Design of an Accessible VR-Escape Room for Accessibility Education

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Agenda

1. Motivation
2. Basics
3. Disciplines of Accessibility
4. Implementation
5. Discussion & Limitations
6. Conclusion

Motivation

- What is the challenge?
    - Increasingly digital nature of everyday life
      → Digital Accessibility (DA) moves further into focus
        but lack of knowledge about DA

- How can this challenge be addressed?
    - sensitizing computer science students

- Which criteria should such learning material fulfill?
    - low threshold / tangible
      → Gamified learning and Immersion via Virtual Reality (VR)
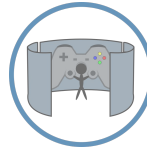   - Accessibility

Research Question

"What does the design process for creating an accessible VR application entail, and what implementation steps are necessary to achieve this goal?"
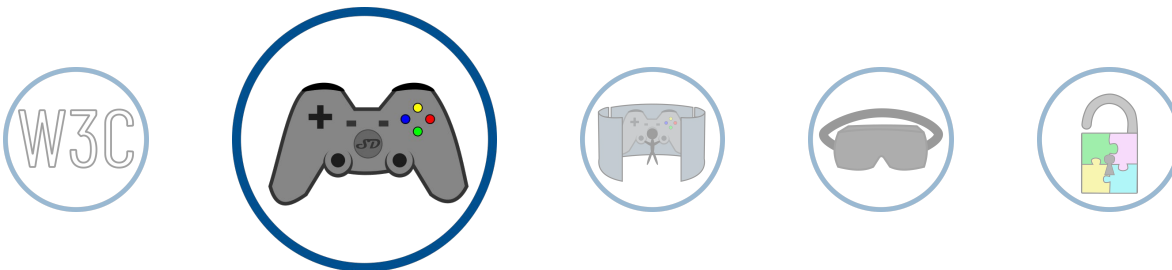
Basics

Web Content Accessibility Guidelines [1]

- Recommendations for developing accessible web content
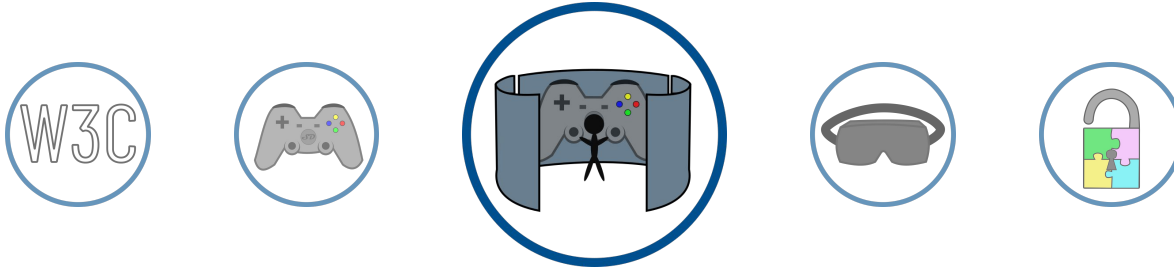- Perceivable, Operable, Understandable and Robust

Basics

Serious Games

- Fully functional games for teaching serious topics **[2]**
  - Increase of motivation and engagement **[3]**

Basics

Immersion

- The feeling of being *in* a game disregarding anything else, e.g., the real environment and losing sense of time **[4]**, **[5]**
- More immersion leads to more attention and effort towards the game **[5]**
- Factors that increase immersion (**[6]**, **[7]**)…

…tension …realistic game environment

…atmospheric audio …fascinating game characteristic

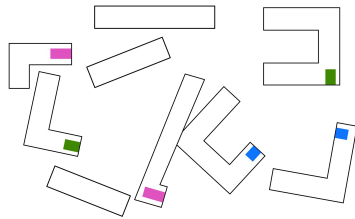…and much more

Basics

Virtual Reality [8]

- Computer-generated 3D **replica** of real world elements
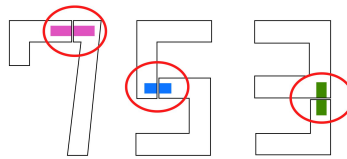- **Immerse** into and **interact** with the virtual environment
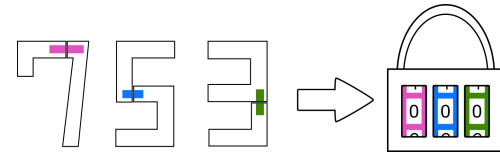
Basics

Escape Room [9]

- Game mechanic: A group must leave a room by solving puzzles under a time limit

Challenge

Solution

Reward

Serious Games in Education

"Lolas first Semester" **[10]**

Learning Goal:

Raising awareness for accessibility

Game story:

- Players accompany the student Lola on her first day at university
- 5 barriers introduced by mini-games

Lessons Learned:

- Serious games are a suitable format for raising awareness of barriers
- Identification of important game elements

https://lolaserstessemester.sd.uni-frankfurt.de/

Agenda

1. Motivation
2. Basics
3. **Disciplines of Accessibility**
   a. Accessibility Education
   b. **Game Accessibility**
   c. Accessible VR
4. Implementation
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Game Accessibility Guidelines [11]

- International Game Developers Association (IGDA)
- 122 guidelines
- Recommendation of a workflow

1. Familiarise

2. Evaluate & plan

3. Prioritise & schedule

4. Implement

5. Inform

6. Review & learn

Virtual Reality

Benefits for Education

- **VR** offers great potential for education especially thanks to its immersion **[12]**
- Interviews revealed that students see potential in the technology if it is used in specific areas **[13]**

Challenges and risks

- Necessary **hardware** hinder broad participation **[14]**
- Simulator Sickness **[15]**
- **Accessibility of VR application**

VR Accessibility

Oculus Manual [16]

- User Experience (UX) and User Interaction (UI)
- Controls and Interactions
- Movement and Locomotion
- Display
- App Design
- Audio
- Captions and Subtitling

[16]

Game Design

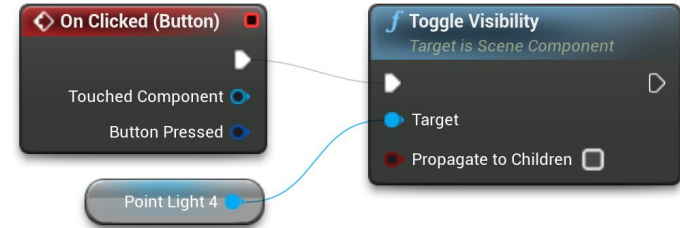## Technology
- Unreal Engine 4.27
- Visual Scripting

Story
- The player experiences the first day at a university and needs to find a lecture hall

Mechanic
- Game concept: Escape Room

Pedagogy
- Target group: Computer scientists → with an affinity for technology and familiar with logical thinking
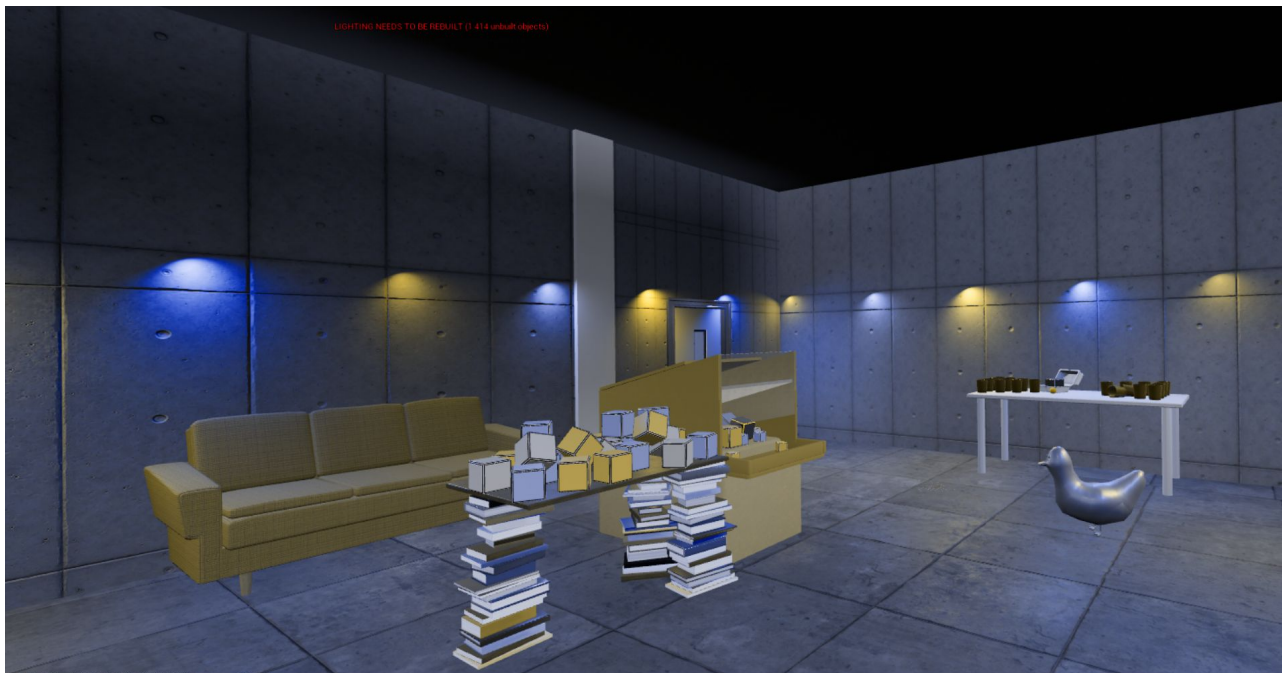
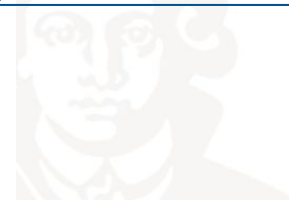# Training Room

Puzzle 3: Alternative representation of colors

Learning goal: WCAG - 1.4.1 Use of Color

Puzzle 5: Minimum size for buttons

Learning goal: WCAG - 2.5.5 Target Size

Implementation of GAG-Workflows [Ass22]

1. Familiarise	GAG [Ass22] & Oculus manual [16]
2. Evaluate & plan	GAG: Excel spreadsheet & Oculus manual: continuous text
3. Prioritise & schedule	Rating using the Excel spreadsheet
4. Implement	Integration of usability and accessibility experts
5. Inform	Not fulfilled
6. Review & learn	Accessibility features help all players

Implemented Accessibility Features

1. Implementation by the game engine

2. Implementation based on prior knowledge of accessibility

3. Implementation through elementary game design

4. Implementation through high effort

5. Implementation not possible

Discussion & Limitations

Research Question: "What does the design process for creating an accessible VR application entail, and what implementation steps are necessary to achieve this goal?"

- **GAG Workflow** as starting point: identifying and prioritizing policies
- Accessible VR application requires sufficient **planning** and careful **time management**

- Our VR Escape Room has **limited accessibility features** and is only partially accessible
- The question of inclusion can only be **answered theoretically** - no participant with impairments tested the application

Conclusion

- **Recommendations** for future research:
  - Plan enough time and resources
  - Categorization of guidelines
  - Application of the GAG workflow

- *Access to Escape:* implementation of remaining guidelines necessary
- Benefit of our Escape Room: participants were **sensitized for accessibility**

Thank you for your attention!

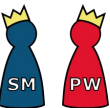**Contact information:**

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