The weight of color

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Abstract

This paper explores the weight of color, with the focus lying on the symbolic significance of color. Exploring whether color in itself conveys symbolic significance and is the symbolic significance of color permanent, or is it an after construction? It will be looking at different areas such as what makes us humans able to perceive colors in the first place, beginning with an insight at some of the foundations in the area of color theory. Mentioning experiments on decomposed white light, that contains the visible color spectrum and its contribution to the evolution of the color wheel. The color wheel's contribution to the art world, the construction of color harmonies and their significance. It will also be looking at some of the more common symbolical meanings of colors and its symbolic significance as color language. It will be covering previous research such as what the symbolic significance of color was under the Elizabethan era, consequences when combining color and taste and finally an insight on the theory of the emotion wheel and its conceptual design in combining emotions with color. There will also be a discussion part looking at the area of color therapy and thoughts revolving the subject. The second last part will revolve around my own observations and analysis. Keeping in mind what I have explored in the earlier parts of this paper and using that knowledge in my observations and analysis on three different methods utilising the symbolic significance of color, focused in the area of films. The last part of my paper will be the results of my exploration on the subject of symbolic significance of color and also a discussion part, with my own thoughts on the subject.

Keywords:
Symbolic, Significance, Color, Associations, Films.
# Table of Contents

1 Introduction ........................................................................................................................................ 1  
1.1 A short backstory .......................................................................................................................... 1  
1.2 Aim ................................................................................................................................................ 1  

2 Color theory ....................................................................................................................................... 2  
2.1 Trichromacy .................................................................................................................................. 2  
2.2 Color wheel ................................................................................................................................... 3  
2.3 The modern color wheel ................................................................................................................ 4  
2.4 Color harmonies ............................................................................................................................. 6  

3 Previous research ................................................................................................................................ 10  
3.1 The Elizabethan era (1558-1603) ................................................................................................. 10  
3.2 Symbolic significance of color in the Elizabethan era .................................................................. 10  
3.3 The taste of color .......................................................................................................................... 13  
3.4 The emotion wheel ....................................................................................................................... 16  
3.5 Color therapy ................................................................................................................................ 18  

4 Methods ............................................................................................................................................. 20  
4.1 Color accents ................................................................................................................................. 20  
4.2 Color scripting ............................................................................................................................... 21  
4.3 Color harmonies and common color meaning ............................................................................. 23  

5 Results ............................................................................................................................................... 25  

6 Discussion .......................................................................................................................................... 26  

7 References .......................................................................................................................................... 27
1 Introduction

The first part of this paper will be covering in short, some of the foundations in the area of color theory and begins with how we are able to perceive colors. Following up with the visible color spectrum as an experiment on refracted light and leading to the color wheel and its contributions. The majority of the paper will be a triangulation of different areas of color, exploring whether color in itself conveys symbolic significance and the application of this knowledge in my own observations and analysis.

1.1 A short backstory

So why did I want to immerse myself in the subject of a color's weight? As an aspiring 2D artist, with my focus lying on learning as much as possible about color, I wanted to deepen my knowledge of color relations and explore the symbolic significance of color. Not just the relations between colors, such as color harmonies, but more in a way of why we choose specific colors when creating a visual color design and how they convey significance. That is the origin which led to the aim for this paper.

1.2 Aim

The aim of this paper is to explore whether color in itself conveys symbolic significance and is the symbolic significance of color permanent, or is it an after construction? My approach will include an insight in some of the foundations of color theory that will be used as a base. It will be exploring previous research on the subject of color and an observations and analysis part on three different methods utilising the symbolic significance of color. The paper ends with a summary of the results of my observations and analysis and a discussion of my own thoughts on the subject matter.
2  Color theory

This part will look on some of the foundations within the area of color theory. Before going into the subject of the symbolical significance of colors, an insight on color theory is needed.

2.1  Trichromacy

Why do we humans perceive colors

This can be seen as the foundation of this paper, as it will give insight in how we are able to perceive colors in the first place.

(Tovée 1996:10-15) Light is composed by attributes of both particles and wavelengths. Wavelengths being a great factor in how the human eye perceive visible colors and how the retina which lies in the inner surface of the eye, possesses three independent channels for conveying color information. The three independent channels are made up of three different types of cone-cells. These cone-cells are categorized as follows the S-cones which absorb blue light and can receive wavelengths ranging from approximately 390-550 nm. The M-cones which absorbs green light and can receive wavelengths ranging from approximately 390-675 nm and the L-cones which absorb red light and can receive wavelengths ranging from approximately 420-700 nm. The character indication of the cone-cells, S-cones (blue), M-cones (green), and L-cones (red), stands for short, medium and long, being the perceived length of the light wavelengths that can be absorbed by the cone-cells. Each of the three cone-cells will have the absorbed light peak at different wavelengths, resulting in the colors of blue, green and red. The combination of the three different types of cone-cells extended wavelengths, makes up of the entirety of the visible color spectrum and range from approximately 390-700 nm. The color spectrum of the complete RGB color wheel, are made up of the three primary colors its secondary and tertiary colors, both infrared and ultraviolet are excluded and instead it cycles from violet to red (with the color of magenta completing the circle), making out the basics of a color wheel.
2.2 Color wheel

The weight of the color wheel

In a series of experiments on light refractions made by Isaac Newton (Newton 1730:23-63) who was a physicist, mathematician and one of the key figures in the scientific revolution, showed that a prism is able to decompose white light into a visible color spectrum and recompose the visible color spectrum to white light with the use of a lens and a second prism. The experiments resulted in Isaac Newton's conceptual color wheel that was a study of light refractions going through different kinds of media. In the case of the color wheel, light refracted going through a prism projecting the visible color spectrum on a white surface. His experiments was made up of a simple contraption of one or several prisms, refracting sun light through different boards with holes in them lying on the windowsills. He let the sunlight refracted through one or several prisms that projected on the wall a visible color spectrum. The simple contraption demonstrated that the light contained in itself colors and after led to a conceptual arrangement of colors around the circumference of a circle (Newton's color wheel). The primary colors used in the conceptual color circle being blue, yellow and red (yellow instead of green, when it comes to the analogous primary colors), was arranged so the complementary colors paired up with the primary colors, in opposes to each other, for a more enhanced effect through optical contrast. The color wheel of this time had not yet become complete and it lacked colors such as magenta and more symmetrical spacing for a more accurate color wheel (Goethe 1840:56-98). Johann Wolfgang Von Goethe (writer, artist and politician), was a great inspiration with his book "Theory of Colours" (1840), and his theory on color became widely adopted by the art world.
Opposed to Isaac Newton's analytic color theory, Goethe's color theory was a more compiling and comprehensive rational description of wide variety of color phenomena.

In the same manner as the retina generally is affected by brightness and darkness, so it is affected by single bright and dark objects. If light and dark produce different results on the whole retina, so black and white objects seen at the same time produce the same states together which light and dark occasioned in succession (Goethe 1840:5-6).

Johann Wolfgang Von Goethe's "Theory of Colours", was more of a catalogue that perceived colors in different circumstances. Instead of being a scientific study on the subject of white light refracted through different kinds of media, such as prisms and their attributes, the theory was instead portraying the observation of color, as arising from the dynamic interplay of light and darkness through the mediation of a turbid medium. Goethe influenced and contributed to the art world with the study on color's physiological effects, observations on the effect of opposed colors and that led to a symmetrical arrangement of the color wheel. He also made the recognition of non-spectral colors and their essential role for the completion of the more well-known color wheel. Goethe's study of the color wheel included the colors of Purpur (magenta, the mix of violet and red, which do not exist in the visible color spectrum), rot (red), gelbrot and orange (orange), gelb (yellow), grün (green), blau (blue), violett and blaurot (violet) and the relationship of the colors and their complementary attributes. Making up of a symmetrical and a more accurate color wheel than the one made by Isaac Newton.

In ordinary experience we scarcely notice this, for objects are seldom presented to us which are very strongly relieved from each other, and we avoid looking at those appearances that dazzle the sight. In glancing from one object to another; we are not aware that some portions of the impression derived from the object first contemplated passes to that which is next looked at (Goethe 1840:7).

2.3 The modern color wheel

The differences in visual design throughout time

The color wheel throughout time has evolved countless of times. The color wheel created by Sir Isaac Newton could be compared to a run of musical notes. Where a dorian mode was being used, starting at D and the color wheel was divided in musical proportions round the circumference of a circle, in arcs from DE to CD. Which each segment given a spectral color, beginning from the color red at DE, through the color orange, yellow, green, blue, indigo, to violet in CD and completing the visible spectrum of colors which was the result of previous research on the refractions of white light decomposed into a visible color spectrum through a prism. The color wheel then evolved from Goethe's series of observations of light refractions through the mediation of turbid media and added the non-spectral color magenta, which is a mixture of red and violet. Goethe's color wheel was made up of six different colors in a symmetrical spacing with each respective complements in a circumference around a circle.
When it comes to the modern color wheel, it is usually portrayed as a twelve-colored symmetrical wheel, like a clock, and begins with yellow pointing upwards.

There is also the digital color wheel which is portrayed as a three-dimensional color wheel, with the (non-spectral) color white often at its center. With the colors saturation intensity increasing and decreasing along the x-axis and the colors brightness increasing and decreasing along the y-axis, reaching the (non-spectral) color black.

Figure 2: Itten's twelve-colored color wheel.
2.4 Color harmonies

Harmonious designs

Working with visual color design, one or several colors are needed to create a working design. These color designs are called color harmonies. There exists several commonly known color harmonies and they are considered to have different attributes.

When combining different colors, the result can range from elegant to jarring combinations, called harmonic results. With the color wheel in mind (the twelve colored color wheel, based on the RYB, which is an analogous color model, countless combinations can be made of one or several colors and a number of these combinations are considered especially pleasing. These are called color harmonies and consist of one or several colors, with a fixed relation in the color wheel. This part will be on the constructions of the more commonly known color harmonies and their considered attributes.

Here are some of the more common known techniques for the formation of color harmonies in a twelve-colored color wheel, stated from the site tigercolor. The first and the most basic color harmony is the monochromatic color harmony.

The monochromatic color harmony uses variations in lightness and saturation values of a single color. The monochromatic color harmony is considered to be a clean, simple, elegant color harmony and to produce a soothing effect.

The complementary color harmony consists of colors that are opposite of each other in the color wheel and are considered complementary colors. The high contrast of a complementary color harmony creates a vibrant look, especially when used at high saturation values. This color harmony must be managed or it will easily become jarring. Complementary color harmony is considered to be tricky to use in large doses, but work well when creating something that needs to stand out.
The analogous color harmony uses colors that are beside each other in the color wheel. They usually match well and are considered to create serene and comfortable designs. The analogous color harmonies are often found in nature and are harmonious and pleasing to the eye. When using the analogous color harmony, it is considered essential to use high values of contrast, otherwise the colors in the harmony will blend together. In creating an analogous color harmony, choose one color to dominate, a second for support and the third color as an accent.
A triadic color harmony uses colors that are evenly spaced around the color wheel. The triadic color harmony is considered a quite vibrant color harmony and even when used with lighter tints and different variations of tones of chosen colors for the harmony, it will remain vibrant. When creating an efficient triadic color harmony, the colors should be carefully balanced, with one dominant color and the other two colors used as accents.

Figure 5: A triadic color harmony.

The split complementary color harmony is a different variation of the complementary color harmony. In addition to the base color, it uses the two colors that are adjacent to its complementary color. The split complementary color harmony is considered to have the same strong visual contrast as the complementary color harmony but with less tension. The split complementary color harmony is considered a good choice for beginners, because it is difficult to make the color harmony unbalanced.

Figure 6: A split complementary color harmony.
The tetradic color harmony uses four colors arranged around the color wheel creating two complementary pairs, which makes a harmony rich of colors and offers plenty of possibilities for variation. The tetradic color harmony is considered to work best with one dominant color and with the other three colors focusing on the balance of warm and cool colors in the design.

![Figure 7: A tetradic color harmony.](image)

The square color harmony is similar to the tetradic color harmony, but in this case all four colors are spaced evenly around the color wheel. Also with the tetradic color harmony the square color harmony is considered to work best with one dominant color and the other three as a balance of warm and cool colors in the design.

![Figure 8: A square color harmony.](image)
3 Previous research

I have chosen to just look at three different areas, as previous research on the symbolic significance of color and will implement them in my observations and analysis later on in my paper. First, we take a look through a historical viewpoint on the Elizabethan era, then on the article "Optimization of food expectations using product color and appearance" and "The multisensory perception of flavor: Assessing the influence of color cues on flavor discrimination responses", consequences when combining color and taste. The last one is the emotion wheel, a conceptual theory on the combinations of emotions and colors.

3.1 The Elizabethan era (1558-1603)

Colors symbolical meanings through a historical viewpoint

Under the Elizabethan era, colored clothing worn by people provided information about the person wearing them. This information was often bound to the persons status, wealth, social standing and in some cases even their occupation. This was determined by the needed materials for creating the dyes, their costs, both dyes and fabrics and also the vibrance of the dye.

As explained by the site noblesandcourtiers.org there was a restriction by law on what colored clothing people was allowed to wear and these were called the sumptuary laws. It did not matter how wealthy a person was, they still could not wear colored clothing by their own choosing. These laws were designed to limit the expenditure of people on cloths and to maintain the social structure of the Elizabethan class system. The penalties for violating the sumptuary laws could lead to fines, the loss of property, title and even life. With the dyeing process being complicated, there was a wide range of different materials used and there was also a wide range in the costs of the different dyes. It is also mentioned that the symbolic meaning of colors was important and well understood among the people under the Elizabethan era. The color symbolized events which occurred in history, many of which dated back and related to biblical meanings of colors. The meaning of colors during the Elizabethan era therefore represented many aspects of their life.

3.2 Symbolic significance of color in the Elizabethan era

As mentioned earlier, colors symbolized both historical and religious events and represented many aspects of their life. But what other associations did color have under the Elizabethan era? This part will be a list on the colored used for clothing under the Elizabethan era, the association to these colors and an insight in what kind of materials was used to produce the different dyes.
Red

The symbolic meaning of the color red was of fire and associated with power and importance. Cheap dyes made from madder root were used to produce the color red. The madder root produced the whole spectrum of red based colors, including pink, coral, light red, dark red, russet and brown. The red dye produced by the madder root, was not colorfast and red colored clothes was worn by the lower classes, not to be confused with the brilliant color crimson. That was produced by using the expensive kermes and cochineal dyes which was used to produce cloth which could only be afforded by the wealthy. Both the lower and upper class was allowed to wear the color red, depending on the quality of the dye and its cost. Madder root is a European herb (rubia tinctorum).

Crimson

As with the color red, the symbolic meaning of the color crimson was fire and associated with power and importance. It was the color of the church and the biblical meaning of the color crimson, symbolized the presence of God and the blood of martyrs. It is the Christian liturgical color for Pentecost and represents atonement and humility. Crimson dye held colorfast and the brilliant color was worn by the wealthy. Both the cochineal and kermes dyes was produced by tiny insects.

Indigo

The color indigo was sometimes referred to as royal blue. The symbolic meaning of the color indigo was power, importance and wealth and the biblical meaning of the color indigo in combination with the color blue, symbolized heavenly grace. The Virgin Mary is often depicted wearing indigo or blue clothing. The source of the dye, for the color indigo, was produced from the imported indigo plant and therefore its expensive cost. Indigo dye held colorfast and this rich color was worn by the wealthy. Not to be confused with the color blue that was produced by using cheap dye obtained from woad.

Purple

Purple was associated with royalty and the symbolic meaning of the color purple was penitence and mourning. The color purple and its biblical meaning is the liturgical color for the seasons of lenk and advent. In the production of the color purple, only the most expensive dyes were used. The color purple was produced from an extremely expensive dye called tyrian purple.
White

The pristine white color was only worn by those who could keep their clothes clean. The dye for the pristine white color was difficult and expensive to produce and the symbolic meaning of the color white was purity and virtue. The biblical meaning for the color white, stands for holiness and is the Christian color for all high holy days and festival days of the church year. Especially the seasons of Christmas and Easter. The color white is used for baptism, marriage, ordination and dedications.

Black

The symbolic meaning of the color black was authority and power. The dye for the color black was difficult to produce in a colorfast format, without the tendency to fade, black is also symbolic of death and as such is used as the biblical color for Good Friday. Black clothing also symbolized humility and plainness and for this reason was associated with monastic life and could be cheaply produced by using coarse, rough, non-dyed dark wool.

Pink

The symbolic meaning of the color pink was joy and happiness. The religious meaning of the color pink is the Christian color for the third Sunday of advent. The color pink was made from cheap dyes, produced from madder root. The color pink was a favorite color for the hose worn by medieval men.

Blue

The color blue is closely associated with the state of servitude and was a popular color of clothes worn by servants. As with the color indigo, the biblical meaning of the color blue symbolized heavenly grace. From the leaves of woad, the dye for the color blue was produced. Woad was a European herb (isatis tinctoria).

Orange

The symbolic meaning of the color orange was a symbol of courage. The colors of orange and russet were produced by cheap dyes, produced from madder root.

Brown

The symbolic meaning of the color brown was humility and poverty. The color brown was also made from cheap dyes, produced from madder root. Brown clothes were worn by the lower classes and the clergy, associated with monastic life and could be cheaply produced by using coarse, rough, non-dyed dark wool.
Grey

The symbolic meaning of the color grey was mourning and repentance. Gray was the color of ashes and a punishment or penance and the biblical meaning of the color grey was the Christian color for the season of lent and closely associated with fasting and prayer. The color grey was produced from cheap dyes. As with brown colored clothing, grey colored clothing symbolized humility and plainness.

Green

The symbolic meaning of the color green was renewal of life and nature. The biblical meaning of the color green was the Christian color, for the season of epiphany. The dye for the color green was made from woad and lichen and there were also other common vegetable dyes which could produce a variety of green colors.

Yellow

The symbolic meaning of the color yellow was renewal, hope and also associated with envy, greed and treachery. The more expensive dyes for the color yellow, was produced from saffron and the dried stamen of an oriental or Mediterranean crocus. The cheap dyes for a more pale yellow color, was produced by weld (reseda luteola).

Gold

The color gold is associated with royalty and nobles. The symbolic meaning of the color gold was for divinity, majesty and wealth and the biblical meaning of the color gold, symbolized divinity and God's glory.

But if we look at the modern world, colors are not nearly as rare as under the Elizabethan era. Especially as majority of color use, is often digital where in computer graphics, these colors, are often obtained through software using raster graphics.

3.3 The taste of color

Consequences with color and taste

The article called ”Optimization of food expectations using product color and appearance” published by Shuo-Ting Wei, Li-Chen Ou, M Ronnier Luo and John B. Hutchings, investigate the effect of color on the perceived quality of taste and flavor of food.
The experiments in the article looked at the relationship between color appearance and sensory characteristic of expected levels. The beverage they used for the experiment was orange juice, where 15 participants were to observe and look at 174 different colored juices. Thereafter they had to judge what the natural color of orange juice should be. The observing participants was asked to estimate the same panel of stimuli, by using five sensory characteristics and the test came to the conclusion that colored juices were perceived with different flavors and intensity. A green hue induced sourness and bitterness, also the darker juices were seen to be bitter. The redder and yellow juices were expected to be sweeter and have a more intense flavor and colored juices with a higher color intensity and saturation were associated with a more intensified flavor. Brown colored juices were associated with bitterness.

Another article on the subject was published by Massimiliano Zampini, Daniel Sanabria, Nicola Philips and Charles Spence with the title of “The multisensory perception of flavor: Assessing the influence of color cues on flavor discrimination responses”. The introduction of the article reads:

The perception and evaluation of food and drink is an inherently multisensory experience. Gustatory, olfactory, visual, oral-somatosensory, auditory, and even nociceptive cues can all play a role in determining our perception of what we eat and drink.

The article displays the relationship between colors and the expected flavor. In one of the conducted experiments, eleven participants observed different colored solutions and were asked to associate specific flavors from the solutions by merely looking at the different colored solutions. After the first conducted experiment, the participants had to taste the different colored solutions and distinguish the flavor of the solutions that had been colored either appropriately or inappropriately. The experiments resulted in that the modulatory effect of visual cues on flavor perception can override participants awareness that the different colored solutions would frequently be inappropriately colored. The result of the first experiment was that a solution with certain colors has a strong association with specific flavors. The orange colored solution was associated with the flavor of orange, the yellow colored solution with the flavor of lemon, the blue colored solution with the flavor of spearmint and when it came to the red colored solution the association was more varied and more close to flavors such as cherry, strawberry and raspberry. According to the article, in preparation for the other experiment all of the participants were explicitly informed that flavored solutions would frequently be colored inappropriately. This experimental manipulation allowed further investigation on whether or not the visual cues would still influence flavor perception when the participants was aware of the lack of any meaningful correspondence between color and flavor. They noted that the issue has never been addressed previously in research on the influence of color cues on flavor perception. The participants received a plastic cup of colored and flavored solution on each trial. The plastic cups were transparent and specifically designed for the use of food. The solutions in the experiment were colored red, green or orange. Strawberry, lime and orange fruit flavors were used. Each of the flavorings was associated with each of the different colors (red, green, orange and colorless). This meant that, for example, the strawberry flavored solutions was just as likely to be colored red, green, orange, as to be presented as a colorless solution.
Consequently, the color of the solution did not have any predictive validity regarding the likely flavor of the solutions being tested. The participants were told that they would often be tricked by the color of the solutions (i.e. that the color of the solutions would not correspond to the flavor typically associated with that color). All of the participants were explicitly informed that the colors of the solutions that they were to taste provided absolutely no useful information with regard to the likely flavor of the solutions. Flavorless samples were also presented and they could be colored or colorless just as for the flavored solutions.

The result of the other experiment demonstrate that the compulsory role of visual information on multisensory flavor perception was so strong to override any awareness the participants had about the possibility that the solutions was inappropriately colored and that changing the intensity of the different colored solutions did not affect the participants perception of flavor intensity. The conclusion leads as follows, that colors that appear in food and beverages might interfere with a person's flavor indication at both the perceptional and abstract levels.

Figure 9: Colored solutions.
3.4 The emotion wheel

The theory of the emotion wheel, made by Robert Plutchik, is an interesting take on utilizing emotions, as a symbolic significance of color. As the color transition in both brightness and saturation, the intensity of the emotion will also be influenced, ranging from a brighter color of low saturation, to a darker and more saturated color. The emotion wheel is also based on the foundation of the color wheel, resulting in a symmetrical arrangement, with opposing complementary pairs of both colors and emotions.

Robert Plutchik (21 October 1947-29 April 2006), professor emeritus at the Albert Einstein college of medicine and adjunct professor at the university of south Florida, Received his PhD from Columbia University and was also a psychologist. He authored and coauthored more than 260 articles, 45 chapters, eight books and also edited seven books. The research interests of Robert Plutchik included the study of emotions, the study of suicide and violence and the study of the psychotherapy process.

In one of Robert Plutchik's books "The Nature of Emotions" (Plutchik 2001:348-350), there is a conception of what Plutchik call and describe as an emotion wheel. The depicted version of the emotion wheel is a three-dimensional circumplex model that describes the relations among Plutchik's emotion concepts. The concepts of emotions used, was 8 primary bipolar emotions, joy versus sadness, trust versus disgust, anger versus fear and surprise versus anticipation. Each emotion is combined with a color and with the emotions in opposite pairs and the colors are also complementary. As described in "The Nature of Emotions" (2001), the relation among emotion concepts, which are analogous to the colors on a color wheel. The cone's vertical dimension represents intensity and the circle represents degrees of similarity among the emotions. The eight sectors are designed to indicate that there are eight primary emotion dimensions defined by the theory arranged as four pairs of opposites. In the exploded model the emotions in the blank spaces are the primary dyads, emotions that are mixtures of two of the primary emotions. The concept of the emotion wheel has its base from the color wheel and is a result of combining both. Having the attributes of mixing different emotions in a symmetrical circle, with the eight emotions chosen by Plutchik and spaced evenly along the circumference. Connecting in the middle with the emotions and their respectively color opposites. The emotions as less intense in the outermost part of the circumplex, increasing in intensity further in to the center and the emotion's respective color pairs gain a darker and saturated hue.
Figure 10: The colors and their paired emotions in the emotion wheel are as seen here extremely arbitrary and non-scientific and can be used with different emotion pairs using different colors, as long as it follows the conceptual design of the three-dimensional circumplex model.

Robert Plutchik's emotion wheel

The emotion wheel is an interesting method of combining emotions with colors for example, through a visual narrative, where specific colors are given a symbolic significance in the form of a specific emotion.
3.5 Color therapy

Colors therapeutic properties for mind and body

This is actually a subject I did not want to bring up, but I found a very interesting discussion about the subject when reading through the book "Color and Light: A Guide for the Realist Painter" written by James Gurney, the creator of "Dinotopia". This part will be taken directly from the book (Gurney 2010:148-149). According to Gurney, an entire field of alternative medicine called color therapy or chromotherapy has developed around the belief that colors have specific therapeutic properties for the mind and body. These practices are rooted in ancient beliefs of the Ayurveda in India, and in ancient Egypt, where rooms were built with colored-glass windows to promote effects on the body. In China, specific colors were associated with certain internal organs. In various practices of color therapy, patients observe colors through special viewers, or colors are applied to acupuncture points on the body, using gemstones, candles, prisms, penlights, colored fabrics, or tinted glass.

Although not all systems of color therapy agree on the associations of each color, most agree that red signifies blood and the base passions, including anger and power. Orange is often associated with warmth, appetite, and energy, followed by yellow, which represents the energy of the sun, and which is used for glandular problems. Advertisers use these bright, warm colors to whet the appetite for fast food. The spectrum of colors continues through green, blue, indigo, and violet, moving more and more toward states of serenity and meditation. This progression corresponds to the ascending chakras of yogic practice, and can be charted on the body by superimposing the progression of hues on each of the seven spiritual centers of the body. Mainstream marketers have recently made connections between certain colors and chakra centers. Such claims even appear on the websites of commercial interior paint manufacturers.

Those who doubt the claims of chromotherapy argue that these associations are nothing more than pseudoscience, because the health benefits cannot be proven by clinical tests. If the contemplation of certain colors has any effect on a patient's recovery, they would argue, it is simply due to the placebo effect. To some extent, the color symbolism on New Age catalogs owes as much to fads and fashions as it does to physiological response. More recent catalogs have a rather different palette than we would have seen ten years ago; these days health-promoting catalogs tend to sport gold, dull olive, and venetian red.

Regardless of the scientific validity of these claims, artists, designers, and photographers might wish to remain open to the general idea that color can affect us at an emotional and a physiological level.
While still on topic I will also mention an article "Color it Effective: How Color Influences the User" written by Katherine Nolan (January 2003). This article follows the same mindset, the symbolical significance of color to influence on a physiological level and the idea of colors' influence, how we perceive colors and what the effects may be.

In the article, Katherine Nolan takes up the importance of choosing the right colors, in this case focused on the area of advertisement. She writes that advertisement has been quick to capitalize on psychological research into the effects of color on our emotions and perceptions. The ads we watch use this knowledge to evoke feelings or memories, which make us, want the goods on display, but it is not only in advertisement that colors are chosen to have a subconscious effect on the viewer. She continues, research has, for instance, led many employers to use a green colored harmony in the workplace, as there is evidence to suggest that this results in less absenteeism through illness. She also takes up the topic of common color meanings, but categorized in both positive and negative responses. The color white stands for clean, innocent, pure as positive responses and cold, empty, sterile as negative responses. The color red stands for strong, brave, passionate as positive responses and dangerous, aggressive, domineering as negative responses. The color yellow stands for happy, friendly, optimistic as positive responses and cowardly, annoying, brash as negative responses. The color brown stands for warm, earthy, mature as positive responses and dirty, sad, cheap as negative responses. The color green stands for natural, tranquil, relaxing as positive responses and jealous, inexperienced, greedy as negative responses. The color blue stands for trustworthy, authoritative as positive responses and cold, depressing, gloomy as negative responses. The color purple and black, was not mentioned among the other colors and did not have positive and negative responses. The mentioned colors was not fixated on different values of tones, tints or shades and focused on the color in itself.

There are no "good" or "bad" colors. All colors have positive and negative effects depending on context, and evoke responses tempered by the experience of those viewing them. None of this is clear-cut. Because colors are capable of so much variation, making absolute statements about meaning is impossible. However, understanding some important concepts about color will help us appreciate how varying a color, and combining it with others, can affect its impact (Nolan 2003).
4 Methods

Observations and analysis

This part of the paper will cover three different methods utilising the symbolical significance of color, for three different films. These three films are two live-action and a 3D-animated short. The three different methods will cover the use such as, a color accent as visual color design, color scripting and the use of color interpretation as a descriptive narrative of a scene. Keeping in mind what i have explored in the earlier parts of this paper and using the knowledge in my observations and analysis.

First, a simplified example of how the symbolic significance of color can be adapted in films. The example came from a book called "If It's Purple, Someone's Gonna Die: The Power of Color in Visual Storytelling (2005) and will be a short summary, since I cannot refer to the content itself. The book in itself contains lots of observations on the subject of colors and emotions, and the example is actually the name of the book. The idea came from a series of films, where they used the color purple as a foreshadowing of murder and death. These methods lead the audience to subconsciously associate the color purple with murder and death. As soon as something purple was shown, the audience would respond and feel that something was to take place. The colors and visual color designs created for films, games and more, are not chosen by random, but with lot of care and knowledge and will hopefully stir up some kind of response in the observer.

4.1 Color accents

In this next observation, the method of a color accent will be used. The chosen color is the color red and will convey a symbolic significance, relying on foreshadowing. The color accent will be used as means to move the plot of the film forward. The film “The Sixth Sense” (1999), follows a man named Malcom Crowe who works as a child psychologist. After an unfortunate encounter with an ex-patient, he takes on the task of curing a young boy with the same illness as the ex-patient. In comparison with the film "Lucky Number Slevin" (2006, mentioned later in the text), the visual color design is subtle and uses more earthy color harmonies through the film. But a more noticeable distinction between the films is that the film “The Sixth Sense”, uses a color harmony relying on the method of a color accent. In this case, a red color accent and what you can call the red thread or the main theme through the film's plot. Why did they choose the color red in combination with an earthly color harmony, as their visual color design for the film? As mentioned earlier the color red is one of the more easily perceived colors by the human eye, and as an accent in combination with an earthly color harmony, its purpose is destroyed.
From the viewpoint of the creators for the film, they wanted the color accent for the film to be red and use it as a guide, for the plot of the film to revolve around. The use of the color red would also be for the purpose of foreshadowing and hinting at the development of the plot. As the time of the film passes by, more and more red will get noticeable and hopefully create a reaction in the audience. In the end the observer should be conscious of the red accent and the plot of the film would become unmasked. The creators of the film put the focus on utilizing the method of a color accent, for the development of the film's plot. The most common use of a color accent is to attract attention, or make a statement and is more pleasing as a jarring visual color design. But as they combined the red with an earthly color harmony, the jarring effect disappears and the contrast becomes subtle, destroying the purpose of a red color accent. This might as well be what they had in mind, but feels instead as a bad execution and could with another color have been more alluring for the audience.

4.2 Color scripting

A visual guide constructed from color

This method will involve the use of a color script and will be given a short explanation. Under the pre-production phase of an animated film, clarification is needed when setting the mood of the film and there is where a color script comes in. So why the use of a color script and what has it got to do with the symbolic significance of color? First off, what is a colors script? A color script is a guide, a pathway through the actual story and the construction of a color script can be compared with children's books, for its similarity to the use of color transitions between different moods through the story. It is also a great tool at controlling the mood of the story and arranging specific sequences. These sequences will have their own visual color design and can represent many things, such as colors combined with emotions, key transitions in the story and more.

A color script can also be considered a crafted set of illustrations detailing the color palette and lighting of the different moods, intended as a visual guide for tone of the film. Pixar studios take on the 2D-animated film “Toy Story 3” (2010).

We came up with the concept of blue connoting safety and home. At the beginning of the film. Andy... his bedroom is blue, the sky is blue, his T-shirt is blue. He is in blue jeans, he's got a blue car-these are not accidents. These are conscious choices. Everything in the movie is there for a reason. We are making a commitment to say that blue will connote safety and trying to avoid that in situations where we don't want the audience to feel safe (Amidi 2011:15).

The following example will be on color scripting for a 3D-animated short, made for a school project and why the use of a color script was necessary for the films visual color design.
The 3D-animated short is called “Golem” (2012), it takes place in what seems to be a big and hollow cavern. Through the film, we as an audience, follows a pile of animated rocks in the form of a humanoid character, its journey through the cavern and its ascent. The journey leads the golem to a steep hill in the middle of the cavern and ascends to a manmade looking building, looking a lot like some sort of temple or a sacred ground. Throughout the Golem's journey it becomes weaker, loses strength and drops parts of itself. When it reaches the temple and the sacred ground, it falls to its knees and with its remaining strength rips it own core. The rocks falls to the ground in a lifeless pile, at the same time, pure energy is released and ascends upwards towards the caverns ceiling and throughout a hole at the top of the cavern and the 3D-animated short ends. The key and the focus of the story lie in the Golem's journey and its ascent.

The focus on the visual design was that the Golem would walk through darkness into light and that the colors would increase and bleed out in bright white light. With the help and use of a color script, there was a lot of control in adjusting the transition from darkness to light, where the emotional responses became the strongest and at the same time, giving an easy overview of the whole story.

![Figure 11: Color script for the animated short “Golem”](image)

When working with color scripting, it also opens up the ability to apply different theories, knowledge of color theory, how we perceive colors and how we can influence and appeal to the audience.
The concept of an emotion wheel made by Robert Plutchik, mentioned earlier in the text, is one theory that is easily applied. When working with a color script, a color or color harmony can be chosen with its respective emotion as a construction of symbolic significance.

In storytelling (such as the animated short “Golem”), the story is broken up in different acts and as well with a color script, the transition of the mood changes through the story. With a chosen color or color harmony, with its respective emotion, transitions to its opposite visual color design, a complementary pair of color and its respective emotion. To illustrate an example on how the theory, the concept of the emotion wheel and its three-dimensional circumplex model can be applied in a color script. The story example will be simplified and follows the protagonist, or the hero of the story and its journey. At the start of the hero's journey, a color and color harmony is chosen for the visual design, paired with a specified emotion. As the journey progresses through different events, in this case, benefiting the hero, the visual color design increases in intensity, contrast values and saturation, as well as for the specified emotion, as seen in the concept of Robert Plutchik's circumplex model of the emotion wheel. This design is not set in stone and can be experimented with, as long as the design fulfills its specified purpose and successfully appeals to its audience. The second part, when using the theory of the emotion wheel, comes when the hero meets with its adversities and even the hero's downfall. The second part is the transition between the events of the story, where the mood changes for the opposite. In this case where the transition becomes clear, the visual color design also changes for its complementary color and emotion pair and increases the intensity the bigger the hero's adversities and downfall is. As seen in the “Golem” color script, it starts dark and in combination with a depressing feeling, intensifies and transitions into light, with a feeling of tranquility.

4.3 Color harmonies and common color meaning

A color harmony can contain several colors. These colors can represent their own symbolic significance and together they can endeavor and enhance the mood. The film “Lucky Number Slevin” (2006), uses a great deal of color and emotion pairs throughout the story of the film. This particular scene takes place a further bit in, from the beginning. The scene depicts what seems to be a long hallway or a crush-room, in this case of an airport. The crush-room is long, with some windows in the back and has white and light grey walls, the same goes for the ceilings and details of the room, with the exception of the crush-room's chairs, that are colored in a deep blue color. This part will cover my analysis of what I think the creators wanted to convey with the chosen color harmony for this specific scene.
With the knowledge and use of the common color meanings from the article by Nolan, this scene can be considered to be depicted as a safe haven. With the color white standing for clean, innocent, pure, empty, cold and sterile responses and the color blue standing for strong, trustworthy, authoritative, cold, depressing and gloomy responses, the events that unfold in this scene are quite accurate to what the colors represent.

The scene begins with a lone man in warm clothing, walking down the hallway of the crush-room towards the camera and taking a seat in one of the blue plastic chairs. The crush-room is empty with the exception of what seems to be a homeless man sleeping on a row of chairs further down from his faced position. The lone man then takes a good look around the crush-room and then after a while nods off.

As this scene takes place in a crush-room and with its purpose in mind, it would seem better from the crush-room's point of view to have its walls, ceilings and details colored in a green color harmony. With the color green standing for natural, tranquil, relaxing, jealous, inexperienced and greedy responses and as previously mentioned is usually the color of waiting rooms, for its relaxing effect. But with the story in mind and what will unfold next. The color combination of white, light grey and the color blue depicts the story in a more accurate way than the combination of a green color harmony. With the combined symbolic significance of the different colors in the chosen color harmony, the chosen visual color design for the scene in this case, endeavor and enhances the mood, making the outcome of the character's actions to feel more credible.

![Figure 12: The airport scene from “Lucky Number Slevin”](image-url)
5 Results

First a short summary

In the inner surface of the retina lies the cone-cells, which are able to absorb wavelengths of approximately 390-700 nm and register it as color information, enabling us to perceive colors with our eyes. The three different types of cone-cells are called S-cones (absorbing short wavelengths), M-cones (absorbing medium wavelengths) and L-cones (absorbing long wavelengths). The subject of color theory has changed a lot through time, contributing with knowledge as, decomposed light containing the visible color spectrum, colors relations and what led to the construction of color wheels and harmonies. Under the Elizabethan era, the colors on clothing stood for a person's status and wealth and were associated with religious and historical events. From the results of the experiments in the articles "Optimization of food expectations using product color and appearance", "The multisensory perception of flavor: Assessing the influence of color cues on flavor discrimination responses", it can be considered that we humans have a preconceived view on colors' influence on how we perceive different tastes. The conceptual theory of the emotion wheel, as a tool in creating visual color designs with emotions as a symbolic significance of color. In the area of color therapy, colors are considered to have specific therapeutic properties for the mind and body. In the observation and analysis part of the paper, three different methods for three different films was looked at with the focus lying on the symbolic significance of color and its influence to convey the mood of the scene.

The aim of my paper was to explore, whether color in itself conveys symbolic significance and is the symbolic significance permanent, or is it an after construction. Regarding whether color in itself conveys symbolic significance and is this significance permanent or an after construction, the result turned out to be that the significance is an after construction.

A color in itself does not convey symbolic significance, but is rather an after construction based on associations, for example previous experience and events. In the case of the common color meaning as a color language, the color in itself conveys symbolic significance, but is still an after construction and not permanent. In comparison with the knowledge of colors used under the Elizabethan era, they are associated on historical and religious events and as time passes by, the associations will be based on new occurring events. With the experiments on color perceived as taste, in this case as with the common color meanings. The color in itself conveys symbolic significance but is still an after construction based on our own associations to previous experiences. Meaning it will also change from person to person.
6 Discussion

This part will be on my own thoughts on the subject and what I came up with by exploring the symbolic significance of color. With the knowledge from the exploration on the subject whether color in itself can convey symbolic significance, my own opinion remains unchanged. My opinion being, that you can actually create a visual color design for a specific purpose. The visual color designs we see every day, all around us, are not just chosen on random. As with the example mentioned earlier in the paper (if it's purple, someone's gonna die), clarifies my thoughts on the subject. The clarification being that the artist, or creator of a visual color design, utilises great knowledge of color, color harmonies and how to convey symbolic significance. With the mentioned example, the color purple represents death, but in such a way, it becomes acceptable among the audience that the symbolic significance of the color purple is death. Another thing I think is important is the results of the articles on color and taste. The experiments on color and taste, shows that we are influenced on some level when it comes to how we associate to color. The color orange can represent a taste of sweetness or literally orange, lemon etc. In the end it all comes down to our own opinions and how we associate to the symbolic significance of color.
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