

# MARIA JOÃO

*Colour in the Built Environment*

# DURÃO

## ***Introduction***

The purpose of this paper is to establish a deeper awareness of the potential of colour as an important factor in the design of the built environment. Colour, inseparable from light, is an integral part of our total sensory and perceptual experience. It not only conveys information about our surroundings, but also has great impact on our psychological reactions and physiological well-being.

The scope of this paper includes considerations upon the complexity of the colour and the different meanings it has as a multidisciplinary phenomenon; the different approaches and conceptual views on colour in the built environment; the multiple potential of colour and its uses within architectural design, and finally, it underlines that an integrated and interdisciplinary approach is needed for the understanding of colour in the built environment.

## ***Colour as a multidisciplinary phenomenon***

The complexity of the phenomenon of colour is evident in the different meanings it has in disciplines such as psychology, physiology,

neurophysiology, linguistics, philosophy, social and art history, physics, psychophysics, architecture and art.

Physics deals with the measurement of properties and characteristics of light that have nothing to do with the eye, therefore without reference to the observer, and in applied research it uses methods that are repeatable and do not even require that light be seen.

The measurement of appearance of light such as the perceptual organization of colour falls into the realm of psychophysics. Factors of attention, attitude or feeling are excluded from psychophysical measurement but are considered the domain of psychology, largely concerned with tendencies and the ways in which light affects consciousness —the mind.

As a general definition, psychology studies the relationship between the colour calculated for the standard observer and the colour actually perceived by the mind. Unlike the physiologist who studies the eye as a standardized mechanism, psychology studies the effect on the observer produced by the conditions. What they have in common is that both the psychologist and the physiologist deal with the neural responses of the eye and brain in the perception of colour. Neurophysiological research is also concerned with colour and light in the environment due to its role in feeding the needs of the right side of the brain, and in increasing our level of response, thus preventing sensory deprivation by introducing stimulation and variety.

As a cultural and social phenomenon, colour interests the art and social historians, anthropologists and linguists. However, it is the architect, the designer, and even more the painter, that use colour in the production of their work. Painting has been a source of research on chromatic phenomena and has provided the most significant contributions for the understanding of chromatic relationships and interactions.

### ***Conceptual views on colour and the built environment***

Colour has been secondarized and considered supplemental in the architect's education for being considered to be a matter of individual expression and taste. There seems to be two main reasons for this. The first is found in the misconception regarding the use of colour in classical architecture and sculpture that come through via the work of the Renaissance and Neo-classical periods. This resulted in the emphasis given to the natural colours of the materials, even though European and Scandinavian archaeologists in the 19th century discovered that Greek architecture and sculpture were coloured after all. How the temples had looked when they

were painted can be seen in Hitorff's published lithographies of 1851, based on archaeological evidence.

The other reason that may account for the lack of concern with colour at an educational level of architecture may be justified by the influence of the doctrine of the Modern Movement and its belief that colour distorts form and therefore reduces the objectivity in the act of seeing. Nevertheless, colour has been used in architecture in all civilizations and has played a vital role in the cultures of different parts of the world including «the ornament of savage tribes» as Owen Jones notes. A promoter of coloured architecture, he specified red, yellow and blue for interiors and blue and white for the external framework for the Great Exhibition at The Crystal Palace (1851).

In Jones *Grammar of Colour Ornament*, (1856/1986) he proclaimed that brilliant bright primary colours were used in the highpoints in art while decadent periods were synonym with secondary and tertiary colours. Polychromy was used in the architecture of Ancient Greece and Ancient Rome; in the Byzantine world; in Mesopotamia; in China; in the pyramids of Egypt; in the pyramids, temples and shrines of Inca, Mayan and Toltec cultures of Central and South America, and later in the gothic architecture.

In the 20th century, colour was used extensively in architecture. Prieto (1995) notes that two periods are commonly distinguished: first between the 1920s and the outbreak of the second world war, when architects either adopted polychromes or excluded colour from the design of buildings. And a second period, in the 1950's during which «a new form of coloration emerged» at the initiative of artists-painters.

The partnership between architects and painters in the exploration of colour and spatial effects is found in the first period, of which Schroder-Schrader house in Utrecht (1924) is an example. In the 20's the group of artists «Neue Sachlichkeit» was the foundation for movements such as the «De Stijl». Theo Van Doesburg, Le Corbusier, Gerrit Rietveld and Piet Mondrian aimed at working through the arts using colour for the creation of a new spatial experience. Mondrian experimented with colours on canvas and Rietveld used the same principles to decorate the internal and external planes of his buildings, i.e. they used the primary colours defined by black borders so as to change the volumetric characteristics of space.

Bruno Taut (1880-1938), a painter-architect, also intended to combine his talents as a painter with regard to colour with his architectural ability. His words state this intention: «... It seems that I can give my character its fullest expression in this medium (painting) —probably better than in

architecture...» (in Lancaster, 1996:44). He had the opportunity to express himself as a painter in the design of the garden suburb of Falkenberg. Taut describes the choice of colours in terms of spatial and emotional effects. In Berlin, his ideas on colour were later put into practice at the Prenzlauer Berg in the Weissensee district where he used colour to give identity to housing blocks. He was particularly successful when using a complementary scheme of colour for Onkel Toms Hutte, Waldsiedlung Zehlendorf (1926-32).

The image of a city from the point of view of colour is construed over time and affected by its environmental setting. Among many other architects, Richard Rogers and Renzo Piano, Hans Poelzig and Hans Scharoun, Tomás Taveira, Luis Barragan, Aldo Rossi, Frank O’Gehry, Michael Graves, Bernard Tschumi, Zaha Hadid, Zoe Zenghelis, Aldo and Hannie van Eyck, consider the importance of the role of colour in their work

Contributions to environmental colouring also come from colour researchers such as Lenclos & Lenclos (1990) who aim to harmonise architecture with the surrounding landscape and with its inhabitants. Their methods are grounded on site investigations in various countries and include a detailed colour analysis of the relevant materials. Samples are gathered from materials that constitute the overall colour from walls, floors, doors, roofs, etc, and impermanent elements such as vegetation and samples of rocks and soils. Later, in the workshop they are analysed against the landscape context and assessment of the views from inside is made, in which details such as doors, frames, windows and shutters are considered. All the coloured elements of the building are then assembled in colour design cards—the result of joining the whole in a rural or urban context and the more specific elements of the facades. The analysis of the chemical composition of the materials and paints, as also the changes in use over periods of time have also been researched.

The choice of exterior colour for a building requires that it may first be seen in its relationship with its immediate surroundings such as its visual function within the city or district. Moughtin et al. (1996) establish some issues that have to be taken into account when deciding a colour scheme for a building, such as examining whether the building is an important landmark or a closure to a vista or if, for instance, the building lies upon an important path with a particular colour coding. The building itself should be examined in terms of decoration: cornices, window frames, overhanging roofs, balconies, projecting bays and oriels. The details that are the final constructional elements are important to the overall effect of the street. The base, middle zone and roof zone together with the relief and detailing are elements that make up the architectural treatment of a

street: planes, projections and ornaments can be emphasized with colour to create a pattern.

Another methodology used in the research of the exterior colours of buildings, consists of the evaluation of peoples response to it. Sivik (1974) used semantic scales to study people's attitudes and associations to colours, first using individual colours and later the colours on buildings. The aim being to research the relationships between colour meaning and colour appearance when colours are part of a building. His study was carried out initially in Sweden and later in Greece in order to identify possible cultural differences. Tosca (1994) adopted a similar methodology to study the impact that building colours had on the population of Thessaloniki.

### ***Modelling the dynamics of colour in the built environment***

There are a number of decisions to be made in the process of developing colour solutions within a design programme. These decisions concern the appropriate colours to use, and encompass a range of design variables that are linked to the function of an environment. Colour can be used to control, to an extent, the character of a space. This is achieved through the articulation of wavelength and it results in affecting multiple dimensions of colour, figure-ground relationships, associations, harmonies, and simultaneous or successive contrast.

Colours adopted modify the perception of the physical architectural form. Spatial features can be manipulated by colour to modify a structure or break down a scale. Colour can be used to increase or reduce the apparent dimensions of volume and size as well as the apparent depth and distance of planes. It can alter the apparent architectural weight by reducing heaviness or to establish stability and gravitational links.

Along with other synaesthetic dimensions, colour makes sounds seem louder or softer, it makes surfaces seem harder or softer and even influences the perception of wet and dry. Colour can affect the perception of temperature and it holds associations with taste and odour.

For operational and safety purposes, colour can be used to signal, to give direction, to delineate or underline what is important. It can be used to define elements to enhance or identify equipment or to mark hazards.

Colour and light may be used to induce patterns of behavior along psycho-physiological dimensions. The deeply rooted connotations with certain colours are part of our collective heritage, and therefore, provide a

credible basis upon which to develop design solutions. Light, on the other hand, is a key element for visual ergonomics. Furthermore, the effects of light radiation are traced beyond the visual level, to a non-visual biological level.

Colour and light affect body functions and arouse the emotions. This is particularly important in the very specific case of space architecture. Colour, along with a number of complex design aspects, plays a significant role in the design of space living and working environments. The isolation and confinement of space environments, where life and work may be carried out for extended periods of time, require the design planning to be sensitive to the effect that it has on the emotions as a result of the monotony of enclosure and prolonged confinement (Durão, 2002).

The fact that we are gradually becoming 'indoor species', requires a deeper understanding of the effects of colour on the human being. For instance, Faulkner (1972) expressed this concern by forecasting images for the future in which 'entire cities enclosed under colossal domes that are artificially ventilated and lighted will present new problems of planning on a gigantic scale'.

If the images that this architect and left us with have not yet come true, his concern with human response to colour in the built environment has especially indoors, where we gradually spend more time. The understanding of the human response to the environment is shared by architects, designers, city planners, lighting engineers, and colour consultants as well as by psychiatrists and psychologists. Mahnke (1996:xii) asserts that they are confronted with problems and faced with questions that they are often ill equipped to answer and reinforces the need for spaces that 'safeguard the mental and physical well-being of the user'.

It is therefore important to consider the existing knowledge on colour and adopt an interdisciplinary approach in dealing with it when used in the built environment. This has already been stressed by Birren, the first colour consultant to address issues concerning the human responses to colour, in the great number of books and articles he published, as well as by Porter & Mikellides (1976) and Mahnke (1996), among others.

The integration of the available body of knowledge on colour should be considered as a frame of reference to the study of colour in a real environment. Much of the research carried out in architectural space interior settings, is normally done in laboratorial environments using a question-answer format in which psychophysiological responses are elicited, or a combination of these with other dimensions of colour, e.g.

dynamism, excitement, complexity, or evaluative dimensions (Durão, Curwell & Hinks, 1997). While the effects of colour have been investigated extensively using coloured chips, coloured lighting or coloured space models, real world research presents unexpected and uncontrolled phenomena, that are not bound to occur in controlled experiments. Research carried out by the author of this paper (Durão, 2000) used methodologies centred on persons responses and judgements of colour in real settings and integrated related fields of colour in an interdisciplinary study focused upon the interpretation of aesthetic and psychophysiological phenomena.

The body of knowledge should also include the results obtained from a variety of research techniques that range from objective measures, to observational techniques and self reported measures. Experiments on physiological response may use one or more of the following objective measures: EEG, GSR, heart rate, respiration rate, blood pressure, oximetry and eyeblink frequency. Subjective self-reported measures and observational techniques are suited for collecting data on affective responses or associations, as well as for establishing relationships among variables in complex situations.

## ***Conclusion***

Colour has become a major factor in the built environment and that those who are responsible for its design have to depend upon scientific research and empirical evidence, both covering many disciplines. Even though research is undertaken in various disciplines, the integration of their respective findings in the design of the built environment has been occasional and limited. This fact results in a fragmented rather than a unified perspective of the colour phenomenon and its effects. Research on colour effects should be interdisciplinary, yet for the interpretation of the effects to be fulfilled, the approach should be dynamically subjective and global.

The Architect's Council of Europe (1995) echoes two concerns regarding the built environment that connect the psychophysiological with the aesthetic. One is to ensure that our indoor environments do not injure our health and the other is to make every building beautiful. In the same document it is added that a new direction can be achieved through the 'change in patterns of thought—a paradigm shift'. The contemporary approach to environmental response and environmental interaction requires that research be more systemic. If coupled with the looking at the subjective from a more global point of view, a new paradigm can be explored.

## **References**

Architect's Council of Europe. (1995). PROPOSITIONS FOR EUROPE'S BUILT ENVIRONMENT. Brussels.

Durão, M.J., Curwell, S, & Hinks, J. (1997, November). «Colour in the built environment: The need for a holistic and aesthetic approach». PROCEEDINGS OF THE INAUGURAL BIZARRE FRUIT CONFERENCE (pp. 41-46). England, U.K.: University of Salford.

Durão, M.J. (2000). COLOUR AND SPACE: AN ANALYSIS OF THE RELATIONSHIPS BETWEEN COLOUR MEANING EXPRESSION AND THE PERCEPTION OF SPACE. Unpublished doctoral dissertation, University of Salford, England, U.K.

Durão, M. J. (2002). «Color in Space Architecture». Paper presented at the SPACE ARCHITECTURE SYMPOSIUM-THE WORLD SPACE CONGRESS (10-11 Oct.), George Brown Convention Center, Houston, Texas. Paper n.º AIAA-2002-6107.

Faulkner, W. (1972). ARCHITECTURE AND COLOR. New York: Wiley-Interscience.

Jones, O. (1986). THE GRAMMAR OF ORNAMENT. London: Studio Editions (First published, 1856).

Lenclos, J. P. & Lenclos, D. (1990). LES COULEURS DE LA FRANCE. Paris: Du Moniteur.

Lancaster, M. (1996). COLOURSCAPE. London: Academy Editions.

Mahnke, F. (1996). COLOUR ENVIRONMENT AND HUMAN RESPONSE. New York: Van Nostrand Reinhold.

Moughtin, C. et al. (1996). «Colour in the City». ARCHITECTURAL DESIGN. COLOUR AND ARCHITECTURE. 120. Pp 18-21.

Prieto, S. (1995). «The Color Consultant: a New Professional Serving Architecture Today in France». COLOR RESEARCH AND APPLICATION. 20(1). Pp 4-17.

Porter, T. & Mikellides, B. (1976). COLOUR FOR ARCHITECTURE. London: Studio Vista.

Sivik, L. (1974). «Color Meaning and Perceptual Color Dimensions: A Study of Exterior Colors». GÖTEBORG PSYCHOLOGICAL REPORTS. 4 (11). Sweden: University of Göteborg.

Tosca, T. F. (1994). «Dreams of Light for the City». COLOR RESEARCH AND APPLICATION. 19 (3). Pp 155-170.