View Clarity towards Visual Satisfaction

Iason Konstantzos, Ph.D.

Assistant Professor

University of Nebraska - Lincoln

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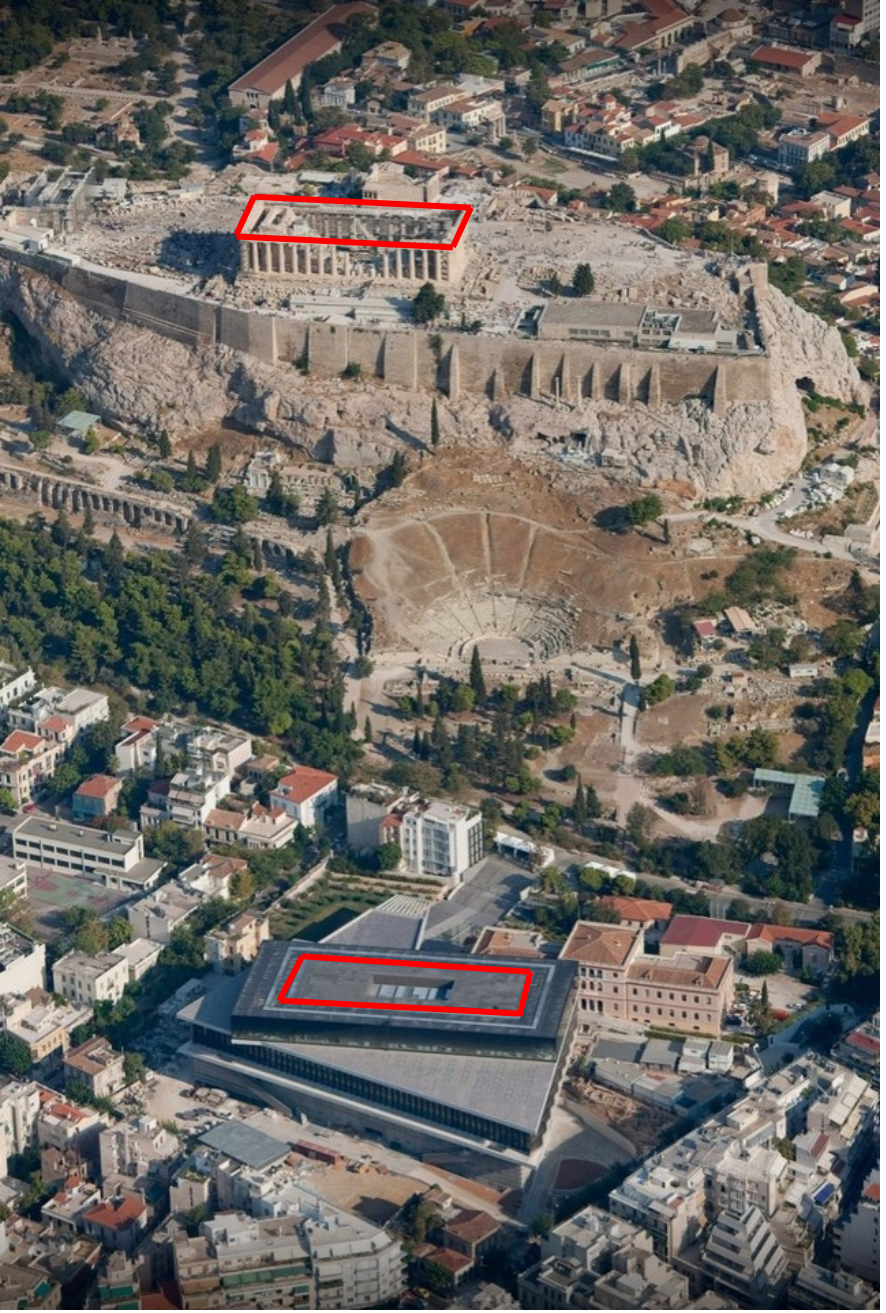
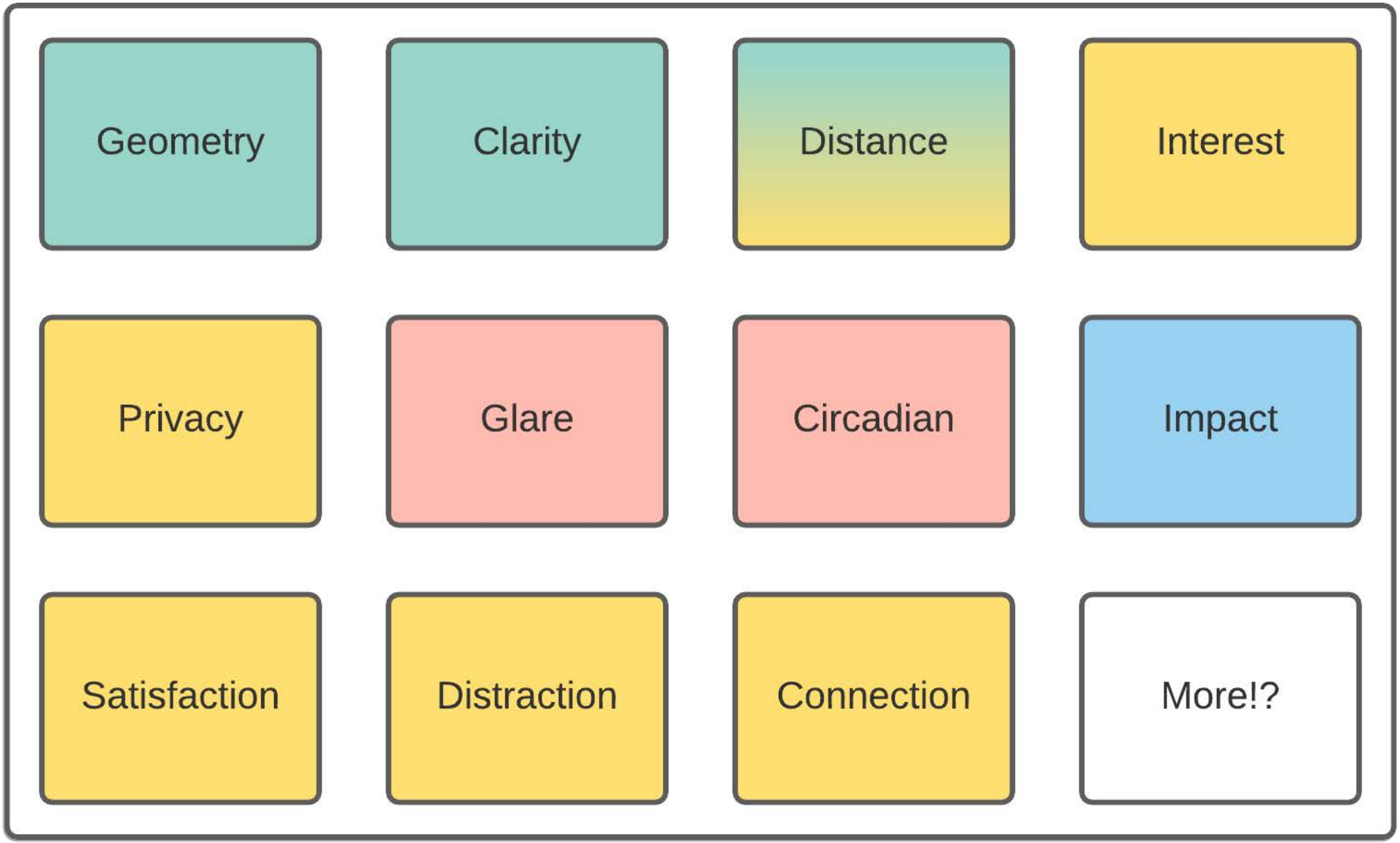
Presentation Outline

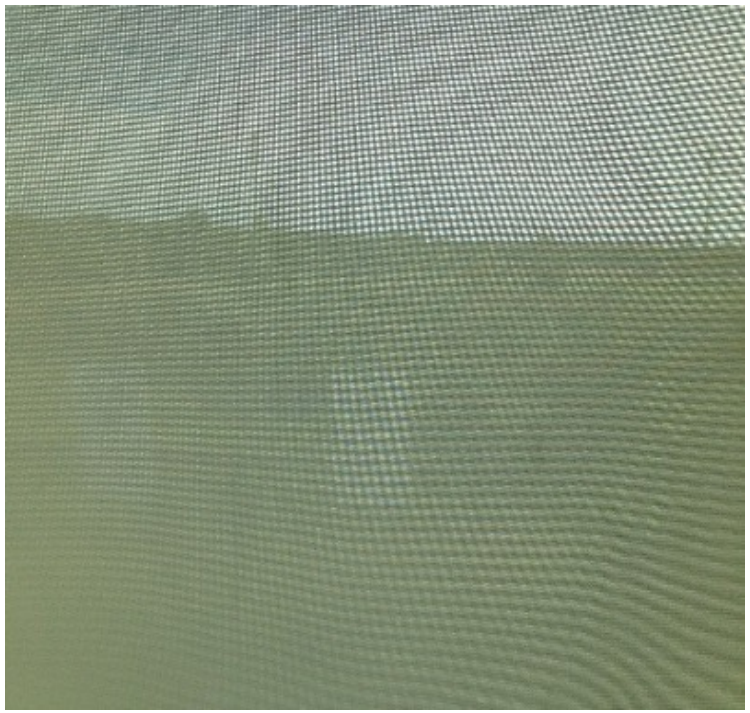
1. Introduction
2. Implications and challenges
3. View Clarity and roller shades
4. Experimental Overview
5. How do we define view clarity?
6. Results - View Clarity Index (VCI) - Takeaways
7. Ongoing projects on other aspects of view



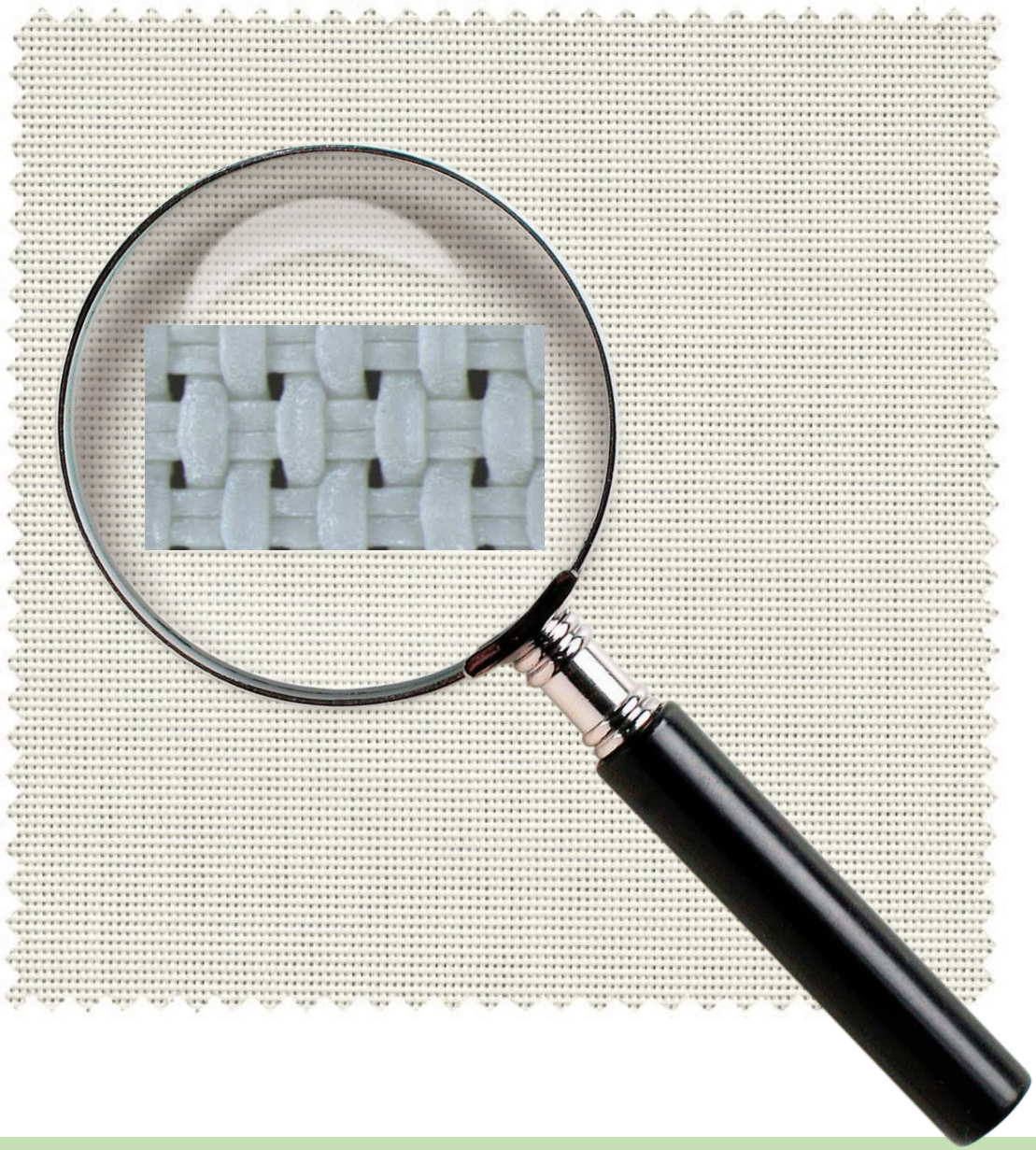
Acropolis Museum
Athens, Greece


Geometry
Clarity
Distance
Interest
Privacy
Glare
Circadian
Impact
Satisfaction
Distraction
Connection
More!?

Why do we care about clarity?



… but first a few things about roller shades



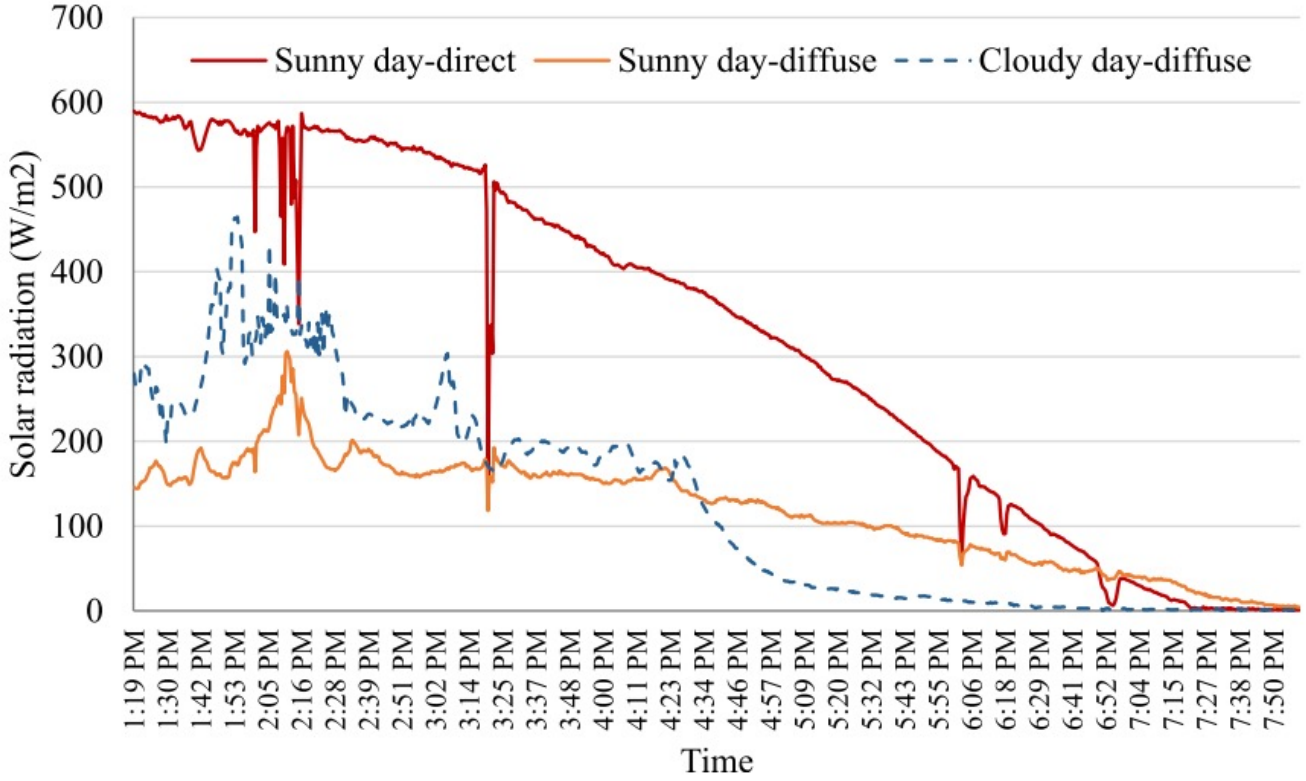
Openness factor (OF):

- Expresses the ***weave density***
- Associated with ***direct light transmission***
- Necessary for *view*

Visible transmittance (Tv):

- Expresses the ***total light transmission*** through the fabric
- Associated with fabric ***color***

Impact of fabric properties on the connection to the outside



Objective: Assessment of visual clarity through windows with roller shades

Methodology:

- 18 subjects - 14 fabrics
- Properties covering commonly used ***range***
- ***Near*** vs ***Far*** distance from the window (1m vs 2.4m)
- ***Sunny*** vs ***Cloudy*** exterior
- No sun in the FOV

Defining Clarity

- General subjective clarity perception (introductory)
- Perception of colors (vividness and distinction ability)
- Objective visual acuity question
- Distinction ability for specified areas/objects/targets
- General impressions questions (not used in the grading)

Fabric Code _____

1. How clear is your outside view through the window and shade?

Not clear at all ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very clear

2. Can you tell the sky conditions outside by what you can see (sunny/cloudy/extends of clouds)?

Not clear at all ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very clear

3. How would you grade the vividness of the outside colors?

Not vivid at all ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very vivid

4. Which outside objects can you distinguish from the following: Fence, Street, Power cables? Please circle all that apply:

None Fence Street Power cables

5. Can you clearly distinguish the color of moving cars on the street?

Yes No

6. Observe the target outside the window, and count how many O symbols you can clearly distinguish for each line:

1st line_____ 2nd line_____ 3rd line_____ 4th line_____ 5th line_____

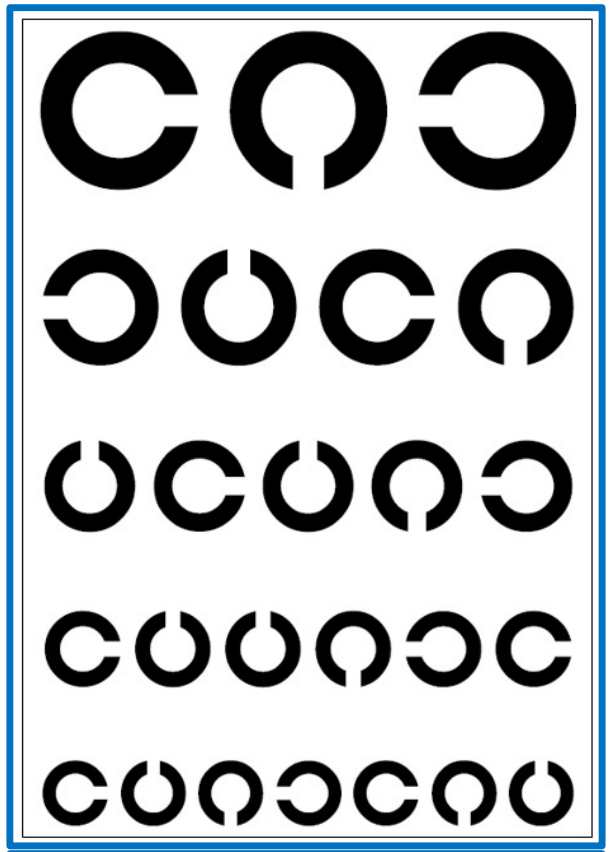
7. Are you satisfied with the visual comfort conditions (glare, reflections, etc)?

Not at all ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very much

8. How would you comment about this fabric? (Circle all that apply):

Too bright Too dark Good color

Too open Too opaque Good openness/transparency

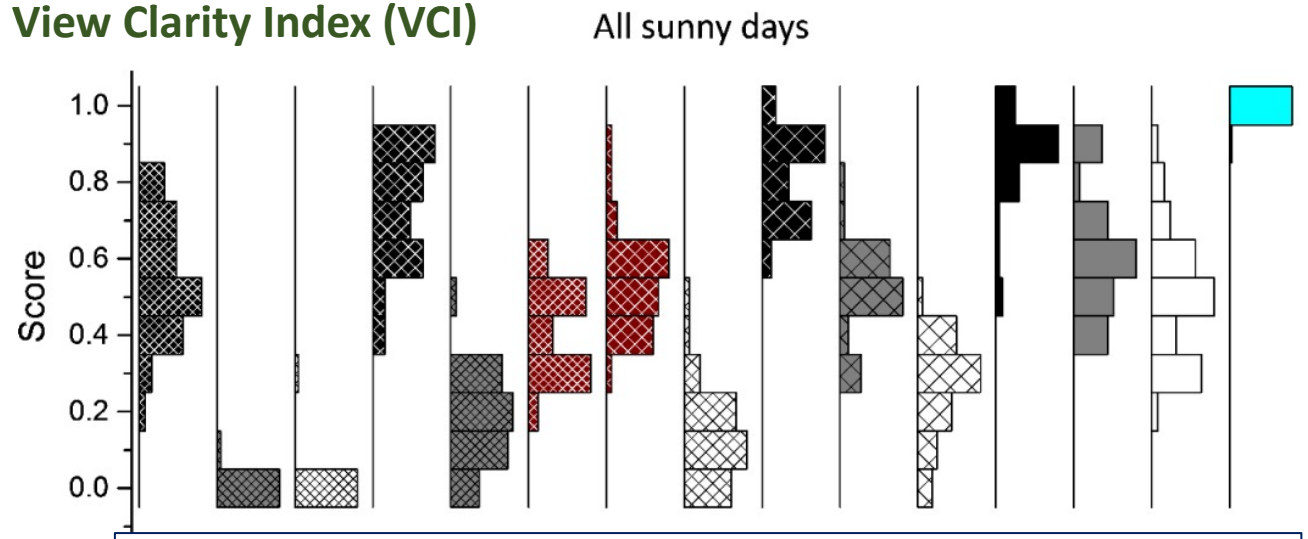


Ranking of fabrics – impact of shade properties

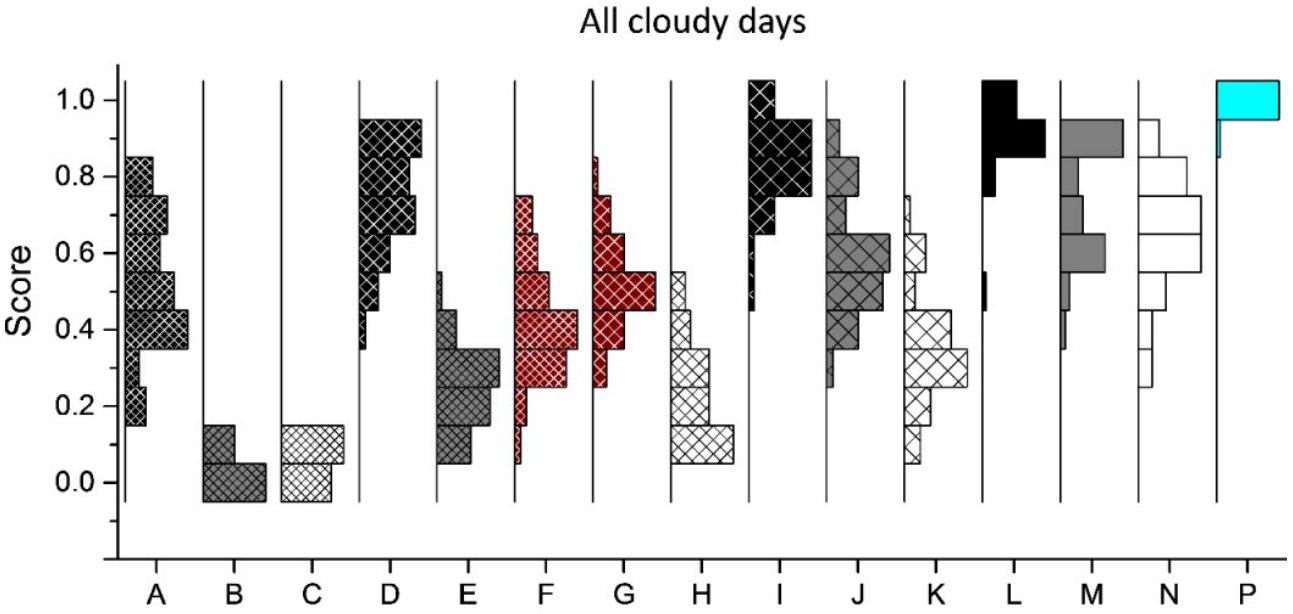
Rank	Fabric code	Fabric Color	Measured *OF*	Measured T_v	Normalized view clarity score
1	L	Black	11.3%	12%	0.893
2	I	Black	7.0%	7.3%	0.817
3	D	Black	3.7%	4.1%	0.730
4	M	Grey	12.6%	19.9%	0.682
5	N	White	12.5%	25.1%	0.585
6	J	Grey	6.7%	13.0%	0.560
7	G	Brown	3.9%	5.9%	0.531
8	A	Black	2.6%	2.8%	0.527
9	F	Brown	3.0%	4.5%	0.420
10	K	White	5.9%	18.2%	0.298
11	E	Grey	2.3%	6.6%	0.212
12	H	White	3.9%	15.9%	0.187
13	C	White	1.6%	13.7%	0.026
14	B	Grey	0.7%	6.4%	0.013
	P	N/A	N/A	N/A	1

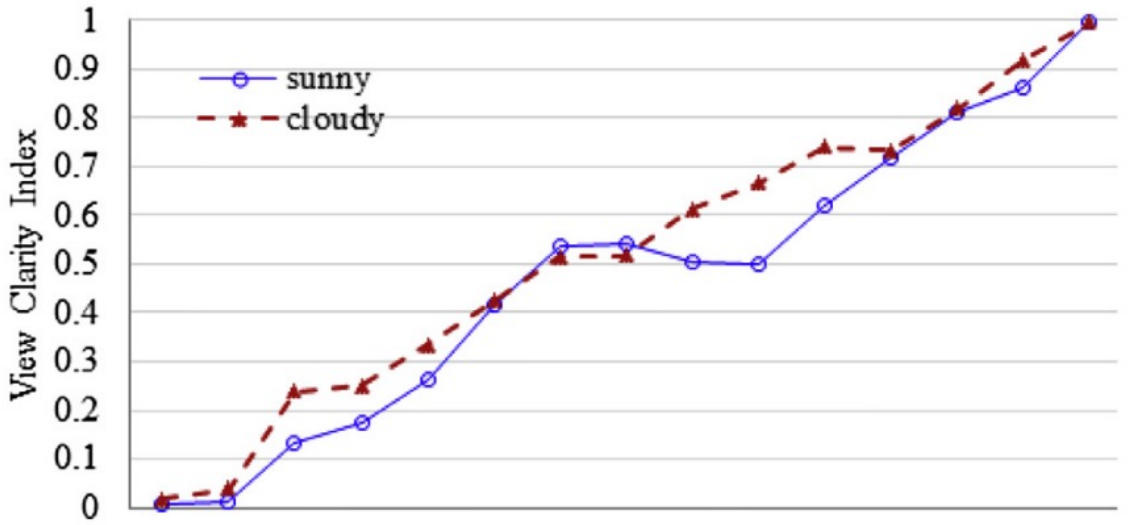
- ***Black*** fabrics tend to rank the highest
- Importance of ***Openness Factor*** (OF)
- ***Complex Interaction*** between Tv and OF
- **Randomness**, but with some ***structure***!

View Clarity Index (VCI)

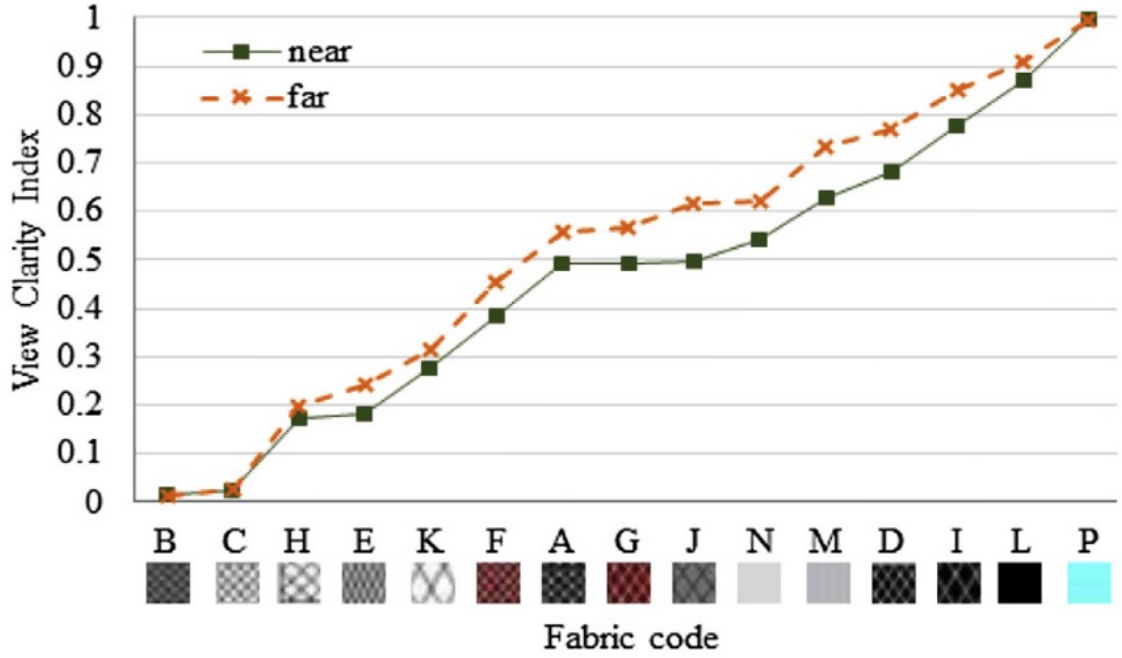


- ***Density** of bars reflects openness factor (OF)*
- ***Colors** of bar reflect fabric colors (Tv)*



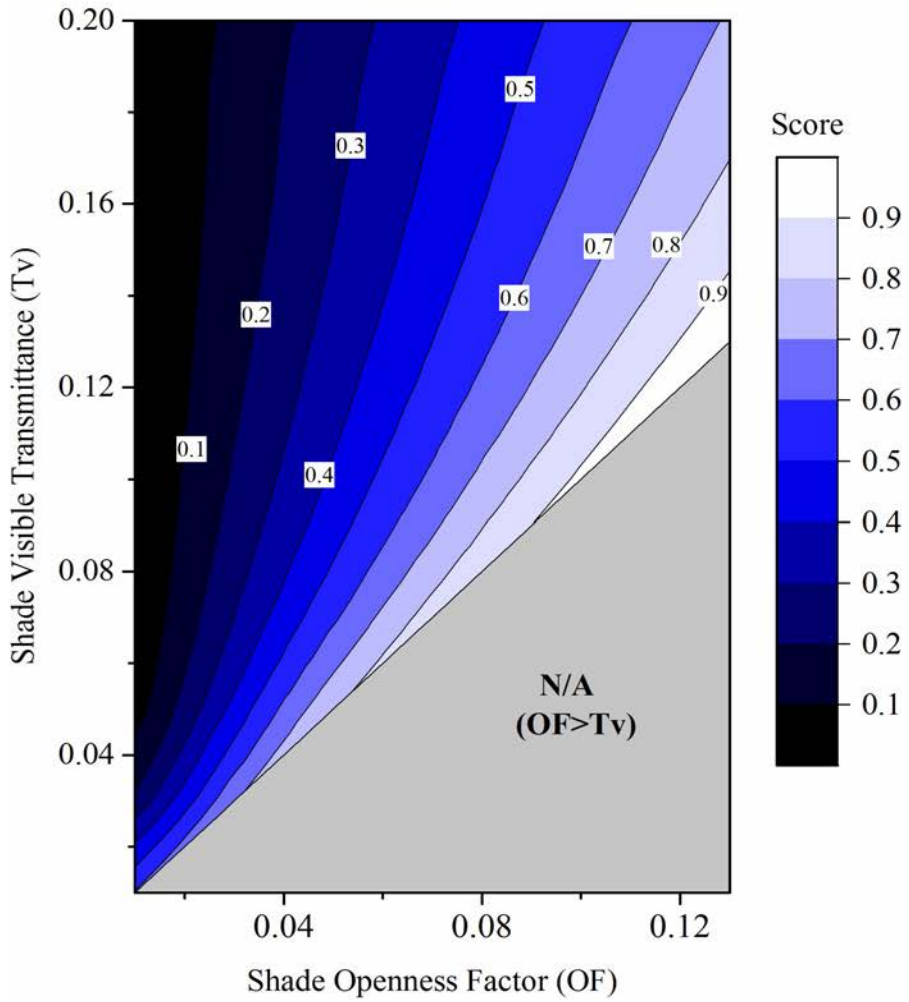


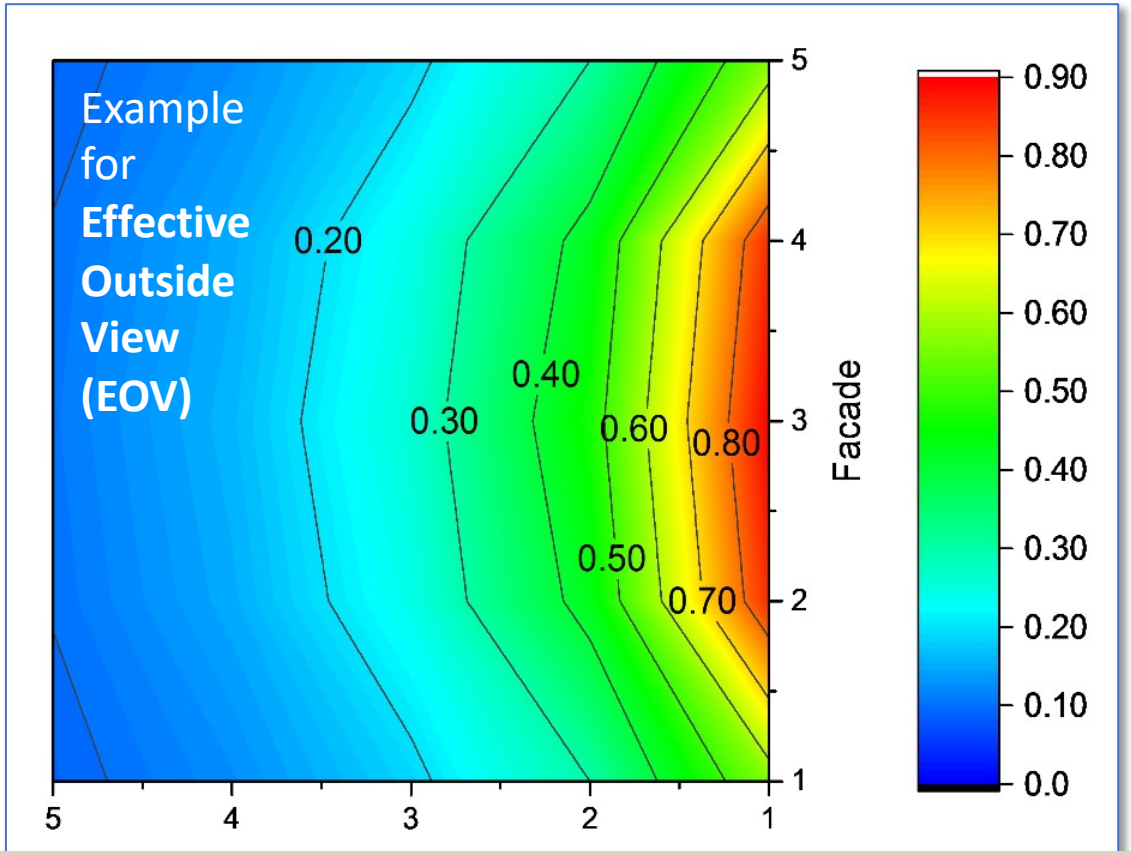
- ***Distance** and weather were indeed significant*
- ***Their interaction was not!***



Takeaways – applications

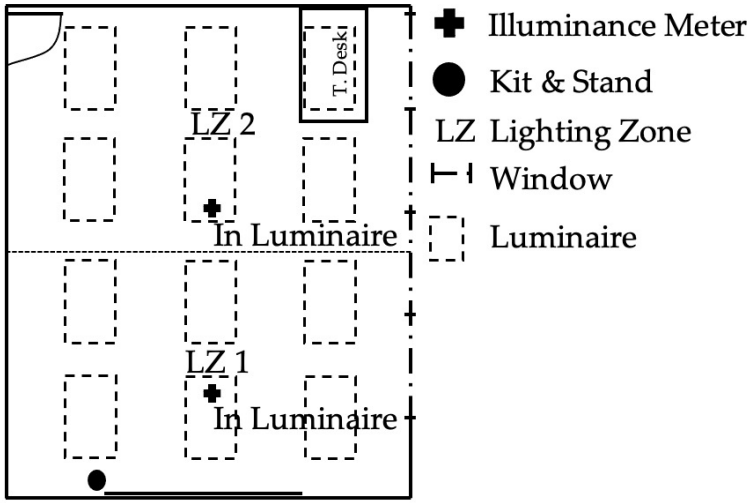
- First available metric to ***predict clarity in design***
- Can be used as ***Correction factor*** for current or future quantifications of 'amount of view'
- Can be applied towards ***Spatial*** consideration for open layouts
- ***Holistic*** evaluation (design, controls, layout)





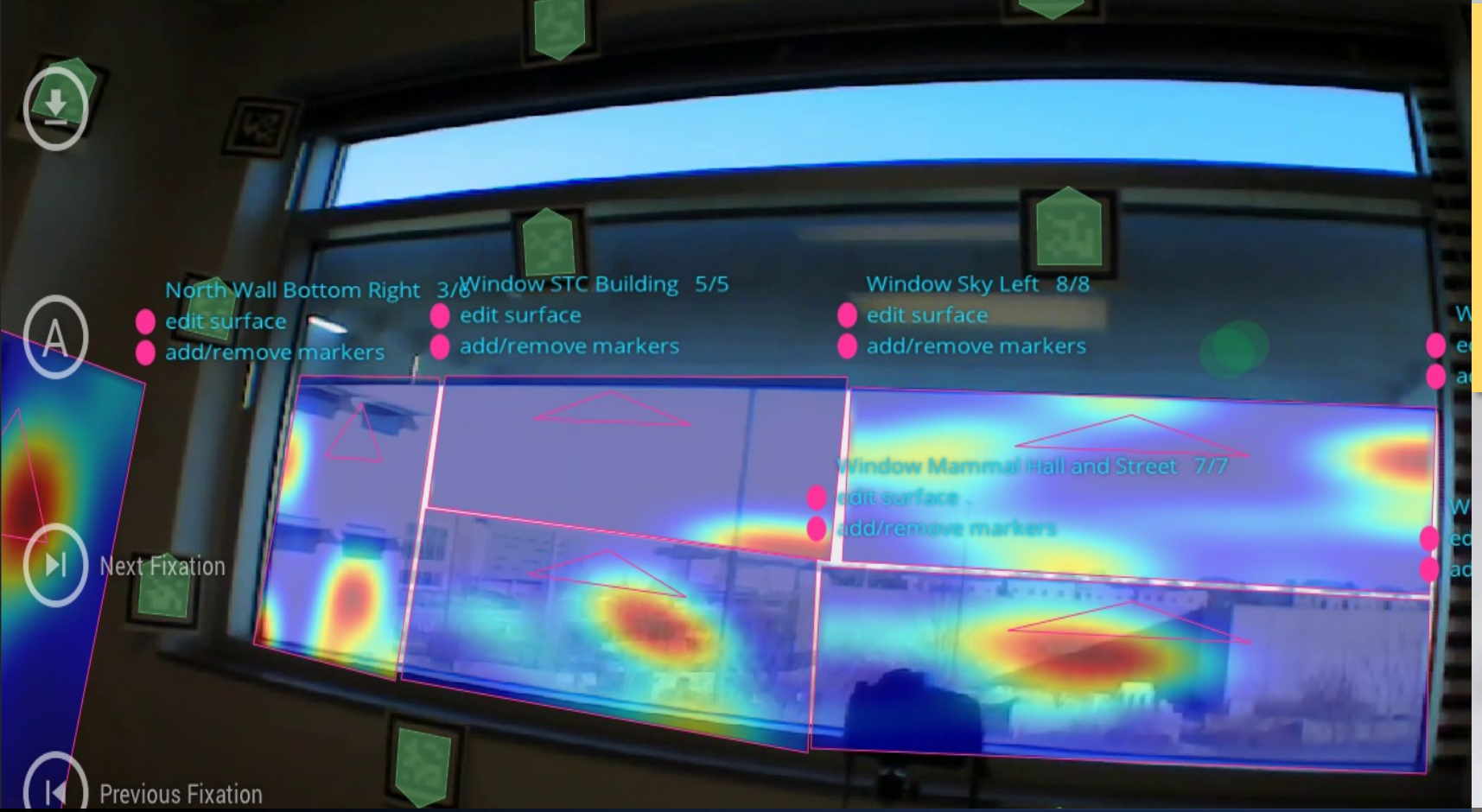
View Clarity Index (VCI)

$$VCI = 1.43 \cdot (OF)^{0.48} + 0.64 \cdot \left(\frac{OF}{T_v}\right)^{1.1} - 0.22$$



- Field Measurements in ***220 K-12 classrooms***
- Analysis of '***View Out***' practices of EN 17037
- Positive effect of ***number of view layers***
- Importance of ***socioeconomical*** variables
- Insight for future ***design decisions***

School Environmental Effects on Student Achievement



- ***How*** do we use our environment?
- ***Heatmaps*** in the space
- ***Sequences*** of window gaze
- Prediction of ***gaze behavior***
- Address ***limitations*** of glare metrics
- More…?

Investigation of Human Gaze Behavior in Office Settings

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- Dr. Brent Protzman

Some references

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Thank you!


CHARLES W. DURHAM SCHOOL
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