds:
  ✓ Crashing waves
  ✓ Bubbling water
  ✓ Birdsong
  ✓ Synthetic ‘dropping’ sound
Sound Design

- Natural
  - Birdsong
  - Crashing waves
- Abstract
  - “Pulse”
  - “Dropping”
- Musical
- Voice

Liked in workshop

Common in HCI

Used in perceptual research
Outcomes

• No large differences in accuracy
• Birdsong generally less useful
• Means that personalisation of ABBI is possible with no effect on localisation
Spaces
Spaces
Encouraging Engagement

From RNIB SSC Early Play
Encouraging Engagement

- Congenitally & early blind children:
  - **Develop motor skills more slowly**
  - Are less engaged with their environment (lack of awareness/object permanence)
- Sound (and touch) can be used to:
  - **Inform** the child of an object’s existence & location
  - **Encourage** him or her to **reach for it**
- Camera-based system that can activate ABBI and sounding toys could be used to:
  - Encourage and **guide self-initiated** reaching: engagement with the environment?
  - **Create a connection** between the hand and the object?
Sound Design

• Changed dynamically based on proximity of hand to *target* object
• Sound source = **Object**, **Wrist** or **Both** (object + wrist)
  • **Object/Wrist** played *Individual* design
  • **Both** played alternating *Coalescent* design
Sound Design

• Dynamic Geiger Counter
• Dynamic Pitch
• Constant (unchanging)
• Control (no feedback while reaching)
Study

- Ran study with blind and visually impaired children (12-17yrs) and adults (18-22yrs)
- Does dynamic feedback improve reaching accuracy/time
- Do the sound designs help to “create a connection” between the reaching hand and the object?
- Are there effects of where sound is played (wrist, object or both)?
Outcomes

• Dynamic feedback led to better reaching accuracy in young adults, but not in children
• Sound from object was most helpful
  • Sounds from wrist more confusing
• Dynamic sounds helped to create connection between hand and object

• Will next look at reaching in younger children (<12)
  • Whether dynamic sounds encourage reaching in very young
iBeacons are small objects which can be detected by Bluetooth-enabled devices ("beacon scanners")

- Limited range, quick discovery, low power
- Used for detecting proximity
  - If my device finds an iBeacon and knows where the iBeacon is, it can estimate its own position

ABBI bracelets are scanners and beacons

- They can detect nearby beacons and can also be detected by other devices
ABBI and iBeacons

Example: detecting child’s location within the home and within a room
- Warn a child about obstacles using sounds from their bracelet
- Allow parents to keep an eye on their child while out of the room
- Play position-based games, e.g. using sound to guide children on a ‘treasure hunt’ around the room
- Adapt the lighting (e.g. turn lights on) when a child enters a room
Example: **detecting nearby objects**

- A favourite toy might attract child’s attention as they approach it (using sound from their bracelet)
- Turn lights on if they stand under the light switch (if they can’t reach it)
- Help child find ‘landmark’ locations in an unfamiliar place
Adaptive Lighting

Using iBeacon technology with **smart lighting** to create lighting which adapts to visually impaired children and their behaviour.

**Smart lighting** includes light bulbs, lamps, light-up objects which can be controlled remotely.
Adaptive Lighting

**Beacons** provide a way of implicitly interacting with lighting, which could be used as part of the ABBI system.

Example: **change lighting intensity** as person wearing an ABBI bracelet enters the room.
- Increasing brightness to help those with low-vision see more effectively.
- Decreasing brightness to assist those with photophobia.
All lights within the room have become brighter to make it easier to see.
Adaptive Lighting

**Beacons** provide a way of *implicitly* interacting with lighting, which could be used as part of the ABBI system.

Example: *attracting attention* as person wearing an ABBI bracelet enters the room.

  Bright, colourful light from a lamp could attract a child towards their toys.
Colourful lighting to attract attention. Could pulse gently, loop through different colours, etc., to make the light more attractive or more easily noticed.
Concept Development

These are very early ideas

Any feedback and suggestions would be very much appreciated! :)

Do you use light-based activities with visually impaired children?

Examples: illuminating shiny objects with torches, playing with light-up toys, using light boxes
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Do you use light-based activities with visually impaired children?

Examples: illuminating shiny objects with torches, playing with light-up toys, using light boxes
Being involved

Designing ABBI with our users

Want to be involved?

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