

Factory Design by Taking into Account the Colors From the Psychology Perspective

Abstract

The facility layout and ergonomic were taking into account in the design of industrial units. Many books and articles have been written and reviewed. Manpower that are currently working in the industrial units usually work in the environment that walls and uniforms are white and gray. In this paper it has been tried to assess the industrial units design from the psychology perspective using the colors and psychology book by Max Luscher and some other papers. We want to discuss the effect of colors on the behavior and reactions of workers.

The investigation led to the conclusion that we can put workers in non-uniform and joyful atmosphere and create more social interactions and incentives to work.

Keywords: Design - Factory - color - psychology - Industry – Labor

1. Introduction

There was no common language between man and his surroundings to increase mutual understanding. However, human found that the colors in nature have secret as the sign code that if he can realize the secrets, then he could communicate with wild nature. For this reason, he was observed and thought about different colors. Primitive man realize that he should go hunting in days due to his physical characteristics, because his vision system has more usability during the day and a lot of his visual ability was declined at night.

Thus, sunrise and beginning of the day were human activity and interference caused by yellow color and activity beginning, human gradually bind the activity with yellow color in his mind. And, precisely psychologists have found after much scientific research that individual interest to the yellow color is his motivated sign to the unlimited progress and hope for solving the difficulties of life. Since his home was forest and green jungle would be safe camouflage for him, so he hides himself behind green plants and trees when alarmed in order to be safe from the clutches of wild and powerful animals. After a while, the "green" color appeared together with security and relief in the human brain. Human identified these two homogeneous with each other. Maybe the cause of peace in the midst of the nature emanates from the same state of our ancestors. Hunter man was lurked feed animals for livelihood since the beginning of the day and always waiting for an opportunity to hunting and killing and gladly takes it to his residence. He would lurked for hours in the woods and thinking and dreaming during these moments that if I could hunt the big buffalo then I'd be eating meat for a few months; If I could hunt deer, I'm certain the winter supply and so on. The animals hunting was accompanied with their bleed and seeing red color! In this way, the red color be effective in the human thought with hunting.

Psychologists also believe that tendency to red color is a sign of great hopes, the spirit to life, strength and determination in the person.

Sunset and the beginning of night was the end of daily hard work in order to achieve peace of mind and rest with his wife and children and later friends and relatives. When he decided to sleep, blue sky and bright stars appeared before him and this is caused primitive man to intermix blue color with peace. New psychological research suggests that blue color reflects the need for complete relaxation and satisfaction and great interest to the friends and relatives (Asefzadeh, 2004, 15).

This paper investigated the effect of colors on the workers in terms of motivation, attention and interest, the rate of doing work, collaboration with their colleagues and business promotion.

Problem-solving approach is that the change of walls color could have different impacts on the behavior and character of workers.

2. Literature Review

It can be said that history of psychology is older than all of the scientific systems. Its roots can be traced back to the fourth and fifth centuries BC with scientists such as Plato and Aristotle. However, in the words of Hermann Ebbinghaus, 19th century, "The Psychology has long past but short history" (Schultz and Schultz, 1372, 18). A German philosopher named Rudolf Guelenious is the inventor of "psychology" term (1950). Until the late nineteenth century, psychology was regarded as a branch of philosophy as well as a cult in some cultures that includes thought invasion and destruction of the inner unity.

Sigmund Freud (German pronunciation: Sigmund Schlomo Freud) (born in 6 May 1856-died: 23 September 1939) is an Austrian neurologist who is known as the father of psychoanalysis.

3. Methodology:

1.3 What is color?

The color is the light that emitted on the objects and reflected to the eye and is a common name for one of the emotional components that relates to the retina activity and nervous system. The color can be known as cognitive phenomenon. Our influence of different wavelengths creates the color perception. Scientifically, the color is light waves that is detected by visual sense and is a ray of light that is composed of different longitudinal and transverse waves' vibration.

Physicists pay attention to the color phenomenon with regard to the vibrations and fluctuations. In their view, color is the light that has specific and recordable wavelength. Physiologists know the color the only effect of light on some of the cells and stimulation of components. The group of philosophers believed that the color is not something more than mental image. While, an artist and a painter sees life in the colors and feels the world with the colors. Physiologists assess the color differently from psychologists, physicists, philosophers and painters. They know the colors as an environmental exciting factor or stimulus. They believe that if the colors are selected rational and purposeful then it will create the desired behavior in the individual. So that an appropriate color application around emotional and more active people gives them calmness and transforms the sedentary and motiveless people. (Khajehpour, Samandi, Abdollahi and, Tabesh 2010, 9)

3. Classification of Colors

The colors can be divided based on the being original or combination, being contrast, dark or light, cold or warm, harmonious and complementary or supplementary as well as spectrum, harmony and contrast.

Primary and secondary colors:

The primary color is the color that it cannot be gained from combining other colors and based on the classical theory of color the primary colors are: yellow, red and blue

The secondary colors arises from the combination of the primary colors or groups of colors such as pink, lime, orange, purple and ... (Khajehpour, Samandi, Abdollahi. and Tabesh, 2010, 10)

The confliction of colors:

The colors can be conflicted in many ways, such as:

1. Darkness and lightness that are created in terms of the reflection ability of the color.
2. Coldness and warmness that are created in terms of the color being cold or warm and stimulate the coldness or warmness feelings in the human.
3. The smallness or largeness of the colors levels. Use appropriate colors to create luminous divergences affect the visual phenomenon during the work.

When talking about the color difference, it means contradiction between large surfaces (walls, etc.) and surfaces with small sizes (levers, knobs and other working tools).

3-3-1 Light and Dark Colors

Light colors refer to the colors group that are close to the white in the color circle and dark colors refer to the colors group that are close to the black in the circle colors.

3-3-2 Warm and Cold Colors

The reason of colors division into the warm and cold is the effect of these colors on the spirit and emotional associations that gives us the warmness or coldness.

Cold colors include blue, purple, olive and green, because most of these colors are seen in the coldest areas such as forest and sea and when glacial.

Warm colors include red, orange, yellow and purple. These colors create warm feelings in human.

If you look carefully, you'll see that the in the division of the colors into the warm and cold, purple is in both of the groups because this color is perceived among two-dimensional colors and depending on the effect of its surrounding colors and also due to the sensitivity and spirit of the observer, this color can be either in the cold colors or in the warm colors.

And depending on the effect of the surrounding colors and also due to the sensitivity and spirit of the observer, these colors can be either in cool colors and color groups.

Although some experts know that color steps have third category of lukewarm in addition to the two colors of warm and cold and green and purple colors are included in it.

3-4 Complementary Colors

Complementary colors include purple, brown and gray. Purple is a mixture of blue and red while brown is a mixture of orange and black and it is a dark and relatively tame color. Preference each of these colors can be an indication of a negative point of view to the life. (Khajehpour, Samandi, Abdollahi, and Tabesh, 2010, 12)

5-3 The Division of Colors Based on the Spectrum

From three centuries ago, pay attention to the color has been increased. Newton discovered that when sunlight passes through a prism, it decomposes into a strip of colorful strips named spectrum. As it can be seen in the rainbow. In this case, different colors arise due to the different wavelengths.

In color divisions based on the color spectrum, the colors are divided into two groups: chromatic colors (colored) and achromatic colors (non-colored).

Chromatic colors include the spectrum colors, namely green, red, orange, purple, blue and achromatic colors include black, white and gray.

6-3 Harmony of the Colors and Complementary Colors

Generally, coordination means order and balance between powers of color. The harmony of colors would calm nerves. Harmonious and complementary colors create neutral gray when combined together. For example:

Gray= orange + blue or (red+ yellow) + blue

Gray= green + red or (blue + yellow) + red

Gray = purple + yellow or (blue + red) + yellow

The human eye wants the complementary color after seeing every color and if that color is not available to see then the eye create it automatically. (Khajehpour, Samandi, Abdollahi and Tabesh, 2010, 13)

3-7 Harmony of Colors

If we want to stimulate the emotions of a person and affects one or more of his senses then we use harmony of colors. To better understand the harmony concept we should be accurate in the color circles and know that every color in the circle of colors has harmony with its side colors.

For example, red color has harmony with orange and purple and green have harmony with yellow and blue colors. And, if we want to stimulate the feelings of a person in order to create emotion, excitement and enthusiasm then we should use the warm colors. Or vice versa if the goal is to

stimulate the diluted and spiritual sentiments and we want to inculcate the silence, attention to the spiritual to the person, we should use the cold or lukewarm colors or their harmony (Sutton, 2007, 32)

We used from this method in the background colors of the pages of the paper columns related to the war, peace, advertisement, Quran competitions, religious orders, etc. (Fallahi-Atarodi, 2003, 14)

8-3 Colors Contrast

When we want to stimulate the involuntary attention of the audience and immediately attract to the something, the colors contrast was used. The word meaning of the contrast is opposite and maximum competition in the word and it is method in that the opposite colors and beside colors of the opposite of the colors circle have been used. For example, the contrast of the red color in the colors circle are green, blue and yellow and the contrast of the green color are red and its beside colors (purple and orange) and also the contrast of the blue color are orange and its beside colors (red and yellow). The contrast of colors is used mostly on issues such as posters and advertising films, brochures, illustrations, images contained in the press, especially the images of their first and last pages, the design of the books and so on. It is noteworthy that the greatest contrast is between day and night or black and white.

The neutral gray color is made from the combination of the two contrast and opposite colors. For example, the gray color is formed in the combination of the black and white, green and red, yellow and purple, blue and orange colors. And, from this viewpoint, the contrast concept closely associated with the colors coordination. (Sutton, 2007, 27)

9-3 The Color Physiology

There are two types of cells in the human retina to receive visual messages from the environment:

1. Cylindrical cells

2 Conical cells

Cylindrical cells form the basis of vision and generally undertake the task of vision. They have ability to work in very poor light and their numbers are very large (about 120 million).

Color detection in the eye is the responsibility of conical cells. These cells are only work in bright light and their numbers in the eye compared to the cylindrical cells are very low (about 6 million).

There are a small number of humans who are not able to distinguish colors. They are called "color blindness". They see the world in white-black and gray and are color blindness to the red and green colors that called Daltonism. These people do not have ability to do the things that needs to distinguish colors such as pilots, painting and ... and of course these people are excluded from the effects of the colors. Scientists know that the roots of this disease is genetic. Main parts of color materials are photons which are different in terms of the type of radiation and the rate of photons.

(Theo, 2007, 19)

There are seven types of main colors in the nature that are called color steps totally. All of the colors in the world are combinations of these seven colors. The seven-colored steps are:

1. Red
2. Orange
3. Yellow
4. Green
5. Blue
6. Blue
7. Purple

All colors are seen and felt with affection on conical cells (Khajehpour, Samandi, Abdollahi. and Tabesh, 2010)

10-3 Color Psychology

The issue of color psychology is the affection of colors on the people's emotions. Each color stimulate the different part of the brain. No doubt the importance of color when designing a creative atmosphere or mood of space is very valuable. (Shamloo, 1991)

For more information about colors and creativity, please pay attention to the following table:

Color	Symbol	Consequences
Gray	Lighting – intelligence	It may seems dull and boring as well as a symbol of aging and discomfort.
Blue	Silence - peace - Honesty and loyalty- creativity - the creation of thinking mind	It may seems cold and unpleasant, and can be a symbol of sadness and depression and suppress the appetite.
Green	Energy - nature - silence - Security Balance Growth –life – Success	It can also be a symbol of greed and envy.
Red	Lust –risk- warmth and intimacy - Optimism- energy- power	It can seem aggressive. It may be too much energetic and cause headaches. Among colorblind people, red or green color blindness is very common.
Yellow	Spirituality - spirituality - joy – growth	It is reinforces emotional anguish. It can be symbol of cowardice, hypocrisy and deceit.
Purple	Happiness - creativity – Spirituality	It can be the symbol of evil and oppression, death and arrogance.
Brown	Security – Stability- Functional	It is not stimulating the mind and may be seem dull and dirty.
Black	Perfection - eccentricity - Drama – Power	It cause depression, boredom, fear, sadness, anger and remorse and confusion. Black is a symbol of death in the West.
Pink	Love - femininity – Young	It may seem too crude and childish or be symbol of weakness and inexperience.
Orange	Stability - Devotion - Trust	It may be seem as calling attention and dark rooms seem smaller.
White	Cleanliness - innocent - pure relaxation – simplicity	It may seem cold and barren. White is a symbol of death in the culture of the East.

(Khajehpour, Samandi, Abdollahi and Tabesh, 2010, 21)

11-3 Meaning and Concept of Eight Colors

1-11-3 Gray

The gray color is actually colorless color, not dark, not bright, be free from any stimulus or psychological tendency, it is neutral, it is not objective and not subjective, not internal, not external, not stress not de-stress. Gray does not occupy anywhere but it is on the sidelines, it is inscrutable.

In fact, by choosing the color on the wall inside the factory give this feeling to the worker that he want to building walls around everything, he wants to remain unrelated to the others in order to maintain himself from every stimulus and effect. He does not involved in any activity, isolate himself, and avoid from direct participation in the mechanically and artificially works.

Even when apparently interference in the work or issue, remain out of the pit and be spectator. He never seriously involve.

3-11-2 Blue

The dark blue represents complete peace. The concept and subjectivity of this color have calming effect on the central nervous system. Blood pressure and breathing rate decreases.

The body adapts itself with stress and recovery. So, the need of this color increases in illness and fatigue. The dark blue like four main color represents a fundamental biological need. Physiological need for calm, and mentally, represents disdain and living in peace and happiness. Blue is honesty and loyalty color. According to the Sanskrit, the indigo was given to the dark blue that creates the suitable environment for thinking. If the blue color is chosen to the walls of the factories, it brings tranquility, peace, unity and richness or de-stress for workers.

3-11-3 Green

It represents the purpose and determination in action from the psychological point of view, like persistence and endurance and tenacity in achieving the goal. It causes social security and enhance the reliability and self-worth. If we use this color for the walls of the factory then it increase the confidence and belief sense to the certain values and we do this action either by providing the ideal image or by appreciated it.

The green color is symbolically similar to the pine tree with deep, persistent and consistent roots, dominant on the other tress with independent nature. Its sensory perception is tenacity and its emotional content is pride and its related members are smooth muscles.

The green color indicates the tension and pressure that hides the excitements that still did not find and boost morale, pride, abnegation, feeling superior to others, power and grip the events or at least ability to organize and direct them. However, most important of the mentioned issues, if we choose the green color it makes comments and beliefs be unchangeable. Such workers put themselves the focus and tries to guide the others and hope to affect the others, he needs to be recognized and consolidated and has the certain beliefs and practices of management that is possible to show their obstacles and oppositions.

3-11-4 Red

It reflects the release of energy in the psychological status. It raises the pulse rate and increases the respiration rate. It represents the vital power and means willingness and relish and includes all

forms of desire. The red is insist on obtaining results, achieve prosperity and success, and greedy desire to all things which has a sign of perfection and is a graph of desire intensity to live.

The red color symbolizes the dominant blood, eternal flames, fiery temperament and nature.

Its understanding feeling, its appetite and emotional content and desire and passion and related member of it is skeletal muscles. If we choose the red color for factory wall, it is engaged in specific activities of factory that can includes experimental perfection and end of life for workers.

4-11-5 Yellow

Yellow is brightest color in the test and its effect is lighting, friendliness and happiness. It reflects some kind of comfort and laziness and represents the relaxation and expansion (in psychological, relaxation means getting rid of the problems, obstacles and contradictions of life). Its understanding sense is keenness, its emotional content is hope and its related members are sympathetic and para-sympathetic nerves.

If we choose this color for the walls of the factory then it makes the workers affiliated to the Industrial Group. If the yellow color is chosen then it reflects the desire of freedom and hope or expect larger celebrations. If there is not yellow color then it makes workers be less hopeful or be frustrated and fell lonely and cut off from others.

3-11-6 Purple

Purple merges the excitement, obsession and compulsion of red color with peace of blue color and is identification and authentication. If we choose the purple color, in fact we are looking for a magic relationship. In terms of psychology, the individual who reached the maturity intellectually, prefer to choose one of the main colors compared to the purple. While the minor chooses the purple color intellectually and emotionally. The selection of the purple color represents the legendary world.

3-11-7 Brown

Brown represents the feeling that is concerned to the body sense. The sense that is follow the sensual pleasures and feelings and directly related to the body. The selection of this color makes the sense of deprivation, lack of relief, the lack of security and physical satisfaction. All of these issues can affect the workers. Workers are seriously affected and try to find an environment that can get rid of this pain and emotional conflict.

3-11-8 Black

The black is the darkest color and is negation of any color. The black color represents the absolute boundaries that life stops behind them. The black color is destruction, annihilation and absurd. The black color is as negation of any color, ignore, the final submission and deviation and has sever effect on the color that is be in a group with it and in fact enlarge the specifications of another color. If we consider the black color for the walls of the factory then we are encouraged the nihilism of the workers. (Max Luscher, 1989, 64)

4. Conclusion

No doubt, all of the colors are necessary for the survival and each of them has special effect and play an important role (Asefzadeh, 2004, 35) so that the imagine of nature without them is difficult or impossible. It must be acknowledged that the human psyche is not associated with something else to the extent that is exposed to the colors. (Ansari, 2008, 11)

Colors have two parts:

- 1) Basic or main colors: dark blue, bluish green, orange red- bright yellow
- 2) Auxiliary colors: purple, brown, black, neutral gray

The main colors should be preferred. (Max Luscher, 1989, 12)

The four main colors represent the fundamental psychological needs. The need for love, the need to show off, operation and success and need to explore the future and achieve dreams are all of psychological importance. Thus, one of these four colors or combination of these four colors are used for walls of a factory (Max Luscher, 1989, 13)

Based on the above investigations it can be concluded that it is better not to use the brown, black and gray colors in the painting of the factory walls. It is better to use blue, yellow and red colors. In this way we can put workers in a joyful and non-uniform atmosphere and create social interaction and a greater incentive to work.

5. Suggestions

1. The combination of colors as shapes on the factory walls and its psychological effects on workers can be examined.
2. What color of clothing do the workers wear in order to have better psychological effect with the wall colors?
3. The combination of colors with each other and create a new color instead of the mother colors for wall colors and its effects.
4. Use different pictures and investigate the reaction of workers.

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