An Architectural perspective on daylight filtering using recycled materials

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Summary

In the project we seek to explore the possibilities in different types of recycled materials as daylight filtering elements. We aim to explore how such materials can best be used as part of the climate shield under the strict rules for energy economy in low energy houses. Our thesis is that it is possible to create solutions where the daylight in the room has a high perceptive quality.

We explored the possibilities with two materials 1) A shield of cut aluminium-cans and 2) a shield of misprinted plastic cards in different colours. Both shields were contained in a 100x165 cm frame of mahogany wood and were tested at three different positions in a 575x595x292 cm room. We measured the light conditions in 144 points in the room and evaluated the light perception.

The aluminium cans dispersed the light to provide a pleasant light and given a suitable frame size. We consider the aluminium cans as a relevant possibility for daylight shielding in low energy houses. The plastic cards provide a decorative element by creating interesting contrasts between light and shadow and consequently create a particular atmosphere in the room. They exclude however, in the current variant, too much light, which may be rectified by development of the concept.

Keywords: daylight, shielding, perception, light distribution

1. Methods

The project aims to produce information on the potential of two selected shields (constructions) at the aesthetic, experiential and functional level and to examine and describe the quality of daylight coming into the room.

The two shields were investigated and compared with an aperture without screening.

Shielding 01:
The enclosures are constructed from the cut aluminum cans which are held together by aluminiumsclips from the same material (cans) and contained in a frame of 100x165 cm. The rings are inside untreated aluminum and the outside is multi colored. In approximately 1/3 of the cans smaller screens of the same material are attached. These screens are positioned so that the cans without screens form a circle. The enclosures are mounted in a wooden frame (100x165 cm) and fill the frame out *(Fig.1)*.

Shielding 02:
The enclosures are constructed of misprinted plastic cards in different colors. The cards are broken twice and welded together to form a 3-dimensional structure through which daylight can be filtered.

The cards are mounted in a wooden frame (100x165 cm) with fishing lines and cover nearly the entire frame *(Fig.2)*.

Fig.1

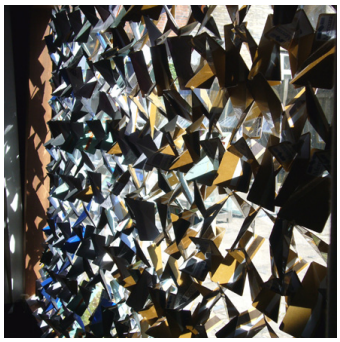

Fig.2

The frames were placed in a room with an envelope of glass (10 mm) from floor to ceiling which fills the entire one wall of the room. The room is 575 x 595 x 292 cm and oriented towards the southeast.
In a grid with 50 cm between the grid points I measured the brightness in lux at a height of 80 cm (a.p. table height) and calculated based on these measurements a daylight factor. I used a daylight meter (Gossen, model Mavolux 5032C), which measures both the room light power (lux) and contrast level (luminance / Candela).

Study1:
Frames with and without shielding were placed in the middle of the glass facade, with the lower edge of the frame at a height of 75 cm. The rest of the facade was covered with a blackout curtain.

In the first study we compared, the effect of the two shields with respect to daylight filtering with an aperture without shielding and related the measurements to the two different materials properties and expression.

Study2:
In study 2, we examined the impact of the location of the light-emitting surface on the impingement of daylight and compared again the two shields.

The frames with screens were placed respectively in the middle of the glass facade with the lower edge of the frame at a height of 75 cm and 160 cm and in one side of the room with the lower edge of the frame at a height of 75 cm.

2. Conclusion

Daylight conditions in a room is as expected, both materially dependent on any one the shield character and materials and light disc location. But the room's distance from a given opening affects the lighting conditions.

We conclude that daylight shielding with aluminum cans are suitable for use in rooms used for staying (eg dwelling) as well as rooms used for work (eg office buildings), since it has a great spreading ability and creates a pleasant light in the room. One could however easily imagine that a further development of the shield e.g.an opportunity to make it flexible in relation to the climatic conditions would optimize this shield further.

The shields with plastic cards will not readily lend itself for use in rooms used for longer stays or for rooms with workspace function unless the room has several light opening. It will be best suited in rooms a decorative mood element is wanted because it only sends a small amount of daylight into the room and creates a more flickering light. On the other hand it does provide an interesting light / shadow play in space by direct sunlight.

This pilot project is seen as an important addition to the discussion on new forms of daylight shielding in low energy houses. At the same time it aims at creating optimal daylight conditions which is important from an energy efficient and sustainable perspective.