CONTRAST GLARE

AND VISUAL COMFORT IN RESPONSE TO DAYLIGHT

Peter Hansen | PhD advisors: Prof. Marilyne Andersen and Dr. -Ing. Jan Wienold

OVERVIEW

There are uncertainties in the current daylight glare prediction models as they do not accurately predict the glare sensation that people experience. The objective of this research project is to investigate daylight glare stemming from contrast between task area and its immediate surroundings.

In order to control for bias, several of the main factors that are suspected of influencing individuals' glare ratings will also be investigated, among others self-reported glare sensitivity, gaze direction and eye contrast sensitivity. The expected research outcome is an improvement of the current daylight glare prediction models.

METHODOLOGY

The research consists of several experimental phases in offices and office-like test rooms. Questionnaires are used to collect the subjects' demographical information and glare ratings, while measurements of vertical and horizontal illuminance are being made together with luminance maps.

PILOT STUDY
Phase I

A preliminary study investigated if contrast glare between a task area and its immediate surround can be used as a glare estimator. Correlations between glare ratings and luminance ratios between task area and its immediate surround were calculated. The correlation for these was similar (rs=0.22) to those of Daylight Glare Index (rs=0.21) and Daylight Glare Probability (rs=0.31). The conclusion was that simple ratios between task area and immediate surround correlate relatively well with glare sensation, suggesting that further studies into contrast glare between task area and its immediate surround should be done.

A pilot study was also done to test the usability of a newly created experimental facility for glare studies, and it also served to test equipment, questionnaire, protocol and experiment methodology for future daylight experiments.

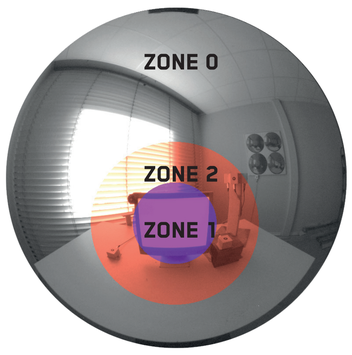
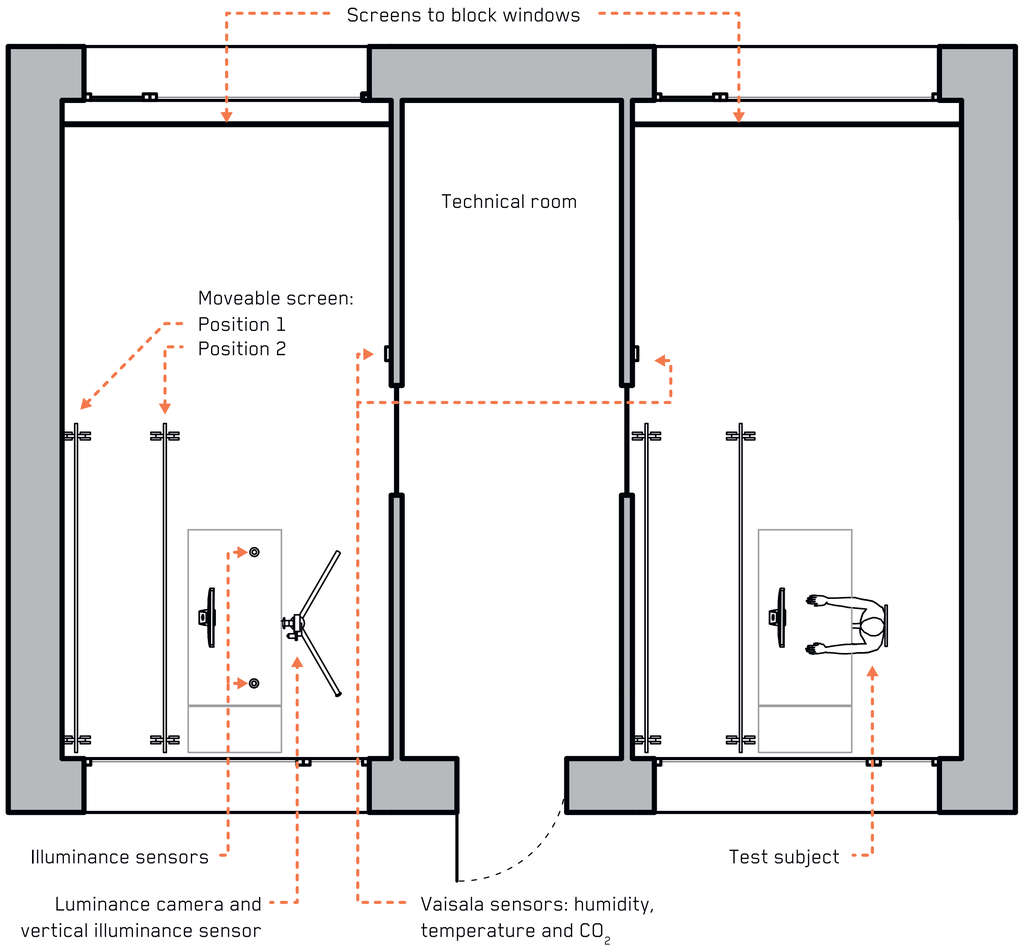


Image from the study showing the location of the task area and its immediate surround.



Plan of the test facility for daylight glare experiments. The test subject performs tasks and glare assessments in one room, while measurements are made in the other.

DAYLIGHT
Phase III

Experiments with daylight in the office-like test facility. Different light conditions can be created in the field of view of the subjects, including:

- glare patch sizes
- glare patch locations
- background luminances
- glare patch intensities

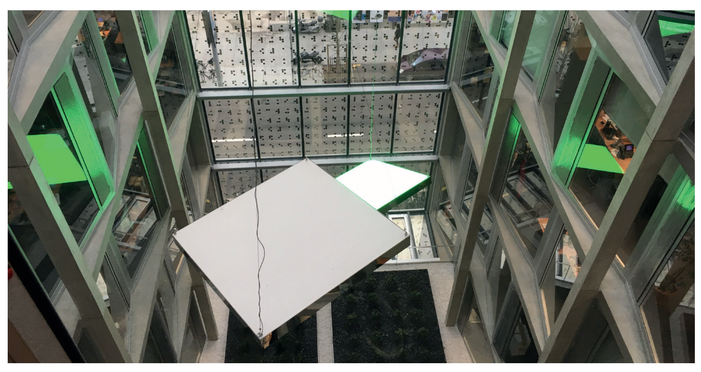
The conditions are reached for example by changing the size of the window, by moving a screen in front of the subjects and by testing at different times of day. The subjects will occupy one room where they perform a simple task and rate glare, while photometric measurements will be made in the other.

Examples of the different light conditions. Notice the light patches.

Images of the experimental setup and the facade of the test facility.

VALIDATION
Phase IV

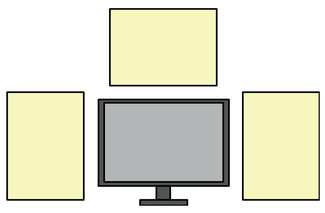
To validate that any improved glare model can be used in real spaces, a post occupancy evaluation study will be performed at different offices in Switzerland. Here subjects are asked to rate, among other things, glare at their workstation and a luminance map is made. Collection of data has already begun as part of a larger project investigating comfort in Swiss Minergie buildings.



Two of the buildings wherein data collection for the validation study has begun.

ARTIFICIAL LIGHT
Phase II

Experiments with electric light where location of glare patches can be varied. Here a range of precise glare positions and intensities can be created with a high level of reproducibility.



Electric light positions.

PETER HANSEN
peter.hansen@epfl.ch
Peter is a PhD student at the Civil and Environmental Engineering (EDCE) doctoral program and he joined the LIPID Lab in July 2015. Peter is originally from Denmark where he received his B. Eng. in 2012 from the Engineering College of Aarhus and his M.Sc. Eng. in 2014 from Aarhus University.

ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE

LIPID
Laboratory of Integrated Performance In Design