Visual Accessibility and Inclusion

An Exploratory Study to Understand Visual Accessibility in the Built Environment

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She is engaged in the research of innovative, INCLUSIVE, ACCESSIBLE models for the experience of ARCHITECTURE, with a specific focus on CULTURAL HERITAGE and KNOWLEDGE transfer.

She has participated in various NATIONAL and INTERNATIONAL projects, workshops and conferences on topics of design and architecture, sustainable development and cultural heritage.

- accessibility assessment
- social inclusion
- multisensory perception
- interaction design
Content

- What is Visual Accessibility?
- State-of-the-art of tools and systems for visual accessibility
- Why Cambridge simulation glasses?
- Pilot study
- Conclusion and future developments
What is Visual Accessibility?

**VISUAL ACCESSIBILITY**

«the property that allows the **USE OF VISION** to TRAVEL EFFICIENTLY and SAFELY through a SPACE, by perceiving the spatial layout of key features in the environment and keeping track of one's location» (Thompson et al., 2017)

Currently focused on objective, physical-dimensional features

Visual accessibility assessment for severely visually impaired people

?
What is Visual Accessibility?

SIZE

[Images of various examples of visual accessibility, including text on signs, braille, and a person reading a braille sign.]
What is Visual Accessibility?

CONTRAST
What is Visual Accessibility?

LIGHTING
## State-of-the-art of tools and systems for visual accessibility

<table>
<thead>
<tr>
<th>Date</th>
<th>Authors</th>
<th>Description</th>
<th>Virtual</th>
<th>Physical</th>
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</thead>
<tbody>
<tr>
<td>2020</td>
<td>Adobe</td>
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1. **Awareness raising simulation tools and systems**
2. **Pass/fail tools and systems**
## Studies on Reduced Acuity and Contrast

<table>
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<tr>
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### What?

**Thompson et al. (2017)**

Simulating visibility under reduced acuity and contrast sensitivity

Application of filters to HDR photographs of a space to identify potential mobility hazards and landmarks that might go unrecognized by low vision individuals

### What Not?

The complexity of the algorithm makes it rather hardly accessible to the general audience

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### State-of-the-art of tools and systems for visual accessibility

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### Objective measurements of contrast levels

**Dalke et al. (2010)**

**CROMOCON Light Reflectance Value (LRV) meter**

- **What?** measures colour contrast values to understand the visibility level of objects, texts or building components for an impaired person

- **What not?** partial objective evaluation, **no empathical** experience provided to the person without an impairment
### «HUMAN OBSERVER» approach for signage visibility

| 2020 | Adobe | Adobe Accessibility Tools | ✓ |
| 2017 | Thompson et al. | Simulating visibility under reduced acuity and contrast sensitivity | ✓ |
| 2017 | Arditi | Rethinking ADA signage standards for low-vision accessibility | ✓ |
| 2016 | Mahjoob et al. | Effect of yellow filter on visual acuity and contrast sensitivity under glare condition among different age groups | ✓ |
| 2019 | Dalke et al. | A colour contrast assessment system: design for people with visual impairment | ✓ |

#### Arditi (2017)

**Rethinking ADA signage standards for low-vision accessibility**

**what?**

- simulates impairment to human observers by adjusting the viewing distance to assess the legibility of signs

**what not?**

- does **not consider** the amount of space necessary to walk backwards and the **lighting** conditions, neither other features of the built environment besides signage
The state-of-the-art research highlighted the COMPLEX INTERACTION between ENVIRONMENTAL VARIABLES and PEOPLE CAPABILITIES, as well as a lack of specific bespoke design requirements for wayfinding in a space, making visual accessibility in the space hard to achieve. The tools and systems studied do not cover SIZE, CONTRAST, LIGHTING AND EMPATHY at the same time.

visual accessibility within built environments ought to consider more than just signage.

need for a tool that covers size, contrast, lighting and an empathic understanding of whether an environment or object is visually accessible.
Why Cambridge simulation glasses?

CAMBRIDGE SIMULATION GLASSES

experience the built environment with visual impairments, understand what could be improved and support assessment of visual accessibility

- SIZE
- LIGHTING
- CONTRAST
- EMPATHY
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Why Cambridge simulation glasses?

**SIZE AND LIGHTING FROM BEHIND**

- without glasses
- with 2 pairs of glasses
- with 4 pairs of glasses

**SIZE AND FRONTAL LIGHTING**

- without glasses
- with 2 pairs of glasses
- with 4 pairs of glasses
Why Cambridge simulation glasses?

CONTRAST SENSITIVITY

without glasses

with 2 pairs of glasses

with 4 pairs of glasses
Exploration of a PUBLICLY ACCESSIBLE EDUCATIONAL BUILDING while wearing 3 or 4 pairs of the Cambridge simulation glasses: features that remain visible with 4 pairs of simulation glasses worn simultaneously should mean that the exclusion due to visual acuity issues is less than 1%.
STEPS WITHOUT EDGING STRIPS

- **without glasses**
- **with Cambridge simulation glasses**

**without glasses**
- no particular issues were recorded

**with Cambridge simulation glasses**
- when wearing the glasses, the edges of the steps completely disappear
- the steps felt «unnerving»
- «considerable concentration to place the feet on each step»
STEPS WITH EDGING STRIPS

without glasses    with Cambridge simulation glasses

- without glasses, no particular issues were recorded
- when wearing the glasses, the edges of the steps remained visible
- the experience felt «considerably more pleasant»
- descending the steps «felt safer»

Luminance: 184 lx  Distance: 150 cm  Focal length: 4 mm  Exposure time: 1/17
3 SIGNAGE

without glasses  with Cambridge simulation glasses

without glasses, the researchers were able to identify the directions of the arrows and read all of the text

a bit of glare due to the lighting

when wearing the glasses, the sign becomes difficult to read

the large amount of light coming from behind was considerably unhelpful
without glasses, the researchers were able to easily read the text when wearing the glasses, the text becomes difficult to read because of the lack of contrast with the background
**VISUAL ACCESSIBILITY ASSESSMENT**

<table>
<thead>
<tr>
<th>subjective experience</th>
<th>trained subjective experience</th>
<th>impaired subjective experience</th>
<th>heuristic guidelines</th>
</tr>
</thead>
<tbody>
<tr>
<td>personal beliefs and taste (e.g. interior designer, non-expert user)</td>
<td>informed through training (e.g. access consultant)</td>
<td>persons with a particular level of impairment (e.g. user with VA 6/18)</td>
<td>following guidelines</td>
</tr>
</tbody>
</table>

**+**

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<tr>
<th>simulated empathic subjective experience</th>
<th>shared empathic experience</th>
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<td>assessor with simulated visual impairment (e.g. wearing the Cambridge simulation glasses)</td>
<td>assessor with simulated visual impairment + person with visual impairment</td>
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Conclusion

- increase AWARENESS and EDUCATE stakeholders on visual accessibility for impaired users
- create shared EMPATHIC EXPERIENCES of visually accessible features in the built environment
Future developments

- engage OTHER USERS
- explore different USE CASES of the glasses
- MEASUREMENT OF THE BENEFITS in daily working practice
- use of vision for FUNCTIONING EFFICIENTLY in an environment (e.g., in a workspace, visual accessibility to controls for heating, ventilation, lighting, door handles etc.)
Thank you!

www.inclusivedesigntoolkit.com