light and Colour in Design

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How MANY OF US realize the importance of light and colour in our daily experience? On every hand, ever changing light plays on nature's subtle and complex colour palette, creating atmospheric effects, dynamic colour music and emotional reactions. From the tropics to the arctic, man is captivated by the mysterious glamour of the play of changing light: the long low sunset of the arctic, the hot sultry world of the limpid jungle atmosphere, the nostalgic gloom of the eclipse, the ominous sky suddenly rent by blinding lightning, — all exert an hypnotic power, dramatic in essence.

The designer who consciously uses light and colour to define, control and enhance his design, — whether it be a teacup, a chair or a whole room, — recognizes that these two elements are closely associated with the other basic elements of design, — line, pattern, texture, form and space.

What is Design?

We may well ask the fundamental question, "What is design?" If we take the definition, "Design is the orderly arrangement of things for use and beauty," we find the three essentials which have always been emphasized in design: the planned arrangement according to basic principles; the organic quality which stipulates that its form shall be the direct outgrowth of its function or use; the aesthetic quality which generates a sense of visual satisfaction as well as an inner awareness of the meaning of the form.

Robert G. Scott, in his book *Design Fundamentals*, gives us this definition: "Designing means creative action that fulfills its pupose." Here we are reminded that design is the result of "creative action"; in other words, it involves and results from a series of acts or processes in which certain elements are combined according to accepted laws or principles, and the result fulfills the purpose for which it was intended.

This fulfillment of function (the "functional theory" about which we hear so much these days) implies that its form shall express the meaning or intention; that, since it cannot exist apart from the material, the form shall express that material from which it was fashioned; and that the form shall be the logical outcome of the method by which it was built or put together.

Thus it is evident that every design has both an aesthetic and an intellectual aspect. Visually, we see and appreciate the relationships of line and form, pattern and texture, light, shadow and colour; intellectually, we recognize and appreciate the material and structural relationships we know to be there.

Design in Practice

The practitioner, — the designer who creates for a purpose, — works with basic elements and employs basic principles or rules for their correlation and integration. *The Basic Elements:* line, form or mass, space, texture, pattern, light, colour. *The Basic Principles:* unity, balance, rhythm, harmony, direction, dominance or emphasis, proportion, scale.

Habitually, most of us look at things without really seeing them. We are surrounded by countless objects, patterns and textures. We think we know what each looks like. We have seen millions of leaves, for example; yet when we inspect one closely we find unexpected structural patterns of great beauty.

Much of our knowledge of things depends on touch as well as sight. Our fingers convey impressions of rough and smooth, hard and soft, just as our eyes tell us of form and colour. Every surface has texture, one that is either natural to the material or the result of fabricating or finishing processes.

By considering the object itself, the purpose it must serve, the spirit it should express, the designer determines the material best suited to the task. Whatever the designer's tools and materials, he works with the same basic elements and applies the same basic principles of composition listed above.

The elements of light and colour are, in many ways, the most important. Light is the medium which, through lights and shades, reveals and defines forms in space and surface patterns and textures. Where there is light there is bound to be colour, since light is colour. These two closely interdependent elements are at once visual and emotional in their use: each defines visually; in addition, each expresses or creates a mood, a feeling, a quality.

Light

Basically, light is, of course, essential for good visibility. In the design of the lighting for any interior, the provision of the right amount and the right kind of light in the right place is the major consideration. Through careful control of the quantity, colour, direction and distribution of light,

the lighting engineer can create just the right seeing conditions for the activities that take place within an area, whether it be a restaurant, a living room, a business office, a corridor, an operating room, or a beauty parlour. Light thereby fulfills its prime function of providing good visibility; but light also has an equally important and parallel function as a creative or expressive element of design.

Light is more than just a convenience by which to see things, a means of revealing or explaining the visual aspects of a form or a design; it is an emotional language with power to induce and maintain moods through its direction, intensity, quality and colour. As an element of spatial design, it unifies, explains and emphasizes forms in space. The shadows it casts define both form and space, underlining the brilliance of the light itself. In themselves, they form patterns and become integral parts of a design, frequently evoking emotional or symbolic ideas.

Light and shadow thus enhance and control the visual appearance of a design, while in a room they establish and maintain an emotional atmosphere consonant with the intended spirit and use of the space.

LIGHT AS COLOUR

Of the controllable aspects of light, — its quality, quantity, colour, direction and distribution, — colour is often misunderstood and neglected. Although we remember our fundamental physics of light and the experiment in which white light is broken down into its component colour wave lengths by being passed through a prism, we generally fail to connect this phenomenon with the daily experience we call "seeking colour." We think of colour as something we look at, rather than the sensation produced by light reflecting from a surface at a certain speed and wave length which produces the visual reaction we call a colour.

Without light, colour could not exist. In a completely black room, paints have no colour: the colour sensation does not occur until light strikes the paint surface and reflects therefrom into the human eye. If the paint appears to be green, it is because the peculiar consistency of the paint is such that it absorbs all parts of the white light falling on it except the green wave length which, reflected from the surface to the eye, produces the sensation we call green.

Architects and interior designers find these two elements of design, — light and colour, — inseparable; one cannot be planned or controlled without providing for the other, and each exerts a strong influence on the other.

COLOUR DEFINITION

The sensation or phenomenon which we call colour can be defined specifically by determining its hue, its value and its chroma. Colour authorities may vary in the terminology, but all recognize (i) that there are characteristics which differentiate one colour from another and therefore determine the name or *hue;* (ii) that colour may vary in the amount of light reflected from its surface and can therefore be described as having a light or dark *value;* and (iii) that colour may vary in its intensity or concentration of pigment, from very strong to very weak or greyed *chroma.*

The study of these three dimensions of colour has led colour authorities to establish certain standards of measurement and comparison which facilitate col matching and mixing, as well as provide a basis for col harmony.

COLOUR MIXTURE

Early in the study of colour, time must be spent exp menting with coloured pigment and coloured light ascertain how each is mixed to produce the infinite var of hues and colour tonalities. The mixing of complem ary pigment colours to produce either greyed chroma each other or a neutral grey, and the mixing of other p of colours to produce the shades between, reveal the of considering both the values and the chromas of th pigments being mixed. In contrast to the subtrac mixture of pigments (in which each colourant subtract opposite from the mixture: light is subtracted from lig the mixing of coloured light becomes an additive proc (the wave lengths of the coloured lights add up to pro a new totality of colour for the eye: light is added to lig

PECULIARITIES OF HUMAN VISION

No colour in nature exists entirely separate from oth colours; seen always in conjunction with other colou it is the relationship of two or more colours which crea the remembered effect. Not only does a strong colou appear to "colour" a weaker one adjacent to it, but the eye itself does a lot of "colouring" as it reports sensatio The physiological process of seeing colour involves actio and reactions within the eye which, in turn, convey to the brain a report about the colour.

The phenomenon of *after-image,* — in which the eye tains an impression of colour seen, which affects tho colours seen immediately thereafter, — must always considered in the juxtaposition of colours in a design. T fact that the eye is always looking for relief from inten colour, causes it to introduce a film of the complement colour over anything seen immediately afterwards. Th may cause an impression of greyness or a sense of colo which actually is not there. This phenomenon accounts fo the fact that shadows on coloured surfaces appear to ha a complementary hue; hence a roughly textured surfa always looks greyer in chroma than a smooth surface of th same colour.

The phenomenon of *irradiation* causes the eye to enlarg the apparent size of the light form seen against a dar background and conversely to contract the dark form see in front of a light background.

The phenomenon of *fusion* or colour mergence caus the eye to mix the mosaic of two or more colours, meltin them into another colour quite unrelated to the paren colours. Landscape painters of the late nineteenth centur developed this reliance upon the spectator's eyes to do th mixing in their impressionist paintings to its logical con clusion in their technique of broken colour.

VISUAL APPEARANCE OF COLOUR

Not only do we have to anticipate the ways in which the mechanics of human vision will alter the colours being used in a design, but we also have to recognize that colou appear to have certain qualities which convey definite im pressions of temperature and space.

Colour "temperature." The colours in the red half of the

circle of colour described as cheerful, stimul warmth and a g attention on an room, giving th apparent size. or hot colours m ing a sense of c

The remainin described as c soothing, tranqu mosphere of res vision and dispe design and ma contraction in large quantitie barren, almost impersonal.

Colour "solid nature of their define the form pear vaporous, sense of solid colours could b the blues and n form destroyin values and the sense of solid fo chromas of any space. Suitabil very important chair calls for chromas than, would create a

Advancing closely allied t namely that wa definitely the p to come forwar the size of the the case of a r colours tend t thus to reduce the sense of spa desired effect In the small ro the ever popula of the space by room appears pears stuffy an

We design horizontal, ver character and colour we can the planes of c the movement

Furthermore and maintain t people while t

...le of colour (from purple to greenish yellow) can be ...scribed as *warm colours*, — those which are active, ...erful, stimulating and noisy. Such colours bring life, ...rmth and a glowing richness to any design. They focus ...ttention on an object, a part of a design or the wall of a ...m, giving that element significance by increasing its ...parent size. If used in too great quantities, such warm ...riot colours may become irritating and disturbing, creat... ...g a sense of conflict or confusion.

The remaining colours on the blue half of the circle are ...scribed as *cool colours*, — those which are passive or ...othing, tranquil, restful and quiet. They create an at... ...osphere of rest and relaxation; they extend the range of ...ion and disperse the attention, separating the parts of a ...sign and making it seem less crowded because of the ...ntraction in the apparent size of each part. Used in ...rge quantities, cool colours may create a cheerless, ...ern, almost barn-like effect which becomes cold and ...personal.

Colour "solidity." Some colours, because of the inherent ...ture of their appearance, seem to be solid and therefore ...fine the forms on which they occur. Other colours ap... ...ar vaporous, translucent or transparent, removing the ...nse of solid plane or form. Thus the reds and earthy ...ours could be described as form defining colours, while ...e blues and more ethereal colours could be described as ...rm destroying colours. Generally speaking, the darker ...lues and the more intense chromas will establish the ...nse of solid form, while the lighter values and the greyer ...romas of any colour will create the sense of atmospheric ...ace. Suitability of colour to the object or design becomes ...ery important. The obvious solidity of a bulky, massive ...air calls for definite tones of darker value or richer ...romas than, say, a light orchid pink upholstery which ...ould create a bulging, balloon-like effect.

Advancing and retreating colour. A third "effect" is ...osely allied to colour temperature and colour solidity, — ...amely that warm and solid colours not only establish very ...finitely the planes on which they occur, but they tend ...o come forward in the composition, — to expand visually ...e size of the object or to reduce the sense of space in ...e case of a room. Conversely, cool, powdery or smoky ...ours tend to destroy solidity, to recede from us, and ...us to reduce the apparent size of an object or to expand ...e sense of space. It thus becomes possible to control the ...sired effect of length, width or height in a given space. ...the small room, for instance, the use of warm tones, like ...e ever popular amber-buff, will reduce the apparent size ...f the space by as much as 20 or 25 percent. Visually, the ...om appears small and cramped; psychologically, it ap... ...ears stuffy and lacking in freshness.

FUNCTION OF COLOUR

...We design objects and enclose spaces with planes, — ...rizontal, vertical, sloping or curved. Each has its own ...aracter and texture. Through the appropriate use of ...lour we can define not only the form or space, but, by ...e planes of colour creating that space, we can also direct ...e movement of people into and through the space. ...Furthermore, these planes of colour will help to create ...d maintain the emotional moods and reactions of these ...ople while they are in the space. It becomes apparent,

therefore, that colour fulfills the dual function of defining space and establishing emotional atmosphere. In both these capacities, it is a creative agent, — creating space or defining form on the one hand, and creating mood on the other.

COLOUR PSYCHOLOGY

In all the colour qualities and phenomena mentioned thus far, the process of visual transcription and interpretation has been involved. It is the impression which the visual appearance creates and which is transmitted to the individual that defines the form and colour. However, the "seeing" of colour also involves the "feeling" of colour, — the reaction to the emotional connotation of colour. Subtle colour variations and their association with our personal experiences of enjoyment and delight enrich our appreciation of the sensation of colour in a way which no mere optical experience of "seeing" colour can equal.

Individually, we have certain colour preferences, while we find others inimical, depressing or distasteful. Traditionally, we have come to associate certain ideas and qualities with certain colours. Often there is a great variety of conflicting associational ideas: red, for instance, has been connected with early Christian martyrdom, with flags of nations, with robes of church officials, with revolution, with Christmas, with St. Valentine's Day, with Mother's Day, with danger, with the 4th of July, with the R.C.M.P. uniforms.

Furthermore, emotional associations are generally linked with colours: red suggests courage and strength, danger, war or passion; orange conveys a note of warmth, happiness, harvest plenty, laughter and glory; yellow, the colour revered by oriental religions, may suggest sunshine and cheerfulness, or, in its harder tones, cowardice, deceit or decay; green symbolizes victory or safety, and supplies all the satisfying and restful character of the subtle nuances found in nature; blue suggests peace and, although inclined to be "cold," is the most soothing of colours; purple has been reserved traditionally as the badge of royalty.

The designer must understand the psychological reactions to and the associational ideas of colour in order to create the desired effects of gaiety, charm, vibrancy, soothing quiet, freshness, or etc. which a particular space for human occupancy or use may demand.

COLOUR HARMONY

Much has been written about the combination of colours into harmonious colour schemes, but we should remember that the "rules" are merely guides. The success of any colour scheme depends largely on the many conditions attendant to the situation. Any one colour cannot be a "bad" colour; rather, it is its combination with particular values or chromas of other colours that is unsuccessful.

The arrangement of colours in a design of any kind involves three types on contrast. (i) *Contrasts of value* (light versus grey versus dark) are, of course, basic to visibility: we see things because of light and dark contrast. A great variety of effects, — sharp emphatic accents of black and white, or subtle nuances of tonality in greys, — is to be achieved in the manipulation of values alone. (ii) *Contrasts of chroma* (pure versus greyed colour) produce exciting counterpoints of emphasis through rich intensities

seen against greyed, subtly tinted backgrounds. Thus focus, accent, vibrancy and colour insistence are achieved through the relative power of colours. (iii) *Contrasts of hue* produce the endless variety of colour combinations which seem ever tailor-made to create new and fresh designs and spaces for living. Actually, any colour can be combined successfully through the careful manipulation of their values and chromas in relation to the proportionate areas of each. Nevertheless, it is often helpful to recall certain basic colour combination patterns which usually will produce effective results:

The monochromatic scheme, with values and chromas of one colour.

The analogous scheme, with several neighbours from one part of the colour circle.

The complementary scheme, with the two colours at the opposite ends of any diameter in the colour circle.

The split complementary scheme, with the two neighbors of one of a pair of complements substituted for that colour.

The adjacent complementary scheme, with the neighbour of one of a pair of complements added to the pair.

The analogous complementary scheme, with the complement of one of a group of analogous colours added to the group.

The double complementary scheme, with two pairs of complements.

The triadic scheme, with three colours equidistant on the colour circle.

One must remember that the creation of a harmony of colours depends not only on the colours used, but upon the values and chromatic intensities of those colours as well as upon the proportionate relationships of the areas of those colours. The same fundamental principles of good design must be applied in the planning of the colour scheme as are utilized in the creation of a design itself, — balance, unity, contrast, emphasis, rhythm and repetition.

LIGHT AND COLOUR

Colour thus becomes a defining or explanatory agent in design as well as an emotional medium capable of establishing and maintaining atmosphere and mood. Having become acquainted with the physical properties of colour itself as well as with the ways we see it and feel its influence, the designer must investigate the interaction of light and colour. What happens when light falls on colour, — how it reacts, is absorbed or reflected; how light is broken into its component parts to create colour; how the colour of light affects the colour on which it falls; how these reactions can be regulated and controlled by foresight and careful planning. Both light and colour are elements of spatial design and act as agents to unify, explain and emphasize forms, patterns and textures in space.

Light, except that proceeding directly from a light source to the eye, is always coloured by reason of its being reflected from coloured surfaces. Colour sensation, as revealed or produced by light reflecting from coloured surfaces, actually precedes form sensation. Thus colour, light and form are inseparable. Too often this fact is overlooked and colour is thought of as an applied disguise without relation to the form it clothes. Design involves the orchestration of colour, form, pattern and texture bathed in and revealed by that impalpable medium, light.

Colour schemes are effected by conditions of natural well as artifical lighting, — by dazzling sunshine, by sunlight, by cold clear greyness, by heavy mistiness. E regional climate has produced its colour patterns: strong intensity of the colours used in the tropics, the markable restraint and clarity of colour as used in orient, the medium colours and broken tints found regions of grey misty atmosphere, the radiant and gl ing solidity of colour in the clear vibrant atmosphere of Rockies.

LIGHT AND COLOUR ON THE STAGE

Light as a plastic, interpretive medium is best illustrated by the creative work of the twentieth century stage signers.

The stage set is the actor's enviroment; it aids in bring to life the words and characters of the play; it establish the mood of the play; it creates the environment for actor (the time and place); it not only locates action, but forces it and enhances it. Obviously it is not, then, fancy, elaborate decorative composition to catch the and impress the spectator.

"The performance of a play is a living picture. Fir light — the master sculptor — takes for the medium of art the actor with his natural characteristics changed p haps by make-up and costume; it raises to prominence high-lights, and cuts deep into the furrows of shadow produce that life-like appearance which makes the act look his best. When all the shadows have been destro and there is only light, the actor appears flat and two dimensional; when the shadows are natural, he immedi ately comes to life in three dimensions. The director de signs his stage pictures by a variety of groupings as th centre of interest changes from one part of the stage another, from one group to another. As in painting, light directs attention to the centre of interest, and shade leaves the unimportant in its place. Balance in the stage picture is maintained by different intensities of light i different places and on different groups of players."

The stage designer no longer maintains intense illumi nation by which the actor's face can always be seen; rather he seeks to create a mood. Light becomes an instrument for the creation of many changing moods and composition within one basic scene design, — the actors form a group of moving sculpture. Such light that casts shadows is cap able of arousing emotions by so emphasizing and accent ing forms as to give them new force and meaning Dramatic lighting, that will thus reveal the emotional as well as the significant form, is the expressive medium for the scenic designer. Its unifying power creates the desired fusion of stage floor, scenery and actor.

By reason of the fact that the key of emotion can be established almost immediately by the degree and quality of light pervading a scene, light is more than just a scene painter, — it is a scene builder. Impressions of solidity and immensity can be created by this medium. The emotional power of colour, controlled by chiaroscuro of plastic light and shade, can create any desired atmosphere which shall reflect at the designer's will the mood of the actor's speech and movements. Plastic light, rich and in tense, or soft and caressing, falling on surfaces of varied colour and texture, achieves the desired effects comparable to the fluidity of music.

Loss of a

AT SUNRISE on May the passenger train stood on the Esplana Had this great woo might have found it a straight-forward ea lem. Possibly the fe historical hand to un

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The Great Wester the land north of La Cornelius Vanderbilt' way by the famous su with our station. At shared uncovered pla ing. In the same year elaborate terminus, Pa quarters in Ottawa. H capital the following sured. Near the static before erected elegant been made to serve in t Not far away was b Academy of Music — I