

PERCIFAL method in use: Visual evaluation of three spaces

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Abstract

In this paper we describe the use of PERCIFAL method for visual registration and evaluation of three architectural spaces in Trondheim: an atrium, a skylight room and a room lit by electrical light. A group of subjects visited those three rooms in August 2010. They were asked to make a spontaneous verbal evaluation as well as evaluation with the help of quality descriptor differentials developed in the PERCIFAL project. Despite differences between subjects, it was possible to find a strong correlation between surface illuminances, the score at *Light level* scale and the impression of openness/spaciousness versus darkness/gloominess. Furthermore, it was possible to find a correlation between the occurrence/absence of chromatic colors in the room and the impression of the room being serious and severe versus lively and playful.

1. Background

PERCIFAL *Perceptive Spatial Analysis of Colour and Light* is a subproject within the Nordic research project *SYN-TES: Human colour and light synthesis; towards a coherent field of knowledge*. SYN-TES is funded by the Knowledge Foundation, Sweden. The project grew from a need to share knowledge and to find better ways of communication across disciplines and research areas that deal with the human experience of light and colour in space. For further presentation of the PERCIFAL method see Arnkil et al.

2. Method

Three architectural spaces in Trondheim, Norway, were chosen for evaluation: 1. Atrium, 2. Skylight room and 3. Electrical light room. The Atrium is a part of the hotel building situated in Trondheim Centrum and called Porthuset. The courtyard is nearly square in plan (11 x 12m) and has a height of 5 storeys. The courtyard is the secondary daylight source for apartment rooms adjacent to it. The glazed roof covers the whole courtyard, some of the window panes at the roof are made of coloured glass; this contributes to a nice play of coloured and uncoloured daylight at the facades of the courtyard, especially during sunshine hours. Daylighting is supplemented by an artificial lighting system that consists of evenly distributed, spherical lamps with compact fluorescent light bulbs, hanging about 3m over the floor. The room is also characterized by a strident colour composition with strong colour contrasts, see figures 1 and 2.

The Skylight room is the largest and most spectacular room in Kunstmuseum, the Art Museum in Trondheim. There is a linear, large and elegantly designed skylight in the room that nearly dominates the visual environment in the room. It has a specially designed internal sun shading device fastened to a steel construction that has a similar shape to the skylight, but is oriented downwards. Different types of lamps (spots and wall-washers) are fastened around the

skylight, but they were not switched on during the visit. The colours chosen on the room surfaces are solely nuances of grey, see figure 3.

The Electrical light room is a part of the exhibition area in the Nordenfieldske Kunstindustrimuseum, a museum of applied arts in Trondheim. The room has some high and narrow windows that are covered by sun-proof textile roller blinds. However, there are gaps between the blinds and the walls, which became very bright during the visit. The room is lit by halogen light spots distributed over the space and giving light precisely where it is needed. The color composition in the room consists of wooden floor, dark gray ceiling and white walls, except for one that is painted in green. (See figure 4).



Figure 1 and 2. Atrium in the Porthuset, photos Kine Angelo.



Figure 3. Skylight room and 4. Electrical light room, photos B. M.

A group of 30 subjects visited those three rooms in August 2010. The participants were: master students of architecture (n=15), a group of electrical engineers (n=13) and architects (n=2). They were asked to make a spontaneous verbal evaluation as well as evaluations with the help of quality descriptor differentials developed within PERCIFAL: *Light level*, *Light distribution*, *Shadows and light spots*, *Glare and specular reflections*, *Light colour*, *Surface colour*, *Interaction between space, objects and people*. During the same visit the illuminance was measured in a few places in the room and colour sample matching was carried out.

3. Results

Spontaneous linguistic description:

1. Atrium: comfortable/relaxing (13), colourful (9), open (8), playful/alive (7), high/tall (7), contrast variety (4), exciting (3), modern (3), warm (2), flat (2).
2. Skylight room: spacious/open (15), light/aerial (14), comfortable/comf. lit (13), large/high (9), sacred/serious (4), exciting (3), cold (3), calm (2), relaxing (2)
3. Electrical light room: dark/gloomy (30), calm/quiet (12), cosy/comfortable (6), uncomfortable (5), mysterious (4), solemn (4), exciting (3), disordered/messy (2), quiet (2), feels small (2), artificial (2)

The colours in the respective rooms registered by colour matching with NCS samples are:

1. Atrium: dark gray stone S 8500-N and red carpet S 3560-Y80R on the floor, dark palisander S 8010-Y70R (-Y80R), white plaster S 0500-N and green painted walls S4050-G70Y on one side and S2030-G70Y on the opposite side of the room.
2. Skylight room: white plaster S 0500-N, light blue marble tiles on the floor S 2002-B and around doors: S 1002-B
3. El. light room: wooden floor S 4502-Y, gray ceiling S 6000-N, plaster walls painted white S 1500-N, one painted green S 7020-G, black curtains S 9000-N.

The illuminance measured during the visit was:

1. Atrium: 1750 – 2300 lux on walls, 1300 – 6800 at tables, 920 lux at the counter
2. Skylight room: 1200 – 1650 lux on walls, 1350 – 2550 on the floor
3. El. light room: on white walls 150-200 lux, 800 – 1050 lux at the center of light spots and objects, 50 lux on the green wall, 300 – 800 lux on the table 1500 – 2000 lux on the daylighted reveals.

The evaluation results for some of quality descriptors used in the PERCIFAL project are presented in figures 5 and 6; 7 steps differential.

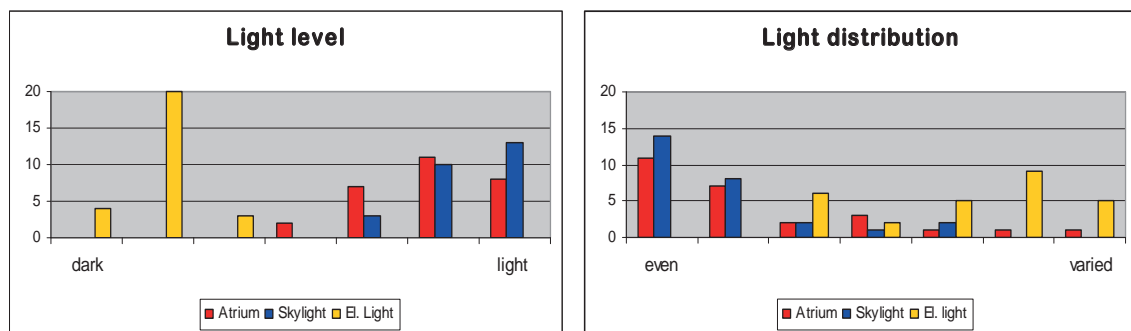


Figure 5. Evaluation results for Light level and Light distribution.

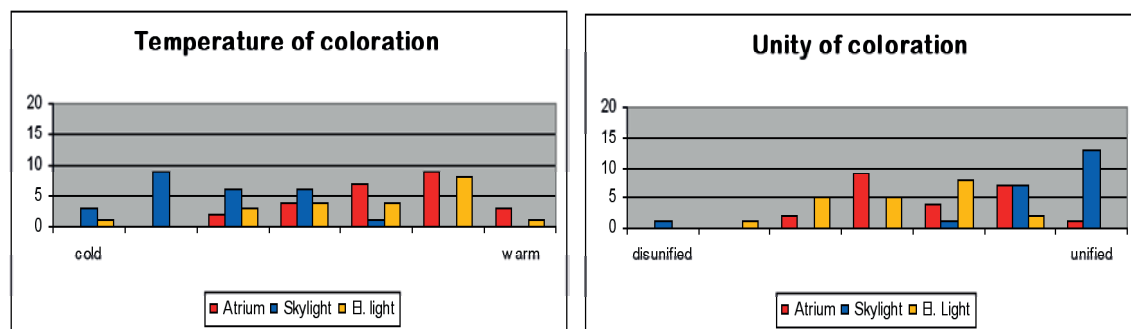


Figure 6. Evaluation results for Temperature and Unity of coloration

4. Conclusions and discussion

The Atrium was described as most colourful, open and playful/alive of all rooms but also as the most comfortable. The colour composition was most vigorous of all rooms. Both, the chromatic red-green contrast and the luminance contrast between walls and window frames are strong. The coloured glass on the roof appearing as reflections on the window glass contributed probably to the impression of the space being playful/joyful. Since it was the only room having strongly chromatic, warm and bright colours, there is an indication about the coherence between the occurrence/absence of such colors and the impression of the room being respectively serious/severe versus lively/playful.

The Skylight room was described as lightest, most spacious, and most serious/ascetic of all rooms. At the *Light level* differential it was evaluated as the lightest one despite of the fact that the measured illuminance was somewhat lower than in the Atrium. Since the room has the coldest and the most uniform colouration, with nearly no colour or luminance contrasts, it is very probable that the clear impression of lightness and spaciousness is strengthened by this faint, cold and uniform coloration.

The Electrical Light room was liked least of all. It was described as most dark/gloomy, most calm/quiet and most intimate of all rooms. The room was evaluated as darkest in *Light level* and most varied in *Light distribution*, something that is in agreement with measured illuminance values. The very high illuminances at window reveals, caused by sunlight, were evaluated as glary by 7 subjects and gave an important reference.

The PERCIFAL method was evaluated as a very useful tool for helping to observe, analyse and better understand spontaneous evaluation of visual qualities of architectural space. Most concepts were easily understandable, besides of *specular reflection* and *modelling*. To improve the method the scale for *modelling* could be changed to e.g. *planar – three-dimensional* instead of *diffuse – clear*. The skin colour was evaluated as most natural, the textures as most clear and it was easiest to read in rooms with daylight predominance. The clearest correlation in this survey was found between illuminance values measured in a room, the score at the *Light level* differential, fig. 5, and the linguistic description of the room: openness/spaciousness versus darkness/gloominess.

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