

COLOUR AND LIGHT: ORIENTATION AND WELL-BEING IN HEALTH CARE FACILITIES

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Abstract

Colour and light in health care facilities should not only fulfil architectural or aesthetic criteria, but over all regard specific user requirements. In this paper the concept of freedom of action is used as a framework of criteria to categorize and assess various measures of colour and lighting design.

Keywords: *freedom of action, orientation system, intensive care unit, personalisation*

1. INTRODUCTION

There is no doubt that colour and light in architecture have a strong influence on physiological and psychological well-being, performance and spatial orientation.

According to Brainard [1], "it is well established that light can regulate physiology both on the body surface (skin or dermis) and internally (circadian and neuroendocrine systems). [...] The intensity and wavelength are important in determining the capacity of a photic stimulus to regulate human physiology. Light has been used successfully for treating SAD winter depression. Claims about the therapeutic effect of colour therapy or chromotherapy - however - are not supported by controlled scientific studies and thus await empirical confirmation."

Bartenbach and Witting from Bartenbach Light Laboratory in Austria [2], have shown in well controlled experimental series how light, natural and artificial, its spectral composition, colour temperature and flicker frequency influences work performance and well-being.

Izsó and Majoros at the University for Technology and Economy in Budapest [3] recently compared the effect of static versus

dynamic light. They came to the conclusion that dynamic light is more pleasant, stimulating and activating and therefore also increase the quality of work.

Küller and Mikellides [4] reviewed the research on colour, physiological arousal, thermal comfort and subjective time from 1921 till 1993. Their remarkable experiments with full-scale spaces helped us a lot to clarify the persistent confusion and misconceptions about the physiological and psychological effects of surface colours.

These are just some highlights of the newer findings in this important field of research. But despite all our knowledge about colour and light, the appropriate use of it in modern architecture remains a big challenge.

Colour and light in architecture are always perceived in the context of space, time and movement, material, surface and form, as well as the characteristics and activities of the observer.

In some of my publications [5 and 6] I have pointed out that the increasing use of modern materials and artificial light makes it difficult even for an experienced architect to predict accurately the actual appearance, impact of and responses to colour and light in the completed architectural space. For

example, recently I was concerned with a new office building in Austria, which had an outstanding innovative glass façade. Unfortunately the employees complained about headache, dizziness and other symptoms. As I could demonstrate after some measurements and analyses, the problem was neither the colour of the glass elements of that façade nor the light itself but the totality of the visual scene determined by the daylight from outside, the artificial lighting of the building, the position and colour of the glass elements and the employee's position/movement in relation to these factors.

Now, while e. g. in office buildings the users are usually (more or less) healthy individuals who spend only part of the day at their working place and therefore are more or less able to cope with such a stressful environment, old, handicapped and disabled people, patients of health care facilities and inmates of psychiatric wards do not have much choices and are therefore even more exposed to the quality and effects of the architectural environment. To be sick, disabled, handicapped or old, usually means a decisive limitation of our freedom to move, to act and to experience. We become dependent not only socially, as we need care, therapy and maintenance, but also spatially, for example when using a wheelchair.

Today there is a growing awareness that besides the measures essential for care and therapy, architectural design is of considerable significance for the purposes and demands of health care facilities. For patients, staff and visitors, the considerations – variously evaluated – are: well-being, minimising of stress factors, gaining control, and participation in the life of the institution, and (inner and outer) orientation by means of clear and readily comprehensible orientation systems. Thus design should not only fulfil architectural or aesthetic criteria but above all regard specific user requirements.

2. COLOUR AND LIGHT IN HEALTH CARE FACILITIES

How can colour and light in the design of health care facilities contribute to achieve these goals?

Before we look at this question in detail we should try to evaluate the potential of colour and light for the design of health care facilities in a broader context.

2.1 A general perspective to environmental design: the person-environment-setting

Environmental Psychology and in particular Transactionalism emphasizes that person and environment are part of one inclusive entity. Neither individuals nor settings can be adequately defined without reference to the other. Under this premise any kind of institution can be understood as an open system consisting of 3 components:

- the (physical) setting
- the socio-cultural script
- the person

The success and efficiency of a health care facility will therefore depend on an optimal relation and interplay of all components.

2.1.1 The concept of "freedom of action" and its importance for the user's environmental satisfaction

Rudolf Welter [7] in his article about therapeutic environments points out that the most important criterion for the user's satisfaction is personal control and participation in the spatial, organizational and social conditions. In health care facilities the opportunities for control and participation by the user are essentially related to the freedom of action available. This consists of the following dimensions:

- freedom of movement
- freedom of relation-forming

- freedom of operation and activation
- freedom of decision and control

The extend of the freedom of action available is determined by:

- architectonic and technical conditions
- organisational and administrative conditions
- attitudes and behaviour

These dimensions and conditions can be related to each other in a matrix of 12 fields. Freedom of movement for example is determined by architectonic and technical conditions like accessibility of rooms, windows, wardrobes, also for patients in wheel chairs (barrier free access), further by organisational and administrative conditions like rules of the house that regulate when and where patients can go, as well as by attitudes and behaviour, for example tolerance of the management and staff that patients visit each other.

If we read the matrix in the other direction it may also serve as a framework of criteria to assess the design of therapeutic environments. Measures to be taken in the field of colour and lighting design as elements of architectonic conditions should be categorized in this framework of criteria and assessed with reference to the latitude mentioned above.

So far, the following questions are of central interest:

How can colour and light in health care facilities support:

- the freedom of movement?
- the freedom of relation-forming?
- the freedom of operation and activation?
- the freedom of decision and control?

To each point I will try to give some general recommendations, with reference to some concrete examples of my work.

2.1.1.1 How can colour and light support the freedom of movement?

A colour concept can form the basis of direction signs and orientation systems, thus contributing to safety, effectiveness, well-being and identification with the place of residence. Colour, or to be more precise, hue, chromaticness, black- and whiteness, lightness, colour combination, contrast and harmony are crucial for the visibility and readability of direction signs and information boards. Of course colour coding does not have to be limited to direction signs and information boards but may also strongly contribute to the understanding and readability of the total physical structure of a building. Striking colours can provide clear spatial, emotional and symbolic points of reference. Contrasting colours and intensities may help to distinguish different spatial functions and elements, to define and separate different areas, indicate directions and floor levels, mark intersections, circulation paths, destinations and information points.

However, when a colour coding scheme is used, it must be logically and consistently and should not conflict with other coloured elements (as for example coloured lines for decoration, indication of technical elements and functions) in order to avoid confusion. Also only a small number of highly contrasting colours should be used because people – especially under stress – would not be able to distinguish and remember subtle nuances. In general coloured lines on the floor or wall are highly preferred by the staff, patients and visitors, but may be very confusing if the ways are too long or if there are too many destinations. A major disadvantage of floor lines is that the paints or materials used are often not very resistant, are covered during renovations and often conflicts with other signs or visual elements (see also Carpman and Grant [8]). Lighting can significantly influence the overall ambiance of corridors and the effectiveness of a variety of way-finding ele-

ments. Circulation areas, corridors, stairways and entrance areas should be illuminated in a way to facilitate safe and comfortable movement. Lighting can be used to signal changes such as the beginning of a ramp, to distinguish circulation paths from other spaces, to break up long corridors into segments, to define areas along a hallway and to highlight meaningful spaces, such as reception and waiting areas or major intersection. The effectiveness of orientation or navigation systems is significantly influenced by lighting. The visibility and readability of direction signs and information boards can be greatly enhanced if they are well illuminated or self-luminant. Coloured lights attract interest and provide strong visual cues. Colour coded lights can be used to distinguish circulation paths from other spaces, mark different areas and to represent destinations (see also Carpman and Grant [8]).

In one of our actual hospital projects in Austria we are installing coloured light bands in the floor as part of the navigation system, using side radiating optical fibre cables. Compared with simple colour codes (e. g. painted lines) these means are much more visible and also resistant to usage. Another advantage is that the hue and intensity of the bands can be changed or even modified dynamically. The combination of colour coding and advanced lighting technologies offers us new possibilities to design effective and flexible navigation aiding systems, that can be adapted to the changing institutional needs and thus support the patient's / visitor's freedom of movement under different organisational conditions (e.g. ambulant treatment during daytime, night or holydays).

2.1.1.2 How can colour and light support the freedom of relation forming?

Freedom of relation forming has to do with the possibility to choose or adjust the level of social, acoustic and visual stimulation.

Colour and lighting design should therefore try to create a balance between stimulation and sedation, order and variability, affinity and contrast. It should on the one hand link, create order and convey information; on the other hand it should offer sufficient variety to encourage the observer to interact with his architectonic environment. Modern lighting design and decentralized lighting management offer new technical solutions that allow a maximum of flexibility and the adjustment of light and colour to individual needs. For example, electronically controlled window shields, mirror elements and prisms allow an optimal use of daylight.

A carefully planned arrangement and mix of different light sources together with bus-connected technology make it possible to program and recall different light scenes and light sequences for different needs, activities and times of the day. The fast development of LED technology will soon make it possible to produce colour mixing lamps for a reasonable price that will give the user the freedom to choose his individual colour moods.

As I explained in my presentation at the AIC congress in Kyoto [6], a basic consideration of our work is that human beings have spent the greater part of their social evolution in a natural environment characterized by surfaces of varied texture and subtly variegated colouration. Under this premise my colleague Thomas Nowotny and I have been working now for many years on the development of different painting techniques, which have allowed us to produce, using modern industrial materials, surfaces that are more in accordance with "visual-ecological" requirements. We first applied this concept in a nursing-home for the elderly and a children's hospital [9]. During the last years we have developed this concept further and applied it in highly sensitive therapeutic areas like Dialysis Centre, Post-operant Observation, Coronary and Intensive Care Units. Intensive care

units (ICUs) in particular demand sensitive use of colour and lighting, in order to convey to the patient a sense of comfort, relaxation, recuperation and security.

In ICUs the design of the ceiling is probably the most important design measure, not only because for the patient lying on his back, the ceiling becomes the dominating horizon, but also because in most cases there are no walls or free plains in the room that can be painted or decorated. Room walls or separations are mostly built from glass, in order to enable the staff to monitor the patients, or if they are solid they are hidden behind medical equipment and high-tech instruments. In respect to the design of the ceiling, visually confusing elements must be strictly avoided. Also abstract forms, geometric patterns, strong colour contrasts and glossy surfaces should not be used.

Instead, when using surfaces in accordance with "visual-ecological" requirements as mentioned above, the (visual) ambiguity of the patterns on the one hand and the unobtrusiveness of the colour texture on the other ensure that the observer does not get tired of it after only a short time. According to mood and receptivity, angle of vision and lighting, the ceiling offers stimuli of varying intensity, their interpretation being left to the imagination (see also [6]).

Other important factors are the link with the outside world and with daylight, directing daylight or, if necessary, supplementary artificial light. If artificial light is used, special attention must be paid to the lighting level and the direction and colour of the light. Dazzle from ceiling lights but also from light-sources for examination, night-lights and orientation lighting should be avoided.

Through a combination of these design measures, symptoms of the ICU syndrom – like hallucination, delusions, psychotic episodes, sleep disturbances, disorientation and

misjudge of the length of the stay – can be considerably reduced.

Another important aspect of the freedom of relation forming is the possibility to control one's private sphere. Visual privacy can be easily achieved through flexible screens or curtains. Window curtains, due to the large area they cover, can be dominant elements of a room. It is therefore important to find the right relationship between the architectural style of a room and its decorative elements. In general, most people prefer representational motives over abstract ones (see also Carpman and Grant [8]), although usually it is not easy to discover motives suitable for the hospital environment. A further aspect is the partial translucency of the material so that in connection with sun light the colours can become vivid and beautiful.

2.1.1.3 How can colour and light support the freedom of operation and activation ?

Freedom of operation and activation means to be able to decide or influence the content, amount and process of actions and activities. The impression and affordances of spaces and rooms depend to a great extent on their visual design. The materials, surfaces and colours together with the illumination provide clear information about the purpose and usage possibilities of a room. Colour and light of a room can therefore encourage or hinder activities. For example, a room in which everything is painted white can hinder activities because it appears clean and one might be afraid to dirty it. In the same way an abundantly coloured room can also hinder activities because the total impression is overwhelming and does not leave any freedom for personalisation.

When developing colour schemes for health care facilities, it is important that the selected building materials, their colours and texture are clearly readable in a sense that they communicate their physical properties, the purpose value and usage possibilities in order to stimulate appropriate behaviour. If

for example colour, texture and gloss of a floor tile do not communicate solidity and stability it will definitely limit the freedom of operation and activation.

2.1.1.4 How can colour and light support the freedom of decision and control ?

Freedom of decision and control has much to do with the possibility to regulate privacy and to control a personal or group territory. Control over a personal or group territory also means that the owner (or owners) physically or symbolically demarcate and personalize it, for example through signs, personal object or decoration. Where this can not be realised, colour and light can offer some kind of compensation for territorial markers and objects for identification. Wherever possible the user should be incorporated in the planning and decision process, although most of the users do not have design competence. It is therefore essential to find a good compromise between user participation on the one hand and not losing control over the design process on the other. One possibility of controlled user participation is to offer a limited range of colour choices within a given design concept. For example, the option to choose from different colour schemes for specific staff areas (recreation rooms, changing rooms...), according to our experience significantly increases the staff's identification and satisfaction with the working place. Here colour gives the user a concrete possibility of control as it serves as a powerful symbol for personalisation and territorial marking.

3. CONCLUSIONS

Colour and light in architecture are not qualities that can be easily understood. The impressions of colour and light emerge from the constant flux of changing and overlapping scenes, in themselves the result

of a complex combination of various factors. Colour and light are perceived in the context of space, time and movement; material, surface and form as well as the characteristics and activities of the observer.

Especially concerning the (architectural) design of health care facilities – with the purpose to optimally serve the sensitive requirements of patients, medical/therapeutic staff members and visitors as their users, an integrative approach seems to me necessary: A sensible, technologically flexible/adaptable integration of colour, light, material, information signs, decorative elements and art into the architectural concept enable us to create a more comprehensible environment with positive emotional reference that will support the user's orientation and well-being.

However it is difficult to establish generally prescribed criteria for the design of health care facilities. The design recommendations given in this paper can be taken as suggestions. In order to arrive at the best possible design solution a differentiated and comprehensive analysis of each individual project is inevitable.

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