

# Use of colour in art and architecture



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The use of colour in history has gone through a long story. It has been used because of its ability in altering mood and atmosphere, and also because of its symbolic meanings.

The earliest known usage of colour in interior spaces started when man drew on walls of caves and tombs, which continues with the application on cathedrals, palaces, and ordinary homes.

However, despite the usage in daily life, there're times when the potential of colour is forgotten. Few causes such as the movement Minimalism and the term 'chromophobia' are part of it. But considering its ability in altering perception of space and creating direct connection with the user, should we re-examine the use of colour in modern architecture in order to prove its value?

The usage of colour has been involved in the architectural development in ancient Egypt and Greece. It has been used mostly because of the association of colour with certain symbolism in the cultures.

Ancient Egypt, one of the most documented civilizations, used paintings on walls and ceilings in order to tell the story of their civilization, from daily life to battle scenes. Earth pigments are used in creating these paintings - red, yellow ochre, also green, blue, purple, black, white, and gray. Each colour is used to symbolise certain aspects, for example red ochre for skin colour of men, while yellow is used for the women. While in the Greece history, the Palace of Knossos, is a distinct example of the use of colour in its architecture. The most outstanding feature in the building is its large red and black columns (Rompilla, Ethel, 2005).

## Palace of Knossos

Based on these examples, we realize that colour can be used to create certain effects in its application, either symbolically or structurally. In the Palace of Knossos, colour is able to manipulate the appearance of the building. The colour red and black applied creates a distinct feature in the building. Even in its usage in symbolism, colour creates relation with certain people. This kind of occurrence, relation between colour and certain culture, still lives nowadays. We can see how certain culture is associated with certain colour. For example, the Japanese is often associated with the subtlety of white and blue. On the other hand, Mexico is associated with brighter colour tones. For these people, the colour chosen can serve as a connection between them and their culture and therefore its application is more than just decoration. This is one of the aspects which can be used as a consideration in applying colour in architecture.

The colours in Japan culture ( left ) and Mexico ( right )

Association with culture and impact on structure will contribute on how objects and spaces perceived by the viewer. More on this issue will be examined thoroughly in the next chapters.

## **THE REDISCOVERY OF COLOUR: Towards a Dynamic Architecture**

### **Colour Throughout History**

Considering the importance of colour in everyday life, to observe what has been done in its usage in the past, is part of knowing to what extent colour has achieved in its application. Therefore, the following is an observation on

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the role of colour in three ancient civilization, Egypt, Greece, and Rome. The observation will focus on the role of colour not only in its symbolic meaning to a particular culture, but also in terms of creation of arts. These include paintings, ceramics, sculpture, and also architecture.

## **1. Egypt**

Egyptian civilization,(3000-500 B. C. E), had developed an advanced creation in arts. Colour, was used as an integral part in the process. The colours of the Egyptian were obtained from finely ground minerals, and mixed with a tempera base, material prepared from glue or egg albumen. In the later time, they began to get colour pigments from inorganic sources, too. The ten basic colours being used by the Egyptians are white, gray, yellow, burnt umber, brown, red, green, blue, violet, and black. In portrait paintings, the Egyptian always used black for eyes and hair. This practice is also used in portrait sculptures to outline the sculptures, resulting an enhanced colours and defined shapes.

## **2. Greece**

The recorded history of Greek civilization spans from about 800 B. C. E to 250 B. C. E. Colour was widely used in ancient Greek. It was also applied in their human figures sculpture. These figures did not look like what we see nowadays as colourless sculptures. In its production, these figures used to be coloured with vivid-coloured paints. However, time and weather caused these colours to fade, leaving these sculptures colourless as we see them nowadays.

In terms of the colour palettes they used, the Greece has its foundation from the Egyptian. They used white, light brown (ochre), purple (reddish violet also known as Tyrian purple), black (from soot and smoke), yellow, yellow-orange, brown, gray, green (known as Greek green or verdigris), and blue. The colour Tyrian purple was used in the later civilization of Roman, however it was the Greeks who found it first. Plato wrote about the importance of the Tyrian purple in his Republic, indicating its usage in various major rites, such as births, deaths, and marriages. And also about how the colour was perceived by the Greeks as the most beautiful colours due to its equal proportions of dark and light.

Tyrian purple ( left ) and Greek green or Verdigris ( right )

### **3. Rome**

The Romans usage of colour were mostly influenced by the tradition of Greeks, this includes their colour palettes and usage in arts. However, unlike the Greece admiration to tyrian purple, the most popular colour in the civilization was red, which was reflected in the ruins of Pompeii.

Red colour dominates the walls of Pompeii ruins

The colour palettes used are mostly similar but brighter than the Greeks. They are white, black, warm red, Tyrian purple, blue green, foliage green. Yellow, earth brown, purple, sea foam green, cool red, and gray.

As how we've read about the history on how different colours were used in the civilization, the tradition of colour as a symbol of culture is still carried along nowadays. However, besides its relation to culture, there's another

concern regarding on how colour is perceived based on science. The findings are regarded as an important achievement which helps to enhance the sensation perceived, especially in terms of arts and design.

## **Colour Theory**

" Take a good look round and you'll see that everything is coloured."

K. Schippers

In order to understand the colour sensation, one must first understand how our eyes perceive them. Colour, dissolving perfectly in our life, may seem as a very normal experience. But it actually is a very important aspect in our vision because it plays a big part in shaping our visual perception. So, what is colour?

Colour, in physics and optics, is defined as 'component parts of light' (Fisher, Pat and Zelanski, Paul, 1989). Being able to see colour enables human to differentiate objects seen more easily , compared to what might possibly be seen in only shades of gray ( known as monochromatic vision). The benefits of seeing colour is absent in some animals. Animals such as dogs, don't experience colour vision. This condition causes that they can only spot other creatures, for example rabbits, only if they move.

The experience of seeing colour would not be possible if not because of the assistance of light in our vision. Our eyes perceive differences in light frequencies just as how we perceive differences in sound frequencies with our ears. While differences in sound frequencies enable us to hear different pitch, differences in light frequencies enable us to see different colour. The

colour field that human perceive ranges from the longest visible wavelength (red) to the shortest visible wavelength (violet).

Light, in various wavelength and brightness, enters our eyes through cornea, a transparent outer covering. The received light then will be focused on the back of the surface of the eye. The back of the eye is covered by the retina, which contain many layers of cells. The layer which is important in colour vision consist two receptors called rods and cones. Rods enable us to see black and white visions in dim light, while cones enable us to see hues under brighter lighting condition. Hence, through these series of mechanisms, we are able to see colour.

An observation of how light affects the colour perceived by human eyes has been done by the French Impressionist, Claude Monet, in creating his works. In the creation of his works, Monet often painted the same scenes, such as haystacks and cathedral' face, under different lighting condition. Once, he decided to rent a room opposite Rouen Cathedral and stayed there for months painting the cathedral in different times of the day. It appeared that in full midday sunlight , the facade of the building is washed with gold colour and a slight blue shadow. While at sunset, the surface is coloured pale bluish pink, with lots of oranges and reds in the building's recesses.

#### Paintings of Rouen Cathedral by Monet

Monet is not the only one who was in search of finding the explanation behind the role of colour in human' visual perception. Many theorist and authors, spent years researching in order to gain more knowledge about the relation between to assist them in the usage of colour. Their curiosity

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brought them to a series of experiments in order to find explanation on how colours affect our vision. The studies include examination on the mechanism of eyes and the colours perceived, which also brings about the role of light in affecting the appearance of colours.

The first manifesto closest to colour theory was created by an ancient Greek philosopher named Empedocles. He concluded that it is the eye of the observer which perceived colour and that colour is not a property of the object being observed. This idea had been evolving along with the discoveries by other people, such as Aristotle. Aristotle, another Greek philosopher, assumed that the colours were formed by the blending of sunlight, light, fire, and the lack of light in various degrees. The development was continued afterward with people from different backgrounds, such as theorist, authors, and physicist. Some of these people are Sir Isaac Newton, Johann Wolfgang von Goethe, Albert Munsell, Johannes Itten, and Joseph Albers. Each contributes to the knowledge of colour we use nowadays.

## **The Loss of Colour**

Being used and developed since the early civilization, there were times when the use of colour is being ignored. The situation is caused by several reasons, such as the idea of white as a better choice than colours, and how this idea is strengthened by the emergence of the Modern Movement and International Style, who preferred the natural colour of the materials, and later on the idea of black, white, and gray in Minimalism. These movements have changed people's perception of colour and therefore resulting avoidance in its application.



## 1. Whiteness

" Though your sins be as scarlet, they shall be as white as snow."

Isaiah 1: 18, Bible

The colour white, through various cultures, has been associated with perfection, innocence, and cleanliness. Colour, on the other hand, is perceived as the opposite of whiteness, which is dirtiness and the less-than-true. The word 'colour', which is *colorem* in Latin, is related to *celare*, means to hide or conceal. In Middle English 'to colour' means to disguise.

## 2. Chromophobia

Another form of rejection of colour is called chromophobia. Chromophobia, based on David Batchelor, is defined as ' a fear of corruption or contamination through colour'. He mentioned that chromophobia " manifests itself in the many and varied attempts to purge colour from culture, to devalue colour, to diminish its significance, to deny its complexity. "

(Batchelor, David, 2000)

The rejection of colour happens in two ways. First, colour is perceived as being 'made out of foreign body- usually the feminine, the vulgar,...'. In this case, colour is treated as something foreign, something 'alien'( Batchelor, David, 2000 ) so that it is considered dangerous. Charles Blanc, a colour theorist, identified colour with the 'feminine' in art and as something that cannot be detached from life. Not just that, he even consider colour as a permanent internal threat. Therefore, he came up with the idea of either completely ignoring colour or controlling it, in order to preventing it from ruining everything.

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Besides defining colour as dangerous, according to David Batchelor, the word 'chromophobia', is also used for the idea of colour as " something superficial, supplementary, and as a secondary quality of experience" ( Batchelor, David, 2000 ), which leads to lack of consideration in its usage. This perception also resulting colour being used only as decoration in architecture. This case had happened in the past and was criticized by Vitruvius. He complained that buildings were painted without considering its relation with the architectural form, which means there was not much consideration put in the thought process therefore resulting an unsatisfying project.

### **3. The Modern Movement, International Style and Minimalism**

The influence of chromophobia and perception of white as a better choice also had its impact in architecture. It appeared in the form of architectural styles called the Modern Movement and the International Style, which often termed their works as 'minimal'. In this period, light and neutral tones are preferred in the space. White is the most dominant colour because it allows colours and light of the surrounding reflects into the space and that it is felt as natural colour. Colour, on the other hand, is being avoided because it makes a striking contrast with the surrounding. The famous people in this period are Mies van der Rohe and Walter Gropius. Their works, reflecting the idea of Modern Movement, shows restraint use of colour. Instead of using colours, they use the genuine colour and texture from the materials used, such as steel, glass, concrete, masonry, and stone, which dominates their works.

Minimalism, another architectural style, is also much associated with the use of white. The term 'minimalism' is applied to works showing reduction in forms, usually created with flat surfaces that reflect a simple and tranquil atmosphere. White colour is chosen as the most dominant colour, since it is seen as colour with pure, smooth, and serene quality, and therefore goes along with the idea of calmness and tranquillity in minimalism. Samuel Wagstaff, an art curator, mentioned that this new aesthetics in black, white, and gray, is aimed to keep the viewer from being 'biased by the emotionalism of colour.' (Meyer, James, 2010). So, white colour, along with black and gray are preferred to be used here.

The rejection of colour in architecture does not only happen among the architects, but it also affected the people. A few cases of rejection of colour towards coloured buildings in the past had been experienced by architects. It happened to Belgian architect Huib Hoste, who throughout his career has been experimenting with colours in his works. One of his works, the Zwart Huis ( Black House ), which was created for Raymond de Beir Knokke in 1924 was painted deep black and partly red for its walls. Complaints came from the neighbours who felt uncomfortable by the too-striking-colours and on how it broke the harmony within the surrounding environment. In 2001, a similar problem occurred with the work by MVRDV. Designing an entire orange office building in a courtyard in Amsterdam, provoked disapproval from the neighbours who felt annoyed with the orange glow that forced its way to the surrounding homes. " Everything around you is orange - you didn't ask for it, you didn't want it, but you can't do anything about it", they said (Komossa, Susanne, 2009, p. 254).

## **Colour in Architecture**

Traces of the perception of white-black-gray as a better choice than colour in spaces can still be seen in today's architecture. However, despite the rejection of colour, few modern architects who believe in the benefits of colour in architecture emerged into practice, for whom the idea of colour was an essential element, opposing the idea of colour as decorations.

The first idea of using colour in modern architecture emerged in 1920s, inspired by paintings. Three architects who were known to use colour in their works in this period are Le Corbusier, Theo van Doesburg, and Bruno Taut, but each architect has different approach in applying colour in their works.

Theo van Doesburg is the member of De Stijl Movement, an important accomplishment in applying colour in architecture. Other movements using colour as their conceptual design basis are Constructivism and Expressionism. In De Stijl, colour is considered as an important element and is developed as a tool in creating a new spatial experience. The goal of the movement is to achieve an ideal future where walls that separate men would be broken down. The architects of De Stijl believe that the three-dimensional properties of mass and volume is against the goal of the movement, and in order to achieve their goal, these components must be broken down through the use of colours. The method they used is to place colour planes on corners and boundaries, resulting a change in the volume of space. Here, colours were used not just as mere decoration, but it also plays an important part in altering the visual experience of the user spatially.

However, Le Corbusier called van Doesburg's application on colour as camouflage architectural and disagreed with the use of colour to weaken the physical space or to conceal its actual spatial proportions (Komossa, Susanne, 2009). Opposing this idea, in his work, Le Corbusier coloured the entire wall surfaces to make them an individual element, so that it would not disturb the spatial effect of the architecture. These coloured walls were used as an intervention against the mostly painted white spaces in the building. The colours here, as Batchelor commented, were used by Le Corbusier to make his architecture 'even more white.'

Having a different approach with his two fellow architects, Bruno Taut's intention was to use colour as 'an agent of social reform'. His goal was to create various identities in a large housing estate, where people from overcrowded flats in the backyard of Berlin will be the occupants of the building.

Along with the development of colour in architecture, more "colour-architects" emerged. Some of the recent architects are Luis Barragan and Ricardo Legoretta whose works constantly exhibit the use of vibrant colours. Their usage of such bright colours are influenced by the place where they grow, Mexico. Mexico covered its land with colourful buildings such as red, pink, turquoise, yellow, creating bright figures under the broad amount of sunlight perceived in the country. Luis Barragan used the colours in his building more towards a psychological way which is to evoke dreamlike and surreal atmosphere. While Ricardo Legoretta, inspired by the 20th century mural paintings, focused more on the benefits of colour physically, which is to emphasize shapes and to deny mass of the buildings.

Herzog and de Meuron, is also another example of those who supported the usage of colour in modern architecture. The design of their first house in Basle suburb is covered with blue layer that engages the viewer.

In the past, colour in architecture was mostly used in order to relate to certain symbolism and culture. But, with the emergence of these architects, the usage of colour in spaces has gone towards a different direction, which is to concern more about how it enhance the perception of space and not just by delivering symbolic meaning or by using it as decorating elements applied on the walls. Looking at the development on how colour is perceived in today's architecture, just as mentioned by Rem Koolhaas, " the future of colour is looking bright." ( Koolhaas, Rem, 2001)

## **Colour Affects Perception of Space: Psychology and Physically**

The importance of using colour in space is based on the idea of the impact it has on the user of the space. Hence, before further explanation about how the user is affected by the presence of colour in space, the following will first briefly explain the importance of colour in shaping human visual perception.

Perception is a critical connection between human and their surrounding environment. It can also refer to a more complicated and higher level of thinking process. Perception enables human beings to decide what has been sensed and then analyze that sensation. Besides absorbing the information received from the sensors, perception also acts as a filter that classifying important and useful information.

In architectural design, where work mainly is about the creation of space, perception of space is nevertheless important. In order to perceive the space, one must first sense the space. To sense a space is to become aware of own self's existence in the space and therefore one is able to distinguish between the self and the surrounding. This is done through the use of human senses, which are hearing, seeing, smell, taste, and touch. But as we always hear, " Seeing is believing", visual perception is very important in shaping perception of space. Here, colour can play a major role.

As mentioned earlier, colour has the ability to affect our perception of space. It could happen either psychologically and physically. Physically, colour is capable in affecting the size, shape, mass, and volume of a building or an interior space, which means colour has an ability to deceive its viewer. This aspect was observed in Joseph's Alber's book, Interaction of Colour, as how colour is always never seen as it is in reality, resulting the actual (space perceived by the viewer) and the factual (the physical space border by walls in reality). He also stressed the needs to always keep the idea of colour deceives in mind, in order to use it effectively.

The manipulation of a building's physical structure due to its colour usage is reflected in the High Tech Park project in China. The use of white and blue colour is chosen in order to accentuate each other on the appearance of the facade. The colour blue creates the perception of depth and at the same time, involving the continuous form of the facade, makes the shapes appear longer than it actually is in reality.

High Tech Park Project in China

In terms of psychological, colour is able to affect the mood of the user of the space. Different tones of colours create different atmosphere in the space. This phenomena was then being observed scientifically in terms of how it affects the health of human body. One of the direct example of this benefits can be seen in chromotherapy. Chromo therapy, or colour therapy, is the " practice of using coloured light and colour in the environment to cure specific illness and in general to bring about beneficial health effect " ( Hope and Walch, 1990, p. 75). The study on chromo therapy is based on the discovery of how our bodies, acting like prisms, absorb white light and other colours, too. The therapy involves the use of natural light that is filtered through a certain colour of glass. For example, patient with migraine will be treated with sunlight filtered through blue glass, and depression can be treated with red light.

Shower Chromotherapy gives beneficial effect

The ability of colour to heal creates the opportunity for application in healthcare spaces such as clinics and hospitals. However, as mentioned earlier, colour does not only affect human psychology in terms of healing, but also in terms of altering the mood of the viewer.

Based on people's daily activities which are either active or passive, we can differentiate between the needs of stimulation and the needs to rest.

Therefore the role of colour in the space is to offer atmosphere/moods that support stimulation and calmness to the viewer. Balancing between both in the same space can result a dynamic environment and avoid monotonous atmosphere created by a single colour.



The sense of balance between the two conditions can be achieved through controlling the degree of brightness in the space, because it is the aspect that determines the mood created by colours. The psychological effect of colour on human body was also written by Kandinsky. He wrote, " Various attempts to exploit this power of colour and apply it to different nervous disorders have again noted that red light has an enlivening and stimulating effect upon the heart, while blue, on the other hand, can lead to temporary paralysis." ( Dudek, Mark, 1996.)

In order to achieve the right degree of brightness in the space not only the brightness of the colour need to be considered, but also the intensity of light that illuminates the surface.

### **Brightness and Darkness: The Intensity of Light and Colour**

As explained in the earlier chapter, colour can only be perceived with the existence of light. And it is because of the presence of light that architecture can be seen and experienced. At the same time, existence of light as natural element in the space does not only define architecture and the colour perceived, but also nurtures the user of the spaces. This goes along with the usage of colour in creating a desirable mood and therefore the combination of both can strongly enhance a sense of a comfortable space to dwell, which is the aim of every spaces built. Hence, in order to incorporate both, the degree of brightness of both elements have to be considered.

Controlling light in the spaces requires consideration in few aspects. The condition of light and the changes it made due to its direction, form, colour, and its arrangement; has a potential to create various colour perceptions.

Considering the possibility of changes in perceiving colour based on the lighting condition, various kinds of atmosphere might be created. Both natural and artificial lighting is able to be used in assisting colour in the space.

Direct sunlight can make surfaces in the space appear lighter, while the indirect sunlight will cause less dramatic shadow casting. Since the sun moves throughout the day, different kinds of light will be experienced. Different lights will reflect colour differently, resulting the same colour might be perceived differently during different time of the day. This has been proven by Monet's observation in his painting of cathedral as mentioned in the previous chapter.

Based on our ability to see objects hit by light, we can differentiate the degree of brightness we perceived. Brighter light makes it possible for a person to see the environment that surrounds him. At the same time it can also stimulates the nervous system of the body. Dim light, as the opposite, has the reverse effect. It causes the body to retire into itself. The comparison on how degree of brightness affect human body can be experienced in how people feel when there is maximum light on a sunny day compare to a rainy day with little light. People tends to be more active when the sun is still out and rest when it is dark.

However, as much as our body needs to rest, to be in a completely dark spaces cause feeling of uncomfortable. As Goethe wrote in his book Theory of Colours, " If we keep the eyes open in a totally dark place, a certain sense of privation is experienced." ( Goethe, Johann Woflgang von, 1970.). The

sense of privation is perceived due to human' needs to have contact with the external world and becomes part of the whole, which once again brings back the importance of light in spaces.

On the other hand, despite its ability to give a sense of connection with the surrounding, light that is too strong or bright might be disturbing for the viewer. The effect might be experienced when one look on a white, strongly illuminated surface. Looking at a very bright surface might dazzle the eye and for a moment disables the ability of eye to distinguish objects in the surrounding environment. This might be experienced when one look up at the sun as the brightest source of light on earth. Then, when we alter our gaze away the sun afterwards, we will experience a temporary discomfort in our vision.

A high degree of brightness has a kind of force that demands attention from the viewer and stimulates the nervous system, hence it might cause distraction on the activity a person is doing and reduce the level of concentration . Dim light, on the other hand, is more useful to concentration-demanding activities, because it demands less attention which means less distraction for the viewer. ( Danger, Eric P., 1987)

Hence the needs for stimulation and the needs to rest has to be balanced, as well as the context of the space which includes types of activities held in the space, user of the space, etc.

As how brighter light cause stimulation and demands attention from the viewer, the

same goes with bright colour and therefore bright colours fit well for spaces requiring lots of activities, while on the other hand, darker colours tend to calm people and therefore fit well for spaces to rest. The lighter the colour, the greater the effect because the brightness of light colour tend to spread out on the retina, causing the eyes to give more attention towards it.

Bright coloured space to stimulate ( left ), dark coloured spaces to rest ( right )

Bright colours are associated with warm hues which contain colours related to red, with red-orange as the warmest hue. Others included in the category of warm hues are yellow, yellow-orange, orange, red, red-orange, and red-violet. While darker colours are associated with cool hues which contain colours related to blue, with blue-green as the coolest hue. Others included in this group are yellow-green, blue-green, blue, and blue-violet.

The differentiation between the brightness and darkness in colour is first being observed by a theorist, Johann Wolfgang von Goethe. Goethe is a German poet who was also interested in the phenomenon of colour. In 1810 he published a book called *The Theory of Colours*, consist of his investigation and record about the function of the eye and its interpretation of colour, rather than the properties of light.

Goethe assigned numbers to primary and secondary hues based on their luminosity (ability to give a glowing impression). White, as the most luminous, is given the number 10, followed by yellow (9), orange (8), red (6), green (6), blue (4), violet(3); while black, as the least luminous is 0. The numbers are used to match these colours, creating pairs of complementary

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colours. Each pair consist of a light hue and a dark hue : yellow - violet, orange-blue, and red-green. (Feisner, Edith Anderson, 2006)

This knowledge therefore can be further used in the space because our eyes in reality require any given colour along with its complementary. This is due to the way complementary colours provide psychological balance in satisfying the needs of both warm and cool colours.

People have a strong tendency to unconsciously seek warm and cool hues in the same space. This has been proven by Louis Cheskin, a colour consultant and author. Cheskin did an experiment with three rooms coloured in green. The first one was painted in a single shade of green. The second one is treated in three values of green. While the last one also used three values of green yet he added the colour wine red, which is the complementary of one of the values of green. The occupants of the first room gave a negative reactions due to monotony. Occupants of the second room did not show any defined respond, either favourable or unfavourable. While occupants in the last room showed 94% favourable reactions. ( Danger, Eric P., 1987)

By using complementary colours in the space, a sense of perceive