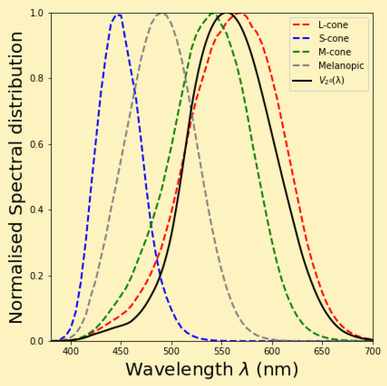
DOES THE COLOR OF GLAZING INFLUENCES OUR PERCEPTION OF GLARE FROM DAYLIGHT?

Sneha Jain, Jan Wienold, Marilyne Andersen
Laboratory of Integrated Performance in Design (LIPID), EPFL, Lausanne, Switzerland

INTRODUCTION

Window glazing properties such as **color and transmittance** play a key role in defining the quality and quantity of the daylight. With the current trend of **colored glazing** such as the EC glazing, colored PV panels, and dye-sensitized solar cells, it is essential to know **the effect of altered spectrum** of daylight on the **glare perception**.

We determine the **effect of color** of transmitted daylight of **similar luminance** on human perception of glare. Since luminance is mediated by achromatic visual channels and don't consider color information. We question the applicability of luminance under **non-neutral lighting** conditions.



RESEARCH QUESTIONS

- Does the spectrum of transmitted daylight through colored glazing influences our perception of discomfort glare?
- Whether the luminance (as characterized by V(λ)) is a good measure of quantifying glare under colored light sources?

DESIGN OF EXPERIMENT

We tested four glazing colors within each participant: red, green, blue and color-neutral and two levels of glazing transmittance (3% and 0.3%) between the participants.

	Glazing Colors	Sample
Transmittance level 1		25
Transmittance level 2		25

METHODOLOGY

X 50 Participants
were recruited to take part in the experiments. Each person was exposed to four scenes with the sun behind the glazing of same intensity but different color for two hours in the morning.

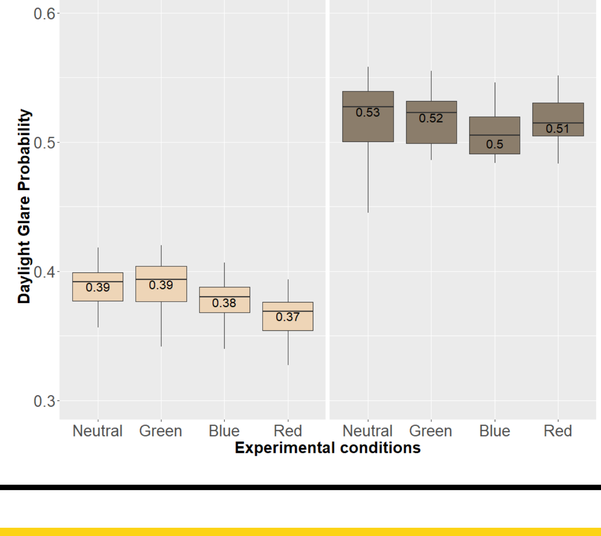
Measurements
of the indoor environmental parameters were done during the experiment using a luminance camera:. total light levels on the eye, intensity and spectrum of the transmitted sun disc

Survey Questionnaires
After exposure to each of the four experimental scenes participants reported their level of visual comfort, discomfort glare and color perception through an online questionnaire.

Statistical analysis
Measurements and Subjective data were analyzed and compared amongst the four test scenes to determine the effect of color on the perception of discomfort glare.

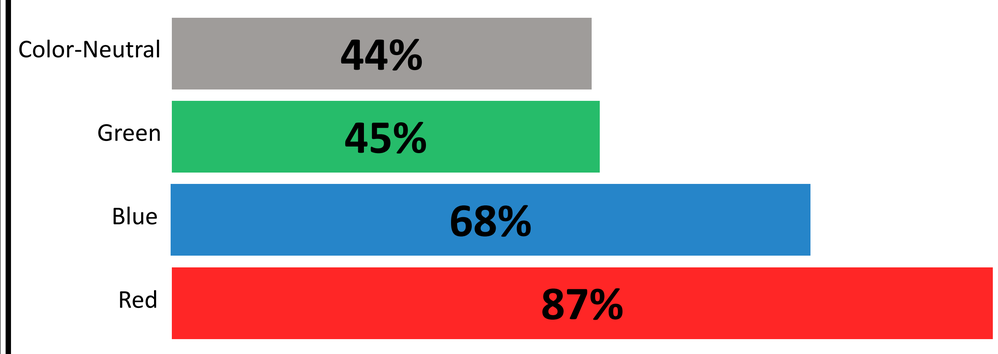
RESULTS

Sun luminance

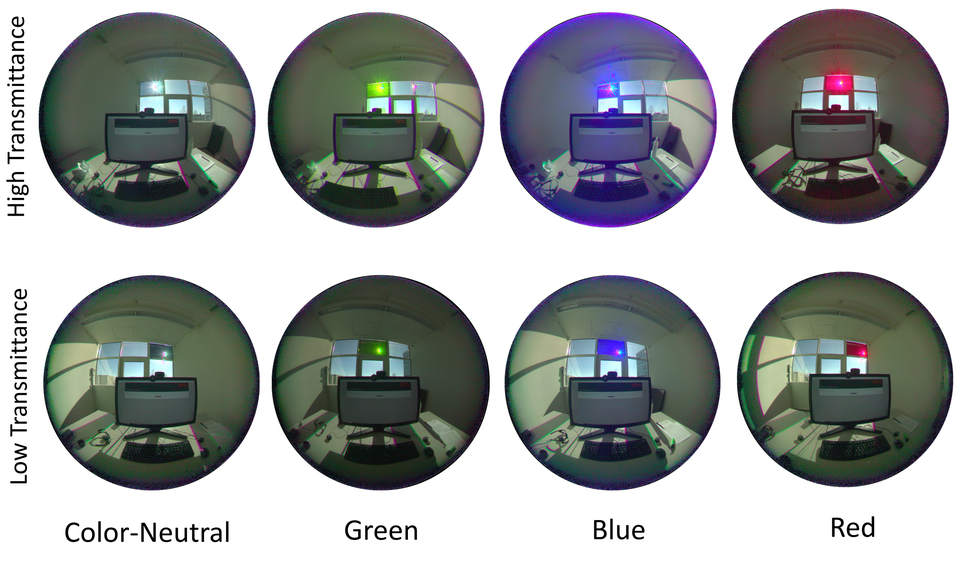


Daylight Glare Probability

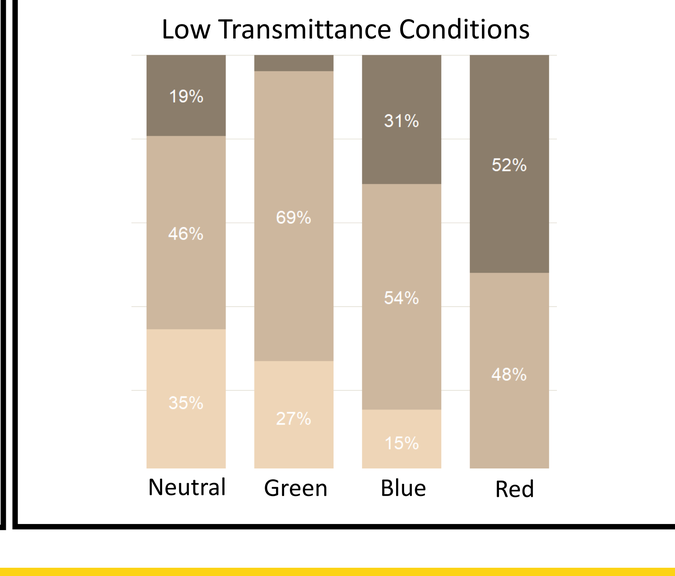
% Of occupants experiencing discomfort from the glare under each glazing color



Color HDR images of the eight experimental conditions shown to the participants



How would you describe glare in your field of view?



CONCLUSIONS

- Daylight spectrum altered by colored glazings of same transmittance have a strong influence on perceived glare.
- Color-neutral and green colored glazing were the best performing glazing compared to blue and red colored glazing in preventing glare from the sun. People perceive glare much strongly under red and blue colored glazing.
- Luminance as characterized by photopic luminosity function V(λ) is inapplicable in quantifying discomfort glare under colored light sources.

FUTURE PERSEPECTIVES

- Current discomfort glare metrics should be modified to include the effect of the light source spectrum into their equations.
- Luminance and illuminance quantities as weighted by V(λ) should be redefined for non-neutral lighting conditions.
- Brightness quantification based on color appearance models present a potential alternative to luminance since brightness is mediated by both chromatic and achromatic channels unlike luminance.

Swiss National Science Foundation

Project: "Visual comfort without borders: Interactions on discomfort glare" (SNSF #182151).

Further information:

LinkedIn

Google Scholar

Sneha Jain, PhD
Student at EPFL