A Study on Gesture Interaction with a 3D Audio Display

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Motivation for Gesture Controlled Spatial Audio Displays Research

• Visual Display Limitations
• Use Audio, Spatial Audio
• Conventional Input Devices (Mouse, Keyboard) are hard to use when mobile
• Use gestures
Literature Review

• Cohen et al, Audio Windows, Interacting with spatial sound, pointing, moving and grabbing sound, filtears
• Schmandt et al, Nomadic Radio, Audio Hallway, Dynamic Soundscape
• Brewster et al, Auditory Pie Menus
Interface Design

• Substitute/Augment Visual Display with a gesture controlled Auditory Display
Spatial Sound -> Ambiguity

• Auditory Perception of Space is less accurate than the Visual Counterpart
• Non-Individualized Ear Measurements
• Performance improves with experience, most experiments done with trained listeners

Ideally …
Browsing & Selecting Experiment

Features

• Real Time Orientation Update
• On Target Audio Feedback/No Feedback
• Three interaction techniques for browsing and selecting a sound.

We look for

• Effect of Interaction Technique
• Effect of Sound Position
• Effect of Feedback
• Effective Selection Angles
Experiment Design

Independent Variables

• Three interaction methods
• Feedback vs. No Feedback (Between Subjects)
• 8 sound positions, random order

Dependent Variables

Effective Selection Angle (Two Down - One Up Procedure)

Angular Deviation from Target
Procedure

Twelve participants:
five females, seven males
Age span: 19 to 30.

Participants had no experience in interacting with a spatial audio display
Effective Selection Angle - Feedback

Interaction Technique

\[ F_{2, 22} = 10.777, p < 0.001 \]

Sound Location not Significant – Participants were facing the sound

Tablet significantly more accurate

No difference between hand and head

Only 1 out of 3 participants could complete the no feedback case. It took much longer, but accuracy was comparable.
Deviation analysis

Interaction Method
$F_{2,192} = 7.463, p < 0.001$

Sound Position
$F_{7,672} = 7.987, p < 0.001$

225° != 0°, 45°, 90°, 135°, 270°, 315°
180° != 45°, 270°, 315°
Ease of Use & Comfort

Tablet significantly harder to use

No statistical difference between hand and head
Conclusion

• Effective angle is interaction method dependent
• Tablet significantly better but not preferable from users, unnatural.
• Hand based interaction ineffective for sound locations in the back of a user
• On Target Cue very Important
• Real Time Orientation Update Cue quite demanding
Future Work

- Sound Design
- Display Design
- Multiple Sounds
- Feedback
- Navigation