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THE EFFECT OF CINEMATIC LIGHTING ON STORY EMOTIONS IN 3D ANIMATION FILM

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ABSTRACT

Main Objective: The objective of this research is to complete the exciting and fictive effects of each color and lighting type when practiced in 3D animation setting. In addition, this research also proposes several lighting design recommendations in 3D animation. Background problem: The main sense for the advance of animated films is cinematic lighting effects. Various techniques and approaches have been planned to create lighting effects, but how these effects affect the viewer's sentimental sense and especially the storytelling practice is not understood. Novelty: The results of the emotional effects of lighting styles show that these effects are not shown in an imposing aspect, which means, not all lighting style affects the feelings on each scale. In this study, several differences were found in several color scales with different cinematic meanings. Research Method: The research method used is quantitative and subjective data analysis adopting a qualitative grounded theory coding with several animated video scenes developed with various colors and low and high-key statistical lighting designs to analyze and measure the effects of different lighting designs. Finding/Result: The finding of this study indicate that cinematic lighting influences the emotional impact of scenes and stories in plan. Conclusion: This study also confirms the current lighting approach, according to the result of this study, it brings guidance on how certain lighting and color techniques can be adopted to influence the audience in 3D animation about feelings and story perception
***Keywords**: Cinematic Lighting, 3D animation, Emotional Storytelling*

1. Introduction

Cinematic lighting is another major factor that determines the success of an animated film. In some film scenes, lighting artists will carry out the set target of the film. As well as playing a major role in live-action film and animation, cinematic lighting also provides a wide range of benefits across a wide range of media ranging from photography to interactive play. There are two biggest roles of lighting in a film, according to Birn, (2013), cinematic lighting plays a model in enhancing the emotional feelings of the audience besides, according to Kim et al., (2020) cinematic light supports visual storytelling. Several approaches and concepts have been planned by lighting artists to reach the target. This boosts the investigation of how best to

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choose a lighting approach that will complete the particular effect that the viewer wants. This research analyzes how different the variables in lighting style ("High-key" or shorted HK & "Low-key" shorted LK) affect the viewer's perception of a scene and the viewer itself. Considering the effect that a particular lighting design has on the viewer will be useful for more research on cinematic lighting and can bring a guide to reach current effects and be of profit to interactive lighting design over a variety of media. In terms of empirical studies, this study determines the feelings and fictive effects of various colors and lighting models when add to 3D animation scenes. In addition, this study also proposes recommendations for lighting design in 3D animation for animators. In this research, scenes of animation are built and lighted personally adopting 6 types of color lighting (R (Red), P(Purple), B (Blue), G(Green), Y (Yellow), and N (Neutral)) in 2 lighting styles (HK & LK) lighting.

2. LITERATURE REVIEW

2.1 Cinematic lighting (CL)

CL has existed since film and photography came but although lighting technology has changed, convinced variations have persisted. "Most lighting techniques for creating attractive and emotional images are timeless and constant" (Schaefer & Salvato, 1984). "Lighting can change the surrounding situation and change a mood, it can affect the audience's feelings so that a better understanding of the story can be achieved" (Huang et al., 2014). Lighting in the animated movie has no different function from the "lighting in live-action films", it's a significant sign that the methods are different. Nevill (2017) proposed "lighting design in live-action, the staging and framing of each scene are carried out rapidly and require more creation in combination because every process influences one another during filming". In contrast, lighting in the flow of 3D animation generally occurs preparing. Art directors in the production of 3D animation films are also more convoluted in the lighting style and design for the entire movie. Lights are expressed as logical. On another side, when the obvious light is influenced by real light assets, it is logical. Another side, logical lighting usually takes the lighting direction only because it produces charming images (Nevill (2017). Nevill (2017) also mentions that "lighting style is not only to make the view esthetic charming because the main part of cinematic lighting is storytelling". It is great to recognize the narrative behind the different scenes before designing lighting. When setting up the tone of the scene, it's really important to use color. If the scene is bright enough it will most reasonably give the viewer a feel. Conversely, low light and darkness are generally adopted to specify the threat. Sharp shadows usually express a cold and hygienic situation, whereas soft light is adopted in mild settings because it produces shadows that are dim and almost invisible. Light can give some effect to an image to respond to the viewer, it can set pressure, make the viewer enthusiasm, and can suggest the weather and time. When designing lighting especially in cinematic, there have many targets as storytelling and building a mood to boost the viewer's feelings of involvement appear to be the two essential aim of a lighting designer.

2.2 Cinematic lighting and ambiance

"most moviegoers will never deliberately show the lighting during enjoying the story, but they will feel it" (Jeremy, (2013). The main goal of cinematic lighting style is to build up the mood that boosts the viewer's feelings sense. Nevill (2017), states that many identified properties contribute to mood formation through lighting, the first is can put a sense for a scene. The emotion and cast of a stage can be dramatically impressed by the space of inflection values (light-dark). Cheerful or comedic scenes usually take in the HK lighting style. HK lighting measure that the stage is well-light with few shadows and contrast, in make the audiences feeling of peace. "Maybe some dark areas, brightness is bright with lots of soft fill light and dark areas soft and few" (Nevill (2017). LK lighting is dark with low brightness to candid the audience's consideration. "Darkness is meant to excite the viewer's imagination" (Nevill (2017). Lighting style is usually determined by the aspect of light. Birn (2013), described "the main qualities of

light that viewers pay attention to in an image are color, brightness, softness, emission pattern, and angle. The number of logical sources will help define the mood of the scene". It should be noted that even if the total of logical assets is not big, the real amount of lights adopted to complete the view may be large.

2.3 Feelings in Bright colors

The right colors can incredibly impact the emotion of a plot. "Nonetheless, there are enough common life experiences and contexts to draw some abstraction about how colors affect us emotionally". (Nevill (2017). "Neutral colors are desaturated colors, colors that appear almost gray". (Nevill (2017). "Red, orange, and yellow are generally described as warm colors compared to blue and green which are cool". (Birn, 2013). "Different colors were displayed on a computer screen to students and the last section was asked about their emotional response which they associated with each color" Epps et al., (2004). The result is that green and yellow get a mostly positive response. The feelings response to the color green shows emotions of enjoyment, calm, euphoria, pleasure, love, desire, and joy. Likewise, yellow looks cheerful and powerful and evokes (+) emotions as well as euphoria and joy. They specified that the blue color expresses (+) emotions along with negative emotions. Red also has a identic result by showing (+) and (-) emotions. Purple creates a feeling of relaxation and calm (Epps et al., 2004). The intensity of domination increases continously with color saturation and decreases with increasing color illumination. Conversely, hue's relationship with emotions is weak, especially for reactions of passion and dominance.

2.4 Storytelling and Cinematic lighting

"The main aim of lighting is storytelling" Calahan, (1996). To express the vision in lighting design is significant to foigure out the fantasy and desire behind the different shots and their relation to the rest of the fantasy. Even the viewer understands the overall gist of the story, lighting style can propose a feeling for a scene. Calahan, (1996), "adapted knowledge and theoretical principles from design, fine art, photography, illustration, cinematography, and visual perceptual psychology, and developed theory and advice on how to create lighting designs that can enhance storytelling in computer graphics". The shots are often shown on screen for a short period and the persuasiveness of the storytelling for a different shot depends on how fast the viewer's eyes are drawn to the main story elements. The simple process of guiding a flashlight can adjustment the rhythm and centerpiece of a shot. In lighting in 3D animated films, redundancy is often used by animators and lighting designers. Completely natural or physically corrected lighting is often not enough to create drama and captivate an audience. Presuming the boundaries of realism can construct illusion and charm that attach the fantasy to the stories being told. Lighting can convey times and seasons which are important for placing stories and illustrating the passage of time. During the day, the sun is directly overhead, which makes shadows disappear and turn to crush the image and make colors turn up less bright and attractive, whereas at night, the darkness are deep, and the color of the light turns up glowing more than at sunset.

Lighting style, color, and direction can influence the viewer's effect on a particular character. It can also confess the viewer about a character's condition. Sharp shadows and dark lighting are usually adopted to manifest the devil or crime characters or situations. Lighting directly upward can glance dim during the cast is look over. But that same overhead lighting can look uplifting and hopeful if the characters look up into the light. There is a need to make custom lighting designs for a different story. "How a story is told, structured, and how it is to be experienced will require a special lighting approach to direct the viewer's attention for effective storytelling". The research illustrates a sample of its lighting approach, fitting from using light contrasts, light colors, faded lights, pulsed lights, and spotlights to follow. This research brings observation into how to effectively design lighting in a virtual world plot to get the most out of storytelling. Adenuga, (2016) proposes guidelines to consider adopting the lighting to candid the audience's

attention in virtual reality stories. Much research on storytelling over lighting has been created for educational purposes to serve as a guide for lighting artists. However, it should be noted that research was not aimed to test this concept.

Birn (2013) and Kahrs (1996), mention TPL as the most popular and basic method. “In TPL have different roles, the key light is the key assets of lighting”. “It is often brighter than any other light illuminating the subject and usually produces the most visible shadows in the scene”. A Familiar headlight induction brings ¾ lighting, its attributes to the realism that the majority of the subject. The point of the main light also calculates what motivates the stage. “Fill light softens, fills in the shadows created by the main light, and makes more of the subject visible”. Here any 2 categories of fill lights, 1st is natural ambient, where the light is reflected by objects that are illuminated by the general illumination. Another type of fill light is added to fill in shadows, it makes them softer. In TPL, the fill light is added filler. A rim light usually called a backlight, it brings a highlight and creates a defined frame to the isolated subject from the background. Rim light can take a classy aspect to an image. When it has nothing to do with what naturally appears on the stage, it leans to come across as very solemn but in far pieces, it’s typically split life from a Hollywood movie. The rim lights are generally placed directly reversed of the main lights.

2.5 Interactive lighting

Rendering ng techniques adopted in interactive entertainment has advanced in previous years, consisting of collective lighting. Colaco et al., (2012) advanced a “new real-time lighting design model based on cinematic lighting design theory”. “ELE or Expressive Lighting Engine” uses optimizations to measure visual design targets proposed by cinematic lighting design concepts and accommodate unpredictable interactive environments. This approach also naturally adjusts the lighting to ensemble the condition and gain stress and feelings stimulant. Entrenched in the total of aspects in the frame and the significance of dramatic actions, ELE regulates to rapid the viewer's attention. Once the lights are defined to a certain area, ELE chooses the angle and color for each light. “The light settings are then given to the rendering engine to render the frame” (Karamouzi et al., (2013).

Walch et al., (2020), build a “model for an interactive multimedia storytelling project”. The concept is meant to be nearby to the comic book reading sense with options for the user to choose from. The method from movies and comic books is also used to convey joy, fear, and melancholy. Color and brightness are key factors for creating ambiance and enhancing visual storytelling. User choices summarized pleasant fictive outcomes by causing the incense to be yellow and a hint of red to build the feeling of a radiant. Selections that map to scary outcomes gain blue values during overshadow the image. The sorrowful image is defined by adopting a gentle color value which gives the effect of a stormy afternoon. He et al., (2016). The studies of Karamouzi et al., (2013) and Walch et al., (2020) are just 2 of the many emerging collective lighting technologies. New collective lighting technologies are constantly evolving and understanding the design of current lighting effects for viewers and stories can take advantage of these technologies. If you know the relation between lighting and the emotions of the viewer and the interpretation of the story. It is possible to combine know-how with collective technology for innovative collective factual-time lighting entrenched the viewer's emotions

3. METHODOLOGY

3.1 Methodology

In this research, the different participants viewed six video clips in randomly light colors, the color variable has 6 levels. The different colors in different videos use a variety of HK and LK lighting styles. The basic conditions of cinematic unlit scenes are also supplementary to the different plots. The independent variables are thus the lighting style (HK and LK) lighting and the color of the light. The dependent variable is the emotion of the audience and the interpretation of

the story. After viewing the different videos, participants fulfilled survey questions about their feelings and what stories they felt in that scene.

3.2 Application of lighting

Scenes are different 3D animations created in Autodesk Maya with a few characters as props. A total of 12 different lighting are applied to the scenes, with different styles including with and without cinematic lighting. In addition, three-point lighting (TPL) is applied as the main approach used in this study. TPL is the main method adopted in this plot with supplementary fill lights to make the background pop. Next, that method is adopted to illuminate the characters. The TPL process starts with the main light, then the fill light, and the rim light sequentially.

3.3 HK and LK Lighting

In HK lighting, the intensity is set at 0.1-0.2. The key-light scale is (x, y, z) 28.6, 23.0, 44.7. Point light for white eye highlights with an intensity of 0,9. The light intensity is also limited within a certain range for consistency. For low-key lighting, all positions and light scales are the same as when applying HK lighting. Nonetheless, the saturation of the light colors is higher and the light intensity is modified to make the scene darker and produce a low-light appearance.

4. DATA ANALYSIS AND IMPLICATION (RESULT)

Quantitative was performed in “IBM SPSS Statistics software” using “one-way and two-way ANOVA” to disclose the variety between the outcome built by the different lighting styles for the scene. “One-way and one-way Welch ANOVA” was performed to regulate whether the feelings affect variety for each lighting design. Since “one-way ANOVA” is an omnibus analytical test and can’t to explain which one important from one another (LS, 2015), “Tukey and posthoc Games-Howell's” test was aimed to classify lighting designs. “Mixed ANOVA” aimed to explore the effect of lighting design and color on feelings reactions. “A two-way mixed ANOVA (analysis of variance) is a statistical test used to determine whether there is an interaction effect between two independent variables on a continuous dependent variable” (Laerd Statistics, 2015). The software used in this analysis is “MAXQDA”. Coding defined the process of choosing parts of the data material. In this study, the axial coding process was carried out, then analyzed by measuring the codes for different questions with the respons for each lighting style.

4.1 RESULTS

Lighting design and emotion

Positive effect

" In the PANAS-X scale the dimensions of positive influence consist of active, alert, attentive, determined, enthusiastic, excited, inspired, interested, proud, and strong" (Watson & Clark, 1994). The results regarding the positive effect in this study indicate that the lighting design that gives the highest positive effect is HK Green, followed by LK Green, LK Yellow, and HK Yellow lighting designs respectively. The results of the “one-way Welch ANOVA” show that the positive effect is analytically contrasting enough between the various lighting designs. “Games-Howell's post hoc” test disclosed that the average decline from HK-G (Green) to HK-N (Neutral), LK-P (Purple), HK-R (red), HK Purple, LK-N (Neutral), NL (No-lighting) and LK-R (red) was analytically important.

Negative effect

"In the PANAS-X scale the dimensions of negative influence consist of fearful, nervous, anxious, irritable, hostile, guilty, ashamed, annoyed, and depressed" (Watson & Clark, 1994). The output outcome shows that the lighting design with the highest negative effect is HK Neutral, LK

Purple, and LK-R. the "one-way Welch ANOVA" was performed and a "posthoc Games-Howell analysis" disclosed that the mean loss from LK-P to HK-Y (Yellow) was statistically significant.

The Influence of Carefree Nature

"In the PANAS-X the cheerfulness scale of influence consists of happy, excited, happy, cheerful, excited, enthusiastic, lively, and energetic". The outcome shows that the lighting design with the highest cheerfulness effect is HK Green, HK Yellow, and LK Yellow respectively. Results from a one-way Welch ANOVA indicated that the effect of cheer was statistically significantly different between lighting designs. Posthoc Games-Howell's analysis disclosed that the mean decreases from HK-G to LK-P, HK-N, LK-N, and LK-R and the mean decreases from NL to HK-N and LK-P were analytically important.

The Effect of Self-Confidence

"The PANAS-X Self-Assurance scale consists of proud, strong, confident, brave, courageous, and fearless". The outcome shows that the lighting design with the highest confidence effect is HK Green, LK Green, LK Neutral, and HK Blue. The outcome of "one-way Welch ANOVA" indicate that confidence is analytically important various in lighting designs. Posthoc Games-Howell's analysis disclosed that the average loss from HK Green to HK Neutral and LK Purple, the average decrease from LK Green to HK-N, and the average decrease from No Light to HK-N were analytically important.

The Influence of Attention

"The PANAS-X Attention Scale consists of alert, attentive, concentrated, and determined" (Watson & Clark, 1994). The outcomes show that the lighting design with the up-attention effect is HK Green, LK Green, LK Yellow, and LK Blue. The outcomes of the "one-way Welch ANOVA" show that the effect of confidence is statistically significantly different between lighting designs. The "Posthoc Games-Howell's analysis" disclosed that the average loss from HK-G to HK-N, HK-P, LK-P, HK-R, NL, LK-R, and LK-N, and the average loss from LK Green to HK Purple, HK Neutral, LK Purple, and HK Red are statistically significant

The Effect of Fear

"The PANAS-X Fear scale consists of: fear, fear, fear, nervousness, anxiety, and trembling". The outcomes show that the lighting design with the highest fear effect is LK Red, LK Purple, LK Neutral, and KH Red respectively. The outcome of the "one-way Welch ANOVA" show that the effect of fear is statistically significantly different between the different lighting designs. Posthoc Games-Howell's analysis disclosed that the average decreased from LK Red to HK Blue, and HK Yellow. While No lighting and the average loss from LK-P to HK-B are analytically important.

Influence of Hostility

"The PANAS-X Hostility scale consists of angry, hostile, irritable, scornful, disgusted, and hateful" (Watson & Clark, 1994). The outcome shows that the lighting design with the highest adversarial influence is LK Green, HK Red, HK Green, and Lk Red. The outcome of the "one-way Welch ANOVA" indicated that important variables in adversarial influences in each lighting design were not found.

The Effect of Guilt

"The PANAS-X Guilt scale consists of guilt, shame, disgrace, anger, disgust, and dissatisfaction with oneself" (Watson & Clark, 1994). The outcome shows that the lighting design with the highest guilt effect is HK Neutral, HK Red, LK Blue, and HK Green respectively. The

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results of "one-way Welch's ANOVA" suggest that there was no analytically important variation in the impact of guilt in each lighting design.

The Effect of Sadness

"The Sadness X-HOT scale consists of sad, blue, sad, alone, and lonely". The outcome shows that the highest sadness effect are LK Blue, HK Blue, and HK Neutral. Results from one-way Welch ANOVA found no analytically important in various in the effect of sadness between the different lighting designs.

The Effect of Shame

"On the PANAS-X Shyness scale consists of shy, shy, and timid" (Watson & Clark, 1994). The outcome shows that the highest embarrassment effect are LK-N, HK Neutral, and HK Red.

Effects of Fatigue

"In the HEAT Fatigue-X scale consists of sleepy, tired, lethargic, and sleepy" (Watson & Clark, 1994). The outcome shows that the lighting design with the highest fatigue effect is LK Neutral, HK Yellow, LK Yellow, and HK Neutral. The results of the "one-way Welch ANOVA" show that no analytically important difference in the effect of fatigue in each lighting design.

The Influence of Calm

"In the PANAS-X Serenity scale consists of 3: calm, relaxed, and comfortable" (Watson et al., 1994). The outcomes show that the lighting designs with the highest calmness effect are HK-G, HK-Y, LK-Y, and LK-N. The outcomes from the "one-way Welch ANOVA" show that the effect of quietness is statistically significantly different between the different lighting designs. Posthoc Games-Howell analysis disclosed that the average loss from HK-G to LK-P, LK-B, LK-R, and HK-R, the average decrease from LK Neutral to LK-P, the average decrease from LK-G to LK-P, The average decrease from HK-Y to LK-P and the average loss from NL to LK-B, LK-P, HK-R, and LK-R are statistically significant.

The Effect of Shock

"The PANAS-X Surprise scale consists of 3 factors: amazement, astonishment, and astonishment" (Watson & Clark, 1994). The outcomes show that the lighting design with the highest shock effect is HK Yellow, HK Green, LK Yellow, and LK Green. The results of Welch's one-way ANOVA statistically indicated that in the effect of shock between different lighting designs no significant difference was found.

The difference between lighting styles

The positive effect increased from low-key and high-key lighting styles to no lighting, but the characters in lighting styles were non-analytically important. It should be noted that during the (+) effects of HK and LK lighting are the same, they differ from positive results regardless of lighting style. The (-) effect increases from a lighting style to a high-lighting style to a low-lighting style. The negative effect is statistically significant between lighting styles. Tukey's posthoc analysis showed that the average gain from NL to low light was analytically important. The baseline positive emotion scale increased from low-key lighting styles and high-key lighting styles to no lighting but the characteristic between lighting styles was no-analytically important. It should be noted that the characters between the HK and LK lighting groups were smaller than the difference between each group without exposure. The basic negative emotion scale increases from no style to a high exposure style, to a low exposure style. The baseline (-) emotion scale was analytically important between lighting styles. Posthoc Tukey's analysis disclosed that the average gain from NL to low light was analytically important.

Light Color

"one-way Welch ANOVA" was performed to regulate whether the PANAS-X (+) affect, (-) affect basic (-) emotion scale, and basic (+) emotion scale differ for each color of light. The outcomes showed that there was an analytically important difference in the light colors of the 4 scales. The positive effect is statistically significantly different for different colors of light. "Games-Howell post hoc" test disclosed the decrease from GL to NL (0,035), red (0,001), purple (<0.0005), and neutral (<0.0005) was also analytically important as the decrease from NL to purple (0.048). The negative effect is statistically significantly different for different colors of light. It decrease from red light to yellow (0.011) and NL (0.032) was analytically important, along with the decrease from neutral to yellow (0.003) and no light (0.011). The basic (+) emotion scale is analytically important for each color of light. Posthoc Games-Howell analysis disclosed that the decrease from green to no light (0.036), red (0.001), blue (0.047), purple (0.0005), and neutral (<0,0005) was analytically important, along with the decrease from there is NL to purple (0,018) and neutral (.031). The basic (-) emotion scale is analytically important in each color of light. Posthoc Games-Howell analysis disclosed that there was a loss from red lighting to yellow lighting (0.037).

Interaction

"two-way mixed ANOVA" was performed to test even if there was a synergy of light color and lighting style on (+) affect, (-) affect the basic (-) feelings scale, and the PANAS-X basic (+) feelings scale. Regarding the positive effect, there is an analytically important synergy between the color of the light and lighting style on the positive effect. Meanwhile, in the negative effect, there is an analytically important interaction between the color of the light and the style of lighting on the negative effect. For the basic (+) emotion scale there was an analytically important synergy in a light color and lighting style on the basic (+) emotion scale. Meanwhile, on the basic (-) feelings scale, there is non-analytically important synergy in the color of light and lighting style on the basic (-) emotion scale

The cause of the emotional effect

The qualitative data were coded in the MAXQDA program with the result that story prospect had the highest density in the high and NL styles group, during it had the 2nd highest number in the low lighting style group. Lighting has the highest number in the LK lighting group, the 2nd highest number in the HK lighting group, and the least number among the 3 groups in the NL group. Aspect reactions and aspect expressions as a whole have a relatively high frequency in the three groups. Character expressions as a whole also had the second highest frequency in the group without lighting.

Table 1 Results of story genres

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		Lighting Design													Total
		No lighting	High-key Red	Low-key Red	High-key Blue	Low-key Blue	High-key Yellow	Low-key Yellow	High-key Purple	Low-key Purple	High-key Green	Low-key Green	High-key Neutral	Low-key Neutral	
Story Genre	Other	3	0	0	0	1	0	3	1	0	0	0	2	2	12
	Suspense/ Thriller	15	11	7	10	8	3	3	4	4	2	9	2	2	80
	Sci-Fi	4	0	2	0	3	4	4	0	1	0	2	0	0	20
	Romance	7	8	3	3	1	0	2	2	1	0	2	0	0	29
	Mystery	4	0	0	0	0	0	1	0	1	4	5	1	2	18
	Horror	6	3	12	3	11	1	4	0	11	2	8	2	7	70
	Feel-Good	37	5	0	4	0	7	10	5	0	7	1	4	7	87
	Fantasy	12	1	6	0	1	2	1	0	1	0	2	0	3	29
	Drama	61	3	4	7	3	9	3	9	11	8	5	19	10	152
	Crime	7	2	0	0	3	0	1	1	0	1	0	1	0	16
	Comedy	25	3	2	3	0	1	1	7	0	5	1	0	0	48
	Adventure	16	2	0	2	1	7	0	1	0	5	3	0	1	38
	Action	9	0	2	0	0	0	1	0	0	4	0	3	0	19
Total		206	38	38	32	32	34	34	30	30	38	38	34	34	618

Cinematic lighting effects in movie scenes

A total of 97% of participants think that cinematic lighting influences film plots. A total of 71% of viewers feels the “cinematic lighting” influence the feelings and vibes effects of the plot of the story, 13% influence the scenario of the stage, 9% influence the language of characters, 4% can direct the audience's attention and 3% influence time day.

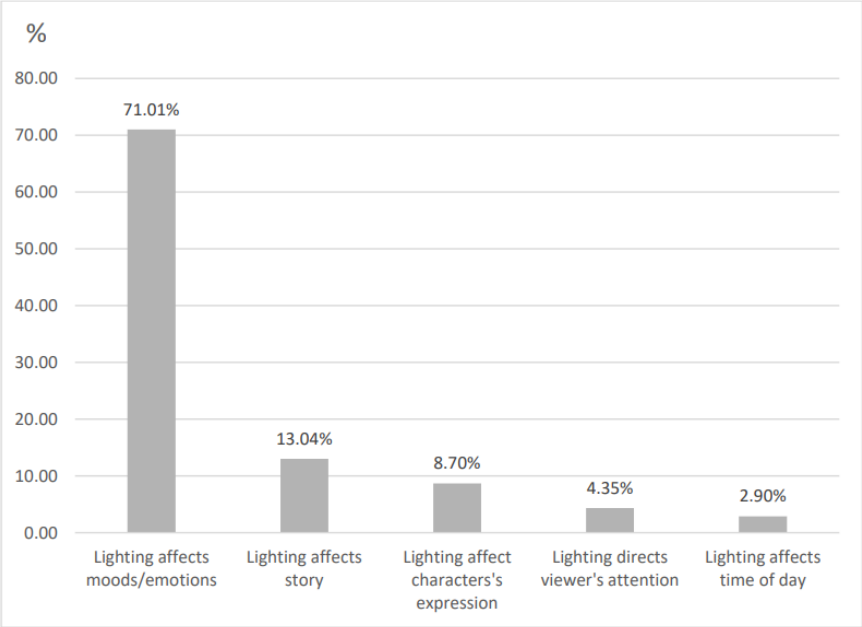

Figure 1 Cinematic lighting in a movie scene

5. DISCUSSION

This study provides evidence regarding the effect of cinematic lighting on viewers' emotions and perceived stories. Cinematic lighting influences the viewer's emotions, even more greatly in low-lighting styles. The outcomes also show that the anticipated story is not the same for different lighting designs, attesting to the effect cinematic lighting has on storytelling. Regarding the emotional effect on scenes that use lighting design, lighting, and story are the greatest aspects that bring some effect on the emotions of the audience. Lighting is a greater aspect of that story in low-light scenes. The results of the emotional effects of lighting style show that these effects are not shown in an imposing aspect, an effect that no different lighting style affects the feelings at a different scale. Specific feelings effects were only got in the dim lighting style measure to NL and were only shown in (-) effect and (-) emotions. This means the impressive essence of LK make this impact the feelings stronger, because LK generally conveys the negative, the effect only exists on a (-) scale. Additionally, the plot without “cinematic lighting” had really weak (-) impact and the basic (-) feelings scale.

The HK lighting style gave minimum (+) and baseline (+) emotion effects than the NL group, meaning that the HK lighting style did not consistently produce strong (+), (+) emotion effects. This shows that the HK lighting style, in this case, “High-key Neutral”, has a higher (-) effect than the LK lighting style. It should also be esteemed that the synergy between light color and lighting style is currently for the (+) effect, (-) effect, and basic (+) emotion scales. HK lighting with green and yellow lighting colors provides the highest rating on the joy scale. Yellow lighting in HK and LK lighting styles has an analytically high cheer effect. The results confirm the current concept that yellow and green lighting is generally identic with happiness. HK Green, LK Green, LK Neutral, and HK Blue are the lighting designs with the highest impact on confidence. HK Green, LK Green, LK Yellow, and LK-B lighting designs are the lighting designs with the highest impact of consideration. From this outcome, green develop to be the lighting color identic with the most elemental (+) emotions chased by yellow light color. This is amazing because even though green lighting is also specified as a (+) color, yellow lighting is most identic with (+) emotions.

The outcome of PANAS-X essential (-) feeling scale reveal that fear is most identic with LK-R, LK-P, LK-N, and HK-R. Antagonism is most identic with the lighting design of LK

Green, HK Red, HK Green, and LK Red. As predicted red light can generate alarm, anger, and fear. On the guilt-influenced rate, the lighting designs HK Neutral, HK Red, LK Blue, and HK Blue gave the highest averages. The lighting designs of LK Blue, HK Blue, and HK Neutral had the highest effect on sadness, supporting the theory of Birn (2013) and Calahan (1996) that blue lighting can induce feelings of sadness. This amusing that although green lighting has an energetic effect on (+) feelings, it is also strongly identic with some (-) feelings similar to aggression and guilt.

Storytelling effect

The positive scenario is felt the most when the scene is lit with HK-R, HK-B, and HK-P. The outcomes prove the concept of (+) scenes is generally lit with the HK lighting styles but during the bulk of HK indicates (+) stories HK is neutral and HK-G lighting is identical with (-) story themes. It's worth noting that the green lighting is identic with the most (+) emotions, and (+) scenarios are not the most anticipated stories from green-lit scenes. On the other hand, Negative stories are most felt when scenes are lit with the LK-P lighting design and are also generally felt in scenes lit with LK-G, LK-B, HK-N, and HK-G. Creepy or horror stories are often felt when the scene is lit with low lighting styles, except for the LK Neutral design. Also often felt in HK Red, HK Purple, and HK-N. The lighting design in the creepy plot is felt the most in LK-B. The anxiety plot is a different generally felt story. This is most noticeable when the scene is light with the LK-R lighting design. Also regularly experienced with HK Blue, LK Purple, and HK-G lighting designs. These outcomes help the existing theory which states that red light is identical to blood, assault, and crisis scenarios are often seen when the scene is lit with HK Yellow lighting and is slightly felt with the HK-P and LK-Y lighting designs. While many high-key lighting designs are associated with positive stories, HK-G and HK-N are more identical with (-) stories. The results for cinematic lighting effects in film scenes support the theory that lighting influences mood, directs the viewer's attention, influences timing, and reveals the personality of characters and situations.

Recommendation

The story is the first thing to deal with in designing cinematic lighting. The lighting artist should figure out the narrative of the scene and the mood it needs to feel. The different plot has each stage and cinematic lighting style to be constructed especially for a different scene. After analyzing all of that, design cinematic lighting should be created, it will build up the story and feelings impact of the scene. Entrenched in the outcomes of this research, lighting design recommendations can help to achieve certain emotional and developed fictive effects. While it should be remembered that lighting is an art form this recommendation aims to bring guidance for lighting design. It’s also a practical scene that needs attention. Lighting artists are added to use and adapt from these recommendations to design the lighting that is most suitable for the scene and that they like. Lighting designs are allowed to bring about certain feelings with lighting designs that are not recommended. The recommended lighting design is the design that provides the highest effect for different special emotions from this research, during the lighting design that provides an analytically important in each effect from the recommended lighting design is not recommended. If a non-recommended lighting design is unlisted, it means that the felt sense is not significantly different from the lighting designs for that explicit emotion.

Table 2 lighting designs recommendation to build up certain emotional effects

Emotional effect	Recommended lighting designs	Not recommended lighting designs
Positive Affect	High-key Green, Low-key Green, Low-key Yellow, High-key Yellow	High-key Neutral, Low-key Purple, High-key red, High-key Purple, Low-key red
Negative Affect	High-key Neutral, Low-key Purple, Low-key Red	High-key Yellow
Joviality	High-key Green, High-key yellow, Low-key Yellow	Low-key Purple, High-key Neutral, Low-key red
Self-Assurance	High-key Green, Low-key Green, High-key Blue	High-key Neutral, Low-key Purple
Attentiveness	High-key Green, Low-key Green, Low-key Yellow, Low-key Blue	High-key Neutral, High-key Purple, Low-key Purple, High-key Red, Low-key Red, Low-key Neutral
Fear	Low-key Red, Low-key Purple, Low-key Neutral, High-key Red	High-key Blue, High-key Yellow
Hostility	Low-key Green, High-key Red, High-key Green, Low-key Red	N/A
Guilt	High-key Neutral, High-key Red, Low-key Blue, High-key Green	N/A
Sadness	Low-key Blue, High-key Blue, High-key Neutral	N/A
Shyness	Low-key Neutral, High-key Neutral, High-key red	N/A
Fatigue	Low-key Neutral, High-key Yellow, Low-key Yellow, High-key Neutral	N/A
Serenity	High-key Green, High-key yellow, Low-key Yellow, Low-Key Neutral	Low-key Purple, Low-key Blue, Low-key Red, High-key Red
Surprise	High-key Yellow, High-key Green, Low-key Yellow, Low-key Green	N/A

Lighting design to enhance the story

The recommended lighting design is the design most participants associate with each story theme. If the drama topic is not 1 of the top two lighting designs, the two lighting designs most closely related to the story will be listed. Repetition does not make recommendations ineffective. During designing the lighting in a scene, the lighting forward another story character must convey the tale effectively.

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Table 3 Proposed lighting style to enhance the fictive effect

Story theme	Recommended lighting designs
Positive	High-key Yellow, Low-key Yellow, High-key Blue, High-key Red, High-key Purple
Negative	Low-key Purple, Low-key Green, Low-key Blue, High-key Neutral, High-key Green,
Scary	Low-key Red, Low-key Purple, Low-key Blue, Low-key Yellow, Low-key Green
Romantic	High-key Yellow, High-key Purple, High-key Red
Suspense	Low-key Red, Low-key Purple, High-key Blue, High-key Green
Dangerous	Low-key Blue, Low-key Red,
Exciting	High-key Purple, Low-key Yellow
Supernatural	Low-key Neutral, Low-key Purple
Sci-Fi	High-key Yellow, Low-key Yellow, Low-key Blue
Mystery	Low-key Green, High-key Green, Low-key Neutral
Fantasy	Low-key Red, Low-key Neutral, Low-key Green, High-key Yellow
Drama	High-key Purple, High-key Neutral, Low-key Purple
Crime	Low-key Blue, High-key Red,
Comedy	High-key Purple, High-key Green, High-key Red
Adventure	High-key Yellow, High-key Green, Low-key Green
Action	High-key Green, High-key Neutral, Low-key Red

5. CONCLUSION

This research on cinematic lighting has not been guided to analyze the theory. In this study, 26 animation video scenes in HK and LK lighting styles and 6 light colors were created. Concept research was aimed to analyze the impact of cinematic lighting in 3D animation scenes on feelings (emotions) and audience perceptions of the fictive. Through analysis outcomes on a range of different lighting, designs influence certain emotions, and story themes can be found. The results demonstrate that an important feeling impact was only initiated in the dim lighting style correlated to no lighting and was only found in (-) effect and emotions. The synergy of light color and lighting style is displayed for the (+) effect, (-) effect, and elemental (+) emotion scales. This research also confirms several previous lighting concepts. Entrenched these results, recommendations for design for lighting to be considered when designing lighting for the 3D animation scenes in this study were developed. Recommendations recommend the best lighting model to accomplish certain sentimental effects and boost certain novel themes.

Limitation

In this study, longer animations and higher-quality animated scenes were created. In addition, combining multiple color in one scene is not done, even though in real life different bright colors can mix to create other colors and effects. Several participants and scenes of animation in could be expanded, to abbreviated learning time and make them watch unrepeatable videos, and the outcome might be influenced by the associations that the viewers learn. This means that earlier lighting in a previous film animation they saw may have influenced their feedback. The initial state of the participants, such as their mood before starting the study can

influence the results. Finally, qualitative data analysis lacks the reliability of the intercoder because coding and analysis are carried out by one person.

Future Research Suggestions

There are research gaps that can be continued about CL and emotion. Specifically, when collective technology is growing speedily. It will be attractive to see the lighting become so reciprocal that it can change in factual time entrenched in the detected emotions of the audience. Cinematic lighting can also be applied to various virtual reality games. Because this research only focuses on 6 colors and 2 lighting styles. Many more lighting approaches can be applied and analyzed. Blending more than 1 color of light in 1 scene can produce different results. The aim of lighting to create depth, guide the viewer's eye, and maintain constancy is not intended in this research and might be explored in the future. Participant enumeration equally maturity and gender-specific were also not assumed. Aspects analysis of these variables may be carried out in the next research.

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