Survey of Virtual Reality and Accessibility

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Presentation Overview

- Introduction and Motivation
- Related Work and Past Surveys

1. Virtual Reality for Accessibility
    a. Design
    b. Education
    c. Assistance Method
2. Accessibility for Virtual Reality
3. Virtual Reality for Inaccessible Cultural Heritage

- General Conclusions
- Strengths and Weaknesses of the Current Research

Introduction

- The study of Virtual Reality is fairly new especially the with Accessibility Considerations

- Virtual Reality (VR) ➜ “The creation of the effect of immersion in a computer-generated three dimensional environment in which objects have spatial presence.”

- Accessibility ➜ refers to the extent to which a product, device, service, or environment is available and navigable for persons with disabilities, or for persons with other special needs or functional limitations.

Motivation for this Field of Study

- Explore how this fairly new technology can be used in the area of accessibility
  - Find new use cases that previously were not thought of

- Try to give every user regardless of ability the opportunity to use the technology

Related Work and Past Surveys

- The Raising Role of Virtual Reality in Accessibility Systems **[39]**
  - Primarily relates to the field of Virtual Reality for Accessibility
- Bringing Basic Accessibility Features to Virtual Reality Context **[36]**
  - Primarily relates to the field of Accessibility for Virtual Reality

- How to improve upon these?
  - Combine the different areas as well as add a third area of research
  - Present a wide variety of relevant papers to support each field
  - Try to update these surveys with new research that may have not conducted yet

1. Virtual Reality for Accessibility

Goal of this Area :Use Virtual Reality Devices as a medium to make the world outside of VR more Accessible to people with some of the following disabilities:

- Color Blind, Wheelchair users, Dementia, Upper Extremity Mobility issues, Neurodegenerative diseases, Anxiety
- Broken into three subsections
  - Accessibility for Design
  - Accessibility for Education
  - Virtual Reality as an Assistance Method
- Largest Research Area discovered

1a. VR for Accessible Design

Goal of this subarea: Give designers interfaces to create reproducible results where they can:

- Simulate disabilities in order to create prototypes for people with disabilities to test
  - Example: Training designers to develop interfaces for colorblind people **[6]**
- Allow people with disabilities to test future designs
  - Example: City planning wheelchair simulations **[15]**
- Allow people with disabilities and others to test current designs
  - Example: Urban Auditing using VR led walking **[32]**

1b. VR for Accessible Education

Goal of this subarea: Give students with disabilities virtual tools in order to get a better education experience including:

- Educational Frameworks and Environments
  - Example: Deaf Accessible Virtual Environment for Education **[29]**
- Already existing tools and games to promote engagement
  - Example: Using Virtual Reality Games to promote special education engagement **[20]**

1c. VR as an Assistance Method

Goal of this subarea: Use virtual reality devices in order to assist people with disabilities in the following ways:

- Wearing the VR headset in certain settings to promote accessibility
  - Example: Deaf or hard of hearing captioning in live theater performances **[38]**
- Using VR as a training method for rehabilitation
  - Example: Shark Punch Aquatic Game for Stroke Patients **[31]**
- Exposure to simulated situations
  - Example : Exposure therapy for people with anxiety and social anxiety **[2]**

2. Accessibility for Virtual Reality

Goals of this area: Make Virtual Reality systems more accessible to people with disabilities by:

- Assessing the current state of systems and the issues
  - Example : “I just went into it assuming that I wouldn’t be able to have the full experience” **[25]**
- Evaluating current accessibility features
  - Sensory substitution for the people who are blind or have low vision **[24]**
- Evaluating known issues
  - People who are older using handheld devices **[7]**

3. VR Accessibility for Inaccessible Cultural Heritage

- This area is not related to disabilities but rather cultural limitations
- Background on this issue:
  - Some cultures no longer exist and not many artifacts are still present
  - Seismic stability, fragility of the artifacts, conflicts, deterioration, natural disasters, climate change and visitors

Goals of this area: Give the future generation access to cultures that are or may one day be inaccessible

- Rebuilding of a virtual environment and culture while the information still exists
  - Virtual Reality Digitisation for endangered cultural heritage sites **[16]**

General Conclusions Over All Areas

- Virtual Reality gives designers an effective way to create testable prototypes as well as test current or new designs
- Virtual Reality Frameworks can help give users with disabilities an easier learning experience
- Virtual Reality can be used as an effective assistance method for users with disabilities
- Large steps are being taken in order to make VR systems more accessible
- Virtual Reality is an adequate medium to inaccessible cultural heritage sites

Strengths in the Research

- Wide variety of disabilities and use cases being studied at the current time
  - Especially considering how young the field is
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- The research uses a lot of the newest technology

- All of the research includes people with disabilities or plans to in future testing

Gaps/Weaknesses in the Research

- A lot of emphasis placed on using Virtual Reality for accessibility but not as much on making virtual reality more accessible
  - 2:1 ratio of good papers
- User acceptability is not always high
  - Need more research on how to make the setups more comfortable in general
  - More research/update procedures to make environments easier to understand for older users especially
- Not much research on the general accessibility of Virtual Reality
  - It is interesting and has a lot of uses, but why is it not more widespread?
- A lot of theoretical research
  - Hopefully in coming years these systems will actually be implemented

Questions?

Full List of References

Full Numbered Sources List