

**Colour Design Of Exterior Surfaces As An
Expression Of Architectural Thought**

By

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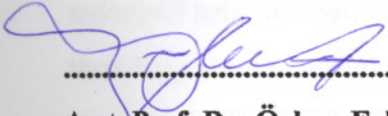
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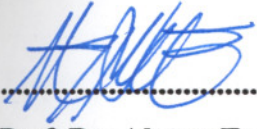


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ABSTRACT

Based on the postulation of the architectural end products communicate with the context by means of their exterior surfaces, this study claims that colour as a design concept is one of the main elements in expressing the architectural thought through out the products' surfaces. Being in a universe where human beings identify the three dimensionality with their perceptions, surface becomes one of the main concepts in identifying and communicating with the environment which they live in. The identification and communication of an object exposes itself through the way which it have been created. This exposition can be the structural and physical properties of the object where as it can be a semantic reflection of its designers' thoughts and personal expressions. The architect utilises the surfaces of the architectural end-products as a canvas in order to reflect their architectural thoughts. However, apart from the other objects, architects' canvases is three dimensional and they are two sided as inner and exterior surfaces. The architectural product's inner surface can be considered as the bordering surface of the designed space. On the other hand, the exterior surface should be considered as the inner skin of the environment.

Within this thesis the components which visualises the thoughts of the designer, as the exterior facades of the building becomes the surfaces of environmental borders, these components will be studied as a part of this design process. Since colour is an important concept of the design process, it will be emphasised within its exterior surface application and its design notions. Especially, in the developing countries colour concept usually comes to the fore just as an esthetical component on the surfaces of the architectural products and can not go further than being a dye which is chosen during the last stage of the construction process. In these circumstances, colour as a surface property becomes one of the main reasons of the visual decay in the cityscapes. In this respect, this thesis does not only point out that colour is one of the main components of the design process but also indicates that colour is an inherent part of the expression of the architectural thought on the exterior surfaces of the architectural design objects which should be considered in relating with the characteristics of the environment.

Keywords: Surface, Architectural Surface, Exterior Surface, Environmental Skin, Colour, Colour Perception, Functional Colour, Surface Colour, Colour in Architecture.

ÖZ

Bu tez mimari ürünün dış cidarının, içinde bulunduğu ortamı oluşturan yapı ve doğal çevreyle ilişki kurduğu ve mimari fikrin sunum zemini olduğu kabulüyle, rengin de yüzeyde düşüncenin ifadesini sağlayan dili oluşturan ana tasarım öğelerinden biri olduğunu öne sürer. Algılarıyla anlamlandırıldığı üç boyutlu cisimler evreninde yaşayan insanoğlu için yüzeylerin, cisimlerin onunla ve onunda içinde bulunduğu ortamla iletişim kurmasını sağlayan önemli elemanlardan biri olduğunu ön görmek yanlış olmayacaktır. Bu iletişim dilini oluşturan öğeler, salt objelerin yapısal özellikleri hakkında fikir veren bir bağlamda olabileceği gibi tasarımcısının ona yüklediği anlamı yansıtmak amacıyla da kurgulanmış olabilir. Bir obje olarak mimari tasarım ürünü de içinde bulunduğu veya oluşturduğu çevre ve bu çevrede bulunan canlılarla olan iletişimini büyük ölçüde yüzeyleri ile gerçekleştirir. Tasarımcı kurgusunu uzay ve mekanda var eden bu yüzeyleri, aynı zamanda mimari fikrini ortaya koyan tuvaler olarak kullanır. Ancak mimarın tuvali, üç boyutlu ve çevresini oluşturan diğer objelerin çoğundan farklılıkla iç ve dış olarak çift cidarlıdır. Mimari ürünün iç cidarı tasarlanan mekanı sınırlayan bir öğe olarak düşünülürken, dış cidarı ise içinde bulunduğu çevrenin iç cidarını oluşturur.

Bu tezde, tasarımcının söyleminin ifade yüzeyleri olarak çevresel cidarları oluşturan yapı yüzeylerinde düşünceleri dile dönüştüren öğeler ortaya konacak ve bu öğeler tasarım elemanları anlamında incelenecektir. Renk kavramı, bu öğelerin en önemlilerinden birini oluşturduğu kabulüyle dış çeperdeki tasarım kurgusu anlamında irdelenecektir. Özellikle gelişmekte olan ülkelerde salt estetik bir öğe olarak düşünülen renk kavramı, çoğu zaman mimari ürünler için yapı üretimi aşamasında karar verilen bir malzeme olmaktan öteye gidememektedir. Bu durum renk öğesini kent dokuları için görsel bir kirliliğin en önemli sebeplerinden biri haline getirmektedir. Bu tezin amaçlarından birini, renk kavramının da tasarım süreci sırasında çevreye ait fiziksel özelliklerle beraber düşünülmesi gereken kurgusal bir öğe olduğunu ispatlamak oluştursa da, bunun ötesinde olarak bu tez rengin mimari düşüncüyü dış çeperde ifade etmede temel bir tasarım aracı olduğunu öne sürer.

Anahtar sözcükler: yüzey, mimari yüzey, dış çeper, çevresel cidar, çevresel imge, ifade aracı, renk, renk algısı, fonksiyonel renk, yüzeyde renk, mimarlıkta renk.

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CHAPTER I

INTRODUCTION

“Colour as enhancer and modifier of space and form, colour as symbol, colour as generator of mood: it is time to struggle to understand the wonderful complexities of colour.”
(Davey, 1998, p.35)

1.1. DEFINITION OF THE PROBLEM

As an inherent part of the visual integrity, colour constitutes one of the most important properties of *visual impression* of the physical or virtual objects. It has the greater part of the role in defining the surface identity of the substances which forms out the elements of the living environments. Perceiving the colour of the physical objects provides the observers, not only to sense the pleasure of the diversities but also to get the knowledge about their surroundings. As a matter of fact, beyond being just an element of the visual beauty, colour in nature, has always included functions such as attracting attention, imparting information or expressing emotion. Being inspired from the nature; human beings, especially in visual arts, have utilised these properties of colour in order to express themselves.

From the architectural point of view, colour should be considered as an indispensable part of the design concept which provides the architects to transform their discourse to a three-dimensional object. However, within the contemporary architectural end-products, colour usually comes to the fore with its aesthetical aspects rather than its conceptual notions. Particularly for developing countries, this underestimation when combined with insensitivity to the context of the architectural design object, causes a colour pollution in the cityscape. Even some individual examples of good colour applications may involve into that kind of pollution too, when they are juxtaposed with the other end-products in a city context. One of the other reason of the insensitive colour application in the developing cities is also derived from disrespect of the colour concept at the beginning of the design process and leaving it to the last phase of the construction process. The reasons of the colour pollution and inattentive colour applications especially in the cities of the developing countries, can be itemised as follows;

- *The physical properties (such as colour, texture, shadow...) and the significance in the city contexts of the exterior surfaces of the architectural design objects, have been ignored by most of the architects.*

Architectural end product, which constitutes a figure in the shapeless and endless ground, separates its physical structure from the remaining universe with its contours that are defined by its shell. The shell of the building since its main function as defining space quality, differentiates from the other mass objects with its dual faces property which determines as inner and outer. The inner surface of the shell limits the inner space by means of defining its physical limits, on the other hand exterior skins constitutes not only the physical boundaries of the building but also the inner surfaces of the environment. However, exterior skins of the buildings generally is considered as the outermost parts of the design activities and, therefore, their visual interactions with the context have been underestimated. Whereas, it is not possible to be perceived the physical properties of exterior surfaces of the buildings apart from the effects of the environment. As being one of the most important of these tangible concepts; colour of the exterior surfaces are highly affected from the variable and dynamic effects of the surroundings.

- *Colour is applied to the exterior surfaces of the buildings, mostly without being conscious of its physical properties and characteristics.*

Since, the perceiving colour activity is a result of a physical process, it is required to control all its extends in order to understand it as a natural phenomenon. There are two main ways of utilising colour as a design notion in architecture: as a quality of surface and quality of light... Colour of the surface differentiates from the colour of light with its property which depends on the physical characteristics of the objects. Therefore for the architectural activity in designing colour it is required to know not only the physical properties of it but also effects of perceiving it on the surface of the objects. However, most of the architects consider colour concept as dye and utilise it without knowing its physical capabilities. When this lack of knowledge about the visual properties of colour combines with the insensitive application techniques, colour pollution starts to be appeared.

- *Colour schemes of the cities are being ruined for the reason of the disrespect of the relation between the colour of the exterior surface and its urban context.*

Colour quality of an exterior surface as a physical property, is borne on the environmental effects of the surroundings simultaneously affects the colour scheme of

the context. Besides, appeared colour of the exterior skin can be altered with the variable peculiarities such as weather, time, value of the sunlight, of the environment. However, the interaction between the colour scheme of the surrounding context and the design object is being underestimated, namely the change in the perception according to the figure-ground relation. The reason of this is that the designers usually deal with the exterior skin only without considering them in the urban context. Consequently, this insensitive approach causes a colour pollution instead of creating a harmonious colour scheme, particularly in the developing cities.

- *The wide range of opportunities of colour in expressing the design thought on the exterior surfaces have been underestimated by most of the architects.*

Apart from the inner surface, exterior skin of the shell of an architectural design object can be considered as a scene where the architectural thought is displayed. Beyond the complexity of the architectural discourse that is being reflected in the very presence of the end-product, there can be always a series of basic design concepts on the exterior surfaces. Although, colour should be considered as one of the most important tools of the architect in order to express or emphasise his/her architectural design approach, in the contemporary architectural agenda it mostly comes to the fore with its aesthetical value rather than its conceptual capabilities.

1.2. AIMS OF THE STUDY

Within the conceptual framework which is originated by the expressive quality of colour as a design concept, the major subject of this study is defined by the physical and conceptual peculiarities of the exterior architectural surfaces. In the light of the defined problems the objectives of this study can be itemised in four main articles;

- *This study aims at evaluating the exterior surfaces of the buildings as figures in context by emphasising their physical properties in relation with the environment.*

Exterior surface which is called as environmental skin in this study in terms of the surface continuum property of the architectural shell, owing to be the contours of the three dimensional figure simultaneously forms out the inner surfaces of the context. Therefore, the physical peculiarities of the outer skin of the architectural shell started to be involved by the surroundings. In this respect, this study aims to examine the

distinctions between the exterior and interior surfaces. Another objective of the study is to evaluate the physical properties of the exterior surface which are affected by its dual characteristics by means of constituting the inner surfaces of the environment. Being beyond the outermost part of the building, environmental skin is given a responsibility as displaying the architectural approach to the observers. Another objective of this study is to examine the exterior skin in terms of its physical properties, in order to question the capabilities of colour in the expression of the architectural thought.

- *This study which assumes that colour is utilised in built environments without knowing its physical capabilities, also aims to explicate the basic concepts of colour from the architectural point of view.*

Appeared colour as a result of a physical phenomenon, has been researched by the scientists artists and architects since the antiquity in order to explain its complex and versatile structure. From the architectural point of view, colour is generally concerned by its properties which affect the perception quality of the architectural design objects. Therefore, this study aims to examine not only the basic concepts of colour in pertaining to the physics but also its dimensions in relating with the architectural activity.

- *This study which claims that the disrespect of the relation between the colour of the exterior surface and the context ruin the colour scheme of the city, aims to evaluate the quality of colour on the exterior skin under the influence of the environment.*

Owing to the nature of the physical process of the colour perception, it is not possible for the buildings and its surface peculiarities to be perceived apart from its context. In the light of this statement, this thesis aims to evaluate the colour design activity on the environmental skins of the architectural end-products in relation with the effects of the characteristics of the physical context.

- *This study aims at examining the conceptual capabilities of colour in order to emphasise the architectural thought on the environmental skin.*

An overview of the various ways of expressing the architectural thought shows that architect as a designer utilises the basic design concepts in order to state the architectural approach on the exterior surface which is called as environmental skin by this study. Therefore another objective of the study which aims to analyse colour as a

functional notion on the architectural skin, should be investigated the methods and ways of the architects in expressing themselves on the exterior surfaces. This study assumes that colour as a notion which is one of the most important tools of this expressiveness process, should be considered beyond its esthetical values as a conceptual notion.

1.3. METHOD OF THE STUDY

This thesis investigates the answers of these four major questions, stated above, by following these cognitive ways as follows;

- *This study examines how the colour concept as a physical property changes when the exterior surfaces of the objects are assumed as the inner faces of the context simultaneously.*

This study, which proposes a conceptual definition to this dual structure of the exterior surface, focuses on the differentiation of the environmental skin compared the inner surface. In this respect this study also zooms at the physical properties of the environmental skin which provides the architects to express themselves on the environmental skin and assumes that colour is one of the most important tool in order to achieve this goal.

- *This study investigates what are the basic physical notion of colour in order to utilise it as a design concept on the exterior surfaces of the architectural objects.*

This study also focuses on the physical properties of colour owing to be a diagnostic property in perceiving the architectural end-product attitude. The basic concepts of the colour phenomenon should be explained in order to throw a light on the further parts of the study. Considering an obvious fact that colour perception process can not be evaluated apart from the environmental effects, this study zooms at the theoretical levelled process of the perception in relating with its effects on the result.

- *This study aims to apply the figure-ground relation in the colour theory to the building-city couple in order to understand the changing quality of the colour perception.*

For the reason that appeared colour of the exterior skin is the result of a perception process, and therefore, this study foremost zooms at the effects of the architectural

context in the perception process of the surface colour. This study also focuses on the effects which stems from the physical peculiarities of the surface such as material or texture, alter the appeared colour. In order to provide an approach model for the architects to the colour quality of the urban context, this study also focuses on the city examples which have preserved colour schemes.

- *This study investigates the methods that the architects can utilise in order to express or emphasise the architectural design thought by means of the colour concept.*

This study, which assumes that in order to be able to form out a general scheme for the colour approach of the contemporary architectural discourse, examines the evolution of the concept. In order to achieve this goal the general evolution of the colour idea with the transformations of the environmental skin in the architectural design history should be investigated by means of the inferences of the historical surveys. As an evaluation of these examinations this study also zooms at to the ways of utilising colour of the architects on the environmental skin as an expression of design thoughts, particularly in terms of the crucial examples of the 20th century architectural agenda. The sampling is based on the examination the specific cases that display the main properties of the selected subject.

1.4. ASSUMPTIONS AND LIMITATIONS

This thesis which aims to examine the ways of utilising colour concept in architecture in order to express or emphasise the architectural thought, is required to focuses on the environmental skins of the architectural objects with the design discourse of their period. For the reason that it is not possible to consider the design approach of the environmental skins and their colour apart from the contemporary architectural discourse, parallel reading technique is preferred by the study. This technique is required to study on a comparative basis with respect to the colour preferences of the architects as well as the contemporary design discourse. Aiming to constitute a conceptual framework for utilising colour on the environmental skins, this study focuses on the examples of architectural end-products of the 20th century discourse. Changing function and the meaning of the shell of the three dimensional architectural objects as environmental skins in this period constitutes one of the main reason of this decision.

CHAPTER II

EXPRESSION OF ARCHITECTURAL THOUGHT BY MEANS OF THE EXTERIOR SURFACE

The world that human beings live in and experience all along their lives, is formed by the spaces, which are recreated by their perceptions in their mind. The interpretations of the environmental stimuli enable us to get all the knowledge about the universe and, therefore, provide the living beings to survive in it. In fact, most of these perception inferences depend concerted on the objects that constitute the world by means of their existence. In other words, living beings take place in a universe of the three-dimensional substances, which define the environment itself. From the beginning of their lives they started to interpret the objects and this effort of analysing the surroundings continue during the life till the end. As a matter of fact, if the definition of the object is determined as the definition of the volume, the surface can be considered as the outermost skin of the substance, which is perceived at the first glimpse. In entire life, the individuals spend their times to communicate with the other three dimensional substances like them, and they generally just perceive their surfaces which are covered. In the light of this statement, it is possible to consider that the surfaces of the objects are one of the basic elements of the three dimensional universe.

2.1. THE DEFINITION OF ARCHITECTURAL EXTERIOR SURFACE;

The exterior surface or the outer skin of the architectural object becomes the most perceived part of the object-world that the human beings experience. For the reason that, the architectural end product, as a three-dimensional design object, forms out a great part of the substances in the surroundings. As long as the human beings keeps on modifying the terrestrial environment, the architectural objects became the most important part of their surroundings with their tactile qualities and three-dimensional effects. The architect is not only a designer of a specific construction but also he/she becomes one of the persons who decide and organise what kind of an environment that the human beings will experience in their entire lives. For the reason that every building in the environment simultaneously forms out an interference to its context with its existence. From the point of view of the observer it stimulates a new

figure in the old background because he/she establishes a relationship with its physical boundaries. This physical boundaries which is designed by the architect according to him/her architectural thoughts, can be called as the exterior surfaces of the building too. As a matter of fact these exterior skins at the same time shows the approach of the architect to the concept of the context of the architectural design object. Therefore, It is proposed that in this study that the surface as a concept should be examined in order to explain the architectural surface and its visual properties.

2.1.1. THE GENERAL STATEMENT OF THE SURFACE

“ Surfaces – largely overlooked, mostly ignored, each with its own story – are all around us, the fabric of our existence. Natural or man-made, complex or simple, rough or smooth, they underpin our tactile and visual experience of the world. Whether mountainous or microscopic, they are with us at all levels, creating a universe of infinite texture and detail.” (Baran, 2000)

The surface can be defined as an outer region of the object, which separates it from the rest of the universe. In other words, it is part of the substance, which shows and defines its properties. The definition can be pointed out that;

“ The surface of a solid object is the outside or top part of it..... a surface is the thin layer of a particular substance that covers the outside...” (Collins, 1988)

In the light of this statement, it is possible to consider that the surface as the outermost portion of a mass, becomes an illustrative part, which bears its material, constitutional or conceptual properties. Although our universe is formed by the three-dimensional substances, the surfaces of these objects have generally been regarded as two-dimensional. Since its measurement of the third dimension (width) is usually accepted as comparatively shorter in proportion. It can be also assumed that conceptually the surface as a concept can be considered as two dimensional, although for the three-dimensional universe it is not possible the existence the two-dimensional things. By definition, surface includes the meaning, which is considered as a skin or only about the outer relations of the object. However, for various examples, it is hard to define where the surface begins and where it ends.

“French poet and critic, Paul Valery once ironically noted that ‘the skin is the deepest’ – which is an intriguing way of drawing attention to ‘skin’ as a surface of maximum interface and intensity..... In its very nature a surface is in an unstable condition. For where are its boundaries? What is its status?”
(Imperiale, 2000 pg. 5)

Especially, for the mass structures, surface is formed by the outermost points touching to the space, for the reason that the material structure of them has the same properties from the outermost points to the deepest. On the other hand, for the three-dimensional objects, which the surface exists just as a covering material of a volume or a system, it becomes a shell for the inner functions. For instance the individual’s surface as a concept transforms in to the skin and takes the function upon itself, which includes covering the body and protecting it against to the effects of the outside. Nevertheless, in the situation of the surfaces of a volume or as a covering of a space, it should be considered by the way of two orientations as inner and outer surfaces.

“The external configuration is usually rather simple, but there is packed into the interior of an organism an amazing complexity of structures which have long been delight of anatomists” (Venturi, 1977)

In their entire life, the human beings usually perceive and communicate surfaces of the objects. Therefore most of the information about the environment that they live in, are based on the knowledge which are related to the surface properties of the objects. Because, the stimuli that constitute the origin of our perceptions, can be arisen from the surface qualities. Especially, two of our five senses, which provide us to understand the surroundings and the relations between them, are the senses of touching and seeing. They generally depend on the surface qualities that usually bear all the peculiarities of the object surrounded by it. Our visual perception is formed by the light. However most of the light beams do not come directly from the illuminating objects. Our perception phenomenon, which provides us to see the environment, extremely depends on the reflected or transmitted lights, which are come from the objects and their surfaces. On the other hand, it is possible to consider that the sense of touching almost extremely depends on the surface quality. In fact, this term includes the peculiarities of the

surfaces, which forms most of the information about it such as material, colour, texture or pattern.

From the scientific point of view, the surfaces basically can be examined in two groups as physical and perceptual surfaces. Perceptual surfaces which in fact do not exist as a material but to be perceived, such as holographic surfaces or the light images. They are not just created by the three or two-dimensional light base images but also are constituted by the optical illusions. These optical illusions can be examined with the Gestalt perception rules. Most of the visual surfaces of the optical illusions stems from the rules, which are called as the *purest and the biggest*. For instance as can be seen at the figure 2.1. a row which is constituted by the columns can be perceived as a illusionary surface.

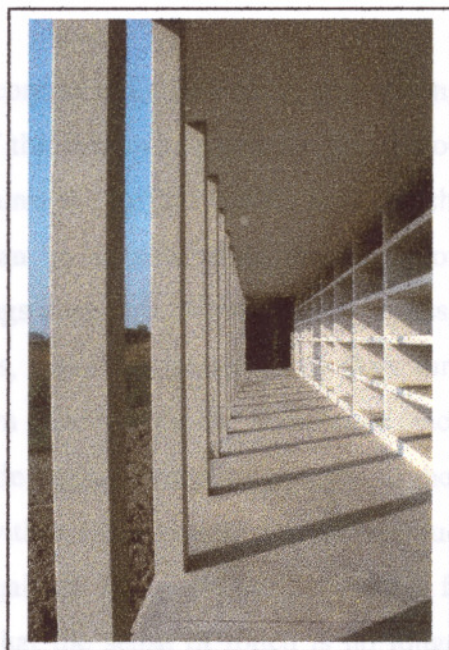


Figure 2. 1. Perceptual surface (source: Curtis, 1997)

According to this Gestalt psychology rule, the eye completes the figures to the purest and the biggest form. The substances, which are repeated, or the object which is only defined by its borders can be good examples to this phenomenon. On the other hand, some kind of substances has the surface, which is hardly to be perceived even if existed, such as transparent objects. The liquid surfaces constitute a different category among these because of their unstable and extremely depend on the gravity surface property. Physical surfaces can be examined in two groups as the organic and inorganic surfaces.

Organic surfaces are formed mostly by the outermost skin of animates and almost for every time they are important for the creatures in order to survive. It is the part of them, which provides people to communicate with the surroundings, to give shape of them, to explain the things that are formed their environment, besides for various living beings it is the only way to breathe. Furthermore, the objects that surround and create our space that the human beings live in, are usually come into existence by inorganic surfaces. They can be organised in two group as natural and artificial surfaces. It is possible to consider that the human civilisation had begun with the first attempt of changing the objects which are formed their environment, by shaping their surfaces. Transforming them has always been a some kind of adventure, which has been continued throughout the mankind history. Consequently, in the light of this statement, as a different definition, technology may be determined as augmentation of the artificial surfaces.

As mentioned before, according to an individual, perception of the surface is constituted the basic information of the life and its surroundings. However, like all of the other stimuli, the reactions against the surface quality have psychological meanings in it and growing as a process can be considered as increasing of the knowledge about the environment and the things created it. While in this process, living beings forms a code for all kind of substances, which are perceived by their surfaces. Therefore every kind of surface gains their own meaning and the code takes place in the individual's minds. The senses, which provide human beings to understand the universe, are developed as they grow older and within this process the sense touch is so improved by the experiences, which are gained. Therefore the individuals form out a code system for every specific surfaces that the sense of touch is no longer needed to understand its properties. For instance, experiencing by touching the steel, cotton, or marble once in a life, knowledge of their specialities that the steel is tough, cotton is soft and the marble is cold, are coded in the mind even if it is not touched. These codes are not only about the surface's peculiarities such as softness, toughness, but also the psychological signals such as danger, hot, cold, etc...

Certainly, it is not possible to conceive the codes of the surfaces by separating their characters, which are formed by the material and its texture and colour. Besides, generally the psychological meanings or the codes of the surfaces are created by them.

Sometimes these surface codes are hardly depended to the substance that it reminds the individuals not only its physical properties but also the object itself. The skin of a cow or a zebra can be good examples to this statement, because of the shape of their pattern. Whenever or wherever this pattern is perceived by an individual it is directly retrieved the object. As far as it is considered, the developing of the human civilisation can be conceived as parallel to the improvement of the artificial surface technology. Every new source of material, which is created, has expressed its own surface quality and this has influenced a different fashion or a style with in different periods of the time. However, during the recent years, with the usage of the enhanced technology, substances are started to be perceived as a different material by changing their surface peculiarities such as colour and texture. Thus, this causes to be sliding of the meanings of the surfaces and its codes in the individual's minds. Being perceived the plastic material as steel, wood, or glass can be good examples to this statement. Since, for the most of the artificial surfaces it is not possible to be imitated the material and textural effects, which are based on the sense of touch, just, to be liken its external view.

2.1.2. THE DEFINITION OF THE ARCHITECTURAL SURFACE

The definition of the surface was expressed as a part of any object, which is separated it from the remaining space that included all of the substances created our environment. In the light of this statement, architectural surface can be considered as a part of the architectural design, which is constituted a limit of the defined space and a distinctive element, which separate it from the universe (Beşgen, 1999). Although the definition of the architectural surface has been formulated like as same as the explanation of the surface, the primary difference of the statements can be summed up concern of creating space. According to a different approach, architectural surface is defined as a place in between the body or inside of the volume with the environment or outside. Since the living beings perceive the existences or products by their appearances and these surface appearances are the in-between places which cover the body of the object or effecting area (Pamir, 2000). Conceptually architecture already includes the aim of defining space in itself. Exemplifying this, a shelter is constituted by a surface, which is located as a parallel angle to the ground. The surfaces are generally instituted in order to build a volume. This statement can be examined by determining the definition of volume itself as below;

“A line extended in a direction other than its intrinsic direction becomes a plane.” or surface and *“a plane extended in a direction other than its intrinsic direction becomes a volume...all volumes can be analysed and understood to consist of... planes or surfaces which define the limits or boundaries of a volume.”* (Ching, 1996, p: 18)

The definition of the architectural surface has both the meanings of the produced explanations of the surface and the created volume that has a privilege since it forms space providing the individuals to live in. In the light of this statement, it can be pointed out that the architectural surface is a part of the design, which exposes the form of the construction and its peculiarities. Generally, these properties of the architectural surface constitutes the quality of the space such as height, length, texture, colour, ...etc. According to Le Corbusier architecture shows itself by the agency of the body and the surface. He pointed out that the masses are covered by surfaces, which are divided with the contours that lead and create the body. The surface gives its character to the body (Corbusier, 1999). In fact it is possible to point out that the architect designs the surfaces, which create the volumes in order to serve any function. Therefore, it is an obvious fact that these surfaces, differentiate from the artistic surface, which can be called as canvases too for the reason that, they have the third dimension or width.

“Planes in architecture define three-dimensional volumes of mass and space. The properties of each plane –size, shape, colour and texture- as well as their spatial relationship to one another ultimately determine the visual attributes of the form they define and the qualities of the space they enclose” (Ching, 1996,p:19)

The formation of the surface of the architectural space can be considered in two lines of thought approach as induction and deduction in terms of mathematics. Induction approach can be summed up as defining the architectural surface by means of the limiting component of it. On the other hand, deduction approach of the architectural surface has a different meaning, which defines it as a discriminating element of the designed space from the rest of the universe. At this standpoint, the meaning of the architectural surface changes, therefore, starts to be exaggerated its third dimension

(width) and transforms to a shell, which has two surfaces as inside and outside. From the perception rules point of view, the counter of the object has a changing attitude related to the standpoint. According to the figure and ground relation, perception of the contours changes depending upon the acceptance of which one is figure or ground.



Figure 2. 2. Figure and Ground perception, Esher (source: Zelanski & Fisher, 1996)

“In perceptual studies particularly, psychologists have limited their attention mostly to the simplest case of the figure-ground relationship, in which the ground, only one relation appears as endless and shapeless... The figure has an articulate shape, from which the active properties of the percept derive. Its shape is the sole determinant of the relation between the two partners in the situation. The ground is induced by the figure to lie behind, and it lacks boundaries even in relation to the figure since it continues beneath the figure without interruption.” (Arnheim, 1977)

Vase and face image, which is very famous, can be a good example for this suggestion (Arnheim, 1977). This relationship can be established not only for the graphics but also for the three dimensional objects. Architectural environment is formed by the three-dimensional objects and therefore the contours become the most perceived part of them. Inside of the surface can be considered as a limit of the space, which forms and defines. Hence, it relates to the inside of the architectural design object and generally it has a meaning of privacy for the reason that concerning to the living beings of the inside. On

the contrary, outside of the surface has a public meaning and it belongs to the environment more than the users of the architectural end product. In the light of this statement, another simple figure and ground relation occurs. It is possible for the figure and ground concepts to reverse each other according to the standpoint.

2.1.3. GENERAL DEFINITION OF THE ENVIRONMENTAL SKIN

“Forms are not bounded by their physical limits. Forms emanate and model space. Today we are again becoming aware that shapes, surfaces and planes do not merely model interior space.” (Giedion, 1976)

As mentioned before the architectural surface has binary meaning as inside and outside, one of which belongs to the interior space, the functions to be served and the inhabitants. The other meaning of the architectural surface on the other hand belongs to the surrounding, the cityscape, the silhouette and the spectators. According to the figure and ground relations the environment, which is created not only by the natural surroundings but also by the other architectural objects that we live in, is admitted as an endless space. Since the outside of the exterior surface forms the contours of the architectural object. Besides in the endless and the shapeless ground, contours are controlled by the positive figures. Rudolf Arnheim pointed out that;

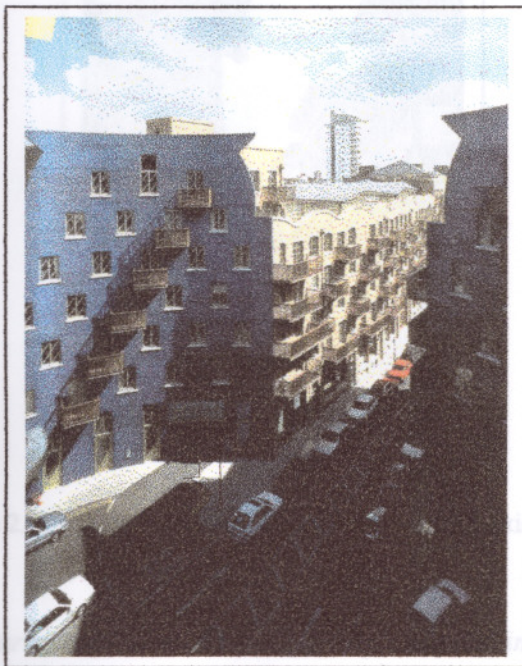


Figure 2. 3. Example to the environmental skin concept

(sources: Curtis, 1997)

“A building certainly stands in an environment, and for better or worse the two depend on each other... But physically the environment is endless, and we find it by no means easy to decide how much of the context we must consider to do justice to a particular building.. Clearly there are no fixed bounds in either space or time for any object. But relativity should not deter us from attempting to describe architectural objects with some precision.”(Arnheim, 1977)

Therefore, the architectural surface has two faces where the inside of it constitutes the inner skin of the created space. Although the outside of the surface constitutes the outer skin of the architectural end-product, therewithal, it is possible to consider as it forms the inner face of the environment related to the figure and ground relation phenomenon. As a contour, outside of the architectural surface can be related to different figures according to the point of view and the acceptance of which the figure or the ground is. Consequently, the outside surfaces of the architectural objects can be considered as the inside faces of the environment where these objects are located on, and it is possible to define these faces as environmental skins.

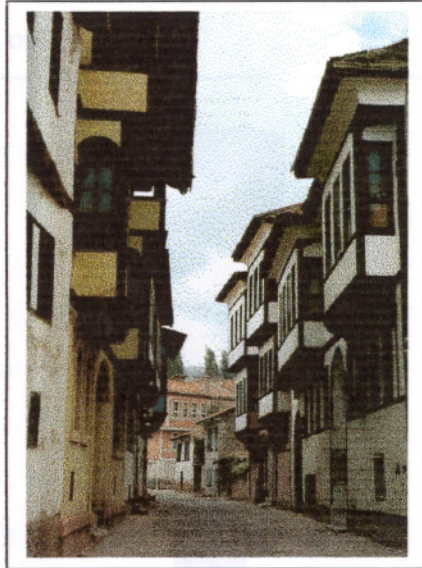


Figure 2. 4. Example to the environmental skin in Turkish pattern
(source: Küçükerman, 1995)

“Boundaries turn out not to be the kind of inert delimitation they seem when looked at as properties of physical objects... The man in the street is even less likely to be aware of the dynamism of perceptual objects, although it always has

some influence on his visual world. The basic premise of this approach is the recognition that interspaces can be, and often are, visual objects in their own right. Some years ago, the British artist David Carr exhibited sculptures derived from the interstices between New York's skyscrapers. The steplike setbacks of the buildings yielded a kind of hanging stalactite." (Arnheim, 1977)

This sculpture shows an in-between space, which the perception as an object is not common in daily life (Figure 2.4). It can be considered as a good example of reversing the figure and ground concept. According to this, the architectural objects form the ground of the image and the figure is created by the space which is in their between. Hence, the contours of the figure are the outside surfaces or the facades of the buildings. In the light of this statement, it is possible to point out that the environmental skin or the facade of the building (the definition changes according the point of view) are the same and express the one thing. However as a word facade has a meaning which includes both inside and outside, furthermore it also means perceptual faces of the building. Nevertheless, the environmental skin of the architectural object means its outermost surface or its shell, which relates with the surroundings more than the inner parts of the building. Arnheim pointed out that;

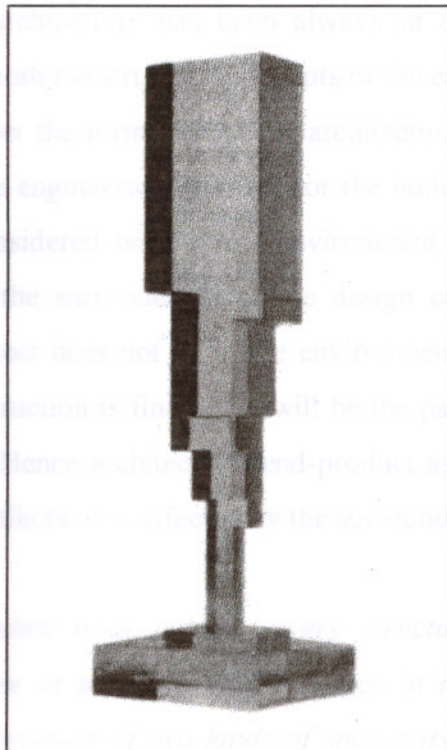


Figure 2. 5 sculpture by David Carr (source: Arnheim, 1984)

“Architecture as we know it combines two not easily reconciled tasks. On the one hand, it has to provide a shelter that protects its inhabitants against unwelcome outside forces and offers them a congenial internal environment. On the other hand, it must create an exterior physically adapted to its functions and visually impressive, inviting or deterring, informative, etc.”(Arnheim, 1977)

Architectural design object is a whole where the parts of the design cannot be considered as separated abstracts. However throughout the history, architectural approaches according to the shell of the building, has differed relating to the spirit of the age, because of the transformation of the relation with the inside and the outside of the surface. Sometimes outside has existed as the reflection of the inside, on the contrary sometimes it has been separated and has declared its independence. In other words, the point of view of the architect or the age can be analysed by determining their approach against the environmental skin of the design. These approaches have transformed age to age in the light of the changing respects of the architecture since the beginning of the civilisation. The evolution of the environmental skin will be examined in the forth chapter with the evaluation of the colour idea in architecture.

The standpoint of the architecture has been always in between of the art and the engineering. It includes both the structural concepts of the engineering and the esthetical values of the art. However the formation of the architectural form neither just depends on the formulation of the engineering science, nor the building stands alone like an art object which can be considered without the environment. Wherever the architectural end-product is located, the surroundings of the design constitute the ground of the figure. Even if the architect does not let to the environment to affect the design of the building, when the construction is finished it will be the part of the ground, which will affect the other figures. Hence architectural end-product as an art object can never be considered alone and it affects or is affected by the surroundings.

“Since every architectural volume, every structure of walls, constitutes a boundary, a pause in the continuity of space, it is clear that every building functions in the creation of two kinds of space: its internal space, completely defined by the building itself, and its external or urban space, defined by that

building and the others around it. It is evident then that all those subjects which we have excluded as not being true architecture –bridges, obelisks, fountains, triumphal arches, groups of trees and, in particular, the facades of building- are brought into play in the creation of urban space” (Zevi, 1993)

In the light of this statement, environmental skin as a relative part of the design can be regarded as a surface which is both belonged by the architectural construction and not. It is belonged by the building because, it is the surface, which forms a boundary for the created space and has two faces as inner and outer. It is not belonged by the building because of its peculiarity, which forms a part of the ground for the other figures. Consequently, the architectural end-product is perceived as a portion of the environment. Nevertheless, for the observer it is not possible to perceive the architectural object both from the outside and the inside simultaneously.

“Perceptually and practically, the worlds of outside and inside mutually exclusive. One cannot be in both at the same time. And yet they border directly each other.” (Arnheim, 1977)

This contradiction has always been a problem for the architectural design history, which obliged the architects to accept one attitude towards to the inner and outer relationships. As mentioned before, although the main purpose of the construction of the shell of the building is to form the boundaries for the designed space, the outer surface of the building constitutes the inner facades of the pattern, which is shaped by the environment. Therefore, the environmental skin as a plane between the outer and the inner spaces is transformed to a place where the ideas are expressed as well as its function, which depends on being a separation. The characteristic of this separator varies according to the relation of the spaces, which are distinguished by it. If this relation is completely isolated the environmental skin is transformed into a border. On the other hand, if the inner and outer spaces are tried to be combined and as a single space this boundary starts to disappear and sometimes it starts to lose its perceptibility.

“Designing from the outside in, as well as the inside out, creates necessary tensions, which help make architecture. Since the inside is different from the

outside, the wall- the point of change- becomes an architectural event. Architecture occurs at the meeting of interior and exterior forces of use and space. These interior and environmental forces are both general and particular, generic and circumstantial. Architecture as the wall between the inside and the outside becomes the spatial record of this resolution and its drama.” (Venturi, 1977)

2.2. EXPRESSION OF THOUGHTS ON THE ENVIRONMENTAL SKIN IN TERMS OF COLOUR

“ ‘surface-into-meaning’ ‘How meaning occurs on the external plane.’ ‘... worry about surface, about the interface formed by materials as they stretched across the frame of either painting or three-dimensional object, aligning the meaning of the work with its physical medium. As that medium ‘surfaced’, contingently, into the world.’ ” (Rodolofa & Khoury, 1995, p.43)

The surface, which forms the three-dimensional boundaries of the designed space, simultaneously is a part of the construction, which provides it to communicate with the environment. Besides the environmental skin gives its perceived character to the building. Consequently, the architect as a designer establishes the visual relation between the design and its surroundings by means of the exterior surface attitude. If the definition of the architecture is basically stimulated as organisation of the environment, it is a fact that cannot be denied that, the design object cannot be isolated from its context. In the light of this statement, the architectural end-product as a figure has always a ground and the environmental skin as the inner surfaces of the environment or the contours of the ground, expresses its designer's behaviour.

“Among the various kinds of meaning that this third group of theories attempt to ascribe to architecture, three are especially popular: expressive, symbolic and semantic meaning...” (Weber, 1995)

The expression of the behaviour on the environmental skin is formed out in order to organise the design components of the architectural activity. Architectural three-

dimensional object as an end-product of a design process, created in the way that being influenced by the attitude of the designer. Even though the architect does not want to express a specific thought on the exterior surface, he / she is concerned in design process by the culture, background or interests and the design is occurred in light of these effects. According to some theories, perception of form is always loaded with meaning and they are considered that the architecture as a designing activity, is a system of signs or languages. (Weber, 1995) This language can be seen as an architect's private tendency on the other hand can be formed out as a style.

“The word ‘element’ denotes a characteristic unit which is a part of an architectural form. The term has a double meaning as it denotes both an independent whole (Gestalt) and a part belonging to a more extensive context. It is convenient to classify the architectural elements. Our main categories we will base upon the concepts ‘mass’, ‘space’ and ‘surface’. The surface may act as a boundary to masses and spaces...” (Norberg Schulz, 1997)

Architects form out their private language and exhibits it on the surface where the building communicates with its surroundings, by means of using the components of a three dimensional object in order to combine them according to his/her architectural design approach. At the point which these designs have a three-dimensional property, the environmental skin is gained its visual characteristics such as static, dynamic, heavy, light, stable, unstable... etc. by means of these elements. Furthermore, it is transformed into a whole occurred by them. From the artistic and the architectural point of view, these elements generally are considered as the peculiarities of the beauty. On the other hand, the environmental skin as a contour between the figure and ground or inside and outside can be examined in terms of the principles of the figure and ground relations. The architectural end-product is affected by these laws as a figure on the ground, which occurs by the natural or artificial surrounding objects, the earth itself and the sky. Consequently an architect as a designer designates a standpoint against these laws according to the thought, which he/she wants to express on the environmental skin of the architectural end-product.

2.2.1. THE ENVIRONMENTAL SKIN IN TERMS OF THE FIGURE AND GROUND LAWS

“It is their appearance, which is crucial to the sense of a building’s ‘character’. Of the many properties of a facade’s articulation, its textural appearance and the organisation of component elements into figure and ground are of predominant importance.” (Weber, 1995, p.229)

Architectural end-product as well as all the objects forms a figure in the environment as a ground where it exist and all of the other objects perceive as the parts of the surroundings. For the reason that the figure dominates the ground and the perception as a process has a property which selects the stimuli as dominant or subordinate. So except the figure which the retina is focused, all the other objects with their surroundings constitutes the continuous background for the figure. However in a three-dimensional environment the spaces between the dominant figures can be perceived as shapes. This kind of areas called as *negative spaces* which occurs in between the principal figures that are called as *positive spaces*. (Weber, 1995) This negative spaces forms the context of the building and the points of this figure which meets with the ground are the primary parts that determine its shape and identity.

“It is an area where the complementary nature of the relationship between figure and ground can be used as a graphic tool by architects in order to get a clearer idea of the form of spaces. When we draw a plan, we give concrete expression to the walls and objects; we draw what surrounds the space rather than the space itself” (Von Meiss, 1996)

In the perception of a figure and ground relation the contours take on the most important function. The contour which surrounds an area, becomes a part of the perceived figure. This phenomenon is called as *one-sided function* because of the property of a contour that can not be concerned by the figure and the ground simultaneously. Consequently the ground becomes boundless and the contour subordinate it. However if the figural character of the ground become strong it starts to subordinate the figure in other words the ground transforms the figure and the contours began to be concerned by it. This kind of tendency was named by Arnheim as *contour rivalry*. (Weber, 1995) This figure and

ground relation can be established between the shell of the building and its parts as well as between the building and context. For instance windows as a hole can subordinate the wall or the shell as a multilayered configuration according to the standpoint can be dominated different parts of the construction as a figure on the ground.

Almost in every respect the gravity is considered as the primary aspect of the architectural activity. For this reason the building as a figure is not a floating object on the contrary it is usually occupied with the ground in one way. Consequently, the portions of the environmental skin can be perceived that belonged by the figure or the ground according to the choice of the architect. For some kind of instances, building can be perceived as completely separated from the soil, or can be perceived as like growing from the ground. Consequently, it can be pointed out that there are some rules which dominates an object as a figure and subordinates the others as its background. From the architectural point of view this rules both can be established between the architectural end- product and its surroundings and can be considered just for the environmental skin which its components occurs figure and ground relation each other. These laws can be listed as below (Weber, 1995);

1. Orientation; Figures forms easily if the dominant orientation of the shape extends along the primary axes. On the contrary, if a shape is constituted from the divergent axes, its figural character is weakened.
2. Proximity; Figural character of a small area is more powerful than the large area. So the larger areas usually tend to be the background for the small ones which dominates them.
3. Closure; The completely enclosed shapes dominates the partially enclosed one because of the boundless effect. Contours designates the figure so if the contours is not completed the figural tendency is weakened.
4. Articulation; The articulated shapes dominates the simple one and their figural character more powerful than the pure ones.
5. Concavity/Convexity; Concave shapes and forms easily perceived as figures in comparison to the convex shapes.
6. Symmetry/Asymmetry; Symmetrical shapes dominates as a figure the asymmetrical ones and transforms them into the ground.

7. *Colour and Texture*; Colour and texture occurs the other perception rule of the figure and ground relation. As mentioned before, the environmental skin as a figure in the ground or the context of the building is the most expressive part of the design which provide the architect to communicate with the observers by means of the building. Therefore the exterior surface of the building on the shapeless and boundless ground of the environment becomes a contour. Consequently colour and texture as design concepts on this contour occur to express the architectural thoughts in terms of the figure and ground laws. However its effects and assistance to the architectural design process will examine in the fourth chapter.

2.2.2. THE DESIGN NOTIONS OF THE ENVIRONMENTAL SKIN

Architect as a designer while creating a three-dimensional architectural object, benefits from the characteristics or the design notions of a form which is constitutes by an specific or group of shapes. This elements of the design are based on the visual perception rules. On the standpoint which the architecture is drawn near to the art this characteristics started to become the rules of the aesthetic. On the other hand, architect utilise this design notions in order to create a particular language for the exterior surface. The way of the architect to create a building by means of using these notions expresses her/his behaviour. Sometimes the outermost skin of the building states a specific idea and communicate with the human beings who experience the design by means of the environmental skin. On the other hand , in some situations it only influences with a feeling which emphasises by its all component. In the light of this statement it is possible to point out that the basic design concepts of the architecture did not only provide the architect to evaluate his/her idea in creating process but also they enable them a way to show their architectural thoughts. Therefore, the architects apply these design notions in order to express or emphasise an idea, a behaviour, opinion or a feeling on the environmental skin of the building as well as being utilised in all the process of the design.

Order and Disorder; The perception as a phenomenon ,as mentioned before, selects the stimuli and tends to form relations between the objects. This relation as a property shows a wide range peculiarities from well ordered to chaos. *Repetition*

can be considered as the simplest kind of succession, however *Rhythm* occurs in a situation which a sequence of repetitive elements is interrupted at repeating intervals. *Similarity* is group of elements which they are similar each other by means of any property. *Hierarchy* can be defined as the combination of the elements in relation to a scale of importance. It constitutes primary and secondary elements. *Contrast* occurs by the opposing characteristics of the elements which is achieved a tension each other. It provides us to establish differences. (Von Meiss, 1996)

Measure and Balance; Architectural activity always concerns about the dimensions and its effects of relative parts of the building. In the design history the relations with the measures of the human body and the building had always tried to be established. *Proportion* can be defined as a ratio of an object's measures or between the elements. On the other hand Balance can be defined as;

"To the physicist, balance is the state in which the forces acting upon a body compensate one another. In its simplest form, balance is achieved by two forces of equal strength that pull in opposite directions." (Arnheim, 1974)

Symmetry as a balance special case of the principle of the coherence through the orientation of the elements. The *Asymmetric* balance occurs in the situation which opposing elements or structures develop a tension.

Light, Texture and Colour;

"Illuminating, colour and texture are other important means to the definition of the mass-elements. While one texture, such as a polished and reflecting surface, can make the mass dissolve, another may stress its concentration. (for instance the rustication of Renaissance and Baroque architecture) Through an appropriate use of colour a mass-element may be separated visually from its surroundings. The light finally models the shapes" (Norberg Schulz, 1997)

Light, texture and colour as the different basic design notions provide the architects to express themselves and their architectural thought on the environmental skin. In the light of this statement it is possible to state that colour as a design notion is not only a esthetical tool or a value for the artists but it also becomes an expressive element for the

architectural design activity. This study examines the colour as a design notion for architects to express their architectural thought on the environmental skin of the buildings.

THE PHYSICAL DEFINITION OF THE COLOUR AND THE COLOUR PERCEPTION

As far as this study has considered, the exterior surface of the architectural end-product is a kind of a scene for the expression of the architectural thoughts and the emotions. This study suggests that the *environmental skin* as a concept to the exterior surface for the person that the shell of the building, the outermost portion of the design, has a bilateral instance. If the environmental skin is considered as a colour of a figure on the ground, according to the figure and ground laws, it should be consisted by the building or its surroundings, related to this point of view. In the light of this statement, it can be pointed out that the exterior surfaces of the architectural end-product constitute the inner surfaces of the urban context. Hence the environmental skin of the building can be considered through the outermost portion of the building which provides it to communicate with the surroundings by the words of its architect. As a matter of fact, the artists and the architects utilize various tools for expressing themselves through the agency of their works.

Therefore, the basic notions of design in general, provide the architects to develop their individual design language, specific to the environmental skin of the architectural object one of which is colour use. In the light of this statement, the theoretical, physical and perceptual distinctness of colour will be addressed in this study in order to guide to explain the colour idea in architecture. Consequently, this chapter will examine the colour concept from the physical and perceptual points of view. That is an undeniable fact that our senses are the basic basis for the individuals in order to understand and communicate with their surroundings. Notwithstanding, as a result of visual process has superiority in comparison of other senses that enable us to perceive the environment. Colour is an indispensable part of vision in order to define the surrounding object's properties such as form, texture, size, and so on. Therefore, as a term 'colour' has many technical definitions in terms of the definers' profession which varies from one to another according to their point of view.

CHAPTER III

THE PHYSICAL DEFINITION OF THE COLOUR AND THE COLOUR PERCEPTION

As far as this study has considered, the exterior surface of the architectural end-product is a kind of a scene for the expression of the architectural thoughts and the emotions. This study proposes that the *environmental skin* as a concept to the exterior surface for the reason that the shell of the building, the outermost portion of the design, has a bilateral attitude. If the environmental skin is considered as a contour of a figure on the ground, according to the figure and ground laws, it should be consisted by the building or its surroundings related to this point of view. In the light of this statement, it can be pointed out that the exterior surfaces of the architectural end-product constitute the inner surfaces of the urban context. Hence the environmental skin of the building can be considered that the outermost portion of the building which provides it to communicate with the surroundings by the words of its architect. As a matter of fact, the artists and the architects utilise various tools for expressing themselves through the agency of their works.

Therefore, the basic notions of design in general, provide the architects to develop their individual design language, specific to the environmental skin of the architectural object one of which is colour use. In the light of this statement, the theoretical, physical and perceptual declinations of colour will be addressed in this study in order to guide to explain the colour idea in architecture. Consequently, this chapter will examine the colour concept from the physical and perceptual points of view. That is an undeniable fact that our senses are the basic tools for the individuals in order to understand and communicate with their surroundings. Notwithstanding, as a result of visual process has superiority in comparison of other senses that enable us to perceive the environment. Colour is an indispensable part of vision in order to define the surrounding object's properties such as form, texture, size...and so on.. Therefore, as a term 'colour' has many associate definitions in terms of the definers' profession which varies from one to another according to their point of view.

3.1 THE PHYSICAL DEFINITION OF COLOUR

Throughout the history, colour has been tried to be explained not only by artists, physicists, psychologists in relation with their profession, but also by many other human beings who naturally experimented it in their daily lives. Because of the vital importance of seeing on the way to understand and analyse the environment, colour is one of the most effective component that makes it possible for interpretation. Therefore, according to many people, colour as a concept was considered as a puzzle of the nature which could not have been solved until the beginning of scientific thought system. Colour was tried to be understood since the antiquity by the human beings and various theories were formed not only about the physical definition but also about the analysis of different colours. During the mankind history various definitions for the colour were formed, however it could not be completely possible to analyse the constitution of it for the scientists until the near future. Recently, as far as the current theory assumes that colour is the function or quality of light (Zelanski & Fisher, 1989). In other words, colour is formed by the light itself and it is required to analyse the light in order to explain the colour concept. In fact, light is the small portion of the electromagnetic spectrum that can be perceived by the naked eye. Beside of this electromagnetic spectrum can be defined as a kind of energy that consists of separate energy packets, which travel as continuous waves. These waves of energy constitute the peak points and the distance between these peaks called as wavelength.

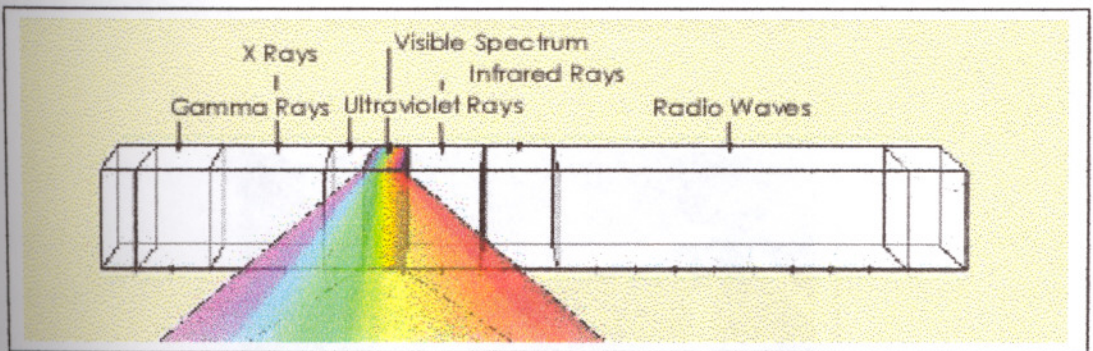


Figure 3. 1. Electromagnetic spectrum

(Source: Faulkner, 1972)

This spectrum is subject to change of the electromagnetic power, radio waves from the cosmic rays or gamma rays according to the wavelength of the wave (Kuehni, 1983).

However, the visible spectrum that is generally known as light, which forms the source of the life on the earth, is only a small segment of the spectrum. The shorter distance between the crests of waves (shorter wavelengths), the higher the energy content of the radiation. These distances are measured in nanometers, which is only one-billionth of a meter. The visible spectrum is formed by the wavelengths, which vary between 400 and 750 nanometers. In addition to this the different colours are formed by the tiny differences between the wavelengths. The red light has the longest wavelength, which varies from approximately 625 to 740 nanometers, however the violet has the shortest which varies from 380 to 440 nanometers in the visible spectrum (Zelanski, Fisher, 1989). Sir Isaac Newton has invented that the white light contains all of the colours in it by means of an experiment. He admitted that a thin light beam to enter a dark room and he orientated it to a prism in order to pass and to refract and as a consequence the experiment caused to be seen colours of the rainbow on the white wall. He observed seven basic colours that are red, blue, orange, yellow, green, blue, indigo, and violet (Zelanski, Fisher, 1989).

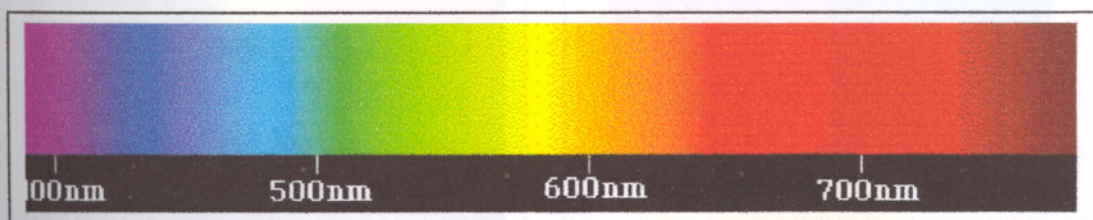


Figure3. 2. Visible Spectrum

(Source: <http://www.sfasu.edu/astro/color.html>, 03,2001)

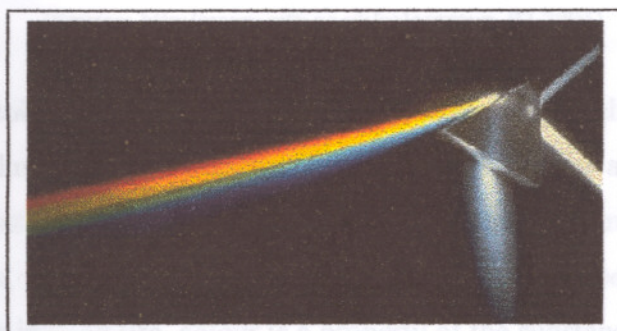


Figure3. 3. Prism

(Source: <http://www.sfasu.edu/astro/color.html>, 03,2001)

However, Newton worked with the colours, which are stimulated by the light. These kind of observed colours are called as additive because when they mix the other colours they become lighter. White light can be formed by mixing the three major colours in proper intensities, green, blue-violet, and orange-red, which are called as primary colours. The colours, which are stimulated by mixing of these two primaries, called as secondary colours, yellow, cyan and magenta. On the other hand, we generally observe subtractive or pigment colours, which are formed by the reflected wavelengths by an object. According to one of the colour theories for subtractive colours, there are three primaries, which are red, blue and yellow. They cannot be formed by mixing other colours but they all can be mixed by using these primary colours. As contrary to the additive colours when they are mixed in proper intensities they produce black. When the primaries are mixed in order to organise bilateral groups, secondary colours are created, orange, green and purple.

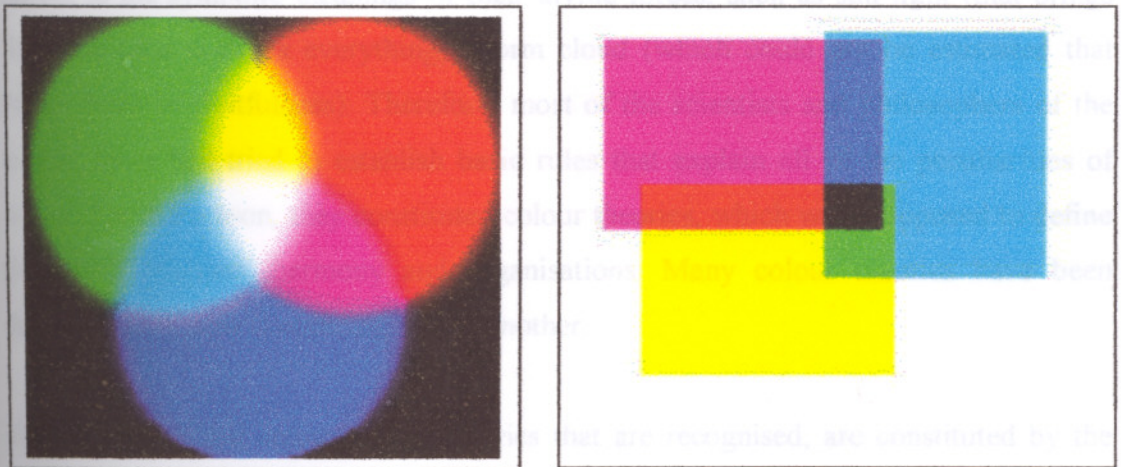


Figure3. 4. Additive Colour Mixture and Subtractive Colour Mixture

(Source: <http://www.city.ac.uk/colorgroup>, 03,2001)

The definition of colour can be changed from one person to another according to their profession. According to an artist colour is pigment however for a physicist it can be a function of a radiant energy or light. From the psychologist's point of view it can be a mean of perception, which forms out in the mind. Furthermore, according a person who experiences objects in daily life, colour is a property of the substances and light sources. Actually, the definition of colour is the total of all these results. On the other hand, according to an architect, despite of changing definition from one to another, colour generally means as a design concept, which affects the perceptual experiences of the

architectural end-product. Architect as a designer, mostly benefits from the natural tectonics of the materials while creating architectural objects in order to apply colours to the environmental skin. Hence, it is possible that the property of the constructional and the structural elements can be meant to the colour according to many architects. As a matter of fact, from the architectural point of view the colour is a design concept, which is actively involved into the language of the architecture for the expression of thought.

3.2.COLOUR THEORIES

“By convention there is colour, by convention sweetness and bitterness, but in reality there are atoms and space.” (Democritus, ca.460 BC–ca.400 C, quoted from the original source: Kuehni, 1983, pg.)

Human beings have always been inquisitive about colour and its wonders, which are related to the symbolic meanings of their divine forces, such as sun light (that brings life), fire (that destroys everything), storm cloud (which could not be estimated that brings death or fruitfulness). Therefore, most of the scientists and philosophers of the ancient times had tried to establish basic rules that explain all of the peculiarities of colour. For this reason, they constituted colour theories, which were supposed to define the colour relations, harmony and organisations. Many colour theories have been developed until now succeeding one to another.

The first colour and colour vision theories that are recognised, are constituted by the ancient Hindu Upanishads, the early Greek philosophers and physicians, and Arab physicist Alhazen in order to explain the basic system of the colour perception. Especially, the scholars of the classical times had tried to explain the nature of the colour such as Pythagoras, Plato, Aristotle, Pliny, etc. Aristotle which was known as one of the most famous colour theorists of the classical period beside of his philosophical achievements, has pointed out that all kind of hues that individuals perceives were the result of mixtures of darkness and light.

“Simple colours are the proper colours of the elements, i.e., of fire, air water and earth... black mixed with sunlight and firelight turns crimson...” (Aristotle quoted from the original source: Birren, 1969 pg.9)

“...the common origin of nearly all colours in blends of different strengths sunlight and firelight and of air and water... darkness is due to privation of light.” (Aristotle quoted from the original source: Zelanski & Fisher, 1989 pg.46)

During the centuries, the ideas of Aristotle, which are about colour theories, were used to be accepted by the artists and the alchemists. For instance red colour of the sunset was considered as the mixture of the white light of the sunlight and the darkness of the night or the firelight was considered as the mixture of the white light of the fire and the darkness of the smoke. Scientists could not develop a better colour theory than the Aristotle's until the sixteenth century, on the contrary, after this era many theories were started to be formed, however none of them could be completely explained the colour phenomenon up to twentieth century. These theories can be categorised in two groups as two-dimensional and three-dimensional colour theories.

3.2.1. TWO DIMENSIONAL COLOUR THEORIES

This kind of theories can be called as two dimensional because of their created graphics, which mostly just expressed the hues and their relations, is based on plan geometry.

Colour Theory of Leonardo da Vinci:

Leonardo da Vinci who was the first person that had developed a colour theory after the Greek philosophers, was not only great Renaissance artist but also he was a scientist who had formulated many theories which are included colour and its organisations. Different from the Greek philosophers, he considered black and white colour but in a simple form. He pointed out the importance of light on the perception of colour. From his point of view, there were six basic colours, which were listed in order first of which was the white, and yellow, green blue red black comes next. Meanwhile he thought that some colours, which we observed, are not intrinsic colour, they are kind of illusions.¹ He expressed his theories on colour in his book, which was published in 1651 according to his notes;

¹ Consequently, all of his research on colour provided him to evolve his painting techniques and he started to use the optic illusions that depend on the colour combinations, perspective and shadow effects. The technique that was developed by him which is named as sfumato, made a painting of him become very famous, which is known as Mona Lisa. (Zelanski & Fisher, 1989)

“I say that the blueness we see in the atmosphere is not intrinsic color, but is caused by warm vapor evaporated in minute insensible atoms on which the solar rays fall, rendering them luminous against the infinite darkness of the fiery sphere which lies beyond and includes it.” (Leonardo da Vinci quoted from the original source: Zelanski & Fisher, 1989 pg.47)

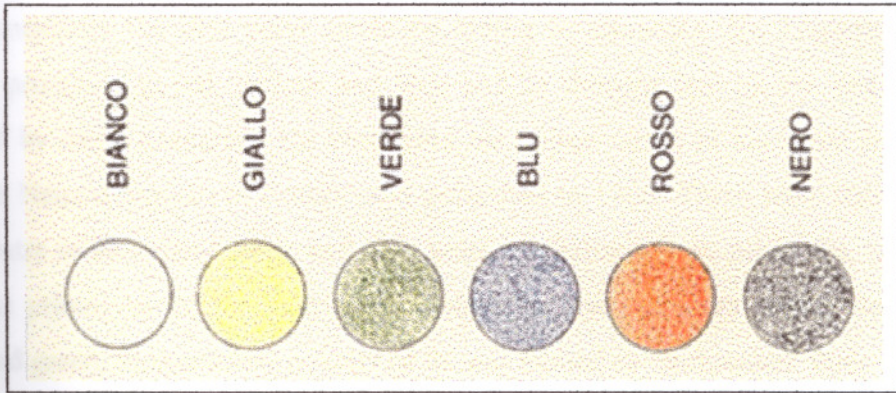


Figure3. 5. The colour graphic of Leonardo
 (Source: <http://www.Colorsystem.com> 3.2001)

Colour Theory of Sir Isaac Newton;

Sir Isaac Newton who was a British physicist, examined the light which is considered the source of the colours, in a laboratory environment and he succeeded in distinguished the light to its components which are known as colours by us, in order to use a prism He produced the first colour circle which is represented the colour relationships each other.² He considered that the white light which includes all the colours, was constituted by the packets of rays of atoms and according to him the red colour's atoms were large, on the contrary, blue and violet's were small. (Faber Birren, 1987). Although he pointed out that the mixture of three primaries constitute the white, he could never prove his hypothesis with his experiments, unfortunately.

“I could never yet by mixing only two primary colours produce a perfect white. Whether it may be compounded of a mixture of three taken at equal distances in the circumference I do not know, but of four or five I do not much

² While he was forming his colour circle, he has chosen seven basic colours and named them as 'primary colours'. Although he was a scientist, so mystically these seven colors have been based on proverbial seven spheres and seven notes of the diatonic scale in music. He divided his colour circle with the lines in order to express the hues and he put the white to the centre of the circle in order to mean that the white is the mixture of the colors.

question but it may. But these are Curiosities of little or no moment to the understanding the phenomena of nature.” (Newton quoted from the original source: Paul Zelanski & Mary Pat Fisher, 1989 pg.48)

Colour Theory of Moses Harris:

He was an English entomologist who examined pigment colour rather than light and he constitute the first color circle according to pigments. He suggested that the pigment primaries as red, yellow and blue and he thought that all the hues could be produced by these primaries. He illustrated his colour circle in his book which name was ‘The Natural System of Colors’ and published in 1766. There were three triangles in the centre of his colour circle and they were symbolised three primaries, which were named as primitives by the Harris. He designated there colours which were orange, purple and green, as secondary colours or he was named as ‘compound’ hues.



Figure3. 6The Colour Circle of Moses Harris
(Source: [http:// www.colorsystem.com](http://www.colorsystem.com))

Colour Theory of Wolfgang von Goethe:

Wolfgang von Goethe who was the great German poet, mystically wanted to be known with his colour theories rather than his poems, which was published in his book, which named as ‘Theory of colours’. The theory, which was formulated by him, was completely opposed to the Newton’s colour and light theories. His theories were closer the ancient Greek theories such as Aristotle or Leonardo than his contemporaneous. For instance, contrary to Newton, he considered colour as a visual phenomenon rather than

the function of light.³ Consequently, his researches on the visual perception problem provided him to find out the detailed reasons of illusions on colour perception such as simultaneous and successive colour contrasts. He produced two colour relationship models, a circle and a triangle. Circle was formed by two triangles which were overlapped, the angles expressed the primary and the secondary colours and meanwhile, the arrows that were drawn an angle to the other, connected the complementary hues. And the second colour graphic was a triangle, which the primaries were located at the corners of the triangle. The secondary and tertiary colours were completed the triangle.

Colour Theory of Michel Eugene Chevreul:

Chevreul (1786-1889) who was a chemist and a director of the dye house, constitute a two-dimensional colour circle, which was published in his book that was named as *The Principles of Harmony and Contrast of Colors*. In his colour circle the primary colours were red, yellow, blue and the secondary colours were orange, green, and violet because of working with liquid dyes. He tried to formulate basic rules about the colour harmony in order to use colour best and he worked on the visual effects of colour such as simultaneous contrast, successive contrast.⁴ Chevreul paid so much attention to the colour harmony principles and he presented his opinions in his book, which was considered as an important source for the following artists. He suggested that

“...with little contrast, such as hues adjacent to each other on a color circle (analogous hues), will tend to blend optically, whereas highly contrasting colors (such as complementary colors lying opposite each other on the color circle) used in sufficiently large quantities will make each other appear more brilliant, without any optical change in their hue.” (Zelanski & Fisher, 1989 pg.52)

³ Goethe also worked on the shadow as an aspect of colour. He suggested that the hue of the shadow directly depends on the hue of the light, except for the sunlight of the midday. If the coloured light is strong, the shadow that depends on the illumination will be pale and if there are two light source, the mixtures of the shadow where they overlap constitute secondary colours. In the Impressionist and the Post-Impressionist period so many great artists such as Vincent van Gogh, Monet, used the rules that Goethe formulated in their paintings. (Zelanski & Fisher, 1989)

⁴ Like so many colour theorist, he tried to find out the basic rules about colour harmony. The principles that he formulated can be categorised in two groups, which are harmonies of analogous and harmonies of contrast colours. Harmonies of analogous colours can be explained as the harmony of the slight variations of the same hue. Neighbouring hues and the Harmonies of the contrast colours can be defined as the harmony of the opposite hues.

Colour Theory of Ogden Rood: *Commission Internationale de l'Éclairage* in

Ogden Rood who was an artist and scientist, worked on optics of colour and he was mostly known by his colour theory which was formulated the there major variables of colour as purity (saturation), luminosity (value) and hue. According to him, the results when lights were mixed could be achieved by mixing pigments if the dots of the colours forms very close one another. In his book that was named *Modern Chromatics* and published in 1879, he constituted a colour circle, which was formed by the complementary colours. However his most important contribution for the colour science was the technique that made the brightness of colours possible for comparing each other. The book, which was written by him, *Modern chromatics* was considered as '*the Impressionist's bible*'. Although as an irony, when he first met the Impressionist paintings, he did not like it and he expressed his opinion as follows;

"If that is all I have done for art, I wish I had never written that book" (quoted from the original source: <http://www.noteaccess.com/Texts/Harlan/HaCS.html-4.2001>)

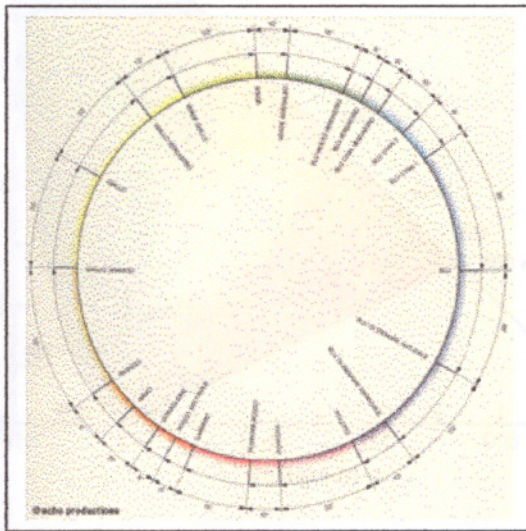


Figure3. 7. The colour circle of Ogden Rood (source: <http://colourpeople.com> 3,2001)

Colour Theory of CIE:

Actually, CIE colour theory is a part of a colour system, which includes the physical aspects, and the perception of colour. This system, which was formed by the

international commission on illumination (Commission internationale de l'éclairage) in 1924, defines a *standard human observer* who reacts a typical reaction towards the same stimulus. This theory has a different attitude according to all of the other theories because of its scientific point of view. The system was based on the biological reaction of the human eye in the colour sensation process. As far as one considers that the human eye is sensitive to very narrow portion of the electromagnetic radiation (which is known as visible spectrum or light) and the middle point of this visible spectrum, which is the most effective for the visual brightness response. As it goes far away from the middle to the limits of the visible spectrum, the effectiveness of the stimuli decreases. This phenomenon was named as *luminosity efficiency function*. In the light of this, CIE constitutes a diagram, which was a curve that shows the human response according to the different wavelengths of light.

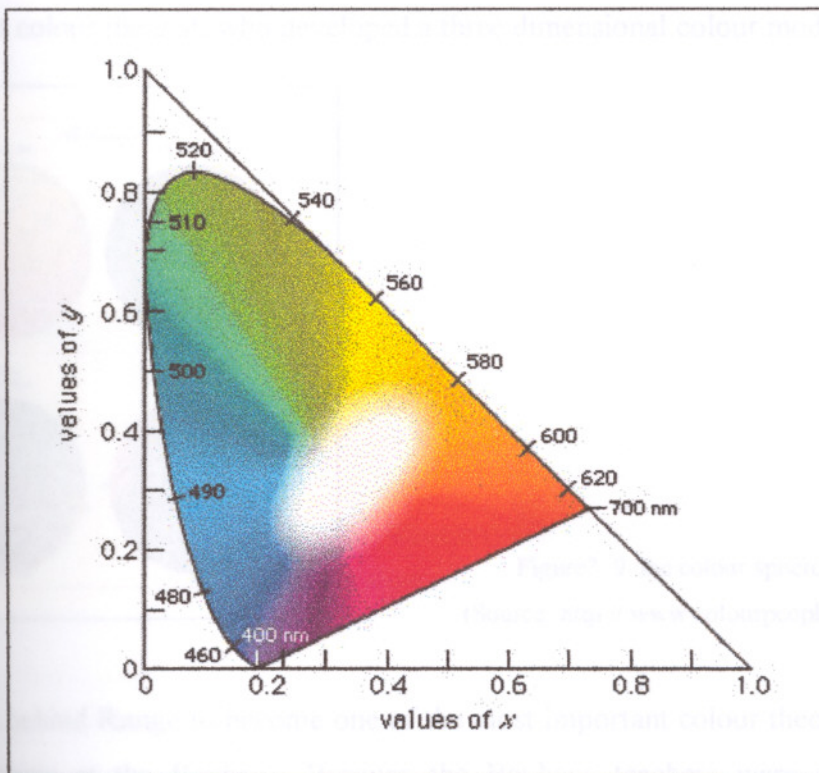


Figure3. 8. The CIE chromaticity diagram

(Source: <http://uni-mannheim.de/fakul/psycho/irtel> 3,2001)

CIE colour theory was based on the colour perception theory, which determined two types of retinal receptors, rods and cones. According to this theory, rods are sensitive to

the dim light (scotopia) and perceive achromatic (colourless), on the contrary, cones are sensitive to the bright light (photopia) and provide us to perceive colours (Faulkner, 1972). There are three types of cones that were considered, and they are sensitive to different wavelengths of light and they were named as x, y and z receivers. The CIE colour diagram was constituted according to values of these receivers.

3.2.2. THREE DIMENSIONAL COLOUR THEORIES

This kind of theories can be called as three dimensional because of their created graphics which were generally expressed the colours in terms of hue, value, saturation worth, is based on a volumetric geometry.

Colour Theory of Philipp Otto Runge:

As a contemporary artist of the Goethe, Philipp Otto Runge (1777-1810) published his colour theory in his book, which was named as *The Colour Sphere*. He was the first colour theorist, who developed a three dimensional colour model.⁵

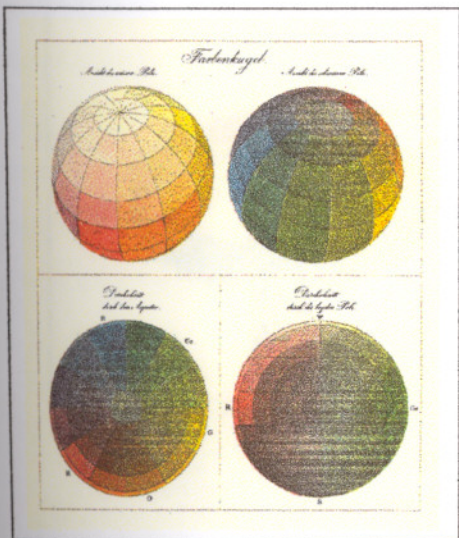


Figure3. 9. the colour sphere of Otto Runge
(Source: [http:// www.colourpeople.com](http://www.colourpeople.com), 3,2001)

The reason behind Runge to become one of the most important colour theorists was his colour teaching at the Bauhaus. Because the Bauhaus teachers were accepted his theories for their lessons in order to combine with their colour ideas. Johannes Itten, who was one of the important teachers of the Bauhaus, transformed the colour sphere of

⁵ His colour sphere was occurred by the 12 hues around the equator and the hues that was varied from the equator to the poles which was formed by black and white. Although he did not suggest the three dimensions of colour, his colour theory can be considered as three-dimensional interference. (Zelanski and Fisher, 1989)

Runge to the colour star and he developed the theories of Goethe, Runge and Hoelzel from their subjective approaches to the objective one. (Ural, 2000)

Colour Theory of Albert Munsell:

Albert Munsell's colour theory, which was first published in 1905 in his book, *Color Notation*, is one of the theories, which is approved by today's scientists and artists. Originally his theory has its roots in the colour theory of Rood. However, he developed the idea of the three dimensions (saturation, hue and value) of colour, which were first put forward out by Rood.⁶ Despite of the fact that Rood mostly worked on the visual and sensational truths of colour but he never tried to formulate them in mathematical systems, Munsell tried to form objective standards for the pigments of colour. These peculiarities of Munsell colour theory provided it to be preferred by the artists and architects (Michel, 1996).

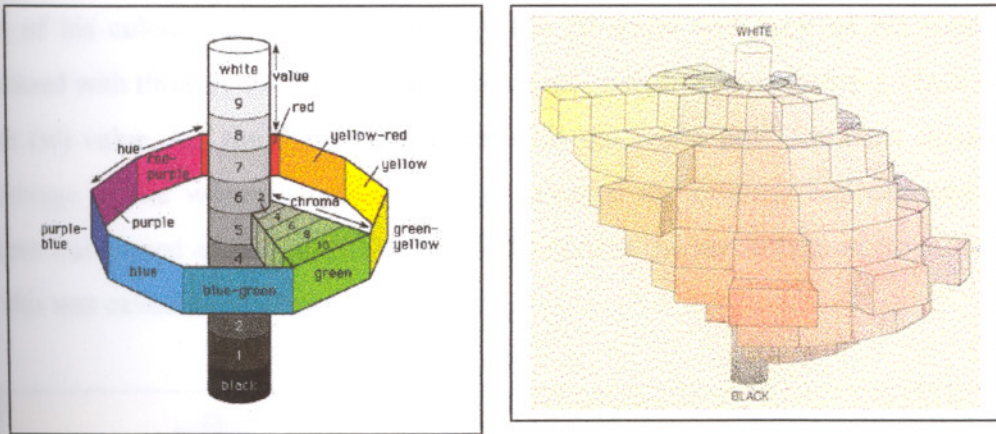


Figure3. 10 Albert Munsell Colour graphic
 (Source: [http:// www.colourpeople.com](http://www.colourpeople.com), 3,2001)

The main difference of the Munsell colour solid according to the Runge sphere was its irregular form. He pointed out that the pure colours do not have equal value and in addition of this the saturation of the colours vary from the strongest to the weakest. In respect of realising these differences, he organised that colour solid which was formed 100 hue steps that 10 of them were major hues that were red, yellow-red, yellow, green-

⁶ He formulated it in a diagram, which was formed by three major axes. Vertical axis that is known as y axis, was substituted for value and it varied from the bottom where the black was placed to the top where white was placed, consequently this vertical axis was expressed the grey scale too. Horizontal axis that is known, as x-axis was substitute for the chroma and the axis, which formed a circle like an equator around the value axis, was substitute for the hues.

yellow, green, blue-green, blue, purple-blue, purple and red-purple. On the value axis 9 value steps between perfect white and black were placed and saturation step were varied according to purity in the colour solid.

Colour Theory of Wilhelm Ostwald:

Wilhelm Ostwald (1853-1932) was a chemist who won the Nobel Prize for his work of chemistry in 1909. He developed a colour solid, which was formed by the double cone. Although the form of the solid's looks like similar each other, Munsell's colour theory was based on hue, value and saturation, on the other hand, Ostwald colour solid was formed by a series of triangles, related to hue, white and black. The pure 24 hues were placed on the equator and black and white were placed on the poles. Each hue constituted a monochromatic triangle which formed the colour solid when the triangles of the 24 hues was combined. (Zelanski and Fisher, 1989)

Each of his colour triangle comprised by the 28 tones and each of his tones were expressed with three symbols and their percentage, which were colour (c), black (b) and white (w) value. On the diagonal axis towards the white pole from the equator the percentage of the white increases and the value of the original hue decreases. This process was named as *tinting*, in the reversed situation the percentage of black increases and this was called as *shading*.

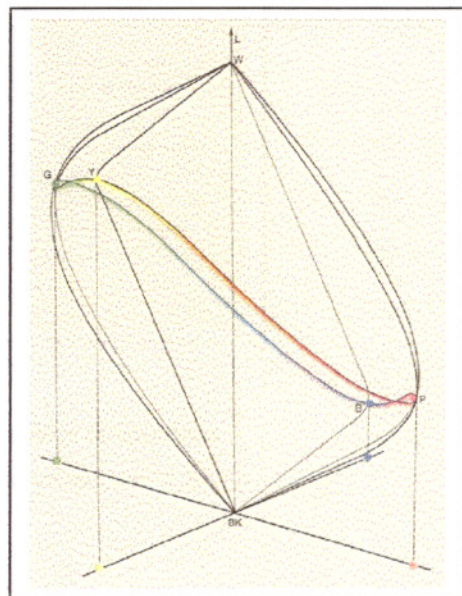
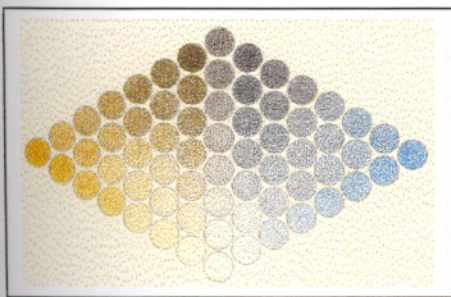


Figure3. 11. the section of the Ostwald colour solid

(Source: [http:// www.britanica.com](http://www.britanica.com))

On the other hand, on the axis that towards the equator from the centre, percentages of white and black decreases and the percentage of the original colour increases. This process was called as toning by Ostwald himself. Although from the scientific point of view, the theoretical definitions of Ostwald's colour system was explanatory enough in terms of colour science. From the artistic point of view, it was too scientific to use in the creation itself. Consequently, some artists declined his theory to use. Because they considered that it is a compulsion to restrict the all kind of colour variations in a black and white peculiarities.

The relation:

The colour theory of ISCC-NBS;

As a matter of fact, ISCC-NBS can be considered as a system rather than a theory for the reason that it was based on the Munsell colour theory. However it is a method of specifying colours by name. This system was first published by Inter-Society Colour Council (ISCC) and National Bureau of Standards (NBS) in 1939 as *Method of designating colours and a dictionary of colour names*. The purpose was to develop a simple colour description and to create a common language for colour in order to provide the art, architecture, science and industry to communicate.⁷

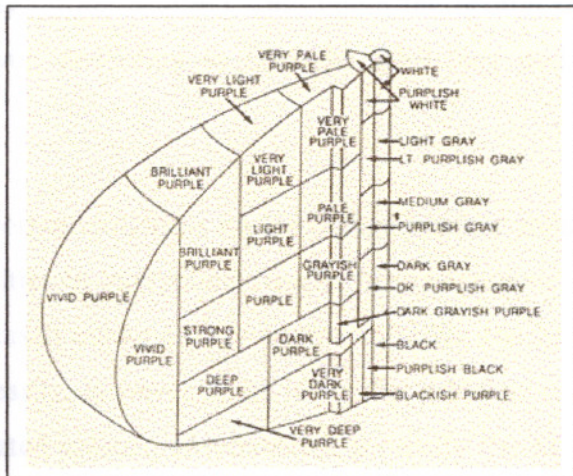


Figure3. 12. ISCC-NBS colour designations

(Source: [http:// www.coloursystem.com](http://www.coloursystem.com), 3,2001)

⁷ For further readings;

Architecture & Colour, Waldron Faulkner, Wiley Inter-science Company, New York, 1972
New Horizons in Colour, Faber Birren, Reinhold Publishing Company, New York, 1955

3.2.3. COMPARISON OF THE COLOUR THEORIES

Works on the theoretical analysis of colour have been evolved starting from the ancient Greek period that first attempted to bring physical definitions for the colour perception. Even today, the technological innovations excel the natural opportunities, however none of the colour theories could be completely explain the colour phenomenon and its all dimensions. Nevertheless, the recent system proposals do not only suggest a harmony method but also form a complete system for the colour phenomenon. These are considered as illustrative enough to understand and establish the relations, such as Ostwald, Munsell, and CIE colour theories. From the technological point of view, CIE colour system is accepted as the most scientific one in respect of the other systems since it includes all of the hues. However it is also necessary to add that it was considered as too scientific by the artists. Besides, from the architectural point of view, it was too complicated that might cause an obstacle against creativity. Meanwhile, the Munsell colour system is considered as the most convenient one by the artists, although it is being criticised by its physical acquiescence. One criticism is about complementary colours, which are mixed, in the proper proportions, they constitute neutral colors. If the mixing colours are lights, they produce white light or if they are pigment colours they produce black. These complementary colours are located symmetrically on the Munsell solid about the neutral centre with equal value and chroma. However, according to Ostwald solid they do not have equal value. (Faulkner, 1972)

One of the most important criticisms on the Ostwald colour solid is about its geometry, which causes difficulties to interpolate visually between colours and to perceive them. On the contrary, Munsell colour theory and its solid has the geometry which provides colours to visualise easily, however, there is another criticism on its solid that does not include highly saturated colours. Nevertheless generally the Munsell colour system is considered as more appropriate for the architects for the reason that it can be utilised to design easier than the others.

complementary (grey, black)

3.3. COLOUR HARMONY

“The aesthetic colour problem for the architect is then not merely how to choose a single colour, but how to develop colour schemes for exteriors and interiors of

entire buildings of different types. Colour schemes should recognise the symbolic, the functional, and the aesthetic aspects of architecture." (Faulkner, 1972)

From the architectural point of view, colour as a concept bearing an inherent meaning that is based on the private creativity of the architect. However it is possible to point out that the colours have basic relation rules between one and another, which depend on the aesthetical and the scientific values. As mentioned before, this study proposes that the colour concept in architecture is beyond the aesthetical concerns and it is conceived as the functional notion, which provides the designers to express their thoughts. However juxtaposing them on the environmental skin of the architectural end-product is required to conform the basic harmony principles. Harmony as a concept has always been concerned by the artists and architects as a tool, which is supposed to add an aesthetical quality to their works. Therefore various rules and principles were constituted in different ages, however none of them could be completely assumed by the majority. As an instance, Munsell colour solid, as mentioned before, is one of the most preferred system, because of its easiness to be utilised by the artists and architects. In his solid, colours with the same hue are consisted by the same vertical plane.

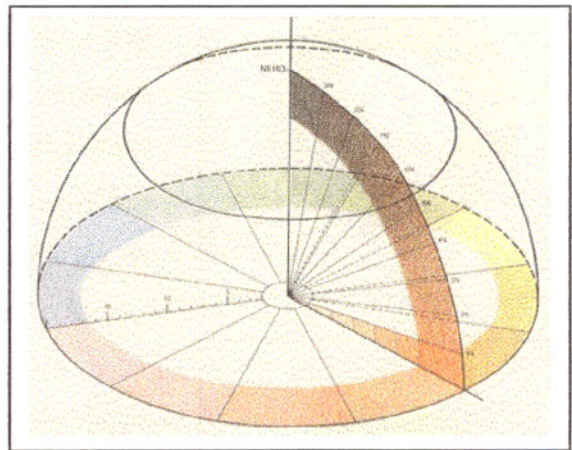


Figure3. 13. Chevreul colour circle
(Source: www.coloursystem.com)

As a matter of fact, the colour harmony simply can be organised in three groups as achromatic (grey, black, etc.), monochromatic (the tints of the same hue) and polychromatic (different hues). On the other hand colours of constant lightness are consisted by the same horizontal plane and colours with constant saturation are consisted by the cylindrical plane. Nevertheless harmony principles that were created by

the colour theorist Chevreul, is one of the common system, which is still utilised by the designers. This system's rules can be summed up in five major articles as:

1. *The harmony of adjacent colours;*

Adjacent colours that can be called as analogous, are the colours, which are placed next to each other on the colour circle. They generally form an emotional quality. This kind of colour scheme is usually observed in nature. If the key hue is a primary colour the effect of the analogous scheme.

2. *The harmony of opposite colours;*

Opposite or in other words complementary colours is formed by the hues, which are placed opposite each other on the colour circle. The complementary relations of the hues are superior to every other (Birren, 1987). Combinations of a primary hue with a secondary hue forms a direct appeal effect on the individuals.

3. *The harmony of split-complements;*

The split complement is combined by a key hue and the two hues that lie next to its exact opposites (Birren, 1987). This kind of combination provides to form more various relations and it has more refined colour expression. The primaries as with adjacents and secondaries create better effect.

4. *The harmony of triads;*

Triad combinations stimulate the basic relations of the colour circle. The primary triad of the red, yellow and blue has a direct and universal impression on the mental of the individuals. However the secondary triad of orange, green and violet forms more refined combination impression.

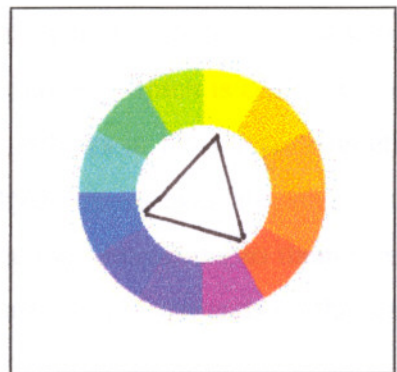
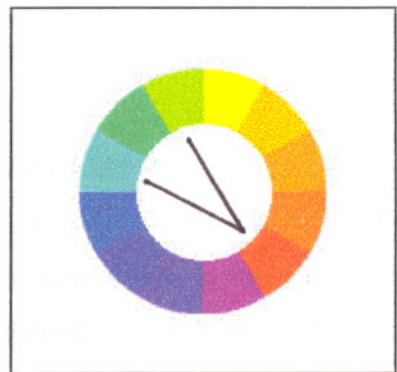
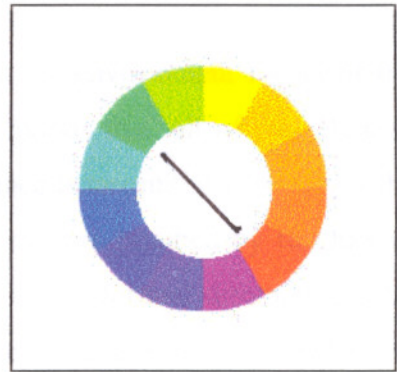


Figure3. 14. The colour harmony circles

5. *The harmony of a dominant tint;*

The dominant tint harmony is constituted by a group of colours which are all-pervading hued tint. As a matter of fact this kind of harmony principle is one of the most observed combinations of nature. Since the colours of nature and its objects are commonly seen under tint lights such as yellow of sunlight, blue of the skylight. On the other hand most of the artificial lightning element has its own tint. The easiest method to apply this principle is to design a composition of colours and wash a transparent tint over it (Birren, 1987).⁸ From the architectural point of view, this principle can be easily applied in interior coloured lightning design.

3.4. HUMAN COLOUR PERCEPTION

Perception is the only way to communicate with the environment for all of the creatures who live and experience this universe. It is obvious that, all of the relations between a living beings and another depend on the balance between the stimuli and the reactions Like all the other living creatures human beings are bombed by the lots of stimuli, in daily life and most of the reactions against them are formed automatically by the human body. However, none of the stimulus is as important as the one that has a visual effect. Because, the visual perception provides us to recreate and modify the environment in our minds.

Colour is one of the most important aspects that constitute the visual perception. It provides us to perceive three dimensions of the object or distinguish them. From the scientific point of view, human colour perception can be considered in three different points of angles, which are determined by the different scientific disciplines. They can be categorised as the physiological, the physical and the psychological of colour. All of these domains define colour perception by the way that their professional point of view. The standpoint of physicists is based on the definition of colour, which is considered as the function of light. Therefore the wavelengths of the colours in the electromagnetic spectrum is concerned them. On the other hand the physiologists evaluate the colour perception by determining the anatomical structure of the eye. According to them there are four primaries as red, green, blue and yellow, which are formed, depends on the way

⁸ For further readings '*Principles of Colour*', Faber Birren, Van Nostrand Reinhold Company, Pennsylvania, 1987

of the study of the human eye. From the psychological point of view, the colour perception phenomenon is a psychological phenomenon as well as physical and they examine the colour perception by means of the effects on the human affairs and behaviour. However the visual system of human is still a puzzle that the physicists have not been completely solved yet. Various scientific theories were formed for each step of the process. As far as the scientists consider that colour perception process includes four important factors and steps (Porter & Mikellides, 1976). They can be categorised as;

1. Light can be easily changed the conditions of perception
2. Object absorbs, transmits or reflect the light
3. Eye and brain can affect the sensitive of perceiving the colour
4. Psychology that can be changed the perception of colour according to experiences and the personality of the observer

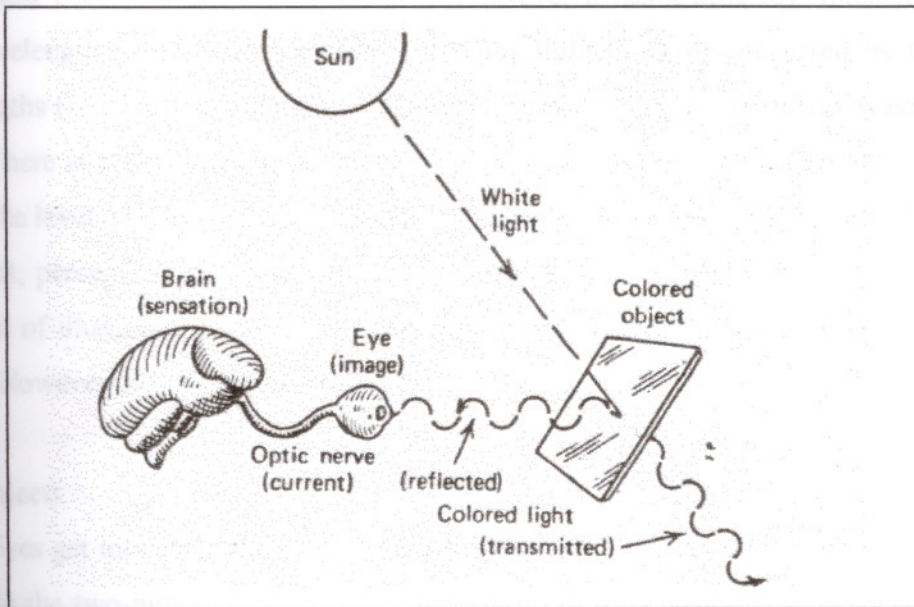


Figure3. 15. Human colour perception process
(Source: 'Architecture and Colour', Faulkner, 1972)

3.2.1 Light;

"All colours in the universe which are made by light, and depend not on the power of imagination, are either the colours of homogeneal lights or

compounded of these", (Newton, quoted from the original source <http://www.britanica.com>)

Light, which as mentioned before is the small portion of the electromagnetic spectrum of the radiant energy which is visible for the eye and provides us perceiving the space which we live in, is the primary element of seeing and observing colour. There are so many ways to perceive light, which stem from the environment that we exist. Light almost never comes our eyes directly from the glowing object, it is usually reflected or transmitted by them. Even if it comes from both the natural or artificial light sources, the objects, which creates our environment, is required to refract them in order to let us perceived.

There are two major light sources; the sun and the artificial light source elements such as tungsten filament bulbs, fluorescent bulbs, neon, etc. Lights that depend on the sun have almost equal amount of wavelengths. However it has a little low intensity in the long wavelength range. Tungsten filament bulbs light is mostly occurred by the long wavelengths (red), on the contrary, fluorescent light has heavily the short wavelengths (blue). There is a limitation for the level of illumination in order to perceive colours. Even if the level of illumination is enough to be perceived shape, movement and size, of the object, perception of colour required higher level. For instance at night under the low level of illumination one can perceived the environment and the properties of its objects. However the colours of them cannot be perceived clearly.

3.2.2 Object;

Eyes get information from the environment and transform the three-dimensional objects to the two-dimensional retinal images but brain reconstructs the objects to the three-dimensional images. The information about the space that we live in is converted in our minds with the objects that define the world according to their shape, size, texture and colour.

In fact, the objects do not have any inherent colour. They do not have any intrinsic energy to show themselves or their properties such as colour or texture. However, their reflected light provides them to be perceived. Objects can never be appeared without

light that is always reflected, transmitted or absorbed by the surface of the object depends on the physical properties of the material. Consequently the changing of the quality of light alters the object's perceived colour and its visual perceptual peculiarities. From the architectural point of view, this situation causes to differentiate the experiences, which are based on the architectural end-product by means of its spatial and object quality. The perception of the environmental skin of structure as an object strictly depends on the physical effects of the context. Its perceived colour can be changed according to the time or the climatic factors. Besides the exterior surface as a figure on the ground is highly influenced by the colours of the surrounding objects.

"If we take light for granted, we can consider colour as a property of objects in so far as it is the physical and chemical composition of the objects which will determine how much light to be absorbed and how much to be reflected."(Porter & Mikellides, 1976, pg. 82)

Both absorbed and reflected light determine the colour of the object. If an object, which is made by an opaque material, appears white this means that it reflects all wavelengths of light almost equally, and absorbs or transmits little or none. On the contrary, if it looks like black, this means that the opaque object absorbs light of all wavelengths equally and reflects or transmits very little. Since, in order to look coloured, the opaque object should reflect light of certain wavelengths and absorb their complementary selectively. (Faulkner, 1972) For instance, if we see a red object this means that it absorbs all the wavelengths of light except the wavelengths, which are between 625 and 740 nanometers.

3.2.3 Colour vision;

" In his younger years the sixth Ch'an patriarch Huineng visited the Fa-hsing temple. He overheard a group of visitors arguing about a banner flapping in the wind. One declared: 'the banner is moving'. Another insisted: 'no, it is wind that is moving'. Huineng could not contain himself and interrupted them: 'you are both wrong. It is your mind that moves.'" Tun-huang manuscript, Tenth century (quoted from the original source: Kuehni, 1983)

Although the basic components of the seeing have been understood as eye and brain for years, the relationship between these two organs has not been completely solved yet. It is considered as simple to explain colour in physical terms such as wavelength, reflection or absorption. However, the perception of colour includes also a complex series of effects. The basic components of colour perception process are eye and brain. Eye collects the information and the brain interprets it. Lights, which are reflected or transmitted by an object, contain sensory messages of which the inner colour meaning will not be solved until reach the brain. They enter the eye through the cornea that covers and protects the eye from the environmental effects. It is a transparent outer covering. The muscles of iris provide to see well under different conditions of illumination. They expand or contract the iris in order to regulate the quantity of light available through the pupil (Kuehni, 1983). Refracting process includes three components; aqueous humor, the crystalline lens and the vitreous humor focused the light, which is admitted amount by the iris, on the back surface of the eye, which is known as retina.⁹

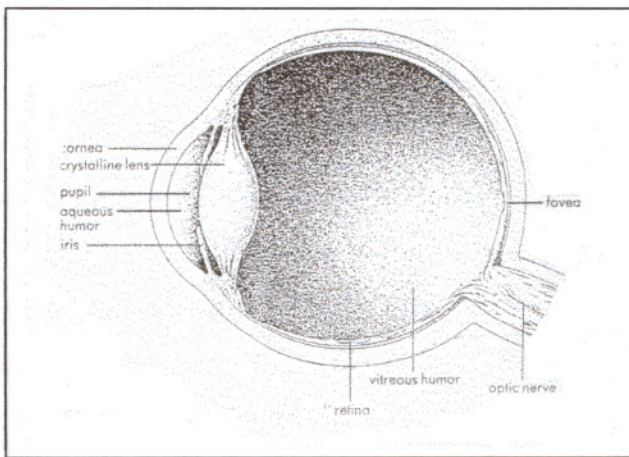


Figure 3. 16. The anatomical structure of the eye
(Source: Zelanski & Fisher, 1989)

⁹ The human retina of eye have two types of photoreceptor cells which are called as the rods (approximately 130.000.000 in each eye) that are distributed rather uniformly over the entire expanse, and the cones (approximately 7.000.000), which are especially numerous and refined in the central area or fovea (Birren, 1955). The rods are sensitive to light and they have not any sensitivity towards colour, they provide us perceiving white, grey and black. Although the rods function in varying different illuminations in terms of low and high levels of light, in day and night, the cones are the nerve cells which are sensitive to the colour of the object that the eye is focused. They provide us perceiving the hues. However, the fovea, which contains only cones, constitutes the very small area of the cornea, gives the sharpest colour vision. (Porter & Mikellides, 1976, pg. 82) Rods and cones have disks of a light-sensitive pigment, which transform the light into the electrical signals. Rod's disks of light-sensitive pigment which are known as rhodopsin, are generally found out the details of the process, however, the cone's which are known iodopsins, have not been understood completely yet.

“Structurally, the retina may be regarded as a light-sensitive expansion of the brain” W.D.Wright. (Quoted from the original source: Birren, 1955, pg. 176)

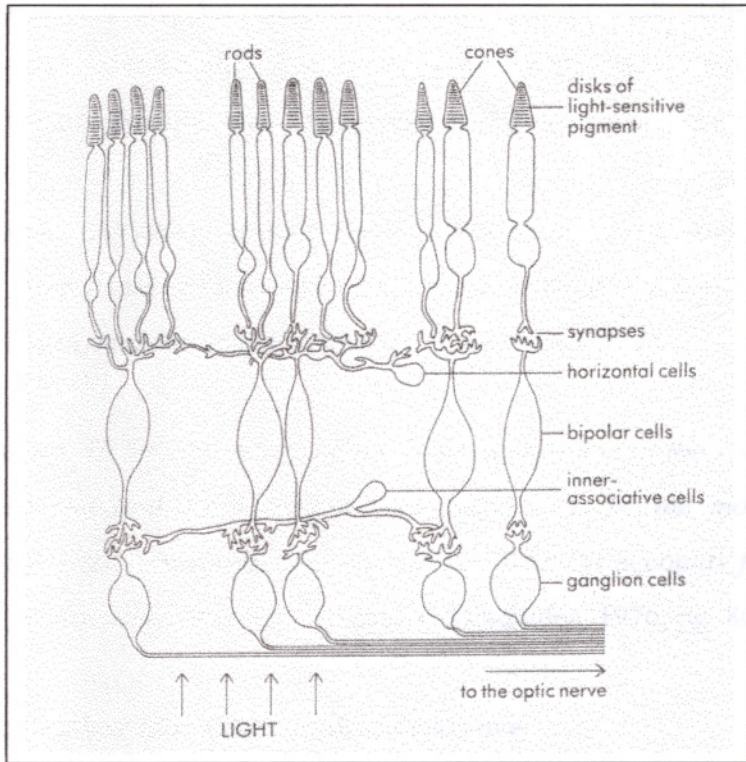


Figure3. 17. The scheme of the Rods and Cones

(Source: Zelanski & Fisher, 1989)

Throughout the centuries many theories about the colour vision are also formed by the scientists however two of them are known as more successful than the others: the Trichromatic theory and the Opponent colour process theory. The first one was thrown out for consideration by a English physician, Thomas Young, and improved by the German scientist Herman Von Helmholtz (<http://www.britanica.com>, 10,2000). According to this theory there are three general kinds of cone pigments, which are distinguished by their sensitivity to the certain wavelengths. L cones sense the long (red range) wavelengths, M for the middle (green range) wavelengths, and S for the short (blue- violet range) wavelengths. These are the primary levels of the colour perception and all of the other colours are formed by these sensitive cones like the additive mixtures of light and if they stimulate equally white can be perceived. Meanwhile this theory can only explain the cones role when the light strikes their sensitive pigment, however, it is inefficient to explain how the electrochemical signals are transferred to the brain. The Opponent colour process theory, which is proposed by a German physiologist Ewald Hering in 1878, presumes that there are three mechanisms, which is

formed by pairs of opposites; light-dark, red-green, and blue-yellow. Each pair contains only one kind of signals at a time, that is to say that we cannot perceive these two components simultaneously, for instance reddish-green or yellowish-blue. If they stimulate equally we perceive grey. According to this theory black is not the absence of light. This theory more directly related to appearance of surface colours.

Trichromatic theory can easily explain the colour blindness, however, the Opponent Colour Process theory makes us to understand the reasons of the simultaneous colour contrast, after images, and chromatic adaptation. As a result of this;

“ The Young- Helmholtz theory offers an understanding of the visual processing of colour by the eye and the Hering theory appears to be the most satisfactory explanation of our final perception of colour in the brain. It accounts for most of the colour phenomena discussed thus far.” (Porter & Mikellides, 1976, pg. 86)

3.2.3.1. The factors that affect the colour appearance

From the physiological point of view, colour is the phenomenon, which starts and ends in the individual's mind, even if it has the physical results. Consequently, from this point of view it is a physiological effect like all of the other mental reactions, moreover that it is a result of perception and so like all of the other perceived things and mental phenomenon's, it is convenient to be misinterpretation.

Chromatic Adaptation (Successive colour contrast or After-images):

Adaptation is a peculiarity of a sense organ that provides one to perceive in different intensity or quality of stimulation. For instance, the eye adjusts its seeing ability in varying circumstances of illumination by means of adaptation property. If a person enters a dark area from the illuminated brightly one, it takes a few seconds for the eye to regain its ability. Meanwhile, in the contrary position, the eye adjusts the new stimulus more quickly than the first circumstances. (Faulkner, 1972) If this stimulus affects the certain portion of the retina, it is called as local adaptation. According to a theory, Chromatic adaptation or After-image depends on the local adaptation that occurs in the eye. When the person is exposed to light of a particular colour for a long time, even if the intensive stimulus does not exist, after-images may be produced. For

instance if one looks at a person who wears a brightly coloured clothes for a long time, even after looking at somewhere else, he/she goes on perceiving the person in complementary colours (Zelanski, Fisher, 1989). As an example to this effect, if one focused the black dot in the red square for several minutes (figure 3.18) and then transfers his/her gaze to the dot on the right, can easily observe the after-image of the illustration. Thus, the after-image occurs as a opposite illusion of the original one.

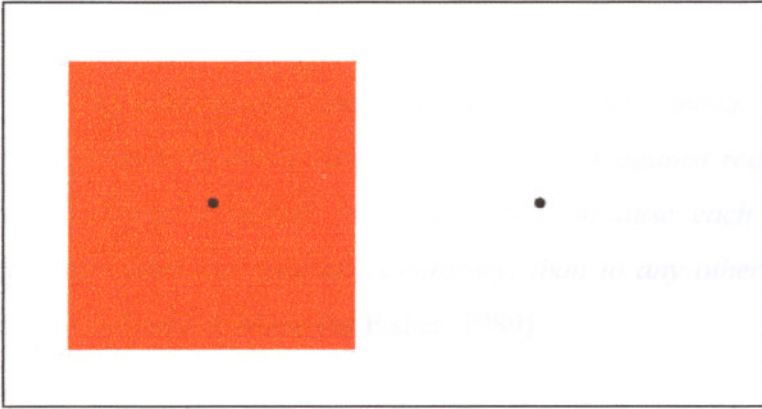


Figure3. 18. After image effect

Colour constancy:

Colour constancy, which is another factor affecting the colour perception, is a kind of adaptation of the eye. It forms an illusion that transforms the stimulus of the object in to an image, and causes the object to be perceived as the same colour even if the colour of the illumination changes. For instance, if an object is perceived white in the daylight it is seen white under tungsten filament bulb although the artificial light may be yellow. The brain analyses the sensations and decides which stimulus belongs to the illumination and provides us to perceive colour of the object correctly. Nevertheless chromatic adaptation has limits, which are designated by illuminated light level. If light is saturated highly, the appearance colour of the object can be changed. For instance if an object is perceived red in white light, this means that it absorbs short wavelengths and reflects long wavelengths. For this reason, it can be appeared grey or black under the blue light. As it can be considered that colour constancy phenomenon occurs only in small range of white light variations.(Faulkner, 1972) Furthermore another theory, which was proposed by Kruithof, says that the human colour perception varies according to the levels of the light. Under the light sources of warm colours object

appears normal, on the other hand cool colour illuminations cause it to be perceived unnatural.

Simultaneous colour contrast (Background):

Background has an important role in the colour perception process of an object. It can modify the perception of the object's hue, saturation and brightness. It was first observed by the great scientist and artist Leonardo da Vinci. He explained his examinations as;

“Of different colors equally perfect, that will appear most excellent which is seen near its direct contrary: a pale color against red; a black upon white;... blue near a yellow, green near red: because each color is more distinctly seen when opposed to its contrary, than to any other similar to it.”
(Color, Paul Zelanski & Mary Pat Fisher, 1989)

Background's effects are listed below;

. **Influence the object with its complementary hue.** For instance if the background is green, the object appears redder than the original colour, or if the background is blue, it appears yellower. If the background more saturated and brighter than the object, the effect will be stronger. (Faulkner, 1972)

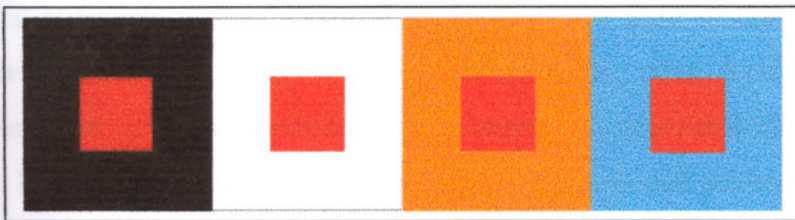


Figure3. 19. Simultaneous colour contrast effect-illustration 1

. **Induce or reduce the brightness of the object.** If the background is dark, the object appears brighter, or if it is bright, the object appears darker. For instance, a black background makes the grey object lighter and brighter than the original.

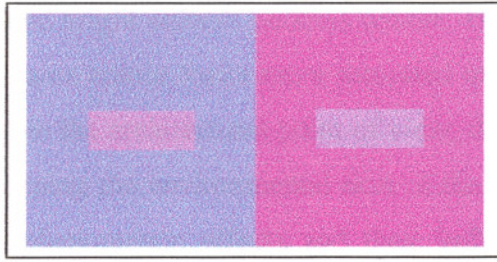


Figure3. 20. Simultaneous colour contrast effect-illustration 2

. **Spread to the object.** The background's colour tries to spread to the object. For instance the boundaries of the object looks lighter if the background is white or it looks darker if the background is black. This effect can be called as 'spreading effect'. (Faulkner, 1972)

Meanwhile simultaneous colour contrast effect also occurs in the situation that the two objects of different colours are placed next to each other. The eye tries to make the distinctions more intensive than the normal. From the architectural point of view, this effect of the colour perception phenomenon provides architects to have wide range of design opportunities in transforming their thoughts to the three dimensional end-product. As mentioned before, as a figure in the environment architectural object is always located on a background and this background influences it with its physical quality. Colour is considered as one of the most important properties of the surrounding which the building exists in. The colour of the context of the building is not only be designated by the natural peculiarities of the environment but also by the other man-made objects, especially the architectural products. In the light of this statement it is obvious that architect as a designer should consider the other architectural design objects, which exist in the surroundings, while creating a new environmental skin for this context. For the reason that especially for the high-developed settlements they form out the greatest part of the background of the design

Abney effect (Area effect):

The size of an object is another important factor that affects the colour perception. The bigger object, the more saturated colour will appear. Because, perception of the larger area expands the visual angle. If the object shrinks, its colour appears less distinct. According to this effect, if the object becomes small, dark colours

intend to become black and bright colours become whiter. This theory can also explain the situation, which the same colour looks more saturated on a large area than a small one (Faulkner, 1972). From the architectural point of view, this effect can be utilised as an important tool in designing the environmental skin of the building too. However all these colour perception phenomenon effects and their influential importance on the architectural design activity will be examined in the fourth chapter.

2.2.4. Psychological Factors:

“... when light enters the eye, either directly or reflected from some object, it generates nerve impulses which are transmitted to the brain and there converted into mental impressions by a process in which the brain interprets the impulses by comparing them with previous experience, heredity, tradition and other factors which are stored up in the mind. What the brain does with the message received results in the impression ultimately made on the mind.” (E.P. Danger, 1987, pg. 54)

In so far, in this study, the physical definition of colour, physiological explanation of colour perception process, the role of the brain and of the eye in the colour vision have been described. However the most important part of the colour perception process, the psychological analysis, has not yet been explained. Although, from the technological point of view, the scientist can measure the signals, which occurs on the retina and forward to the brain, they could not explain the mystery of how these electrical signals are transformed into three-dimensional coloured images yet.

Despite of the necessity of the light for the existence of the colour, there are so many situations, which the colour images, are perceived, in the absence of light. For instance when someone's eyeballs are pressed, he/she recognises various colours or when during a dream, it is also experience the same. In fact, the environment that we live in is not coloured and the colours that we perceive are not real. They are just stimulus's which are usually taken from the certain portion of the electromagnetic radiation, strike our eyes. In other words, the colour sensation is a form of the creation of our brain. In this respect, perception of the colour depends strongly on the psychological peculiarities of the viewer. This provides us to understand the different responses (such as emotions,

feelings, sensations...etc.) of the different persons against the same stimulus. Scientists define this phenomenon as 'psychophysical colour' that is a term which essentially describes the stimulus as it exists after initial absorption of the photons by the receptor cells.

The role of the psychology in the colour perception depends on the different aspects, which varies person to person, culture to culture...ext. Because the colour sensation is a result of interpretation, experience, association and perception. Although the psychological reaction towards the colour depends on the personal attributes, some kind of reactions can be estimated beforehand and they are called as objective attitude. On the other hand, there are some kinds of reactions, which are completely arisen from the mental structure of the person that are called as subjective attitude. Therefore, the scientists define these attitudes as objective and subjective scales, which is determined with the consistent rules of the measurement problem. Subjective scales does not involve stimulus quantification on the contrary, the objective scales are based on helpful quantification such as a temperature measurement. Scientists utilise the subjective colour experience in order to measure the objective stimulus. (Kuehni, 1983) There three types of 'psycho-objective' scales;

Psychophysical Scales; these are nominal scales containing the least amount of the subjective, the sensorial... Such scales have no simple relation to visual responses with which they are associated..

Psychometric scales; these are interval scales expressing the instrumentally measured stimulus in terms of the average visual response under standard conditions. Examples are metric lightness, metric chroma, metric hue difference, and so forth. They are based on instrumental measurements the results of which are modified by mathematical formulas...

Psychoquantitive scales; these are ratio scales expressing the stimulus in terms of the average visual response so that not just intervals of the scale but also ratios are comparable. They are absolute scales starting with zero response and proceeding to maximum response." (Color: Essence & Logic, Rolf G. Kuehni, 1983)

Individuals exposed by various colour stimuli in their daily life however most of them are usually upon the unconscious. People are no often aware that the stimulus of colour affects their feelings. Colour sensations can cause physical reactions. It can influence the person's mood, temperament and behaviour. From the psychological point of view colour can be divided into two distinct group as cool (blue or predominantly blue in cast) and warm colours (red or predominantly red and yellow). Complementary colours are warm-cool couples (Cheskin, 1965). There is a strong tendency in the human beings mind to form a balanced complementary pair of the warm and cool colours. Besides, the coolness and the warmth factor have strong effects on the human mental structure and behaviour. For instance, people feel warm in a red room nevertheless they fell cold in a blue room.

There is a part which is highly subjective in the responses of the man-kind mental structure to the colour. Nevertheless, it is possible to come in to general terms for the colour psychology in architecture in terms of the emotions of the human beings which are related with the colours. It should be stated that there are two different shapes of the human responses to the colour as culturally learned responses and intuitive responses (Fehrman & Fehrman, 2000). As a matter of fact the response of a human beings is an association of these intuitive and afterwards learned responses. *Red* as a hue contains exciting and stimulating effects. For the reason that it is the colour of the blood it has an active, strong, warm and aggressive impression. Its dominant and dynamic character causes being gazed the attention. For the reason that in the visual process its focal point occurs behind the retina red is the most convenient hue to create the illusions and it is perceived closer than the in reality it is (Sharpe, 1975). On the other hand *green* which is considered as the colour of nature, has retiring or/and relaxing effect. For the reason that its focal point occurs exactly on the retina it is the most restful colour for the eye (Sharpe, 1975). In terms of psychology *blue* is the opposite of the red. It is perceived as transparent and wet instead of the opaque and dry effects of red. It has calm, comfortable, contemplative and depressing impressions On the other hand *yellow* has a cheerful, vital and egocentric impressions. It is the symbol of the sunlight and therefore enlightenment. Its a comparatively light colour but generally it appears as brighter than white (Sharpe, 1975). Nevertheless the architectural point of view of the psychological effects of the colour will be examined in next chapter.

CHAPTER IV

COLOUR ON THE ENVIRONMENTAL SKIN AS AN EXPRESSION OF THOUGHT

“You may have thought that it was all talk and no reality; but now that you are in the canyon, and in a shadow, look about you and see if there not plenty of colour there, too. The walls are dyed with it, the stones are stained with it- all sorts of colours from strata of rock, from clays and slates, from minerals, from lichens, from mosses. The stones under your feet have not turned black or brown because out of the sunlight.” John Van Dyke, The Dessert,(Michel, 1996,p.88)

As far as it is pointed out in this study that colour is one of the most important property of the environment that we live in related with the way of our perception. In the light of this statement architecture that is defined basically as organising the environment, occurs the main designating element of the surroundings in terms of colour, too. At this standpoint, architect as a designer does not only create an architectural object but also constitutes a colour scheme for the context where the building is located. For the reason that stimulating an exterior surface for the structure means simultaneously to form the inner surface of that context.

4.1. COLOUR AS A CONCEPT

The physical and perceptual properties of colour has examined this study so far in order to explain the basic concepts which will be formed a base to the following descriptions. However, the peculiarities of it which are based on the experience, have a greater importance for the individuals. Colour as a concept for the human beings is a part of their visual information. It is considered as a result of a kind of scientific process, in fact colour, its dimensions, its statements such as wavelength, rays, etc.... means nothing in the absence of the observer. Since the colour is not the property of the object, it is of the stimuli of the individual's mind. Therefore, the interpretation of the incoming message changes when the structure of the mind alters. For the reason that, all kind of living beings have different colour perception relating to their mental system. Black and white visual phenomenon of the dogs can be a good example to this statement.

As a matter of fact in nature, colour, beyond its esthetical role in the man-made world, occurs as a functional requirement. It provides living beings to attract attention, to impart information, to aid deception and to stimulate the emotions (Lancaster, 1996). According to most of the plants to attract the animal's attention is the only way to sustain their sorts or in some situations to hunt. On the other hand according to the some kind of animals to hide themselves in the colours of the environment become the only way to survive. The greenness of the plants in fact is another result of the functional usage of the colour. The chlorophyll which is one of their main material, provides them to absorb red, yellow, blue and violet wavelengths of sunlight and to reflect green as an important part of the photosynthesis. This is the process of life for most of the photosynthetic living beings such as plants, algae, etc... until the end of their lives. According to the most of the plants the colour of the death is the absence of the chlorophyll. This situation occurs the origin of the Red sea or the colours of the autumn.

The definition of the visible spectrum that is pointed out in the third chapter, is based on the human colour perception. However in nature according to all sort of living beings the portion of the visible spectrum on the electromagnetic radiation scheme differs one to another. For instance the visible spectrum of the insects varies from the green region up to ultraviolet. But red as a colour seems to them as grey, it can not be perceived by the insects (Birren, 1982). On the other hand in the light of the experiments it is pointed out that the fishes have a different colour vision because of the effects of the water. They perceive the green as the lightest colour and red as the darkest one. Red as a colour is not common for them for the reason that its radiation easiness in the absorption by the water.

4.2.COLOUR IN ARCHITECTURE

“Colour is an immensely evocative medium, possessing inherent powers to provoke immediate and marked reactions in the onlooker, and as such it has been developed as a language of symbol in both the natural and the man-made worlds. Its use in architecture is no exception, serving to dramatically affect perception of architectural space and form.” (Toy, 1996)

From the architectural point of view, it is a fact that can not be denied colour is one of the most important component of the visual integrity of the three dimensional objects. According to Giedion colour is the living element of bare wall which can be perceived as 'dead, anonymous surface' without the help of objects and colour (Giedion, 1958). On the other hand, Ruskin in his book entitled *The seven lamps of architecture*, pointed out his ideas that colourless architecture could not be perfect. As contrary to Giedion, Ruskin considered that colour and form could not be united. The perceptiveness of the one were based on the simplicity of the other (Ruskin, 1989).

As mentioned before, the living beings explain their living environment with their senses and the most effective one of these senses are considered as is the visual perception. Therefore if light is the basic necessity of this perception phenomenon colour is both its result and complementary. For the reason that the purpose of architecture is to organise the environment that the human beings live in, experiencing the architectural activity highly depended on the visual perception sense. Colour occurs as long as the light exists even if the architect does not design it consciously. It exists in the surroundings as background or in the sunlight itself. In fact, it is not possible to separate the architectural object from the context, the effect of the environment and, therefore, from the colour perception itself. Consequently, the design of the architect is influenced by the colour and its quality whether he/she is conscious or unconscious. Le Corbusier pointed out his ideas about the colour inputs of the environment itself as;

"As early as 1910, I knew about the bracing quality of chalk white. Practice showed me that the joy of white explodes only when surrounded by the powerful hum of colour." (Porter & Mikellides, 1982, p. 38)

As far as it is considered that the basic elements of art and architecture are line, form and colour. However generally in the architectural history, it is admitted that colour is mostly associated with the painting, form and line mostly is related with the architecture. At the beginning of the human civilisation, these elements of the phenomenon of visual perception were considered as similar for the art and architecture. Therefore colour was the element of the design as well as the painting. As the time had gone by, it started to be separated from the architectural activity and was imputed to

painting. It could have only been in the design process as a decorative element with its esthetical value. Whereas colour is the part of the surroundings that can not be distinguished and even in the nature itself, it always expresses a function beyond being the symbol of the beauty. Nevertheless re-understanding this fact cost the human beings for the centuries.

4.3. COLOUR ON THE ENVIRONMENTAL SKIN OF THE ARCHITECTURAL DESIGN OBJECT

“Architecture must not be coloured for colour’s sake. Colour is a property and the language of form, not a separate element or an intruder. Colour in environments need not forsake elegance if it is used intelligently and tactfully; as a matter of fact, it can lend an aesthetic quality that would otherwise be unobtainable.” (Mahnke &Mahnke, 1987, p.69)

Architectural shell, as explained before in this study, basically can be considered that has two faces as inner and outer. The colour design approaches of these two faces of the architectural object differentiate each other. Colour concept of the inner faces is generally shaped by the architect according to the necessities of the function and likes and dislikes of the users. On the other hand, colour comes to the fore on the environmental skin with its power in emphasising the architectural design thoughts. The difference between the design purposes is not the only diversity between the colour concept on the inner and the outer surfaces. The environmental skin as a contour in the endless ground can not be perceived alone apart from the other natural or man-made objects. In the design of the interior, architect can make his/her choice by only considering the autonomous entity of the building, in a considerably free way. On the other hand for the environmental skin, there are various external factors which are acquired independence from the architect and affect the perception of the colour of the building.

“The complexity of architecture is conditional upon the mutual presence of an ‘outside’ and an ‘inside’ which can not be experienced at the same time. Architectural space is created in the same way that artists painted the figures on Greek vases: by painting the background and not the figures. With architecture,

one does not build a space- one builds around it, thus creating space." (Lange, 1995, p. 81)

As a matter of fact, architects do not only create an inner space for the building but also forms out an environmental skin for the surroundings. As mentioned before, this environmental skin as a contour occurs by the architectural object as a figure in the environment as an endless and shapeless ground. From this point of view it is possible to point out that colour as a visual element that is chosen and applied by an architect do not only influence the perceptions of the observers but also affect the context of the building itself. The environmental skins of a building simultaneously become a background for the other building which form a figural character for this example. Therefore, the colour of the building is affected by the colour of the environment and the other architectural three dimensional objects just as it does for them too. For the reason that the simultaneous colour contrast or background effect affects the colour perception of the living beings. Consequently, colours of the context should be considered as important as the chosen colours of the building itself. For the reason that its effects on the architectural end-product.

"When developing a colour scheme for a building it must first be seen in its strategic relationship with its immediate surroundings. The building's visual function within the city or district should also be established." (Moughtin, Oc & Tiesdell, 1996, p.21)

The environmental skins of the architectural products can be considered the inner faces of the city. Therefore the colours of the buildings designate the colours of the urban space in some extend. According to Lange the experience of the urban space is governed by the interplay between space, light and colour (Lange, 1995). Although there are exceptional examples in various patterns, particularly for the traditional settlements, the colour of the city is usually designated by the colour of the natural materials of that geography. For the reason that the construction materials of this kind of buildings are generally produced from the nature, the colour of the soil, rock or wood becomes the colour of the environmental skin of the building and therefore the colour of the inner surfaces of the pattern (Porter & Mikellides, 1976). According to Swirnoff

colour can be considered as a signature of the city and its citizens culture. Especially in the vernacular colour occurs as a symbol of the culture. Besides, colour taste is formed out by the citizens which are distinctive and self- contained as much a part of human coding as their signs and symbols. This phenomenon can be called as a kind of *collective eye* which determines their colour choices in designing process (Swirnoff, 2000). Therefore colour is one of the elements of the context which provide the citizens to evaluate their collective memory.



Figure 4. 1. North African Cottage
(source: Kutlutan, 1999)

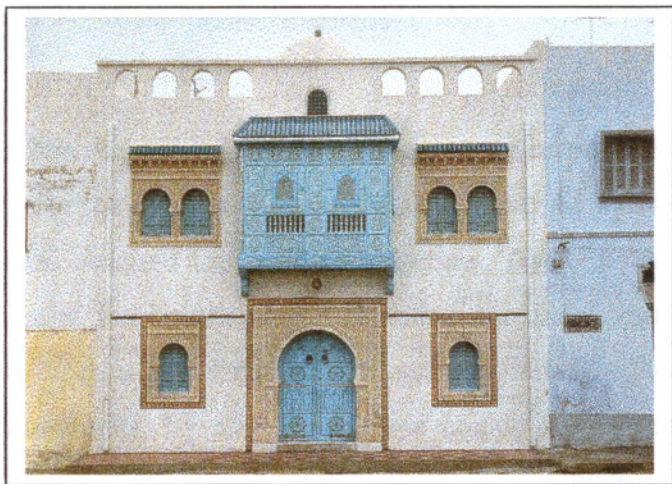


Figure 4. 2. Tunisian House facade
(source: Eyüpgiller, 2000)

“Formal analysts feel it is impossible to fully ‘know’ a building. It can only be understood as a group of diverse abstractions. Likewise, it is impossible to fully ‘know’ a city, but the complexities and ambiguities which characterise the

'reading' of form and space are truly enriched by the diversity of colour, giving great variety to the creative interpretation of the city." (Minah, 1996, p.17)



Figure 4. 3. Turkish pattern
(source: Küçükerman, 1995)

According to Moughtin the city image from the point of view of colour is often formed over a long history. For the reason that even if the architectural styles change, it requires a long time for being changed the building materials. These materials designates the environmental skins of the buildings and therefore the inner surfaces of the cities. Consequently these colours of the materials transforms into the general colour palette for this kind of settlements. By examining these colour palettes colour schemes are formed out (Moughtin, Oc & Tiesdell, 1996). As far as it is investigated that there are two main stages in order to constitute a colour scheme for the city. The first one can be determined as to establish a colour plans and colour schemes for the region or the city by means of the environmental surveys. In the light of these surveys the colour maps which can be considered as the basic shapes of the colour schemes, are established. Second stage can be summed up as to make this colour map comprehensive and capable to implications (Moughtin, Oc & Tiesdell, 1996). As a matter of fact most of the traditional settlements of the Europe already have this kind of schemes. In case of

Turkey, except a few specific examples, it is not common to constitute a colour scheme for the traditional settlements in terms of architectural conservation. Even if a colour scheme is prepared for a traditional pattern, generally most of them does not conserve by the laws. Bodrum can be designated as one of the few examples and most famous traditional settlement which have a colour scheme in our country. On the other hand, according to him there are four different scales of colour of the environmental skin of the building which is designed in a city. The first one is the scale of the city itself and the second one is the scale of the streets or squares. In addition, these scales are generally known as the visual concepts of the city which can not be changed by the architect as an individual. The third one is considered as the individual buildings as a whole and the last scale is formed by the details of the environmental skin itself. Furthermore, these two scales form out the activity domain of the architects in terms of the colour design.

“A response which should be based on a thorough survey of colour in the local environment. For the reminder of the city, colour can be used to highlight important building and landmarks, colour code important paths and give individuality within the overall pattern for important squares and meeting places.” (Moughtin, 1996,p. 21)

In the light of these statements two paradigms should be taken into consideration First it can be considered from the point of view of the city sense and citizens. Secondly colour can be considered from the point of view of the architect as an integral part of his language . At this point it should be stated that this study proposes to examine the environmental skin from the point of view of the architect. It is obvious that for the reason that the peculiarity of the environmental skin which is simultaneously the inner faces of the environment itself, the effects of the context inevitably will be kept in mind. On the other hand from the point of view of the city scale, as far as it is considered in this study, it is not easy to create a colour scheme for the cities of the industrialisation age. However it should be developed for the traditional settlements in order to conserve the colour characteristics of the place.

4.3.1. COLOUR QUALITY

“Colour in architecture is quite unlike that in painting; first of all it is colour in three dimensions. It is also subjected to changing sunlight and, most importantly, it requires the careful use of materials with necessary consideration to their ageing and weathering properties.” (Pelli, 1996)

Particularly, since the Renaissance period, colour had been considered as an element of painting rather than the architecture for about three centuries. However with the influences of the De Stijl and Cubist approaches colour was started to gain a volumetric character. It was given a meaning of being the language of architectural form. As a matter of fact, colour as a property of a figure in the three dimensional environment is perceived highly different from the art objects. Since the paintings generally are exhibited in the places which the conditions of the place are carefully organised. In these specific spaces the colour and amount of light, the surrounding figures, besides the climatic factors such as temperature are determined in order to provide the observers the best view. On the other hand in the three dimensional living environments it is not possible to arrange the physical conditions.

“To take one example, our perception of colour is constantly and simultaneously modified by a supplementary experience of light, texture and form; in other words, colour is light, texture and form.” (Porter, 1997, p.56)

As far as it is explained in the third chapter of this thesis, colour perception process of human beings have four scale as light, object, biological vision and psychological factors. Although the biological and psychological factors are depended on the individual person whether he/she is conscious or unconscious, object and light properties are determined by the environment itself. Therefore, for the reason that the architectural object stands in an environment, the perception of the colour of the building is affected by the conditions of the surroundings too. Furthermore, it is not possible, except the photos, to observe the architectural object from a standpoint which is designated beforehand like for the paintings. Living beings do not only experience the three dimensional object from the different view of angles but also they perceive it in a context in different times of a day and in different weather conditions.

4.3.1.1. LIGHT, SHADOW AND TIME

“All of nature is colourful, and even the grey of dust or soot, even the most depressing and melancholy places have their own typical colours. Wherever light is, there colour must be.” (Taut, 1981, p.14)

The diversities in the properties of light directly affect the colour perception, for the reason that light is the basic necessity of the colour. The relation between the colour and light has been examined by the human beings since the antiquity. Alberti, who was a famous artist and architect of the Renaissance period, pointed out his ideas about the relation between light and colour in his book as;

“It seems obvious to me that colours take their variations from light, because all colours put in the shade appear different from what they are in the light. Shades make colour dark; light, where it strikes, makes colour bright...” (Lange, 1995, p.82,83)

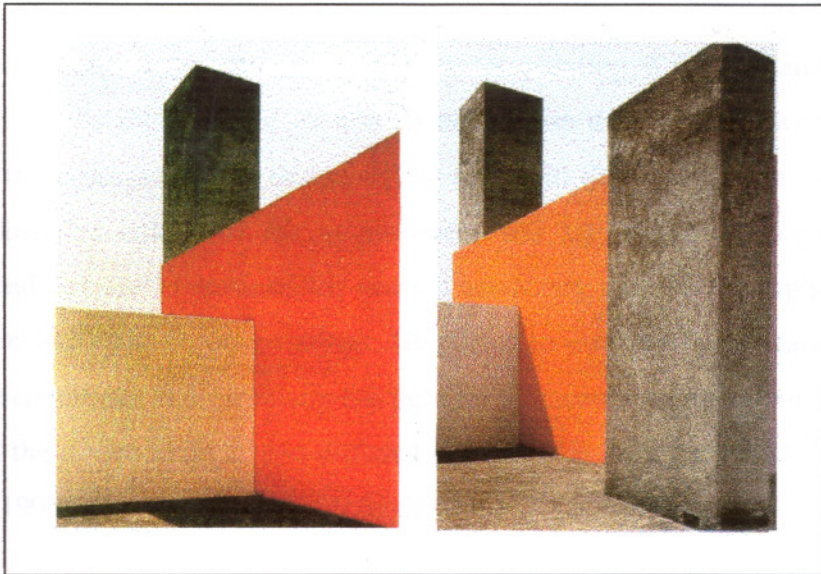


Figure 4. 4. Effects of Sunlight on colour perception

(source: Aysan, 1999)

Sun is known as the basic light source for the living beings. Sunlight, moonlight and lights of the stars were the only known light sources before the inventions of the artificial one. However even the sunlight itself changes in the daytime, and these changing values of the light alters the colour perception. Colour perception is not only

changed by the natural light sources but also is differed by the every specific character of the artificial sources. For instance, under a tungsten light a red object is perceived as orange, on the other hand same object under the white fluorescent tubes appears bluish (Porter, 1997). Although in this study the natural light sources which are the effective for the environmental skin, are accepted as the main illuminating system, with the influences of the developing lightning techniques particularly by means of the coloured lights, architects have the opportunity to create changing colour system for the environmental skins of their buildings.



Figure 4. 5. Effects of artificial light on colour (source: Archiscope, 1999)

According to the artistic activities especially for the painting, it was not an easy process to accept and apply the nature itself and its colours on the canvasses as they were in reality. For the centuries artists described the nature in their minds instead of the real one. Therefore the colour of the environment and the effects of the atmospheric conditions had not been examined for years. Luminosity and the atmosphere began to be effected in 1820's in Turner paintings. He started to examine the alteration effects of atmospheric conditions and especially the light on the perception of colour. For instance he analysed the direct sunlight and diffused light effects on the colour of the building (Lancaster, 1996). He pointed out his thoughts as;

“For me a landscape does not exist in its own right, since its appearance changes at every moment; but the surrounding atmosphere brings it to life – the air and the light which vary continually. For me, it is only the surrounding atmosphere which gives subjects their true value.” (Lancaster, 1996, p.24)

Furthermore the conditions of the atmosphere differ the colour of the sunlight too. For instance mist, cloud, dust and atmospheric pollution cause the light to be diffused

(Lancaster, 1996). This situation causes a change on the perception of the colour. For instance, in sunshine, red-orange hues are dominated the figural character of the building against the context. However in overcast days, red- orange hues causes the building changing its character from figure to ground. On the other hand, blue, blue-green and red-violet hues in the overcast days become more saturated. White especially in the darker environments, shows a figural character. Sunlight increases its saturation and, therefore its figural property (Minah, 1996). Bruno Taut pointed out that mixing pigments are weaker to the effects of sun, light, wind effects than the pure hues. They generally lose their homogeneity. Besides, according to him, this is one of the reason that the green is not the preferred pigment in the antiquity (Taut, 1981).

“Shadow is colour.” John Ruskin (Schumacher, 1981, p.10)

As far as it pointed out that the effects of light changes the impression of the colour. However it is not possible to ignore the effects of shadow on the environmental skin which is created by light itself. Shadow and its effects on the perception of the architectural end product have been investigated from the antiquity. Furthermore according to a legend creating of the Corinthian style was based on a shadow on a wall (Reed, 1990). However with the evolution of the modern tradition designing the effects of the shadow started to be removed from the environmental skins of architectural objects. Besides Frank Lloyd Wright pointed out his thoughts about shadow as;

“Shadows were the brushwork of the ancient architect. Let the modern now work with light, light diffused, light reflected, light refracted- light for its own sake, shadows gratuitous.” Frank Lloyd Wright (Faulkner, 1972, p.8)

Shadow has always been considered by the human beings as the mysterious one. Whereas the in the modern style as the architecture of machine age can never be any narrative approach. Nevertheless that is the fact that no one can be denied, where the light exists there is shadow and colour. From the point of view of Schumacher the chromatic effect of a building is not only depended on the existent applied pigments of its environmental skin but also is depended on the massing or distribution effects of shadow. Shadow dominates the impression of colour. He pointed out that the effects of

shadow on the outer surface of the building form out the chromatic plays and this can be considered the primary effect of the shell. On the other hand the colours of the skin which are designed by the architect, can be accepted as the secondary effect of the environmental skin. According to him designing the relationship between these primary and secondary effects is stimulates a critical decision for the architect in order not to interfere or cancel out each other (Schumacher, 1981, p.11). Lois Barragan who was one of the most important Mexican architects, is known with its polychromatic architecture which is based on cultural and locale characteristics of his nation. Furthermore he designed the effects of shadow on the environmental skins his buildings as well as colour.

The architectural end-product as a three dimensional object in the living environment is effected by the changing time. Besides, its environmental skin form out a scene which provides the living beings to observe the time going by. The shadows of the components of the exterior surface changes and therefore, the perception of the applied colour alters. At the early hours in the morning the colour of the sunlight is yellowish. At the midday when the shadow occurs as their shortest shape sunlight becomes bluish. On the other hand it started to become redden until the setting down (Porter, 1997). According to Bruno Taut in the twilight red is perceived darker and blue started to come to the fore (Taut, 1981,p. 13).

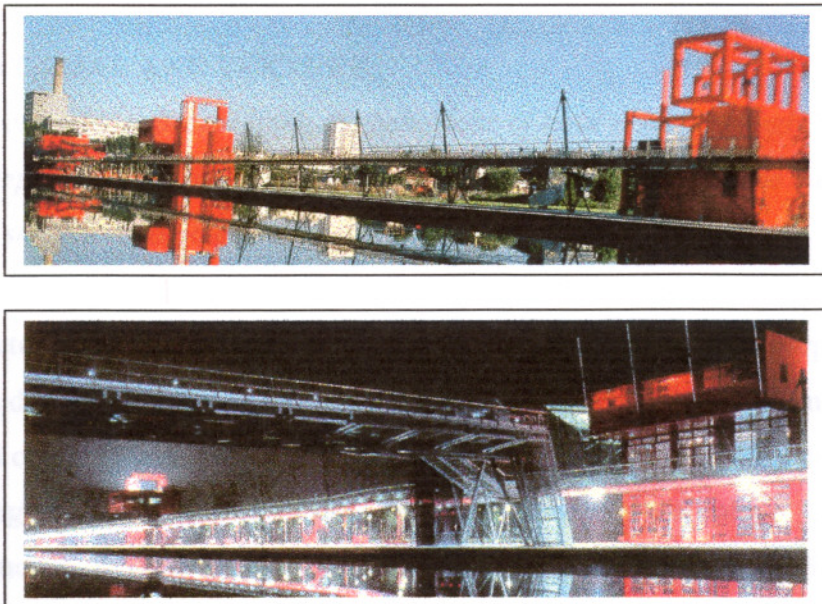


Figure 4. 6. The diversities between the day & night colour perception
(source: Jencks, 1990 & Thomsen, 1994)

As far as it is considered that generally it is not possible to be observed the inner and outer surfaces of a building simultaneously. However in specific conditions time stimulates an exception. When the dark comes with the night the inner surfaces of some kind of buildings are perceived just like as its outer skin. Therefore the colours of the inner surface start to be observed as the colours of the environmental skin. The experiences of the architectural design for human beings are completely change. Time transforms the perception of the environmental skin in the way which is designed by the architect beforehand.



Figure 4. 7. Effects of time on the perception of the environmental skin
(source: Öz, 2000)

4.3.1.2. MATERIAL AND TEXTURE

“As colour is reflected light, the behaviour of light is very strongly related to its perception. The human eye responds both to the quantity and the quality of light that surfaces and objects reflect.” (Demirörs, 1992, p.81)

As it was determined before in the third chapter of this thesis, colour perception process can be considered in four stage and two of them are based on the environmental factors as light and object stages. Light is transmitted, reflected or absorbed by the object and the wavelengths that the object reflect, designate the perceived colour. Chemical and physical structure, in other words, the material of the object is the most effective factor in designating the wavelengths of the reflected light beams. It is possible to point out that colour of the object which is perceived by the living beings, can occur in two ways.

One of them is formed by the colour of the natural surface of the object and the other one is constituted by the colour of the applied material on the natural surface. This applied material can be like as a transparent film on the surface in order to protect the natural structural component of the building but not to hide its physical properties. On the other hand, in some situations this artificial surface is observed as being superior to the natural one and the physical properties of the artificial surface is dominated in order to be perceived by the living beings. In the architectural design history, particularly in the 19th Century there was an important discussion on the way of whether covering or uncovering the environmental skin of the building.

In the 20th Century, innovations of new building materials enabled the architects to alter the environmental skins of their architectural end-products. Therefore the new materials provided the exterior surfaces wide range of possibilities to be utilised various colours. As mentioned before the developing of the surface technology is highly depended on the effects of the industrialisation age. Besides, the augmentations of the human civilisation can be considered as parallel to the developments in the artificial surface techniques. Especially the machine age aesthetic was suggested a specific surface quality. Therefore this esthetical tendency in applying the specific materials to the environmental skin brought with itself the new taste of texture and colour.

“The developments of new materials, including paints, can be seen in terms of the pursuit of precision, which in the machine age can be read as perfection. Modern materials tend to be sleek, smooth, functional and easily reproducible; paints are required to be waterproof, colourfast and durable.” (Lancaster, 1996, p.26)

From the point of view of surface quality texture as a property is accepted as important as the material of the object. textural effects of the building materials has been used in the architectural activity since the first human civilisation. However the textures had been improved with the materials and increased its variations with the developing techniques. As a matter of fact, it occurs at the point which the surface transforms its physical character from planer to three dimensional. According to the gestalt patterns and textures can be occurred in either two or three dimensions from anything that can be

repeated or in other words they can occur by the repetition of similar and dissimilar individual units which are placed in proximity (Güner, 1999, p.25). In general, texture is considered as in two main groups as visual and physical textures. Visual texture as a group is formed by the textures which are just perceived with the sense of vision. However the physical textures are constituted by the textures which are perceived with the sense of touch (Ağaryılmaz, 1973).

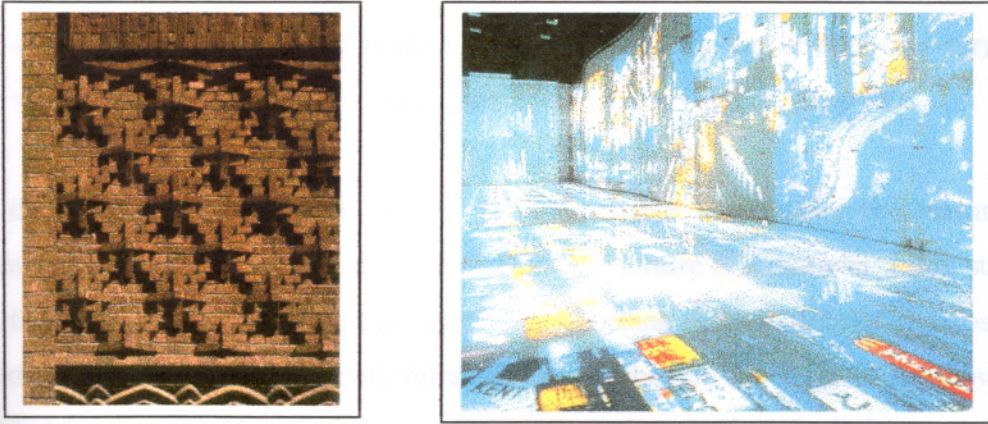


Figure 4. 8. Physical and visual textures (sources: Thomsen, 1994)

Although the textural expression of the material had been considered as an esthetical value for a long time in architecture. Particularly with the beginning of the modern tendencies, functional properties of it had been recognised. First, texture provides the material to form a specific reaction against the effects of heat and sound. However, from the architectural point of view the most important function of the texture can be accepted as its expressive quality. As far as it is considered in this study that texture as well as the colour is one of the design concepts which provides the architects to express their architectural thought. Therefore, particularly architects of 20th Century highly benefited from the expressive quality of material and its texture on the environmental skins of their buildings. For instance one of the most preferred effect of texture can be considered as its dynamic or static characteristics. As mentioned before exterior surface of an architectural three dimensional object becomes a part of the inner surface of its context. Besides every context of a building has its own material and also textural characteristics according to its geographical conditions. In the light of this statement it is obvious that architect as a designer designates an attitude towards the context and expresses this attitude on the environmental skin of the building which

simultaneously forms out the inner surface surroundings. Therefore, as a matter of fact, texture can be considered as one of the most important design tool of the architect in order to present the architectural approach. As an another significance of texture its three dimensionality which provides colour to be perceived with form (Demirörs, 1992). According to Sven Hesselgren as pointed out below;

“A textureless surface appears abstract, while one that is textured makes a more concrete impression, and relative distances between the objects and surfaces within the space are more clearly perceived.” (Demirörs, 1992, p.83)

From the architectural point of view it is not possible to consider the texture as independent from the colour and also colour from the texture of a material. Light strikes the surface of the material and surface modify it according to its molecular composition and textural structure. It is reflected, refracted or absorbed by the surface. As shown in the table 4.1 different materials form out different reactions against the light.

Typical specular materials	Reflectance (%)
Luminaire reflector materials	
chromium	63-66
aluminium	60-70
stainless steel	50-60
Building materials	
clear glass or plastic	8-10
Typical diffusing materials	
Luminaire reflector materials	
white paint	70-90
Masonry and structural materials	
white plaster	90-92
white terra-cotta	65-80
limestone	35-60
sandstone	20-40
marble	30-70
concrete (uncoated)	45-55
granite	20-25
brick	20-40
Wood	
birch	35-50
oak	15-25
mahogany	6-12
walnut	5-10
Paint	
new white paint	75-90
old white paint	50-70

Table 4.1. materials reflecting table (source: Demirörs, 1992)

Consequently, even if two different materials are painted with the same hue, they will be perceived different each other. Furthermore, it is not possible to be perceived same colour impression even for the materials which have the same molecular composition, if their textural characteristics become different each other. Light beams are reflected by the smooth surfaces directionally. On the other hand rough surfaces scatter it in various directions. When the light is scattered by the surface of an object, the colour of that object is perceived less vivid and pure. On the other hand gloss surfaces are increased the saturation of the colour (Demirörs, 1992). Besides the atmospheric conditions affect the textural quality and the perception of colour too. For instance wet surface's colour is perceived brighter than the dry one.

As can be seen in table 4.1, different material reacts to the light in different manner and this situation differentiate the perceived colour. However another significance that can be figure out from that table is the diversity which forms by the time between the same materials such as the diversity between the new and old white paints . As mentioned before, architectural colour differentiated from the other disciplines which are considered colour as a tool such as painting or sculpture, for the reason that the environmental characteristics of the buildings. Under the destructive conditions of the nature itself it is not possible for the environmental objects to protect their appearance just like as at the beginning. Colour is one of the most vulnerable components of the building and time inevitably alters it. For instance, wood becomes grey and darken with years, it loses its endurance. Copper is golden when it first applies but with the ages it continues its life as dark brown and it ends as bright green in twenty years. Ceramic tiles, glass or glazed bricks changes their colour and brilliance. Painted surfaces are highly vulnerable against the effects of time and painting needs to repaint every two or three years (Pelli, 1996). Therefore it is obvious that time does not only affect colour of the environmental skin with its changing perception phenomenon but also it alters its physical structure.

From the point of view of the architecture of the last decade, with the influences of the developments in the material technology colour has been gained a different attitude. Unchangeable structure of colour which is considered as one of the most important characteristics of it, started to be changed by the artists and architects. By means of the

opportunities of the new technologies, the environmental skins of the buildings were saved from its static characteristic. It started to be transformed into a changeable developing and a dynamic attitude. The tower of winds which is designed by Toyo Ito can be a good example to this manner. Changing quality of its environmental skin provides its architect to form out a building which can be react to the effects surroundings. The structures which can change with the alterations of the atmospheric conditions can be other good example to this phenomenon. As a matter of fact, changeable skin system can not be considered an invention for the nature itself. Some sort of animals have developed this technique as a part of their protecting and living manner.

4.3.2. COLOUR AND THE HUMAN ATTITUDE

As mentioned before the colour perception phenomenon is formed out by the four stages as effects of light, object, visual structure and psychological reactions of living beings. Two scales of these four stages are strictly based on the mental and physical structure of the observer. Therefore the greater part of the process occurs in the mind. The psychological and the physiological structure of the individual is influenced by it. As same as all kind of animals, human beings react against to the colour by means of their mental and physical systems.

4.3.2.1. PSYCHOLOGICAL EFFECTS OF COLOUR

As mentioned before the greater part of the colour perception process occurred in the mind of the living beings. Consequently the result of the process is highly influenced by the mental structure of the individual person. However it is obvious that psychological measurements are often subjective and in a manner which is hard to determine the principles for all living beings. Nevertheless although the psychological response to the colour differentiated in details, it is possible to establish the general rules for the human beings. It is considered that by the scientists behind the psychological responses to colour are more basic responses to specific wavelengths of radiant energy. There are various effects which change the colour perception of the human beings such as age, sex, culture, religion, etc...for instance according to the children, perception process is colour dominant more than the form dominant (Birren, 1982). Therefore particularly for the colour designers it is important to know the profile

of their clients in order to communicate. However in this study the general statements of the colour psychology in architecture will be examined instead of the personal tastes which determine the likes and dislikes of the people.

The main colour effects can be pointed out in two groups as warm and cool colours. The major hues of these groups red and blue cause different activation in the autonomic nervous system of the brain. According to the investigations warm colours causes the living beings overestimating time. On the other hand, with the influence of the cool colours time is underestimated. Furthermore, the objects which are coloured with warm hues are perceived longer bigger and heavier than reality. Cool colours causes the objects being perceived shorter, smaller and lighter than the real one (Porter & Mikellides, 1976). Warm colours (advancing colours) can be considered as the colours of long wavelengths and the cool colours (receding colours) as the colours of short wavelengths. However the brightness is one of the most important effect in determining the advancing colours and receding ones.

From the point of view of Gestalt, colour has an effective role on the perception process of the human beings. The rules can be summed up as similarity, continuity, closure and figure and ground phenomenon. Generally warm colours tend to be figure and the cool colours are perceived as background. For instance in a red tends to be perceived as figure on the green ground or According to the similarity rule objects which are similar one and another in some way tend to be perceived as a group. Similar hues or degrees of brightness with the effects of the similarity rule are perceived as a group as well as the warm colours and cool colours. Pastels of the same hue tend to be formed a group with their primary colour. Form the point of view of the rules of Gestalt, this rule is primary significance of the completion. This phenomenon is developed with the ages by the human beings for the reason that it is a learned concept. In the light of this statement, it is possible to consider that psychological closure of the colour design is a kind of experience process of the mind (Sharpe, 1975). If there is an object which is painted with warm colours mind started to look unconsciously for a cool colour in order to establish the visual balance.

“Colour not only produces mood associations, subjective and objective impressions, but also influences our estimation of volume, weight, time, temperature and noise. Collective findings have shown that there are basic reactions to colour common to most people.” (Mahnke & Mahnke, 1987, p. 10)

4.3.2.2. PHYSIOLOGICAL EFFECTS OF COLOUR

As far as it is stated in this study the greater part of the colour perception process occurs in the mind of the living beings. Therefore, as mentioned before the result of the phenomenon is influenced by the mental structure and influences of the attitudes of the individual. Furthermore the effects of the colour on the organism is not limited with the psychological responses. It also affects the physical structure of the human body. Cure power of the colour had been known and profited by the man-kind since the Egyptian period. However greater part of its opportunities had lost with the celestial religions effects.

“The healing power of colour has been realised and practised for many centuries in the East, where a ‘colour cure’ has been used not only for psychological disorders but also for physical ailments. In India, for example, coloured light was projected on to ailing patients –specific colours being seen as remedial for particular symptoms and stages of disease.” (Porter & Mikellides, 1976, p.87)

From the physical point of view, it is considered that every hue has its own effect on the organism of the living beings. For instance, Red as a colour has an effect on the body of the human beings which causes increasing the bodily tension. It is obvious that the man-kind like all other living beings have a radiation sense. according to the investigations blind people can also recognise the existence of light. Reactions of the muscular system of the human body shows diversities according to the colours. For instance, they are more active with warm colours than the cool ones(Birren, 1982). On the other hand an another experiment was stated that red coloured light increases the pressure of the muscles. Green causes the least pressure on the muscle of the human body. The other engrossing relation between the colour perception and the physical system of the body can be summed up as the sound effect. The investigations pointed out that the loud

noises cause decreasing the sensitivity of the human eye to the red colours and increasing the sensitivity to the green colour (Birren, 1982). As a matter of fact it is possible to establish the relations with the physical effects and the emotions to the colours.

“It may thus be generalised that colour affects muscular tension, cortical activation (brain waves), heart rate, respiration, and other functions of the autonomic nervous system – and certainly it arouses definite emotional and aesthetic reactions, likes and dislikes, pleasant and unpleasant associations.”
(Birren, 1982, p.20)

It is also possible to consider that emotions of a person according to the colours can be formed out during time with the physical reactions of his/her body. In the light of this statement, it can be easy to examine the cultural effects of the human towards the hues. Furthermore this fact shows us the importance of the colours of the environment where the human beings live in. Since the emotions of the growing man-kind is developed by the physical reactions of his/her body towards the colours of the surroundings. As a matter of fact it is obvious that this phenomenon can be defined as the responsibility of the architect in being recognised the effects of his/her colour choices on determining the likes and dislikes of the observer

4.3.3. THE GENERAL BACKGROUND OF THE ENVIRONMENTAL SKIN AND THE COLOUR IDEA IN ARCHITECTURE

“Architecture occurs at the meeting of interior and exterior”

Robert Venturi (Norberg-Schulz, 1971)

It is possible to consider that the architectural activity had started with the attempts of shaping the environment which the human beings live in. At the beginning, the purpose of shaping was limited with finding a place which had supplied a protection against to the natural forces and changing it in order to provide to accommodate. The efforts that had started with using the spaces which were formed by the environment itself, had been continued with constructing the primitive cottages by the mankind themselves. With the evaluation of the agriculture, human beings started to build manmade

constructions in order to use the materials which are easily found from their surroundings. From the architectural point of view it is possible to regard that creating space activity had started with the transformation of the society from the migratory to the agricultural.

For the Palaeolithic ages it is not possible to tell about the environmental skin of the architecture, since the boundaries of the enclosed spaces were formed by the earth itself and the shaping of the surfaces extremely had depended on the natural forces. The effects of the human beings in shaping the surfaces of their environment were limited with the wall paintings. In fact, the wall paintings that were mostly drawn in the caves that were used as temples, can be considered as first attempts in using surfaces for expressing the thoughts. Especially for the reason that they were constituted for the ceremonial spaces, the colour of the paintings gained the abstractive expressions. As a matter of fact, their ability of utilising pigments of colour was limited with the productiveness of the material such as red and yellow ochre, iron and manganese oxides, mud, soot, and calcite (Kurtich & Eakin, 1996). With the evolutions of their painting techniques, the richness of the pigments varieties was increased. For the reason that the basic purpose of the construction of the primitive cottages as first architectural end-products was forming a protecting space, the environmental skin had been shaped by the basic necessities of the structural and the material components. Therefore, while their shelter had being constructed to protect their physical existence against the forces of the environment, the coloured images was formed to protect themselves against the spiritual powers. Because, it was believed by the primitive caveman that colour had magical protective effect.

Hence, according to the Egyptian and Mesopotamian cultures, for the reason that the basic purpose of architecture was to form an enclosure, the environmental skin had still been considered as a boundary for the inner and outer spaces. It had been located for the physical necessities and its conceptual existence had just depended on the figurative works. In fact, especially in the Egyptian culture surfaces had a different place of the informing because of the hieroglyphs. However, this effort which was attained by the pharaohs in order to explain their greatness, could be considered as an artistic activity rather than architectural. However they evolved a highly developed colour language in

order to increase the expressiveness of their representational picture writing (Porter & Mikellides, 1976). This language was depended on the symbolic meanings loaded on colour which stemmed from their religion system. In this system each colour had been personalised with one god. As a consequence all of these symbolic effects of their religion, the architecture of the Egyptians was polychromatic. As a matter of fact, not only the specific buildings but also their city itself was painted in the bright colours according to the hues of their gods. They preferred to juxtapose the contrast colours in order to stimulate different feelings for each hue.

“The architecture of the Egyptians is thoroughly polychromatic,- they painted everything; therefore we have much to learn from them on this head. They dealt in flat tints, and used neither shade nor shadow, yet found no difficulty in poetically conveying to the mind the identity of the object they desired to represent.” (Jones, 1856, p.24)

According to the Mesopotamian culture colour had a strong meaning in terms of symbolism. They were not only stimulated for the necessities of their religion but also they served as a functional notion such as to express the class of the human settlements. Colour was considered as an important element for the built environment in order to signify borders of the city and its parts. The astrology and the scientific works on the solar system were the domains of the Mesopotamian civilisation. In the light of their scientific examinations, they express the planets as the levels of the Ziggurats which were their principle religious structure. The stages of these structures were coloured according to their symbolic meaning. For instance, the lowest one was painted in black in order to represent the dark underworld.

In the age of the Ancient Greek, architecture still extremely depended on the basic constructional necessities, however, in the light of the development of the structural systems, the buildings had started to gain an additional perceptual surface except from the necessity one. Especially in the classical Greek architecture period, the half-open spaces which were created around the outer surfaces of the temples, were limited with the rows of column which were formed perceptual surfaces for the building. The environmental skin of the architectural object started to gain a transparent character and

this increased the building and the environment relation. The solids, hallows and the proportion of them provided to the environmental skin a three-dimensional or volumetric quality. Although the revivalist tendencies of the Classic Greek and Hellenistic architecture have always been represented the purity of it by means of whiteness, in fact, the Greek architecture was formed by the highly polychromatic three dimensional structures. Because of the wet climate, on the contrary to dry conditions of Egypt, the evidences of this polychromatic architecture could not stand against to pigment deterioration. As well as its contemporary civilisations, Mesopotamian and Egyptian cultures, colour usage in Greek architecture was highly influenced by the symbolical meanings of their religion system. According to them blue was the colour of truth and integrity, red was associated with love and sacrifice (Fehrman & Fehrman, 2000). Their god of the sun which provide the human beings light and, therefore, life was Apollo and he represented the colours of the rainbow.

“To many the discovery that the great monuments of antiquity were stained or painted with bright pigments has proved quite unacceptable, particularly to those with a puritanical reverence for the expression of the inherent appearance of natural materials... ‘Statuary was deeply dyed with garish pigments. The marble figure of a woman found on the Athenian Acropolis was tintured red, green, blue and yellow.’... A classical ideal, subscribed to by many designers, mistakenly associated with the architecture and sculpture of Ancient Greece, sees colour in architecture as a product only of natural finishes.” (Moughtin, Oc, Tiesdell, 1996, p. 18)

Colour as one of the design concepts was not utilised as a esthetical value or symbolic element but also it was formed on the environmental skins as a functional notion. Especially they utilised it on the architectural objects as well as the art works in order to emphasise details or refinements (Kurtich & Eakin). Consequently, the environmental skins of the Greek structures, therefore, their cities were highly coloured. From the point of view of colour, the buildings of this period was far from by the feelings of their copies in the nineteenth century. They developed a method which was combined with the other design concepts that were determined in this period. According to different styles they preferred different colours in order to apply. Doric style caused starting to

apply the red and blue in the capital. The Ionic style provide the gold to add this colour scheme. On the other hand in the capitals which were constructed in the Corinthian style, gold was preferred rather than the others (Birren, 1955). In the light of this statement, it is possible to consider that although the general view of the Greek cities were perceived as a polychromatic context, according to every different periods and styles they had a general colour expression. However, they had a treatment according to the some kind of components of the buildings which was not altered in different ages.

Notwithstanding, the architecture of the empire of Rome has been considered as continuation of the Greek architecture, in fact it had differentiated not only by the way of the construction techniques but also the design components of the architectural activity. Especially, the construction techniques that were took from the architecture of Etrurian such as vault, arch and dome, provided them to develop their structural systems. It is possible to regard that the architecture of Rome was a perfect combination of the Greek and Etrurian architecture. It is possible to speak about the beginning of an architectural language for the environmental skins of the buildings of this age. For the reason that the developments of the construction techniques provided to architects to increase the gaps between the structural components and to decrease the solidity of the of the outer surfaces of the architectural objects. For the first time, the differences between the inner and outer surfaces of the architectural shell was started to be formed and this situation caused a transformation on the outer surface of the architectural objects, in this period. The shell as a surface had started to increase its third dimension and as a boundary it had started to shape its faces according to the space belonged. For instance, the vaults which were used to cover the spaces, mostly could not be perceived from the outer scene of the building, because of the transformation of the shell from the inside to the outside.

From the point of view of colour, it can be pointed out that Romans kept up the colour understanding of the Greek architecture in their period too. However they did not continue to apply colours on the sculptures. The colour understanding in this period transformed to apply wide range of different materials to the environmental skin instead of utilising a kind of material in different colours. One of the reason of this consequence was the expending the borders emperor of Rome which provided the architects to find

and stimulate different kind of marbles that had their own specific hue. In other words, although developing techniques and being more practical people, they decreased the application of colour to the environmental skins and they left the sculpture unpainted (Porter & Mikellides, 1976). The symbolical meanings of colour was changed a little bit with the influences of the minor changing of the religion system.

“As the Greek architecture emigrated to Rome, the use of colour declined. The Romans, in truth, erected buildings of white marble and left them uncoated with wax or pigment. Here was the beginning of an austerity that was to continue down through the centuries.” (Birren, 1955, p. 168)

The Early Christian and afterwards Byzantine architecture can be considered as a synthesis of the types of the Roman buildings and the space requirements of the new religion. However, for the reason that both with the effects of the continuing occupations and the under developed construction techniques, the environmental skins of the Romanesque architecture mostly were formed by articulation of the solid blocks. According to this style of architecture it is not possible to speak about the relation between the inner and outer spaces. The shell which was constituted by the functional and symbolical requirements of the inner space, could not be progressed beyond of being a boundary for them. Moreover, for the reason that the small hallows on the outer surface of the buildings cause the inadequate illuminating in the inner space. This situation caused to provide the necessity level of the illuminating to the inner space were one of the basic purpose of the Gothic architecture regarded as the following style.

“Romanesque architecture was characterised by two features: the linking of all elements of a building and metrical space. With the first, architecture ceased to act in terms of surface and expressed itself in terms of structure; the emphasis shifted from the skin to the bony skeleton.” (Zevi, 1993)

In the Byzantine period the colour almost extremely lost its symbolical meaning because of the influences of the necessities of the new religion. The colourful construction technique kept up, however the purpose transformed in to form a sprit for the structures by means of the esthetical values. It was applied in order to stimulate a

specific emotion on the human response. As far as it is considered the reason of trying to decline the symbolical meanings of colour in the Byzantine architecture was to save the new celestial religion from the influences of the paganist way of believing. The colour utilising in architecture generally was limited with the inner space of the structures. The colour of the environmental skins of the buildings of this period highly depended on the diversity of the construction materials.

“St. Sophia’s at Constantinople was built with colourful marble in red, green, blue, black. Portals were covered with gold leaf. Jewels and pearls were woven into curtains.” (Birren, 1955, p. 168)

Gothic architecture can be considered as the end point of the act of becoming transparent. The developments on the construction techniques caused decreasing the structural forcing on the environmental skin of the building. Although, from the technological point of view, constructing the flying buttresses and transferring the dead loads of the building from the shell to the outer structural components was admitted as one of the most important technical invention in architecture. In fact, certainly the main contribution of the Gothic understanding to the mankind’s architectural history should be considered as the change of the concepts of the inner space and its relation with the outer space and transformation of the architectural shell. Romanesque architecture could never serve the need of enough illumination level because of its solid and thick walls, on the contrary, Gothic architecture symbolised the shape where the holly enlightenment was transformed in to the space. By means of the structural system which was become thin and increased the height in order to reach the sky, the shell of the building was altered in to the transparent membrane and the construction itself started to symbolise the bible. The environmental skin where the vertical lines and rows are emphasised, gained a transparent character for the reason that not only by increasing the forming of the proportion of the hallows but also expressing all of the structural components on it.

“In Gothic architecture, also, colour was always employed to assist in developing the panelwork and tracery; and this is effected to an extent of which it is difficult to form an idea in the present colourless condition of the buildings.”

In the slender shafts of their lofty edifices, the idea of elevation was still further increased by upward-running spiral lines of colour, which, while adding to the apparent height of the column, also helped to define its form.” (Harries, 1997,p.118)

Colour completely lost its symbols of religion and the formal characteristics and gained naturalistic attitude. They applied colour as a direct reflection of their spirit in a spontaneous way. Consequently, it can be considered that the esthetical values of applied colour came to the fore according to its functional usage approach. For instance the dark blue vaults of the Gothic churches symbolised the sky. This was the part of the purpose of reaching the sky or heaven in the Gothic architecture. According to the writings, in the middle ages France was completely coloured. For instance the colours of the environmental skin of the Notre Dame was much more vivid than the inner surfaces (Birren, 1982). Besides during the French revolution the statues, sculptures and the surfaces of the church was destroyed and some of the parts which were saved from the destruction, were found in 1977. When they found and completed Russell pointed out that;

“They give us, therefore, an authentic if much effaced idea of what the west front of Notre Dame must have looked like in the second half of the 13th century. Our century has been haunted by the idea of a time ‘when the cathedrals were white’; but the truth is that in the beginning those cathedrals were not white at all, but vivid with high colour.” (Birren, 1982, p.112)

Renaissance architecture which was named after the word *rebirth*, can be considered as the architecture of returning to the humanity rather than relating to God with the influences of the spirit of the age. Hence, contrary to the Gothic architecture, Renaissance architecture strictly attached to the ground and had an order where the horizontal lines were emphasised. According to the philosophers, artists and architects of this middle age was far from the Greek and Roman period. They were accepted as guides the Roman and Greek intellectuals to their new approaches. The Renaissance architects by means of examining the remainders of the Roman and with considering of the book of Vitruvius which they accepted as their bible, formed out orders, laws and

metric systems which stemmed from the propositions of the human body. They believed in the beauty and the purity of the basic geometrical forms. Although Renaissance architecture is considered as re-enacting of the Roman period rather than to imitate it by means of examining and transforming their orders, especially for some of the examples it is possible to consider that this architecture of rebirth became an imitation. The environmental skin started to become independent and the relation of the inner and outer space started to get weak. The opinion which the environmental skin was considered as a component of the surroundings more than the building itself, started to come to the fore. Plasticity took the rhythm of the solid and void place. The design decisions about the outer surface of the building was constituted according to the laws, orders and proportions of perfect geometry of beauty which was defined by the ancient artists.

“Before the Renaissance an elaborate ritualism was followed that had to do with religion, astrology, mythology, the planets, the points of the compass, and other such involvements. Spiritual and emotional qualities for colour came later in the Renaissance of the fourteenth and fifteenth centuries. It was not until then that things abstruse were pursued and the artist was freed to convey his ‘feelings’ without reference to symbolic conventions and traditions.” (Birren, 1955)

Consequently, it can be pointed out that with the influences of the Renaissance, the symbolic meaning of colour as an environmental language was almost completely rejected by the artists and the architects. It became to be thought as the expression of the nature and the spatial behaviour. Therefore the artists and the architects of this period started to examine the ways of expressing both the natural phenomenon and the effects of the colour on the human attitude. Colour was applied in order to define the shapes.. Nevertheless, the most important progress in the architecture of the Renaissance was to understand the visual elements concepts as the space defined concepts. In the light of this statement form, shape, line, texture and colour were accepted as the notions of space by means of form and volume. Besides these principles which had determined with the Renaissance, became the base points of the modern architecture especially the Bauhaus (Porter & Mikellides, 1976). Consequently the design idea which returned to the human from the divine character, transformed the colour idea in to a natural

expressiveness shape which the conditions were determined by the real world. Nevertheless it is not possible to mention any environmental colour approach in this period.

“ ‘The complete loss of colour out of architecture is one of the curious phenomena of the Renaissance,...’ The old order of art passed quickly into oblivion...Spiritual and emotional qualities for color came in the Renaissance of the fourteenth and fifteenth centuries. It was not until then that things abstruse were pursued and the artist was freed to convey his ‘feelings’ without reference to symbolic conventions and traditions.” (Birren, 1955, p. 169)

From the historical point of view, although the Baroque architecture gave the impression of being the continuation of the Renaissance architecture, in fact the consequence of its evaluation performed a very different attitude. At the beginning of this approach even if the components and the orders of the Renaissance period had still been utilise, however as time goes by they lost their conceptual meanings and just started to constitute the plasticity. Some of the elements which were formed as a result of specific instrumental proportions , in order to create the continuity in Renaissance architecture, had started to utilise as becoming independent from the orders, in order to create the optical illusions. This transformation altered the environmental skin of the building by means of changing the meanings of the components which was borne by the Renaissance artist. The outer surface of the Baroque structure was a whole of the continuity of the chaos which never let to be perceived the single forms. As a contrary to the Renaissance architecture which was wanted to reach the perfect by using the purity of forms, it can be pointed out that the Baroque architecture wanted to form out the beauty of the continuity of the complexity. The relation of the inner and outer space was not been constituted yet, furthermore, the shell of the building started to behave different on the inner and the outer surfaces of the structure. Especially in the Rococo period the thickness of the shell was increased in order to create the different perceptions from the outside and the inside of the building. The outer skin of the building not only existed in the surroundings with its visual effects, but also the building was the part of the environment with its space which was defined by it. Although the Baroque building came to the fore with its defined outer spaces, on the other hand it was

transformed into a mask which hid its structural and constructional necessities and the components. Colour started to be used with its esthetical value and perceptual effects rather than its symbolic usage character. With the evolutions on the architectural drawing techniques in the Renaissance period the language of the architectural idea improved. Particularly evaluation of the linear perspective technique changed the point of view of the architects and artist to the paintings and colour. The developed drawing techniques provided the architects to create a illusionary effects on the inner shells of the building. Therefore they recognised that colour was one of the most important element to form out these illusions. Especially on the environmental skin of the Baroque structure, colour existed as a tool just to show the magnificence of the church. From the Baroque artist's and the architect's point of view the environmental skin of the structures and the whole inner faces of the city formed out canvasses for their picturesque language of the religion. Consequently they were considered colour as a tool for their picturesque expression.

4.3.4. THE EVOLUTION OF THE ENVIRONMENTAL SKIN AND COLOUR IDEA IN ARCHITECTURE AFTER THE ENLIGHTENMENT

The age of Enlightenment as being different from the other architectural tendencies, was the period which so many approaches could be observed simultaneously. From the technological point of view, this age can be considered as the beginning of the scientific innovations and the system of the rationalistic thought system. And also as a result of these, this period was the age which the transformation of the social structure of the human beings came to the fore. However, in fact the main effects which caused the architectural activity to alter, was the change of the approach on the point of view of history, and developments on the archaeological researching methods. The ancient Greek had inspired by the Renaissance artists and architects too, but for the first time in the Enlightenment period people could have the opportunity of seeing their life itself by means of examining the remainders. Whereas, almost all of the knowledge about the architecture of the ancient times of the Renaissance artists was based on the book of Vitruvius. Therefore, observing the complex and the masked Baroque and Rococo style and being influenced by the existing on the threshold of the enlightenment period, the architects decided to return to the rationalist architecture which was formed by the pure geometrical and functional forms and the structural

system that expressed itself clearly. Their purpose was to save the shell of the building from the imitating components and the structures which were not constructed according to the structural necessities but just to establish the visual illusions in Baroque period. As a result of this, the perception differences between the outer and the inner surface of the shell of the construction started to be decreased.

The conception of the outer space was evaluated in this period. Since, the developing industrial technologies caused the cities to grow and the inventions on the transportation alternatives had to people constitute the ways and the structures for them. For this reason also, people had to form the new materials and new systems in order to able to construct these structural systems. Notwithstanding, neither the inner space conception nor the environmental skin of the buildings of this period had not been influenced by these developments yet. Being understood, disclosed and changed the point of view of the history relatively brought a wider range of design opportunities to the architects. However these possibilities caused them to approach to the whole past times in a collective way. This eclecticism caused the architects whom had set off for reaching the visual purity, to end up creating periodical complex on the environmental skin of the structures.

4.3.4.1. In 19th Century culture and architecture

At the beginning of the 19. Century , being the influences of the eclectic approach the architects chose the style belonged by a specific period, in relation to the meanings which they wanted to bear to the surface. Most of them solved the plan in respect of the functional necessities of the building, however they designed the shell in order to the preferred style according to the impression which they wanted to form. It was considered that the main talent in designing the environmental skin of these buildings was to constitute perfectly the details of the chosen period. As mentioned before however much the system of thought of the human beings changed and the architectural design approach re-defined in the light of new tendencies with the enlightenment, it was not easy to architect giving up their construction techniques and materials. Consequently they continued buildings with new ideas and old materials. Colour was gone on considering the pigment of material and as the tendency of the chosen period. Therefore it started transform even colour approach in a way of the

eclectic tendency. The talent was to apply the correct colours of the chosen period for the skins of the new buildings. It was a great irony that for generations architects reproduced the Greek architecture with purist tendency by covering white marbles without giving advance notice of the colourful palette of the Greek architects.

“Such colorations as the red of the brickwork and of the clinkers on Neo-Gothic churches or official buildings, the grey of rusticated masonry, in the manner of the Romanesque or the Neo-Renaissance periods, as well as the neutral tones or the Pompeianesque coloration on classicist houses appear to be typical at that time.” (Gatz & Wallenfang, 1961, p. 8)

On the other hand, at the beginning of the 19th Century one of the most important colour decisions at the scale of the city was evaluated. In 1800 the city council of builders of Turin formed out a general colour plan for the city. Their purpose was to constitute a unified colour scheme for the squares, streets and, therefore, the buildings of the city. They designated eighty different hues for the environment and these hues became the only allowed colours to apply in the city. Besides they devised routes or ‘chromatic pathways’ in the city in order to preserve. The specific hue of the yellow of the city was started to call as the ‘Turin yellow’ by the literatures. (Fehrman & Fehrman, 2000)

Notwithstanding, since the middle of the century architectural history started to be scene of a very important revolution. The new structural systems and the components had been formed in order to serve the need of the developing industrial age. But it had been regarded that these new techniques were suitable for the engineering structures such as bridges, factories or hangars until the first world fair. Crystal place can be considered that was the symbol of the honest expression. The shell was transformed extremely in to the whole which as a first time outer and the inner surfaces of it were combined. The body of the new types of system’s buildings gave an impression like an air bubble for the reason that their proportion between the solidity and the covering gap (Roth, 2000). Furthermore from the point of view of colour Crystal Palace was important at least as its revolutionary structure. For the reason that colour had a functional role in designing process of the construction. The structural parts of the building were painted in brightly colours, blue, red and yellow in order to emphasise and to prevent the observer mixing

the details of the components while were watching the whole (Kurtich, Eakin, 1996, p. 278). Therefore the Crystal Palace was threshold for the architectural design history not only by its modern concept but also the functional applying techniques of colour which was forgotten for years. From the concept of the shell point of view, with this structure the distinction between the inner and the outer space started to become indefinite. This indefiniteness altered the characteristics of the environmental skin which formed the inner surfaces of the new outer space conception defined by the new necessities.

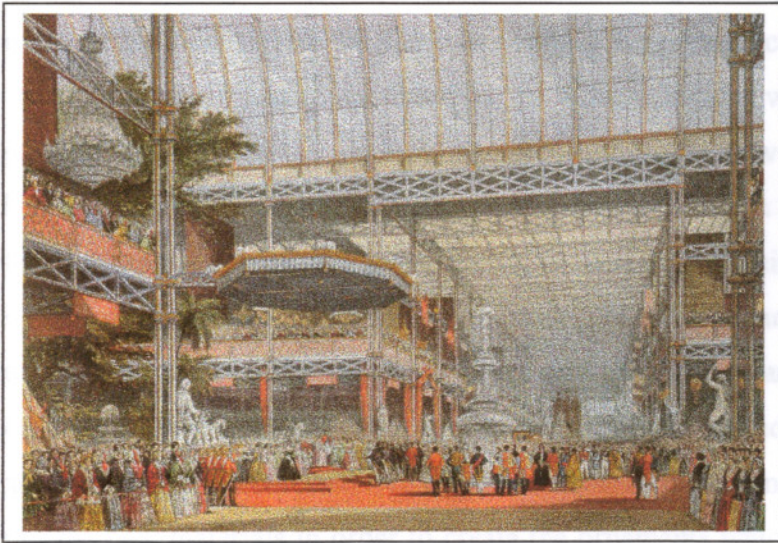


Figure 4. 9. Crystal Palace
(source: Curtis, 1996)

Notwithstanding especially with the influences of the refusal reactions against to the mechanisation age, this new structural systems were gone on not to utilise the buildings which were no need to cover the wide gaps. Furthermore, even if they were used as the structural system of the construction, they had been covered with solid an heavy stone walls by means of the eclectic point of view. The environmental skin of the building had a language which its words were formed out by the architects in order to express their cognitive contents. However the idioms that they used, had been consisted by the phrases which had descanted so many years ago.

“... in the 19th century new materials such as iron, zinc, steel and glass increasingly found their way into architecture. As they were not always used in a visible way, it could quite easily happen that a building that looked historicist on

the outside had modern encroachments on the inside: a daring roof-construction in iron perhaps, or a glass skylight.” (Tietz, 1999)

19th century was a period which so many styles were created and continued synchronous. Although the environmental skin of the building did not affect by the new tectonics of the materials yet, towards to the end of the century the solving of the designing problems set out to be influenced by the functional approaches. Especially the designs which were created in a way of believing in the *forms follows function* idea, started to increase in the new world. On the other hand a new tendency provided to architects to transform the eclectic approach in to a way which was based on understanding and interpreting the remain buildings according to the new necessities of the age and their cultural background. This situation caused to be form the mannerist intentions and this mannerism provided to the architects to evaluate their own surface language. The point of view to the nature started to be changed and the artists set off to examine the real peculiarities of it instead of the fiction one. Hence this caused the some of the architects to look at the nature rather than the history. The curved forms of the nature were transferred in to the architectural objects. Another innovation of these style was the usage of the new materials in order to create the ornaments which was created by means of the influences of the natural objects. However much, the name of the style varied culture to culture in these years such as Art Nouveau, Jugendstil,...etc., the opinions were based on the same anxiety.

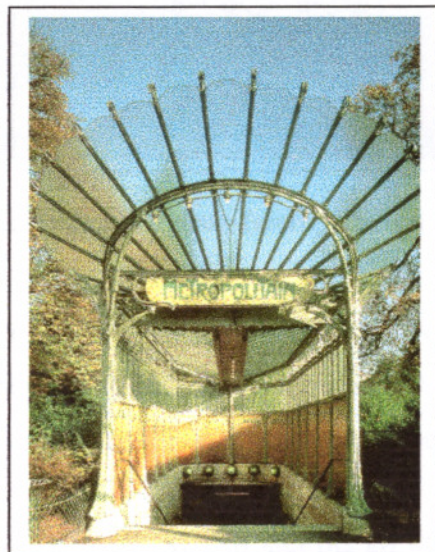


Figure 4. 10. Entrance to a Metro station – Hector Guimard (source: Tietz, 1999)

Owen Jones was published his book which was named as *The Grammar of Ornament* in 1856. That book included a historical evolution of the approaches of the colour and the ornament. this book became one of the most important books which had already been written since that time according to the most of the afterwards architects such as William Morris, John Ruskin, Viollet-le-Duc, etc... The *Red house* of Philip Webb and William Morris can be considered as the three dimensional shape of Jones's book (Figure 4.11). This building as a rejection to the machine aesthetic, symbolised returning to the traditional English architecture. It is possible to point out that colour is one of the important components of building, particularly environmental skin, as well as its form, construction technique or material. in order to express the design idea of Morris in returning to the traditional architecture. Architects started to turn towards the nature in utilising colour too just like as their design techniques. Therefore they tried to apply colour by using natural materials. Besides, Morris pointed out his considered opinion about the artificial material colours as they were the most useless inventions in modern chemistry (Kurtich & Eakin, 1996). Colour was considered as a vital element by the Art- Nouveau architects. They usually applied bold use of colour to the both the inner shell of the buildings and their environmental skins.



Figure 4. 11. Red House (source: Curtis, 1996)

“There followed a time of mostly non-periodic or natural application of colour, if a formative expression of colour in architecture was cultivated at all other things were deemed more important.” (Gatz & Wallenfang, 1961, p. 8)

The alterations of the point of views to the art and the art history changed the definition of the architecture in a shape as it expresses the attitude of the age according to the life

itself. However it was hard to define the character of the period for the human beings still lived in. For this reason that none of the styles could have an opportunity to come to the fore in comparison to the others. Being on the threshold of the new century and starting a new mechanisation and industrialisation era, influenced the environmental skin of the buildings by means of the tectonic of the new materials, wide range of opportunities of the developing structural systems according to the designer. However for most of the architects, despite of the greatness of the revolution, it was hard to give up the forms, systems and materials which had been formed out within the centuries of experience. The famous architectural historian Sigfried Giedion claimed the 19th century architecture and also architects as being became the buildings as empty shells. (Vidler, 1992)

4.3.4.2. In 20th Century culture and architecture

Therefore, in the beginning of the 20th century the environmental skin of the building started to be one of the important evidence of the great revolution of the architecture. Peculiarly, the article which the name was 'ornament and crime' and was written by Adolf Loos (1908) pointed out the architects a new way which at the end would bring them to the international style. That article regarded that a forming a true style could only be possible if the architectural activity was purified from all of the ornaments and if the qualities of form, proportion, clarity and measure were underlined (Curtis, 1996). Therefore Loos designed the Steiner House as a symbol of his avant-garde ideas with its unadorned and smooth white surface (Figure 4.12). With the evaluation of the reinforced concrete structure system the shell of the building was saved from the heavy loads of the construction. In fact concrete as a material had been known since the Roman and Early Christian period but was fully explored again in this century for the reason that its cheapness, fireproof property and the most important one its wide spans character. Therefore with the wide range of opportunities of this system the shell of the building started to become free. (Curtis, 1996) This exemption from the loads of the structure provided to the architects to evaluate their surface language as an expression of thought.

"This is a machine age.

Machine surfaces are smooth and plain.

Machine forms are of rule-and-compass simplicity.

Reinforced concrete is the machine age material." (Banham, 1996)



Figure 4. 12. Steiner House (source: Curtis, 1996)

Glass as a material was considered as one of the symbol of the mechanisation period. Besides it was regarded by many architects that the culture of brick gave only pain while the glass was bringing the new age. On the other hand, some of them who were influenced by the expressionist approach, still used brick in the construction process in order to establish the textural effect which they designed on the environmental skin of the building (Tietz, 1999). During the expressionist period, the basic approach in applying colours was to take the natural colours their model. However there were few examples which tried to establish a dynamic quality on the environmental skins by means of colour and its accented effect (Gatz & Wallenfang, 1961).

"And sometimes strongly contrasting materials or colour hues used for facings or plastering completely destroyed the unity of the building and of the general picture. However, the intention had been less to produce variations in surface effects than to turn decidedly away from the principle of an architecture complete and sufficient in itself." (Gatz & Wallenfang, 1961, p.8)

The surface of the shell from that time on was transformed in to a three-dimensional characteristic. Peculiarly with the influences of the first Cubist approach the language of the environmental skin was started to formed not only by the textural expressions but

also by the volumetric effects of the light and shade relations. Cubist shapes and forms was constituted to reach a specific meaning and the symbolical expression. Cubist architecture as well as the painting and sculpture was not only the design approach of the three-dimensional forms but also the expression of the fourth- dimension on the surface of the structure. Cubism as an approach which mostly effected the artists, provide the architects to evaluate a visual language which was formed by the abstractions of the reality and the new terms of the space and form. However, the main contribution of this tendency to the architecture was its guidance to the other styles such as purism, De Stijl. Besides De Stijl was the 'style' which the language of the environmental skin transformed into a pure expression of thought. This approach which first was formed by the painters, transformed the surfaces of the boxes into the single planes.

"Increasingly, though, the elements of his paintings achieved their own autonomy, as Mondrian began to sense that a pure language of form, colour and rhythm –a visual music in touch with the emotions- might be possible." (Curtis, 1996)

Theo van Doesburg who was one of the most important artists of De Stijl, tried to create a mathematical definition of plane and colour. He considered that colour was the harmony of life (Doig, 1986). The other artist who influenced the architects of De Stijl such as J.J.P. Oud and Gerrit Reitvelt was Piet Mondrian. His paintings was important because of their pure abstraction of the ideas which were created with lines planes. Particularly, the role of the colour in his paintings was a kind of way of expression of his thoughts. It was a language which was formed out by the primary colours black, white and the tints of grey. The environmental skin of the Schröder house of Reitvelt was the three dimensional shape of the paintings of Mondrian by means of the planes and lines. The differences between these elements were emphasised by the tints of the achromatic colours and the different primaries. However sometimes the diversity occurred between the artistic and architectural point of view in De Stijl movement works. Architects designed walls as the colour planes and the rectangular elements of the abstract paintings. These walls sometimes overlapped by the architect in order to destroy the boundaries of the box. This visually destroyed structure differentiated the

architectural three dimensional objects according to the paintings (Overy, 1991).

Reitvelt pointed out his ideas about colour on environmental skin as;

“Not with an aesthetic purpose but only to provide us with a more direct experience of reality. We used only primary forms, colours and spaces because they are so fundamental and so free of associations.” (Wilson, 1992, p.158)

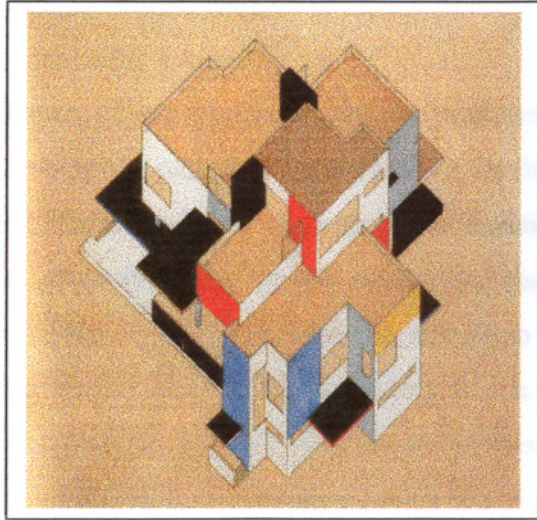


Figure 4. 13. Theo van Doesburg (source: Tietz, 1999)



Figure 4. 14. Schröder House (source: Tietz, 1999)

Simultaneously with De Stijl movement in Holland, Constructivism developed in Russia. It was an architectural approach which was based on the first artistic attempts especially paintings too. Their avant-garde artist was Kashmir Malevich just as Piet Mondrian of De Stijl. Constructivism applied colour to emphasise the function or to

distinguish the components of the environmental skin one from another. Besides it has a symbolic role in architecture. In the light of these movements colour became one of the most important design element for the new school in Germany, Bauhaus. New teachers of the school Johannes Itten, Paul Klee and Vasily Kandisky started to teach the methods of applying colour in architecture. They accepted different colour theories but they all considered as colour as a design concept (Minah, 1996). They suggested colour was form. They pointed out that line was only measurement tone was measurement and weight colour was quality (Whitford, 1991).

Therefore, the new shapes of expression started to evaluate according to the new materials and this developed materials provided to architects to increase the transparency of the shell. Particularly, the corners of the constructions which had been considered as the main structural point for the reason that they were the intersection location of the loads in the history of the architecture, started to transform in to a hallow characteristic. The box started to destroy. Fagus Factory which was designed by Walter Gropius and Adolf Meyer, was one of the first examples of this tendency (Figure 4.15). The separative property of the shell was replaced with the penetrative element which could complete the continuity between interior and exterior space. The environmental skin was saved from the opinion as a plane for the ornamentation and gained a volumetric meaning as the perceptible surface of the body of architecture.



Figure 4. 15. Fagus Factory (source: Tietz, 1999)

“to become a constituent element of a volume, the wall had first to be cleansed of all decorative eruptions of the nineteenth century... This rediscovery of the

surface plane was fundamental. It formed the basis on which a second phase could be developed. This second phase also embodied the plane as an inherent element." (Giedion, 1976)

The era of industrialisation and mechanisation was also the period of the great inventions. Being influenced by these inventions which made people life easier, architects wanted to design their buildings in order to reach the machine aesthetic. Being formed out in the light of these statements and the influences of the new function's buildings which were inspired by most of the architects Gropius, Behrens, Muthesius, such as airports, hangars, multilevel stations, futurist Manifesto influenced some of the architects in terms of the theoretical thought system. Imagining the tomorrows cities in order to look at the contemporary rising forces of their times was the purpose of their architectural activity. The environmental skin of their building sketches evolved in respect of these opinions. The building's surfaces of the new era was constituted by the new forms of the industrialisation, the smooth and unadorned texture of the new materials and the abstraction of the machines of the new age (Curtis, 1996).

"the modernist project is characterised by transparency and the project of architecture is to simultaneously convey the tension between the deep space and surface" (Imperiale, 2000, p.19)

The concept of space transformed in to as a machine which was lived in. The shell was saved from the duty of the structural necessities. The purpose was to stimulate a pure, clear and refinement language as an expression of thought for the environmental skin. From the point of view of colour design purism utilised hues to define spaces (Fehrman & Fehrman, 2000). The indefinite limits of the space caused to change the meaning of the surface of the building. In fact the shell in comparison with the historical buildings transformed in to a skin for the building as an organism which was grown up from the inside to the outside. Becoming free of the facade was one of the 'five points of a new architecture' which were designated by Le Corbusier who was one of the most important architects of the machine age. Pilotis, roof garden, free plan, free facade and ribbon windows were the articles of these five points. He tried to form out a relation

between colour and object, colour and space. Although he known as with his pure white surfaces, in fact primary colours have an important role in his environmental skin language. He proposed that primary forms could be best expressed by the primary colours. Curtis described one of the building's facade of him as mentioned below;

“Rectangles of different sizes set up rhythms across the facade and are held in tense equilibrium within the simple geometrical outline. There are no piloti in sight, but the way the windows extend to the edges is enough to suggest that the facade is a non-weight-bearing skin. At the same time, the subtle displacements and similarities of rectangles, and the glimpses of transparency at the corners, introduce visual ambiguities about the actual position of things, and about the thickness of the facade plane.” (Curtis, 1996 p. 179)

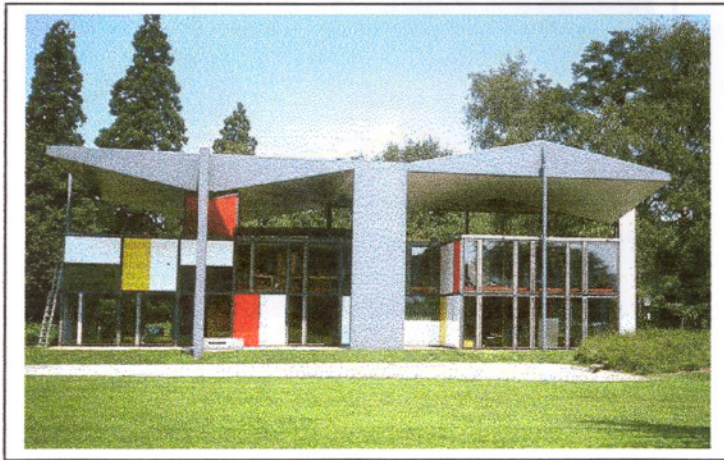


Figure 4. 16. Centre Le Corbusier (source: www.greatbuildings.com)

Consequently the conditions such as the stress on volume rather than mass, regularity, the avoidance of architectural decoration, etc... of the new approach were first determined in the Hitchcock and Johnson's book which was named as *International Style*. (Curtis, 1996) However much they acquired small differences from one architect to another, it was suitable for the architectural spirit of the period. International style which was considered as the style of the mechanisation age, was defined as an architecture of the glass, steel and concrete. In the light of these statements Barcelona Pavilion which can be regarded as one of the symbol of the international style, was a piece of poetry of the surfaces. In fact it can be considered as a deduction of the modern

and classical values. The limits of the inner and outer spaces of the structure which was constituted by the surfaces as planes, were completely indefinite. Moreover the pools which were placed as an architectural design elements, were expressed themselves with their liquid surfaces which were created as a contrast to the planes that were vertical to the ground. (Curtis, 1996) Le Corbusier examined the environmental skin of the Van Nelle factory which was another one of the symbol of the international style as mentioned below;

“The sheer facades of the building, bright glass and grey metal, rise up ...against the sky ...Everything is open to the outside” (Curtis, 1996, p.261)

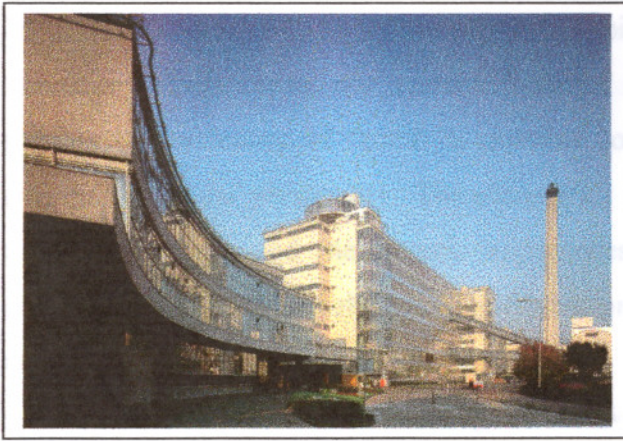


Figure 4. 17. Van Nelle factory (source: Curtis, 1996)

However, the international style, in opposition to the expectations, could not be successful being the architecture of the millennium and according to most of the artists, architects and philosophers it failed during the mid-century. In fact, even in the times when the international style prevailed over the world, mannerist approaches could be observed by means of the singular buildings of the architects. Besides, several architects which were the fervent defenders of the style, designed buildings which were created in the way of expressionist thought. The intention which wanted to form an architecture which was distinguished from the place and time, could not be succeed in the spaces where the physical conditions changed.

As a matter of fact the **second half of the 20th century** was the scene of the many approaches which were formed out as a reaction against to the international style.

Brutalist and new-expressionist tendencies in the architecture began to utilise the reinforced concrete in order to construct sculptural forms. The shell of the building started to regain its symbolical meanings. According to Colin Rowe, free facade which was defined by Le Corbusier as one of the five points of the new architecture, in fact for all intents and purposes, was no facade, in the traditional sense (Vidler, 1992). Because Rowe defined face or facade of the architecture as mentioned below;

“a metaphorical plane of intersection between the eyes of the observer and what one may dare to call the ‘soul’ of the building. It is the existential interface between eye and idea.” (Vidler, 1992)

From Rowe’s point of view, modern architects never preoccupied with the face. He pointed out that the face affects us as the symbol, both of the spirit and of an unmistakable personality. As a matter of fact it is possible to consider that Rowe claimed the modernism to lack of personality. Therefore with the evaluation of the mannerist, expressionist, authentic and the organic approaches in the architectural activity shell of the building started to bear the meaning further on the expression of the function of the building. On the contrary to the international style, acceptance the environmental skin set off to bear symbolical meanings which were wanted to express the thoughts of the architects. The concept of ‘*memory of the city*’ started to be shaped despite of the efforts of the international style in order to reduce them to a single type. In the light of these statements, architects began to influence by the concept of ‘*form follows form*’ instead of function. (Roth, 2000)

“Since the early 1970’s architects have shown interest in the skin of the building as a communicator. We can see this in an earlier plan for the Pompidou Centre in Paris, which incorporated media screens into the face of the building.” (Imperiale, 2000, p.22)

At the beginning of the 70’s the environmental skin of the building started to get free of not only structural necessities but also its dependence of the space and transformed into completely a *free facade*. From that time on it was a communication object which provided to architects to express every kind of thought they wanted. Besides according

to Venturi the shell of the building started to express a polysemous language. As a matter of fact, the interestingness of the popular culture came to the fore instead of elite society. (Aritan, 1997) The environmental skin which was transformed into a mask, reformed as a place where the icons and the symbols of the popular culture were displayed. In this consumption age, architectural surface became a consumption age too which marketed itself with its meanings bore. Venturi gave many examples of this situation in his book which name was *Learning from Las Vegas*. Peculiarity, the environmental skin became the scene of the new approach.

“By degrees a new status was accorded to the architectural image and to the role of the symbol in the making of forms. While the preoccupation with meaning often degenerated into a surface manipulation of signs and references, it also prompted reflections upon the basis of architectural language, and upon the role of precedent in design” (Curtis, 1996)

From architectural historian point of view, with the transformations on the architecture in the second half of the century, the populist approach affected not only the culture but also the architectural tendencies in terms of numerical. Historicist, revivalist, eclectic, high-tech, new brutalist, late-modernist etc... approaches as a positive or negative reaction against the international style were formed. However from the surface point of view, the architectural end-products of these various tendencies extremely differentiated each other. The forms which gave reference to the history and ornaments rediscovered by the architects which were influenced by the eclectic approach of this period. On the contrary, high-tech tendency which was named as *'Futurist revival'* by Reyner Banham, tried to be constitute the architecture of the technology era. In the light of this purpose High-tech architects transformed the environmental skin to a scene for the symbols of the mechanisation age by means of emphasising the components of the technology such as installation system, vertical circulation tools, structural elements, etc... The deep which forms the third dimension of the shell began to be increased Besides, the environmental skin started to be separate into graded ranks. The layers of shells which were designed in order to serve different kind of needs. With the influences of the developing technology provided to be used wide range of construction components on the surface of the buildings. This occupation oriented the architects towards using them

in order to emphasise different specific ideas. For instance the environmental skins which were stimulated completely by the reflective components, were designed in order to display the language of environment instead of creating themselves. On the other hand, De-construction as a design tendency based on breaking down of functions and forms into their component parts. As well as the other parts of the building, the shell was decomposed forms and components which were constructed it. The environmental skin was transformed into a whole which was constituted by the individual but dependent parts. Experiencing the surface can be considered as a challenge against the gravity. The environmental skin formed out its own language and its hard to establish a relation between the defined space of the construction and its shell.

From the technological point of view, with the influences both of the inventions on the productional energy and the changing climatic conditions of the coming millennium, started to bear the new charges to the environmental skin. 'Smart buildings' which occurred the end point of the mechanisation of the building itself, in fact can be considered as the becoming reality of the utopia which was imagined by the architects of the industrialisation age. The windows which controls the quantity of the coming light like a iris of an eye by means of the crystalline lenses or the buildings which produced its needed electricity by means of its solar panels can be good examples to the smart buildings.

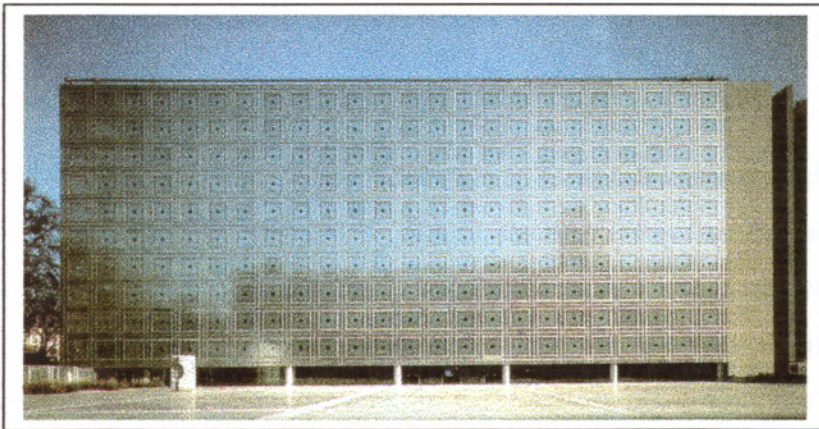


Figure 4. 18. Institute du Monde Arabe, Jean Nouvel (source: Steele, 1997)

“This new scientific definition of substance demonstrates contamination at work: the boundary, or limiting surface, has turned into an somotic membrane, like a blotting pad (...) What used to be the boundary of a material, its terminus,

has become an entryway hidden in the most imperceptible entity. From here on the appearance of surfaces and superficies conceals a secret transparency, a thickness without thickness, a volume without volume, an imperceptible quantity” (Imperiale, 2000)

According to Fredric Jameson the lack of depth characterised the post-modern culture. He pointed out that depth is replaced by surface, or by multiple surfaces and three dimensionality of architecture reduced to pure surface. The environmental skins of the new century which forms as a communicator, not only was used a abstract language but also started to be explained itself with concrete symbols and icons. The relation with the building and ground was transformed into active and dynamic shape from passive and natural one. Most of time the ambiguity between the surface and space was emphasised. Geometrical, volumetric, Euclidean forms were deformed and they were recreated from fragments. Hypersurfaces which is the projection in three spatial dimensions of the hyperspace of four spatial dimensions, started to be the representative of the architecture in the virtual reality. (Imperiale, 2000) In this information age, the buildings gains much more communication property against the environment which they were located. Exterior surface is transforming an individual substance which designates the story itself. From the technological point of view the evaluation of the digital systems provide the skin to change itself according to time and its surroundings. From now on ,the surface which had existed as a definer component of the space, started to be existed the space itself in the virtual reality.

From the point of view of colour it is not possible to form out a general scheme for the 20th century. Various approach in applying colour can be observed on the environmental skin of styles and architects. Therefore it is possible to point out, particularly in the second half of the century the populist tendency of the age show itself in colour too. Further part of the study will examine how the architect can use colour as an expression of thought on the environmental skins of the architectural three dimensional objects. The tendencies of the architects and their style of this age will be determined in that part of the thesis. The evolution of colour idea in the ages showed that from the Renaissance to the 20th century, approximately 400 years, human beings particularly the architects considered colour as a thing apart from life itself as a esthetical value. However from

the ancient Egypt to the Renaissance, about 4000 years, it had been considered as the life itself and had been borne with the meanings and symbols.

4.4. THE USE OF COLOUR ON THE ENVIRONMENTAL SKIN AS AN EXPRESSION OF THE ARCHITECTURAL THOUGHT

“It is up to colour to explain in the service of the architectural idea, the composition, the arrangement, and the value of the individual construction link and of the architectonic ensemble, and thus to serve the form.” Max Laeuger (Gatz, Wallenfang, 1961, p.9)

Although the environmental skin of the architectural three dimensional object can be considered as the inner faces of the context of the building, from the point of view of the architects the environmental skin as the exterior surface of the design object has a role which is contained being the words of the architectural thought. In the light of this statement, it is possible to point out that the exterior surface of the building forms out a scene for the architect to express his/her design ideas. As far as this study is considered colour as an architectural concept can be borne a function due to the persuasion of the architect in order to express it or to increase its emphasis. However, it is not possible to generalise this determination for the entire architectural design history. In some periods human beings profited from the wide range of opportunities of colour for increasing the expressive quality of the environmental skins of their buildings. On the other hand in some periods they just applied it on the exteriors as an esthetical value. The evolution of the colour idea on the environmental skins can be summed up in five stages in the mankind architectural design history;

First stage; this stage can be pointed out as era of the ancient Egypt, India and China.

The colour utilising approach of this age was based on the symbolism, culture and religion. Colour had its own language.

Second stage; This stage includes Greek and Roman period. It can be possible to point out that, in this period colour applied as a concept and evaluate its function as form, contour or composition. Although there were diversities between periods of this stage on the interests of hues, the point of view had not changed.

Third stage; This stage can be determined as the period of the Early Christian, Byzantine and the Gothic ages. In this period colour utilised as a decorative component of the environmental skin. The purpose was to form out an esthetical value system rather than symbolic or functional.

Fourth stage; This stage includes the centuries between the Renaissance and the Enlightenment period. In this stage colour almost completely was banished from the environmental skins of the architectural objects with its all symbolical, functional and emotional meanings.

Fifth stage; This period includes after the enlightenment times up to the 21th century. In this extended period it is possible to observe all kind of colour approaches. Functional, symbolical formal, etc. colour started to be applied to the environmental skins according to the style and architect.

As can be seen in these articles colour has been borne different meanings and roles in different periods. The outer surface or the environmental skin of the building has a meaning or a function to communicate with its context and the individuals who experience this environment. Therefore, even if colour was applied just to add an esthetical value to the exterior surface, it always has been assisted in this communication, which occurs between the building and human beings. The contents or the limits of the message, which is transmitted from the architect to the observer by means of the communication, can be changed.

“Communication is part of man’s nature: any human behaviour, whether conveyed by words, signs or gestures is part of communication... It is a combination of signs assembled according to certain rules called ‘codes’. Colour is one of them... Colour adds a new value to communication. It gives life to the visual messages, it animates it, accentuates it and makes it more perceptible and of easy identification.” (Favre & November, 1979, p. 8,10,13)

On the other hand, the environmental skin forms out a three dimensional canvas for an architect to express the architectural thoughts. In the light of this statement, colour as a notion transforms into a tool for the designer in order to explain or emphasizes the design concepts. This communication can be full of with the expressions of thoughts of the

architect. From this point of view, it is obvious that the approaches of expressive quality of colour differentiated from an architect to the other one because of the diversities of the architectural intentions. Furthermore, the use of colour can be altered between the buildings of the same architect for the reason that the changing of the architectural concepts of the buildings.

Nevertheless it is possible to form out general statements for the use of colour on the environmental skin of the buildings and to determine the purposes of the architects while applying the colour to the exterior surfaces. In the light of the examinations this study proposes that the concepts of the architects in applying colour to the environmental skins can be articulated in four major groups as the use of colour as an effect, the use of colour as symbol, the use of colour as form and the use of colour influenced by the cultural and local characteristics. It is possible to observe more than one of these statements both on the different buildings of an architect and on a single architectural end-product.

Furthermore from the point of view of this study, for most of the architects of the 20th century it is possible to evaluate a different reading method in order to determine their architectural thoughts and purposes in terms of the use of colour on the environmental skins of their three dimensional works. In other words their ways in using of colour on exterior surfaces is influenced by their architectural pronunciations. In just the same way as the other readings of architectural thought such as concept of space and/or articulation of forms. In the light of the statement which the environmental skin is the part of the building that provides the architects to communicate with the observer, it is possible to pointed out that colour is one of the most important design concepts in order to increase the power of this communication. It is sometimes applied as the pure signification of the architectural thought. On the other hand sometimes it is considered as a tool in order to emphasise the pronunciation.

“Colour as enhancer and modifier of space and form, colour as symbol, colour as generator of mood: it is time to struggle to understand the wonderful complexities of colour.” (Davey, 1998, p.35)

4.4.1. THE USE OF COLOUR ON THE ENVIRONMENTAL SKIN IN ORDER TO FORM OUT AN EFFECT

As far as it is pointed out in this study, the greatest part of the colour perception process occurs in the mind of the living beings and the result of the process is influenced by the mental and the physical structure of the individuals. Therefore this result does not always fix the reality. The visual factors that affect the colour perception such as after-image, colour constancy, Simultaneous colour contrast, etc., were examined in the third chapter of this thesis. Furthermore from the scientific point of view, it is considered that the most effective sense of the human beings in collecting information from the environment is the visual sense. Besides, colour is one of the most important factors, which affect the optical phenomenon.

The use of colour as an effect can be considered as one of the oldest technique in applying it to the exterior surfaces. In ancient Greek architecture the effects of colour on the perception of the human beings had been known and used on the environmental skins of architectural end-products. Particularly, visual aspects of colour in figure and ground relationship had been applied to the exterior surfaces in this period in order to make the contours of the buildings precise. From the point of view of the effects of colour another important period was the Baroque. Although the architects of the Baroque period avoided from utilising the wide range of opportunities of the colour effects on the environmental skins of their buildings, they applied and benefited from colour and its effective advantages on the interior surfaces of the architectural end-products. The illusion effect of pictures of the inner skin, which is one of the most important properties of this period, was increased with the perceptual deceptions of the colour.

4.4.1.1. SIGN EFFECT OF COLOUR

“Sign is colour, colour is sign...In fact, signs and colours can be seen as fundamental values – that is, all of those values that can be associated with expressivity.” (Strano, 1998)

From the scientific point of view, colour, which is one of the most effective phenomena of the visual sense, has an important role for the living beings in order to

enable them to collect information from the environment. Particularly, in nature the signal function of it has an important signification for the living beings. The attractive property of colour forms out the greatest part of their surviving efforts. From the point of view of the plants, it is the most important factor to draw the attention of the animals in order to be able to be inseminated. On the other hand for the animals the attractive property of colour is one of the most important sign of danger.

From the architectural point of view, the use of colour as a sign is a technique, which is frequently preferred in the contemporary world. As a matter of fact, this effect of colour is not only utilised to the environmental skins by the architects, it is preferred by the other professions which their works depend on communicating with the observers by means of the concepts of the visual materials such as painters, industrial designer, graphic artists, etc. Especially with the influences of the age, which the advertising of the work is considered as more crucial than the result itself, this effect of the colour is come to the fore. As mentioned before the environmental skins of the architectural end-products is the most communicative part of the buildings. Therefore if the attention of the observers is wanted to call to a specific part of the structure or to the overall design the architect benefits from the wide range of attractive opportunities of colour. The use of colour as an effect in order to stimulate a focal point can be considered in two ways of thought. As a first way of the use of this colour effect can be pointed out as the overall structure forms out a focal point or a sign itself. On the other hand as the second one designer applies colour to a specific point in order to sign particular part of the structure.

The bright red folies in the Parc la Villette (Figure 4.19), which were designed by Bernard Tschumi, can be a good example to first way of the use of colour. As a matter of fact this is the final project of a competition, which was organised for a park at the periphery of the Paris. The concept of the design is based on a grid system formed by superimposition of different plans. Bright red folies as the analogy of the machine trees in a garden are the intersection points of these superimposed plans. They are the structural signs of these points, which were transformed from 10 m cube into an urban sculpture. The green colour of their ground with its contrast effect increases the signal function of these decomposed cubes. Furthermore, from the point of view of the

simultaneous colour contrast effect, as explained in the third chapter of this thesis, the background influences the object with its complementary hue. This statement folies on the green background of the park appear redder than they really are. From the point of view of Charles Jencks as;



Figure 4. 19. Parc la Villette, Folie (source: Personal archive)

“Each pavilion is , in effect, an abstract cube responding to both Tschumi’s and the Neo- Constructivists’ rules of decomposition. Where Eisenman adopted his dislocated L-shapes for a similar point-grid, Tschumi adopts Yacov Chernikhov’s 1930s language. He enamels this syntax a dark blood-red and has a lot of fun breaking it up into giant wheels, useless trusses and spider’s legs.” (Jencks, 1990, p. 285)

As a matter of fact, it is possible to consider that the use of colour technique in architectural activity as well as the design concepts of the Deconstructivist architects is highly based on the determinations of the Constructivists’. Yacov Chernikhov who was one of the most important architects of the Russian Constructivism, designated the new machine aesthetic in his book which name was *The construction of the architectural and mechanical forms*, and proposed in his book that the colour is an important element in order to display this concept (Chernikhov, 2001). This approach is developed spontaneously with the De Stijl movement in Europe. In Russian Constructivism the use of colour as a sign is preferred as well as the other functional utilisation. Particularly, in their drawings they used from the sign effect of colour in order to emphasise the

specific points and thoughts. Kasimir Malevich who was painters of this movement advocated a pure abstraction and proposed his thoughts with his paintings which name was white square on a white ground. He was named this tendency as *suprematism* (Tietz, 1999).

“Rather than reacting to purely formal issues, as Constructivism did, Suprematism made direct analogies between certain colours and social conditions.” (Steele, 1997, p. 212)

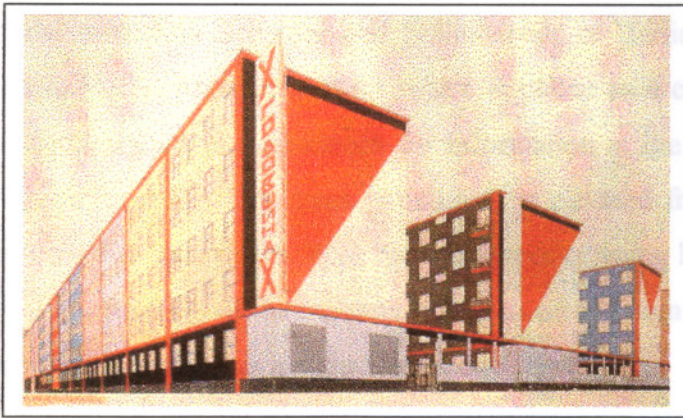


Figure 4. 20. Colour design for a social house settlement, Alexandr Nikol'skii, Mariia & Boris Ender
(source: Cernihov, 2001)

Suprematism as an approach based on expressing the ideas on the canvasses. According to Malevich and friends it can be considered in three stages as the black, red and white squares. Nowadays, it is possible to observe this statement of this approach on the sketches of the Deconstructivists' projects. Zaha Hadid is one of the architects who is influenced the esthetical approach of the Suprematism (Figure 4.21). It is possible to point out that on her drawings colour is used as a psychological signal (Steele, 1997). The sketches of El Lissitzky for Cloud Props, which were known as horizontal skyscrapers for Moscow, signify the use of colour in order to call the attention of the observers. On the other hand the sketch of Vladimir Tatlin for the Monument to the third international was black and white and had never been built. However if it would have been constructed it was going to be the highest tower and bright red one of the world. Nevertheless most of the designs of the Constructivists architects stayed as a drawings or sketches most of them could have never been built.

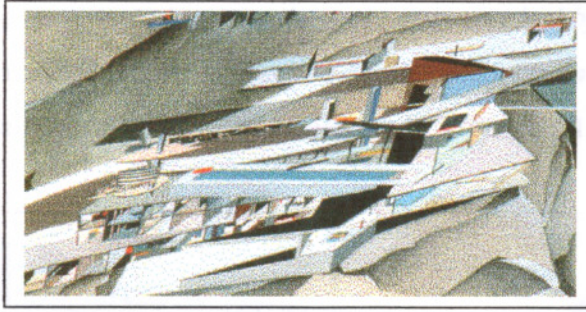


Figure 4. 21. Drawing of Kurfürstendamm Project, Zaha Hadid (source: Thomsen, 1994)

Another example to the use of colour in order to transform the building to a sign, can be the Info Box of the architects Scheider and Schumacher in Berlin. This temporary structure was built in Berlin Potsdamer Platz where is called as a city within the city (Figure 4.22). It was designed as a residence for information at the central point of a future work site (Jodidio, 1997). The main structure was elevated from the ground by means of the steel construction system. With the influences of being heightened and the colour of the environmental skin of the building is perceived as a sign in the context and comes to the fore with its function as a signal for information.



Figure 4. 22. Info Box (Jodidio, 1997)

On the other hand, as a second way of using colour as a sign effect is to apply it in order to signify a specific part of the building. Meteorite Exhibition Centre which was designed by Propeller z (Vienna Architectural Formation) with its red entrance frame (Figure 4.23), Funder Factory 3, which was designed by Coop Himmelblau, with its bright red canopy (Figure 4.24) can be a good examples to this attitude. Red, these examples was bore a role which can be determined as signifying the entrances of the buildings. Charles Jencks pointed out his thoughts about the Funder Factory as;

“The most dramatic eruptions are the front door marked by a zig-zag awning in blood-red (favourite colour of the Neo-Modernists) and a volume in glass and steel – the main office area which faces south.” (Jencks, 1990, p. 277)



Figure 4. 23. Meteorite Exhibition Centre (source: Muhr, 2000)

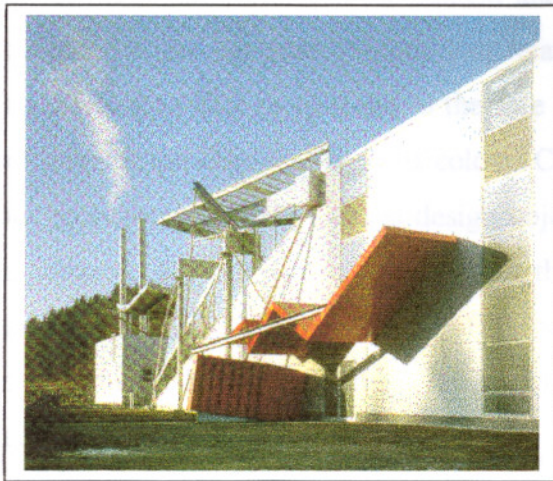


Figure 4. 24. Funder Factory 3 (source: Jencks, 1990)

As a matter of fact, red can be considered as the most preferred colour of the architects in forming a signal function for their buildings. Particularly, for the architects of the 20th century for the reason that its effects on the physical and mental structures of the observer it became one of the most applied colour to the environmental skins. From the scientific point of view red is accepted the most common colour signal in nature too. According to Humphrey, scientist, the reason of this statement is being contrasting well of the red with green foliage and the blue sky (Camgöz, 2000). In colour perception process as mentioned before, the focal point of the red occurs behind the retina. This situation provides red to create illusions in the mind of the viewer.

4.4.1.2. CAMOUFLAGE AND DISPLAY EFFECTS OF COLOUR

Every kind of architectural interference to the environment forms out a new figure on the background. As explained before in this study, the environmental skin of an architectural three-dimensional object displays an attitude, which expresses the language of its designer, towards the context of the structure. Properties of this new construction on the background increase or decrease the figural effect of it. Colour can be considered as the most important one in these properties which has the power to be come to the fore the architectural design object or to be hidden it in its context. The attitudes of hues vary in different conditions of the environment. For instance a grey structure shows different manner in a forest or in a city. Furthermore climatic conditions or the geography affects the perception of the object too.

From the point of view of the relation between the context and the architectural object the first concept of decision of the designer towards this relation is to determine the attitude of the building relating to hide or to come to the fore in its environment. This can be called as camouflage or the display effects of colour. Camouflage effect can be explained as the colour property of an architectural design object, which provides it to be camouflaged in its context. As well as the other effects this function of colour is common for the nature and the living creatures. Most of the animals developed a skin system to the conditions of their habitat. Camouflage can be defined as the use of colour to make objects as inconspicuous as possible (Faulkner, 1972).

From the architectural point of view camouflage effect of colour generally formed by applying the hues of the environment itself to the environmental skins of the building. Most of the design of Frank Lloyd Wright with the influences of the organic architecture can be considered the good examples to this attitude. For instance the Falling water house which is considered as one of the most important building in architectural design history, with the effects of its formal design and with the contributions of the colour of its materials it is perceived as almost completely disappear in its environment (Figure 4.25). He opposed to apply artificial colours to the skin of the materials (Pfeiffer, 1994). Therefore he generally utilised them to his architectural end-products with their original colours in just the same way as the Falling water house.



Figure 4. 25. Falling water House (source: Taschen, 1994)

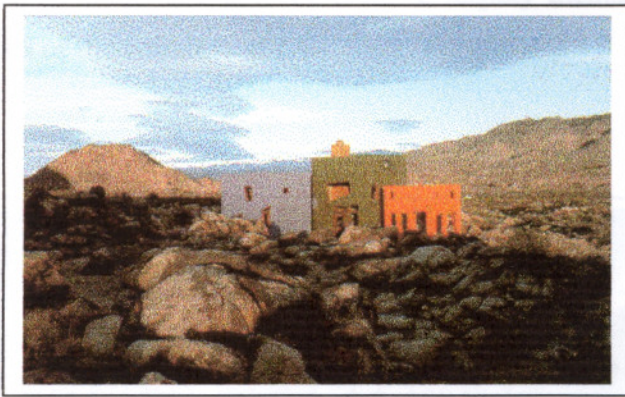


Figure 4. 26. The Monument (source: Steele , 1997)

Another example to the use of colour as a camouflage effect can be *the Monument*, which was designed by Joshua Schweitzer. Although that is a small house, it stands in the desert as a sculpture more than a functional one. It was designed to fit into its natural environment. It is formed out three different pavilion which each one have its own colour. Orange one is a porch, olive-green one is the living room and the purple-blue one have the kitchen, dining room and sleeping spaces. According to its architect the colours of the structure are the colours of the desert in just the same way as its form. Since he pointed out that the monolithic forms of the buildings echo the forms of the rocks (Jodidio, 1997). At this example it is possible to consider that the designer utilised colour as a functional notion to strengthen his design concept, which is based on completely to fit into the context of the building.

On the other hand as an opposite attitude to these examples of the camouflage effect the other approach to the relation of the building and environment is to be displayed or to be come to the fore the figural characteristics of the design. According to this manner architectural object differentiated from its context and therefore it is tried to transform a focal point in the surroundings. Architect Richard Meier creates an attitude between the building and its landscape, which is far from being combined each other (Figure 4.27). According to him, colour on the environmental skin forms out a whole new environment and this causes destruction between the building and landscape. As a matter of fact from his point of view this manner is the most respectful attitude towards the context of the buildings. His architectural end-product is not tried to look like the landscape. Furthermore their environmental skin is covered with a white mask, which the colour is not common for the nature itself. He respect to surroundings by being come to the fore his buildings and provide them to display themselves in the context with the contributions of the colour.

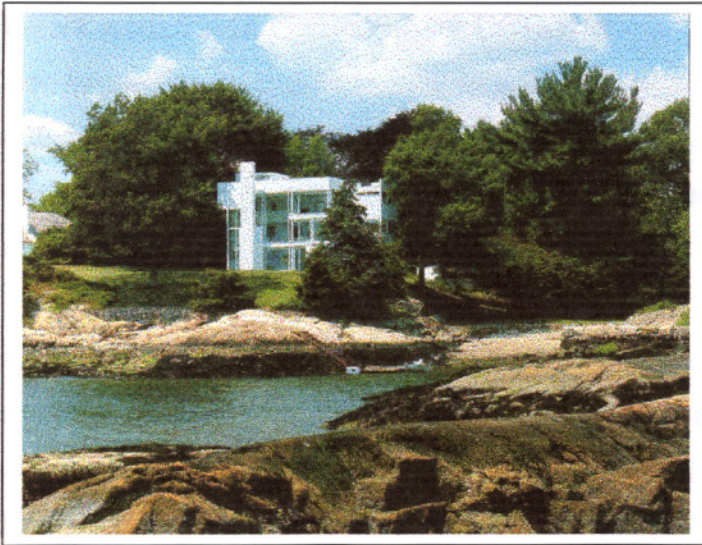


Figure 4. 27. Smith House, Richard Meier (source: Thiel-Siling, 1998)

Another example displays itself with its colour in the context but for different purpose. The *Gatehouse*, which was designed by Philip Johnson, is a pavilion for the visitors (Figure 4.28). According to him, this is a sculpture in the environment and the test of his new theory. The structure with its colour completely reacts to its environment. In the

green meadows and the forest it comes to the fore with its bright red colour and displays itself in the context. Furthermore as explained before with the influences of the simultaneous colour contrast effect it appears redder than it really is.

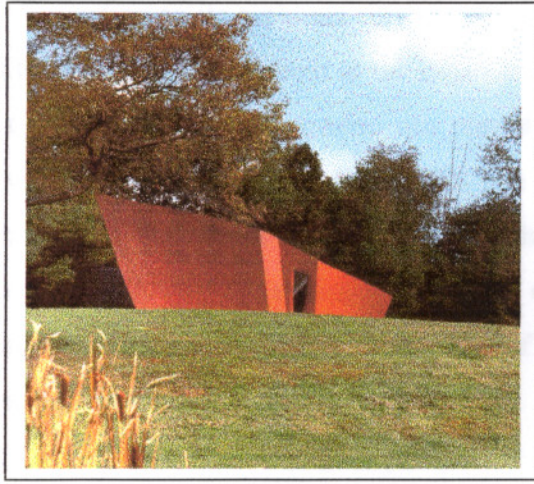


Figure 4. 28. The Gate House (source: Jodidio, 1997)

4.4.1.3. MOVEMENT AND TIME EFFECTS OF COLOUR

“Colour can be used to express movement in a number of different ways. This may be implicit in the nature of the colour itself, in eye movements caused by the juxtaposition of colours or by actual movement of coloured materials or lights.”

(Lancaster, 1996, p. 55)

The use of colour on the environmental skins as an effect is often preferred by the architects in order to emphasise their architectural thought rather than as an only way to express themselves. Particularly the movement effect of colour usually is utilised as a contribution to the general tendency of the form of the architectural design object. It is possible to be pointed out that there are two main approaches to the use of colour as the movement effect on the exterior surfaces as dynamism and stability. According to Kandinsky different hues forms out different movement effects. Yellow has a tendency in spreading action therefore the yellow objects tended to be closer. This effort of the yellow objects in order to be wider, provides them a dynamic character. On the other hand, blue tend to retreat and therefore appears smaller. According to Kandinsky red as a hue is perceived stable (Birren, 1955).

From the architectural point of view, the dynamic quality of colour can be considered one of the most preferred effects by the architects in order to emphasise and increase the dynamic impression of an architectural design object. The golden flame of the *La Flamme* building which is designed by Philippe Starck can be a good example to this manner (Figure 4.29). According to its architect this structure appears as an art object more than a functional building where was built at the edge of a very busy elevated road in Tokyo. He explains his design as black granite urn placed on a luminescent glass stairway, and topped with a golden flame (Jodidio, 1997). The figure which was placed top of the building symbolises a blaze with its form but not with its colour. The architect for this example utilised the colour to the environmental skin of the object in order to increase its dynamic impression not to symbolise the colour of the flame. Vivid yellow hue of this blaze emphasises its flaming attitude.

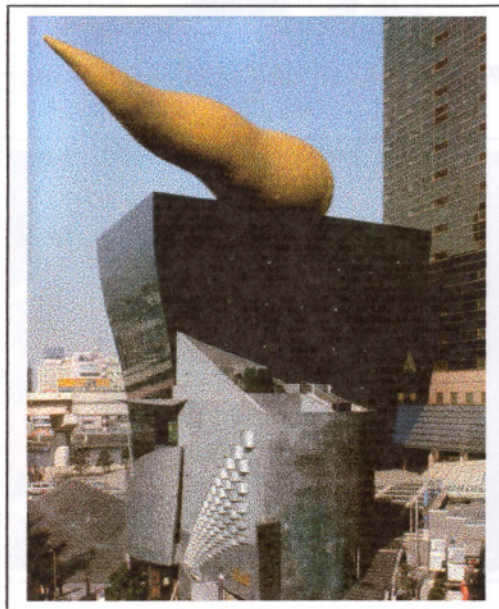


Figure 4. 29. La Flamme (Steele, 1997)

The sketches of Zaha Hadid or Daniel Libeskind can be given another examples of the use of colour as a movement effect. Particularly, Hadid often uses this movement effect of colour in her drawings in order to increase their dynamic quality. On the other hand most of the works of Tadao Ando or Mario Botta have static impression on the Perception process of the observer. The colours of these architectural objects was utilised in order to increase this effect. For instance évery cathedral of Botta as a building

has a static impression not only by its general articulation of formal design and material but also by its colour. As a matter of fact this can be simultaneously an example for the effect of material on the colour quality. It is not possible to form out general statements for the specific colours. For instance, as can be seen at this work of Botta, red as a hue has different impressions depends on the material quality.



Figure 4. 30. Sketch by Zaha Hadid (Jencks, 1990)



Figure 4. 31. Museum of Modern Art, Mario Botta (Steele, 1997)

As mentioned before in this study time is one of the most important effects which determine the perception of the colour quality of the architectural end-products. From the point of view of an observer, the appearance of a building which stands in an environment, alters with the changing quality of the sunlight, which differs with the time. This changing attitude of the colour is often utilised by the architects in order to gain the building various perceptual opportunities. From the point of view of the interior design the estimation property of time gains importance. According to the scientists

warm colours causes the time to be overestimated, on the other hand cool colours the time to be underestimated (Mahnke & Mahnke, 1987). Visionary changeable attitude with the time is always been one of the most wanted properties for the architectural design objects by the designers. Particularly, for the last decade the developments in the building and material technologies provide the architects to create the structures which has changeable environmental skin properties, such as texture, light and colour.



Figure 4. 32. Tower of Winds (source: Steele, 1997)

The effects of the colours of the building which their environmental skins changes moment to moment, highly influenced the time. Actually it is possible to pointed out that the experiences of these kind of buildings for the observer deeply depends on the effect of time. Jean Nouvel who is one of the architects that design the *media surfaces* and changeable skins states that *'The time that interests me... is the time of the moment, which I attempt to materialise.'* (Thomsen, 1994, p. 174). The tower of winds which was designed by Toyo Ito in Yokohama, can be a good example to this kind of attitude. The environmental skin of this building reacts to the changing situations of the wind. These reactions exhibits on the exterior skin of the structure by means of the changing quality of the colour from one moment to the other.

4.4.1.4. WEIGHT, SCALE AND DISTANCE EFFECTS OF COLOUR

As mentioned before in this study the greater part of the perception of colours and the result of this process occurs in the mental structure of the living beings. The process is affected by the physical (stems from the environment) and psychological (stems from the mind) effects. Therefore the physical properties of the coloured object can be differentiated from the reality. Weight, scale and distance effects can be the examples to this changing phenomenon. Generally darker colours are perceived heavier than the lighter ones. On the other hand if the colours have value and intensity, warmer hues appear heavier than the cool ones (Mahnke & Mahnke, 1987). In these kind of situations red as a hue is the colour which is perceived the heaviest. From the architectural point of view the weight effect of colour is preferred in order to change or emphasise the impression of the design object. The most interesting approach to this phenomenon can be creating confusion with the volume and its colour. For instance, for the reason that the dimensions of the object, one considers that that object should be heavier than it appears. Since the colour of the object causes perceiving it lighter than the weight that it should be perceived.

Choosing the white by means of applying them to the environmental skins is the most preferred method for the architects in order to create this lightness effect. The works of Meier can be good examples to this manner. However in this study two building of Le Corbusier are chosen in order to form out a comparison between two different approach and impressions of weight effect of colour. The first one is the Villa Savoye and the second one is the Chapel of Notre-Dame- du- Haunt or with its the most known name the Chapel of Ronchamp. The linear mass of the of Villa Savoye is elevated from the ground with a row of pilotis which is one of the five points of new architecture of Le Corbusier (Figure 4.33). This mass forms out the main part of the building, for the reason that the basic functions of the structure was placed with in. This thin rectangular prism looks like going to fly if there are not these pilotis which are the only forces that tie it to the ground. It is the fact that can not be denied its colour has a very important function to create this flying illusion. Its colour causes the observers being perceived the structure lighter than it really is. On the other hand the second project of Corbusier designed in different manner from the colour effects point of view. The main part of this building again washed with white colour (Figure 4.34). However its roof which is built

as a reinforced concrete shell is black. In fact this shell was constructed by a very thin concrete slab. However owing to its form and particularly its colour the roof looks like heavy than it really is. Contrary to the Villa Savoye this building is nailed down to the ground by means of the weight of its roof. The main white part looks like smashing in by this black concrete shell of the building. As a matter of fact, Corbusier as an architect used to utilise the opportunities of colour on the environmental skins of his architectural design objects.



Figure 4. 33. Villa Savoye (Curtis, 1996)

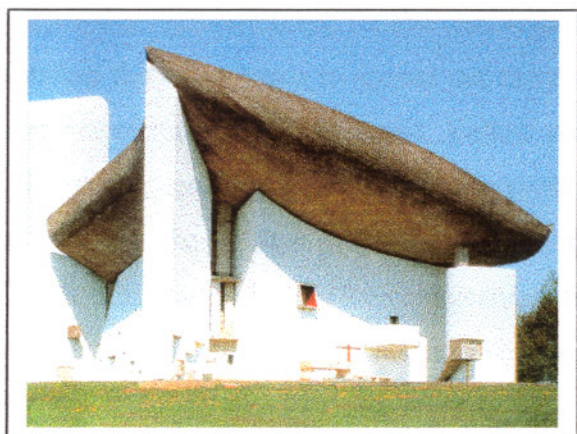


Figure 4. 34. Chapel of Ronchamp (source: Thiel-Siling, 1998)

According to him colour should be considered as a model of communication and it is the key of the process. He pointed out his ideas about colour as *'The question of colour is the question of architecture itself'* (Wigley, 1995). From the point of view of Wigley, the approach of the modern architecture to the colour can be summed as;

“Colour is seen to emphasise, rather than mask, the pure geometries of both the machine and the new forms it makes available. If modern architecture is the child of the machine age, it would seem to make sense that it is coloured like a machine...” (Wigley, 1995)

Colour affects the perception of the sizes or scale of an object too. It causes the objects to appear larger or smaller, taller or shorter, etc. In other words colour causes the scale of the object changing which is perceived by the living beings. Ostwald and Munsell who were the colour scientists explained in the third chapter of this thesis, evaluated the visual illusions of the colour. According to them, highly saturated colours should be applied to the small surfaces for the reason that it can be subdued if it is applied to the large surfaces. In the light of this statement the sizes of the surfaces which the colour is applied, becomes important. If the surface is too large it can be monotonous or overpowering, if it is too small colour can not be perceived (Lancaster, 1996).

From the architectural point of view the effects on the perceptual scale of the colour both can be considered to a significance that the architect should pay attention when he/she applies colour to the environmental skin and furthermore it can be accepted as a conceptual opportunity in expressing or emphasising the specific points of the design. Brighter images looks larger than the dark ones, for the reason that the reflected light of the bright object when strikes the retina tends to spread out more than the dark ones. If the brightness and the values of the colours are equal, Yellow one appears the largest one and followed by white, red, green, blue and black (Danger, 1987). On the other hand warm colours tend to be perceived larger than cool colours. From the architectural point of view the interesting point of this statement is the changeable attitude of the colour on the environmental skin with the time effect. For instance in a sunny day the surface which is constructed by the reflected glass system appears dark black on shiny blue background of the sky. However when the dark comes and the day ends it starts to shine with its interior lightning. This situation causes the building to be perceived larger than the normal in the darkness of the night. On the contrary a white building appears darker and, therefore, smaller in the night than in the day times.

The distance effect is one of the most preferred effects of colour by the architects in order to strength their architectural thought. Just like the size effect bright colours and warm colours are perceived nearer on the other hand the dark colours and cool colours are perceived faraway. From the architectural point of view, the distance effect of colour usually is utilised in order to increase the emphasis of the articulation of the masses of the building. For instance ground level of the Villa Savoye is moved backward in order to expose the linear mass of the upper level. Furthermore Corbusier was applied the dark grey hue to the environmental skin of the ground level. This causes increasing the perception of this level as at the backward. Therefore while the bright white hue is drawing the rectangular prism near to the observer, the dark grey hue draws the ground level faraway from him/her.



Figure 4. 35. Winslow House (source: Curtis, 1996)

The other good example to this phenomenon can be the Winslow House which was designed by Frank Lloyd Wright (Figure 4.35). Although this is one of the early works of the architect, the concept of him which is based on to separate the large roof from the main body and to be perceived the building as floating planes can be easily observed. In the light of this concept Wright generally drawn the level which is between the main body and roof backward in order to break off the roof. However in this example he used the distance effect of colour in order to apply this concept to the building. He covered the upper level of the environmental skin with a black hue in order to appear faraway and the lower one with a bright yellow in order to be perceived nearer. This provided the architect have the observers to be perceived the roof as a separated part from the main body of the building.

4.4.1.5. LEGIBILITY & INELIGIBILITY EFFECTS OF COLOUR

From the scientific point of view, the definition of the legibility can be formed as the capability with which a figure or shape can be recognised against its background. In the light of this statement it can be pointed out that legibility depends on three main conditions as appropriate illumination, the size of the figure, the colour contrast between the figure and its background (Faulkner, 1972). On the other hand, from the architectural point of view, legibility can be defined as the ability to read shapes or functions or the quality that distinguishes one form from another.

“Some of the ancient Roman architectural compositions were so designed that a brightly lighted element would appear behind a dark one, succeeded by another light one, and so on to make them all ‘read’” (Faulkner, 1972, p. 22)

As far as it is proposed in this thesis, legibility effect of colour on the environmental skin can be determined as to be exposed the different building components which have different functions and make them distinguishable by means of applying colour. In the light of this statement, Crystal Palace which its colour design was created by Owen Jones was can be one of the first and obvious examples to the use of legibility effect of colour on the environmental skin of the architectural objects after the enlightenment. For the reason that, as explained before in this study the structural components of the Palace construction were coloured according to their functions. Nowadays it is possible to consider that this effect of colour is often used by the architects of High-Tech approach.

“At the Pompidou Centre and Inmos, Rogers uses bright colours in much the same way engineers do – to distinguish different kinds of structure and services and allow them to be easily understood and effectively used... But this use of colour has an associational component which is as strong as its functional necessity in engineering. Bright yellows, red and blues are the colours of industrial machinery sports cars, ships and tractors, indeed most technical objects of the present. These colours are thus associated with the present and future tense, a world of objects free from the restraints of the past.” (Jencks, 1990,p. 98)

Pompidou Centre which was designed by Richard Rogers in the historical pattern of the Paris, can be one of the good examples to this attitude. According to him colour on the environmental skin of the buildings which are in fact machines, can be considered as a tool for the architects in coding the industrial environments and machinery (Porter & Mikellides, 1976, p.60). He designed the layered skin of the Pompidou in the lights of these ideas as an exterior of a working factory. The hues of this skin transformed a functional notion which provides the observer to read and understand the way of working method of the structure by means of the legibility effect of colour. Each system expose itself with its own colour. Architect expresses the ventilation installation with blue, water installation with green, electrical system with yellow and vertical circulation system with red. From this point of view, it is possible to consider that the building particularly the layers of its exterior surface though seems like has a complicated structure, with the assistance of the legibility effect of colour it becomes a shape which can be easily read by the individuals.

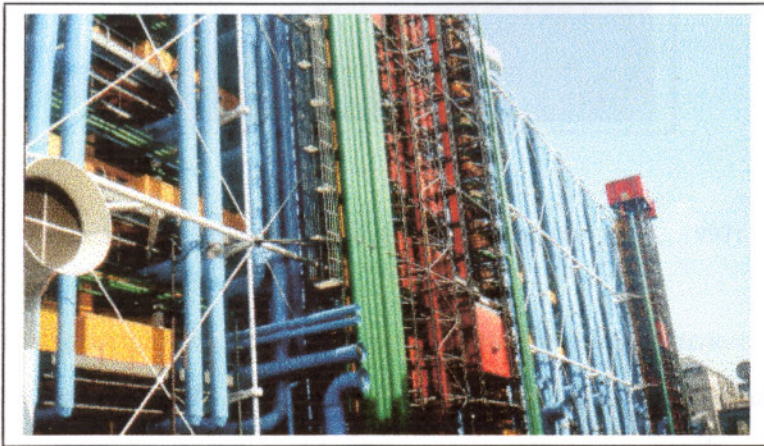


Figure 4. 36. Pompidou Centre (source: personal archive)

On the other hand, at this standpoint there is a significance which is also should be stated that building with its environmental skin in its historical context displays an assertive attitude. Pompidou centre as a figure forms out its background from the historical facades of the Paris. Therefore this surrounding skins are come to the fore the building more than it really is. The building does not hide itself with its colours on the contrary it stimulates a focal point for its physical existing environment. On the other hand, another High-Tech structure in the Paris Monde Arab Institute which was

designed by Jean Nouvel shows an opposite attitude towards its historical context with its transparent and reflected skin just like the Willis Faber Dumas building of Norman Foster (Figure 4.37). As a matter of fact these buildings with their achromatic attitude reflects the colours of the environment on their exterior skins. This approach can be considered as multiplying the background instead of stimulating a figure on it. Foster points out this manner as;

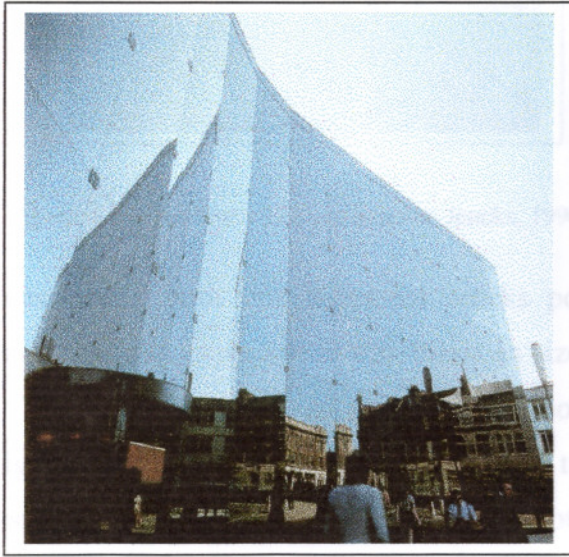


Figure 4. 37. Willis Faber Dumas building (source: Steele, 1997)

“If our response to the site is to make a more imposing statement, we tend to use vivid colour externally...the building looks as if it recently landed... If we wanted to design non-dominant buildings, tend to use glass as the main material.”
(Miller, 1978, p. 44)

Most of the architects of High-Tech approach prefer to use the legibility effect of colour for the environmental skins of their architectural design objects. For instance the *Architect's House* of Helmut Schulitz comes to the fore with its vivid colours in its natural environment (Figure 4.38). In this building, just as the Pompidou Centre, colours are used to designate the different components which are designed for different functions of the structure. However according to Jencks there is another purpose to use these colours on the environmental skin in order to *underscore the hyperbole*. From the

point of view of him, the yellow sun sails accentuate the depth of the balcony (Jencks, 1990).



Figure 4. 38. Architect's House (source: Jencks, 1990)

Consciously or unconsciously, with this statement Jencks points out that another function of the colour which was explained in this thesis as size effect. As mentioned before yellow is the hue which is perceived as the widest colour. Architect in this example by using bright yellow for the sun sails procured the terrace to appear larger than normal. It is possible to increase the examples for the use of the legibility effect of colour on the environmental skins in the High-Tech architecture. The Laboratories and Corporate Facility for PA Technology building of Rogers or the Medical Faculty in Germany of Weber, Brand and Partners can be other good examples to this manner.



Figure 4. 39. The Laboratories and Corporate Facility for PA Technology building (source: Davies, 1991)

From the different point of view, it is possible to apply the colours to the exterior surfaces in order to stimulate a complicated image for the architectural end-products in the visual process of the human-beings. On the contrary to the attitude which is based on exposing each parts of the building with their own colours according to this attitude architect designs the environmental skin of the structure in order to confuse the mind of the observer by combining different patterns and colours. Therefore this effect of colour can be called as ineligibility. Groninger museum which was designed by Coop Himmelblau can be a good example to this manner (Figure 4.40). Its colourful and also complex skin is got difficult to understand the building as a whole.

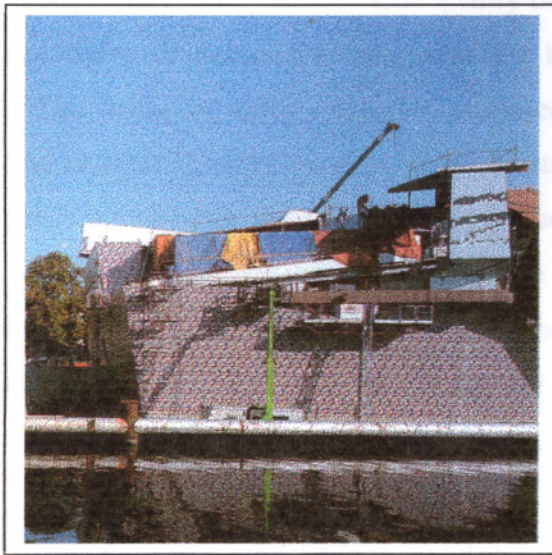


Figure 4. 40. Groningen museum (source: Tietz, 1999)

4.4.2. FORM OF COLOURS

“In 1923 Kandinsky claimed that there is a universal correspondence between the three basic shapes and the three primary colours. Moving from hot to cold, light to dark, and active to passive, the series is an elementary sentence in the ‘language’ of vision.” (Lupton, 1993, p.22,23)

Throughout the architectural design history mankind generally concerned with form much more than colour. However it is not possible to separate them from each other. Furthermore, according to Gestalt theory colour is more important than shape in the creation of forms (Birren, 1961). The relation between form and colour for the first time

is examined by the Greek philosophers. Particularly Pythagoras who was one of the famous philosophers of Ancient Greek, symbolised the elements of universe with a solids such as sphere for god, pyramid for fire, cube for earth. Besides he symbolised each solid with a different hue (Birren, 1955).

As explained before in the dynamic effects of colour each colour has its own movement quality. According to Bauhaus teacher Kandinsky yellow as a hue tends to spread out, blue tends to retreat and red tends to be static. On the other hand triangle, circle and square are generally accepted as the basic forms of the universe. In the light of this statement Kandinsky combined these two main concepts of form as three elementary shapes and colours as three primary hues. The dynamic quality of triangle was approved for the yellow, the static shape of square was suggested for the red and circle was accepted for the blue. The forms of other colours constituted by combining these primary forms. According to other Bauhaus teacher Johannes Itten, it is not possible to consider colour apart from form and one can not exist without the other. He agreed with Kandinsky in his theory which was based on the relation between colour and form. From the point of view of Itten, circle, square, and triangle were the basic forms which were most easily comprehended, and therefore they could express with the basic colours blue, red and yellow (Whitford, 1991). He pointed out his thoughts as;

“Form is also colour. Without colour there is no form. Form and colour are one. The colours of the spectrum are those most easily comprehended. Geometric forms and the colours of the spectrum are the simplest.” Johannes Itten (Whitford, 1991, p 106)

The idea which is based on inherence of colour and form, has not been examined for years after the Bauhaus. However architects have gone on using colour as a generator tool for expressing the architectural forms. Particularly the plasticity effect of colour is often utilised by the architects in order to increase the plastic impression of the forms. The Finnish pavilion of Seville world exhibition which was designed by Monark, can be a good example to this attitude (Figure 4.41). This building mainly as a concept was consisted by two solids which is one of them was a curved wooden form and the other one was a polished steel box. Curved wooden structure was painted with yellow and the

other one, steel box was blue. Yellow, for the reason that as a hue has a spreading out manner, is the most used colour in order to increase the plasticity of forms. On the other hand blue with its retreating effect causes the form to increase its orthogonal appearance. In this example architects increased the contrast between to solids by using the colour and its effects on perceiving the forms and shapes.

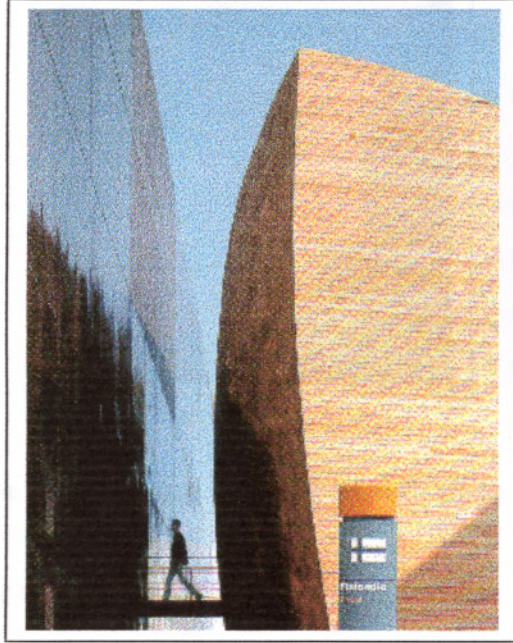


Figure 4. 41. Finnish Pavilion (source: Steele, 1997)

On the other hand, with the developments on the computer design technology in architecture and therefore with the effects of examining the architectural forms beyond the Euclidean geometry, the relation between the form and colour was started to be transformed. Since the discovery of the fractal geometry in 1975, human kind had an opportunity to understand the forms of a mountain, a cloud or a leave (Wolf, 1993). Therefore architecture was influenced this new form comprehension which was beyond the Euclidean geometry that could not be efficient to determine the forms of the nature. Computers provided the architects to create their new geometric forms in cyber-space and to construct them in the reality. At this stand point the relation between the form and colour re-investigated by the scientists, artists and architects. Since as far as it is considered that colour is the primary element in defining and expressing the fractal geometric forms. Particularly in the cyber-space it is transformed the main concept in

creating the forms. The computer drawings of the Nara Convention Hall of Christian de Portzamparc can be a good example to this statement (Figure 4.42). Flower shaped concert hall is never built, however this computer aided design with its red hue and form shows the influences this relationship on the architectural design activity.



Figure 4. 42. Nara Convention Hall (source: Jodidio, 1997)

4.4.3. SYMBOLIC MEANINGS OF COLOUR

As a matter of fact if the architectural design history is examined, it is possible to point out that the use of colour as a symbol is the most preferred colour technique in applying it to the environmental skins of the architectural three dimensional objects. As explained before in this thesis man-kind has always been considered the symbolical meanings of colour and besides its relation with the divine and natural forces. This can be considered a natural result of the teaching and understanding process of the man-kind. At the beginning of their history human beings were impressed by the greatness of the natural phenomenon. Furthermore it was considered that each of the phenomenon had its own colour. For instance the origin of life, sun is yellow, the source of the foods ,earth is brown, the images of the eternity water and sky are blue. Therefore people started to establish correlation between the natural situations with their symbolical colours.

Naturally architectural activity was influenced this process. Particularly in the antiquity, the temples of the specific gods were painted with the colours of these divine forces.

From culture to culture the names of the gods was changed with their symbolic colours but the object which they were dedicated, showed small diversities. For instance in ancient Egypt yellow was the hue of the sun and therefore *Ra*, on the other hand in the Indian symbolism yellow was the colour of *Brahma*, Buddha and Confucius. Black in the mythology almost every time has been the colour of the death even if the name of its god has changed culture to culture. Green has usually symbolised the eternity or the productivity of nature. It is still the holy colour of the Muslims and therefore Muslim's architecture. However it is also possible to consider that the symbolical meanings of colour and the belief which is based on their forces started to be weakened with the replacing the celestial religion with the paganism. This new theology created its new symbols of colour. Although the eastern religions continued to let to affect their colour symbolism the environmental skins of their structure, western countries which is influenced by the Christian church carried the symbolical meanings of the colour from the outer skin of the building to the inner one. However with the Renaissance and than the industrial revolution the divine symbols of colour almost completely rejected by the architects. The new era started to need its new symbols. Architecture which was affected by the scientific innovations of the age, accepted the machines and their aesthetic as its symbols. Therefore the colours of machines started to apply to the environmental skins in order to symbolise the new aesthetic.

“The architect lets buildings and the elements of buildings speak by representing them in the image of other things... The point of symbols in architecture is not to describe but to express. Such expression is essential if we are to experience our environment as a meaningful order.” (Harries, 1997, pg. 130)

From the point of view of colour symbolic meaning of colour was continued to utilise on the environmental skins of the architectural objects in the 20th century but the intensity and purposes changed style to style. For instance the most favourite colour of the Constructivists was *red* for the reason that it was the colour of the new regime. Furthermore although modern tendency completely rejected the symbols from the architecture, afterwards, white and the primary colours on the exterior skin of the buildings became the symbols of the *Purism* and the new aesthetic. From the point of

view of architectural design history it is obvious that the symbolical meaning of colour re-gained its value in the 70's when the pluralist tendencies started to show their powers. In the light of these statements symbolical meaning of colour can be investigated in three main significance's;

1. Natural symbols;

This kind of symbols are formed by the constant analogies in the man-kind history. As a matter of fact all of the religion systems of human-beings either were stems from these symbols or were highly influenced by them. The colours of the natural phenomenon's can be good examples to this manner such as yellow for the sun, brown for the earth, blue for the sky. From the architectural point of view these kind of natural symbols are generally used by the architects who wants to establish a direct relation between the building and nature. On the other hand, natural symbols can be associated with the objects of the world too. In some kind of situations architects imitate to the man-made objects in their design process and they use colour in order to increase the power of the imitation effect. The Ferry terminal of Traynor O'Toole partnership can be a good example to this kid of approach.

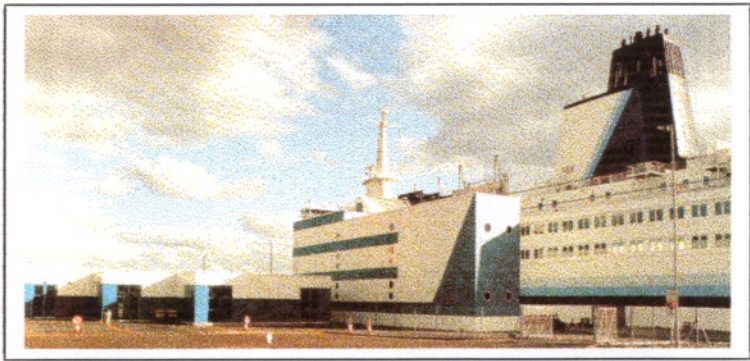


Figure 4. 43. B&I Ferry Terminal (source, Porter, 1996)

Michael Graves can be considered the architect who often uses the natural symbolic meanings of colour on the environmental skins of his buildings. According to him his style is based on the distinction between the external language of *wall* and the technical expression of the *plan* or surface and interior structure. He pointed out that the polychromy is a kind of means of expressing the *figurative, associative and anthropomorphic attitudes of a culture*, which was lost its importance in the Modern

movement that were based on *non-figural, abstract geometries* (Riley, 1985). He explained his colour approach as;

“The polychromy is used to refer to both natural and man-made elements; colour changes in the facades follow a logic consistent with the themes of the design. The colours are used to modify the perfection assumed in the white frame and to make allusions to elements found in the adjacent landscape.”
(Riley, 1985, p.213)

Portland building in Oregon which was designed by Michael Graves in 1980, can be good example to the natural symbolic attitude (Figure 4.44). In this his famous structure Graves wanted to constitute continuity between the building and its context and therefore he used the natural symbolical function of colour in order to achieve this purpose. He pointed out that the reason of applying the light green colour on the base of the building, is to form a reference to the ground. As a matter of fact, his colour approach is referential and based on model of colour associations with nature, blue for the sky, green for the foliage, brown for the earth, etc (Riley, 1995).

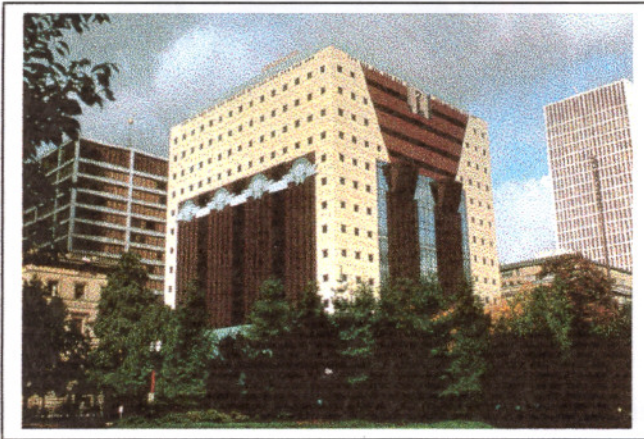


Figure 4. 44. Portland Building (Minah, 1996)

2. Conventional symbols;

Conventional symbols can be determined as the symbols which have a cultural, traditional meaning or imitate to any part or the age of the history. This kind of symbols, particularly with the effects of the populist tendency, became the most

preferred colour usage as a symbol in architecture. In this tendency architects form out associations between building and history. Piazza d'Italia which was designed by Charles Moore in 1979, can be considered a good example to this manner. In fact it was a fountain which was created by imitating the Ancient Greek architecture (Figure 4.45). Architect was used the element of the Ancient Greek architecture in order to form out this imitation such as classical columns, arches (Curtis, 1982). Furthermore colour was utilised in order to increase the emphasis of this imitation. Bright colours were applied to the environmental skin of the architectural three dimensional object in just the similar way of the Ancient Greek architecture.

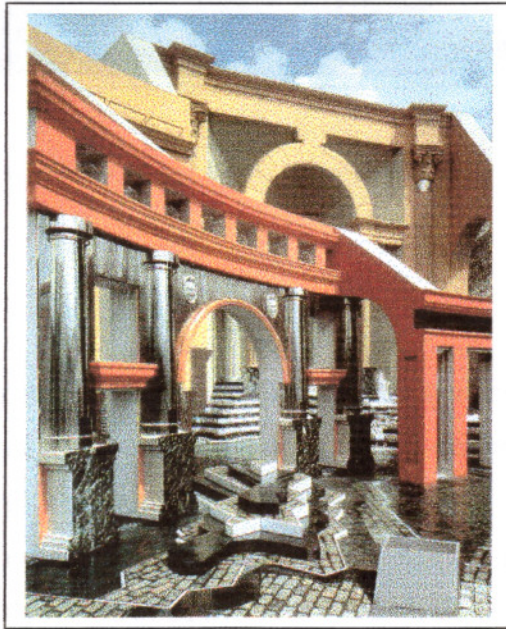


Figure 4. 45. Piazza d'Italia (source: Tietz, 1999)

Wexner Centre for the Visual Arts which was designed by Peter Eisenman in 1989 can be other example to this attitude. In fact that building was constructed as an addition to the between of the two existing structure (Figure 4.46). In the designing process he set out from a pre-existing context which was based on the idea of an excavation between the two buildings. In the light of this excavation he formed out three main axis for the structure as one for the Ohio, one for Columbus and one for the University campus. However the most interesting concept of the building was which was based on a armoury memory. He placed the walls of a castle to the entrance of the building in order

to re-construct this memory. Therefore he also used colour in order to increase the impression of the imitation. This dark red colour to the walls not only utilised for separating them from the other parts of the structure but also applied for imitating a memory which stemmed from a castle.



Figure 4. 46. Wexner Centre for the Visual Arts (source: Steele, 1997)

3. Personal symbols;

This kind of symbols can be defined as the meaning which the symbol is associated with, is based on the personal idea of the designer instead of natural or historical analogies. For this kind of symbols it usually hard to understand the association for the observers as long as the architect does not explain it. The Casa Papanice building which was designed by Paolo Portoghesi in Rome in 1970, can be the first example to this attitude (Figure 4.47). This structure because of its curved walls, was considered by Charles Jencks as a Baroque Revival structure (Jencks, 1990). On the other hand according to the architect these curves were created according to three main significance, light, accesses and function. The exterior skins of these curved walls were covered with coloured horizontal bands. These colours which were applied to the horizontal bands, were green for children and blue for adults. Jencks was defined this symbolism as esoteric and he added that;

“Who would understand this symbolism and the fact that Portoghesi used it partly to keep the client from covering the wall with his questionable paintings.”
(Jencks, 1990, p.51)



Figure 4. 47. The Casa Papanice building (Jencks, 1990)

As a matter of fact this manner which in other words can be called as unconnected symbolism forms the base point of this attitude. In fact usually there is a connection between the symbol and context but this completely is created by the designer and no one understands except him/her. Social Housing and Museum which was designed by Peter Eisenman in Berlin, can be considered the other good example to this manner. The building which was constructed on an important point in the Berlin that is known as *Checkpoint Charlie*, with the effects its design concepts can be considered as creating by various codes which is not possible to decode if its architect does not explain it with a text.

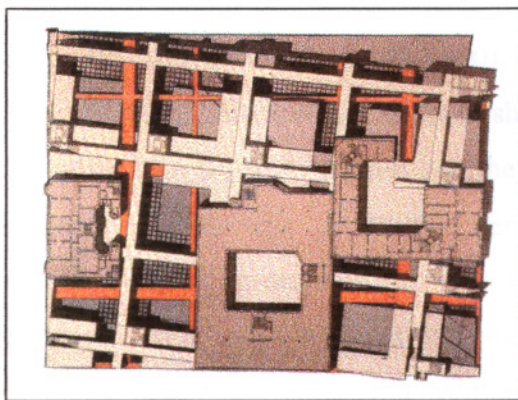


Figure 4. 48. The plan of Social Housing and Museum (Jencks, 1990)

In just the similar way as the other designs of Eisenman, this building is constructed on an abstract grid and this grid can be read from the environmental skin of the structure. According to the architect the green grid symbolised the adjacent nineteenth-century building. On the other hand angled white, red and grey grids symbolised the Berlin wall and Mercator grid of the world (Jencks, 1990). From the point of view of the observer it is not possible understand these symbols unless they were told.



Figure 4. 49. Social Housing and Museum (Jencks, 1990)

4.5.4. CULTURAL AND LOCAL CHARACTERISTICS OF COLOUR

The environment that the living beings grow up or live, has an important role in the developing of their colour sense. Every geography and culture have their own colour approach. It is possible to pointed out the colour of a country, besides of a city. This phenomenon occurs in the time with the effects of the physical and the mental forces. As mentioned before in this study colour can be considered as a visual signature of a city which is least recognised but most direct (Swirnoff, 2000). The colour palette of the pattern was formed by the humans but afterwards it starts to shape the mental structure the settlers. Culture, geography, climate and religion are the most important factors which affect this colour sense. Particularly, geography were the main designating element for the historical settlements because of the colours of the environmental materials. However nowadays, with the effects of the industrial revolution and, therefore, developments in the communication and commerce and also material technology, geography started to lose its importance on the colour palette of a pattern. Nevertheless, climate as a factor which is in fact depends on the geography, still has its importance. As explained in the effects of light and time on the colour perception,

climate directly affects the result of the colour perception process. For instance a same white colour appears different in England from a Mediterranean country (Swirnoff, 2000). On the other hand, beliefs of culture and religion have an important role in determining the symbolic meanings of colour. These symbols transforms into the colour palette for the human beings as time passes.

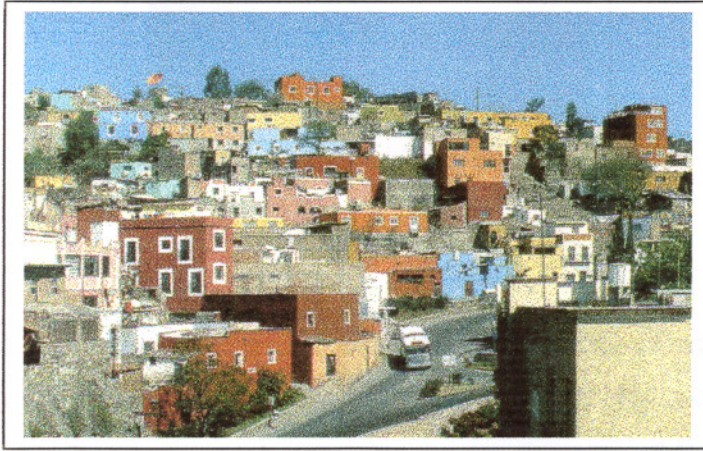


Figure 4. 50. Colour scheme of Guanajuato (Legorreta, 1990)

From the Architectural point of view colour palette of a city means the hues of the inner surfaces of the pattern. This inner surface simultaneously occurs by the environmental skins of the individual buildings. Architect as a person who is expresses his/her experiences to the design, is affected this palette and reflects these knowledge on the environmental skins of the architectural objects. Famous Mexican architect Luis Barragan can be considered as the best example to this manner. It is not possible to separate the effects of his geography from him. Francisco Gilardi House which was designed by Barragan in Mexico city can be the examples to this attitude (Figure 4.51). The colours on the environmental skins of the buildings in fact are the colours of the Mexican culture.

“Though exceptional, the work of Barragan should not be considered atypical of or isolated from Mexico’s architectural traditions. His work shows strong links with his precursors and fits naturally into its chronological and geographical context.” (Julbez, 1996,p.24)

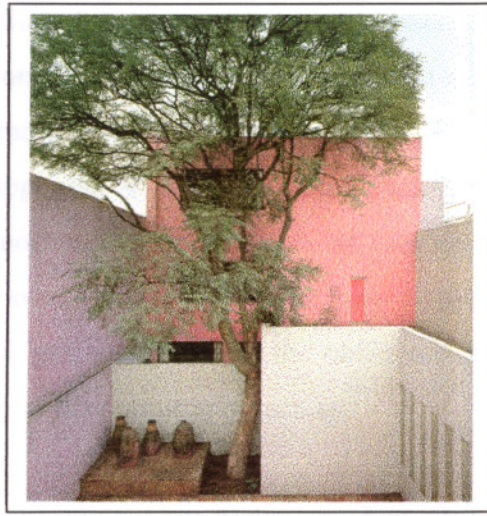


Figure 4. 51. Francisco Gilardi House

Antoni Gaudi can be considered as the other important architect who used the colour that was affected by cultural and local characteristics. He evaluated a unique environmental skin language which depended on the elements of Gothic, Moorish and his creativity. He influenced by the heritage of the Catalan architecture or the Catholic way of belief. Therefore his colour approach was shaped according to these effects of his geography. He generally used fragments of glass and bits of pottery in order to coloured the exterior surfaces of his architectural design objects. As same as all of his buildings the Palau Güell building can be a good example to this attitude (Figure 4.52).



Figure 4. 52. Palau Güell building (Curtis, 1997)

On the other hand in Mexico Ricardo Legorreta started his architectural profession in the light of Barragan. In just the same way as Barragan he used colour by being affected

by the cultural and traditional colour approach of Mexico. According to him, Mexican approach about colour on the environmental skin can be summed up as being freedom which requires pure emotion and no rules. The IBM Technical Centre can be good example to the colour approach of Legorreta (Figure 4.53). As far as he pointed out that he designed the outermost environmental skin as grey on the other hand he applied vivid colours such as violet, yellow, pink to the inner surfaces. He explains his purpose as alluding the inner life and warmth from the observers of the outside. He explained the effects of his culture on his colour approach as;

“There are moments while I am designing when, instead of saying ‘I am going to make a wall red’, I say; ‘I am going to make a red that will be a wall.’ This typically Mexican. Sometimes we are more interested in colour than the object that carries it.” (Legorreta, 1990, p. 58)

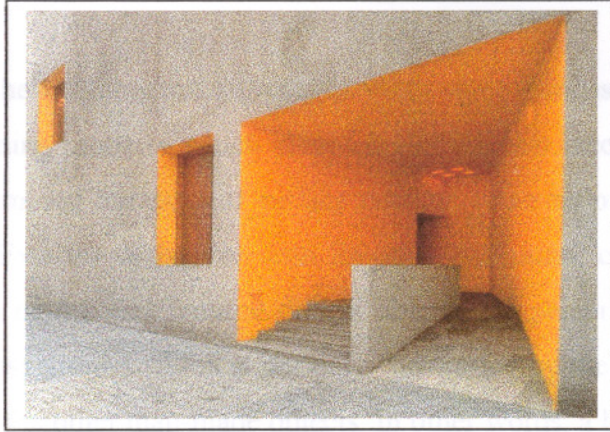


Figure 4. 53. IBM Technical Centre (Legorreta, 1990)

CHAPTER V

CONCLUSION

This study which focuses on the colour concept as a physical property of surface of the substances, has aimed to display the wide range of opportunities of this notion in expressing the design thought on the exterior skins of the architectural end-products. With the reflection that inattentive colour approaches of the architects is one of the major reasons of visual decay in the cityscape, this study has also aimed at examining the visual interaction between the environmental skin of the building and its surroundings. Based on this conceptual framework, this study has proposed four major objectives as follows;

- *This study has evaluate the exterior surfaces of the architectural end-products as figures in context by emphasising their physical properties in relation with the environment.*

The architectural shell differentiates from the other three dimensional object surfaces with its space defining property which causes it to have two faces as inner and outer. This study has examined the exterior surface concept in terms of the Gestalt's figure and ground laws. Exterior surface or with its other definition, created by this study, *environmental skin* of the architectural design objects are perceived as figures in the shapeless and endless ground which is not only constituted by the natural surroundings but also consists of the other man-made objects. In other words, a building as a figure in the ground can be perceived, at the same time as a part of the ground for another architectural object. As a matter of fact, the image of an architectural context comes in to the existence by the additive mixture of the environmental skins of the three dimensional objects of the surroundings. Therefore architects should be aware of the significance of the fact that each structure which is constructed in a context is not only a figure which is influenced by the ground image but also as being a part of this context which forms out a background for the others.

Notwithstanding, this privileged property of the environmental skin provides the architects a wide range of opportunities in displaying their architectural discourses and expressing their surface language. In this respect, this study, which claims that colour,

as a visual notion is one of the most advantageous design components in expressing or emphasising the architectural thought process, has examined this statement in a framework which consists of the diversities of the environmental colour concept.

- *This study which assumes that colour is utilised in built environments without knowing its physical capabilities, has also explicated the basic concepts of colour from the architectural point of view.*

Concerning the colour concept from the different points of view of diverse professions, induces its physical extends from various points of view. For the scientists it can be defined as a physical phenomenon or for the artists as pigment. On the other hand, from the architectural point of view, it usually comes to the fore as a surface quality. As a matter of fact, appeared colour of surfaces as a result of a perception process, is the function of light. In respect of this definition, this study has examined the basic concepts of colour in relation with the physical properties of light which constitutes the visual perception. The general evaluation of the colour theories has displayed in order to provide adequate cognition which is required to understand the physical dimensions of colour. Researches on the concept indicates that it is possible to examine the perception process of colour in four stages namely light, object, vision and psychological factors.

- *This study which claims that the disrespect of the relation between the colour of the exterior surface and the context ruin the colour scheme of the city, has evaluated the quality of colour on the exterior skin under the influence of the environment.*

Colour as a concept on the environmental skins of the architectural end-products differentiated from the other surface utilising characteristics such as painting or sculpture with its three-dimensionality and its surrounding which the conditions can not be totally controlled. For the reason that the process of colour perception consists of four levels which two of them depends on the conditions of the surroundings, the perceived colours of the architectural design object is highly influenced by the physical circumstances of the environment. This study has determined these effects in two groups. The first one consists of the effects which depends generally on the natural environment itself as light, shadow, time. On the other hand the second one is constituted by the effects which depends on the physical properties of the surfaces as material and texture.

- *This study has examined the conceptual capabilities of colour in order to emphasise the architectural thought on the environmental skin.*

The environmental effects on the perception of the applied colour are the parameters and are considered hard to be projected in architectural design process. As a matter of fact, these effects provides the architects a wide range of opportunities in forming out a dynamic design language on the exterior surface owing to the variable characteristics of colour. Actually, considering the conceptual capabilities of colour on the environmental skins of the buildings should not be conceived as a new approach for the architectural design history. Since, in the ancient times colour had been applied to the exterior surfaces in the light of the functional purposes more than the aesthetical concerns. Particularly, the symbolic function of colour was used to protect themselves from the divine and the natural forces. However with the evolution of the celestial way of believing, symbolic meanings of colour on the exterior surfaces of the structures had began to fade. The reason of its existence shaped out to be an element of beauty rather than indication of thoughts and feelings. Although in the Renaissance and Baroque periods, its wide range of opportunities the perception process utilised to create illusionary effects on the interior surfaces, Industrial revolution can be considered as a threshold in the evolution of the colour idea on the environmental skin because of being re-gained its expressive qualities in the architecture of the western culture. Particularly, with the beginning of the twentieth century, modern tendencies was approved the return of the conceptual meaning of colour by means of their architectural discourse. On the other hand for the developing countries which are on the periphery of the high developed ones and also exported the industrialisation and modernisation projects with their exterior surface language, colour had gone on utilising in its symbolic and cultural meanings. However, with the effects of the international style and than the pluralist tendencies, most of them lost this priority and they started to apply colour to the exterior surfaces in a technique which they imitated without having the knowledge of the purpose of the usage. As a result of the researches, this study has constitutes a general method for the architects in order to be expressed their architectural thought. Four major colour application methods proposed in this study can be itemised as follows;

- *Utilising colour as an effect* is formed out the most used technique of colour. This method depends on the perceptual opportunities of colour and usually applies in

order to increase the emphasis of the architectural thought. The ways which the method consists of can be itemised as follows;

Sign effect of colour; This method is utilised on the environmental skins of the buildings in order to call the attention of the observer to a specific part of the structure or to the overall design. By means of the figures, the changing effects of the various skins on the perception of the sign effect of the colour of the building can be easily observed.

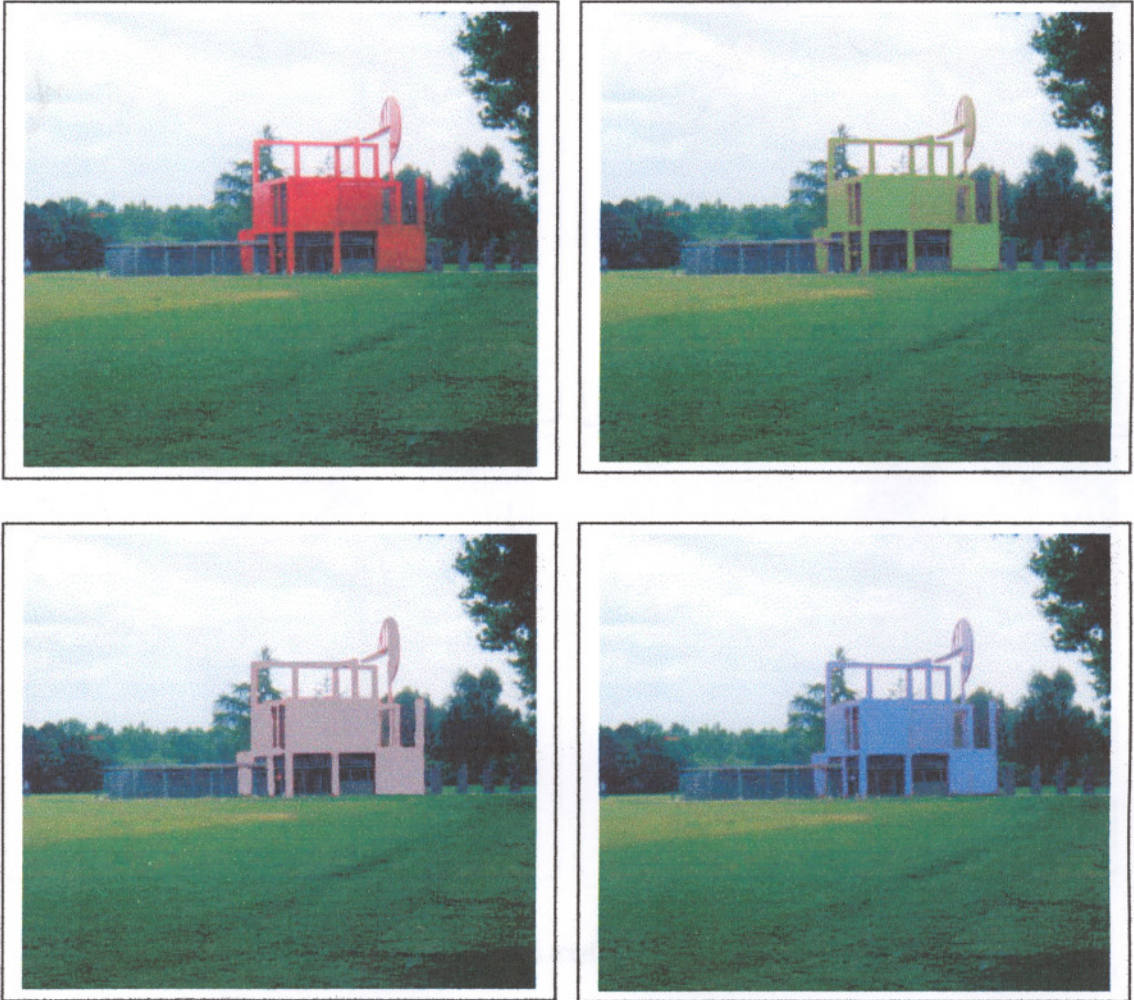


Figure 5. 1. Changing skins Folies (Personal archive)

Camouflage & display effects of colour; Every architectural end-product and its architect, explicitly or implicitly, has an attitude towards the relation

between the building and the context. In some cases it is preferred to hide the architectural design object in its environment and sometimes preferred to display with its opposite properties compared the context. Colour as a design concept involves an inherent power in emphasising these kind of approaches of the architectural end-products. By means of the figures, the changing effects of the various skins on the camouflage effect of colour can be observed.



Figure 5. 2. Various skins trials for Falling water House

(source: Taschen,1994 & Personal archive)

Movement & time effects of colour; This method is utilised to the exterior skins of the in order to constitute a dynamic and variable impression for the architectural design objects. The changing colour of the skin of the form of

a flame which gave the name to the building, in the figure can provide the observers to be seen the dynamic effect of colour.

Changed, the impression of the building alters

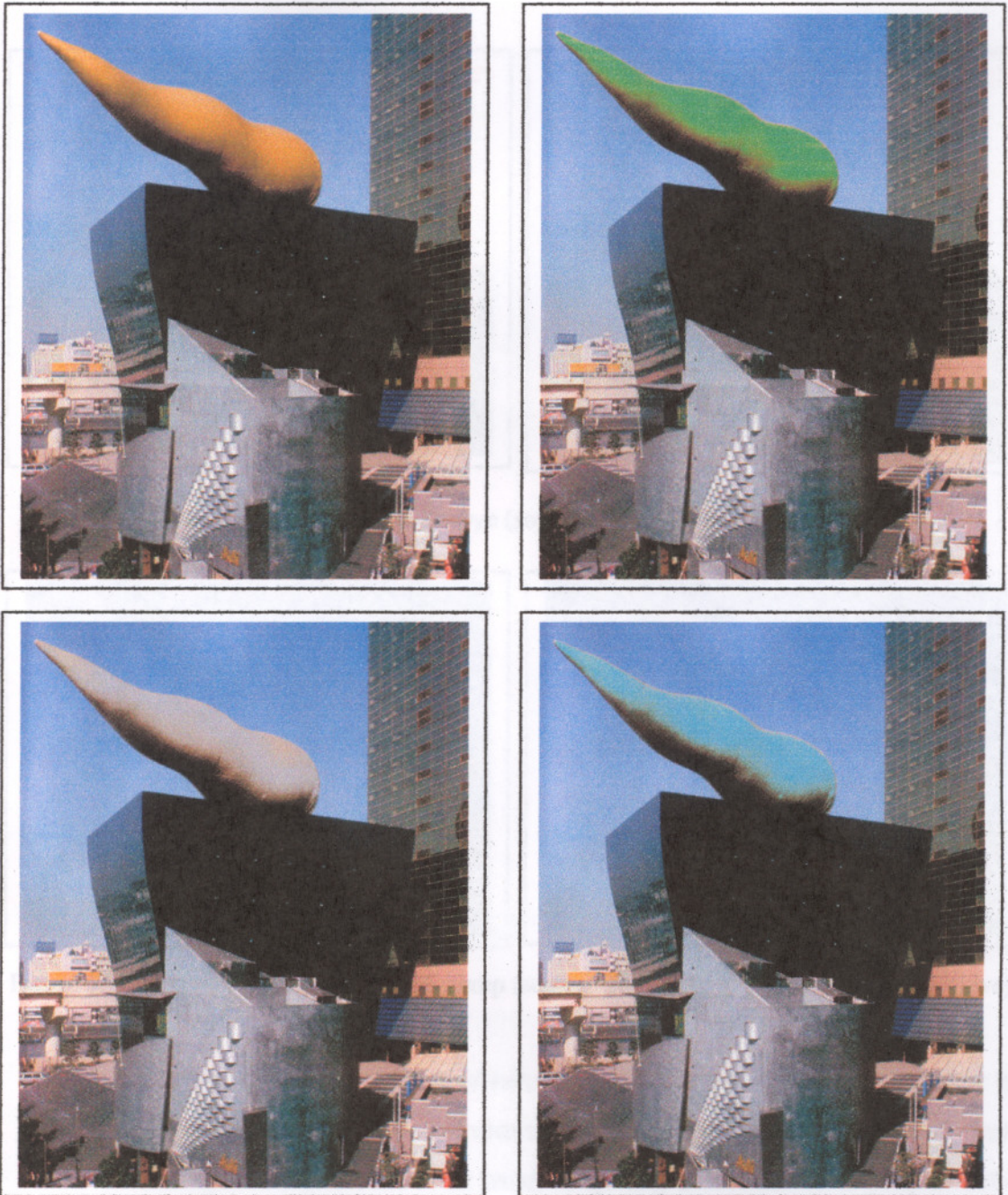


Figure 5. 3. Various skin trials for La Flamme (Steele, 1997 & Personal archive)

Weight, scale & distance effects of colour; This method is utilised to the colour design of the environmental skins in order to be perceived the physical properties of the form of the building such as weight, scale or distance, as

being different from the reality. As can be seen in the figures of Villa Savoye and Chapel of Ronchamp, when the colour of the exterior skin is changed, the impression of the form is alters.

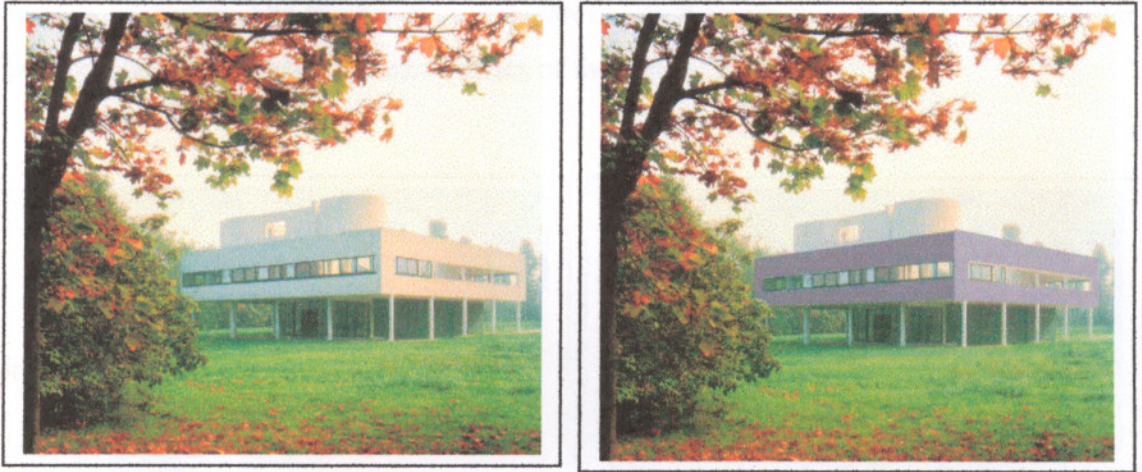


Figure 5. 4. Skin trial for Villa Savoye (source: Curtis,1996 & Personal archive)

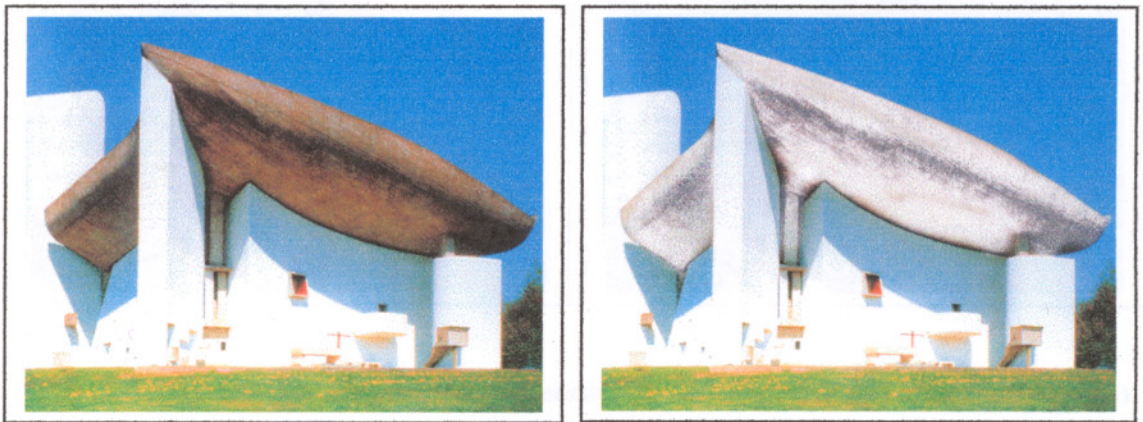


Figure 5. 5. Skin trial for Chapel of Ronchamp (source: Thiel-Siling, 1998 & Personal archive)

Legibility & Illegibility effects of colour; Legibility effect can be defined as to be exposed the different components of the building in order to make them distinguishable. On the other hand, illegibility effect can be defined as to be stimulated a complicated image for the building in order to constitute indistinguishable details by means of the surface quality of colour and texture. By means of the figures, it is possible to observe the changing quality of the legibility and illegibility effects of colour on the environmental skins of the example buildings namely Pompidou centre and Groningen Museum.

- **Form of colour** approach is based on a consideration which assumes that each colour has its own formal expression because of its internal dynamics. This idea which is originated to the ancient Greek colour science, could be found its reflection in the architectural activity in De Stijl and Bauhaus discourses and three-dimensional design objects examples. The figures of the Finnish Pavilion shows the effects of colour on the perception of the physical characteristics of the forms.

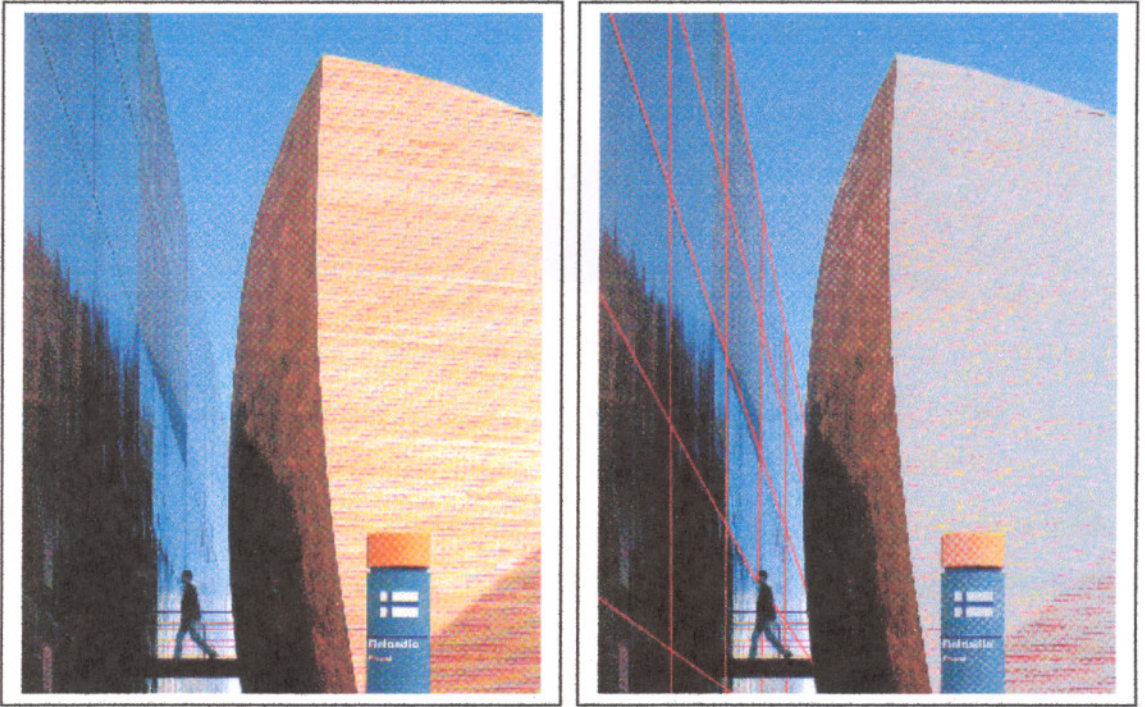


Figure 5. 6. Colour of the skin trial for the Finnish Pavilion (source: Steele & Personal archive)

- **Utilising colour as a symbol** approach, certainly is the oldest technique in applying colour to the environmental skins activity. Even today, most of the contemporary meanings of the symbolic colours which are still used, were originated to the ancient times. Particularly with the effects of the pluralist tendencies in architecture symbolic utilising symbolic meanings of colour on the environmental skin regained its significance in the architectural design activity. This study has examined this approach in three main groups as, natural, conventional and personal symbols. As can be seen in the figure, the symbolic natural effect of B&I Ferry Terminal which is analogised the image of a ship, can be changed when its colour choices on the exterior skin are alters.

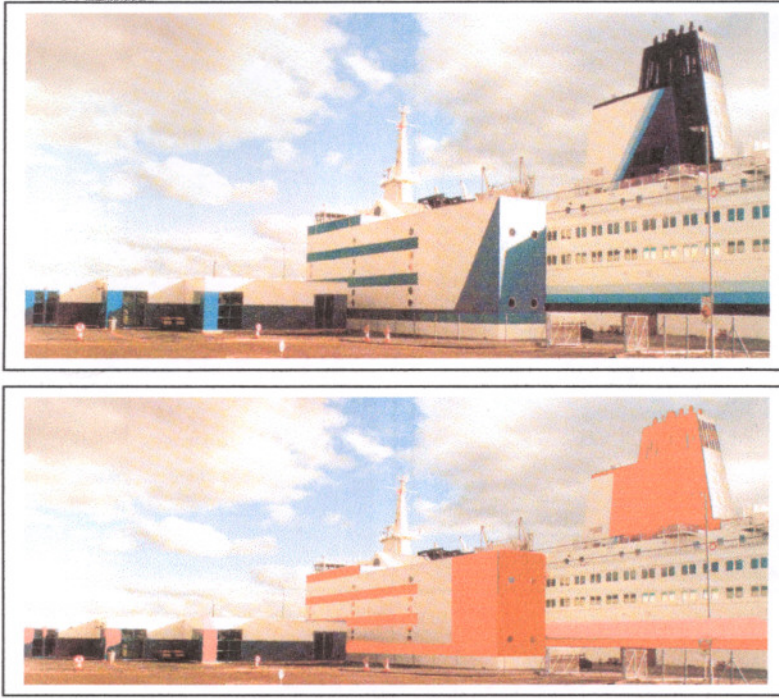


Figure 5. 7. Colour of the skin trial for B&I Ferry Terminal

(source: Porter, 1996 & Personal archive)

- ***Cultural and local characteristics of colour*** in fact is based on a colour approach of specific cultures and geographies. This kind of colour utilising technique requires centuries in order to evaluate. This approach, as a matter of fact can be considered as a reflection of the architects' background according to the culture which he/she experienced with in their architectural activity. The changing attitude of the colour approach of the context changes the colour scheme of the cityscape, as can be seen in the figure, and causes the urban priorities and characteristics of the city being altered which binds the context with the place.

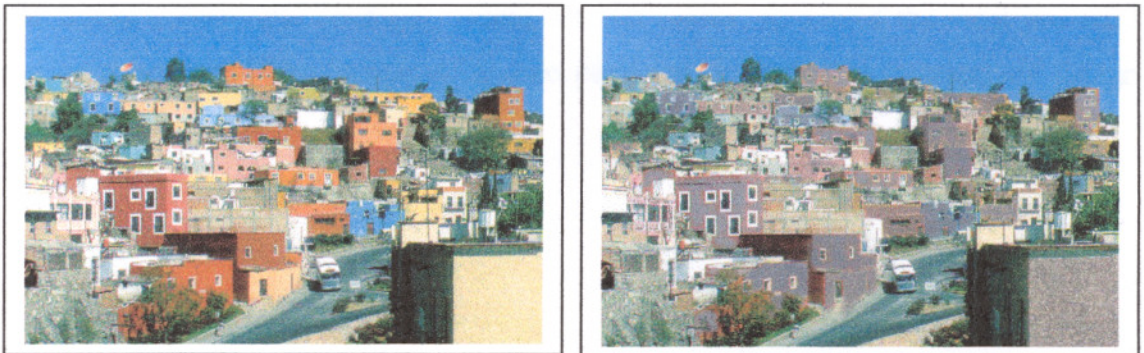


Figure 5. 8. Colour scheme trial for Guanajuato (source: Legorreta, 1990 & Personal archive)



Figure 5. 9. Colour skin trial for Francisco Gilardi House

(Julbez, Buendia,1996 & Personal archive)

Consequently, colour as a concept should be considered as one of the major visual elements of the environmental skin, which provides the architects to express themselves and their architectural discourse. Furthermore, applying colour to the exterior skin should be beyond of selecting a dye process which is decided in construction stage, and should be involved to the design process of the building. The general evaluation of colour is considered as a significant concept in the contemporary architectural discourse in terms of forming out the environmental skin language, with the developments in the surface material technology, particularly with the improvement of the media surfaces which the architectural thought has found the opportunity to display itself in a dynamic and variable way. Furthermore the role of colour in cyber-space concept and in defining the fractal geometrical creations, points out that colour, as one of the most powerful design concepts will be increased its conceptual quality in further architectural design activities.

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GLOSSARY OF TERMS

Achromatic colours: Colours without hue: black, white and neutral grey.

Adaptation: The adjustment of the eye to differing light conditions. It is the process by which the pupils dilate when a person moves from a light to a dark space, when the rods in the retina become more active. Conversely pupils diminish and the cones become more active when the change is from dim to bright light. Adaptation is an essential factor in making colour judgements under different lighting conditions.

Additive colour: The mixture of different coloured light beams reflected from a white surface. Red (orange-red), green and blue (blue-violet) lights of equal intensities added together produce white light: red and green lights produce yellow; green and blue, cyan: and blue and red, magenta.

Additive primaries: Red (orange-red), green and blue (blue-violet) light, which can be mixed in varying proportions to produce a wide range different colours.

After-image The image seen when the eyes are closed and turned away after the cones of the retina have become adapted to an image of a particular colour. The after-image will be in the complementary colour of the original.

Brightness The intensity of a light source. Brightness is sometimes confused with the term 'lightness', which refers to the reflectivity or value surface colours. It is also used ambiguously to refer to colour saturation.

Chroma: The degree of intensity or saturation according to the Munsell system.

Colour assimilation: A process visual mixing, also known as 'optical mixing' which increases with distance, so that the overall colour appearance of similar small-scale units lit units. such as bricks, is changed by the interspersed presence of differently coloured materials such as mortar.

Colour constancy: The process by which in our perceptions the colours of objects remain constant under widely varying conditions.

Colour solid: A three-dimensional model expressing the three main attributes of colour: hue, lightness and saturation. The vertical axis invariably represents the scale of lightness (value or greyness) from black at the bottom to white at the top, the hues being placed in spectral order around the sides in layers according to their lightness and saturation.

Colour system: An arrangement of colours according to their attributes, which makes colour sampling possible.

Complementary colours: Pairs of colours which when mixed as light beams produce white light. Traditionally blue and yellow and also red and green were considered to be complementary pairs, since neither appeared to contain any trace of the other.

Hue: The attribute by which one colour is distinguished from another.

Intensity: The brightness of a light source: colour saturation. Since it can refer to two of the three variable 'dimensions' of colour, the term is somewhat ambiguous.

Optical mixing: The process by which juxtaposed colours, for example coloured light beams or coloured patches on a spinning disc, are mixed and thus perceived to combine as a different colour.

Pigments: Compounds that are especially efficient in selectively absorbing certain light wavelengths and reflecting others, and can thus be used in the preparation of paints, dyes or inks.

Primary colours: A set of three colours from which all other colours can be derived, but no two of which will produce the third. In the 'additive' colour mixing of light, red (orange-red), green and blue (blue-violet) are primary: in 'subtractive' colour mixing, the primaries are magenta (red), cyan (blue) and yellow.

Saturation: The intensity and purity of a colour. The term was originally used by dyers to describe the vividness of a hue.

Secondary colours: Colours obtained by mixing two or more primary colours.

Shade: A colour obtained by mixing a hue with black.

Simultaneous contrast: The effect on contrast of colours that are simultaneously present in the visual field. The phenomenon is seen in receding ranges of hills, which appear to have darker upper edges when contrasted with the lower edges of the adjoining range, or in a grey object that looks lighter against a dark background and darker against a light background.

Subtractive colour: Colour produced by blocking or cancelling out a certain group of light wavelengths.

Tint: A colour obtained by mixing a hue with white.

Value: The term used in the Munsell system for the lightness of a surface colour.

Wavelength: The distance between the peaks of adjacent waves.