Effects of Sound Type on Recreating The Trajectory of a Moving Source

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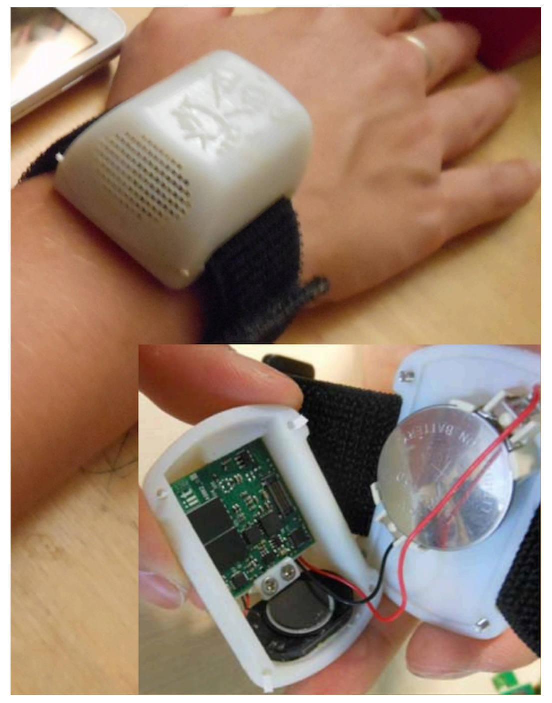
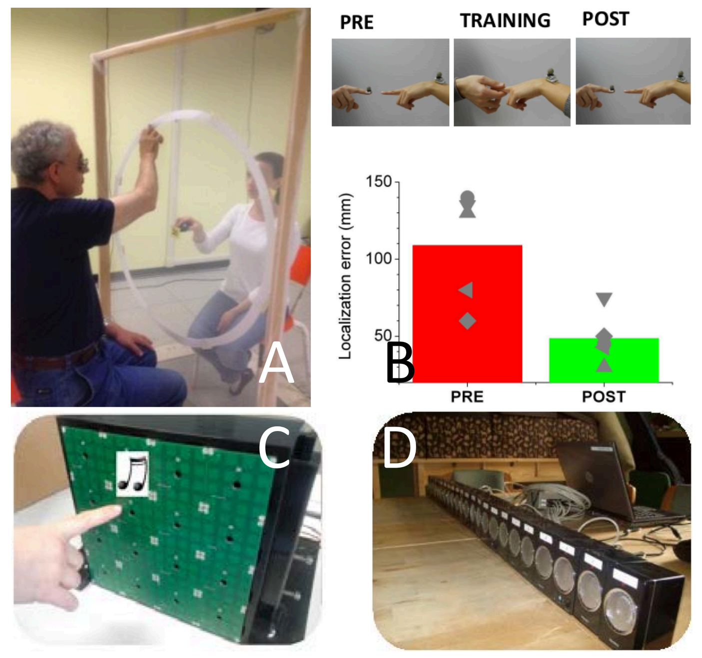
ABBI

SEVENTH FRAMEWORK PROGRAMME

ABBI: Audio Bracelet for Blind Interaction



ABBI Device on the wrist, and internal components



Previous experiments on spatial perception and movement: A, B – matching arm movements; C, D – pointing to sound locations

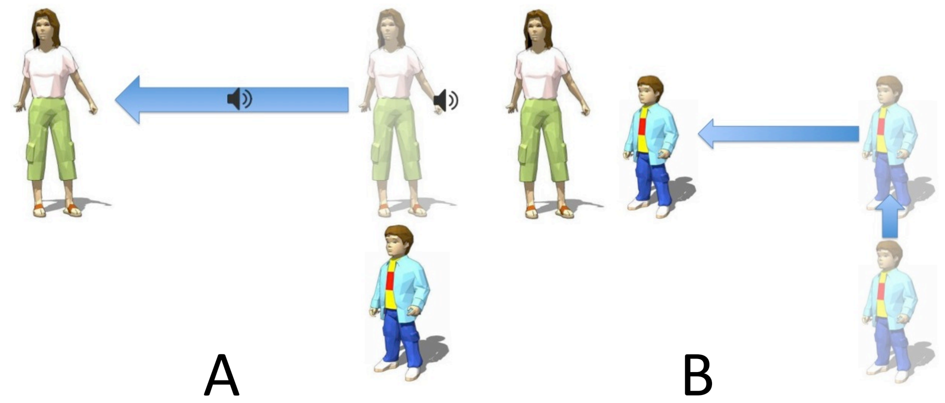
- ABBI is placed on the wrist or ankle and detects motion (acceleration + tilt)
- It produces sound based on movement

✓ Used as rehabilitative tool for blind children
✓ The sound can replace vision to improve motor control and spatial cognition

- Parents or friends can wear ABBI to encourage play/rehabilitation through mimicry of movements
- Blind children can hear the movement of others through the environment, to know where they are and how they got there

Motivation

A workshop was run with 17 blind and visually impaired children to identify sounds and textures that the children like, for use in the design of ABBI



A) A blind child can hear a parent/friend wearing ABBI moving through space and B) make their way to them

- ABBI sounds need to be personalisable to be useful
- We ran a workshop to ask blind children what sounds they like
- ABBI design depends on sound designs that are not only enjoyable but provide necessary information for rehabilitation, **but:**
  ? How accurately can different sounds be tracked and followed through horizontal space?
  ? What sounds facilitate the most accurate movement?

Sounds

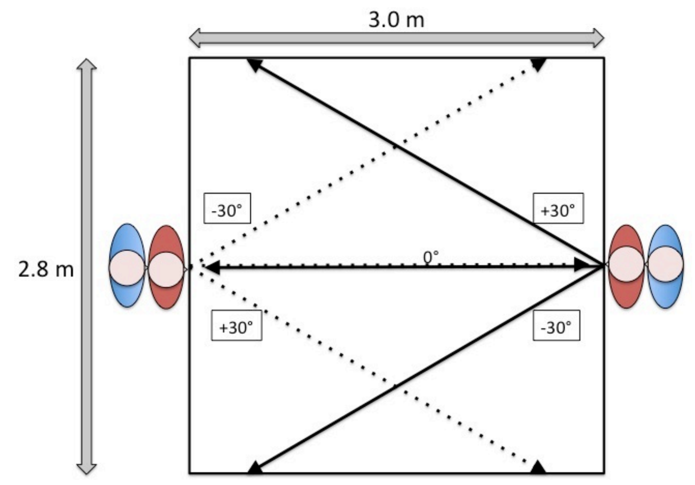
- Took 4 liked sounds from workshop and 2 others from HCI (Earcon) and perceptual science (Speech):
  - Birds = birdsong
  - Waves = waves crashing
  - Pulse = fuzzy, 2-sec C3 note with quick attack and slow decay
  - Dropping = C3 pitched synthetic rhythm/echo (digital drumming)
  - Earcon = 6-note C4 pitched melody
  - Speech = male voice, 1st sentence of "Alice in Wonderland"

Type	Natural		Abstract		Musical	Voice
Sound	Birds	Waves	Pulse	Dropping	Earcon	Speech

Experiment

- Walking routes were 3m straight trajectories at -30°, 0° and 30° from starting point
- Participant stood at start point behind experimenter
- Experimenter walked trajectory while holding sound source; participant remained at start point
- Experimenter stopped sound at end point and participant tasked with walking trajectory

- 6 blindfolded sighted participants were used
- Measured: *end point distance, deviation from trajectory* and *total distance travelled*



Experimental space and trajectories

Results

- Little difference in measures between sounds

= Personalisation is possible

X Birds poorly tracked
✓ Speech and Waves accurately tracked

- Future research will test more sounds and more complex movements with blind and visually-impaired

Sound	End Point Distance	Trajectory Deviation	Distance Difference
Birds	69.60cm	33.09cm	39.27cm
Dropping	62.36cm	33.42cm	30.15cm
Earcon	68.72cm	36.36cm	36.16cm
Pulse	60.26cm	31.75cm	39.95cm
Speech	59.48cm	31.11cm	30.88cm
Waves	57.50cm	30.42cm	37.06cm

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