A STUDY OF ASSOCIATIVE COLORS IN ANIMATED FILMS:

AN ANALYSIS OF COLOR IN PIXAR'S CHARACTERS

MASTER'S DISSERTATION IN COMMUNICATION DESIGN

Isabella Martins Andrade | Supervisor Marta Varzim

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ABSTRACT

This dissertation focuses on color and its use as an associative element to emotions, capable of conveying meanings and messages. This topic intends to explore the visual communication area as a means of investigation and analysis in communication design, focusing on studying the films by Pixar Animation Studios. Therefore, a statistical method was utilized based on the character's colors and emotions. This way, a statistical correlation was generated using specific software for statistics. It was possible to identify the intensity of those correlations (strong, moderate, and weak). So, it was possible to gather a data amount that was subsequently compared based on color theory. With the attribution of the correlation between color and emotions, it was possible to have a better understanding and a scientific approach when comparing them with color theory. Thus, through color theory, one can interpret the character's color on a chromatic level. It can be just the character or it as a whole in the movie. Then, with the theoretical framework previously established about color in the design. It is viable that the colors analyzed in this work were related to the character's emotions that they were supposed to convey. Which makes it a narrative element to associate color and emotion in Pixar Animations.

KEY WORDS:
#Color #Animation #Pixar #Emotions #Character

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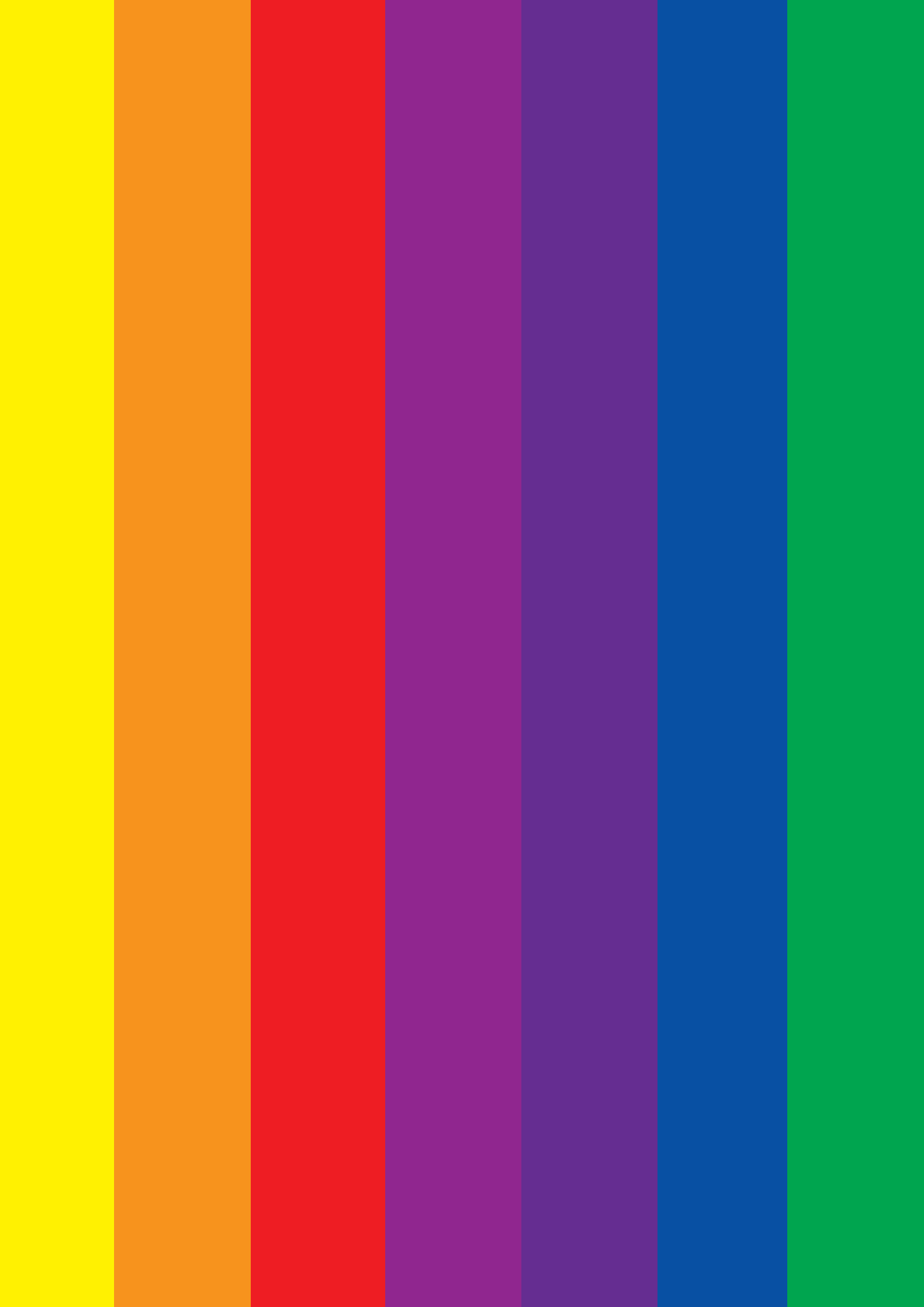
SUMMARY



INTRODUCTION

This document came from the interest in reflecting on how visual communication elements — specifically color — convey meanings, messages, ideas, and values. As designers, we are challenged to produce visual content to reach the public's understanding. Color has always been present in society with such power that it influences people's behavior and culture. It can produce sensations, feelings, and sensory effects. It can influence our senses and perform as a good stimulator or disturb our emotions, conscience, impulses, and will (Farina, Perez, & Bastos, 2006). In this sense, color as a determining element for the perception and understanding of what surrounds us appears, in this dissertation, with special emphasis, constituting one of the guiding motivations of our study. Specifically, we explore this issue in a specific area of visual communication — animation films — having, as an object of study, some of the feature films by Pixar Animation Studios and, as a means of investigation and reflection with the aim of validating if color can be associated with emotions and if the character colors are used to convey the emotion they suppose to.

To this end, methods of visualizing color in films are developed using computer programs created for this purpose. An integral part of everything around us, color is an "attribute of visual experience", a "phenomenon that constitutes a primary experience for most of us" (Gage, 1999). Perhaps for this reason — because it is something so natural and universal, rooted in our daily lives — the attention we pay to it is often neglected. However, there are several studies that, over time and in the most diverse areas, have been dedicated to color — a topic "far from being fully understood" (Gage, 1999). On the one hand, if theorists seek to answer more objective questions — related to the laws of chemistry, physics and physiology —, others are dedicated to a more subjective understanding of color, taking into account concepts found in psychology, for example (Feisner, 2014).

As a result of these studies, we can say that, for the use of color, both points of view must be related: it is important not only to know the scientific mechanisms of color perception but also the reality in which it appears, aware of its character. Emotional, variable, and influenced, depending on the environment.

Furthermore, on a more subjective and psychological level, it is necessary to consider how we react to colors after perceiving them. In this field, we do not have absolute truths that we can apply universally: the interpretation we make of color is relative, intrinsically related to our individual and/or collective identity — in which sociocultural values are implicit.

If human beings do not passively react to colors — since these are not only formed in the visual system but also in the "I", through memories, codes and symbols that we associate with them — we can say that, in addition to a visual phenomenon, color is also a "cultural phenomenon" (Pastoureau, 1993): it is information, it has meaning and it shapes our emotions. Being aware of this becomes especially relevant in the visual communication field, allowing

us to use it with greater assertiveness: “using colors in a well-directed way means saving time and effort” (Heller, 2014). It appears, then, that more than an aesthetic element, color is also functional: either in a more explicit sense (establishing contrasts, balances, highlights, for example), or more implicitly (psychologically interfering with the receiver). In this way, color proves to be an instrument of communication, interfering and constituting itself as a vehicle for transmitting messages.

This question has been the focus of attention of several authors — Feisner and Reed (2014), Fraiser and Banks (2004), Heller (2014), Pastoureau (1993, 2014), etc. — even though the approach is made in a very comprehensive and generalized way. However, there is still a large gap with regard to its study at a more particular level, restricted to a specific scope. For this reason, we chose animation as an area of visual communication for the development of this investigation. In fact, although the bibliography related to color in animation is numerous, its concerns are more related to issues such as the history and study of techniques and processes. Other publications are interested in the restoration and archiving of color in films rather than its functional character, which is a significant part of a film.

One of the reasons that may explain the scarcity of theoretical studies from this point of view is the versatility of color: the fact that it is susceptible to various perceptions and interpretations prevents the establishment of general codes, a fixed system, or a universal understanding of color. Color in cinema allows us to answer, without a doubt, how color acts or functions as a narrative element (Price, 2006). Thus, the study of a specific field is necessary for the most effective analysis and understanding of how the color palette of a character can determine its emotions and personality.

The color phenomenon that influences the psychological state is known and studied as color theory. This tool is also explored in animation films to help bring characters to life by transmitting their emotion. According to Sean Adams, “Color has the ability to evoke a response, create a mood, symbolize an idea, and express an emotion.” (Adam, 2017). Pixar Animation Studios uses color to evolve the spectator into the film’s emotion and help give soul and mood to characters. John Lasseter, previously the creative director at Pixar Animation Studios, said that the color is so charged with feeling and provokes such a strong response in an audience that it is one of the most powerful tools at a filmmaker’s disposal (Amidi, 2011).

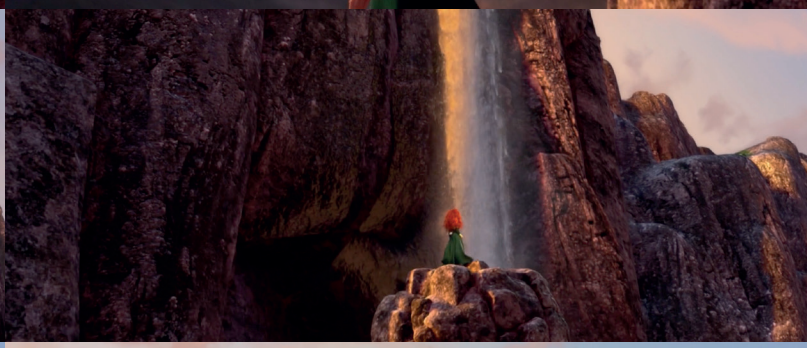
This project intends to analyze Pixar’s characters and collect the color scheme to compare it based on color theory. To compare if this data is relevant to the emotion the character is supposed to convey. The final product will be a thesis that will contribute to the knowledge of the scientific community and anyone involved in the field of design and animation world.

Many projects have been developed using color theory regarding graphic animation and film analysis (Brunick and Cutting, 2014; Sá and Tavares, 2017). However, this research investigates the use of Pixar characters’ color schemes based on color theory and the relationship between color and emotion with the

< Figure [1] Posters from the movies that will be analyzed in this work.











intention to verify if their color scheme has relation with the emotions they are suppose to convey.

When considering the evaluation methodology, the correlation statistics between color and emotion have been the focus of many studies since video game colors emotion (Geslin et al., 2016) to how the text color impact emotions (Strapprava and Ozbal, 2010).

Within the scope of the practical component that accompanies this dissertation, we clarify that design is understood as a means of investigation, reflection, and criticism. According to its most common meaning, it is more than "related to the solution of problems or with the to a customer request" (Noble & Bestley, 2005). It is not our objective to reach a final answer or an ideal solution for a specific problem but rather to contribute to the expansion of the study of color in animation. Also, using color with color theory fosters reflection and the generation of further questions about the topic.

Therefore, the experiments conducted by these studies aim to investigate how the use of Pixar characters' color schemes based on color theory is associated with their personality, allowing to compare their color scheme and whether those are relevant to the emotion the character is suppose to convey.

< Figure [2] Scenes from the movie Brave showing orange and golden tones, giving an excitment emorion to the scene.

STATE OF
THE ART

COLOR STUDY IN ANIMATION FILMS: STATE OF THE ART

Best-known animation studios like Disney, Pixar, Ghibli, DreamWorks, Blue Skies, Sony Pictures, and many others worldwide have inspired the public with their work. So, it is understandable why their films are used as a base for papers and thesis in the academic area when the subject of study is animation films.

Their work is already well established, and because of that, many searches have been developed based on their animation. Since their knowledge in the area resulted in many great works, researchers started to study and compare their way of creation to understand animation films better. The work of Hsu and Hsiang (2018) uses the comparison method between animations from Disney and Ghibli studios to understand what distinguishes American characters from Japanese. They chose six animations from Disney and Ghibli, and they gathered color samples from hair, fur, skin, ornaments, accessories, clothes, and shoes. In total, 1156 color samples were analyzed.

The paper suggested that the national identity and the culture of the focus audience affect design choice about the character's color. That result creates a discrepancy between Disney's and Ghibli's animated films. Therefore, they deduced that the colors chosen for animated film characters are influenced by traditional impressions of the character's gender and age and the traditional impressions of the company that produced the animated film.

Brito and Cho (2017) also compare Disney's and Ghibli's studios, but they focus on comparing both studios' storytelling styles by using color as a narrative agent during movies. According to then, storytelling involves two crucial aspects of cognitive perception: the conscious and subconscious. Therefore, it is an interpretation made by the subconscious. Because of that, it is considered an emotional resource due to its psychological background.

They explain that color effects as a narrative agent can be classified in two aspects: the first is the dynamics of color that analyze how color acts and is perceived on a stage, its meaning, and symbolism regardless of the character's actions. The other aspect is the narrative sequence that studies how color temperature evolves in a scene's development.

After they analyzed and compared films from both studios, they closed their work by saying that actions from characters of films related to Ghibli's studio are not tied to the color temperature like they are in Disney films. Other differences were also noticed, such as, in Ghibli's films, the harmony of color in their visual compositions magnify the actions of the character and history. Also, in Ghibli movies, the light often becomes atmosphere rather than illumination, which creates an intense shadow that expresses the scene's emotion. The use of selective lighting by outlining figures produces a greater depth impression. Due to that fact, they declared that figures in light kept viewers in the main narrative action.

Even though Disney maintains its visual composition with the help of different

Figure [3] ^
Scenes from the movie Luca showing them in a dream in a yellow field. showing a happy moment.

contrast, the studio most often uses types of contrast: tint color, light and shadow, and complementary colors, the authors also affirm that color is predominant on objects' surfaces or acts like a shadow over the characters in those animations. With this technique, emotions intensify unconsciously, making the viewer concentrate all the attention on what will happen. So, this is how the animators in Disney's films use color to prepare the viewer for the film's climax.

On the other hand, even though Shuting et al. (2020) also uses the comparison method between Disney and Pixar animation, the paper focused on explaining Pixar's processes on modeling characters, approaching topics like color, characters proportions, and their defect setting. It mainly compares and analyzes the differences in animation modeling between the six classic works of Pixar and Disney and discusses the modeling paradigm of Pixar's animation modeling to verify what makes Pixar studio stand out in the marketing with their story and characters close to the spectator's life. For that, the study focused on comparing the boy's main character from those six classics.

From a modeling perspective, the paper says that Pixar can summarize and give personality to the characters and highlight it by comparison. By making the character close to the role, giving a very personal connotation. In comparison, Disney's characters have more obstructive lines.

Still, on the modeling aspect, the proportion was analyzed, and it was found that the head-to-body ratio of Pixar's characters was small, while the head-to-body ratio of Disney's characters was large. According to the paper, Pixar is bolder and more innovative with the modeling approach than Disney. Also, it was possible to notice that Pixar uses more accessories and props to emphasize the richness of the character's personality and highlight it.

Figure [4] > Scene from the movie Monsters Inc. showing a high colors saturation.

Figure [5] > Scene from movie Beauty and the Beast showing a lower color saturation.

The next topic was related to colors and saturation. As the comparison's result shown, although Pixar and Disney use the same number of colors, Pixar paid more attention to the richness and saturation of the colors with the use of low-saturation color to bring more attention to the details of color coordination and matching. While Disney only uses high-saturation colors to paint the scene.

Finally, the character's personalities were analyzed. In Disney's animation, what defines the personality of the animated character is very simple, either evil or good. On the contrary, the character's personality created by Pixar is more complicated and has a social humanized mask color. The paper affirms that the storyline of many Pixar animated films lies in the personality defect of the character. There is no story to develop if no such personality defect is set. Pixar managed to show the pains and weaknesses of human nature in the characters' hearts.

As a conclusion of the work, it was implied that Pixar had made animated characters alive. Shuting said that if a Pixar character has an attractive appearance, then its personality will be flat, or the character will be bright at first sight, but it will not last. The superposition of personality attributes makes the character richer, and people will be willing to remember such soulful roles. In addition, the animated characters created by Pixar are mostly circular shapes. These characters are very ordinary, but their qualities and flaws are precisely the focus of Pixar's animated film production.

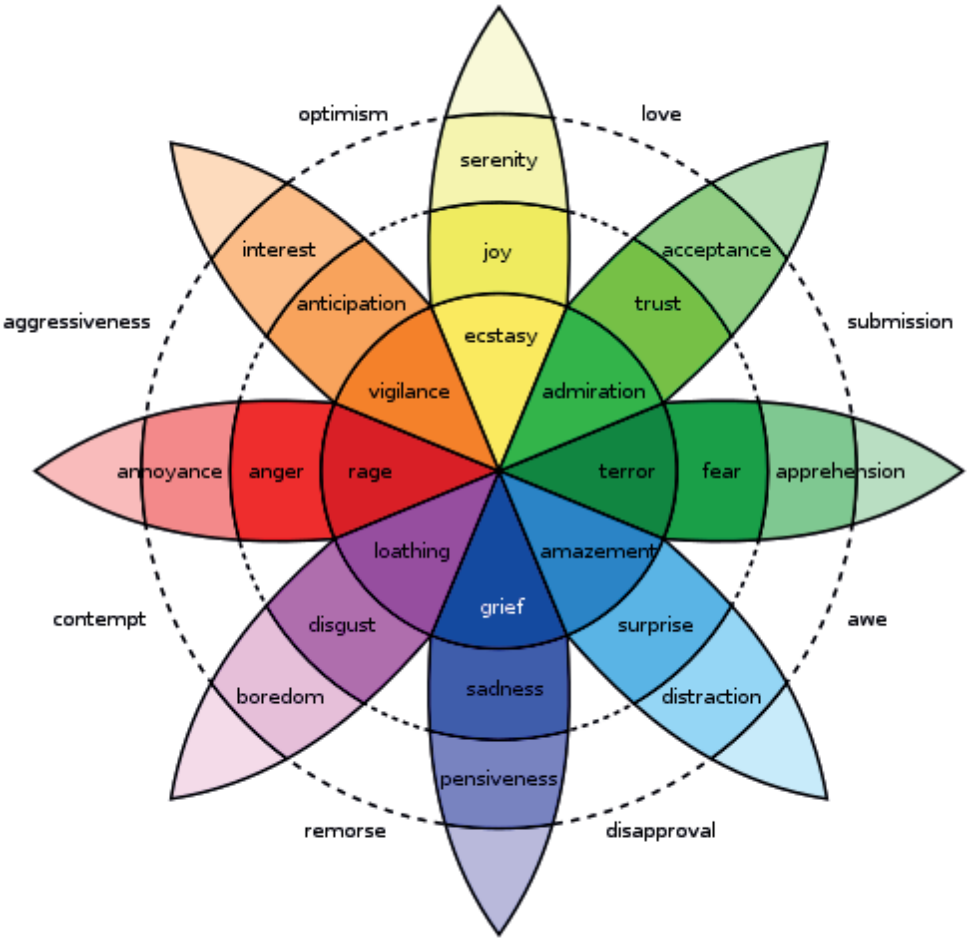
Since Pixar is one of the biggest animation studios in the market, many works explore its aesthetic, like the one made by Ahn and Chung (2017). They based it on the emotional character's appearance using the body shape and theme color as a reference to define the characteristic differences of the emotional outlines in the animation Insideout. See figure 6.

The study indicates the five different characters based on the five emotions used in the animation (happy, sad, fear, anger, and disgust), then analyzed how an individual character's emotional tendency is effectively expressed through visual elements in the facial expression and color expression. The reason to analyze the feature of facial expression of those characters is that their faces occupy a large percentage of the character's body proportion, making this feature visually important to an emotion outline.

^ Figure [6]
Scene from movie Inside Out. Where it is possible to see the difference of color for each character.

Next, the external theme color of the five characters was analyzed to compare the emotional appearance. This study analyzed the character's intentional color scheme effect through the emotional process of psychological changes

applying color values for groups of primary and secondary colors in each character. According to the paper, the color analysis of the five psychological characters was based on a preliminary study by psychologist Robert Plutchik's



Wheel of emotions, see figure 7. In his perspective, colors are closely related to psychological expression, defining emotional changes to represent emotion with hue, saturation, and brightness. According to his wheel of emotion, higher the saturation means stronger the emotional intensity, and brighter the color means blurrier the emotional identity.

The result found was that Joy's primary color confirms the average hue and saturation of yellow and high brightness values. That, according to the wheel of emotion, belongs to emotion joy. See figure 8. In addition, clear color contrast on its hair belongs to the blue on an average color scheme that belongs to the emotion of surprise. This analysis shows consistent results with the character's emotions that have repetitive surprises during the animation, representing a feeling of pleasure.

Then, the primary color of the character Sadness (see figure 9) confirms the medium hue and saturation of deep blue and medium brightness value, which belongs to the emotion sad. In addition, a similar bright blue tone of its costume belongs to

Figure [7] ^ Emotional Wheel by Robert Plutchik

Figure [8] > Character Joy, from the movie Inside Out.

Figure [9] > Character Sadness, from the movie Inside Out.

the saturated blue on its color scheme as a secondary color. This analysis shows results that correspond to expressing the emotion of sadness and surprise, which are the primary emotions of the character Sadness in animation.

For the character Disgust, the result of primary color confirms that the average skin color of medium green unexpectedly shows the feeling of emotion fear. However, the purple scarf expressed a negative or disgust as the character's primary emotion.

The last one to be analyzed was the character Angry. The result of primary color confirms that the average skin color of medium red shows the feeling of anger corresponding to the character role. The dark red series on the character's costume, as a secondary color, also shows low saturation and brightness to express the rage within this character's emotion.

As a result of comprehensive analysis, these five emotional characters satisfied the tendency of basic human emotions to express visual target appearance from a psychological perspective.

Another work that also argued about aesthetics in animation is Ren (2020). The author researched the aesthetic value of color in movies and television and said that *"color is not the only means of expression, but it plays an indispensable role in expressing the author's emotion and central idea"* (Ren, 2020, p. 179). The paper explores the aesthetic value of color art in film and TV animation from transmitting the beauty of the picture, linking the emotional side, and creating connection.

The aesthetic value of the color visual effect is precisely because of the integration of the subjective feelings, emotions, and creator's ideas, making the color contrast more pronounced with more personal feelings and ideas and resonance more to the audience. It shapes characters, expresses emotions, creates scenes, and renders atmosphere in every angle and shot in the film.

An animation film with a rich expression of subjective color can strengthen the narrative role of animation film, balance the color of the screen, give a better understanding of the film's ideas, interpret the film's emotions can be appreciated better.

Focus on animation films as a medium of visual communication, Sun (2015) said that animation is a kind of symbol itself. It is mainly expressed through image, color, light, and shadow.

According to the author, the animation is a special artistic expression form. The character in an animated film is a kind of a linguistic symbol, conveying the idea of the whole film to audiences through the character's deduction. Therefore, different characters' modeling gives the audiences different mental feelings. For

^ Figure [10] Character Joy, from the movie Inside Out.

^ Figure [11] Character Sadness, from the movie Inside Out.

the author, that is the function of symbols in animation images.

The author finalizes by saying that as a cultural awareness symbol, animation makes audiences connect with the symbol in their memory quickly through transmitting and outputting, stimulating emotion and psychological resonance. Also, softly influence the change of aesthetic awareness, taste, and value, making it a new form and value for aesthetic outlook.

Due to everything that was said, it is known that the characters are more profound than just some drawing lines. One of the tools that the designers have in their hands is color. Its use helps characters come to life. The work of Brunick and Cutting (2014) talks about the importance of color, its definition, its uses for creating characters for animation films, and the cognitive experience of color shapes that affect the experience in children's films.

According to them, the color gives depth to the animation design by creating new perceptions and transmitting the idea of feelings. Also, another relevant theory for using color in an art space is that we learn strong associations between emotion and color, and color can consequently be used to evoke a particular state of emotion.

To better understand color in animation films, Brunick and Cutting talked about three matters. The first is related to color, what it is, and how it is defined. The work talks about the importance of color perception study on a physiologically level. Because of that, they also enquired how we respond to color in our minds. They found that our preferences and inclinations toward colors have the potential to influence how we respond cognitively and emotionally to art.

The work also discusses the ecological valence theory of color preference which suggests that the early human associations built with colored objects facilitate their color preferences. Also, another theory, which is particularly relevant for the use of color in an art space, is that we learn strong associations between emotion and color. Therefore, color can consequently be used to evoke particular emotions.

The second matter was to understand the use of color by animators throughout animated film history. The study explains that since the beginning of the animation, animators have been able to select a wide range of colors to best suit their needs. The introduction of computer animation has allowed a tremendous amount of freedom in color control, putting the entire digital color environment under the direction of the artistic team. The precise control of color in this setting has not only artistic consequences but also important implications for how films can evoke psychological responses from their viewers.

The final matter is about the emotional experience of color shape for the viewers in a film, which was addressed to a specific population of animated films (animated films geared for children), intending to understand how the use of color in these films strategically differs from other types of films.

Filmmakers in the children's animation subset face a specific challenge in trying to engage children in their visual narrative. They say that children's cognitive and attentional capacities differ from adults considerably. However, one potential shift to accommodate this audience appears to take place in colorization on animated films.

The work showed that animated films mimic the preferences found in children, like in saturation. On the other hand, the use of hue in children's films does not coincide with the children's predilections but those of the adults. If hue preferences for the children were being exploited according to their likes, "good" characters would likely contain red and yellow. When in reality, the opposite occurs, and adult preference rules over. According to their research, one possible explanation is that the shift in hue preferences supposedly occurs earlier than the shift in saturation preferences. Adults may not be as aware of the hue preference in children because it shifts earlier. Thus, adults and filmmakers have less exposure to this cognitive facet of child color preference.

In conclusion, the predominance of children's films among animated films is, in a sense, very convenient since it allows researchers to observe the reciprocal relationship between children's perceptual favoritism and how filmmakers create art and media for this audience. Also, the developmental perspective affords insights into the origins of perceptions and preferences, which will likely prove to be an important pillar in cognitive perspectives to film.

Although color gives depth to the animation characters, the relation between the character's emotion and color theory is not much seen in the academic field. While seeing an animation, people can notice most of the character's personalities only by looking at their color scheme. Like, villain's colors are usually related to dark colors, and protagonists usually have intense or bright tones. This association is made physiologically like Sam Adams (2017) said in his book that preferred colors can inspire people to feel positive emotions, while disliked colors may inspire them to feel negative emotions.

This affirmation goes along with the work of Gong et al. (2017), which was based on a psychophysical experiment based on the response of color emotion and color preference. The results indicated that positive color emotions were mainly preferred, while the negative color

^ Figure [12][13][14] Seens from the movie Toy Story.

emotions were correlated with the colors of “hate”. Also, the influences of the background and color appearance parameters were discussed. It was concluded that the background influenced the perception of color emotion and color preference to a certain degree. Likewise, hue played a more important impact than chroma and lightness.

CORRELATION: COLOR AND EMOTION

Statistics correlation technics can be applied in many areas. Many approaches have been using it for color and emotional evaluation. Wilms and Oberferldn (2017) presented a three-dimensional space of chromatic colors by independently varying hue (blue, green, red), saturation (low, medium, high), and brightness (dark, medium, bright) in a factorial design. Skin conductance and heart rate were measured continuously and compared with emotional feelings. The correlation ratings showed that saturated and bright colors were associated with higher excitement.

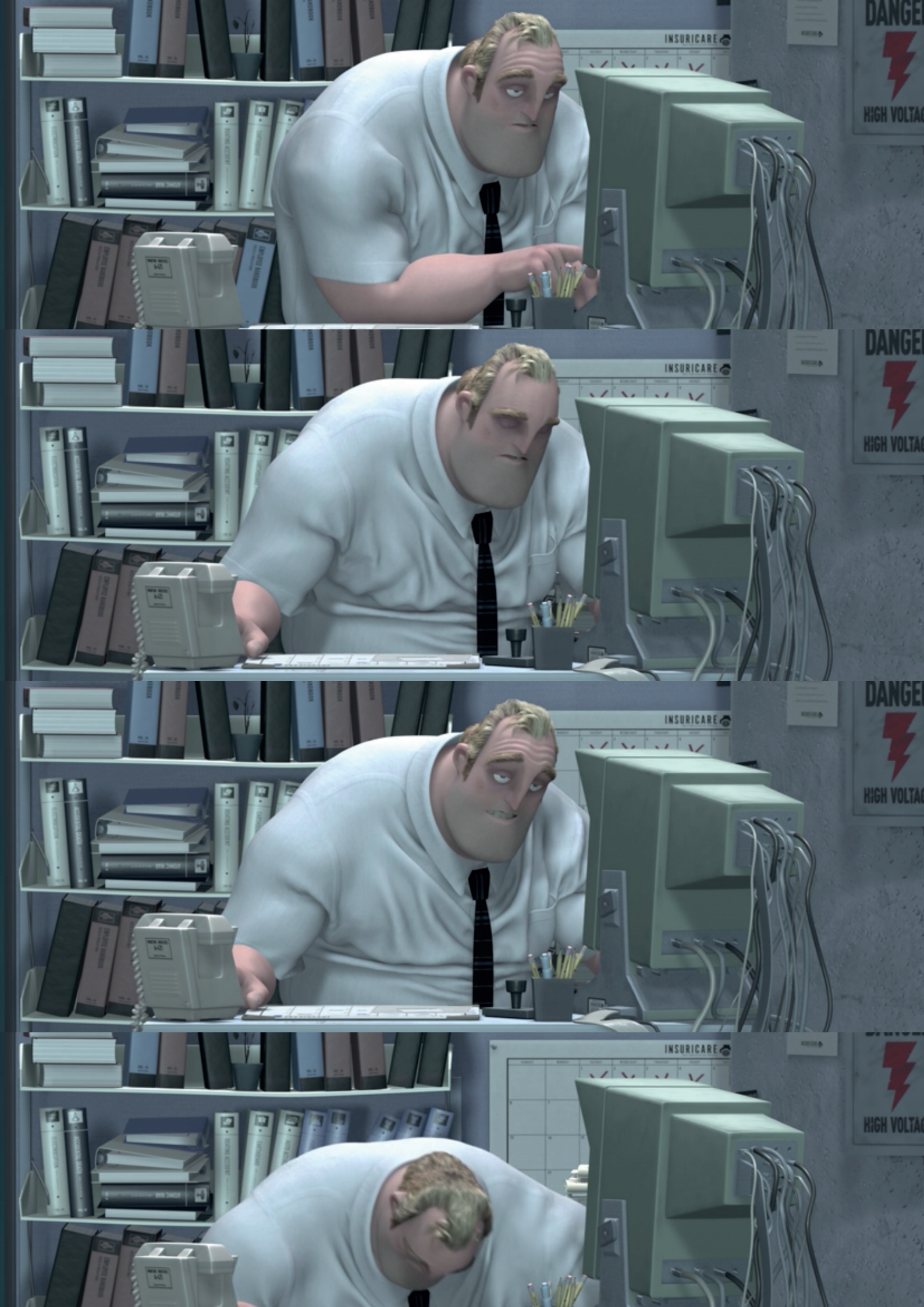
The correlation between color perceptual attributes and color emotions, as well as the influence of different cultural backgrounds, is the subject of Gao and Xin (2006). A total of 214 color samples were evaluated on 12 emotion variables by subjects from seven different groups in the psychophysical experiment. The analysis showed that the three factors were mainly related to chroma, lightness, and hue, respectively. It was concluded that chroma and lightness were the essential factors in color emotion, whereas the influences of hue and cultural background were minimal.

Gong et al. (2017) presented a quantitative analysis, and a detailed discussion was carried out with 18 attributes, including hue, chroma, lightness, and 16 words to describe color emotion. Moreover, the calculation of Pearson correlation coefficients indicated that backgrounds could influence the perception of color emotion and color preference to a certain degree, and hue played a more critical role than chroma and lightness. Further factor analysis revealed that color emotions are not isolated, and color preference could be represented in three orthogonal dimensions.

The effect of colors on emotions was the focus of Valdez and Mehrabian (1994). This research spans more than a century, covers various interests, and exhibits varying methodological rigor. The topics of investigation include color reactions as functions of personality and psychopathology, physiological reactions to color, color preferences, emotions, behavior effects, and reactions to color concepts. The data were evaluated using a correlation coefficient.

Some studies related to video games also consider using correlation in the evaluation. In Geslin et al. (2016), the authors observed a correlation between the RGB additives color spaces, HSV, HSL, and HSI components of video game images, in a total of 85 participants and the emotional statements expressed in terms of arousal and valence, recovered in a subjective semantic questionnaire. The results show a significant correlation between luminance, saturation, lightness, and the emotions of joy, sadness, fear, and serenity experienced by participants viewing 24 video game images.

Figure [15] > Scenes from the movie The Incredibles. Where Bob Par is bored with his normal life.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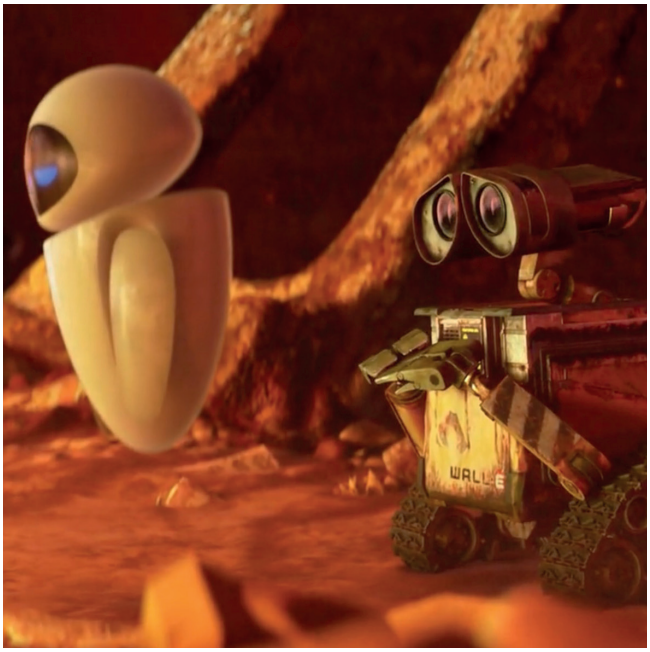
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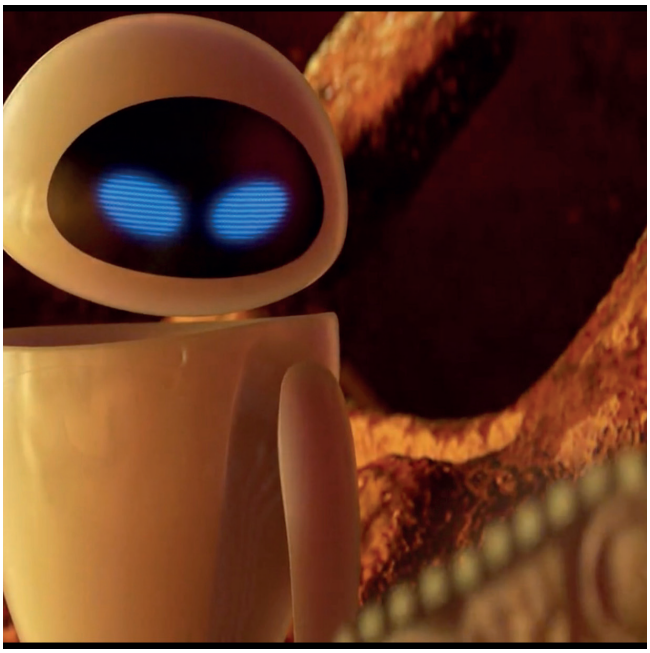


Lucassen et al. (2010) experimented with measuring and modeling how color emotions change when a texture is added to the color sample. They conclude that texture may strongly affect the psychological responses when textured samples are used in color emotion studies.

Color affects many aspects of our lives, but evaluating how the text color impact emotions are the purpose of the article of Strapprava and Ozbal (2010). In the experiments conducted by these studies, subjects have usually been asked to indicate their emotional responses to different colors. They investigate the correlation of our results with the outcomes of some psycholinguistic experiments.

Even though much work has been done in the field of studying animated films and their characters. Or how color is important to bring the characters to life. More searches are still needed about analyzing the character's color, their personality and associating it with color theory. Therefore, the thesis proposal is to analyze this topic to indicate the relevance of color in Pixar characters.

< Figure [16] Scenes from the movie Wall-e, showing a moment of destruction.

THEORICAL ANALYSIS:

COLOR THEORY

THEORICAL ANALYSIS

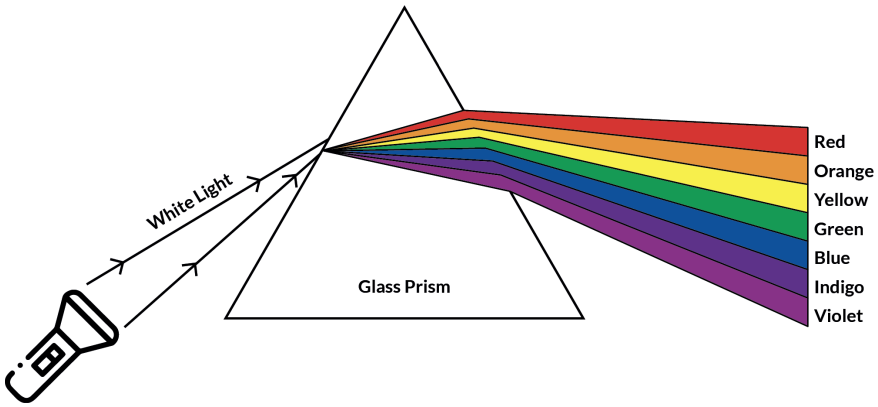
COLOR THEORY

It is through the senses that we relate to our surroundings.
Sensory organs capture information from the outside world, transmitting it to the brain, which processes, decodes, and understands it.

So when the brain assigns meaning to the impulses that the eyes send, by seeing or understanding, it means visually perceiving something Maurice Merleau-Ponty (1908-1961), a French philosopher who focused on the study of perception, said, “the body is our general medium for having a world”. In fact, through the senses and, consequently, through perception, we become aware of reality: due to this ability we can perform actions as simple as identifying, capturing the shape and locating objects, orienting ourselves, moving, having a sense of depth, and see color.

This last point, one of the most basic phenomena of perception, forms part of this study and is what we are interested in understanding.
Color theory is a series of rules applicable to color. It serves to comprehend how color is created and how they complement each other.

In the past, experiments were made to try to understand color.
Like, Leonardo DaVinci who notices that specific colors intensify each other,



discovering complementary colors. By that time, Leonardo DaVinci did not have a convincing scientific explanation for why that was so. However, he knew that complementary colors caused a visual vibration and excitement to the eyes. Later, this will be explained using the color wheel, and with that tool, the visualization of color relationship will be easier.

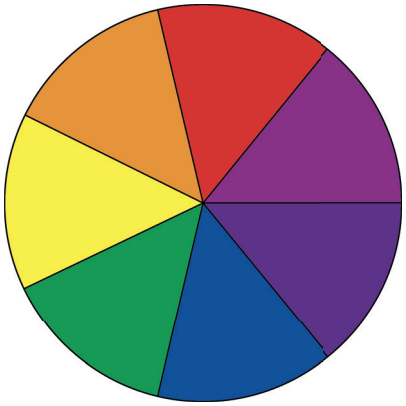
The first color wheel was created by Sir Isaac Newton (Adams, 2017). In his most know experiment with a prism, he found out that he could identify different colors. Adams explains that Newton’s experiment consisted of him isolating a small ray of light and then directing it into a prism that would refract the light into a white piece of paper, where he could see red and blue at the edges of where the ray was hitting the paper.

Thus, due to the prim’s refraction experience, he found the seven primary

< Figure [17]
Newton’s prism

colors: red, orange, yellow, green, blue, “a violet-purple” and indigo, and he published a circular diagram showing a spectrum of those seven colors, see figure 18. Here, he observed that specific colors around the circle were opposed to each other and provided the most remarkable contrast, proving that Leonardo Da Vinci’s theory of complementary color was correct.

Then the poet Goethe bust the theory a little more. He divided all colors into two groups, on the plus side he put the warm colors and on the minus side he put the cool colors. See figure 19.



So, he noticed that the color on the plus side produced excitement in the viewers and he associated the color on the minus side with unsettled feelings. His observation of human’s perception of color allowed him to understand important aspects of color, such as color’s relationship to emotion, rather than just the physics of light (Heller, 2014).

Johannes Itten (1888-1967) and Josef Albers (1888-1976), members of the Bauhaus School (Weimar, Germany), were two artists and theorists who devoted much of their work to the study of color. Not limited to examining color from an exclusively scientific point of view, his publications are, even today, works of reference, following the theory initiated by Goethe. Itten defended the thesis that colors provoke spiritual and psychological effects in us, influencing what we feel (Itten, 1970). In this way, he encouraged his students to look at color more comprehensively and not purely logically: the harmony of color should be appreciated. He developed the color chords and modified the color wheel. Also, he identified seven fundamental categories of contrast: hue, light-dark, cold-warm, complementary, analogous, saturation, and extension. Itten’s invention most used is his color wheel (also known as the twelve-part color circle). It is a graphical scheme consisting of geometric shapes of different colors that makes it easier to create a harmonic color chord, a combination of colors that will look best together (Itten, 1970).

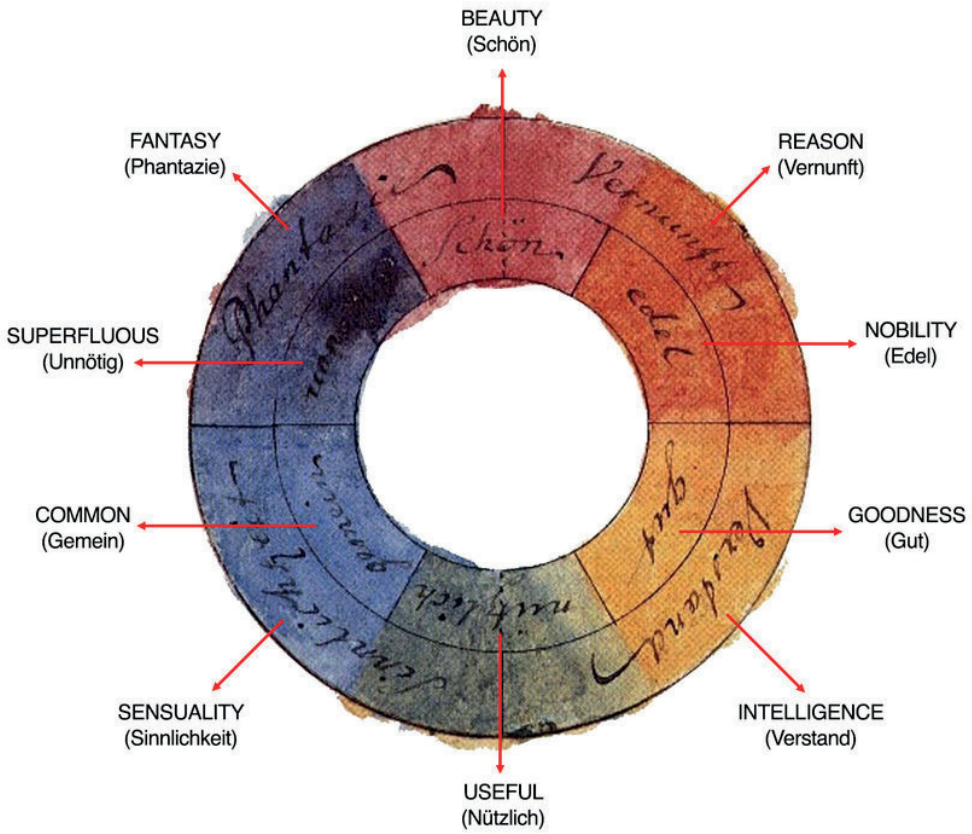
However, there are several studies carried out that allow us to enumerate a number of facts about color. One of them is that color is the first thing we notice when we look at anything. Before identifying the shape, contours, position, or texture, what we see is color. According to Feisner and Reed (2014) color defines our world and our emotions, also it is usually seen before our imaginary. Our eyes are attracted by color to such an extent that the color of an object is perceived before the details imparted by its shapes and lines.

Figure [18] ^ Color distribution of a Newton disc.

They gave the examples of a woodland, since at first glance, we do not see the different species of trees presented in it but rather see the preponderance of green. For Itten, color harmony is entirely subjective, and therefore each person can, through experimentation, achieve their own color palette.

Members of the Bauhaus School, Johannes Itten, and Josef Albers, were two artists and theorists who devoted much of their work to studying color. They did not limit themselves to examining color from an exclusively scientific point of view. However, to this day, his publications are works of reference. Using Goethe's theory as a reference.

Johannes Itten (1979) defended the thesis that colors cause psychological effects on us, influencing what we feel. In this way, he encouraged his students to observe the color in a more comprehensive and not purely logical way. According to him, the harmony of color should be appreciated. Itten comments that color harmony is entirely subjective and, therefore, each person can, through experimentation, achieve their own color palette.



< Figure [19] Translation of the Color Circle of J.W.V. Goethe, 1810.

THEORICAL ANALYSIS:

COLOR EMOTION

COLOR EMOTION

Even though, color is an inseparable part of our everyday lives, and its presence is evident in everything that we perceive (Kaya and Epps, 2004) when it comes to the academic area the topic about color and emotions splits results. Some research leads to believe that an association about color and emotion is real (Wexner, 1954; Hemphill, 1996; Mahnke, 1996; Meerwein et al., 2007), although others have found that the relation between color and emotion is weak (Frank, 1976; Valdez and Mehrabian, 1994; Gao and Xin, 2006).

The study of emotions by itself is one of the most confused (and still open) chapter in the history of psychology (Plutchik, 2001). The discussion about nature of emotions exists since long ago in human history, according to Lyons (1999) this discussion began with the Greeks. He explains that Plato saw both moral perfection and mental health as a triumph of cool reason over hot passion and desire, because of that Plato looked upon emotions or passions as a wild thing, not easily controlled and potentially dangerous aspects of human psychology. The state made by Lazarus (1999), also assimilate with Plato theory, since he said that, according to the theory of emotions, is widely accepted that emotions are a consequence of thought and motivation. Although, in his opinion, the emotions are the ones causing thoughts and motivations, not the other way around.

As reported by Plutchik (2001), more than 90 definitions of “emotion” were proposed over the course of the 20th century and that’s why there is little consensus on the meaning of the term and much disagreement among contemporary theoreticians concerning the best way to conceptualize emotions and interpret its role in life.

According to Ekman (1999) there are three meanings of the term “basic”. The first, is believed that there are several emotions that differ one from another in important ways. Like, fear, anger, disgust, sadness, and contempt, all negative emotions. Also, amusement, pride in achievement, satisfaction, relief, and contentment, are all positive emotions, but different from each other. This first basic emotion perspective is different to those that treat emotions as fundamentally the same, differing only in terms of intensity and pleasure.

Still according to what Ekman (1999), the second perspective is to indicate that the emotion appraisal of the current event is influenced by our ancestral past. He believes that the primary function of emotions is to mobilize the organism to deal quickly with important interpersonal encounters, prepared to do so by the types of activity have been adaptative in the past history of human species, but it also refers to our own past history.

As he continues with his idea, he says that the second meaning of the adjective “basic” is to indicate, instead of the view, that emotions evolved to dealing with fundamentals of life tasks. In another words, our reaction of a current event is influenced by our ancestral past. The reaction is according to what was lived before and how this person adapted or handled that situation in its life. He also believes that the primary function of emotion is to mobilize the organism to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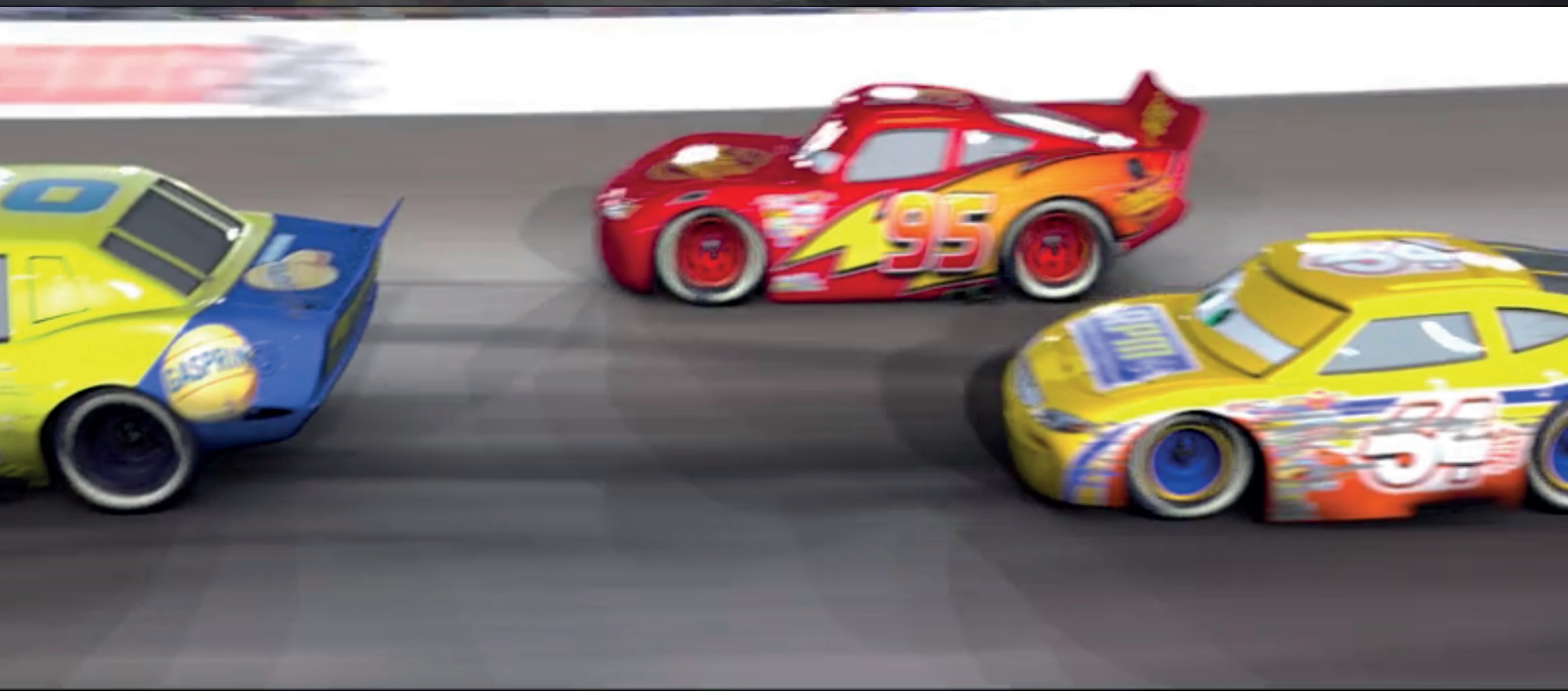
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deal quick with important interpersonal situations, prepared to do so by what type of activity have been adaptive in the past.

Other authors (Lyons, 1999; Lazarus, 1999; Plutchik, 2001) agree that a cognitive response can be the history of our species or the on our own individual history. Although Ekman (1999) claims in addition that the third meaning of the term “basic” is described elements to combine and form more complex emotions. For example, smugness might be considered a blend of two emotions, happiness, and contempt.

Lyons (1999) also follows the opinion that emotions are related to cognition. He says that only a cognitive account of emotion seems to make sense of emotions as not merely motives behind our actions but as subtle and rational motives. He also claims that a person’s reaction can be revealed, at least very often, as the result of more than one emotion (like the result of sadness, affection, loneliness, all mixed in). And only a cognitive account seems able to make sense of such complexities and subtleties.

It is expected that specific emotions regulate the way in which we think, and that this will be relevant in memories, imagery, and expectations Ekman (1999). Therefore, we can be able to understand that how each emotion feels might be the center of what an emotion is. This presumably includes physical sensations and other feelings which are consequence of a feedback from the various response charges which occur uniquely for each emotion.

Ekman (1999) affirms that each emotion is not a single effective state, but a family if related states. Each member of an emotion family shares the characteristics that had been described before. This shared characteristics within a family differ between emotion families, distinguishing one family to another. So, he proposed a list to distinguished one emotion from another: amusement, anger, contempt, contentment, disgust, embarrassment, excitement, fear, guilt, pride in achievement, relief, sadness/distress, satisfaction, sensory pleasure, and shame.

According to the theory created by Palmer and Schloss (2010), named as “ecological valence theory” (EVT), the environment feedback required for a learning-based for color preferences is provided by the emotional outcomes of color-relevant experiences during a person’s lifetime. The more enjoyment and positive affect an individual receive from experiences with objects of a given color, the more the person will tend to like that color. Humphrey (2019) continues the same line of thinking when he says that even though the colors of many modern artifacts are almost completely arbitrary (e.g., the color of a shirt or a car) and thus do not have significant signal value, deeply ingrained natural signals (e.g., the redness of a blushing face) may be strong enough to influence color preferences.

Other authors, like Hurlbert and Ling (2007), also add that the gender difference forms the evolutionary/behaviorally adaptive hypothesis, in that they attributed the difference to the evolution of hunter-gatherer societies mechanism: Females like redder colors because their visual systems are

< Figure [20] Scenes from Cars: Showing the car’s bright colors and giving a perspective of moviment and action.

specialized for identifying red fruit/berries against green foliage, Ou et al. (2004) proposed an account based on "color emotions", which they defined as *"feelings evoked by either colors or color combinations"*. Color-emotions can be liked casually to color preferences if colors are preferred to the extent that viewing them produces positive emotions in the observer. They found that 67% of the variation in their color preference data can be predicted from three analytical dimensions derived from color emotion data: active/passive (active preferred), heavy/light (light preferred), and warm/cool (cool preferred).

Many scholars endeavored in this field, in which various emotion word pairs of descriptive dimensions and color preference were evaluated, including "like-dislike", "warm-cool", "heavy-light", "active-passive", "beautiful-ugly", "natural-unnatural", "dynamic-static", "cheerful-dismal", "unstable-stable", "strong-weak", "hard-soft", "transparent-turbid", "deep-pale", etc. (Xin et al., 2004; Ou et al., 2012).

Afterwards, many studies were concentrated on factors that influence color emotion and color preference, to seek the potential mechanism between color stimuli and human sensation. So far, the conceivable related factors include the sizes, materials, lighting conditions, backgrounds, surrounds of color stimuli, as well as the gender, age, nationality of observers, which might influence human's emotional responses. (Soen et al.,1987; Clarke and Costall, 2008).

Such as the cross-cultural study conducted by F. M. Adams and Osgood (1973), in which subjects from 23 different cultures rated color concepts (e.g., the words, "blue," "green," "yellow") using the semantic-differential factors (Osgood et al., 1957).

In their study the following effects of hue were evident across the 23 samples as a group: Blue and green were good; yellow was weak and bad; red was strong and active; black was bad, strong, and inactive; grey was bad, weak, and inactive; white was good and weak; and color was good and active. In addition, evaluation correlated strongly and positively with brightness, potency correlated positively with darkness, and activity was associated strongly with color (vs. no color).

Generally, the relevant research efforts have been attracted into two categories, one is the experimental aesthetics, i.e., color preference, such as "like" or "dislike", and the other one is concerned with the descriptive dimensions of colors such as "heavy" or "light", "warm" or "cool". (Gao and Xin, 2006).

Although, Wexner (1954) study dealt more generally with associations between color samples and words that describe feelings. His study is also relevant to this work since during his investigation he concluded that the color red was associated with "exciting" and "stimulating," both of which imply pleasure and high arousal. Blue was associated with "secure/comfortable" and "tender/soothing," which imply pleasure and low arousal. Orange was associated with "disturbing/distressed/upset," implying displeasure and high arousal. Black was associated with "powerful/strong/masterful," implying high dominance.

Furthermore, colors are frequently used to describe emotions such as “green with envy,” “red with rage,” and being “in the blues” when depressed (Carruthers et al., 2010). Some colors may be associated with several different emotions and some emotions are associated with more than one color (Linton and Linton, 1999; Saito, 1996).

Frank and Gilovich (1988) also investigated the effects of color association to emotions and found that it is also related to behavior. For instance, their search was about the color black versus nonblack uniforms of professional football and hockey teams on aggressive behavior. They found that black uniforms, compared with nonblack uniforms, not only were associated with greater degrees of perceived aggression but also led to higher levels of player aggressiveness. Furthermore, Boyatzis and Varghese (1994) found that light colors (e.g., yellow, blue) are associated with positive emotions (e.g., happy, strong) and dark colors (e.g., black, gray) with negative emotions (e.g., sad, angry). In a study examining color-emotion associations among college students in Australia, Hemphill (1996) also found that bright colors elicited mainly positive emotional associations, while dark colors elicited negative emotional associations, confirming the results obtained by Boyatzis and Varghese (1994). However, Saito (1996) found that the color black elicited both negative and positive responses among Japanese subjects, and that black was often a preferred color among young people.

Figure [21] ^
Scenes from Inside Out: Showing emotion variation in Riley's mind.


The Mind Reader
NO DESSERT!

THEORICAL ANALYSIS:

COLOR DESIGN

COLOR DESIGN

Choosing a color during the design process is not all about advertising and attention-grabbing. It's also about selling your product and appealing to certain instincts or desires that people have. Also, color is an indispensable element in design that can meet a variety of human needs, which is helpful for the color designers to understand the feelings of the target customers in many industrial fields such as architecture, cosmetology, advertisement, and automobile, etc. (Manav, 2007)

We're able to see different colors because of our retina's innate ability to differentiate frequencies of light waves. In a more scientific explanation Wright (1998) says that the psychology of color works as follows: when light strikes the eye, each wavelength does so slightly differently. Red, the longest wavelength, requires the most adjustment to look at it, and therefore appears to be nearer than it is, while green requires no adjustment whatever, and is therefore restful. In the retina, these vibrations of light are converted into electrical impulses which pass to the brain— eventually to the hypothalamus, which governs the endocrine glands, which in turn produce and secrete our hormones. In simple terms, each color (wavelength) focuses on a particular part of the body, evoking a specific physiological response, which in turn produces a psychological reaction. Wright also claims that particular colors have very different effects on each individual.

Furthermore, Whitfield and Whiltshire (1990) concluded that different experimental condition, including surround color, background color, and illumination etc., might influence human's emotional response and ultimately leads to different color meaning models. Color is an essential part of human-computer interaction, so designers should select colors with care. As this work will show, color is one of the most powerful tools for visual communication. It can influence our emotions, our mood, and our behavior. Johannes Itten (1973) explained his theory about color temperature and how it affects human emotions, he says that since red is always active, so blue is always passive, from the point of view of material space. From the point of view of spiritual immateriality, blue seems active and red passive. Blue is always cold; red is always warm. Blue is always shadowy and tends in its greatest glory to darkness. When blue is dimmed, it falls into superstition, fear, grief, and perdition, but always it points to the realm of the transcendental. Moreover, Greene et al. (1983) determined that warm colors increase stimulation compared with cool colors.

Color is just one of the tools that designers can play with during the working process, but at the same time, it's one of the tools that can be tricky to master. When talking about color is it also necessary to talk about color harmony. Itten (1973) explains about color harmony when he speaks about harmonious color combination. He explains that the combinations that are created based on a color harmony and uses someone personal taste is called subjective color, therefore they are individual opinion. With that in mind, he claims that any experiment that implies that this kind of color combination may revel character or mode of thinking or feeling should be approach very carefully. Although,

Heller (2022) also talks about subjective color in her study about color and feelings, she says that colors do not combine by chance neither they are a matter of individual preference. She explains that they are common experiences that have become deeply rooted in our language and our thinking, since childhood. With the help of psychological symbolism and historical tradition.

Furthermore, other studies like the one made by Gong et al. (2017) implied the influence of color impact according to the background that color is shown. According to them, the color black has a stronger visual impact on product color. They claim that data with only black background show less relativity in comparison to those with only white background, which implies that the black background may result in more influences in color emotion perception than the white background. It might be a common sensation for observers that a color sample viewed with black background would cause stronger visual impact in perceptual feelings than the same color sample with white background, because of the larger contrast between the black and most color samples. As an example, see figure 22.

In term of different areas of design color is very present and also is taking into consideration while choosing which type of emotion designers wants to bring from the consumer . Like in design interface, studies have shown that when a user encounters a target object, the color will attract the main visual attention within the first 20 seconds and its color will evoke their emotions. (Lyu et al., 2022; Bianchi and de Almeida Neris, 2015). Also, other studies claim that the correct interface color design can effectively and quickly express information and greatly improve the user's experience with the interactive system. (Jingxuan et al., 2017). Color and visual perception are combined during the design process to improve the performance of information. Simmonds and Reynolds (1989) affirm that color occupy an important position in user visual perception with the effective use of color matching on information display.

Moreover, the search of Lyu et al. (2022) also affirms that color and visual perception are related. According to them, the analysis of cold and warm colors in children's application interfaces, more specific in children's educational applications, mostly use cold colors as the main color because cold colors, such as blue, can make children concentrated and emotionally stable. The counter idea about warm colors is also consistent with the findings of Lee and Kim (2014) where they studied color psychotherapy in children, since they affirm that warm colors are mostly used in children's game app interfaces because warm colors, such as red, orange, and yellow, give people a feeling of enthusiasm, closeness, and clarity, which makes people feel excited and cheerful.

When it comes to architecture design, color began to gain more space over the years, during the 21st century, there has been a noticeable move toward the versatility of color in architecture (Miller, 1997; Caivano, 2006; Braham, 2019). The color of a construction is like the presentation of a product and acts as a stimulus care to create a first impression, favorable or negative. The interior colors influence our body, character, behavior and mood. This can be attested through an analysis of the color of buildings designed by some of the leading modern and contemporary architects, and a critical review of works written

Figure [22] > Scenes from Monsters Inc.: Showing the scene darkness and how it increses the dramatic impact.

about the colors used in their buildings (Serra, 2013).

Likewise, van der Voordt et al. (2017) found that white is the favorite color for working environment and living space. Color preference differs significantly in different genders, ages, and education levels. Furthermore, López-Tarruella et al. (2019) study on the relationship between nursing room colors and user's emotional response. Also, Taheri and Sichani (2015) found that the colors in hospital projects or the field of health are used as a complementary element for the rehabilitation of patients.

The application of colors on surfaces in architecture, influences the user's experience of the space as much as the constructive elements that make up an architectural object, making color an integral element in architecture; it is not only important aesthetically, but it also has a great psycho-sensory importance.

Furthermore, in fashion design the importance of color elements, together with materials, shapes and patterns, has become a kind of sentiment and image, which can respond to costumers' brain in the form of vision and later form the psychological effect (Zhang, 2013). As to illustrate the idea Woman's dress of Dior in the early spring of 2013 took garden as a theme, using blue and pink series, this collection created an image of young, elegant, and noble, meeting the psychological effect of the target and potential consumers who were looking for beauty and tenderness. Another example is Zegna, a famous Italian brand adopted neutral shades of red and blue, too. Such kind of colors together with stitching design and patterns reflected the sedate and mature brand image.

According to King (2017) it has only been in the last 35 years that color in fashion design has experienced such a change in pace on such a regular basis, and the cycle is gaining momentum each season, with stores and online retailers adding new lines every day. Consumers expect to see regular updates of product ranges, specially the younger, trend led demographic (Diamond et al., 2015). Also, it is common that forecasters take advantage of the importance attached to color by advancing a color palette for a given season.

Color forecasting began in 1915, according to Smith (2002) and is based upon analysis of cultural demographics and color patterns.

Also, Choo and Kim (2003) claimed that modern fashion goods consumers are sensitive to trends, and by the same token, fashion goods designers attempt to roll out products that match the current fashion trends as closely as possible. Fashion design history is often recognized by the colors or color combinations fashionable at the time. Examples include the raspberry pink and lime green of mid-twentieth century, or the pastels and filmy light tints at the end of the nineteenth century.

Indeed, color has been shown to develop in tonal stories in fashion design from one season to the next, as the consumer becomes familiar with the idea of buying into a particular color range (Perna, 1987). Also, it has long been recognized that color does indeed influence the consumers purchasing

behavior: many items of clothing are purchased in accordance with a particular ‘color code’, conservative, dark tones in men’s suiting have been matched by women adopting similar neutral colors (Fehrman and Fehrman, 2000).

many of the films produced by Pixar Animation Studios build on this legacy of animation and deploy it to address the company’s history and explore the effects of socio-cultural and technological change. Despite an ongoing interest in realistic animation, Pixar’s features indicate that the digital era does not amount to a fixation on simulation or the suppression of playful, cartoon presentations.

COLOR
ANIMATION

COLOR ANIMATION

It is through the senses that we relate to our surroundings.
Sensory organs capture information from the outside world, transmitting it to the brain, which processes, decodes, and understands it.

So, when the brain assigns meaning to the impulses the eyes send to it, there is the visual perception of seeing/understanding. In fact, through the senses and, consequently, through perception, we become aware of reality: due to this ability, we can perform actions as simple as identifying, capturing the shape and locating objects, orienting ourselves, moving, having a sense of depth, and see color. This last point, one of the most basic phenomena of perception, forms part of this study and is what we are interested in understanding.

Even though there are no guidelines on how to use color and which specific emotion it will reveal while watching a movie. It helps to understand its cognitive effect. In their video, The Cinema Cartography (2015) explains how colors affect us on a physiological level during a movie. Its use can create some atmosphere during the narrative, and specific color schemes can intensify that too.

PIXAR ANIMATION STUDIOS

According to Ed Catmull (2018), Pixar began its life as an independent company in 1986, when Steve Jobs bought the computer division from Lucasfilm, allowing the team to pursue the dream of producing computer-animated movies. Steve gave backbone to their desire for excellence and helped them to form a remarkable management team. He says that Pixar captures what's best about all the places he has ever worked. A number of them have stuck together for decades, pursuing the dream of making computer-animated films, and they still have the pleasure of working together up until today.

Pixar Animation Studios' films are built on animation's legacy and deploy it to address the company's history and explore the effects of sociocultural and technological change (Herhuth, 2015). Despite an ongoing interest in realistic animation, Pixar's features indicate that the digital era does not amount to a fixation on simulation or the suppression of playful cartoon presentations. Instead, their films explore aesthetic experience and express the challenges of living in a plural world in which knowledge is limited and nature is subject to change.

John Lasseter, the chief creative officer at Pixar and Walt Disney Animation Studios, explains that his primary goal and artistic passion is to provide entertainment for children and families (Amid, 2015). Lasseter has described Pixar's mode of production as one in which storytelling drives technological innovation, believability is preferable to realism, and emotionally compelling character growth serves as the foundation to every film. Also, he says the creative process at Pixar is about building an animated world around this emotional core and finding ways of telling the story visually.

A movie contains, literally, tens of thousands of ideas. They're in the form of every sentence, the performance of each line, the design of characters, sets, and backgrounds. They are also in the form of locations of the camera, the colors, the lighting and the pacing. The director and the other creative leaders of a production do not come up with all the ideas on their own. Rather, every single member of the 200 to 250 person production group makes suggestions. Creativity must be present at every level of every artistic and technical part of the organization (Catmull, 2018).

For example, the movie UP constantly uses bright and vibrant colors while showing Carl's wife, Ellie, who is very energetic and outgoing. Perhaps, an analysis of her color scheme and personality would be interesting to verify if her color scheme is associated with her happy personality. Based on that, it could also be studied if her color scheme leads the viewer to believe that she brings color to Carl's life. Perhaps, her color scheme intends to pass the idea that her personality brings color into Carl's life.

Another atmosphere created by the color scheme can be seen in Luca's movie. It is associated with the story arc changing, which is also related to the character's development. The film starts in the bottle of the ocean, with the predominant colors being green and blue. As the story goes on, the colors change to more vibrant tones, such as orange and yellow, showing the characters' progress and their maturity is being developed.

Which reinforces the idea that in storytelling, color can be associated with a character, elicit a psychological reaction, draw focus to important details and show history transition, all based on the color scheme (Stone, Adams & Morioka, 2008). For example, in an associative scenario, the color can be used by a character so much that it is possible to relate that color to it, inside our subcontinent, during the movie.

Color perception can be approached from two different perspectives: physiological and psychological. Suppose perception is not limited to sensory activity and is then "the act or effect of perceiving". In that case, it is not enough for us to know the mechanisms of the visual system and the scientific theories of color to understand it.

For the perception of color, it will also be important to expose how we interpret it at a psychological level and in which sociocultural values are implicit. According to Feisner and Reed (2014), "Color can be described through two very different methods or points of view: objectively, when it refers to the laws of chemistry, physics, and physiology. The other method is subjectively, when it considers the concepts found in psychology. Likewise, our perception of objects depends either on physical factors — such as their actual colors (the name of a color: red, yellow, blue), their luminosity or darkness concerning the environment (value or hue) — whether from more psychological and cultural factors".

Figure [23] > Scenes from Luca. Showing the bottom of the ocean.

However, despite several authors claiming that color can be a narrative element (Brito & Cho, 2017; Sun, 2015; Ren, 2020), they can only prove it through the

analysis of specific cases. There are no general standards or a fixed system that can be applied to all films. This allows us to answer how color acts or functions as a narrative element. Taking into consideration that the connotations of a color are always related to the context in which it is inserted (Heller, 2014).

Also, Itten (1970) claims that symbolism without vision accuracy and emotional force would be merely anemic formalism. Visual impressive effects without symbolic veracity and emotional power would be a banal imitation of naturalism. Emotional effects without constructive symbolical content or visual strength would be limited to the plane of sentimental expression. Even so, several theorists, philosophers, and researchers have dedicated themselves to its study over the years. Color continues to be an object of analysis.

“Color Consciousness” by Natalie Kalmus (1935) shows concern for understanding color as a functional element, which contributes to the narrative of a film. Kalmus cites some painters, such as Goya, Velasquez, Rembrandt, in order to inspire the preparation of the color palettes he used in the films he collaborated on, in a deliberate attempt to give color films the status of ‘art’ (Hanssen, 1999).

It is important to keep in mind that during this period, the role of color in cinema was fiercely discussed, as it was a novelty that generated controversy. Until then, cinema was widely understood as an instrument for documenting the phenomena of the world. Colors were originally found in a culture of sensationalism and commerce, in media such as advertising and comics. (Hanssen, 1999, p. 13, free translation).

Herbert T. Kalmus, the president of the Technicolor Motion Picture Corporation, stated that if a screenplay for a film was conceived, planned, and written in black and white, then it should, by no means, be done in color. If we intend to make a film in color, then the story and the scenarios must be designed in this sense from the beginning. In order to create environments, emphasize personalities, and achieve the desired effects. Color should flow from sequence to sequence, supporting and propelling the narrative — becoming an integral part of it rather than just an accessory element (Deutelbaum, 2006).

We can draw two important conclusions from this statement. The first is that when we talk about films, we cannot think of color as something static but rather as an element that flows from sequence to sequence and relates to all the other components of the film. The second is that narrative has to be taken into consideration when giving meaning to color. Therefore, it would be wrong to think that there are strict formulas for categorizing colors, just as they do not have meanings attached and there are no rules for their use. For example, red will not necessarily symbolize “passion”, nor will blue have to convey “calm”.

As Hanssen (1999) says that applied color can constitute and play with several levels of different meanings at the same time, and therefore the search for a particular association is very problematic. Edward Branigan (2017) says that color does not have an intrinsic meaning. However, it does not mean that color

< Figure [24]
Scenes frm the movie UP showing variation of color saturation expressing intensity.

has no meaning. Sergei Eisenstein (2014) explains that the definitions and values of colors depend on the organic unity of each individual work, stating that this is a prominent feature of art.

Let us analyze the movie UP again, using the same idea. Since Ellie is always shown in bright colors, it is possible to associate Ellie's personality with these colors. This association creates a happy and fun atmosphere towards her. As she gets sick, those colors fade and become last saturated, showing an atmosphere of caution and tension, like something bad will happen. The colors have a dark color tone at her funeral, but they are highly saturated with pink. Those dark tones pass the idea of Carl's grief. However, the use of intense pink gives the idea of a strong emotion running high associated with a bright color related to Ellie. Carl also holds a blue balloon during this scene. The balloon symbolizes the memory of their years together. Whenever this object appeared before, the color was always the same, which can also be associated with Carl. After Ellie is gone, the colors in Carl's life become monotone and less saturated, giving the idea of a boring life without Ellie next to him. See figure 24.

On the other hand, a transitional color scheme is noticeable in Luca's movie. See figure 25, where the story shows a progressive variation of color to create an atmosphere. When the movie begins, it shows the bottle of the ocean where Luca lives. There, everything is calm and has nature all around. At first, the predominant colors are blue and green, respectively. Green is also related to immaturity (Heller, 2014), which makes complete sense since this is the beginning of the story and Luca's personality is undeveloped. When he meets Alberto, the adventure begins, and the color scheme changes to a different one with more orange and yellow. These colors pass the idea of a happier but uncertain environment respectively (Heller, 2014). While they spend their time together on the island and form their friendship, the colors change between green/blue and orange/yellow. At this point of the narrative, the color starts to transit until they decide to explore the city. The blue and green fade away when they get there and the idea of home and security is gone now. A color scheme of red, pink, orange, and yellow are more predominant in the city. Those colors can be related to danger, playfulness, sociability, and insecurity (Heller, 2014). All those mixed features create an adventure atmosphere during the movie.

One of the ultimate goals of a movie is to convey a sense of emotion through the artistic choices made in each scene. Thus, if filmmakers and designers select color carefully, it can cause a greater impact on their viewers (Birn, 2006). This should be a topic of great interest and concern when developing a project. In particular, the importance of color in visual communication, where it assumes an aesthetic and a practical function above all. Also, due to its range of articulation with elements inside or outside animation, the color goes beyond an orientation of reading the images: it creates meanings, sensations, or emotional states that "are not easily described or assumed in the narrative" (Price, 2006). Color is no longer just an aesthetic issue to be assimilated as a structural element of the image, which raises interpretations and contributes to the film's narrative.

< Figure [25]
Scenes from the movie Luca showing the daylight variation based on color.

METHODOLOGY

METHODOLOGY

METHOD

The purpose of this study is to, first, research the theoretical field of color theory, taking into consideration its history and relevance to graphic design, then, the second topic is a investigation about Pixar animated movies to find out the associative colors and how the relationship between color and characters are used base on color theory, to analyze if the characters convey the emotion they are suppose to.

This research project focuses on analyzing Pixar animated film characters and how they are built based on their color scheme. Also, to explore the emotions, they transmit based on color theory. Therefore, for a better and more profound analysis, the work will analyze the animation from 1995 until 2021, which are:

Toy Story (1995) is an animation is about the 'secret life of toys' when people are not around. A group of toys are preparing to move into a new house and Woody, a good-hearted cowboy doll who belongs to a young boy named Andy, sees his position as Andy's favorite toy jeopardized when his parents buy him a Buzz Lightyear action figure. Even worse, the arrogant Buzz thinks he's a real spaceman on a mission to return to his home planet. When Andy's family moves to a new house, Woody and Buzz must escape the clutches of maladjusted neighbor Sid Phillips where they will get into all kind of trouble while trying to get home and reunite with their boy.

Toy Story 2 (1999) tells the story when Woody was stolen from his home by toy dealer Al McWhiggin, leaving Buzz Lightyear and the rest of the gang to trying to rescue him. But when Woody discovers that he's actually a valuable collectible from a once-popular television show called "Woody's Roundup" and is reunited with his horse Bullseye, Jessie the yodeling cowgirl and his faithful sidekick, Stinky Pete the Prospector, he doesn't want to leave. It's now up to Buzz Lightyear and the gang from Andy's room - Mr. Potato Head, Slinky Dog, Rex and Hamm - to spring into action and save their pal from winding up as a museum piece and to be sold to Japan.

^ Figure [26]
Poster from Toy Story

^ Figure [27]
Poster from Toy Story 2

Figure [28] ^
Poster from Monster Inc.;
Figure [29] ^
Poster from The Incredibles;
Figure [30] ^
Poster from Cars;

Monsters, Inc. (2001): In a world behind our closet doors, monsters reign supreme. The utility company Monsters Inc. specializes in fueling their world with the screams of human children. A team of monster scarers led by lovable Sulley and his wisecracking best friend Mike work hard and long hours to ensure the fuel of the screams. But things go crazy when Sulley discovers a mysterious door and a runaway little girl running amok. However, both Sulley and Mike discover that the little girl (Boo) is not actually dangerous, so they must bring her home to the human world. But what the duo doesn't know is that Boo is actually the key to a sinister conspiracy to saving the monster world from a rising crisis. Than, Sully and Mike will fight to protect the innocence of the children they scare every night.

The Incredibles (2004) tells a story where superheroes are no longer a secret to the world; their identities are known to the US Government and they've become model citizens in a conforming world. Bob Parr (A.K.A. Mr. Incredible), and his wife Helen (A.K.A. Elastigirl), used to be one of those superheroes in Metroville, always saving lives and battling evil on a daily basis. But 15 years later, they have been forced to adopt civilian identities and retreat to the suburbs where they have no choice but to retire as superheroes to live a "normal life" with their three children Violet, Dash and Jack-Jack, who were born with secret superpowers. Itching to get back into action, Bob gets his chance when a mysterious communication summons him to a remote island for a top-secret assignment. He soon discovers that it will take a super family effort to rescue the world from total destruction.

Cars (2006) has his protagonist, Lightning McQueen, on his way to the biggest race of his life, but he got disconnected from his truck hauler, Mack, on his way to the race and winds up in Radiator Springs, a small town in Carburetor County on Route 66. McQueen damages the road and has to repair it watched by the Sheriff or Mater. As McQueen fixes it, he meets a rusty old tow truck, a pretty Porsche, a grumpy old Hudson Hornet, a Ferrari-loving Fiat, and many more nice folks, including Sally, a snazzy 2002 Porsche, Doc Hudson, a 1951 Hudson Hornet with a mysterious past, who help him realize that there are more important things than trophies, fame and sponsorship.

WALL-E (2008) is a movie about a distant future wher humans abandon Earth because there is too much trash on it. WALL-E lives alone on the planet with a pet cockroach. He has a habit of picking up everything he finds interesting, so he has quite a collection of things, from lighters to a working iPod and even a small ring box (without the ring). He even

has the last living plant. When a spaceship comes to earth and drops a sleek and dangerous probe EVE to look for a living plant, WALL-E falls in love with her. WALL-E gives her the plant, which makes EVE go into sleep mode. When a spaceship comes to take EVE back, WALL-E too goes with her. What follows is an adventure onboard the Axiom, where people move on hovering chairs and get liquid food which they suck up through a straw. Due to laziness, they have become so fat that they are unable to move. Due to hastily given instructions given to it, auto, the autopilot it tries to get rid of the plant which compels WALL-E, EVE, the pilot and some malfunctioning robots to find a way to retrieve the plant and save the earth.

Up (2009) starts with the story of little Carl Fredricksen, who is a dreamer and idolizes the adventurer Charles Muntz. One day he meets Ellie, who also worships Muntz, and they become close friends. However Charles Muntz falls into disgrace due to his adventure goes wrong. Therefore, Charles travels in his blimp to South America to try to reinstate his pride back, but is never seen again. Eventually Carl grows up and marries Ellie. They promise each other that they will travel together to Paradise Falls and build a house there. Although, many years later, Ellie dies and lonely Carl refuses to move from their home despite an offer from the owner of a construction company. When Carl accidentally hits a worker who damaged his mailbox, he is sentenced to move to a retirement home. However, after he uses many balloons attached to his house, he is able to float it in order to travel to Paradise Falls as he and Ellies always dreamed. Adventure ensues, Along the way he forms a bond with a boy called Russell and realizes the importance of friendship and see the importance of leving the moment and care about others as well.

Toy Story 3 (2010) happens when Andy reaches the age of 17 and is ready to head off to college, leaving Woody, Buzz, Jessie, and the rest of the toy-box gang to ponder their uncertain futures. When the toys are accidentally donated to the Sunnyside Daycare center they're initially overjoyed to once again be played with, but their enthusiasm quickly gives way to horror as they discover the true nature of the establishment under the rule of the deceptively welcoming "Lotso" Bear. Now, all of the toys must band together in one final, crazy scheme to escape their confines and return home to Andy.

^ Figure [31]
Poster from Wall-e;
^ Figure [32]
Poster from UP;
^ Figure [33]
Poster from Toy Story 3;

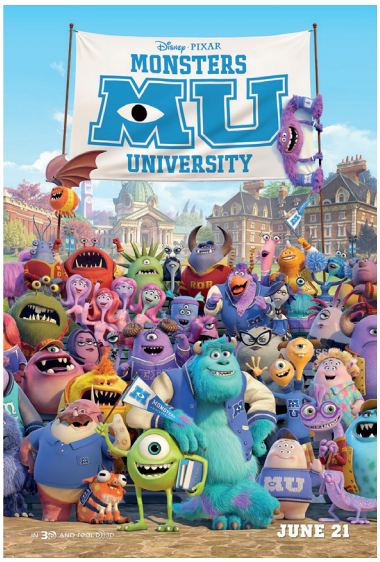


Figure [34] ^
Poster from Cars 2;
Figure [35] ^
Poster from Brave;
Figure [36] ^
Poster from Monsters University;

Cars 2 (2011) continues the story from the first movie, and Lightning McQueen and his team are invited to compete in the World Grand Prix race. There, McQueen's best friend Mater finds himself involved in international espionage, and alongside two professional British spies attempts to uncover a secret plan led by a mysterious mastermind and his criminal gang, which threatens the lives of all competitors in the tournament.

Brave (2012) tells the story of Princess Merida, the impetuous, but courageous, daughter of Scottish King Fergus and Queen Elinor, is a skilled archer who wants to carve out her own path in life. Her defiance of an age-old tradition angers the Highland Lords and leads to chaos in the kingdom. Merida seeks help from an eccentric witch, who grants her an ill-fated wish. Now, Merida must discover the true meaning of courage and undo a beastly curse before it's too late.

Monsters University (2013) travels back in time to when Monsters, Inc. employees Mike Wazowski and James Sullivan were just two promising young students at Monsters University in this frightfully fun Pixar prequel. Long before they were lurking in closets for a living, Mike and Sully were just two Scaring majors at Monsters University, dreaming of the day they would make children shriek in terror. When their heated competition to be the most fearsome in their class gets out of hand, however, Mike and Sully find themselves ejected from the prestigious Scare Program, and they are forced to seek the aid of their oddball friends in order to get their educations back on track.

Inside Out (2015) Emotions run wild in the mind of a little girl who is uprooted from her peaceful life in the Midwest and forced to move to San Francisco. Young Riley was perfectly content with her life when her father landed a new job in San Francisco, and the family moved across the country. Now, as Riley prepares to navigate a new city and attend a new school, her emotional headquarters becomes a hot bed of activity. As Joy attempts to keep Riley feeling happy and positive about the move, other emotions like Fear, Anger, Disgust and Sadness make the transition a bit more complicated.

Cars 3 (2017) starts with Lightning McQueen happily winning all of his races until a new generation of high-tech racers are trained. They all zoom past McQueen, leaving him fading behind. Jackson Storm, a new-gen, wins four times in a row as McQueen pushes himself too hard and crashes. In order to get back on the race track, he needs training from a young racing technician at the Rust-eze Racing Center, Cruz Ramirez. Cruz and Smokey Yunick, the former engineer for the Fabulous Hudson Hornet, help McQueen best they can. With cheering from Mater, Luigi, Guido, and Sally, McQueen could

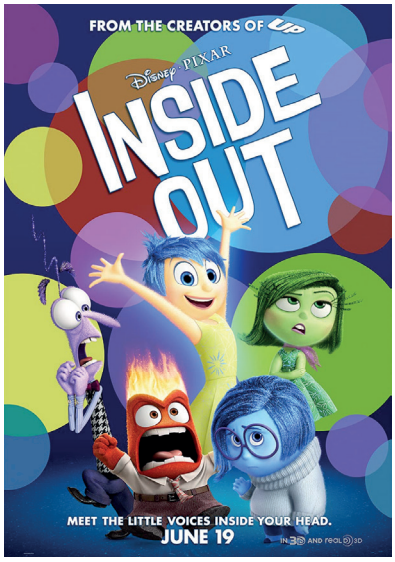
possibly beat Storm in the Florida 500 by learning a few tricks from the history of the Fabulous Hudson Hornet.

Coco (2017) begins with Young Miguel simply loves music. But his family has a mysterious ban on anyone from their clan performing music. The ban dates back for many generations yet Miguel dreams of becoming an accomplished musician just like his idol, Ernesto de la Cruz. Longing to prove his musical talents, Miguel finds himself in the technicolor Land of the Dead. Along his way, he meets the charming trickster Hector, and together, they set out to find the real story behind his family's mysterious ban on music.

Incredibles 2 (2018) the superheros as still balancing between legality and illegality, and always bargaining in the shadow of the law after the events of first sequel the extraordinary Parr family again have a brush with Metroville's police after leaving a trail of destruction in their wake during an epic battle with the Underminer. Under those circumstances, and with the government officially shutting down the secret superhero program, the upbeat benefactor and telecommunications tycoon, Winston Deavor, and his ever-watchful sister Evelyn approach the family in an attempt to restore the Parrs' tarnished public image; however, only Elastigirl gets to be the campaign's new face. Now, the once-popular Mr Incredible has to juggle domestic responsibilities with taking care of the kids, as the invincible super-mum and the household's new breadwinner clashes head-on with the city's latest mega-villain, Screenslaver.

Toy Story 4 (2019) stars with Woody, Buzz Lightyear and the rest of the gang embark on a road trip with Bonnie and a new toy named Forky. The adventurous journey turns into an unexpected reunion as Woody's slight detour leads him to try to find his long-lost friend Bo Peep in a pownd shop, but he got trapped by the selfish Gabby Gabby and her group of puppet toys whom won't let Woody or Forky leave the place without a price. As Woody find Bo they discuss the old days but they soon start to realize that they're two worlds apart when it comes to what they want from life as a toy, each one deciding to leave in different directions in the end.

Onward (2020) takes place in a suburban fantasy world with two teenage elf brothers, Ian and Barley Lightfoot, as principal characters. Due to a gift left by their deceased father, they go on a journey to discover if there is still a little magic left out there in order to spend one last day with him, who died when they were too young to remember. Like any good quest, their journey is filled with magic spells, cryptic maps, impossible obstacles and unimaginable discoveries. When the boys'



^ Figure [37]
Poster from Inside Out;
^ Figure [38]
Poster from Cars 3;
^ Figure [39]
Poster from Coco;

Figure [40] ^
Poster from The Incredibles 2;
Figure [41] ^
Poster from Toy Story 4;
Figure [42] ^
Poster from Onward;

fearless mom, Laurel, realizes that her sons are missing, she teams up with the legendary winged-lion-scorpion former warrior - The Manticore - and heads off to find them. Perilous curses aside, this one magical day could mean more than any of them ever dreamed.

Soul (2020) Joe Gardner is a middle school teacher with a love for jazz music. After a successful gig at the Half Note Club, he suddenly gets into an accident that separates his soul from his body and is transported to the You Seminar, a center in which souls develop and gain passions before being transported to a newborn child. Joe must enlist help from the other souls-in-training, like 22, a soul who has spent eons in the You Seminar, in order to get back to Earth.

Luca (2021) is set in a beautiful seaside town on the Italian Riviera, the original animated feature is a coming-of-age story about one young boy experiencing an unforgettable summer filled with gelato, pasta and endless scooter rides. Luca shares these adventures with his newfound best friend, but all the fun is threatened by a deeply-held secret: he is a sea monster from another world just below the water's surface and together with Alberto and Giulia, they will pass through many adventures and learn the importance of friendship and that leaving your confortable zone is also important for you to grow up.

Although we left aside the animations with animals as the main character, such as A Bug's Life (1998), Finding Nemo (2003), Ratatouille (2007), The Good Dinosaur (2015), and Finding Dory (2016) since in those movies, the animals already have preset colors in nature, so their color won't reflect their personality. Also, in the case of animations that have more than one film, we'll look at the main characters from the first feature film but also the respective villains from each sequel.

The first investigation will explain the beginning of color theory, mentioning scientists like Isaac Newton and his prism and Goeth's discovery of the relationship between color and emotions. Until the present time, with the creation of the color wheel, the color chord, and some others. The second research is more practical than the previous one and has two parts. Both parts will use comparative analysis. The first part is based on the characters from the movies mentioned previously, where an individual examination of each character's color scheme will be collected. This color scheme will be related to the basic emotions mentioned by Ekman (1999). Then,

a comparison between color and emotion will be made based on correlation statistics to verify which color relates to which emotion. Then, these results will be analyzed based on the color theory, for this analysis, we will use the research from Heller (2014) as our primary case of study. In the end, our goal is to determinate if the character's color relates to the emotions the character is supposed to convey.

^ Figure [43]
Poster from Soul;
^ Figure [44]
Poster from Luca;

BASIC EMOTIONS

As mentioned before, the study of emotion by itself is very confusing, and the investigation in this area splits results. Therefore, to avoid misunderstandings about this topic, for this research, it was decided to use Ekman's ideas as a foundation for analyzing basic emotions. Where he claims that emotions are also submitted to memory and life experience, where its division leads to splitting them into families to distinguish one from another.

Ekman (1999) says that the distinctive feature of each emotion, including the changes not just in expression but in memory, imagery, expectations, and other cognitive activities, could not occur without central nervous system organization and direction. His position about emotions is that they are two distinct modes: one automatic, reflective, and unconscious, and the other deliberated and conscious.

He also claims that the term "basic" has three meanings. Still, for this investigation, we will focus on the third meaning, where he affirms that each emotion is not a single effective state but a family with related states. Each member of an emotion's family shares characteristics. These shared characteristics within a family differ between emotional families, distinguishing one family from another. So, he proposed a list to distinguish one emotion from another: amusement, anger, contempt, contentment, disgust, embarrassment, excitement, fear, guilt, pride in achievement, relief, sadness/distress, satisfaction, sensory pleasure, and shame.

This is the list of basic emotions used in this investigation. It will be compared with colors using the correlation method. This method will use statistics to verify the relation between color and emotion. The only emotion from this list that will not be in the analysis is the "sensory pleasure" since this is related to a sensory act and could not be analyzed in this theoretical investigation.

THE CHOICE OF COLORS

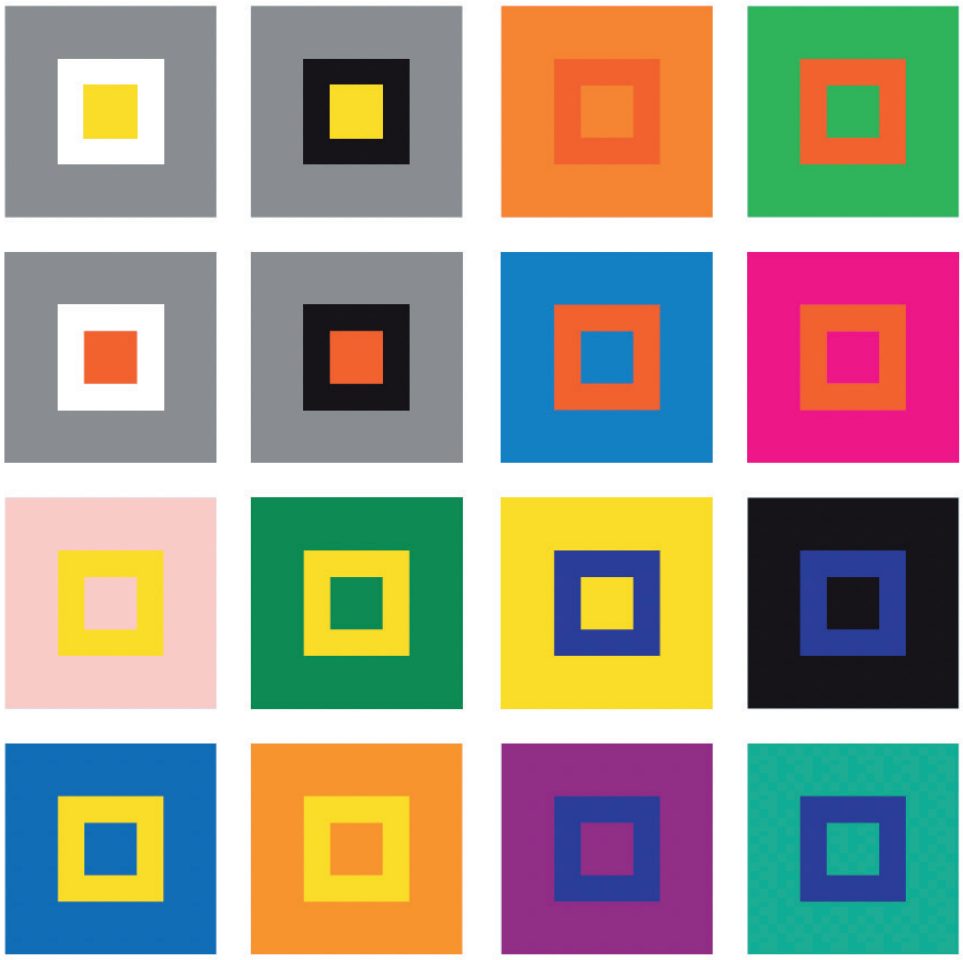
Accordingo to Sam Adams (2017) the constant experimentation that occurs in the design process brings to light which colors are most pleasing to a particular designer's eyes. By understanding that all color is relative, designers can observe for themselves the effects colors have on each other. Sometimes a slight variation in tint or shade is enough to create the required emotional and aesthetic feeling.

Optical color mixing, also referred to as partitive color or simultaneous contrast, is another important contextual phenomenon. This is the color perception that results from the combination of adjacent color areas by the eye and brain. Human perception mixes colors that are next to each other and forms a color impression based on the entire composition. The viewer may perceive colors that are not actually present. If it is imperative that a specific color is perceived first by the viewer, be sure to keep this phenomenon in mind.

In addition, a hue's position on the color wheel can affect the perception of other hues. Hues that are next to each other have an easier relationship than those that are opposite each other, which results in active complementary contrast. The concept of the advancing and receding natures of colors must also be considered. Warm colors always advance and seem nearer, while cool ones recede and seem more distant.

Color is derived from light, either natural or artificial, but not everyone's color-sensing cells respond alike. According to Adams, the identification of a specific color is highly subjective. Since our eyes have three types of color receptor cells, or cones: red, green, and blue. As a result, all incoming light is reduced to these three colors. All perceived colors are generated by a mixture of these three colors. However, according to him, not every color can be seen by humans.

For this work we decided to work with Johannes Itten (1970) concept of color wheel and color sphere. Also, the idea of subtractive primary colors, explained by Adams (2017), which falls into two types: the printer's primaries,



< Figure [45]
An illustration of color effects—how one color impacts another.

which are cyan, magenta, and yellow (CMY), and the artist's primaries, which are red, yellow, and blue (RYB).

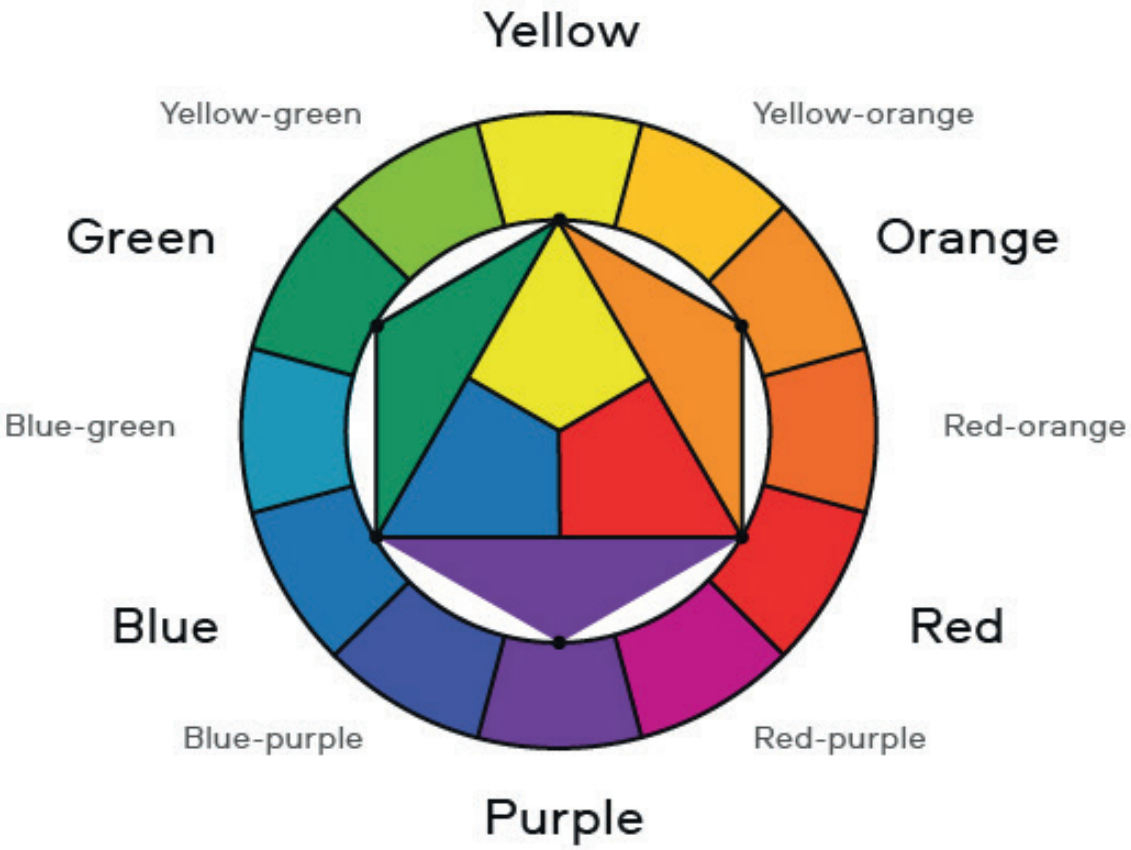
Also, environmental influences change color perception, so the end use of the piece—its particular medium—must be considered as well. A design for a retail environment involves different considerations than a design for television broadcast, for example. Both applications require that the design be seen, be understood, and communicate a given message. However, the color considerations may be totally different.

A retail product package color is probably chosen in relation to other products—if every other competitor is pink and purple, then perhaps orange is a better choice. The color helps the product stand out. This is an example of the context influencing the concept as well as creating an idea that is context specific.

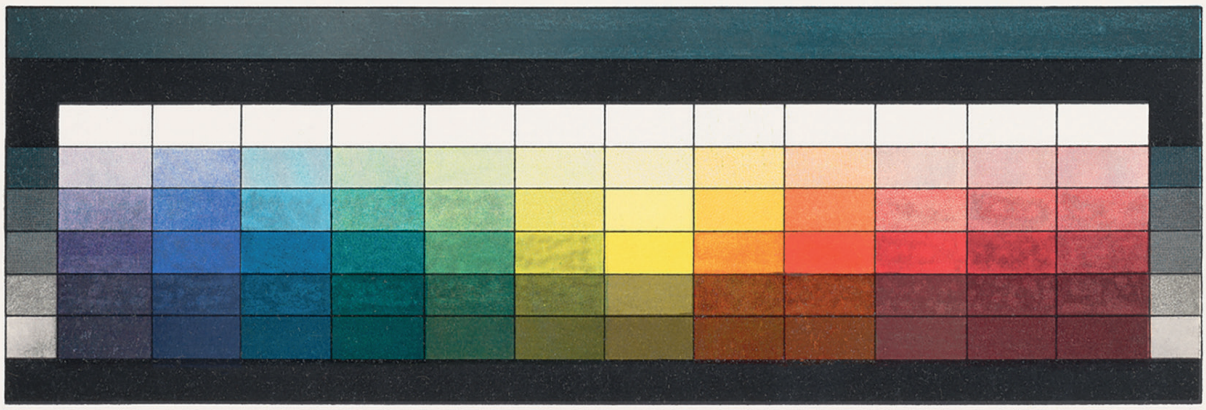
COLOR WHEEL

Itten (1970) developed a color circle starting from the primary colors: Yellow, red, and blue. In this circle, he also included mixed colors, each composed of primary and secondary colors: orange, green, and violet. After that, the circle mixes primary and secondary colors again and the tertiary colors: yellow-orange, red-orange, red-violet, blue-violet, blue-green and yellow-green. Finally, the regular 12-hue circle has been constructed. According to Itten, this sequence is that of the rainbow or natural spectrum.

Furthermore, in an attempt to provide a clear and complete map of the world of color, Itten (1979) explained the color sphere. According to him, the sphere is the elementary shape of universal symmetry. It serves to visualize the rule of complementary. It illustrates all fundamental relationships among colors, chromatic colors, and black and white. Where 12 hues are displayed from white to black. Since we cannot reproduce the sphere on a plane and the result is a 12-pointed star, where white is in the center, then we have the zone of tints, the zone of pure hue, and two zones of shades with black at the extreme point of the star.



^ Figure [46]
The Color Wheel
By Johannes Itten.
1961.



Farbenkugel

in 7 Lichtstufen und 12 Tönen

von

Johannes Itten.

ADDITIVE COLOR

According to Adams (2017), additive colors, or rgb are used by designers while working with rays of colored light, as on computer screens, since visible spectrum colors are pure and represent the greatest possible brightness or intensity. When these colors overlap, other colors are produced: red and blue light form cyan; red and green light form yellow; and green and blue light form magenta. When all three additive primaries overlap, white light is produced, see figure 31. It is called them additive because all together, these primaries create white. rgb reflects actual human color receptors. Mixtures of these primary colors produce a large part of the human color experience. Television sets, computer monitors, cameras, and color scanners all produce mixtures of red, green, and blue.

SUBTRACTIVE COLOR

Adams (2017) also explained about subtractive color, he says that this type of color is experienced through reflected light. There are two sets of subtractive primary colors: the artist's primaries — red, yellow, and blue (RYB) — and the printer's primaries — cyan, magenta, and yellow (CMY) — transparent inks and dyes. Coupled with black, known as K, we get CMYK, or a four-color process. Each of these triads is combined to produce all visible colors. In the subtractive CMY model, magenta combines with yellow to form red, yellow and cyan form green, and cyan and magenta form violet (purple). In the case of both versions of the subtractive primaries, when all the primary colors are combined, black is produced, and no color is reflected.

In the RYB triad, see figure 49, red combines with yellow to produce orange, red and blue create violet (purple), and blue and yellow create green. RYB, the primary color system used in art classes, forms the basis of most color theories. As with CMY, black is produced when all the primary colors are combined, see figure 33. Therefore, no color is reflected. The secondary colors produced by the three triads indicate the purity of the colors that can be obtained by the different mixing methods. RGB makes pure CMY as secondary colors, and the CMY triad produces RGB as secondary colors. Still, they are duller than pure RGB light. The secondary colors resulting from RYB are even softer than those in the RGB or CMY triads.

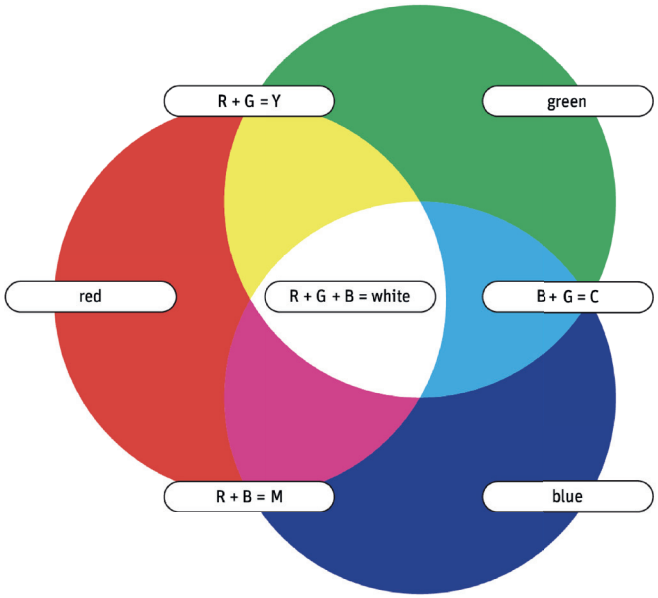
So, for this work we decided to use as main palette the two types of primary colors: the additive colors (RGB): red, green, and blue with the mixture of colors that results from this primary colors overlaps, which are cyan, yellow, magenta and white, please see Figure 48. Followed by the subtrative colors (RYB): red, yellow, blue, and its overlap colors results, such as, orange, green, purple and black, see Figure 51. And the subtractive color (CMY): cyan, magenta, yellow and, also, its overlap colors, blue, red, green and black, see figure 52.

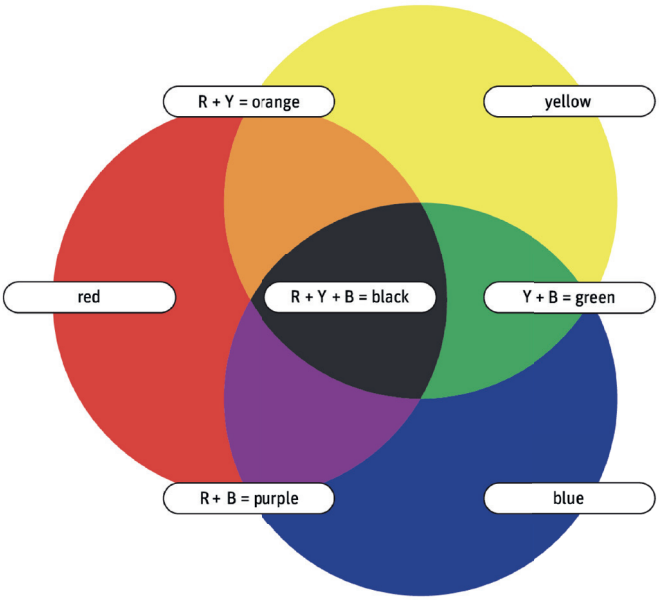
So, after putting the primary colors together and eliminate the color that repeted, the result of the main color palette is red, yellow, green magenta, blue, cyan, white, orange, purple and black, as seeing in the Figure 53.

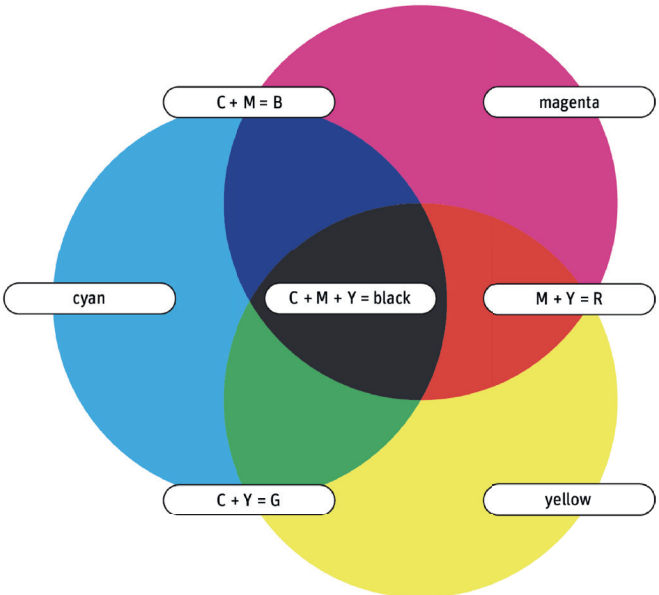
< Figure [47] Color sphere in 7 light values and 12 tones, Johannes Itten, 1921. Lithograph. 74.3 x 32.2 cm. From Bruno Adler, ed., Utopia: Dokumente der Wirklichkeit I/ II (Weimar, 1921), foldout from inside cover.

Even though we had the main color palette it was necessary a bigger range of hues, so we decided to use a darker tone and a brighter tone. So for each color we decided to add two more colors, one with 50% less saturation and another with 50% more saturation. The result was 28 colors as show in the figure 54.

Color science becomes art when a designer knows how to use colors, in what proportions, and for what purpose, to create a response. Designers know that contrast intensifies color. Fully saturated colors create a lively impression. White and black alter the perception of other colors. Different types of color schemes have different positive and negative factors.



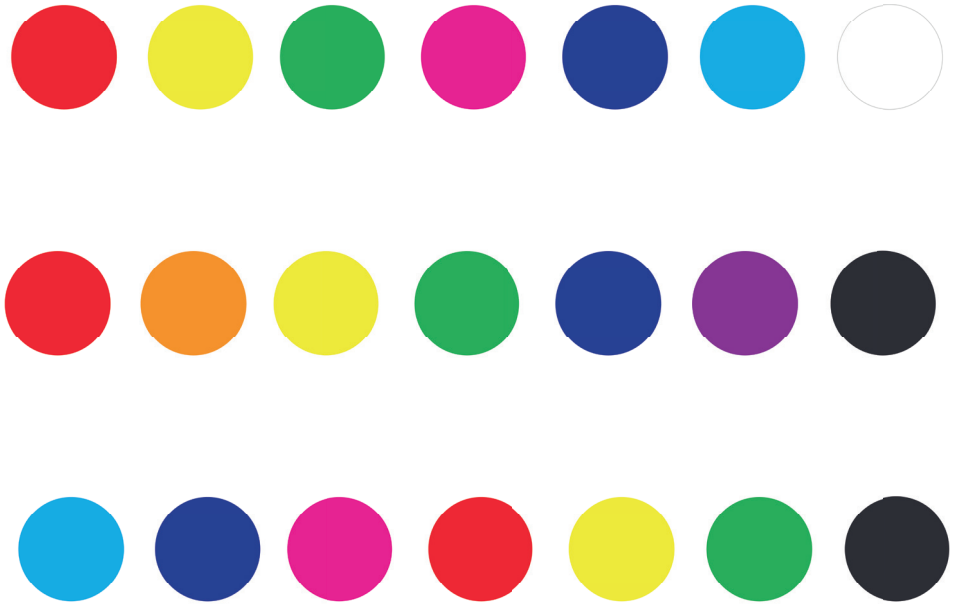




^ Figure [48] Additive Color The RGB Primaries (light).

^ Figure [49] Subtractive Color The RYB Primaries (Opaque Pigments).

^ Figure [50] Subtractive Color The CMY Primaries (Transparent Pigments).



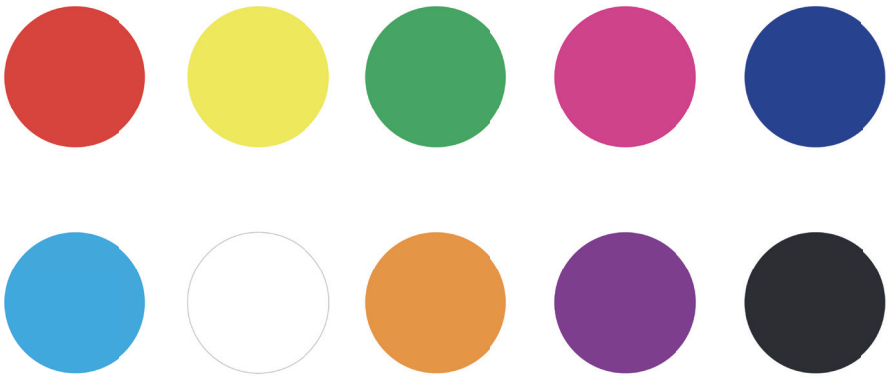


Figure [51] ^
Color palette based on additive color RGB.

Figure [52] ^
Color palette based on subtractive color RYB.

Figure [53] ^
Color paltte based on subtractive Color CMY.

Figure [54] >
Teste 1 - Color palette.

^ Figure [55]
Final color palette based on all colors and its saturation variation.

THE CORRELATION

In statistics, correlation or dependence is any statistical relationship, whether causal or not, between two variables. Although in the broadest sense, “correlation” may indicate any type of association, in statistics it normally refers to the degree to which a pair of variables are related. Familiar examples of dependent phenomena include the correlation between the height of parents and their offspring, and the correlation between the price of a good and the quantity the consumers are willing to purchase, as it is depicted in the so-called demand curve.

Correlations are useful because they can indicate a predictive relationship that can be exploited in practice. In our case, We want to evaluate if there is a association between a color and a behavior. However, in general, the presence of a correlation is not sufficient to infer the presence of a causal relationship (i.e., correlation does not imply causation), that’s why after we will compare the correlation results with color theory.

According to Géron (2017), the correlation coefficient ranges from –1 to 1. When it is close to 1, it means that there is a strong positive correlation; for example, the median house value tends to go up when the median income goes up. When the coefficient is close to –1, it means that there is a strong negative correlation; you can see a small negative correlation between the latitude and the median house value (i.e., prices have a slight tendency to go down when you go north). Finally, coefficients close to zero mean that there is no linear correlation. Figure 3.1 shows various plots along with the correlation coefficient between their horizontal and vertical axes.

To obtain the correlation between the colors and the behavior of the characters, in which the columns represent the characteristics and colors, and the lines represent the characters. For each character, we attempt to identify the presence of color and behavior. If there is, fill it with ’yes’ and if not, fill it with ’no’, as shown in figure 40.

After filling the table with color/behaviors annotations for each character, the data will be processed using the KNIME[2] tool. KNIME can quickly look for

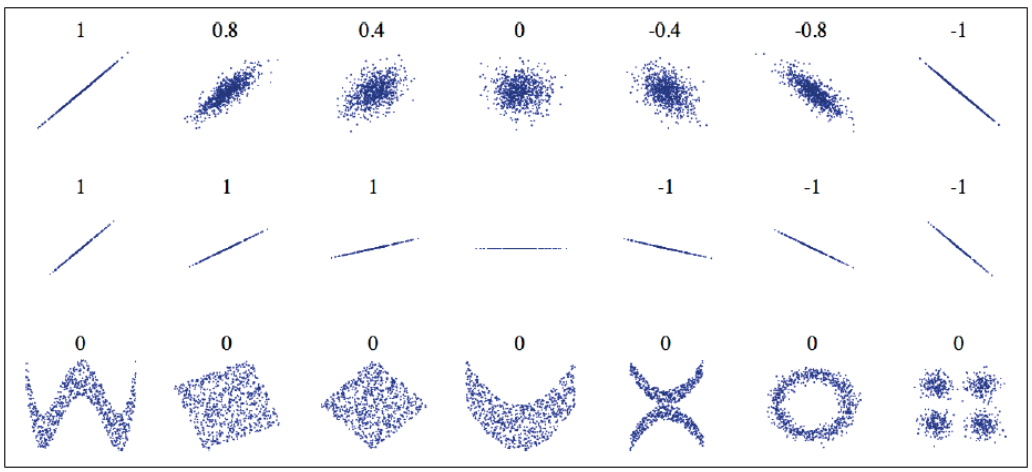


Figure [56] > Standard correlation coefficient of various datasets.

correlations in data using the Linear Correlation node. Values of 1 are a perfect correlation, -1 is a perfect inverse correlation, and 0 is no correlation.

The usage of statistical correlation has been the focus of attention of several authors — Valdez and Mehrabian (1994), Gao and Xin (2006), Lucassen et al.(2010), Strapprava and Ozbal (2010), Geslin et al. (2016), Wilms and Oberferldn (2017), Gong et al. (2017) — with some different purpose. However, all these articles commonly evaluate how emotions can be associated with emotions. So our study also plans to use the same approach.

	Color 1	Color 2	Color 3	Behavior 1	Behavior 2	Behavior 3
Character 1	Yes	Yes	No	Yes	No	Yes
Character 2	No	No	Yes	Yes	No	Yes
Character 3	No	Yes	Yes	Yes	No	Yes
Character 4	No	No	No	Yes	Yes	No

[2] https://www.knime.com/

^ Figure [57] Illustrativdatabase table.

PRACTICAL
ANALYSIS

PRACTICAL ANALYSIS

THE RESULTS

Color can have political, religious, and cultural connotations. It can represent gender, and, according to some theorists and researchers (as we saw in the previous chapter), it can cause emotional effects. And psychological connotation, as well as awakening memories. In addition, it can influence purchasing decisions, convey messages, tell stories, and indicate meanings. This last point is what we are most interested in exploring in the course of this investigation: color as a fundamental part of the character structure to convey its personality, which contributes to the emotion it is supposed to mean.

This part of the work will show the test's results. Here each character's color scheme was collected and analyzed based on the parameter previously explained about emotions and color. In this phase, it will also be analyzed the correlation between these two subjects based on statistics. Furthermore, these results will be analyzed based on color theory to confirm if the color used for the character relates to the emotions the character is supposed to convey.

So, with what was processed, we decided to treat the correlation with values of 1.0 as a very strong correlation. This correlation was identified between the color dark green (olive) and emotion contentment. Also, another very strong correlation was noticed between the color orange and the emotion excitement.

This was followed by moderate correlations, with the range of values from 0,5 to 0,7. It was observed that this kind of correlation appeared between dark red (light brown) and the emotions of anger and pride in achievement. Also, yellow correlated moderately with satisfaction, contentment, and excitement. Followed by green with contentment, black with anger, orange with pride in achievement and satisfaction, green with amusement, light magenta with disgust, white with sadness and fear, and light purple (lilac) with amusement.

Weak correlations were also generated, and they had values from 0,3 up to 0,5, but we won't analyze them. Since the relationship is not very strong, they will not be relevant for this work.

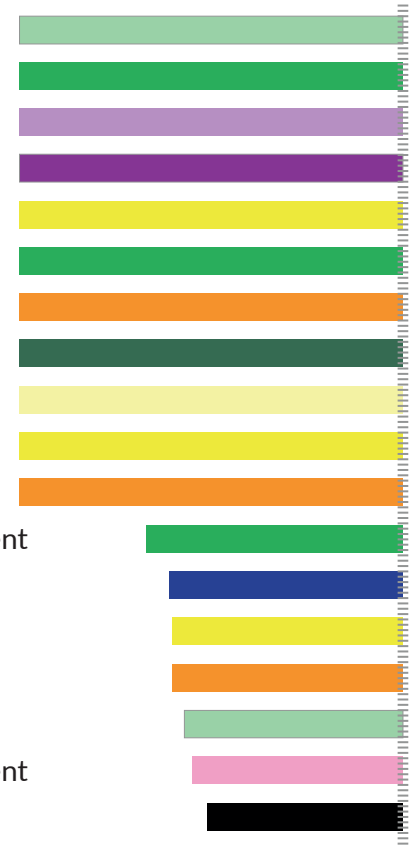
Furthermore, it was verified that very strong opposite correlation happened, and the values for this correlation were -1.0. This kind of correlation happened between the emotion anger and the colors: light green, green, light purple (lilac), and purple. Still, this happened with fear and the colors green and orange, followed by sadness with dark green (olive), light yellow, yellow, and orange. Those correlations were noticed to be a very strong opposite type. Also, yellow and disgust were on this list.

After analyzing the opposite correlation, it was possible to verify that a moderate level (-0,5 up to -0,7) could be noticed between green, pride in achievement and contempt, followed by blue and anger, yellow and fear, orange and contempt, light green and fear, dark green (olive) and contempt, light magenta and pride in achievement, black and amusement, purple and disgust.

POSITIVE CORRELATION

Contentment	1.0
Excitement	1.0
Anger	0.6923
Satisfaction	0.6593
Excitement	0.6551
Contentment	0.6310
Anger	0.6307
Pride in Achievement	0.6277
Satisfaction	0.6246
Pride in Achievement	0.5918
Amusement	0.5897
Disgust	0.5833
Sadness	0.5789
Anger	0.5409
Amusement	0.5348

OPPOSITE CORRELATION



Anger	-1.0
Anger	-1.0
Fear	-1.0
Anger	-1.0
Disgust	-1.0
Fear	-1.0
Fear	-1.0
Sadness	-1.0
Sadness	-1.0
Sadness	-1.0
Sadness	-1.0
Pride in Achievement	-0.6759
Anger	-0.6163
Fear	-0.6049
Contempt	-0.6033
Fear	-0.5720
Pride in Achievement	-0.55
Amusement	-0.5157

The correlation shows how strongly the colors are related to the emotions, so we can proceed to analyze the characters based on the data collected and its relation with color theory.

THE ANALYSE OF RESULTS

The results shows that the colors and emotions are correlated such in a positive way, where the color tends to be use in favor of the emotions. Also, the correlation can be negative, in this case, when they have a negative correlation, where the color and emotions don't match and one leads to a contradictory perception about the other, see figure 41. According to that we will analyze who this is relevant when it comes to Pixar's characters.

DARK GREEN X CONTENTMENT

Figure [58] Graphic of oppositive and negative correlations.

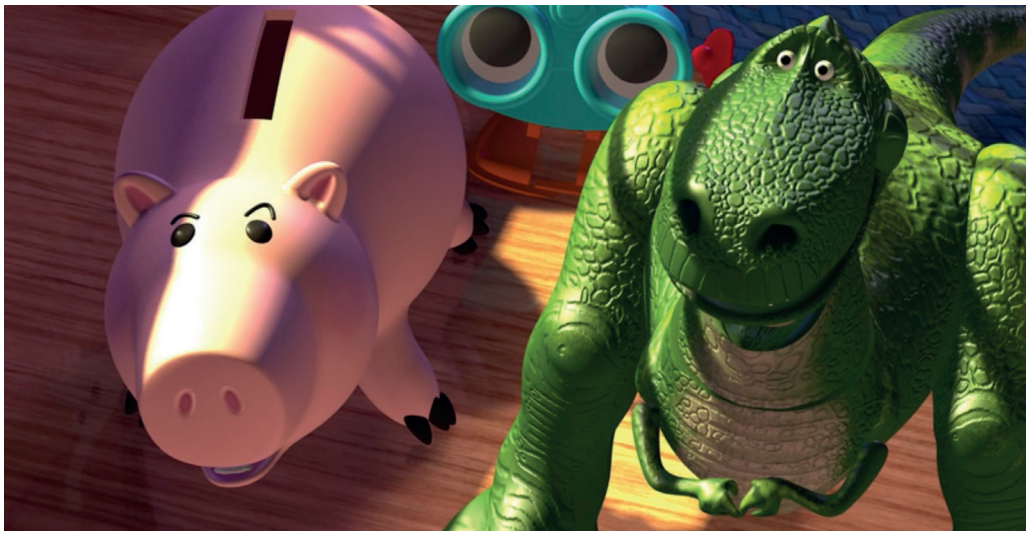
Figure [59] ^ Screenshots from the movies. Characters related with color dark green and emotion contentment.

As we can see, a strong correlation could be found between the color dark green and the emotion contentment. According to Heller (2014) color theory explains that green, in its most complete neutrality between all extremes, acts in a way that calms and conveys security and green is also related with positive feelings like lucky, fertility, perseverance, wealth, growth, healthy, success, nature, equilibrium, honesty, youth, hope, calm, security.

Some Pixar's characters use dark green in a positive connotation, like Rex in

Toy Story who is an insecure about his lack of ferociousness, as he's not scary enough, those characteristics makes him a goofy and funny character full of joy.

The color dark green was also incorporate in Merida's character from the



^ Figure [60]
Rex from the movie Toy Story and its color scheme

^ Figure [61]
Screenshot from the movie Toy Story.

^ Figure [62]
Screenshot from the movie Toy Story.

animation Brave, mostly because of her Scottish ancestry, which this color has strong relation with. But, also, Merida has a headstrong and intrepid personality, where she challenges her kingdom's longstanding traditions to live a life of independence and that shows she has a strong willing to fulfill her desire for a change in her life. Other characters from this movie also wear green clothes, like her mother, father, and brothers, each one of them also has a strong personality, showing Medida inherited this trace from her family.

Dark green can also be found in Luca's father, Lorenzo Paguro, in the movie

Figure [63] ^ Merida from the movie Brave and its color scheme

Figure [64] ^ Screenshot from the movie Brave.

Figure [65] ^ Screenshot from the movie Brave.

Luca. The dark green appears in his color palette in their sea monster form. He has a easy-going personality and he is content to live a very calm and monotonous life in the bottom of the ocean, taking care of his algae and his crabs, although this is disturbed when his soon starts to get curious about life in the surface and then decides to live the safeness of the ocean to explore the surface, that's when his wife takes him along to the human world to bring their son back home.

Figure [66] ^ Lorenzo from the movie Luca and its color scheme

Figure [67] ^ Screenshot from the movie Luca.

Figure [68] ^ Screenshot from the movie Luca.

Figure [69] ^ Screenshots from the movies. Characters related with color orange and emotion excitement.

ORANGE X EXCITEMENT

Moving forward to the next strong positive correlation, we have orange with the emotion excitement. Heller (2014) research showed that this color has relation with a lot of positive emotions as well like creativity, invigoration, uniqueness, energy, vibrancy, stimulation, sociability, health, whimsy, activity, delight, playful, disinhibition, controversial, originality, excitement, transformation.

In the movie The Incredibles it is possible to see some orange touches in the

superhero family outfit to fight the crime, although is not the main color, this touch of orange is relevant to increase the energy that the colors of their clothes intend to give the characters. Heller (2014) said that red, yellow, and orange putted together gives the idea of fire and fire leads us to think in excitement, therefore, the combination of those colors give is related with the emotion excitement, stimulation, energy, activity, as well, all of these are characteristics from the Incredibles' characters: Bob Parr, Elen Parr, Dash Parr and Violet Parr.

Another case of orange being using with another color to give the idea of

^ Figure [70]
The Incredibles from the movie The Incredibles and its color scheme

^ Figure [71]
Screenshot from the movie The Incredibles.

^ Figure [72]
Screenshot from the movie The Incredibles.

excitement is Russell in the animation UP. Even though, Russell predominant color is yellow, the orange is relevant to this character's composition. Russell is a loud, hyperactive, anxious, high-strung, and curious boy. His behavior and personality often annoyed Carl throughout the movie. Russell beholds a spirit that somewhat reminded Carl of Ellie in Russell's curious nature, and he is also determinate. Heller (2014) claims that orange is the color of recreation, according to her the combination of orange, yellow and red are related to a playful felling, which suits this character perfectly and the correlation as well.

In Luca's movie another character that has an excitement personality is Giulia

Figure [73] ^ Russell from the movie Up and his color scheme

Figure [74] ^ Screenshot from the movie UP.

Figure [75] ^ Screenshot from the movie UP.

Marcovaldo, the color palette used in this character is related with some color that brings her bight personality, orange is one of those, as she is very excitement about everything, but it goes along with red, that is related to passion and energy, green related to honesty and contentment, and with blue which is related to loyalty. According to Heller (2014) the color scheme between blue, green, red, yellow, and orange, is associate with sympathy, which is also one of the main personalities for this character.

^ Figure [76] Giulia Marcovaldo from the movie Luca and its color scheme

^ Figure [77] Screenshot from the movie Luca.

^ Figure [78] Screenshot from the movie Luca.

Also, Bing Bong from Inside Out, has orange on his color palette, along with light magenta, orange, light orange, purple, light purple and dark brown. Also, his eccentric colors are there to show that he comes from an imaginary world but also that it enhance his excited personality.

DARK BROWN X ANGER AND PRIDE IN ACHIEVEMENT

Figure [78] ^
Bing Bong from the movie Inside Out and his color scheme

Figure [79] ^
Screenshot from the movie Inside Out.

Figure [80] ^
Screenshot from the movie Inside Out.






The correlation between the emotion anger and the color dark brown is a moderate positive correlation, which means that the correlation is not as strong as the previous one, but it is also very relevant for this work since the data shows an accurate relationship between those items.

According to Heller (2014), brown is one of the most rejected colors and most of the concepts regarding brown are used in a negative way, it is associate with negative feelings like dumbness, laziness, nasty, ugly, unpleasant, evil, bad, rotten, languish, selfishness, bitter, outdated, monotonous, mediocrity infidelity, frivolous, poverty, brutality, conservatism. Therefore, it makes sense that this color has a moderate correlation with a negative emotion like angry and pride.

In Pixar's movie we can see this being used with the character of Dean

Figure [81] ^ Screenshots from the movies. Characters related with color dark brown and emotions anger and pride in achievement.

Hardscrabble from Monsters University, her dark red tones tens to lead into a dark brown, giving the idea of an evil and bad character, her personality is also very commanding and demands respect, passing the idea of fear. Her low tone of her voice makes her pass the idea of angry and danger.

Other character that has his color palette based on brown is Charles F. Muntz,

Figure [82] ^
Dean Hardscrabble from the movie Monster University and his color scheme

Figure [83] ^
Screenshot from the movie Monster University .

Figure [84] ^
Screenshot from the movie Monster University .

from the movie Up. Even though is his case, he also has light brown colors in his color palette, the dark brown stands out. It is possible to relate this color with his personality, since in the animation he is a selfishness and bitter old man, that ends up being the movie's antagonist. He starts the movie as with a monotonous character, just an old man who is looking for his final adventure, and the use of light colors suits his personality well up until the end, we can see the that his pride is hurt since he couldn't find the exotic creature and now he is angry and he shows his real self, when Carl and Russell don't tell him where the creature is, keeping him to prove the world that he was right all along.

^ Figure [85]
Charles F. Muntz from the movie UP and its color scheme

^ Figure [86]
Screenshot from the movie UP.

^ Figure [87]
Screenshot from the movie UP.

Also, in the movie Up, we can also find another character that has a dark palette of dark blue, black, and dark brown, Alpha, the leader of Charles' pack. He has a very strong personality and demands power which makes him the secondary antagonism of the movie. As his name says, he is the pack's alpha, with an unpleasant, bad, and angry personality which is highlighted by his color scheme, although dark brown is not his main color, this color also intensifies the aspect of his bad temper.
Still in the same movie, we have Carl Fredricksen. His color palette is composed

Figure [88] ^
Alfa from the movie UP and his color scheme

Figure [89] ^
Screenshot from the movie UP .

Figure [90] ^
Screenshot from the movie UP.

by dark brown, white, and black. While he was a kid, he had a willing for adventure, but didn't have courage enough to go and explore the world, so he kept with his boring life and use of imagination to travel, until he meets Ellie and finds joy in his life. It is possible to see in the movie that when Carl is with Ellie, he also uses some different color palette, like light blue, but when she dies, he went back with his monotonous color scheme of dark brown tones, white and black, showing his negative personality, ill-tempered, and bitter.

In the movie Luca, the character Massimo Marcovaldo has the same

^ Figure [91]
Carl Fredricksen from the movie UP and its color scheme

^ Figure [92]
Screenshot from the movie UP.

^ Figure [93]
Screenshot from the movie UP.

monotonous color palette as Charles F. Muntz, from Up, but in the case of Massimo his color only portrays his monotonous and few-worded personality. These characteristics make the character convey the idea of an angry and dangerous personality. Which we find out to be completely wrong, since he is a good-hearted person always welling to help those he love.

Moving forward to the movie Onward, the character Corey, the manticore,

Figure [94] ^ Massimo Marcovaldo from the movie Luca and his color scheme

Figure [95] ^ Screenshot from the movie Luca.

Figure [96] ^ Screenshot from the movie Luca.

also has her explosive personality which makes it difficult for her to deal with outbursts of anger. In the past she was a danger creature, now she is trying to be better and live in society. As the movie goes on, she accepts that she cannot fight against her explosive temperament and her desire for adventure, she unleashes her personality while trying to help the Onward brothers on their adventure. Her color palette predominantly dark brown, also has red and a touch of dark green, which suits her personality, explosive but who is trying to find her equilibrium in life.

^ Figure [97]
Corey, the manticore from the movie Onward and its color scheme

^ Figure [98]
Screenshot from the movie Onward.

^ Figure [99]
Screenshot from the movie Onward.

Figure [100] ^ Screenshots from the movies. Characters related with color yellow and emotions satisfaction and excitement.

YELLOW X SATISFACTION AND EXCITEMENT

The relation between yellow and the emotions satisfaction and excitement was a moderate positive correlation, meaning that those elements have a relevant relationship according to the statistic analysis. According to Heller (2014) the color yellow is related with feelings like glory, harmony, intellect, wisdom, optimism, radiance, joy, satisfaction, idealism, tenderness, spontaneity, loyalty, progress.

It is possible to find yellow in many of those characters that were analyzed

in this work, like in Toy Story Movie. The character Woody has a bright color palette in which the yellow brings the authenticity to his clothes and it reflects his excitement personality. with other colors like blue, red, blue, white, black and brown, showing a colorful color chord show that he has a excited and a little eccentric personality by the clothes he uses.
Followed by Slinky Dog, who has a nice, friendly, and playful personality, has his

^ Figure [101]
Woody from the movie Toy Story and its color scheme

^ Figure [102]
Screenshot from the movie Toy Story.

^ Figure [103]
Screenshot from the movie Toy Story.

color palette combined with a predominate use of yellow suiting the character with his excitement personality.

One last character from this movie who has yellow as his predominate color

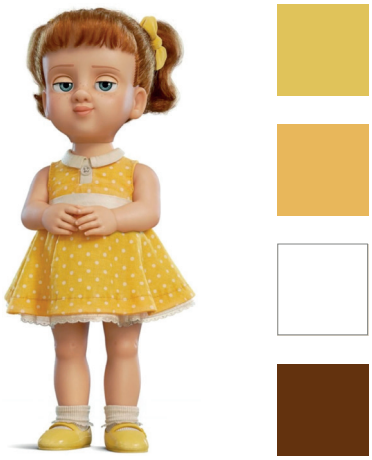
Figure [104] ^ Slinky Dog from the movie Toy Story and his color scheme

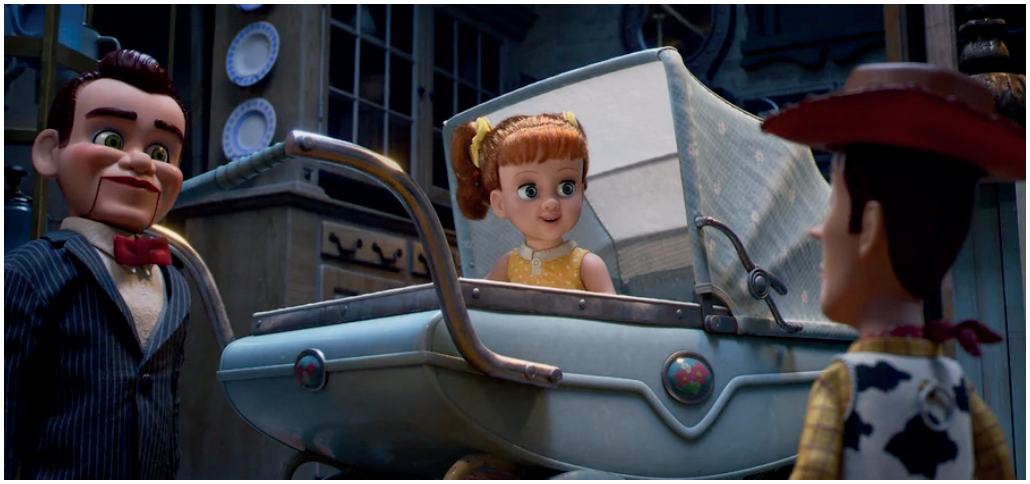
Figure [105] ^ Screenshot from the movie Toy Story.

Figure [106] ^ Screenshot from the movie Toy Story.

on its color scheme is Gabby Gabby, the antagonist from Toy Story 4. Her color palette is predominant yellow, with some touch of dark brown and white, this scheme is used to pass the idea of feelings like happiness, optimism, radiance, and joy for this character. The idea is to contrast the character's colors with her personality, giving a first impression of good feelings. Although she is creepy and has a bitter manner because she got lonely and her honest desire was to make friends, many other characters such as Woody, would pass her off as being "crazy" because of that.

Although the predominant color for The Incredibles outfit color scheme is





^ Figure [107]
Gabby Gabby from the movie Toy Story 4 and its color scheme

^ Figure [108]
Screenshot from the movie Toy Story 4.

^ Figure [109]
Screenshot from the movie Toy Story 4.

red, in this case it is relevant to mention that the yellow brings the feeling of excitement along with the color orange, as explained previously. Just by looking their outfit we get the idea of action, showing their joy personality to fight the crime.

A similar case happens with the character Lightning McQueen from Cars, his

Figure [110] ^ The Incredibles from the movie The Incredibles and his color scheme

Figure [111] ^ Screenshot from the movie The Incredibles.

Figure [112] ^ Screenshot from the movie The Incredibles.

color scheme has a predominate color: red, but the yellow brings the idea of action, movement, and excitement to his palette. So just by looking you already expect the character to be joyfull.

In the movie Up, we can also find character that has yellow in their color

^ Figure [113] Lightning McQueen from the movie Cars and its color scheme

^ Figure [114] Screenshot from the movie Cars.

^ Figure [115] Screenshot from the movie Cars.

palette, and this gives them the idea of satisfaction and excitement. Such as, Ellie Fredricksen, although her color palette involves a lot of bright colors as well, it shows her bright personality in contrast with Carl's who is very boring. She gives colors to his life, her excitement to live brings satisfaction into their relation, which is shown in the movie during the years that they passed together.

Continuing, in this movie, we also analyzed Dug, a playful and friendly dog

Figure [116] ^ Ellie Fredricksen from the movie UP and her color scheme

Figure [117] ^ Screenshot from the movie UP.

Figure [118] ^ Screenshot from the movie UP.

who is always kind and he can be an airhead sometimes. His colors are predominately yellow with a touch of brown. Despite this color palette was used because Dug is a golden retriever and this is the bread natural color, it suits with his excitement personality and goofiness.

Another character who has the yellow in her color palette is Joy from Inside

^ Figure [119]
Dug from the movie UP and its color scheme

^ Figure [120]
Screenshot from the movie UP.

^ Figure [121]
Screenshot from the movie UP.

Out. As her name already says she is smart, lively, hyperactive, exuberant, outgoing, and fiercely optimistic. Since she is an optimistic character the yellow is highlight in this personage, with bright colors along the yellow, such as, blue, and green this composition creates her color palette and transmit her personality as well.

GREEN X CONTENTMENT AND AMUSEMENT

Figure [122] ^
Joy from the movie Inside Out and her color scheme

Figure [123] ^
Screenshot from the movie Inside Out .

Figure [124] ^
Screenshot from the movie Inside Out .

Another moderate positive correlation resulted between the color green and the emotion contentment, although a stronger correlation was made between dark green and this same emotion. Although now the correlation is with a less saturation color, it also a relevant correlation. That shows that this relation between color and emotion is often used. Also, another moderate correlation found during the statistics analyses is between green and the emotion amusement. Which makes sense since those emotions are very similar to each other.

If we look Pixar's character, who also has green as his predominant color is

^ Figure [121] Screenshots from the movies. Characters related with color green and emotions contentment and amusement.

Luca, in his sea monster form. His color palette is based on green and blue, but the first color being more predominant than the other. Luca's personality starts out very timid, shy, calm, and afraid of the surface, but is also very curious. But by the end of the movie, Luca is much braver, amused, content, and wiser than the fearful, nervous version of him that existed early in the story.

Followed by his mother, Daniela Paguro, who has the same color palette as

Figure [122] ^ Luca from the movie Luca and her color scheme

Figure [123] ^ Screenshot from the movie Luca.

Figure [124] ^ Screenshot from the movie Luca.

Luca, green and blue. Her color palette fits her personality, since she is strong and energetic and convey security. She tries to keep her soon safe, away from the surface because she believes that the life in the bottom of the ocean is safer than the surface. She lives in contentment with her family and is a very loving mother, who would do anything for his soon, including going into the surface to bring him back home.

Michael Wazowski from Monsters Inc. has a predominant color palette of

^ Figure [125] Daniela Paguro from the movie Luca and its color scheme

^ Figure [126] Screenshot from the movie Luca.

^ Figure [127] Screenshot from the movie Luca.

green, which reflects the emotion that this color conveys, since his personality is funny, charismatic, smart, and brave, showing he is a very content character.

Also, in Monsters Inc. the character Celia Mae uses green in her dress, although

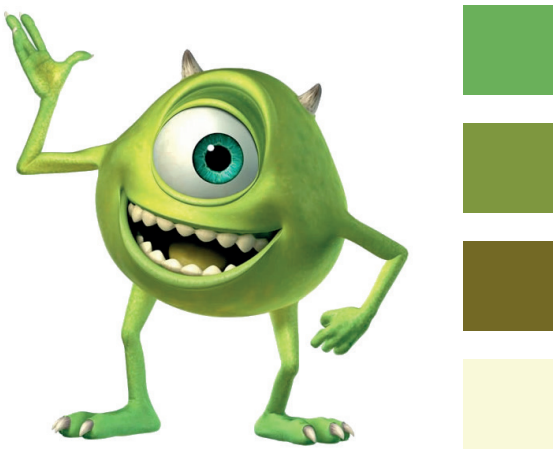


Figure [128] ^ Michael Wazowski from the movie Monsters Inc. and her color scheme

Figure [129] ^ Screenshot from the movie Monsters Inc..

Figure [130] ^ Screenshot from the movie Monsters Inc..

her predominate color is purple, the color green is also relevant to transmit the idea of her personality, since she uses a shiny green dress, showing she is happy, sweetheart and supportive. She is usually content and happy despites sometimes she can have an explosive temper.

The souls from the movie Soul have an iridescent color, but green is

^ Figure [131]
Celia Mae from the movie Monsters Inc. and its color scheme.

^ Figure [132]
Screenshot from the movie Monsters Inc.

^ Figure [133]
Screenshot from the movie Monsters Inc.

predominate to the color palette of Joe Gardner and 22 in their soul format. Even though this color is supposed to convey contentment, this is not related to those characters personality, but to their form. Since they are souls, the idea is to transmit the feeling of equilibrium and contentment which it is supposed to be achieved once you go to the beyond. Although this is not the case for those characters since they are struggling to accept their path. Except the character Moonwind who is content with life and uses the zone to get in and out of the spiritual, where he looks for adventure while helping souls to find their path.

BLACK X ANGER

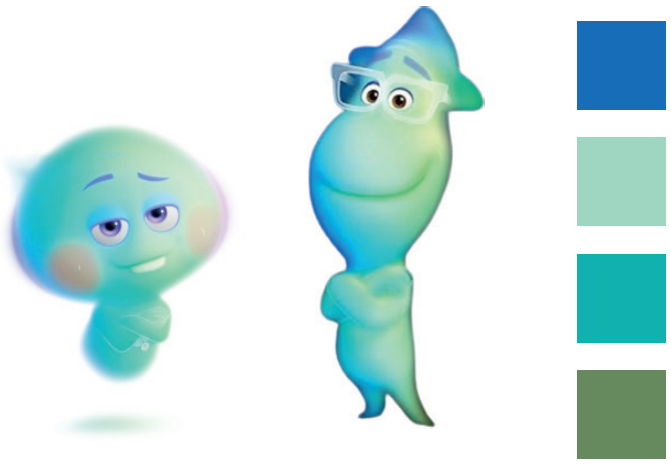


Figure [134] ^ Joe Gardner and 22 from the movie Soul and their color scheme

Figure [135] ^ Screenshot from the movie Soul.

Figure [136] ^ Screenshot from the movie Soul.

Figure [137] > Screenshot from the movie Soul.

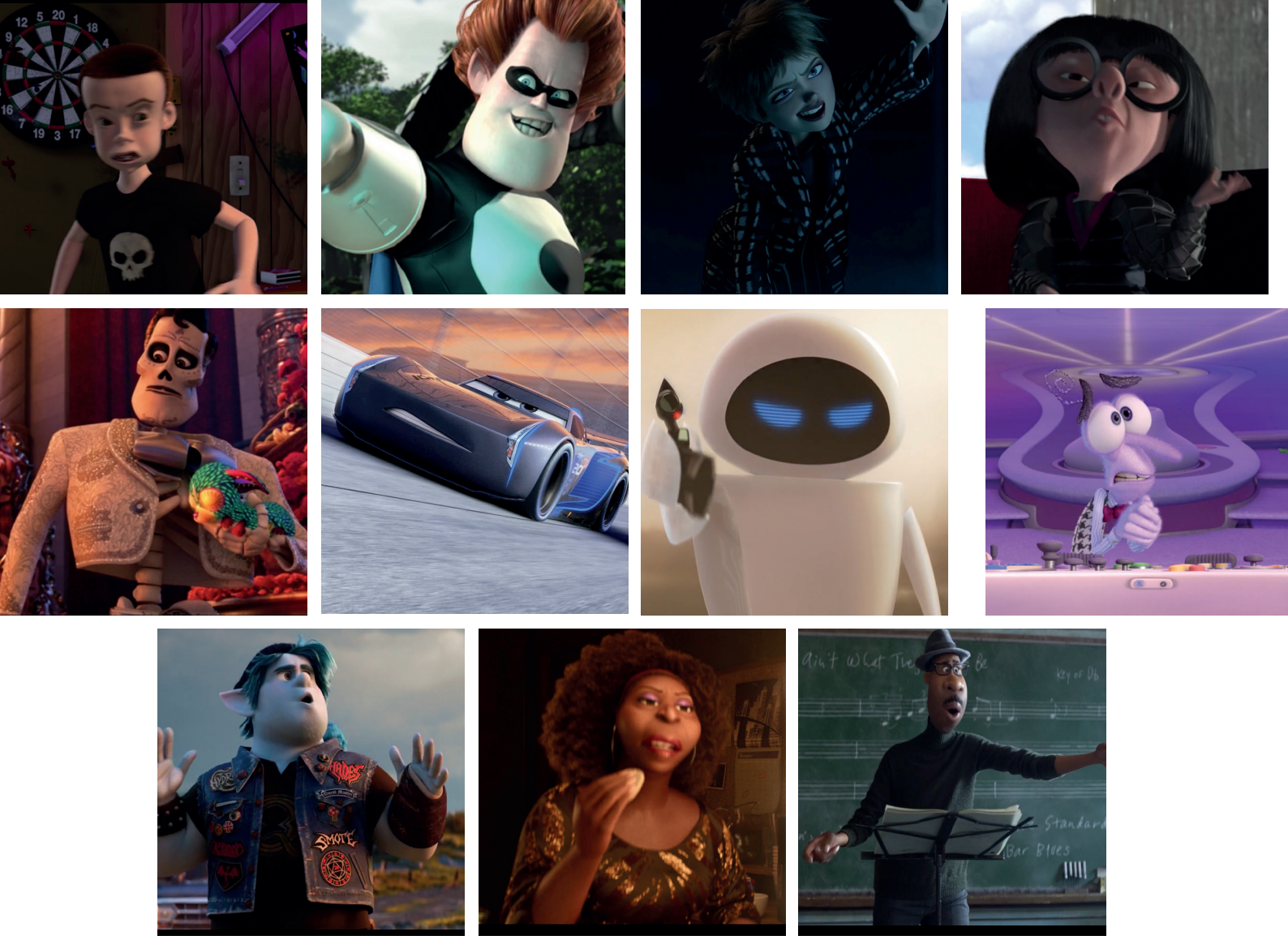


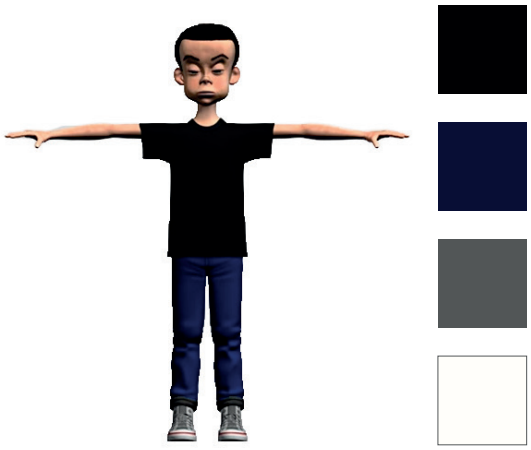
Figure [138] ^ Screenshots from the movies. Characters related with color black and emotion anger.

It is also possible to see that another moderate correlation exists between the color black and the emotion anger. According to Heller (2014) black transforms all positive meanings of all colors chromatic in their negative opposite. She also claims that this color is related with positive feelings like power, authority, weight, sophistication, elegance, formality, seriousness, dignity, solitude, mystery, stylishness, but also with negative feelings like fear, aversion, negativity, evil, secrecy, submission, mourning, selfishness, bad luck, heaviness, remorse, emptiness, illegality, violence, brutality, deniability, aggressiveness. As we will analyze the correlation found during the statistic process of this work, we will keep in mind only the emotion anger and verify how it works with Pixar's characters.

On Toy Story movie there is an antagonism, Sid Phillips, with his color

palette predominate black and white. His acts are very evil and cruel, so it is possible to detect the anger in his personality. Also, the use of black, predominately, gives a stronger impression that he is bad, which it is confirm during the movie when it is shown that he likes to destroy toys in many ways, like exploding, burning, or disassembling and reassembling toys with parts from others giving them a bizarre look.

In the movie The Incredibles the color black is also very used in the characters.



^ Figure [139]
Sid Phillips from the movie Toy Story. and its color scheme.

^ Figure [140]
Screenshot from the movie Toy Story.

^ Figure [141]
Screenshot from the movie Toy Story.

For example, Buddy Pine, the first antagonist from the series, has his color palette black, white and red. He is a mad scientist destined to make himself a hero even if it meant creating a killer robot to murder various retired ones. The colors were used to bring the aspect of darkness to these characters, but with red, also a bit of danger. Therefore, he is an angry personage that intends to conquer the world, but he is also very instable, giving the impression of madness.

Another antagonist from this series, is Evelyn Deavor. She appeared in movie

Figure [128] ^ Buddy Pine from the movie The Incredibles and his color scheme

Figure [129] ^ Screenshot from the movie The Incredibles.

Figure [130] ^ Screenshot from the movie The Incredibles.

The Incredibles 2, as a normal character since her color palette was based on neutral tones: Black and gray, which made her look like a monotonous character. Up until she got discovered. Despite her genius, she's stressed out, workaholic and sleep deprived. Evelyn was deeply affected by her father's murder. All of the acts she committed was so Supers would be outlawed for good.

Also, in The Incredible series there is the character of Edna Modas, who uses

^ Figure [131] Evelyn Deavor from the movie The Incredibles and its color scheme.

^ Figure [132] Screenshot from the movie The Incredibles.

^ Figure [133] Screenshot from the movie The Incredibles.

the dark palette with black being her predominant color. She is the fashion design and tech guru for the Incredible family. Although she is very serious and her rudeness are predominant in her personality, she is also a kindhearted person who always helps the protagonist to fight against the villains. So, the color palette is used to show her severe personality.

Black can also be associate with anger when analyzing the character Ernesto

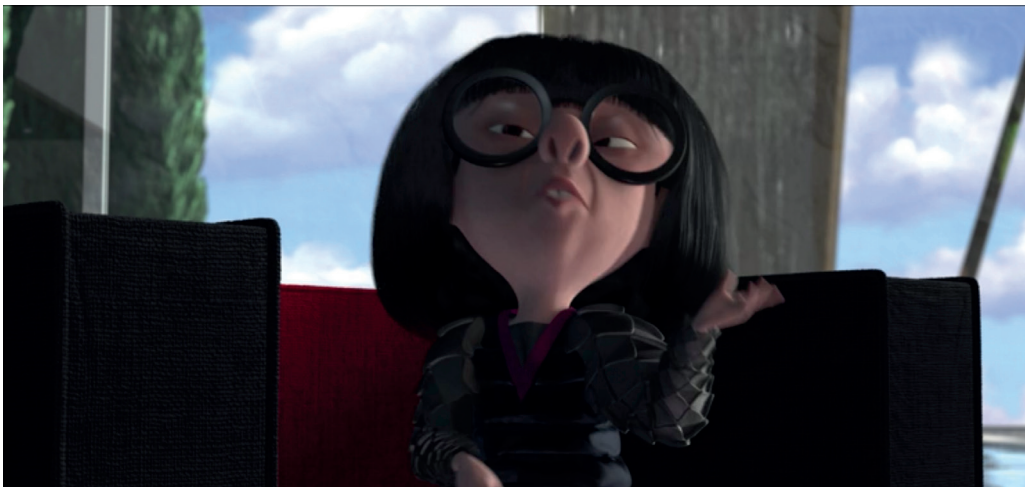


Figure [134] ^ Edna from the movie The Incredibles and her color scheme

Figure [135] ^ Screenshot from the movie The Incredibles.

Figure [136] ^ Screenshot from the movie The Incredibles.

de la Cruz from the movie Coco. In the movie, Ernesto is a greed person who only cares about his fame. He poisoned Hector, his singer partner, and stole the credit for the songs he had written. Despite his black and white palette and the way he tries to show that he is a good guy, during the movie it was revealed that his personality is treacherous, and he is an angry soul, since he didn't want to die and now, he doesn't want to lose his fame either.

Another color palette that gives the idea of anger, elfishness and aggressiveness

^ Figure [137] Ernesto de la Cruz from the movie Coco and its color scheme.

^ Figure [138] Screenshot from the movie Coco.

^ Figure [139] Screenshot from the movie Coco.

is used by the character Jackson Storm from Cars 4, composed by dark colors, predominantly, black with some dark blue as well. Which reflects his personality, cocky, confident, and dismissive of his opponents. Storm sees the older racers as an outdated generation that has to be deposed. Storm believes the future of racing belongs to him, and so is determined to beat anyone who gets in his way.

In Wall-e movie the character EVE also uses black and white as her color

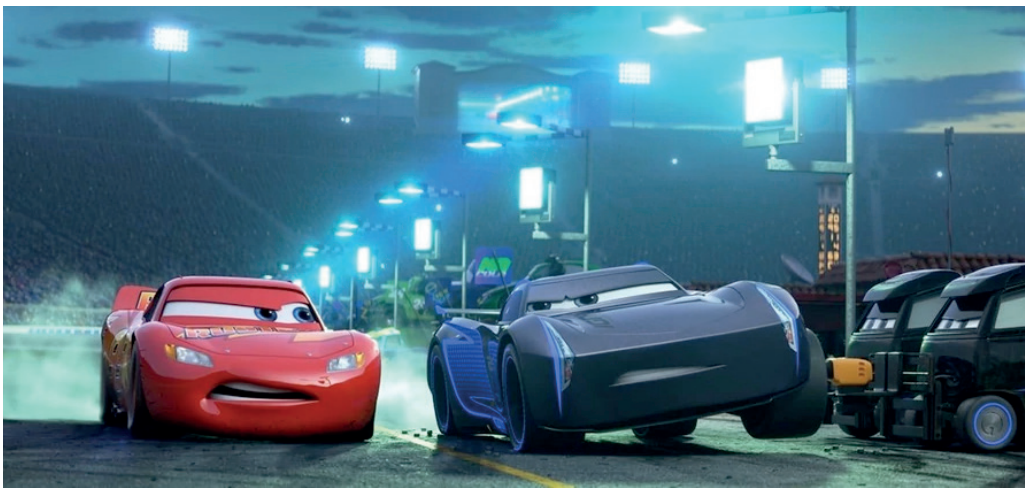


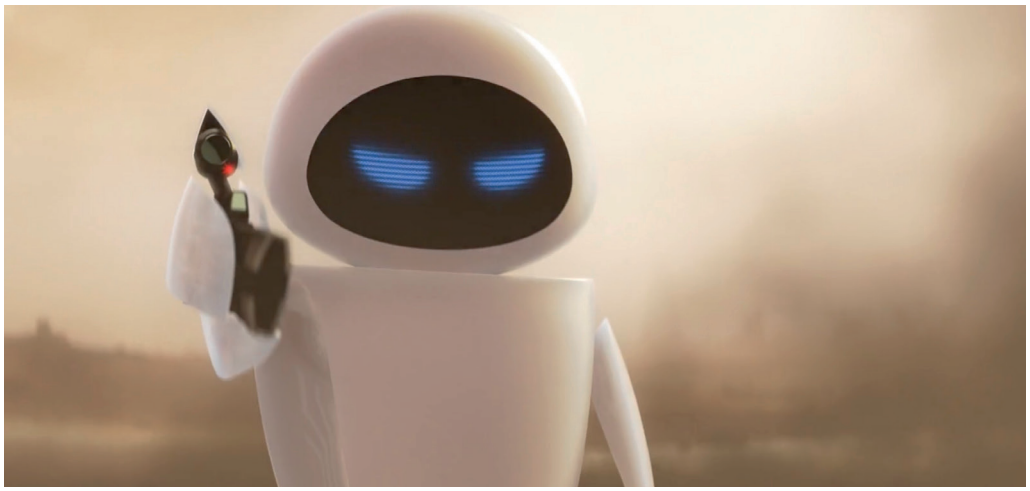
Figure [140] ^ Jackson Storm from the movie Cars 3 and his color scheme

Figure [141] ^ Screenshot from the movie Cars 3.

Figure [144] ^ Screenshot from the movie Cars 3.

palette. In her case, the white is more predominant, but the black brings a dangerous aspect to the character. The anger in her robotic temperament will then be change to compassion and tenderness as Wall-e shows her life.

The character Fear from the movie Inside Out, also have some black on his



^ Figure [143]
EVE from the movie Wall-e and its color scheme.

^ Figure [144]
Screenshot from the movie Wall-e.

^ Figure [145]
Screenshot from the movie Wall-e.

color palette, but we found out not to be relevant in his personality to suggest any idea of anger, since the black is on his clothes along with white, and those colors are only there to give the idea of monotonous. Since a black and white cardigan is a safe combination, showing his boring personality, afraid to risk to be different.

Moving forward to the movie Onward, we have the character, Barley Lightfoot.

Figure [145] ^
Fear from the movie Inside Out and his color scheme.

Figure [146] ^
Screenshot from the movie Inside Out.

Figure [147] ^
Screenshot from the movie Inside Out.

Who uses a color scheme of black, dark green and dark blue. Barley is loud, and excitable. He is a free-spirited, roleplaying metal fan who is prone to getting into trouble. Despite his color palette has black as a predominate color, he is not an angry character, this color is there to represent his passion for roleplaying metal.

Dorothea Williams from the movie Soul. With a black, white, and purple color

^ Figure [148] Barley Lightfoot from the movie Onward and its color scheme.

^ Figure [149] Screenshot from the movie Onward.

^ Figure [150] Screenshot from the movie Onward.

palette. Her personality is skeptical towards certain people, although she knows talent when she sees it and will help her friends out if they need it. Also, she takes music very seriously and can be seen as picky when selecting people to perform with her on stage. Although she means good, Dorothea can come off as sarcastic and unpleasant during first impressions. So, she has serious and direct personality that sometime can even giving an impression of rudeness is reflected in her serious and dark color palette.

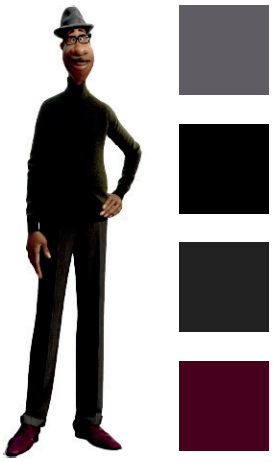
Also in the movie Soul, we have the character, Joe Gardner. As a person he

Figure [151] ^ Dorothea Williams from the movie Soul and his color scheme.

Figure [152] ^ Screenshot from the movie Soul.

Figure [153] ^ Screenshot from the movie Soul.

uses dark tones, predominantly black clothes, and dark gray hat. He is very passionate about music and always supportive. He loves to bring out the best of people. Although sometimes, he is selfish. His dark color palette has more relation with giving the impression of a serious artist instead of an angry person.



^ Figure [154]
Joe Gardner from the movie Soul and its color scheme.

^ Figure [155]
Screenshot from the movie Soul.

^ Figure [156]
Screenshot from the movie Soul.

ORANGE X PRIDE IN ACHIEVEMENT AND SATISFACTION

Likewise, orange has moderate correlation with the emotions pride in achievement and satisfaction. As we explained before, the color orange has a strong relation with energy and excitement, so it makes sense that this color is also related with those two emotions as well, if we take a look again in the previous characters analyzed with orange, it is possible to note that their excitement comes with satisfaction and content personality and also a feature of pride.

Figure [157] ^ Screenshots from the movies. Characters related with color orange and emotions pride in achievement and satisfaction.

A character who have pride and satisfaction in his personality, is Woody from the movie Toy Story. Although orange is not his predominant color, it is there as a bright color, highlighting his excited and happy personality. Which shows that he is satisfied with the life he lives and is proud of that.

As explained before, the color palette from The Incredibles outfit shows

excitement and danger, but after analyzing this correlation, it is possible to see that orange can also add other feelings to those characters, since it is not wrong to say that they are proud to be who they are and satisfied to leave the life they are living. So, this color is relevant to give them those characteristics as well.

A similar case happens with the character Lightning McQueen from Cars.

^ Figure [158]
The Incredibles from the movie The Incredibles and its color scheme.

^ Figure [159]
Screenshot from the movie The Incredibles.

^ Figure [160]
Screenshot from the movie The Incredibles.

Although his predominant color is red, the orange gives also comes to add more for this character, since he is also very pride for his achievements. Despite he still wants more for his carrier, the idea of satisfaction and contentment is also shown in his personality

On Up we also have Russell, with his scout clothes and color palette based on

Figure [160] ^ Lightning McQueen from the movie Cars and his color scheme.

Figure [160] ^ Screenshot from the movie Cars.

Figure [161] ^ Screenshot from the movie Cars.

yellow, orange, and dark brown. Once again, the orange is not predominated but its use gives a touch of personality to this character, highlighting his pride to be a scout and his satisfaction on doing his job to help people.
Bing Bong from Inside Out whit his effervescent, eccentric personality he was

^ Figure [162] Russell from the movie UP and its color scheme.

^ Figure [163] Screenshot from the movie UP.

^ Figure [164] Screenshot from the movie UP.

Riley's imaginary friend. With a color palette based on predominantly light magenta, followed by dark brown, purple and orange. The emotion pride in achievement and satisfaction is related a lot with this character, since he is very proud and satisfied to be Riley's imaginary friend, even though his color palette doesn't have orange as a predominate color, the color chord on this character is passes his personality and as well as the emotions satisfaction and pride of achievement.

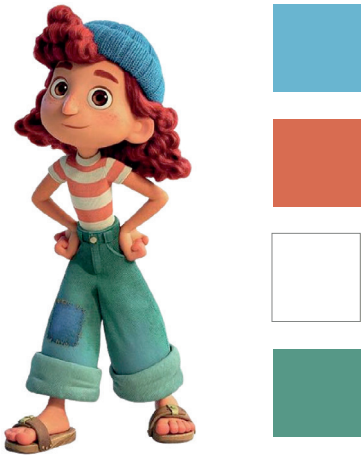
These emotions are also Giulia Marcovaldo's characteristics. As explained

Figure [165] ^ Bing Bong from the movie Inside Out and his color scheme.

Figure [166] ^ Screenshot from the movie Inside Out.

Figure [167] ^ Screenshot from the movie Inside Out.

previously, when we talk about orange relation to another emotion, the bright colors for this character also bight her personality and orange is one of those colors. She is very excitement about everything. In the movie she is the daughter of Massimo Marcovaldo, although they have a simple life, she is very proud of her father, and she is always welling to help him with work. She can be found in Porto Rosso's Street with her bike delivering fish happy and satisfied. Unless she meets Ercole Viscondi, who is always annoying her and makes her lose her temper.



^ Figure [168] Giulia Marcovaldo from the movie Luca and its color scheme.

^ Figure [169] Screenshot from the movie Luca.

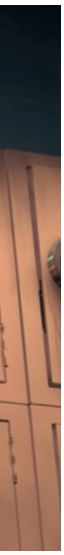
^ Figure [170] Screenshot from the movie Luca.

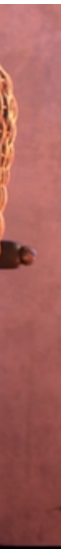
LIGHT MAGENTA X DISGUST

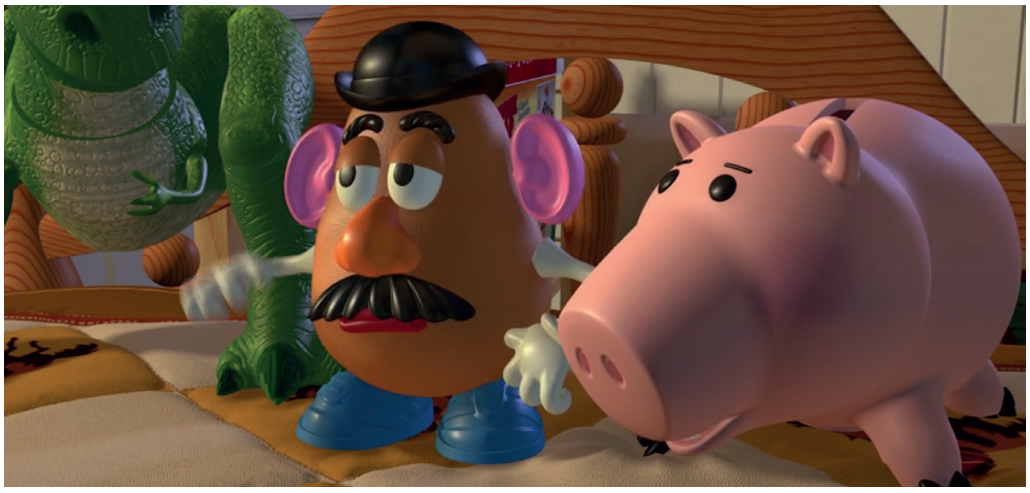
This is the only correlation that does not go along with Heller (2014) study about color theory. For her, the color pink is actually the only color that nobody can say something negative. It is related with positive feelings like charm, kindness, sensibility, sentimentality, tender, seduction, childish, gentleness, tender, romanticism, fantasy, sweetness. Some negative feelings like vanity, eroticism, temptation, artificial where also mentioned by her. Despite that, according to the statistics results, there is a moderate correlation between the color light magenta and disgust.

Figure [171] ^ Screenshots from the movies. Characters related with color light magenta and emotions disgust.

Pixar's characters like Hamm from Toy Story sequel have light magenta as his predominant color and black as second color. His is a wise-cracking plastic piggy bank who is always used as a villain during the play time, by Andy, but he is actually a good guy.







^ Figure [172] Hamm from the movie Toy Story and its color scheme.

^ Figure [173] Screenshot from the movie Toy Story.

^ Figure [174] Screenshot from the movie Toy Story.

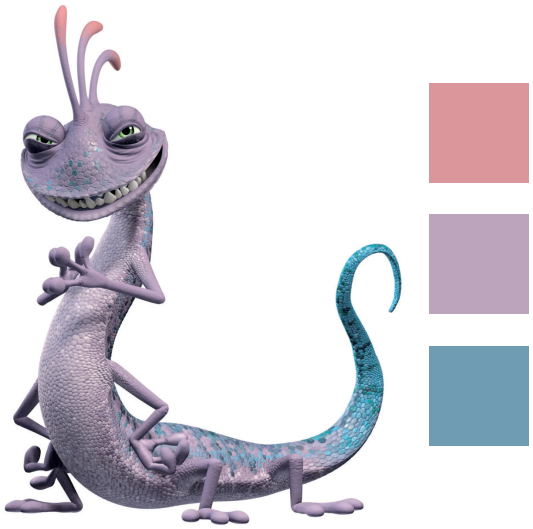
Another character from Toy Story, who also uses light magenta is Bo Beep, although her personality has nothing to do with the emotion disgust, since she is smart, sensible, and quick to share her opinions. Despites her color palette is based on light magenta, white and light cyan. Which makes the softest and most tender chromatic chord of all, pink-white-yellow (Heller, 2014), which makes Boo Beep looks like a sweet shepherdess and the light cyan comes to add more tenderness to her color scheme.

Figure [175] ^
Bo Beep from the movie Toy Story and his color scheme.

Figure [176] ^
Screenshot from the movie Toy Story.

Figure [177] ^
Screenshot from the movie Toy Story.

On Monster Inc., the character Randall Boggs. The colors scheme for this character is light purple, cyan and, light magenta. He is one of the villains and his personality is greedy, ruthless, sneaky, short-tempered, competitive, and overall evil in nature. His power is to get invisible so he can scary kids without them know he is coming. His color palette gives an idea of iridescent, to show that his colors might change any second as his will.



^ Figure [178] Randall Boggs from the movie Monsters Inc. and its color scheme.

^ Figure [179] Screenshot from the movie Monsters Inc.

^ Figure [180] Screenshot from the movie Monsters Inc.

The character Disgust from Inside Out matches perfectly with this correlation. Despites her predominant color is green she also uses a light magenta scarf which its color is enhanced when combined with green. Disgust is very stubborn, honest, easily upset, disgusted, and annoyed, as well as sarcastic, tomboyish, superficial, cynical, vain, picky, and impatient. She is very suspicious about everything. Granting the fact that she always has the best of intentions.

Figure [181] ^ Disgust from the movie Inside Out and his color scheme.

Figure [182] ^ Screenshot from the movie Inside Out.

Figure [183] ^ Screenshot from the movie Inside Out.

Still in the movie Inside out, there is another character, Bing Bong, who also uses light magenta in its chromatic chord, which is composed of light magenta, brown, purple and orange. He is helpful, fun-loving, joyous, illiterate, nostalgic, friendly, childish. Heller (2014) mentioned that pink is related with dreams, according to her, where dreams are, so is pink. Pink is the unrealistic tone. Which suits perfect this character. Although he has nothing to do with the emotion disgust.

^ Figure [184]
Bing Bong from the movie Inside Out and its color scheme.

^ Figure [185]
Screenshot from the movie Inside Out.

^ Figure [186]
Screenshot from the movie Inside Out.

Coco Rivera (Mamá Coco) She is a warm-hearted, supportive, and kind woman who is Miguel's great-grandmother. She suffers from a degenerating memory but doesn't let that interfere with her happiness. According to Heller (2014) this is the color of sentimentalism and miracles. Which is a perfect explanation about the history of Mamá Coco. During the movie she is affected by the diseases, and she already lost most of her memories but in the end, when Miguel sings her father song, a miracle happens, and she starts to sing it too showing that she still remembers. Her predominant colors on her color palette are orange, white, light magenta, she also has some colorful embroidered in her Mexican dress, but those colors are not so relevant in her personality, just gives a glimpse of her culture. Here is another case where the color light magenta does not have the meaning of disgust for the color palette of this character.

Figure [187] ^ Coco Rivera from the movie Coco and her color scheme.

Figure [188] ^ Screenshot from the movie Coco.

Figure [189] ^ Screenshot from the movie Coco.

Figure [190] > Screenshot from the movie Coco.













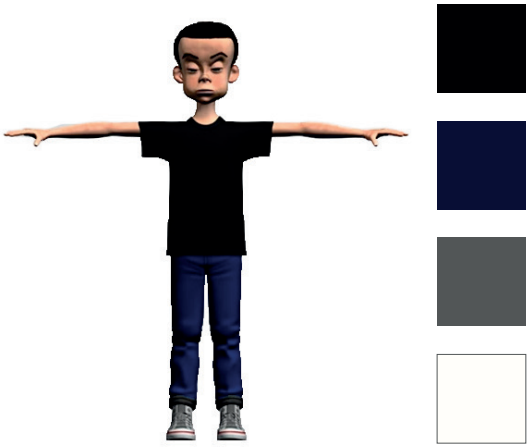

WHITE X SADNESS AND ANGRER

Here we have the emotions sadness and angrer, both are negative emotions and have a moderate correlation with the color white. This is another case, where two emotions have almost the same correlation value with a color. So, we decided to analyze them together and its correlation with the color.

Even though, Heller (2014) says that the color white together with the colors blue and gold are the colors related to honesty and good. In this case, as we will see, some of the characters have dark colors in their color palette as well, giving an opposite feeling to this color. She says that white is related usually with good feelings like perfection, good, clarity, cleanliness, purity, virtue, innocence, lightness, softness, sacredness, simplicity, truth, but some negative feelings are also related to this color, like fragility, isolation, death. For this study we will only take into consideration the feelings sadness, angry and the other emotions that are related with this two previous mentioned.

Figure [191] ^ Screenshots from the movies. Characters related with color white and emotions sadness and anger.

It is possible to see the white as one of the main colors in one of the antagonists from Toy Story movies, Sid Phillips, his black and white palette gives the idea of evil, since the black tends to bring a negative feeling in the color chord. Which it is confirmed in the movie, by his angry personality.



^ Figure [192]
Sid Phillips from the movie Toy Story and its color scheme.

^ Figure [193]
Screenshot from the movie Toy Story.

^ Figure [194]
Screenshot from the movie Toy Story.

Although Sid is evil, there is others character in the movies that also have white predominantly in their color scheme as well, like Buzz Lightyear, an astronaut toy who is heroic, friendly, loyal, humorous, good-hearted, protective, brave, noble, enthusiastic, determined, adventurous, funny. His predominantly color scheme is white, the color for the original astronaut suits, but also gives the idea of isolation in space, green, which gives a touch of color, and it is also related to the feeling of security, and purple, which is related to imagination.

Figure [195] ^ Buzz Lightyear from the movie Toy Store and his color scheme.

Figure [196] ^ Screenshot from the movie Toy Story.

Figure [197] ^ Screenshot from the movie Toy Story.

Also, Bo Peep has white as one of its main colors, along with light magenta and blue. As explained before, this character color scheme, light magenta-white-yellow makes the softest and most tender chromatic chord of all (Heller, 2014), and the light cyan comes to add more tenderness to her color scheme, so white has nothing to do with sadness or anger for this character.

^ Figure [198]
Bo Peep from the movie Toy Story and its color scheme.

^ Figure [199]
Screenshot from the movie Toy Story.

^ Figure [200]
Screenshot from the movie Toy Story.

In the movie The Incredibles, the antagonist Buddy Pine has a black and white color scheme. Just like mentioned before, this color scheme gives the idea of evil, since the black tends to bring up negative feelings, combining with white, this mono chromatic palette increases the emotion of evil/death. A touch of red it is also used in this character, for his hair, giving the feeling of danger as well.

Figure [201] ^ Buddy Pine from the movie The Incredibles and his color scheme.

Figure [202] ^ Screenshot from the movie The Incredibles.

Figure [203] ^ Screenshot from the movie The Incredibles.

Although the white along with black tends to give the idea of evil characters, its use along with light cyan gives the idea of cleanliness, purity, which makes us thing about the ice. According to Heller (2014) blue-white-silver are the chromatic accord of icy and cold, therefore, this is why the character Frozone, has this color palette. His civilian name is Lucious Best, he is Mr. Incredible best friend and helps the family to fighting against the evil. His power is to be able to manipulate water molecules in the air and freeze them. He has a “cool” personality, strong morals and he is always there to help his friends. Here we have another case where the color white is not used to transmit the feeling of angry or sadness, but good feelings like cleanliness, purity, virtue, and it is also related to the ice aspect.

^ Figure [204] Frozone from the movie The Incredibles and its color scheme.

^ Figure [205] Screenshot from the movie The Incredibles.

^ Figure [206] Screenshot from the movie The Incredibles.

From the movie Coco we have the character, Ernesto de la Cruz. He is also the antagonist from this movie and his color palette, as a skeleton, is all black and white. Again, we have evil emotions related to this color palette. Despite he has a charming, smooth-talking personality in the beginning, later it is shown that he is actually, ruthless, ambitious, deceitful, arrogant, greedy, two-faced, opportunistic, hypocritical, cruel, traitorous guy, who murderer his own friend for the sake of fame.

Figure [207] ^ Ernesto de la Cruz from the movie Coco and his color scheme.

Figure [208] ^ Screenshot from the movie Coco.

Figure [209] ^ Screenshot from the movie Coco.

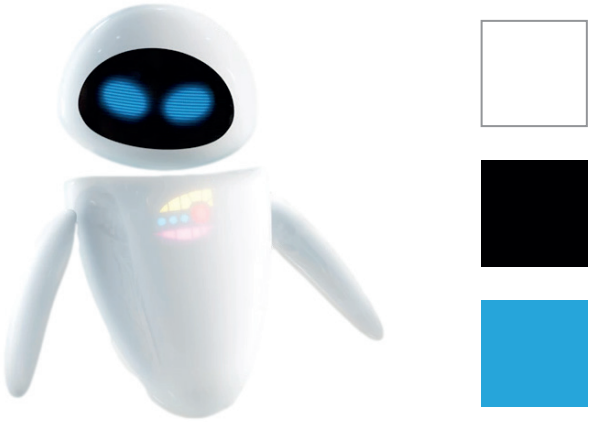
Another character from this movie who also uses white is Miguel Rivera, a teenager boy who has a great passion for music but is forbitten to play or sing due to his family banned music from their lives. He is a brave, kind-hearted and passioned by music boy, who leaves home during a discussion with his grandmother because of music. During the movie he finds out his history and discover that his grandfather never left the family because he didn't care, but because he was murderer as a selfish act of his singing partner after that he comes back to his family and clear his grandfather's name. His color palette is red, white, and blue. Although these colors are related to his clothes, they show his personality as well, since red gives the idea of his passion temper, while combining with white, which brings his simplicity to live and the blue is for his cool and easy-going temper. Again, here we have the use of white, not to show anger or sadness. This color scheme shows a different emotion, also relate to white.

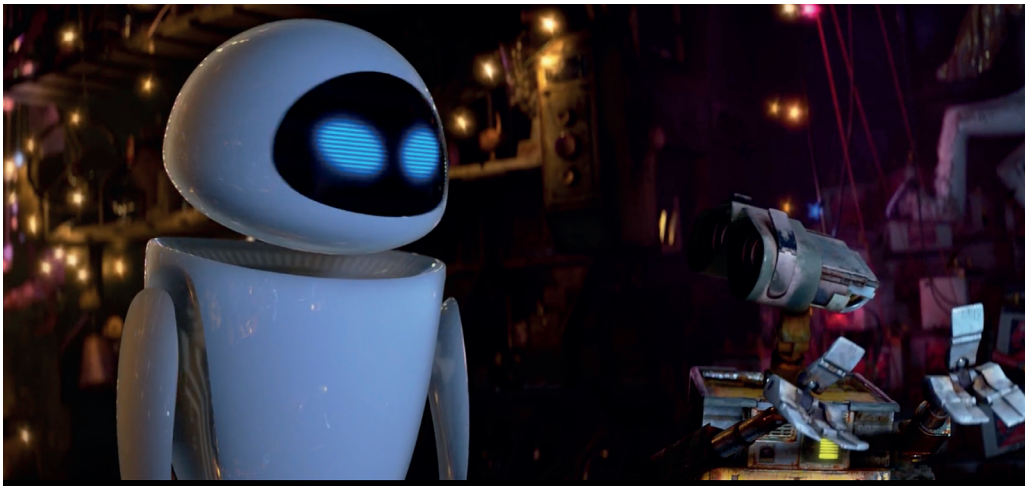
^ Figure [211] Miguel Rivera from the movie Coco and its color scheme.

^ Figure [212] Screenshot from the movie Coco.

^ Figure [213] Screenshot from the movie Coco.

EVE from the movie Wall-e has a color scheme made of white, black, and cyan. Even though white is her main color this color scheme gives the impression of aggressiveness. Where white is used to give the impression of something sterilized and brand new, but when combined with black it also gives the impression of something dangerous, plus the color cyan, that has the aspect of a neon and pops over black background. EVE can be trigger-happy and destructive. But in the later part of the movie, she mellows out and shows she can also be quite shy, kind, and protective. Even though the black and white combination on EVE gives the idea of dangerous at first glance, later, we start to emphasize with her personality and the emotion dangerous is replaced by her caring personality towards Wall-e.





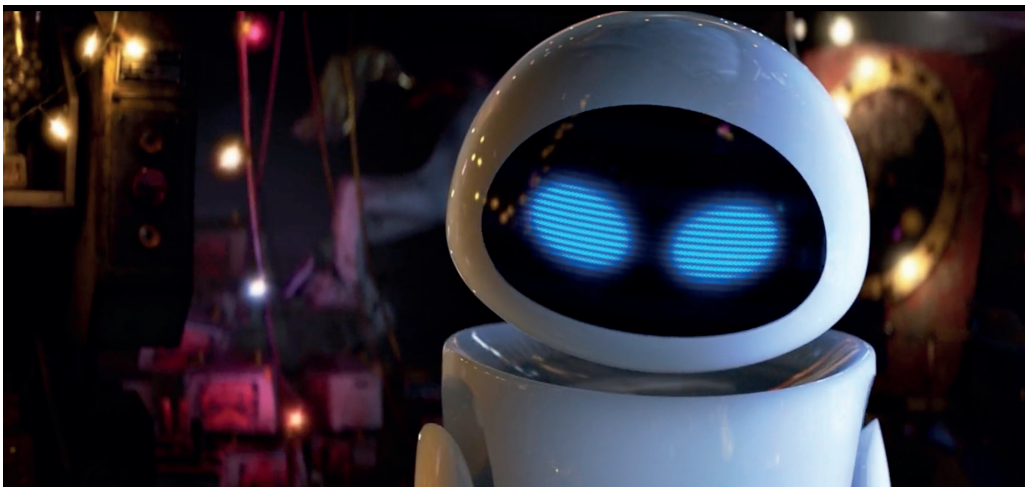


Figure [214] ^ EVE from the movie Wall-e and his color scheme.

Figure [215] ^ Screenshot from the movie Wall-e .

Figure [216] ^ Screenshot from the movie Wall-e .

The color white is also used by Carl Fredricksen on the movie Up, but in this case, it does not have relation with the emotion angry. His color scheme is based on dark brown, black and white. As analyzed before, these colors show his monotonous life, although white has a small portion in his color scheme, we can also relate this color to his sadness of not being with his wife.

^ Figure [217] Carl Fredricksen from the movie UP and its color scheme.

^ Figure [218] Screenshot from the movie UP.

^ Figure [219] Screenshot from the movie UP.

Moving on to the movie Inside Out we can see some of the main characters also using the white in their color palette, like Anger, who's color palette is red, white, brown, and black. Despite white is related to angry in this analysis, in this case, the color that gives the idea of angry feelings is red, the color white is there just to show his boring and strict personality, combined with brown and black.

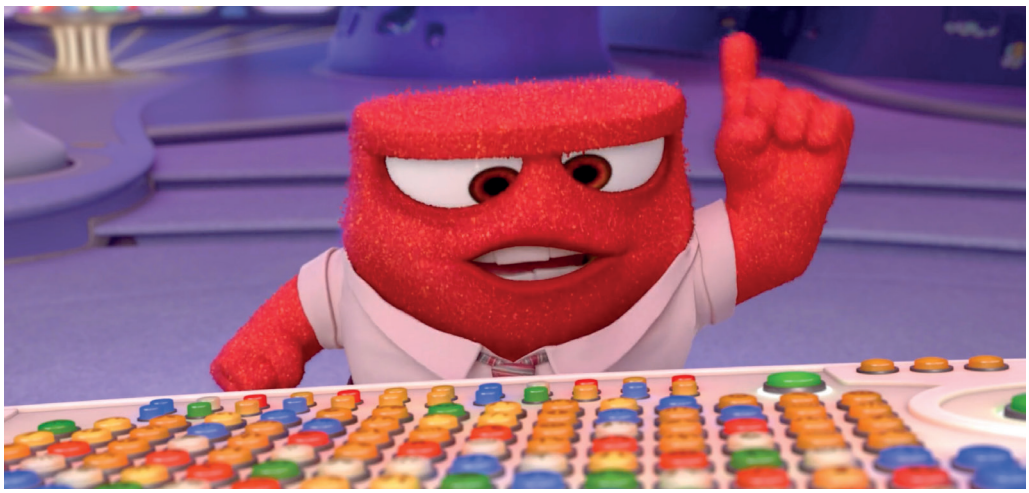
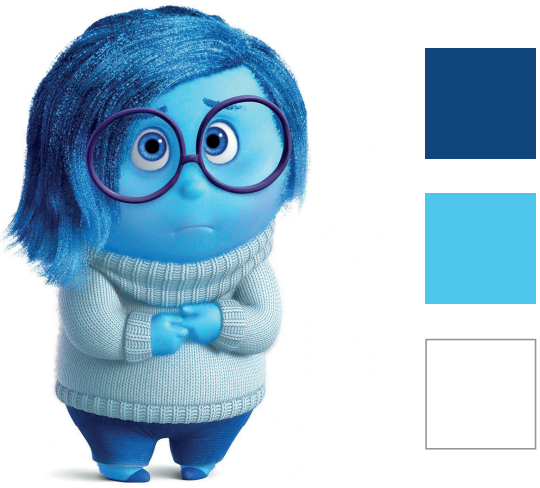


Figure [219] ^ Anger from the movie Inside Out and his color scheme.

Figure [220] ^ Screenshot from the movie Inside Out .

Figure [221] ^ Screenshot from the movie Inside Out.

Also, Sadness has her color scheme consisting of blue and white and this color chord enhance the emotion sadness for this character. Although, in this case, white can be related to the emotion sadness due to his combination with blue, it does not go along with anger.



^ Figure [222] Sadness from the movie Inside Out and her color scheme.

^ Figure [223] Screenshot from the movie Inside Out.

^ Figure [224] Screenshot from the movie Inside Out.

And one last character that also has white in his color scheme is Fear. His colors are purple, magenta, black, white, and blue. Here we have another case, where the color white, by itself, is not relevant to show this characters personality, but when used with black in a cardigan, combining with a social shirt and a magenta bowl tie, it is possible to analyze this set and understand that due to his clothing he has an awkward personality, despites that, he tries to fit as much as he can with his boring and outdated clothes.

Figure [225] ^
Fear from the movie Inside Out and his color scheme.

Figure [226] ^
Screenshot from the movie Inside Out .

Figure [227] ^
Screenshot from the movie Inside Out.

On Soul, we have the character Dorothea Willians and her color palette of black, white, and purple. Since we already talked about her and her personality while analyzing the color black and the emotion anger, let us just skip to analyze the color white and the emotions sadness and anger. In her case, the white can also be related to angry due to her serious personality. Besides, the combination of white and black enhances her serious, and unpleasant side, which also are related to emotions like danger or caution.

^ Figure [228] Dorothea Willians from the movie Soul and her color scheme.

^ Figure [229] Screenshot from the movie Soul.

^ Figure [230] Screenshot from the movie Soul.

Other characters from Luca like Giulia Marcovaldo and Daniela Paguro, has white in their color palette, but this color does not have relation to anger or to sadness, it is there more as a neutral color to enhance and balance the color chord from those characters. This also happens with Woody, Mr. Potato Head and Bo Beep from Toy Story. Also, with Boo from Monsters Inc.

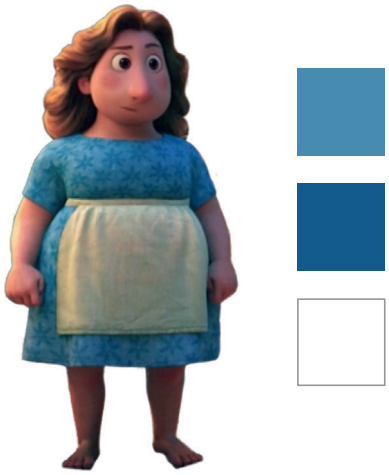


Figure [231] ^
Giulia Marcovaldo from the movie Luca and her color scheme.

Figure [232] ^
Daniela Paguro from the movie Luca and her color scheme.

Figure [233] ^
Woody from the movie Toy Story and his color scheme.

Figure [234] ^
Bo Peep from the movie Toy Story and her color scheme.

Figure [235] ^
Mr. Potato Head from the movie Toy Story and his color scheme.

Figure [236] ^
Boo from the movie Monsters Inc. and her color scheme.

Figure [237] >
Screenshots from the movies.


ALIMENTARI
ROCK
MB.
Milton Bradley
Ages 6 and Up
The game that
ties you up in knot

Figure [238] ^ Screenshots from the movies. Characters related with color light purple and emotions amusement.

LIGHT PURPLE X AMUSEMENT

As our last positive moderate correlation, we have light purple and the emotion amusement. According to Heller (2014), this color is also related with positive feelings like wisdom, imagination, sophistication, inspiration, wealth, nobility, luxury, mysticism, also with negative feelings like exaggeration, excess, madness, cruelty, vanity. Despite that, this work will focus on the correlation between light purple and the emotion amusement, since the statistics shows that this correlation has a medium correlation, and it is relevant to this work.

If we look into James Sullivan from Monsters Inc. Sullivan has a loyal personality and he is Mike Wazowski's best friend. He is very friend and sociable. He is always up to a good time, and he lives life with pleasure. His color scheme is light green and light purple, this light color combination brings a happy and friendly aspect to this character. Making his colors working with his personality.

^ Figure [239] James Sullivan from the movie Monsters Inc. and her color scheme.

^ Figure [240] Screenshot from the movie Monsters Inc.

^ Figure [241] Screenshot from the movie Monsters Inc.

Also, Boo has this color in her color scheme as well, with light magenta, light purple and white, as we explained before, those tones give the idea of sweet and childish aspect, which fits perfect for this character, since Boo is a child who accidentally gets into the monster world in Monsters, Inc.

Figure [242] ^
Boo from the movie Monsters, Inc. and her color scheme.

Figure [243] ^
Screenshot from the movie Monsters, Inc.

Figure [244] ^
Screenshot from the movie Monsters, Inc.

Another characters who has this color in its color scheme is Celia Mae. Her color scheme is made by light purple, purple and green. It is possible to see her fanny, outgoing and happy personality matching the statistic's analyses and having a relevant correlation to the emotion amusement.

^ Figure [245] Celia Mae from the movie Monsters, Inc. and her color scheme.

^ Figure [246] Screenshot from the movie Monsters, Inc.

^ Figure [247] Screenshot from the movie Monsters, Inc.

Although, light purple tends to get the idea of amusement to the previous characters from this movie to Randall Boggs is not like that. He is the antagonist his color chord is light purple, light cyan and light magenta, but his colors do not reflect the evil aspect of his personality. We assumed that this is due his color chord to be related to imagination (Heller, 2014), since this character is from a fantasy world, this color palette would suit him because of that, but not because of his personality.

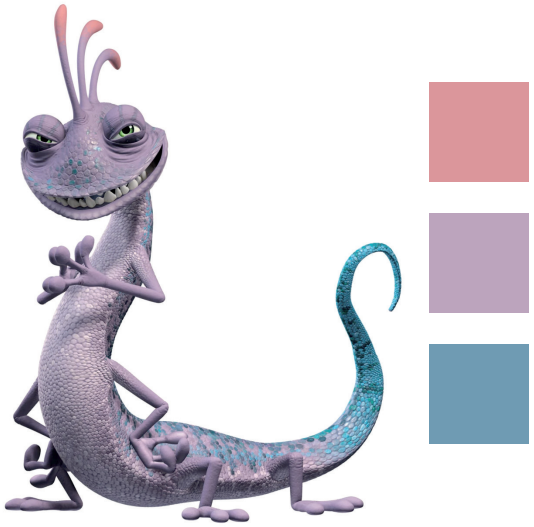


Figure [248] ^ Randall Boggs from the movie Monsters, Inc. and his color scheme.

Figure [249] ^ Screenshot from the movie Monsters, Inc.

Figure [250] ^ Screenshot from the movie Monsters, Inc.

From the movie Inside Out we have the character Bing Bong, although his main color is light magenta, his color scheme is light magenta, purple, light purple, orange, light orange and dark brown. His color combination shows his happy and outgoing personality, he also was made up by Riley, so it makes sense that his colors reflect a color chord for imagination as well (Heller, 2014). He is a happy character and is always willing to cheer others as well. So, this emotion makes sense with this character's personality as well.

^ Figure [251] Bing Bong from the movie Inside Out and his color scheme.

^ Figure [252] Screenshot from the movie Inside Out.

^ Figure [253] Screenshot from the movie Inside Out.

Although, the character Fear, who's colors are light purple, black, white, dark magenta, light blue and dark blue, does not fit this emotion very well, despite his color has a significant amount of light purple. In this case, this color is more related to his exaggerated personality, always afraid of everything, makes him react way more than necessary about life's situations.

Figure [254] ^
Fear from the movie Inside Out and his color scheme.

Figure [255] ^
Screenshot from the movie Inside Out.

Figure [256] ^
Screenshot from the movie Inside Out.

OPPOSITE CORRELATIONS

Finally, we have the opposite correlation where the colors and the emotions are opposite to each other, in other words, their relation is contradictory, which means that color will not relate to that emotion. Like, strong opposite relations happen between the emotion anger and the colors green, light green, purple. Also, fear has a strong opposite correlation with the colors light purple, green, orange. Disgust has a strong opposite correlation to yellow. Sadness has a strong opposite relation between dark green, light yellow, yellow, and orange. Which means that these colors have a strong contrary meaning to these emotions.

Other moderate opposite correlation is Pride in achievement with green, anger with dark blue, fear with yellow, contempt with orange, fear with light green, light magenta with pride in achievement and black with amusement.

CONCLUSION

CONCLUSION

So after analyzing the characters and their color palette, we considered that indeed, most of the colors, has relation with the emotion that the characters is supposed to convey.

Like when analyzing the color dark brown and the emotions anger and pride in achievement. Even though, it was possible to initially assimilate this color with bad emotions we considered that most of those characters that use this color give a bad first impression, most of the times related to the emotion anger. Usually those characters are also pride and tends to use their anger to sub judge other characters or to impose their will over them. Or sometimes de dark brown is only there to show the unfriendly side of a character, like Carl Fredricksen and Massimo Marcovaldo.

Also, the color yellow and the emotions satisfaction and excitement shows that the characters who has this color in their color chord tends to be more excited and therefore are satisfied with the life they have, since these colors brings those good feelings. For example, the character Gabby Gabby uses this color but the predominance of yellow leads to an idea of good, although she is one of the antagonists, deceiving about the character's personality.

The characters which were analyzed while working with the color green and the emotion contentment shows that all of those has relation with this emotion, also this color works with their color scheme to transmit the idea of happiness and as a similar emotion, also the idea of amusement. The strong correlation between dark green and the emotion contentment also show that this relation between color and emotion is often used.

When we considered the color orange and those characters it is possible to relate this color and the emotions like pride, satisfaction, and excitement. The characters who have this color in their color scheme seems to pass the idea of being pride of doing something and this emotion is usually related with satisfaction. Also, this emotion tends to give more energy to the characters as well.

In this correlation, between light magenta and disgust, it was possible to see that even though it was a moderate one, for most of the characters did not fit their personality quite well, since the correlation shows that disgust and light magenta were moderated related. It could be the case for some character's color palette like, Randall Boggs and Disgust, although they only have light magenta as a secondary color in their color scheme. The rest of the characters who use the color are not giving the idea of disgust, on the contrary, they tend to show good emotions.

In the case of white and its correlation with the emotions of sadness and angry. It was possible to see, while analyzing the emotions, that the color chord that usually is used to give the impression of angry personalities are black and white, this was possible to conclude while analyzing characters such as Sid Phillips Buddy Pine, Ernesto de la Cruz, EVE, and Dorotheia Willians. Therefore, it is

possible to interpret that white conveys angry feelings as much as black when putted together. In the other hand, when we have sad characters with white in their color palettes. This emotion can be conveyed with brown tone, such as in the characters like Carl Fredricksen and Anger. Other than that, the white color is very used to enhance other characters personality. Although it is important for us to have in mind that the color chord has influence on how we can interpret the character's color and therefore, their personality.

Although black gives a sense of angry and negative feelings to a color scheme, it can also give the impression of seriousness, like when analyzing characters like Edna from the Incredibles, Dorothea Williams from Soul, Anger from Inside out, all of them use black in their outfits but in this case the color is not related to the emotion anger. Another case that can also be listed as a not angry emotion but uses black in his color palette is Barley Lightfoot from the movie Onward, his clothes are mostly black creating the idea of a rock music listener, although this kind of music gender has a more aggressiveness vibe, his personality is the opposite of this emotion, since he is outgoing, and he is always happy to annoying his brother.

It was also relevant analyzing the opposite correlation and verify that most colors that have not being used. Except fear and light purple, from the character Fear from the movie Inside Out, but it is important to considerer that according to what was analyzed, this character color is no related to the emotion fear but to his eccentric personality, which makes a proper interpretation for this color. Since purple can also be related to the emotion exaggeration (Heller, 2014).

Therefore, our interest in exploring color as an element that carries meanings and acts on the viewer. It led us to meet several publications and authors dedicated to its study from an objective and subjective point of view. Through different perspectives, we came across theories formulated over time about how we see color, how it interacts with the surrounding environment, and how human beings interpret it. In a more or less conscious term, we attribute to it meaning, connotations, symbols, memories, etc. On the one hand, we consolidated some knowledge that we already had. Additionally, we discovered new questions and curiosities that allowed us to develop our reflection and critical positioning in the face of the more functional character of color. Furthermore, as most authors mentioned, we conclude that color and emotions are vast and complex topics with several ramifications. Thus, despite being the subject of study for many theorists, scientists, psychologists, and artists, there is still a lot of work ahead for color to be understood in its entirety — if that can be considered at all.

The fact that color is seen as an element associated with emotions in animated films leads us to question its role in other sectors. Specifically in other visual communication areas, like animated films, some scholars defend color as more than an aesthetic element, elevating it to a structural element of the images, capable of establishing emotional understandings, creating atmospheres in scenes, marking rhythms, creating associations and contributes for the narrative (Adam, 2017; Amidi, 2011; Brito & Cho, 2017; Ren, 2020). However, color in animation as a way of conveying feelings still needs to be better documented,

although greater interest in exploring the theme has started to increase only in recent years. Therefore, a recommendation for future researchers includes exploring if the antagonist color pallet can be associated with the emotions they are supposed to convey. If the protagonists have brighter colors than the antagonist and which emotions the protagonist is supposed to convey based on their color pallet. Also, verify if color influences the scene and creates an atmosphere in animated movies. In conclusion, I intend that this work can contribute to extending the academic research related to graphic design and animation movies. Also, it continues to lay the grounds for other researchers to develop the theoretical study of color association in animation films.

ATTACHMENTS

ATTACHEMENTS

	Amusement	Anger	Contempt	Contentment	Disgust	Embarrassment	Excitement	Fear	Guilt	Pride in Achievement	Relief	Sadness	Satisfaction	Shame
Carl Fredricksen					1				1			1		
Ellie Fredricksen	1			1			1							
Russel	1			1		1	1			1				
Dug	1			1			1							
Kevin	1						1							
Charles F. Muntz		1	1		1			1		1				
Alpha		1	1		1			1		1				
Luca Paguro (mosnter)	1			1			1							
Luca Paguro (person)	1			1			1							
Alberto Scorfano (monster)	1			1			1			1			1	
Alberto Scorfano (person)	1			1			1			1			1	
Giulia Marcovaldo	1			1			1			1			1	
Ercole Visconti		1	1		1					1			1	
Daniela Paguro (monster)	1			1										
Daniela Paguro (person)	1			1										
Massimo Marcovaldo										1				
Lorenzo Paguro (monster)				1		1								
Lorenzo Paguro (person)				1		1								
Grandma Paguro (monster)	1			1										
Grandma Paguro (person)	1			1										
Joe Gardner (person)							1					1		
Joe Gardner (soul)							1					1		
22	1		1		1		1			1				
Libba Gardner				1						1				
Dorothea Williams			1							1			1	
MoonWind (person)	1			1			1						1	
MoonWind (soul)	1			1			1						1	
Miguel Rivera	1			1		1	1							
Abuela		1	1	1	1					1		1		
Hector Rivera (person)	1						1		1			1		
Hector Rivera (skeleton)	1						1		1			1		
Ernesto de la Cruz (person)	1		1	1	1		1	1		1			1	
Ernesto de la Cruz (skeleton)	1		1	1	1		1	1		1			1	
Imelda Rivera			1		1					1				
Coco				1										
Woody	1			1			1			1			1	
Buzz Lightyear				1			1			1			1	
Mr. Potato Head		1	1		1		1							
Slinky Dog	1			1										
Rex	1			1			1							
Hamm	1	1		1			1							
Bo Peep	1			1			1							
Sid Phillips		1	1		1			1						

Table [1] ^
Relation between characters x Emotions.
Data collected by author on the 26th of September 2022.

	Amusement	Anger	Contempt	Contentment	Disgust	Embarrassment	Excitement	Fear	Guilt	Pride in Achievement	Relief	Sadness	Satisfaction	Shame
Andy Davys				1										
Michael Wazowski	1			1			1			1			1	
James Sullivan	1			1			1			1			1	
Boo	1			1			1						1	
Randall Boggs			1		1			1						
Celia Mae	1			1			1							
Roz			1		1	1		1						
Dean Hardscrabble			1					1						
Squishy	1			1		1	1							
Don Carlton	1			1			1							
Art	1			1										
Terri and Terry Perry	1			1			1							
Bob Parr / Mr. Incredible				1			1			1			1	
Elen Parr / Elasticgirl				1			1			1			1	
Dash Parr	1			1			1			1			1	
Violet Parr				1			1			1			1	
Lucius Best /Frozone				1			1							
Edna Mode		1	1					1		1				
Buddy Pine		1	1				1	1						
Merida				1			1							
Queen Elinor				1						1				
King Fergus	1	1		1			1	1		1				
Harris, Hubert, Hamish (the triplets)	1			1			1							
Anger		1	1				1	1		1			1	
Sadness			1			1		1				1		1
Fear			1			1		1	1			1		
Disgust			1	1	1								1	
Joy	1			1			1			1			1	
Bing Bong	1			1			1			1			1	
Barley Lightfoot	1			1			1			1			1	
Ian Lightfoot				1		1		1				1		
Laurel Lightfoot	1			1			1			1			1	
Corey the Manticore	1	1		1			1	1		1			1	
Colt Bronco				1						1			1	
Wall-E	1			1			1			1		1	1	
EVA	1	1		1				1						

^ Table [1] Continue of relation between characters x Emotions.
Data collected by author on the 26th of September 2022.

Table [2] > Relation between characters x Colors. Data collected by author on the 26th of September 2022.

	light Red | Salmon	Red	Red Dark | Brown light	Green light	Green	Green dark | Olive	Yellow light	Yellow	Yellow dark	Blue light	Blue	Blue dark	Cyan light	Cyan	Cyan Dark	Magenta light	Magenta	Magenta dark	Orange light	Orange	Orange dark | Brown dark	Purple light | Lilac	Purple	Purple dark	White	Grey	Black
Carl Fredricksen																					1				1		1
Ellie Fredricksen								1										1					1					
Russel							1													1	1							
Dug									1												1							
Kevin								1			1							1		1	1		1					
Charles F. Muntz			1				1														1							
Alpha			1									1									1							
Luca Paguro (monster)				1	1	1					1																	
Luca Paguro (person)							1				1			1														
Alberto Scorfano (monster)			1						1					1								1	1					
Alberto Scorfano (person)			1				1																					
Giulia Marcovaldo		1	1	1							1			1						1					1		
Ercole Visconti			1								1							1										
Daniela Paguro (Monster)				1	1	1					1																	
Daniela Paguro (Person)													1		1										1			
Massimo Marcovaldo			1				1														1							
Lorenzo Paguro (monster)				1	1	1																						
Lorenzo Paguro (person)							1						1								1							
Grandma Paguro (monster)					1																	1	1					
Grandma Paguro (Person)			1	1	1	1																						
Joe Gardner (person)																										1	1	
Joe Gardner (soul)				1	1						1																	
22				1	1						1																	
Libba Gardner		1																					1					
Dorothea Williams																							1		1		1	
MoonWind (person)					1			1			1			1														
MoonWind (soul)				1	1						1																	
Miguel Rivera		1									1										1				1			
Abuela			1							1							1											
Hector Rivera (person)		1	1																						1			
Hector Rivera (skeleton)		1							1												1		1					
Ernesto de la Cruz (person)											1	1													1			
Ernesto de la Cruz (skeleton)																									1		1	
Imelda Rivera																					1		1					
Mama Coco																												
Woody		1	1					1			1									1	1				1		1	
Buzz Lightyear		1			1																		1		1	1	1	
Mr. Potato Head		1	1											1			1			1					1		1	
Slinky Dog					1				1												1					1		
Rex				1	1																							
Hamm																	1										1	
Bo Peep													1				1								1			
Sid Phillips																									1		1	
Andy Davys		1									1														1			

Table [2] > Continue of relation between characters x Colors.
Data collected by author on the 26th of September 2022.

	light Red | Salmon	Red	Red Dark | Brown light	Green light	Green	Green dark | Olive	Yellow light	Yellow	Yellow dark	Blue light	Blue	Blue dark	Cyan light	Cyan	Cyan Dark	Magenta light	Magenta	Magenta dark	Orange light	Orange	Orange dark | Brown dark	Purple light | Lilac	Purple	Purple dark	White	Grey	Black
Michael Wazowski					1																							
James Sullivan														1								1						
Boo																	1					1			1			
Randall Boggs														1			1					1						
Celia Mae				1	1												1					1						
Roz		1		1																	1							
Dean Hardscrabble		1	1																									
Squishy					1			1									1											
Don Carlton					1														1									
Art																						1	1					
Terri and Terry Perry					1			1												1	1							
Bob Parr / Mr. Incredible		1						1												1								1
Elen Parr / Elasticgirl		1						1												1								1
Dash Parr		1						1												1								1
Violet Parr		1						1												1								1
Lucius Best / Frozone														1											1			
Edna Mode													1															1
Buddy Pine		1																							1			1
Merida		1					1						1															
Queen Elinor						1		1																				
King Fergus		1				1							1								1							1
Harris, Hubert, Hamish (the triplets)		1				1							1								1							
Anger		1																			1				1			
Sadness												1		1										1	1			
Fear											1								1			1	1		1			1
Disgust				1	1	1											1											
Joy				1				1				1																
Bing Bong																	1			1	1	1	1	1				
Barley Lightfoot						1						1													1			1
Ian Lightfoot		1	1									1													1			
Laurel Lightfoot							1						1															
Corey the Manticore		1	1			1																						
Colt Bronco			1					1				1		1							1							
Wall-E									1												1							
EVA														1											1			1

Contentment	Green dark | Olive	1.0
Excitement	Orange	1.0
Green light	Green	0.9178082191780822
Yellow	Orange	0.873015873015873
Purple light | Lilac	Purple	0.8072289156626506
Magenta light	Purple light | Lilac	0.7841726618705036
Green light	Green dark | Olive	0.7611940298507462
Red	Orange	0.7122302158273381
Excitement	Satisfaction	0.7023809523809523
Anger	Red Dark | Brown light	0.6923076923076923
Orange	Black	0.6875
White	Black	0.6607773851590106
Satisfaction	Yellow	0.6593186372745491
Excitement	Yellow	0.6551724137931034
Contentment	Green	0.6310679611650486
Anger	Black	0.6307692307692307
Pride in Achievement	Orange	0.6277915632754343
Cyan	Purple light | Lilac	0.6266666666666667
Satisfaction	Orange	0.6246913580246913
Green	Green dark | Olive	0.6119402985074627
Pride in Achievement	Red Dark | Brown light	0.5918367346938775
Amusement	Green	0.5897435897435898
Disgust	Magenta light	0.5833333333333334
Blue	Cyan	0.582089552238806
Sadness	White	0.5789473684210527
Red	Black	0.559322033898305
Fear	White	0.5409836065573771
Yellow light	Orange dark | Brown dark	0.5362318840579711
Amusement	Purple light | Lilac	0.5348837209302325
Red Dark | Brown light	Cyan	0.5068493150684932
Contentment	Yellow	0.5
Red	White	0.49825783972125437

Table [3] ^ Correlation result between color x emotions. Data collected by author on the 26th of September 2022.

Embarrassment	Yellow light	0.4939759036144578
Pride in Achievement	Yellow	0.49044585987261147
Sadness	Purple	0.48717948717948717
Excitement	Red	0.4782608695652174
Orange	Orange dark | Brown dark	0.4782608695652174
Contempt	White	0.46938775510204084
Anger	Magenta light	0.46835443037974683
Pride in Achievement	Black	0.45098039215686275
Disgust	Red Dark | Brown light	0.44846796657381616
Embarrassment	Orange dark | Brown dark	0.4444444444444444
Red Dark | Brown light	Yellow light	0.44206008583690987
Satisfaction	Black	0.423728813559322
Fear	Black	0.42028985507246375
Pride in Achievement	Yellow light	0.4186851211072664
Fear	Red	0.40919037199124725
Red	Red Dark | Brown light	0.40919037199124725
Blue	White	0.391304347826087
Contempt	Black	0.3849462365591398
Embarrassment	White	0.3793103448275862
Red	Yellow	0.375609756097561
Satisfaction	Cyan	0.373134328358209
Satisfaction	Blue	0.3692022263450835
Amusement	Blue	0.3684210526315789
Yellow	Black	0.36239782016348776
Amusement	Green dark | Olive	0.3617021276595745
Contempt	Magenta light	0.36
Fear	Sadness	0.35802469135802467
Sadness	Red Dark | Brown light	0.35802469135802467
Amusement	Green light	0.35766423357664234
Contentment	Orange	0.3548387096774194
Fear	Red Dark | Brown light	0.3477088948787062
Disgust	Pride in Achievement	0.3392070484581498

^ Table [3] Continue of correlation result between color x emotions.
Data collected by author on the 26th of September 2022.

Anger	Red	0.3370473537604457
Contempt	Red Dark | Brown light	0.33649289099526064
Amusement	Satisfaction	0.32533733133433285
Contempt	Pride in Achievement	0.32075471698113206
Yellow	Blue	0.32075471698113206
Excitement	Black	0.31313131313131315
Cyan	Magenta light	0.2967032967032967
Contentment	Magenta light	0.2923076923076923
Cyan	White	0.2894736842105263
Disgust	Orange dark | Brown dark	0.28
Yellow	Orange dark | Brown dark	0.28
Green	Blue	0.2777777777777778
Sadness	Black	0.27710843373493976
Satisfaction	Red Dark | Brown light	0.2645161290322581
Satisfaction	Purple light | Lilac	0.25170068027210885
Embarrassment	Blue	0.23809523809523808
Sadness	Blue	0.23809523809523808
Cyan	Orange	0.23404255319148937
Magenta light	Orange	0.23404255319148937
Excitement	Cyan	0.22330097087378642
Excitement	Magenta light	0.22330097087378642
Contentment	Purple light | Lilac	0.21991701244813278
Amusement	Orange	0.21568627450980393
Satisfaction	Red	0.21492007104795738
Satisfaction	White	0.21492007104795738
Anger	Orange dark | Brown dark	0.20987654320987653
Excitement	Blue	0.20930232558139536
Red Dark | Brown light	Orange	0.20912547528517111
Red Dark | Brown light	Blue	0.20822622107969152
Excitement	Pride in Achievement	0.20634920634920634
Contentment	Green light	0.20481927710843373
Red	Orange dark | Brown dark	0.20245398773006135

Table [3] ^ Continue of correlation result between color x emotions.
Data collected by author on the 26th of September 2022.

Disgust	White	0.2010443864229765
Contempt	Embarrassment	0.2
Contempt	Sadness	0.2
Pride in Achievement	Red	0.2
Green	Magenta light	0.19540229885057472
Embarrassment	Green light	0.193717277486911
Embarrassment	Purple	0.193717277486911
Pride in Achievement	Orange dark | Brown dark	0.19298245614035087
Disgust	Green light	0.1821561338289963
Fear	Pride in Achievement	0.18032786885245902
Anger	Green dark | Olive	0.17525773195876287
Disgust	Black	0.16666666666666666
Fear	Orange dark | Brown dark	0.16455696202531644
Red Dark | Brown light	Orange dark | Brown dark	0.16455696202531644
Excitement	Green	0.1566265060240964
Green dark | Olive	Blue	0.15471698113207547
Contempt	Purple	0.14285714285714285
Disgust	Sadness	0.14285714285714285
Orange dark | Brown dark	Purple	0.14285714285714285
Contentment	Yellow light	0.13513513513513514
Anger	White	0.13253012048192772
Amusement	Magenta light	0.12727272727272726
Embarrassment	Red	0.12643678160919541
Sadness	Red	0.12643678160919541
Green light	Magenta light	0.12
Cyan	Purple	0.12
Contempt	Cyan	0.11524163568773234
Contentment	Blue	0.11504424778761062
Contentment	Pride in Achievement	0.10891089108910891
Red Dark | Brown light	White	0.08108108108108109
Pride in Achievement	Purple	0.08029197080291971
Blue	Orange	0.07913669064748201

^ Table [3] Continue of correlation result between color x emotions.
Data collected by author on the 26th of September 2022.

Excitement	White	0.07692307692307693
Disgust	Cyan	0.06796116504854369
Yellow	Cyan	0.06796116504854369
Amusement	Yellow	0.06422018348623854
Purple	White	0.06358381502890173
Orange	Purple	0.05263157894736842
Fear	Purple light | Lilac	0.04854368932038835
Red	Green dark | Olive	0.039711191335740074
Magenta light	White	0.039711191335740074
Excitement	Yellow light	0.034482758620689655
Excitement	Green light	0.012658227848101266
Amusement	Orange dark | Brown dark	0.012389380530973451
Contentment	Cyan	-0.0035587188612099642
Purple	Black	-0.010101010101010102
Amusement	Purple	-0.01694915254237288
Pride in Achievement	Blue	-0.02040816326530612
Yellow light	Cyan	-0.024390243902439025
Fear	Green dark | Olive	-0.027522935779816515
Fear	Cyan	-0.027522935779816515
Red Dark | Brown light	Green dark | Olive	-0.027522935779816515
Red Dark | Brown light	Magenta light	-0.027522935779816515
Embarrassment	Purple light | Lilac	-0.03225806451612903
Sadness	Purple light | Lilac	-0.03225806451612903
Contempt	Orange dark | Brown dark	-0.034482758620689655
Embarrassment	Green	-0.037037037037037035
Green	Purple light | Lilac	-0.037037037037037035
Orange	White	-0.03754266211604096
Contentment	Red	-0.06432748538011696
Pride in Achievement	Green dark | Olive	-0.06748466257668712
Pride in Achievement	Cyan	-0.06748466257668712
Green	Yellow	-0.06796116504854369
Red	Blue	-0.0744920993227991

Table [3] ^ Continue of correlation result between color x emotions.
Data collected by author on the 26th of September 2022.

Satisfaction	Green light	-0.08196721311475409
Satisfaction	Purple	-0.08196721311475409
Yellow light	Orange	-0.08527131782945736
Contentment	Embarrassment	-0.09090909090909091
Contempt	Green light	-0.0932475884244373
Satisfaction	Green dark | Olive	-0.09897610921501707
Satisfaction	Magenta light	-0.09897610921501707
Embarrassment	Green dark | Olive	-0.09923664122137404
Embarrassment	Cyan	-0.09923664122137404
Embarrassment	Magenta light	-0.09923664122137404
Sadness	Cyan	-0.09923664122137404
Sadness	Magenta light	-0.09923664122137404
Amusement	Yellow light	-0.10144927536231885
Amusement	Cyan	-0.1044776119402985
Amusement	Pride in Achievement	-0.10650069156293222
Disgust	Blue	-0.11041009463722397
Green dark | Olive	Black	-0.11304347826086956
Magenta light	Black	-0.11304347826086956
Contempt	Purple light | Lilac	-0.11504424778761062
Sadness	Orange dark | Brown dark	-0.11504424778761062
Contempt	Satisfaction	-0.11553784860557768
Yellow	Purple	-0.11864406779661017
Contempt	Red	-0.12087912087912088
Excitement	Purple light | Lilac	-0.12751677852348994
Anger	Yellow light	-0.14074074074074075
Disgust	Satisfaction	-0.14583333333333334
Embarrassment	Orange	-0.15942028985507245
Orange	Purple light | Lilac	-0.15942028985507245
Green dark | Olive	Magenta light	-0.16546762589928057
Excitement	Orange dark | Brown dark	-0.16756756756756758
Red	Purple	-0.16923076923076924
Contempt	Blue	-0.17647058823529413

^ Table [3] Continue of correlation result between color x emotions.
Data collected by author on the 26th of September 2022.

Blue	Orange dark | Brown dark	-0.17647058823529413
Satisfaction	Green	-0.17926565874730022
Pride in Achievement	White	-0.1864406779661017
Blue	Orange	-0.4392523364485981
Agressive	Hyperactive	-0.43283582089552236
Hyperactive	Purple	-0.42857142857142855
Kind	Blue	-0.41935483870967744
Purple	Orange	-0.4117647058823529
Nice	Blue	-0.40540540540540543
Agressive	Fun	-0.3953488372093023
Curious	White	-0.391812865497076
Serious	Nervous	-0.3893129770992366
Bad temperament	Yellow	-0.38738738738738737
Blue	Red	-0.38461538461538464
Friendly	White	-0.3793103448275862
Bad temperament	Protective	-0.37349397590361444
Nervous	Black	-0.344
Nervous	Yellow	-0.344
Hyperactive	White	-0.3434650455927052
White	Orange	-0.33668341708542715
Bad temperament	Red	-0.3333333333333333
Bitter	Passionate	-0.3333333333333333
White	Purple	-0.3333333333333333
Nervous	Protective	-0.3263157894736842
Serious	Nice	-0.3191489361702128
Insecure	Serious	-0.31092436974789917
Kind	Black	-0.3081761006289308
Serious	Yellow	-0.29411764705882354
Bad temperament	Brave	-0.2911392405063291
Bad temperament	Green	-0.2911392405063291
Fun	White	-0.2911392405063291
Passionate	Green	-0.2655367231638418

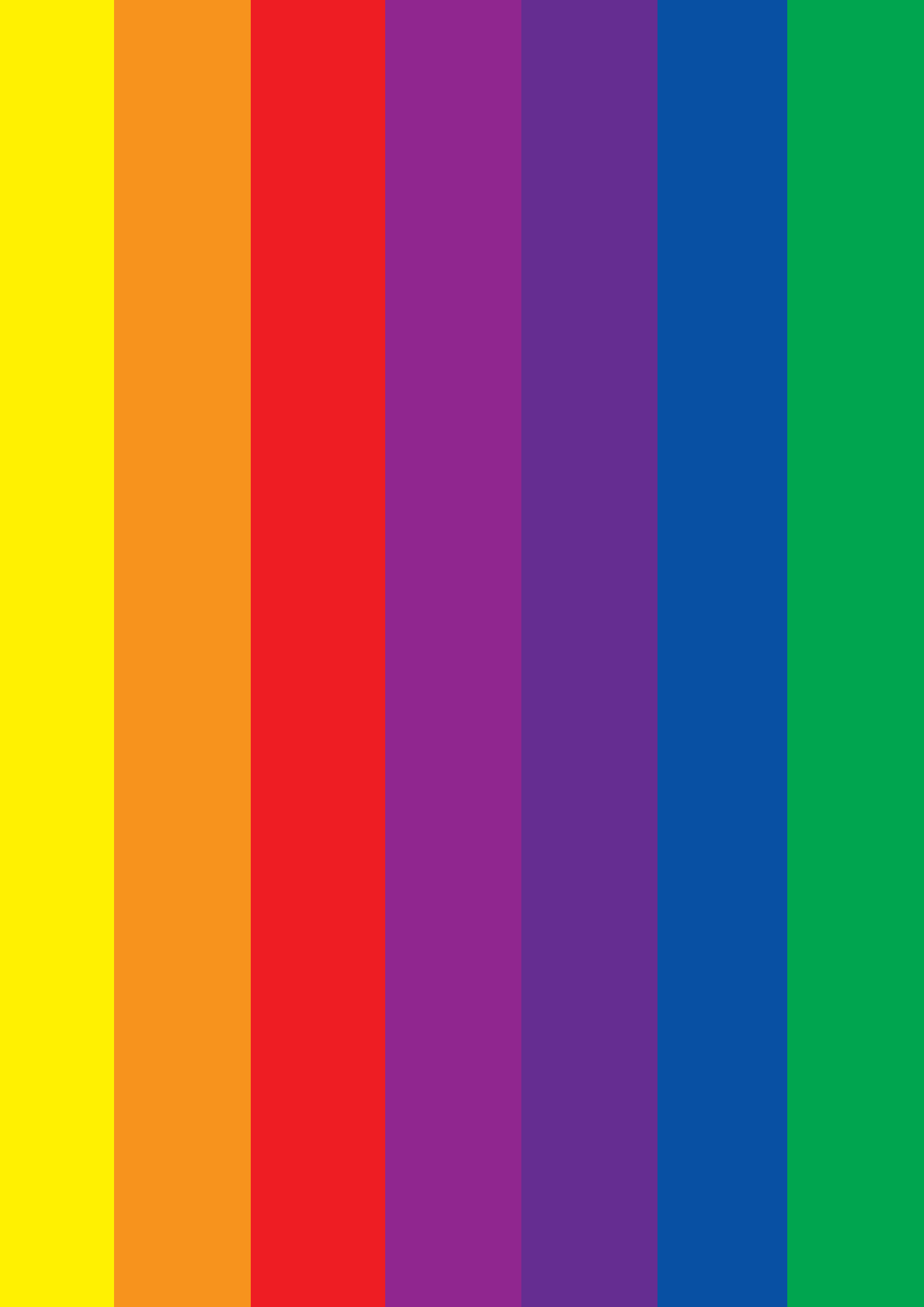
Table [3] ^ Continue of correlation result between color x emotions.
Data collected by author on the 26th of September 2022.

Insecure	Blue	-0.26436781609195403
Agressive	Yellow	-0.2631578947368421
Insecure	Black	-0.2631578947368421
Insecure	Yellow	-0.2631578947368421
Kind	Hyperactive	-0.2631578947368421
Bitter	Kind	-0.2558139534883721
Bitter	Orange	-0.25217391304347825
Nice	Brown	-0.24260355029585798
Bitter	Blue	-0.24050632911392406
Brown	Green	-0.23432343234323433
Agressive	Protective	-0.22807017543859648
Nice	Black	-0.21967213114754097
Serious	Determinate	-0.20481927710843373
Bad temperament	Passionate	-0.2
Brave	White	-0.2
Protective	Black	-0.1916376306620209
Bad temperament	Determinate	-0.19008264462809918
Friendly	Blue	-0.1891891891891892
Purple	Red	-0.1827956989247312
Bitter	Nervous	-0.17757009345794392
Brown	Blue	-0.16923076923076924
Nice	White	-0.16417910447761194
Protective	Blue	-0.15384615384615385
Friendly	Red	-0.14285714285714285
Curious	Red	-0.13924050632911392
Bad temperament	Orange	-0.12643678160919541
Kind	Yellow	-0.1182108626198083
Determinate	Black	-0.1182108626198083
Determinate	Yellow	-0.1182108626198083
Nervous	Orange	-0.10891089108910891
Bad temperament	Purple	-0.10638297872340426
Brave	Purple	-0.10469314079422383

^ Table [3] Continue of correlation result between color x emotions.
Data collected by author on the 26th of September 2022.

Serious	Blue	-0.09967845659163987
Bad temperament	Hyperactive	-0.09859154929577464
Kind	White	-0.09738717339667459
Determinate	Green	-0.09738717339667459
Bad temperament	White	-0.09657320872274143
Bitter	Insecure	-0.09090909090909091
Hyperactive	Red	-0.09090909090909091
Brown	Orange	-0.07692307692307693
Hyperactive	Protective	-0.07163323782234957
Friendly	Brown	-0.06432748538011696
Brown	Purple	-0.05263157894736842
Friendly	Purple	-0.04854368932038835
Bitter	Yellow	-0.047619047619047616
Bitter	Purple	-0.047619047619047616
Nervous	Blue	-0.04477611940298507
Brave	Blue	-0.04
Fun	Red	-0.04
Blue	Green	-0.04
Nervous	Fun	-0.037037037037037035
Brave	Brown	-0.03225806451612903
White	Red	-0.030303030303030304
Determinate	Fun	-0.022222222222222223
Agressive	Orange	-0.02127659574468085
Insecure	Orange	-0.02127659574468085
Serious	Kind	-0.02127659574468085
Determinate	Red	-0.02040816326530612
Passionate	Black	-0.011235955056179775

Table [3] ^ Continue of correlation result between color x emotions.
Data collected by author on the 26th of September 2022.



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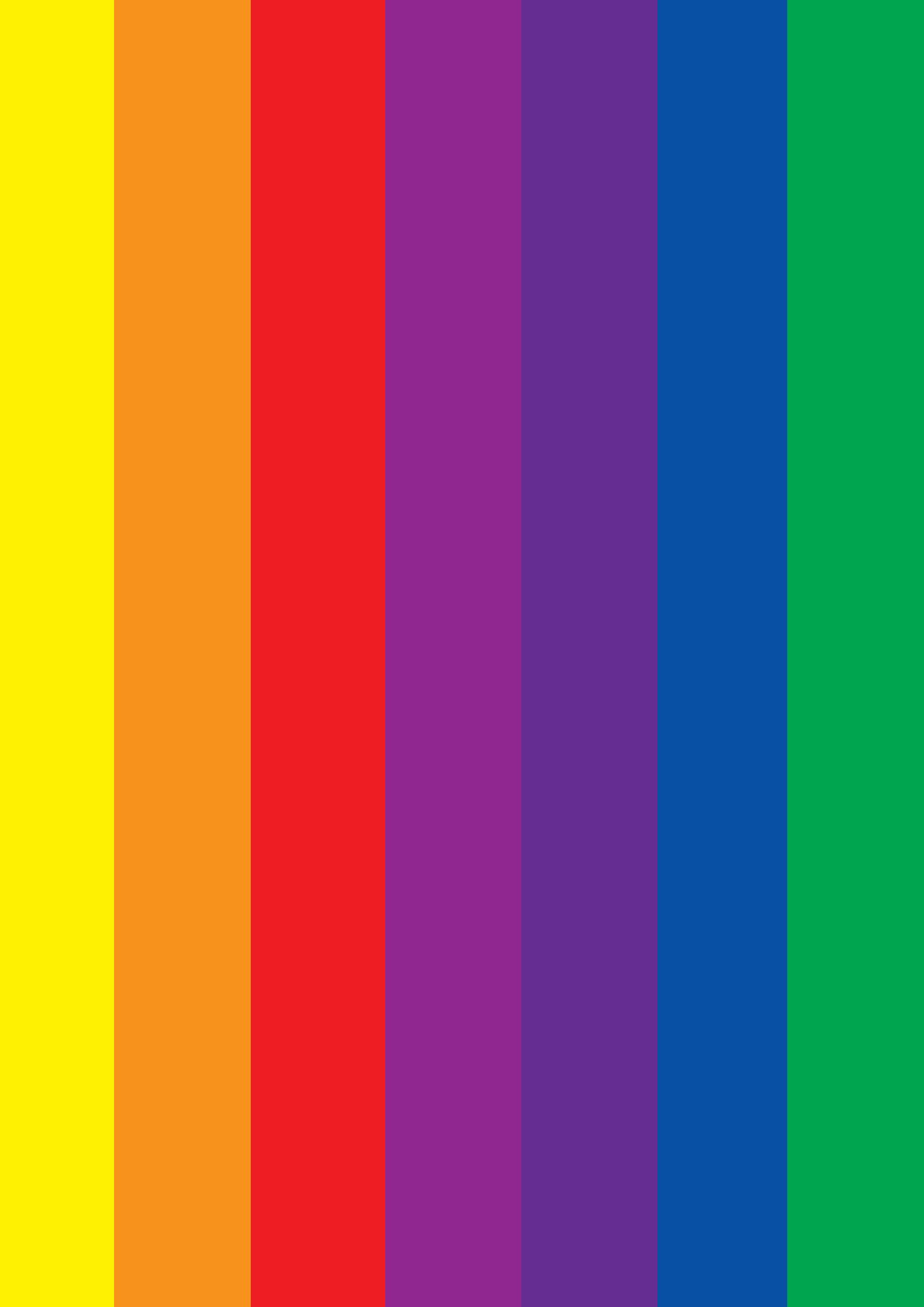

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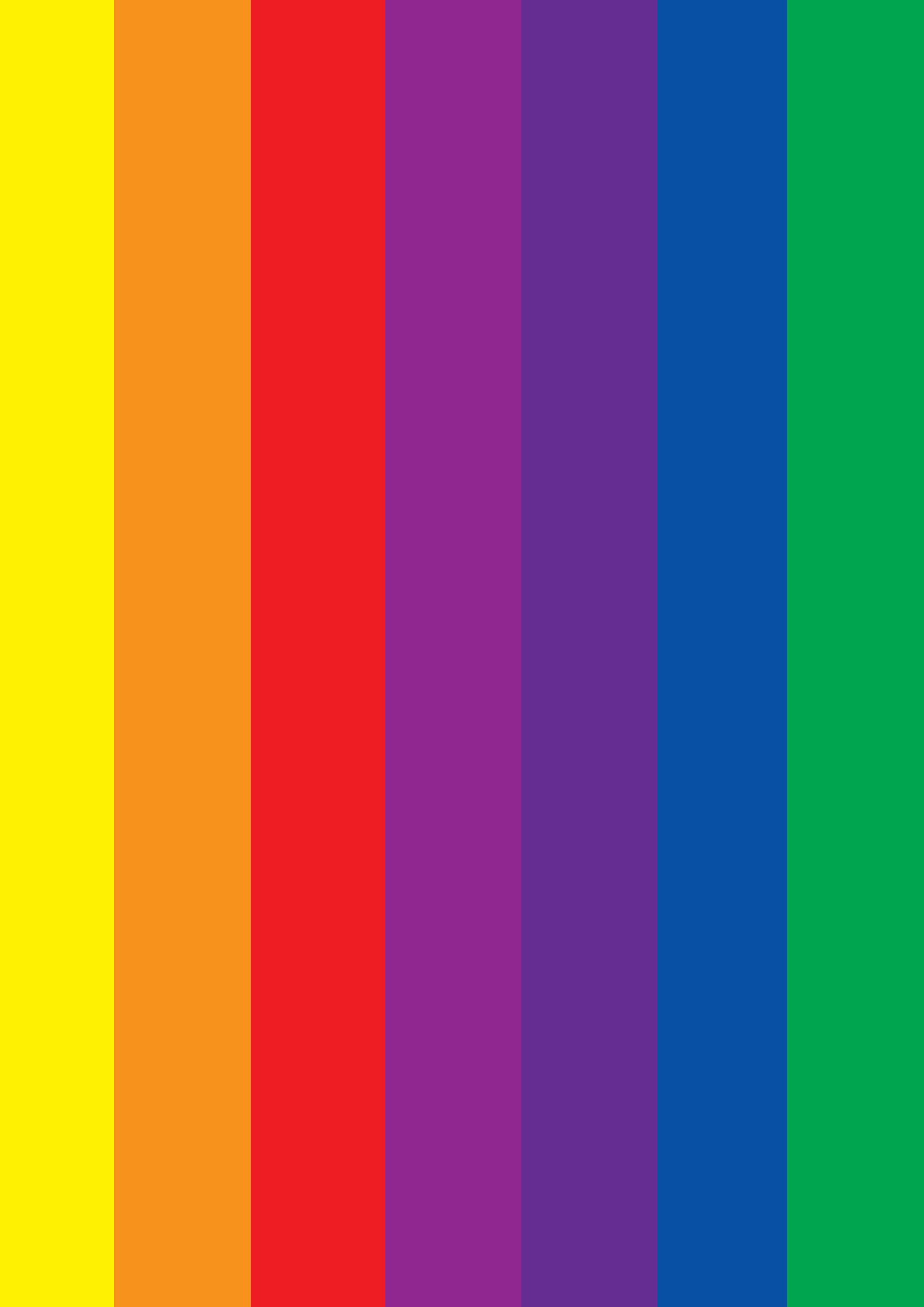

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