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**

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**

?

SIZE


Z R K D C
D N C H V
C D H N R
R V Z O S
O S D V Z
N O Z C D
R D N S K
O K S V Z


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TEMP
AUTO
HEAT
COOL
DRY


Departures
Check-In Desks 1 - 32
Check-In Desks 33 - 50
Departures
Information Point
Special Assistance Point
Toilets
Cash Machine (ATM)
Baby Changing

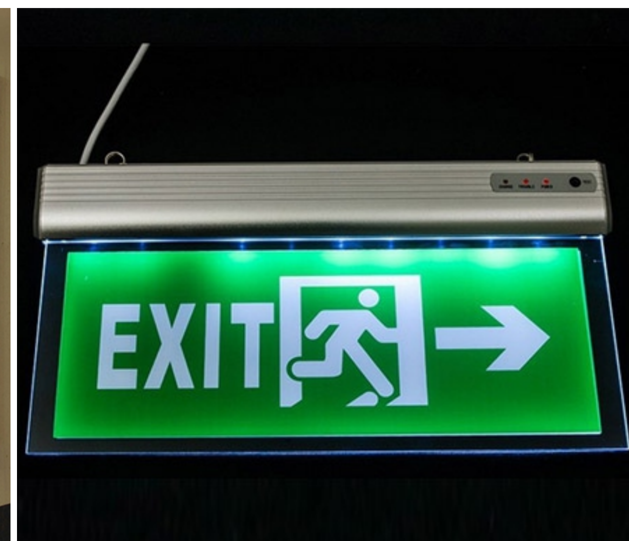
CONTRAST

LIGHTING


CHECKOUT
LOBBY


Exit to
New Museums Site
Fire Exit


Fire exit
Stairs
Lifts
Toilets on L2/L3
Pay point on L3
Level
10
Rose Car Park
shopping riverside guildhall
market nightlife eating theatre


EXIT

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

Year	Reference	virtual	physical
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	✓	
2010	Dalke et al. A colour contrast assessment system: design for people with visual impairment		✓

1 awareness raising simulation tools and systems

2 pass/fail tools and systems

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✓ size

✓ contrast

✓ lighting

1

studies on reduced acuity and contrast

Thompson et al. (2017)	what?	what not?
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	the complexity of the algorythm makes it rather hardly accessible to the general audience

		virtual	physical
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- ✓ size
- ✓ contrast
- ✓ lighting

2

objective measurements of contrast levels

Dalke et al. (2010)	what?	what not?
CROMOCON Light Reflectance Value (LRV) meter	measures colour contrast values to understand the visibility level of objects, texts or building components for an impaired person	partial objective evaluation, **no empathical** experience provided to the person without an impairment

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✓ size

✓ contrast

✓ lighting

1

«**HUMAN OBSERVER**» approach for signage visibility

Arditi (2017)	what?	what not?
Rethinking ADA signage standards for low-vision accessibility	simulates impairment to human observers by adjusting the viewing distance to assess the legibility of signs	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

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

SIZE AND LIGHTING FROM BEHIND

without glasses

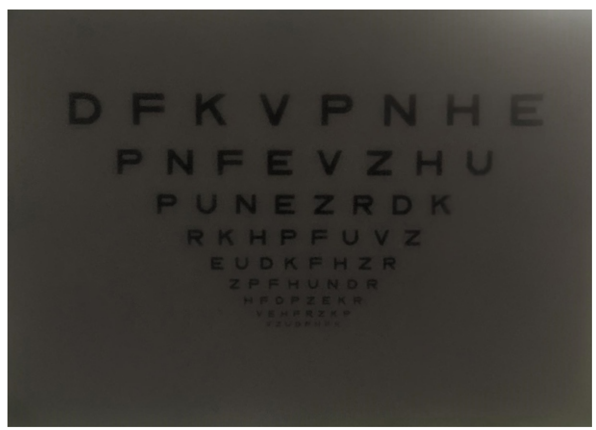
with 2 pairs of glasses

with 4 pairs of glasses

SIZE AND FRONTAL LIGHTING

without glasses

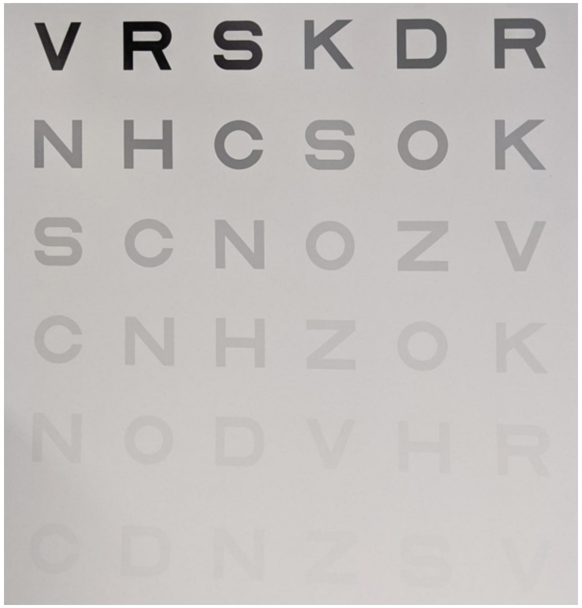
with 2 pairs of glasses



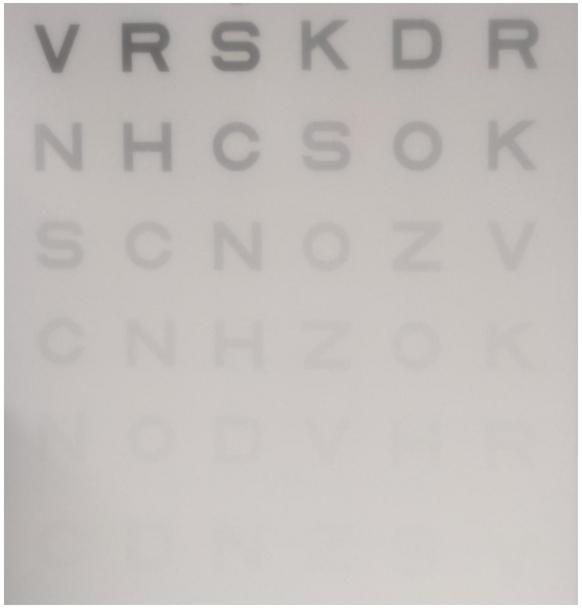
with 4 pairs of glasses

CONTRAST SENSITIVITY

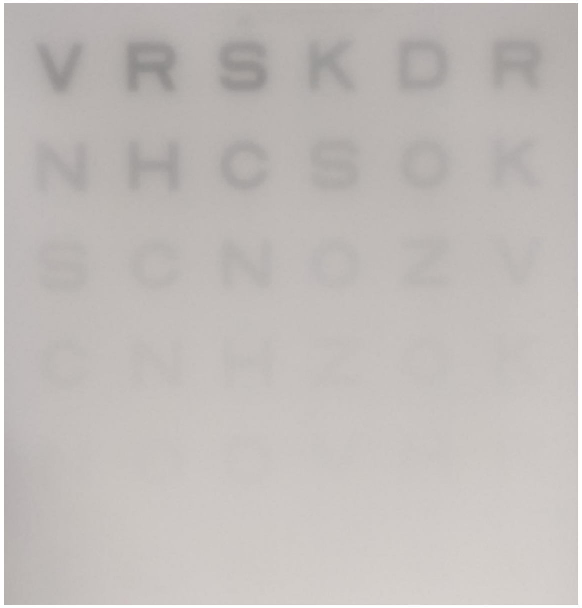
without glasses



with 2 pairs of glasses



with 4 pairs of glasses

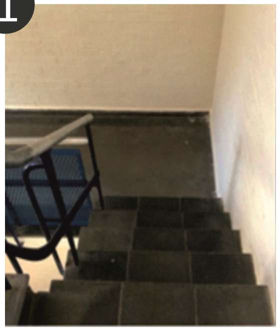


Exploration of a PUBLICLY ACCESSIBLE EDUCATIONAL BUILDING while wearing 3 or 4 pairs of the Cambridge simulation glasses: features that remain visible with 4 pairs of simulation glasses worn simultaneously should mean that the exclusion due to visual acuity issues is less than 1%.

stairs with/without edging strips

contrast sensitivity

1



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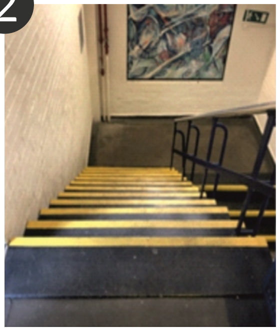
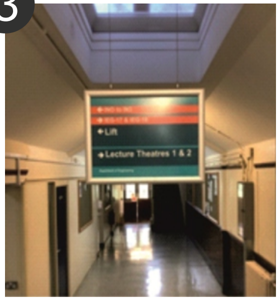


signage/information desk text

size and light directionality/contrast sensitivity

3



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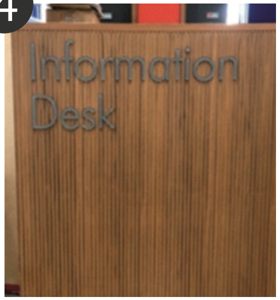
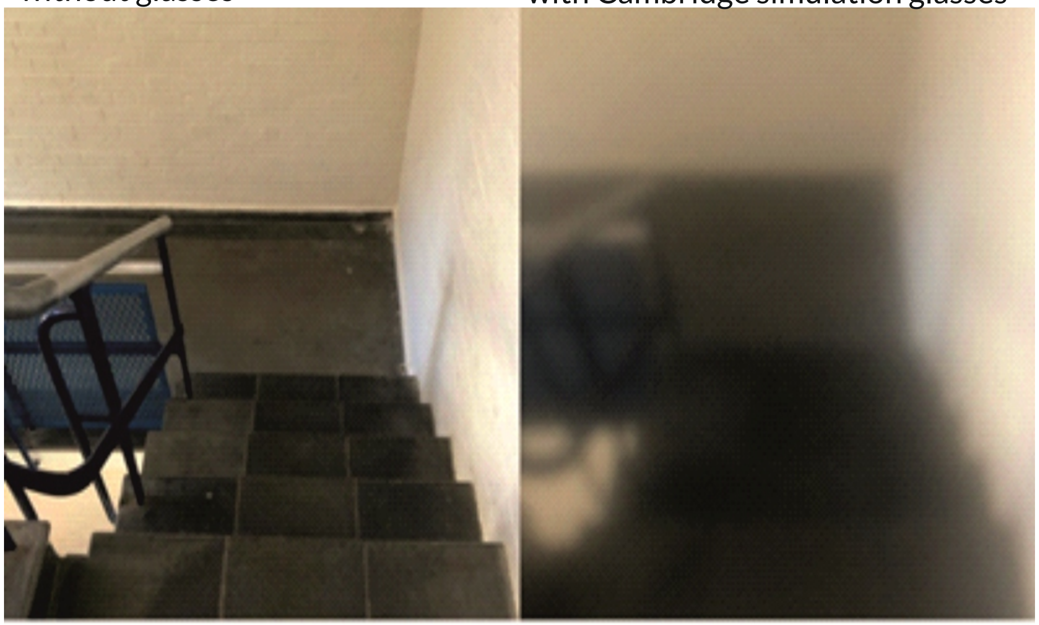


1 STEPS WITHOUT EDGING STRIPS

without glasses | with Cambridge simulation glasses



Luminance: 141 lx Distance: 150 cm Focal lenght: 4 mm Exposure time: 1/15

- without glasses, no particular issues were recorded
- when wearing the glasses, the edges of the steps completely dissapear
- the steps felt «unnerving»
- «considerable concentration to place the feet on each step»

❷ STEPS WITH EDGING STRIPS

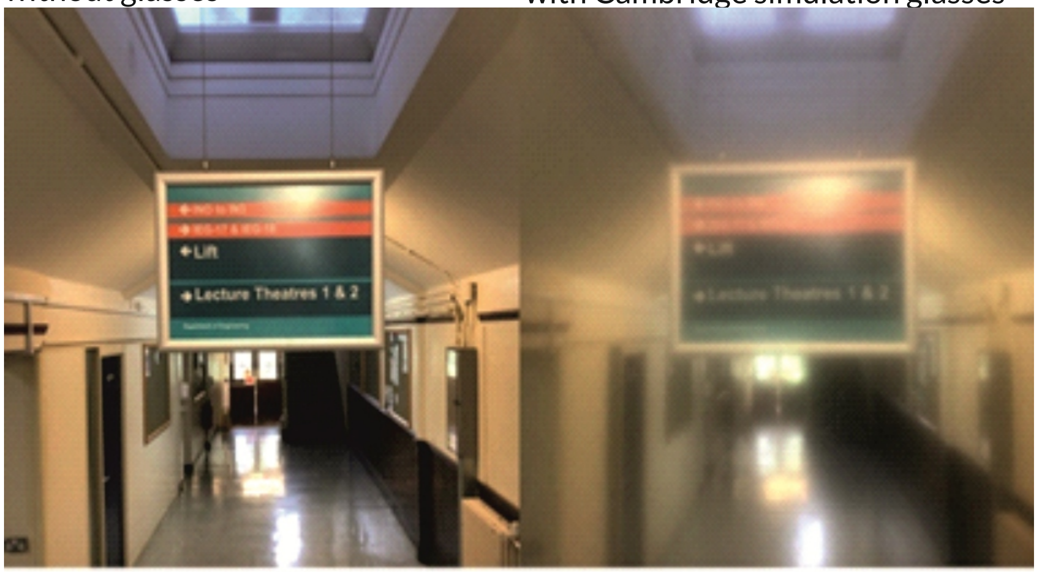
without glasses | with Cambridge simulation glasses

- 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»

❸ SIGNAGE

without glasses

with Cambridge simulation glasses



Luminance: 131 lx Distance: 150 cm Focal lenght: 4 mm Exposure time: 1/17

- 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

❹ INFORMATION DESK TEXT

without glasses

with Cambridge simulation glasses

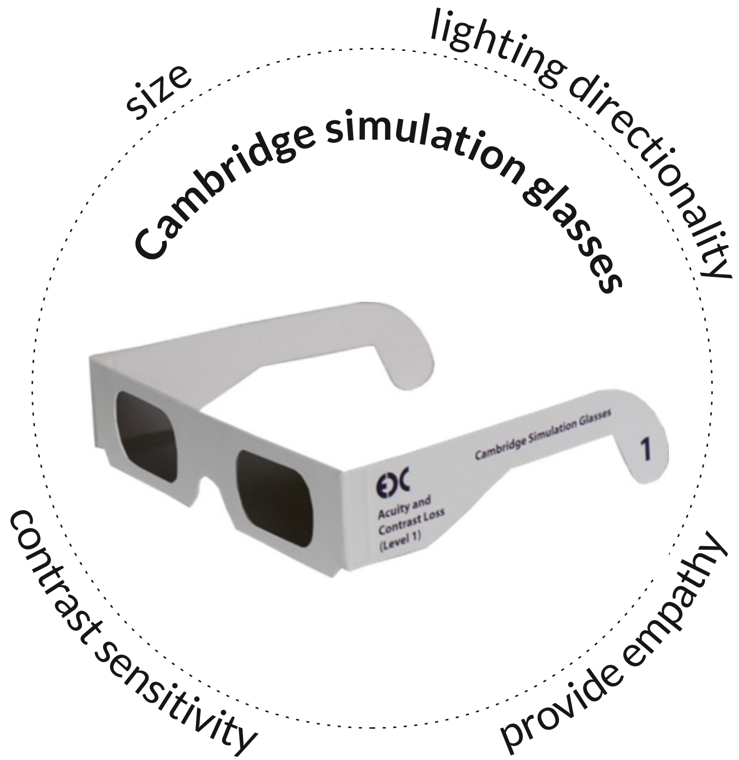
- without glasses, the researchers were able to easily read the text
- when wearing the glasses, the text becomes difficult to read because of the lack of contrast with the background

VISUAL ACCESSIBILITY ASSESSMENT

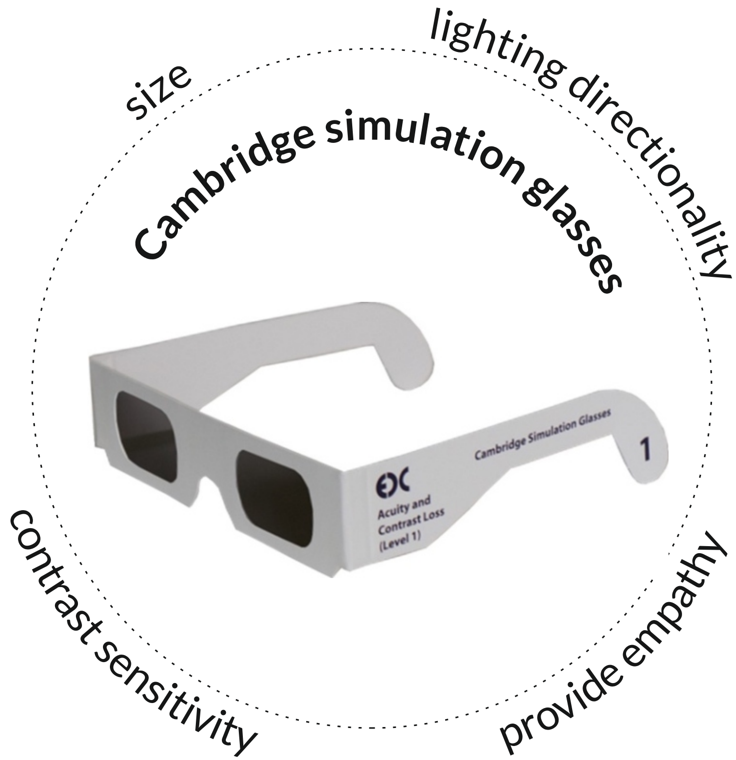
subjective experience	trained subjective experience	impaired subjective experience	heuristic guidelines
personal beliefs and taste (e.g. interior designer, non-expert user)	informed through training (e.g. access consultant)	persons with a particular level of impairment (e.g. user with VA 6/18)	following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

+

simulated empathic subjective experience	shared empathic experience
assessor with simulated visual impairment (e.g. wearing the Cambridge simulation glasses)	assessor with simulated visual impairment + person with visual impairment



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



- 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