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The Impact of Colour

The impact of colour in educational spaces on the learning aptitude of children with learning disabilities.

Abstract

Research into the design of environments sensitive to the human psyche has been part of past and ongoing research across varied disciplines such as education, architecture, behavioral sciences and environmental psychology. Studies related to architecture have shown that architectural spatial planning and design goes beyond superficial aesthetic appeal and affects the users psychologically; the design of space can influence emotions positively or negatively. What seems to be missing is a body of knowledge in architecture that encompasses all the elements that form part of the user's experience. Even though similar studies have been conducted in urban design (Simkins & Thwaites 2006) and some aspects of interior design such as acoustics (Evans & Maxwell 1997) there have been few architectural studies of the effects of spatial design on the psyche to date, and certainly not ones that focus on the design of learning environments, in particular in relation to children with learning disabilities. My thesis explores this nexus between architecture and psychology with the aim of investigating whether architectural spatial planning and design act in a way to improve learning aptitude for primary school children, especially for those with learning disabilities. This will be studied by examining selected elements of architectural space (colour, illumination, spatial arrangement, sound and thermal comfort) and their perception by occupants, using educational assessment tools and the investigation of conventional designs of educational spaces.

This paper describes some of the concepts and theories that will be explored in the fields of colour and spatial planning in this pilot study. The inferences from this research will benefit primary school children by generating a new set of design schemes applicable to children irrespective of their backgrounds.

Keywords: Built environment, learning disabilities, interior design, education, psychology.

Introduction

The concept of architectural psychology has been a subject of research and analysis over the last few decades. Yet there exists a gap between the disparate areas of architecture and psychology which needs to be bridged in order to make informed design decisions and create environments sensitive to the user's psyche.

My thesis explores the nexus between architectural design and behavioral science through current and past issues (in architectural and educational contexts) and aims to determine what conditions need to be addressed to create the best possible learning environment beneficial to students with learning disabilities. Bryan Lawson explains the importance of a humane approach to the design of built environment. He says:

> Critically, the success of education depends so much on the quality of the pupil/teacher relationship. This then requires an architect who is sensitive to human relationships and aware of how to promote and foster through the built environment…. Characteristically those furthest removed from the architect during design may be the most vulnerable to bad design. (2000 p. vii)

Young children spend a significant amount of time within school institutions. As a result, the school environment contributes significantly to the overall development of the child's personality. As children grow up these settings may become less important, but the environmental experiences of childhood continue to be influential (David & Weinstein 1987). Many children with learning disabilities do not attend special schools and are found participating within the normal school environment, along with children who have no discernible learning problems. Both groups study from the same curriculum, even though their abilities and needs are different, and the teachers may need to adapt the curriculum in response to these differences. Teaching such children also requires special remedial work or counseling to enable them to cope with the academic and social expectations of inclusion with the other students. This implies that spaces in educational settings should be designed to support the learning of these students, and it may be found that these design considerations would also benefit other children in the same learning environments.

My thesis examines how the physical environment can be a source of stress affecting the physiological and emotional functioning of the users. It suggests potential strategies for designing environments that aid learning aptitudes, reduce stress and facilitate focus, with an emphasis on primary school age children with learning disabilities in educational spaces. Of four selected qualities, this paper looks at the importance of colour in the built environment and its effect on users.

But before we attempt to explore the nexus between the built environment and users' perceptions, we must first understand how the varying aspects of the built environment when modified impact on users' behaviour within a space. The physical aspects of the environment or architectural space that form the basis for our experience of a space are called 'environmental variables' and these are not objects but conditions, as in spacious, dark or warm. Space is thus defined by these adjectives and is so because of the ambience created by the collective effect of the environmental variables.

The two variables which are used by most environmental psychologists as a measure of the physical conditions of environment are ambient environment & layout (Holahan1982). Ambient environment is not to be mistaken for objects in the environment but comprises the qualities of our surrounding space such as colour, light, sound and temperature. For instance, the knowledge of sound-absorbent flooring materials or noise-proof air-conditioning is important while designing environments for contemplation or study, like libraries. Proper lighting (for reading activities and so on) and ventilation are also essential for maintaining performance levels in work and study spaces.

It is important for designers as well as psychologists to understand how layout of a space aids or hinders in creating functional interactional spaces. The design of the layout would also depend on the intended function of the space and the users' ages and psychological disposition in order for the setting to work to its maximum potential. As Holahan (1982, p.125) explains, while arranging features it is essential to establish the relation between groups of environmental features to one another in a specific space. This means that in

the context of learning spaces, the relationship between placement of teacher's supplies, arts and crafts materials within individual and group work spaces in an open classroom is to be first established and then utilised to create a setting that works best for all the users.

In the same context, a behaviour or activity that is a psychological or physical response to any environmental variable is called a 'performance variable'. This response could be further classified as physical, mental and interactional activities.

The inter-relationship between environmental and performance variables is important in understanding how the physical environment can support performance or impede it. For instance, certain aspects of environment like a noisy ceiling fan can affect the performance of a worker involved in a complex mental task by causing distraction. Even though the ceiling fan is doing its function of maintaining a comfortable airflow inside the office, it creates a noisy work environment not conducive to productivity.

Colour, as mentioned before, is an environmental variable which influences the ambience of a space. It is also one of the most obvious and influential factors of the physical environment, having the capacity to influence our moods, emotions and behavior.

Colour and Environment

It is hard to imagine a world without colour. Colour holds deep symbolic and cultural meaning for us. Our environment is a complex fusion of many elements like sound, smell and so on, which come together with colour to complete the sensations we experience in a place. Colour is one of the constituents of that experience, a part of our memory, our recollection of that space or an event in that space. And it is colour that we now look for when we try to capture a moment in time on our camera. Colour is also one of the most common media that children use to express their feelings and emotions. However, colour preferences differ from person to person and child to child, depending on emotions, age, sex and cultural background. The common misconception about children's environments is that they should be colorful. Children may be fond of colours as a mode of personal expression, but their choices depend on and vary with their moods, emotions, sex and age. And yet, colour has a more complex and important role to play in the experiential

value of a place than personal taste. It has an aesthetic and functional role to play as well, as explained later in the paper.

Figure 1 below is an example of how color or lack of it in an environment gives us cues or evokes in us a very strong response that is not necessarily related to its beauty or lack of it. The image is of an apartment designed in a minimalist style. Even though it probably is well designed in terms of comfort, illumination, air conditioning and so on, the colour palette of white seems to give the sense of a very controlled and unaccommodating environment which perhaps might not suit the aesthetic sensibilities or lifestyle of all except the user who might have wanted it that way. This image further illustrates how certain colour-schemes can be highly unsuitable for children. Children need environments for learning that fuel their creativity and imagination and such a scheme, were it used in a classroom, would surely fail to do so.

Figure 1:http://www.businessweek.com/the_thread/hotproperty/archives/whitekitchen.jpg

As Franke Mahnke (1987, p. 180) explains:

> Colour for the sake of colour accomplishes little that is constructive, just as bleak environments accomplish nothing constructive either. Education leaders ... must understand that the school's physical plant is a vital psycho-physiological contribution to the study situation. Appropriate colours are important in protecting eyesight, creating surroundings that are conducive to study, and in promoting physical and mental health. Many cases of nervousness, irritability, lack of interest, and behavioral problems

can be attributed to incorrect environmental conditions involving poorly planned light and colour.

Furthermore, these behavioral problems are relevant to children with learning disabilities such as ADHD, and unsuitable colours may cause stress and aggravate the symptoms of their learning problems.

Colour is one of the ambient environmental variables and studies suggest that it has the tendency to affect mental activity (a performance variable). For instance, the colour red induces motor excitation, and would tend to influence motor activity, so is not favorable to be used in spaces designed for focused mental tasks (Nakshian 1964*).* This type of mental stimulation by itself is not harmful unless used in excess in an environment that requires students to sit for long hours. Past research also shows that for positive learning outcomes, there needs to be an understanding of how an environment with little or no stimulation can affect the performance of students. This is because colour could act as a tool to maintain levels of mental stimulation, which is necessary to facilitate attention in learning environments (Creekmore 1987). The concept of maintaining levels of interest is to enhance effective reception of information in learning environments. A complex environment could lead to information overload and a bland or too simple environment may lead to loss of interest in surroundings. Either case could lead to an environment with little or no stimulation for learning and thereby affect learning abilities.

Studies show that the sequence or arrangement of colour in spaces influences perceptions of colours, and as L Holtzschue (2002) explains, colour placement is an important aspect of design. Furthermore, colours can be used as tools to create illusions (of size or distance) and special effects (drama or tranquility). For example: a gray square on orange seems blue-gray, but the same gray square on blue appears warmer and more orange-gray (figure 2). An in-depth understanding of this theory is important so that, in accordance with other conditions of built environment such as light, it is possible to create a space that has a motivating or positive effect on teachers and students in the learning environment.

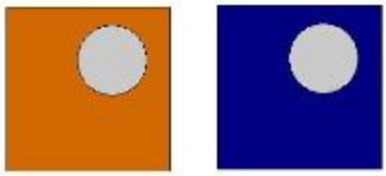

Figure 2: Colour template concept from Holtzschue, *Understanding Colour*, 2002.

Among the various psycho-diagnostic tests for children's intelligence, colour tests are significant in evaluating the ability and personality of children. This implies that colour has a connection to the human psyche, and the fundamentals used for colour tests can be applied in any environment to support a child's psyche and thereby a child's ability to learn. Interestingly, an individual's colour preferences may differ from his or her response to the same colours in the physical environment, due to varying colour perceptions based on the size and texture of the coloured surface and ambient illumination conditions. For instance, what a child may prefer as a favourite blue for clothing may not elicit the same response when applied on wall surfaces or flooring. These differences need to be extracted from colour psychology theories in order to arrive at a workable colour palette for application in design practice. According to Nemcsics (1993, p.186), personality tests based on colour can be used in the practice of colour design that aims 'to express or modify human attitudes'. He goes on to explain that past studies by Freiling, Luscher, and Pfister (1951) in colour psychology show that colour evokes psychological and biological responses in us. Part of these same tests also show that complex mental tasks requiring acute concentration and reasoning were resolved better in blue-coloured environments, whereas mental tasks involving sudden change or explosion of ideas had better results in red-coloured rooms (Nemcsics 1993).

In my thesis I will explore the influence of color in learning environments, specifically, the effects of colour on concentration, stress and anxiety issues for students having problems focusing or grasping data because of learning disabilities. In this context, it is interesting that the theories of Goethe (Nemcsics 1993, Sharpe 1979, Riley 1995) based on emotions and the aesthetics of colour still hold resonance, and these will be compared with scientific studies which also suggest that colours have an impact on the psychosomatic and emotional well-being of users. The inferences drawn from these comparative studies and interdisciplinary theories will help in the architect's selection of a colour palette of shades that enable children with learning disabilities to concentrate better and control motor impulses, while at the same time maintaining an appropriate level of mental stimulation for other children.

Modifying Perceptions of Space via Colour

The concept of space is an aspect of our experience of the three-dimensional elements of the environments we engage with. It has qualities that are defined by the users themselves and by those who created the space with an intention of its being used in a particular way. For example, the arrangement of classroom space communicates expectations for classroom behavior that are then 'reinforced by institutional policies' (Weinstein & David 1987 p. 3). However, the intended use of a space is not always fulfilled and often the space undergoes a metamorphosis into a different space, according to its interpretation by the users.

Colour, as we know, can be used to create an illusion of space or an aesthetic point of interest in design. We also know that the spatial effect of a colour is generally due to interaction with, and dependent on, neighboring colours (Nemcsics 1993). Figure 3 below illustrates how the same colours can appear different on different background colours. So a black background emphasises light colours, whereas a white background emphasises dark colours.

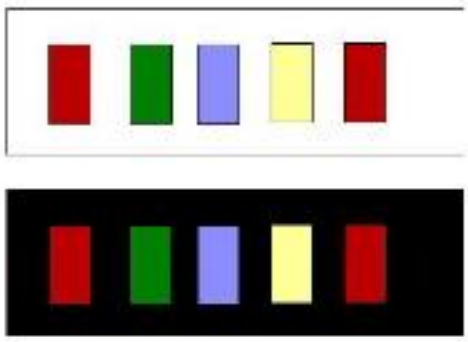

Figure 3: Colour template concept (Nemcsics, 1993, *Colour Dynamics*.)

In order to create an ideal learning space, we need to understand not only how colour acts as a modifier of spatial qualities, but also the specifics of children's perception of colours and their spatial expectations within a learning environment. The possible solutions to these criteria could lie in the theory of space-sensation, which is dependent on colour preferences (based on age and sex) and the psychosomatic effects of colours. Space sensation, as Nemcsics explains, is 'the consciousness content elicited by sensing the space visually, auditively, tactilely, olfactorily, motionally, etc.' (1993, 6) I will be exploring this concept further in my thesis in order to understand the link between the aspects of a three dimensional space and the psychological response it elicits from us, and to inform how children identify with specific conditions in their physical environment, such as colour and spatial dimensions.

The sensation or emotions that arise on entering a space are partly based on the expected function of the place. We behave and act in a specific manner according to the context or anticipated purpose of the environment. For instance, when we are in an art gallery, we tend to be critical, appreciative and quiet. But our behavior in a mall is different. It is spontaneous and active. Partly our behavior is defined by the knowledge of function of

the space, and partly by how the environment makes us feel. However, if we were to modify the environment with colours not suitable to the theme or expected mood of the space, would behavior in the same place be the same as it was with the anticipated colour schemes? Would we be as spontaneous and energetic if the colour palettes in a shopping mall were neutrals like beige or white instead of bright colours, offering backdrops for display or aesthetic points of interest?

This anticipation based on function is fulfilled via form-function harmony. Form-function harmony concerns how a visual or physical appearance of space complements the expected function of the space and vice versa. So, as described in the examples of the shopping mall and the art gallery, we anticipate certain qualities of space, which we relate to its function. When this expectation is not fulfilled, we may experience an incomplete space sensation. It can be inferred that 'form-function' harmony includes 'colour-content-function' harmony, which is important to complete the sensation of experiencing a space. This means that a complex palette of colour may give aesthetic pleasure, but if not in harmony with the content and function of space, this pleasure is too superficial to offer a sensation of complete space (Nemcsics 1993). It can create a feeling of confusion and anxiety in users.

Spaces or physical environments have visual complexities, and colour can be used to simplify some of these complexities by adding definition and using design theories of illusion and aesthetics. Figure 4 below is an example of uncertain space sensation (left image) and definite space sensation (right image), created by the use of colour alone. This comparison illustrates the different effects achieved by the use of colour: how one opens up the space and the other closes it in.

Figure 4: Hangar interior. (Nemcsics 1993, *Colour Dynamics*)

Similarly, children read cues from their learning environment and currently, there seems to be no coherent colour palette definition in the field of architectural design that is based on the emotional and psychological responses of children to specific colours. In order to develop such a colour scheme, it is necessary to draw from the fields of colour psychology and behavioral science and to bridge these concepts and theories with architectural psychology.

Conclusion

Colour is one aspect of design that plays a very important role in modifying the effect of a space on users, in this case primary school children, and in particular on children with learning disabilities. Colour has the capacity to influence the ambience of a space and thereby positively motivate users of the learning environment to perform better. Colour adds definition and beauty to any space. It can either bring life into an environment or make it seem devoid of life. We simply have to look around us to realise the importance of colour in our physical environments. Knowledge about the complex nexus between colour and the built environment will help us as architects or interior architects to provide positive design strategies for educational spaces that offer sensitive and humane responses to the psychological disposition of children.

Colour is an important part of our ambient environment. It needs to be used effectively in designing a learning environment that offers support for behavioural issues faced by children with learning disabilities. Effective use of colour will add definition to a space and aid in enhancing effective reception of information. Colour, which has been shown to elicit a strong emotional response from us, can create an overall sense of well-being in users of a space. In order to develop a colour palette that will elicit a positive response in learning environments, especially for students with disabilities, it is necessary to research theories of colour psychology and the human psyche. My thesis will explore if colour can indeed influence learning abilities, enabling children to focus better and reduce issues of stress. Such a study will add to the ability of architects to design

environments that respond to the psychological disposition of children, specifically of those with learning disabilities.

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