Non-Visual Augmented Reality as an Accessibility Tool for People with Visual Impairments

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Singing Highway?
Non-Visual Speed limit Alert

Albuquerque's Singing Highway
"America the Beautiful" plays for those who drive the speed limit

What blind people can do with non-visual (spatial) information?
Blindsquare uses Foursquare data and Open Street Maps to guide the visually impaired.
Non-visual AR

- Augmented Reality system that does not rely or create primarily visual stimulus or images in order to function
- Non-visual augmented reality is anything that adds to the user's environment without requesting attention from the user's vision. Rather, other senses are augmented and stimulated in the system.
- Haptic, or Touch-Based Augmented Reality
- Location (GPS data)-Based Augmented Reality
- Audio-Based Augmented Reality

=> Towards a Multisensory Augmented Reality (Map)

http://cyborganthropology.com/Non-Visual_Augmented_Reality
Non-Visual Game

Blind Legend: Audio Game

Watch and listen as visually impaired players test the "Blind Legend" game.

HOW TO PLAY?

- MOVE FREELY!
- STRIKE AND DO COMBOS!
- BLOCK AND PUSH BACK!
Why non-visual information?

For Location literacy (Orientation and Mobility) training

Audio Information

Haptic (Tactile) Information
Accessibility in Graphics(map)
-Sound
iSonic(Interactive Data Sonification for Blind Users)

http://www.cs.umd.edu/hcil/audiomap/
Accessibility in Graphics(map) - 3D Audio (Binaural audio)

Binaural audio Mic

https://arvrjourney.com/binaural-audio-how-3d/audio-hacks-your-brain-a3de0ceb4196
3D Tactile design for Blind people
- Finger map Project(korea)
Audio Tactile Map with Motion Detection Device

Tactile Map

Motion Detection Device

Circular motion guide

Daegu city (audio guide)

Motion Detection
Visual information in Non-visual AR?

Brian F. G, et.al, 2012, NAVIG: augmented reality guidance system for the visually impaired
Conclusion: Accessibility for AR and VR

◆ Improve Augmented Accessibility

=> Augmented Reality environment accessible to disabled users

◆ Universal Design Support for geographical information for visually impaired and all other people

◆ Necessity of standardization of Non-Visual AR

(Non-verbal expression such as color symbol)

Color Symbol shapes for:
(a) sky blue, (b) purple and (c) yellow.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Colour represented</th>
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<tbody>
<tr>
<td>▒</td>
<td>Red</td>
</tr>
<tr>
<td>▒</td>
<td>Blue</td>
</tr>
<tr>
<td>▒</td>
<td>Yellow</td>
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<td>▒</td>
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<tr>
<td>▒</td>
<td>Purple</td>
</tr>
<tr>
<td>▒</td>
<td>Brown</td>
</tr>
</tbody>
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RAMSAMY-IRANAH, S. ...et al., 2016. A comparison of three materials used for tactile symbols to communicate colour to children and young people with visual impairments. British Journal of Visual Impairment, 34(1), pp. 54-71