

Examining Color Intensity Shift in Animated Films for the Development of the 'Color Script Generator' Application

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Abstract

This study aims to reveal the pattern of intensity shift in the color script following the Three act story structure of the animated film. Patterns of color palette changes can be found in each act of the story structure of an animated film. The dissemination of story structure in animated films affects the selection of color intensity used in the creation of color scripts. Visual observation will be done by measuring the intensity level of hue, saturation, and values from the color palette of scenes according to the act in several animated films with mainstream visual style. The observation results will produce a pattern of changes in the color palette on every scene that represents the idea of the story act. This pattern data can be used as a measurable system and as the basis for designing an application that can produce a color palette to support the creation of color scripts in animation.

Keywords: color script, color palette, three-act structure

Meneliti Pergeseran Intensitas Warna dalam Film Animasi untuk Pengembangan Aplikasi 'Color Script Generator'

Abstrak

Penelitian ini bertujuan untuk mengungkap pola pergeseran intensitas pada color script mengikuti struktur cerita Tiga Babak dalam film animasi. Pola perubahan palet warna dapat ditemukan pada setiap babak struktur cerita sebuah film animasi. Dengan tersebarnya struktur cerita pada film animasi, hal ini memengaruhi pemilihan intensitas warna yang digunakan dalam pembuatan color script. Pengamatan visual akan dilakukan dengan mengukur tingkat intensitas hue, saturation, dan value dari palet warna yang sesuai dengan adegan di beberapa film animasi dengan gaya visual mainstream. Hasil observasi akan menghasilkan pola perubahan palet warna pada setiap adegan yang merepresentasikan ide dari adegan cerita. Data pola ini dapat digunakan sebagai sistem terukur dan berpotensi sebagai dasar perancangan aplikasi yang dapat menghasilkan palet warna untuk mendukung pembuatan color script dalam animasi.

Kata kunci: skrip berwarna, palet warna, struktur tiga babak

INTRODUCTION

The choice of color inside a scene in an animated film can convey messages that want to be told to the viewers. According to Musburger (2018) and Brinckmann (2014), color is an important aspect that supports visual storytelling in a film as it can enhance the emotional impression of the viewer, Lin & Lin (2008) further adds that color in animation serves as a transformative force, heightening the impact and resonance of the artwork. With the right process, the use of color can create a unique style that captivates the audience. Color also serves a variety of purposes in a story, it can define the time and location of the story, theme, and genre because color has psychological meaning, and humans tend to react to color differently according to their culture and environment (Xue et al., 2013). Holtzschue (2011) further adds that the viewer's reaction to color happens spontaneously and unintentionally, this reaction is defined by Sutton & Whelan (2004) as color psychology.

In animated film production, the color script is a part of the pre-production stage. It is a method to map color and lighting to set the emotional beat in an animated film. To further enhance the mood and emotion, color can also be combined. Each color conveys and can be applied to represent different moods (Bellantoni, 2005; DeLong & Martinson, 2013; Failes, 2015; Risk, 2020; Wei et al., 2004); for example, yellow is a color linked to happiness, blue is to sadness and red will invoke lust and alertness to the viewers. Qiu (2020) gives an interesting take on how the movie *Coco* (2017) how color can not only affect the psychology of the audience but also represent culture, in this case, Mexican culture and also the representation of the world of death in the Día De Los Muertos festival.

Technically, the color script is a sequence of images that shows color usage in every scene of the animated film. Amidi (2015) adds that the creation of color script is not about the quality of the image and more about how image and color can be utilized in the story. The color choice of each scene can be different in intensity according to hue, saturation, and values level. Changes in the intensity of this color appear when the story progresses to another act. Glebas (2013) also notes that a color script design should effectively depict intense emotional moments and the turning point of a story. It should convey dramatic and emotional scenes solely through color selection. Any film production, whether animated or live-action, generally follows Three act structure where each act has different aims according to the filmmaker (Caldwell, 2017). Hue is color in its purest form; it also means the dimension of color we feel when we observe a color. Hue is when the color has a full saturation level. Saturation, on the other hand, is the intensity of the color or the level of purity of color without involving black or white. The level of saturation can determine whether the color is bright or dull. Meanwhile, value refers to the brightness of a color, and it is linear. White has the highest value. On the other hand, black is the lowest value (Sherin, 2012).

Three Act story structure is a classic plot structure where each act represents setup or exposition, increasing conflict, and resolution as illustrated in. Setup/exposition presents the status quo of the characters, the logic of how the world works where the viewers can realize where the story happens (the setting), what motivates the character wants, and the emotional inquiry of what the story is all about and how the viewers can relate. This act accommodates the merest information the viewers need to know about the story. Increasing conflict, or the second act, is where the character goes up against obstruction between them and what they want (their goal). These conflicts build until the last situation has to be settled somehow. Act 3, or Resolution, happens after the Climax. Here, the conflict is settled, the enormous questions are acknowledged, and a new status quo is set up. It is the most limited act, intending to give the story its significance (Caldwell, 2017).

According to Rall (2018), color choices always serve a meaning. Color that is used finely will result in aesthetically pleasing work. In an animated film, the color could not be seen individually. Moreover, animated films are designed to be watched as a whole, not just a single frame. This makes color script an important thing to do when creating an animated film. The color script is a dramaturgical map of color choices in a film. Correspondingly, the color script can be seen as a colored storyboard of the key scenes. The shifting of color design in each frame is represented sequentially and chronologically following the story in the film. Creating a color script can be started by choosing a little color for the color palette. We can start by choosing one single color that represents the whole film. After establishing the color comes the next stage which is pre-color script (PCS).

PCS is where storyboards are drawn with a series of rectangular color bars that will follow the story beats. This process can be done by analyzing the key scene that has to be emphasized in the story. After choosing the color best represents the scene or moment in the film, we have to choose another color for other scenes that support the critical scenes. PCS that is finished, then becomes the base of finishing the color script. Color in the PCS must be applied to the storyboard by coloring the objects in the shot, such as characters, background, set, property, etc. (Blazer, 2015).

To accompany the story, visual is also an essential part of a picture; one of its components is color. Visual also contains the same structure as the story. It has visual exposition, visual conflict, and visual resolution. Visual exposition lays out all visual components or rules, including emotion, mood, situation, or characteristic of a character. To further visualize this, a character's strongest emotion is shown when the film is in the highest drama, which happens in a dramatic climax, as Salway & Graham (2003) stated. Everyone engaged in the visual production rules

established the guidelines for everyone in the production as it offers unity, style, contrast, and affinity in visual structure (Block, 2008).

Visual conflict and climax can be shown by using the principle of contrast and affinity. Contrast is the difference in color intensity; to put it another way, the bigger the contrast in the visual component will boost the dynamic and visual intensity of each object within the screen, making it easier to distinguish objects in contact with another object. On the other hand, affinity has low visual intensity within the screen. Objects in contact will be harder to distinguish, resulting in a feeling of lifelessness or gloominess on the screen. The greater the affinity level, will decrease dynamic and intensity of the visual component. The visual intensity must match the story's intensity. In the visual resolution, as the story ends, the story intensity and the visual intensity decline. We can see the visual structure graph in Figure 1 to better illustrate this.

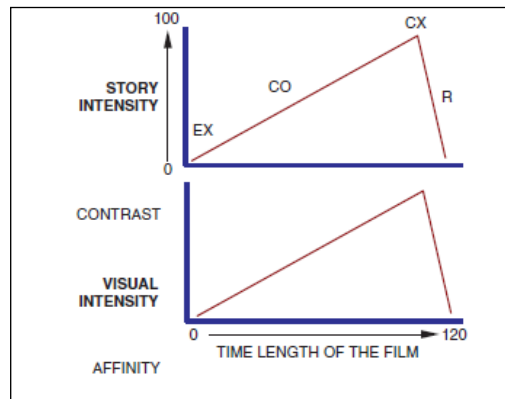


Figure 1. Story intensity and visual intensity structure graph
Source: Christian, 2022

This research examines how color intensity shifts in every act of the three-act story structure within three variables: hue, saturation, and values. This research was carried out by observing several animated films regarding changes in the intensity of the color used in each shot. Observation results will produce a pattern of measurable changes in the color palette that can be the basis for designing an application that generates a color palette to support the creation of color scripts in animated film production.

METHOD

As we know from the information from literature studies, there are connections between the level of intensity in the story and the visual intensity in a film following the story structure (Three Act story structure) and visual structure (Block, 2008). Therefore, to conduct this research and gather the required data, the author will observe some animated and live-action films regarding their color

palette choices as part of the visual component in a scene that represents a specific act in the film, as seen in Figure 2.

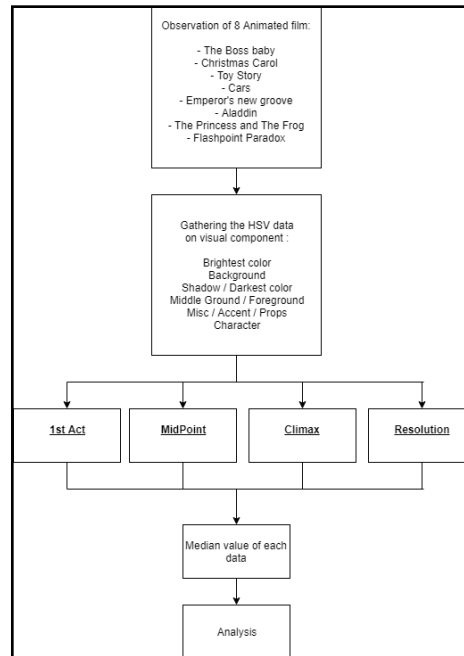


Figure 2. Research Method
Source: Christian, 2022

Observation of the color choices will be focused on the intensity of hue, saturation, and values (HSV) on specific areas resulting in a color palette data of the shot. The specific areas mentioned are:

- Brightest color
- Background
- Shadow/darkest color
- Middle ground/foreground
- Miscellaneous/accent/props
- Character

The HSV data corresponds with every act of the Three act story structure. HSV Data gathered from each act in every film are then calculated to find the median number of its intensity shift. The median number of HSV intensity is then analyzed regarding its possibility of becoming the basis of creating a color script generator application in future research. Other than HSV, additional data that will be obtained are the color harmony and color psychology of the scene aspect of the shot, as this data might be helpful in future research.

Observation of Animated Film

The criteria for animated movies selected are based on the film's visual style, which is mainstream Western animated film style, both 2D or 3D; observation

is done by deconstructing the film scene based on which part of the scene is in the Three Act structure. After knowing which scenes are part of each act, then a shot that represents the scene is chosen and breakdown according to the visual components that have already been established. This process resulted in a 6-color palette where each color is sampled in graphic software to know the intensity data according to HSV.

This paper will represent the process for eight films by one animated film, *The Boss Baby* (2017). That said, the treatment for every sample animated film is precisely the same within this observation process. At the end of this chapter, data gathered from other animated films will be shown in Table 1. The color behind the values reflects the visual component of the shot, as shown in Figure 3.



Figure 3. Story intensity and visual intensity structure graph.
 Source: Christian, 2022

FINDINGS/RESULTS

Observation of the story structure is done by watching the whole film to specify further which scene represents the idea of the first act, midpoint, climax, and resolution within the whole movie. In the first act of *The Boss Baby* (2017), Tim is introduced as a very loved young boy as the only kid in his family before he has a baby brother, as seen in Figure 4.

ACT		SHOT			
1st Act					
COLOR	HUE	SAT	VAL	COLOR HARMONY	
	15	86	93	Analogous	
	312	48	28		
	322	76	11		
	0	90	35		
	4	89	67		
	355	91	67		

Figure 4. Observation of *The Boss Baby* (2017) 1st Act
 Source: Christian, 2022

At the midpoint of the story, Tim and the baby cooperate in order for them to get what they want, yet Tim slowly grows affection for the baby, as seen in Figure 5. In the climax, Tim saves the baby from the rocket that will explode, as seen in Figure 6.



Figure 5. Observation of *The Boss Baby* (2017) Midpoint
Source: Christian, 2022



Figure 6. Observation of *The Boss Baby* (2017) Climax
Source: Christian, 2022

In a resolution, Tim sends a letter to Babycorp that he wants his baby brother back and is willing to share the love he got from his parents with his baby brother, as seen in Figure 7.

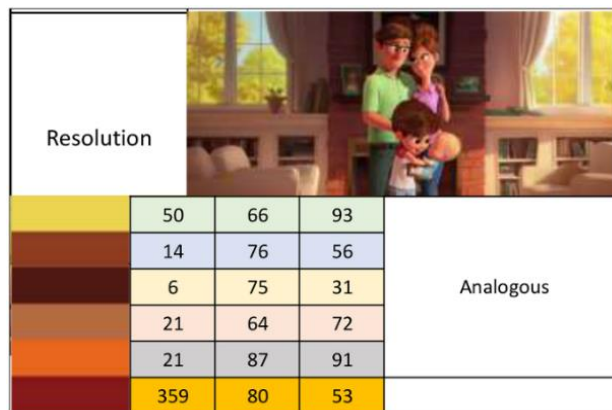


Figure 7. Observation of *The Boss Baby* (2017) Resolution
Source: Christian, 2022

Observing and sampling colors from the shot are also done in every other film. The data shown in Table 1 results from calculating the intensity value to the median value of HSV in each animated film.

Table 1. HSV data of animated film

HUE			
1 st Act	Midpoint	Climax	Resolution
355	349	31	359
4	193	345	355
4	358	5	60
43	56	28	34
14	69	133	338
30	25	203	20
354	358	354	350
297	257	326	269

SATURATION			
1 st Act	Midpoint	Climax	Resolution
91	87	42	80
100	22	85	94
95	60	66	52
72	62	74	58
68	78	75	43
33	40	22	23
92	67	93	70
62	75	98	99

VALUES			
1 st Act	Midpoint	Climax	Resolution
67	41	54	53
35	60	29	58
56	39	51	56
82	69	40	68
48	67	49	32
14	37	29	20
95	84	86	66
33	87	24	43

	The Boss Baby (2017)
	Justice League: The Flashpoint Paradox (2013)
	The Emperor's New Groove (2000)
	Toy Story (1995)
	Princess and the Frog (2009)
	Christmas Carol (2009)
	Cars (2006)
	Aladdin (1992)

After acquiring color intensity data on each animated film in each act and its visual components, intensity values are calculated to find its shift or change between every act. This research categorizes the intensity shift into three variables: First Act – Midpoint, Midpoint – Climax, and Climax – Resolution. This intensity shift data covers hue, saturation, and values in each visual component, each represented by a different color. Each variable is determined by calculating the difference between the values of the corresponding action, as illustrated in Table 2.

Table 2. Color Intensity shift data of animated film

HUE			
1 st Act – Midpoint	Midpoint – Climax	Climax – Resolution	
43,8	98,8	73,5	
108,2	18,3	29,3	
122,0	-92,8	48,8	
99,0	-73,7	4,8	
26,0	155,5	-44,7	
-74,2	151,7	-157,8	
-68,8	-55,5	49,0	
46,7	-53,0	-10,3	
37,8	18,7	-0,9	

SATURATION			
1 st Act – Midpoint	Midpoint – Climax	Climax – Resolution	
-3,7	1,3	16,0	
7,0	-2,0	13,5	
-19,2	14,7	-18,2	
3,8	-15,8	-0,2	
15,7	15,3	-37,7	
37,5	-31,5	-7,8	
31,2	-33,5	6,2	
14,8	-19,2	13,3	
10,9	-8,8	-1,9	

VALUE			
1 st Act – Midpoint	Midpoint – Climax	Climax – Resolution	
-1,7	-2,8	11,0	
29,2	-1,2	-10,8	
-13,3	2,0	3,0	
-16,7	13,0	14,8	
6,8	0,0	1,2	
31,5	-22,2	24,3	
-20,8	23,0	9,0	
-17,3	15,7	1,2	
-0,3	3,4	6,7	

	The Boss Baby (2017)
	Justice League: The Flashpoint
	Paradox (2013)
	The Emperor’s New Groove (2000)
	Toy Story (1995)
	Princess and the Frog (2009)
	Christmas Carol (2009)
	Cars (2006)
	Aladdin (1992)
	Median Color Intensity Shift Value

DISCUSSION

Through observation and sampling from the color palette gathered from the shot, we can see that each intensity shifts from hue, saturation, and value has different patterns and characteristics. This happens because every animated film's story content has different intensities in the story structure and visual structure. Then again, this study does not intend to prove similar results in any animated film, rather than to collect data as the base calculation for creating a "Color Script Generator" application in the future.

In the median hue intensity shift, data was gathered. We can see that in the first section, from the first act to the midpoint of the story, there is an upward trend of 37,8 value. In the second section, the hue values still rise, although lower than in the first section. The last section of Climax to resolution shows a slight decrease in the hue value. Hue is unlike saturation and values, based on a 360-degree circle. In other words, 360 is the same as 0 in the color slider inside graphic software. To better illustrate the shifting of hue level in Figure 8, let us start with the starting value 0 throughout the film's length. The hue value of a color will shift along this pattern.

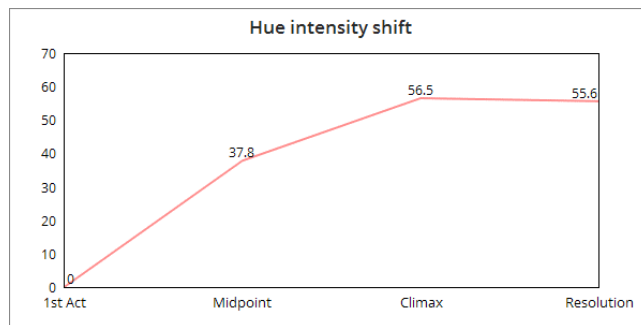


Figure 8. Hue intensity shift chart
Source: Christian, 2022

In the saturation intensity shift data illustrated in Figure 9, the first section shows a significant rise of saturation value from 1st act to the midpoint, as much as 10,9. The value fell significantly to 3,1 or decreased as much as 8,8 to climax. From climax to resolution, there is a slight fall of 1,9, resulting in 1.2.

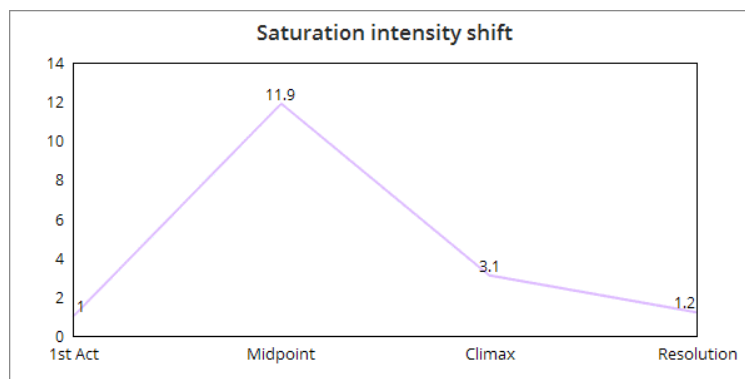


Figure 9. Saturation intensity shift chart
Source: Christian, 2022

Value intensity indicates the level of brightness and darkness, with a lower number being darker and a higher number meaning the lighter color of a specific color in a shot has different results, as illustrated in Figure 10. The first section shows a slight drop of 0,3 from the first act to the midpoint. From the midpoint to the climax, the value intensity is a 3,4 rise. In the final section of climax to resolution, the value intensity from climax to resolution climbed significantly, as much as 6,7 points.

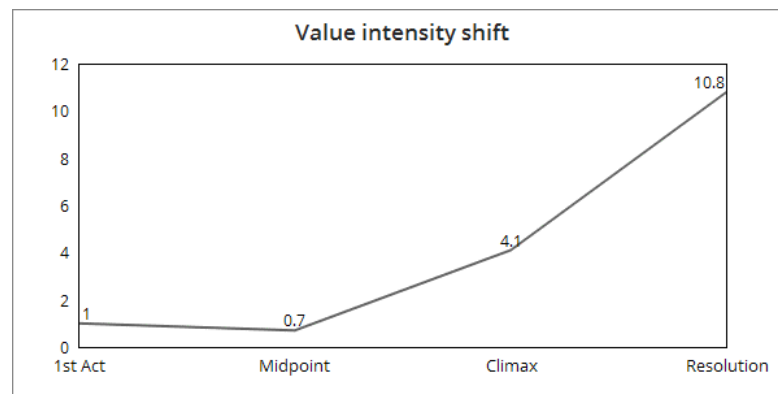


Figure 10. Value intensity shift chart
Source: Christian, 2022

CONCLUSION

This study found that HSV level shift in color does not necessarily parallel the visual intensity of an animated film. However, this result may be determined because the median calculation of HSV does not reflect on the behavior of each color depending on where the color was obtained within the visual component of a shot (brightest color, background, shadow/darkest color, middle ground/foreground, miscellaneous/accent/props, and character).

Therefore, further calculation of color intensity shift in each visual component may have to be conducted. Each animated film's hue intensity data shows the hue level's dynamic result within the visual component; this happens because hue intensity does not reflect structured value but instead shows a specific dimension of the purest color within the 360-degree circle. In the saturation intensity data, from the first act to the midpoint and climax, there is a significant rise in saturation level and a slight decrease in the resolution; this is to be expected since the story and visual intensity of the midpoint and climax, are higher than 1st act or exposition, and the resolution has a lower intensity than midpoint or climax. The contrasting result is found in the value intensity as the value decreases slightly in the midpoint and gradually rises as the story progresses to climax and resolution.

In conclusion, the data found in this study could be a base pattern of an application to automatically calculate the color intensity shift of a particular color palette that represents the color choices in a shot. In the future development of this on-progress application, the determination of color intensity shift calculation can be affected by other influences like the film genre, theme, visual style, and color psychology. Measured data within this research has been set as the basis for the application. The "Color Script Generator" application has been shared for testing to third-year animation students at Universitas Multimedia Nusantara, specifically for those who will design color scripts in their animation projects. Students will use the application on their project and review their utilization of the apps on their project. The survey will provide qualitative data for further improvement of the application in the future.

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