Assessing the Effect of Shade Materials on View Clarity

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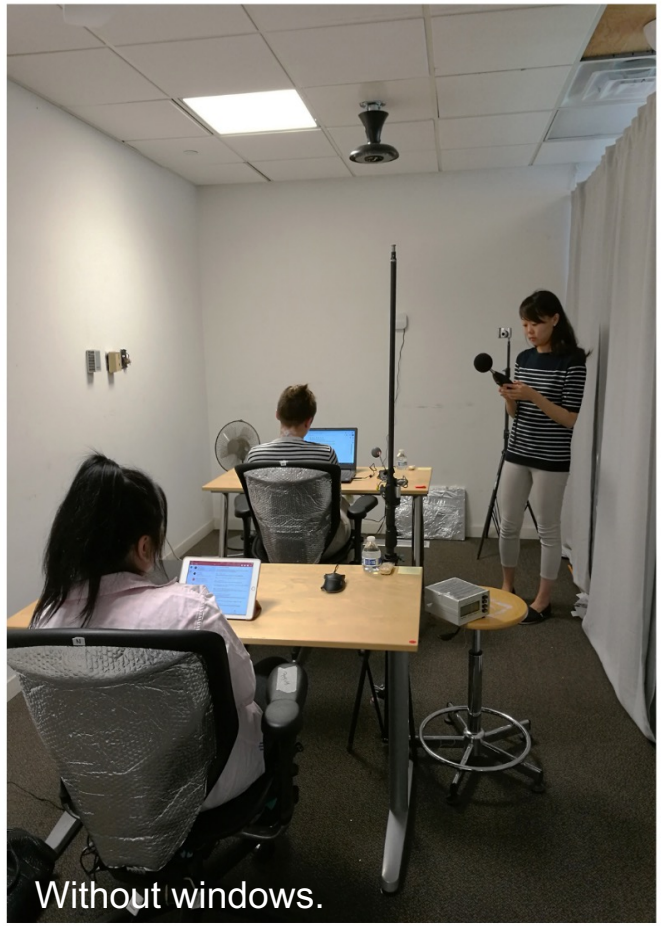
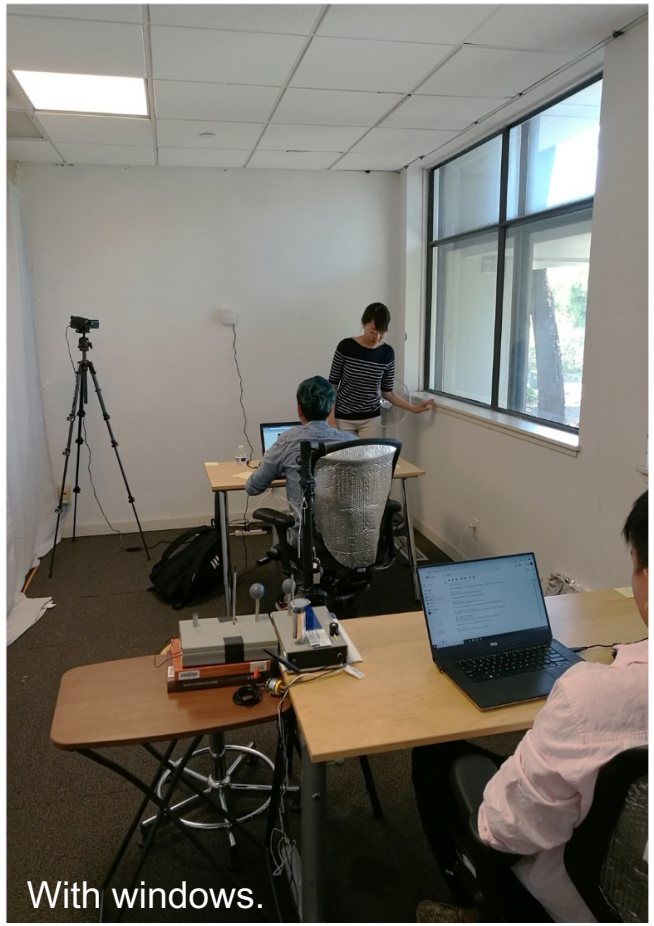
Why view?

Impact of a window view in a workplace setting: Our significant findings

86 participants at the climatic chamber, UC Berkeley





Ko, et al. (2020) *Building and Environment*

In slightly warm conditions, with windows, test subjects:

Felt cooler

- 1.33 °F lower thermal sensation
- 8% in cooling energy reduction for a building in SF

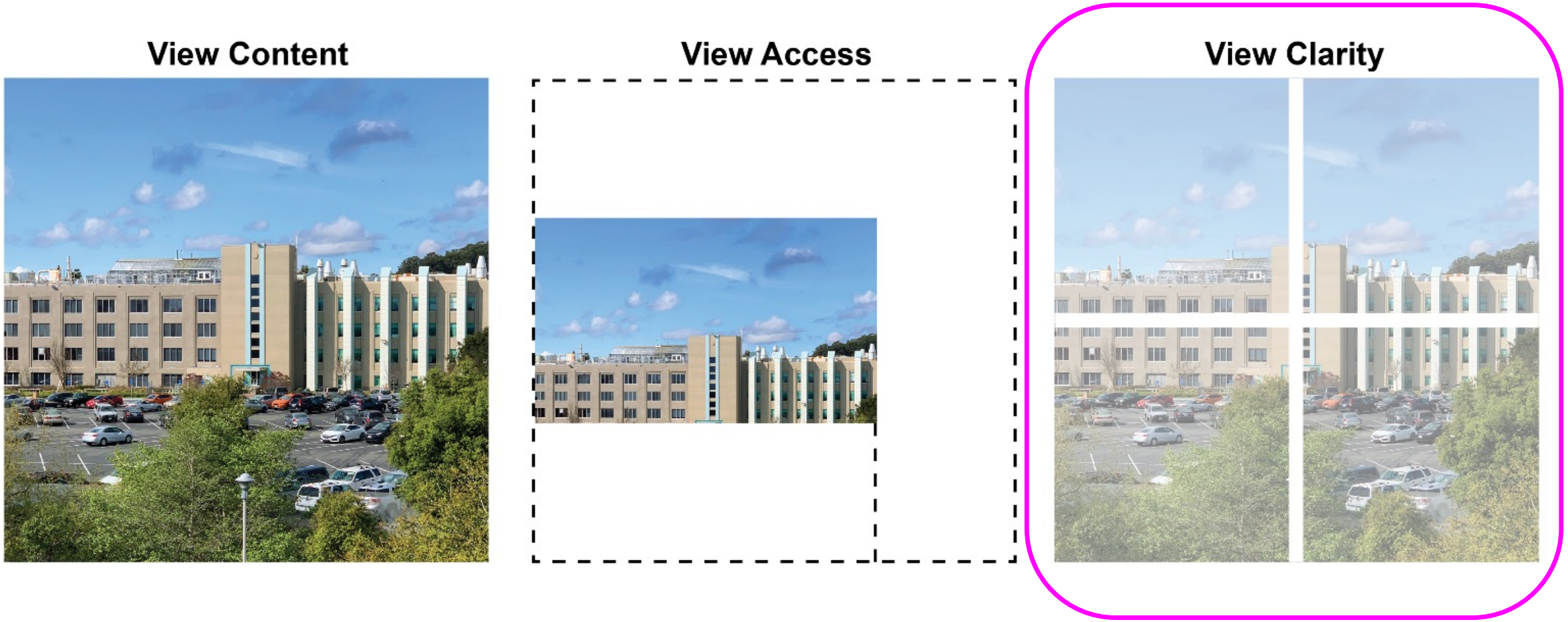
Felt happier

- Increase in positive emotions
- Decrease in negative emotions

More focused

- 6% better working memory
- 5% better concentration

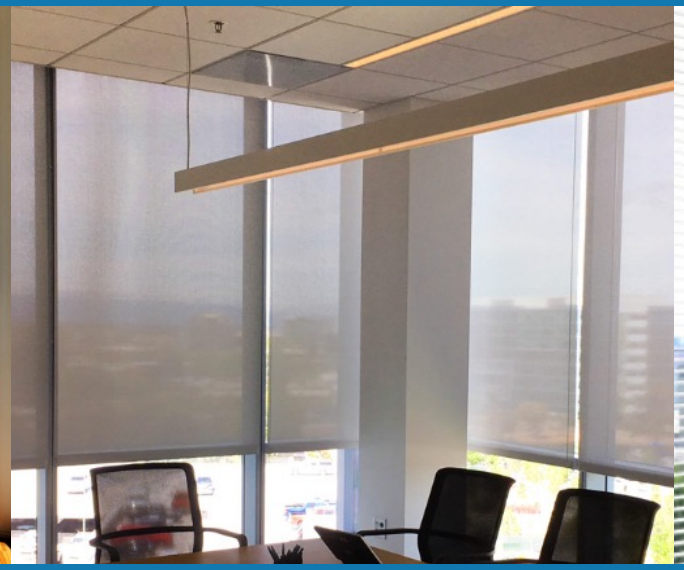
Window view quality assessment: Primary variables



Ko, WH, et al. (2021) *LEUKOS - Journal of Illuminating Engineering Society of North America*

How can we evaluate the **view clarity** of different window and shading systems?






Key variables

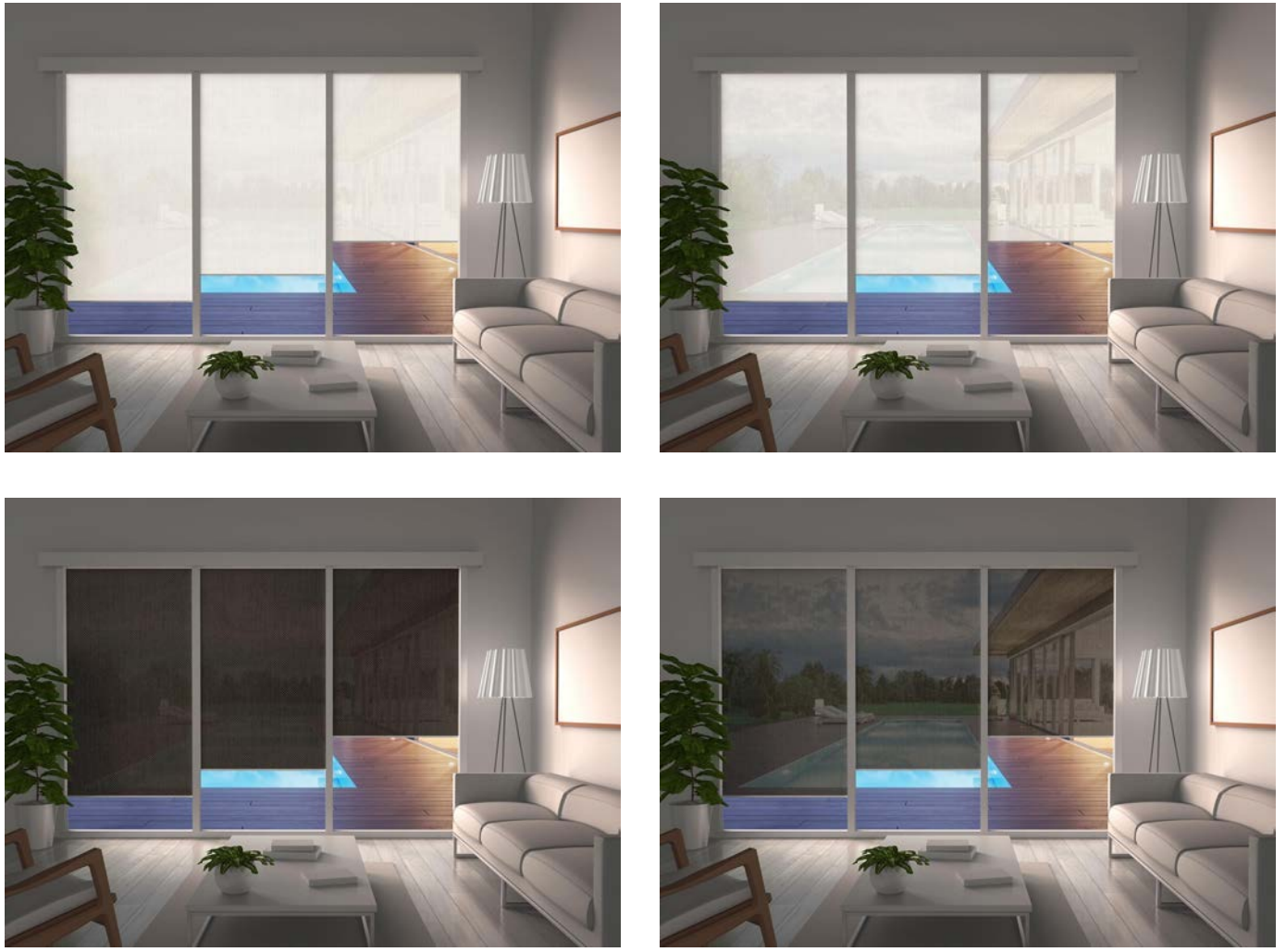
Visual Light Transmittance

- Percentage of visible light striking the glazing or shading system that will pass through to the inside

Openness Factor

- “Open” or “see-through” percentage of the fabric shade

Color



Images from Texstyle Visualizer Tool

Overview

Objective

- Develop an assessment workflow of the effect of different type of shade materials on view clarity

Approach

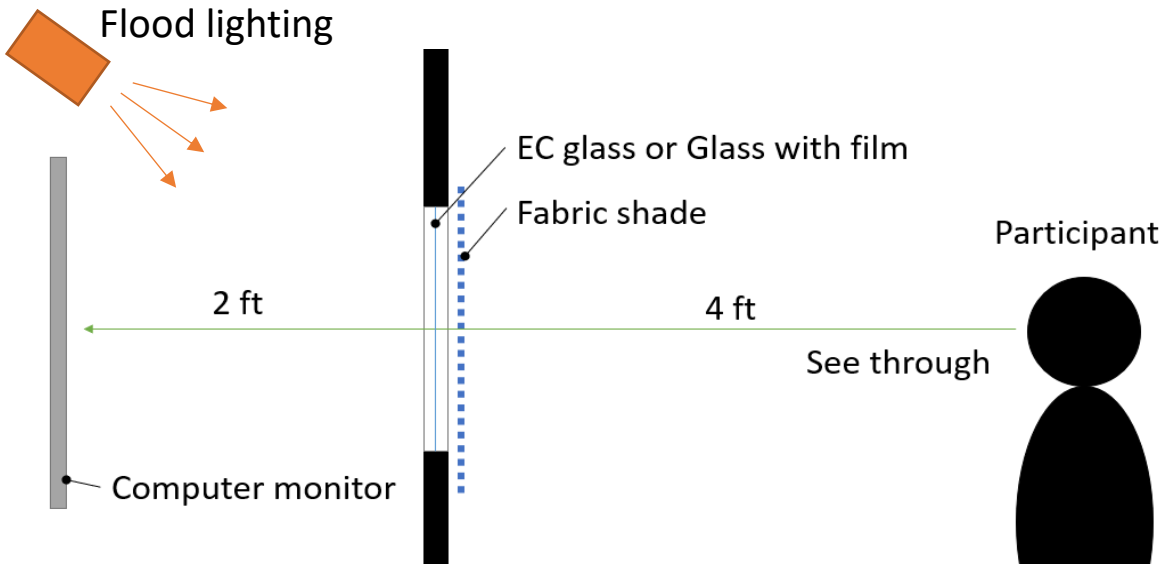
- Human-factors experiment using a physical lab space with an internal window and a screen
  - Changing:
    - Shade materials
    - View images
  - Measuring:
    - Human visual performance
    - Subjective perception on view

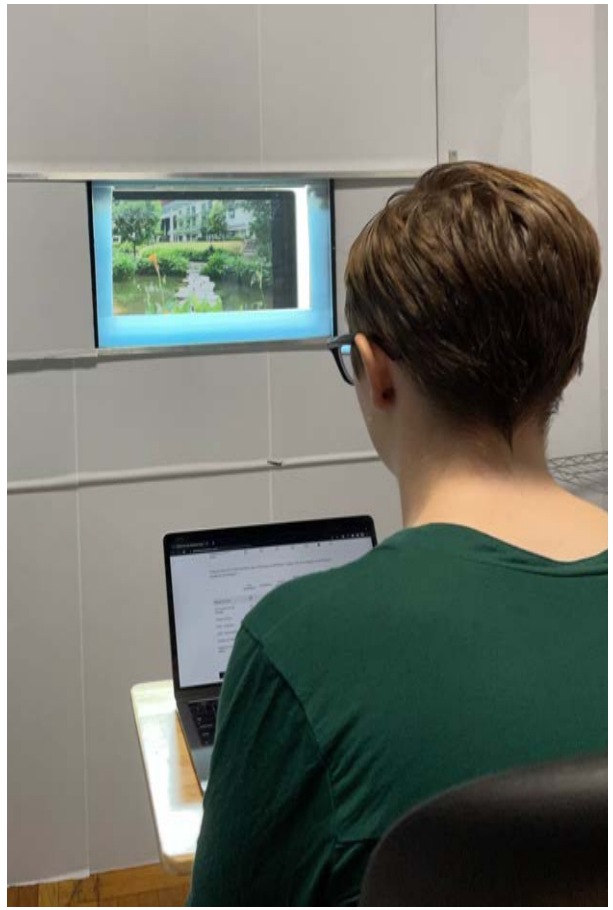
Funding

- View

Experimental design

- 50 participants
- 3-hour controlled lab experimental session
- Vision tests prior to the main session
- 12 window materials in random order





Testing materials

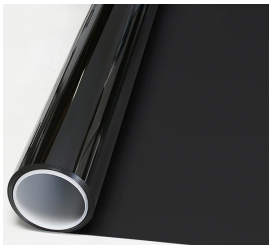
No Glass

Base

Clear Glass

Clear

VLT: 3.2%



VLT: 5%

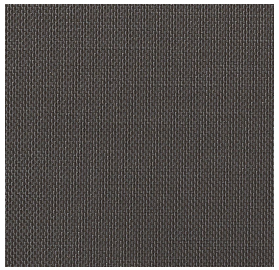
Film Tint + Glass

EC Tint 2
VLT: 31%

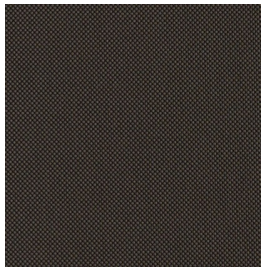
EC Tint 3
VLT: 6%

EC Tint 4
VLT: 1%

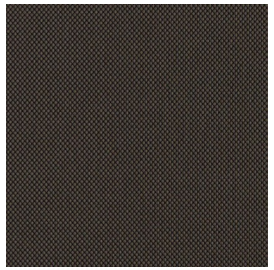
Electrochromic Glass



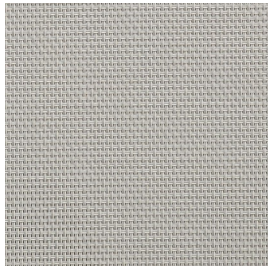
Dark Brown OF-5
VLT: 3.2%



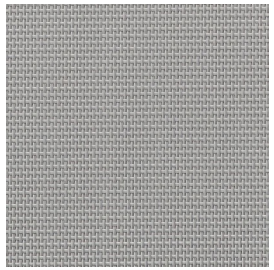
Black/Brown OF-3
VLT: 1.1%



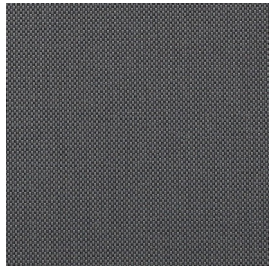
Black/Brown OF-5
VLT: 2.2%



Light Grey OF-10
VLT: 5.9%



Medium Grey OF-5
VLT: 2.7%

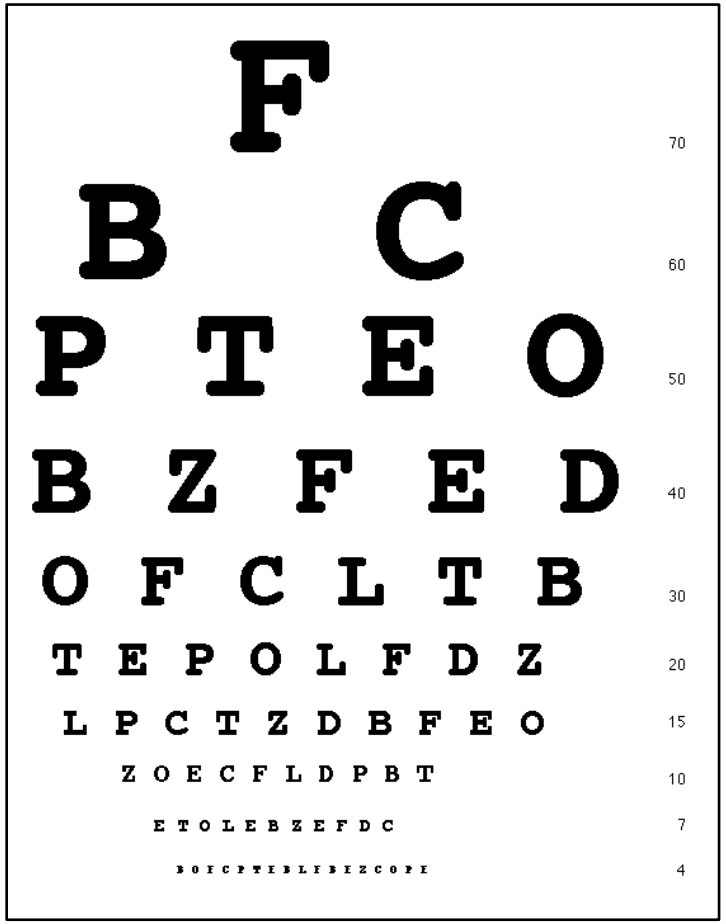


Dark Grey OF-1
VLT: 0.5%

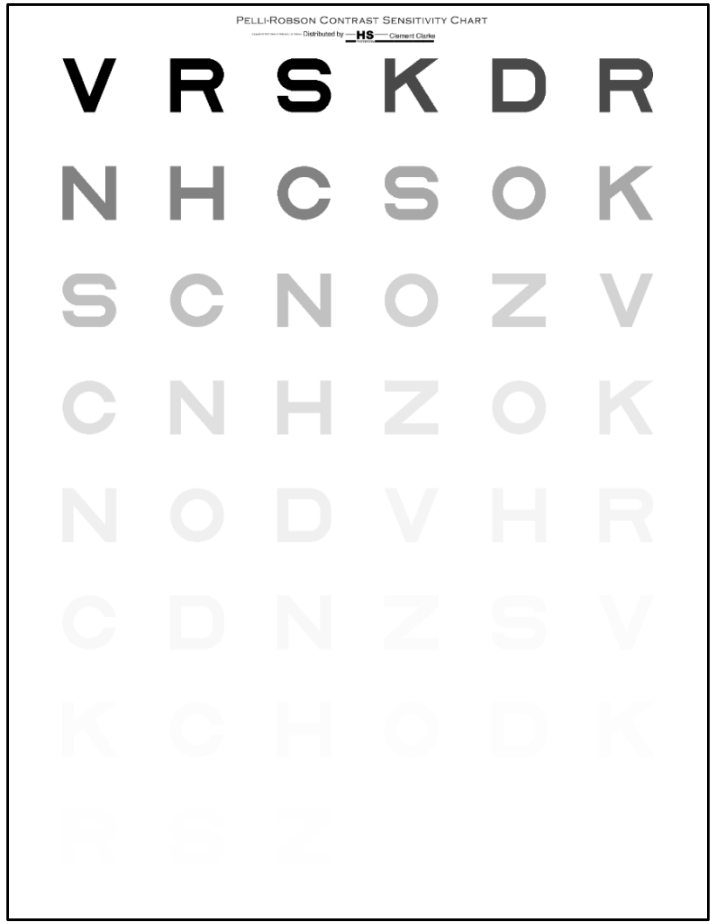
Fabric Shade + Glass

Measures: Visual acuity, contrast sensitivity and color sensitivity tests

Visual acuity

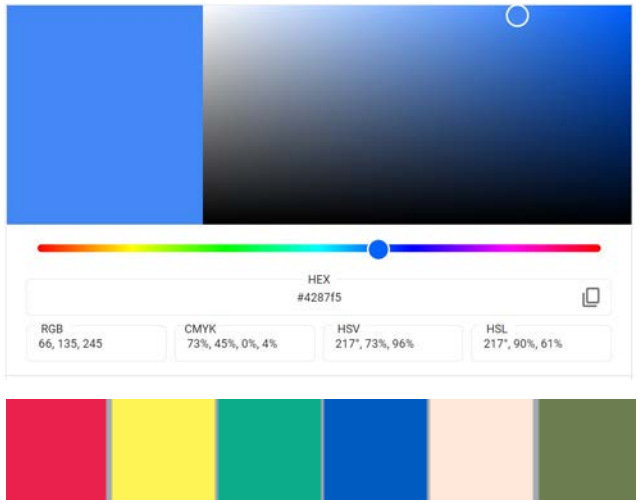


Contrast sensitivity

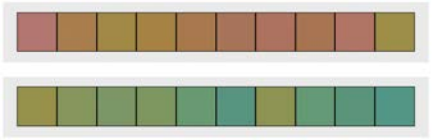


Color sensitivity

1. Test color samples (TCS) 9-14, CIE



2. Color arrangement test, Farnsworth Munsell 100 Hue Test

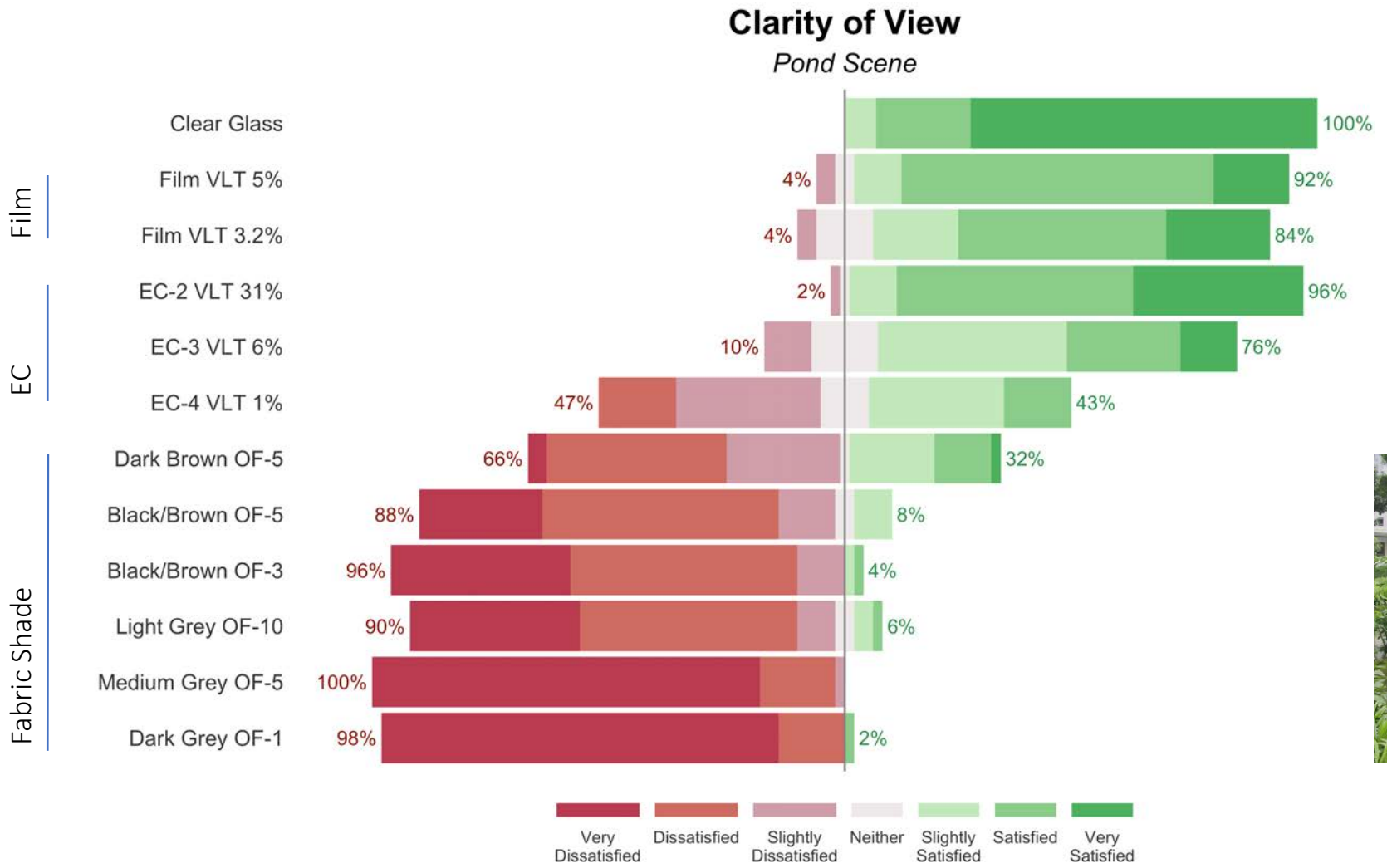


Measures: Subjective perception

Survey Questions

- Participants rated their degree of satisfaction with different aspects of view:
  - Clarity of view, connection to the outside, visual privacy, color vividness, color naturalness, feeling of relaxation, reflections/mirror effect

Measures: Subjective perception



Next steps

Analyze data and write journal article

- Present full results at the April 2023 CBE meeting

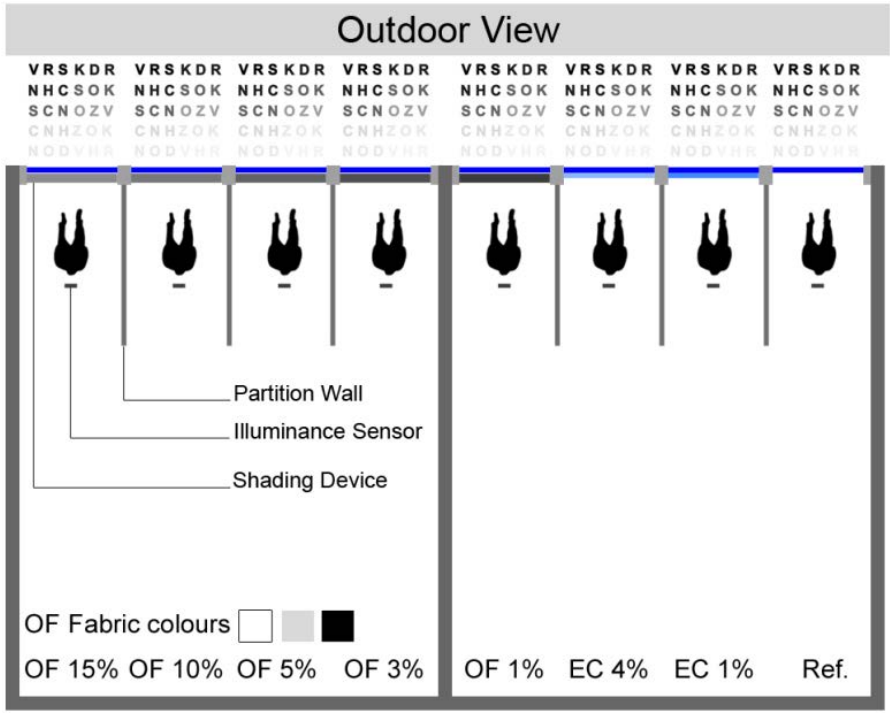
Test more materials to improve the prediction model

- Diverse window materials
  - Non-repeated, irregular patterns

Develop a computer vision model based on HDR images

- Edge detection and other computer vision algorithms

Next steps: View clarity study in daylit space with exterior view



Rotatable test room in Singapore

15 fabric roller blind

- 5 openness factors
- 3 fabric colours

Two electrochromic glazing panes

Impact

Q&A

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