PLAYBILL

Mamma Mia!

CAPTURING THE ART OF LIGHTING DESIGN: A CREATIVE APPROACH

Based on the theories of professional lighting design, how do I develop lighting playbacks and cues for *Mamma Mia!* using high school rigs and technology?

Word Count: 4996

"In spite of popular notions of lighting as a 'glitzy' framing for dance… lighting is not just a decorative facility: it is essentially an illustrative medium, which is certainly not the same thing. Lighting is a scenic art concerned not only with the evoking of atmosphere and ideas, but also with the definition of space and 'body form' in relationship to space" (Mumford 46).

INTRODUCTION

Theatrical lighting design is known as the art of the unknown (Greenberg). In the TED talk, "Science and Magic, Illuminating the Stage with Lighting Design", Greenberg expressed, "As a lighting technician the only way for the audience to notice your existence is when a mess up occurs" (Greenberg). Light programming is one of the most critical parts of technical theatre, a challenge I have enjoyed throughout my high school experience.

As I began my last season in theatre, I welcomed the chance to analytically study this artform of light that I love. In the words of Hobgood, "Theatre is a complex art of intrinsic cultural passion that deserves detailed studies" (Hobgood 6). Therefore, in my final musical I welcome the art of stage lighting.

Role of a Lighting Operator

The operator's job is to shape the environment in which the performance is taking place by creating a visual direction for the audience's perception of a specific area. When recording cues, a lighting designer must consider, "...time of day, the action, the mood, the direction of the main or motivating light, the "flow," the shape of the visual frame, the focus of the audience attention, the focus of the actor's attention, pattern, balance, what's happening offstage, the effect of mixed colors, movement…" (Kaluta 200). Lighting may sound simple to many since some think lighting design is just turning a light on and off to illuminate the actors, props, and set, but poor lighting has a negative impact on the performance because the audience would not be able to make an emotional connection.

LITERATURE REVIEW

For my own creative process, I realized I needed to review key fundamentals including stage geography, stage design, and booth operations before I could approach the application of stage lighting. Additionally, to push my creative process beyond the standard of high school theatre, I realized that I needed to understand how color and aspects of lighting theory impact my work.

Fundamentals of Theatre: Stage Geography

Before one could think about scenery intelligently, one must understand stage geography thoroughly. Two of the most important parts of stage geography are sightlines and available equipment. Sightlines represent the audience's vision from their perspective location. (**Figures 1-2** are visual representations of a vertical and a bird's eye view of a sightline).

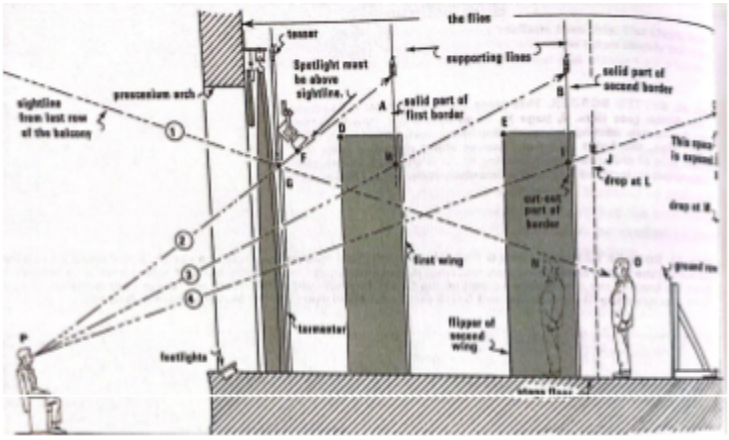

Figure 1, Vertical sightlines for exterior (Nelms 26)

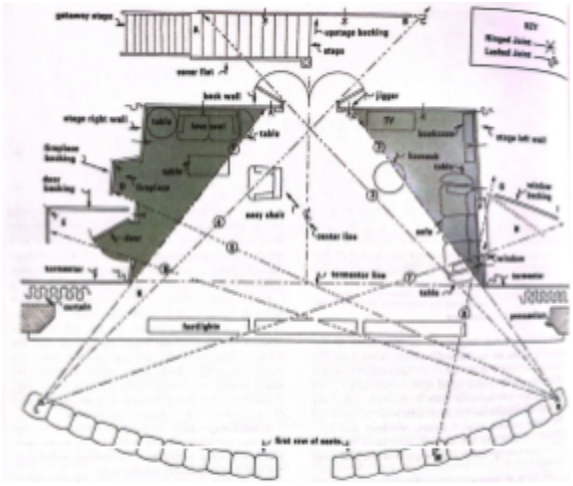

Figure 2, Example set showing sight line (Nelms 12)

The available equipment in conjunction with sightlines is important because the equipment represents the audience's ability to see the stage. Flippers, tormentors, and teasers are all examples of curtain equipment (**Figure 3**). Flippers are narrow pieces that hold tormentors in place, and tormentors mask the sides of the stage (Nelms 11). Once one understands the stage

geography of a stage, they could begin to learn about set-designing.

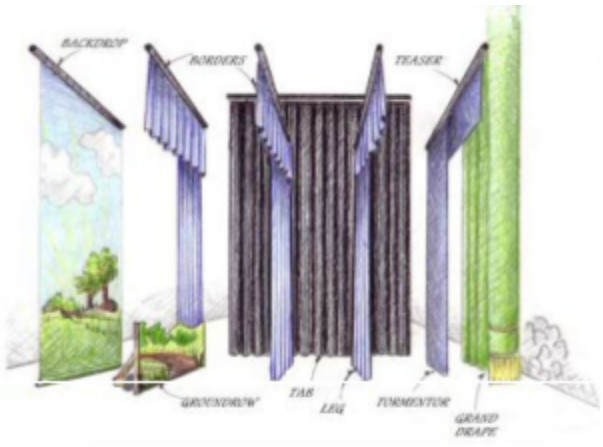

Figure 3, Different types of theater curtains (Sew What? Inc.)

Fundamentals of Theatre: Stage Design

The basics of stage design encompass anything that goes into the creation of a stage performance. Stage design involves set, props, lighting, and sound design. All of these elements help create and solidify the purpose of a theatrical performance. The book *Set-Design* by Henning Nelms is about transposing script to the performance. Nelms indicates how a set should tell the audience what the play is about as soon as the curtains open (Nelms 9). Set and prop design go hand in hand as they are the physical representation of the setting of the performance along with the time period. The stage design influences the basics of lighting as a lighting operator has to design lights in conjunction with the placement of the set, props, and rhythm of the music.

Fundamentals of Theatre: Booth

Booth lighting and sound control are two of the hardest technical activities to perform correctly. A lighting designer illuminates the storytelling by enhancing the text, movement, and emotional context. Lighting flows with actors and is dependent on characteristics such as: their

skin tones, costumes, and height. When creating lights for a show, one of the most important instructions are found within script requirements. For example, the script may have instructions on how the lights should look in the scene. A light cue is a single lighting display that is played out to the stage by the touch of a button or triggered, while a light playback could be a single memory or several sequential lighting configuration(s) controlled by a slider.

In a play, sound control will be used for sound effects and transition music; in a musical, sound control is used for microphone control, music, sound effects, and transition music. An important idea about sound control in correlation to lighting is the rhythm of the music in relation to the timing of cues and playbacks. Light-Emitting Diodes (LED) have created an expansion of the relationship between lights and sound as LED lights are able to change colors and create effects within the light board system (Rubin). After understanding the basics of working in the booth, I can finally focus on understanding lighting in depth.

Theory of Lighting

The theory of lighting, developed by DeLeon, begins by coming to the conclusion: the purpose of lighting is defined by the illustration of performances caught by the human eye (De Leon). Aristotle's theory of vision states, "the sense was made possible by the eyes' ability to receive information from the observed object" (De Leon). Aristotle elaborates upon the vital role sight has in the development of one's surroundings, specifically: color.

In addition to Aristotle's theory, I learned that timed lighting impacts the audience as well. The task of a lighting designer is to attract the audience's attention, convey an emotion, and set a time of day and location (Shimizu 418). For example, a 15-second cue could cause tension for the audience to understand an important moment is about to occur, and zero-timed cues are unexpected as they rapidly happen in relation to the beat of the music. A timed cue works by the

seconds a light is delayed to fade in or out.

Finally, a light programmer controls the mood of a scene by matching the lighting color with the timing of the show to embolden certain emotions within the audience. Color psychology indicates that “Certain colors are associated with different moods” (illuminated integration). For example, the color red excerpts a feeling of aggression or anger, and the color yellow portrays happiness and fulfillment (van Braam). Isolations (ISO) are small defined areas of light. Isolations are a way to move the audience's attention, allowing the light programmer to control the direction of the focus on stage. These theories will be elaborated on further in my analysis. Following, after understanding these theories I will focus on how I could apply my understanding to musical theatre.

Application of Lighting in Musical Theatre

Musicals are a way to portray emotions and stories through acting, singing, dancing, and corresponding color lighting. Unlike straight plays, musicals require more time to design as musicals typically have complex cues, greater variety of color, and difficult settings due to character movement. An important aspect of technical theatre in a musical is learning to create lighting for dancing (Mumford). As a lighting operator, a main job is controlling the bodies’ relation to space, and the kind of lighting that will relate to musical movement. Musicals were created with the purpose of entertaining an audience. Our body releases dopamine, which is the pleasure chemical in our body (SCL Health). The audience is able to release dopamine because of the connection to the music. Audience members are able to create a strong emotional connection as music is able to make us relax, incite us, astound us, and entertain us. Therefore, when creating light configurations for musicals the main idea is to entertain an audience. As a light operator, I am able to entertain the audience by using color. Through the use of color, I am

able to establish emotion and generate the feeling of comfort, passion, anger, nature, and ambition through the use of LED lights in the cove. The cove is an elevated recessed area for light fixtures. Moving on to the base of my creation, *Mamma Mia!*, the musical in which I will design lights and demonstrate later on the importance of my creation.

Mamma Mia!

The story takes place on a mythical Greek island in the present day, with Sophie wishing for her father to walk her down the aisle. The problem begins with Sophie having no clue who her father is, as her mother Donna fell in love with three men around the same time. The possible fathers, Sam, Bill, and Harry were invited to the wedding in the hope of figuring out who is the real father. Next, we meet Sky, her fiance, trying to cheer, while his friends are trying to take him away to have a traditional bachelor party. At Sophie's party, she convinces Sam, Bill, and Harry to play a game of "Who is the father"; which ends with her being hopelessly confused as the party continues. In the end, the wedding begins with Donna giving the bride away to the altar. Sophie abruptly ends the wedding as she says that she just is not ready to get married, then Sam tells Donna about his 20-year love for her, as they get married. The show ends with Sophie and Sky leaving as their future together awaits. While working on the show, I focused on John H. Purnell's-professional lighting operator of *Mamma Mia!*- interpretation of how he was able to capture the rock concert feeling, and emotional attachment the characters had to the music. I will elaborate more on Purnell's inspiring ideas in my analysis.

Gap of High School Lighting

As one can see from the review of literature, professional theatrical lighting is a complex world of theory and application. High school shows are not held to a professional standard since they are practiced within a short period of time, do not have the same capabilities and materials,

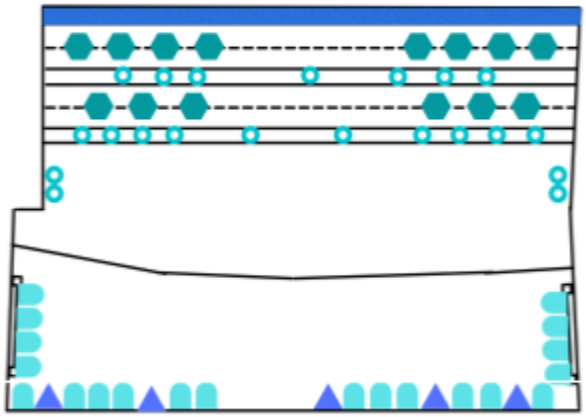

Figure 4, Birds Eye View/Light plot. Note: Each light in stage or on the cove is define by a shape in **Figure 5.**

Figure 5, Representation of lights through shapes. Note: definition of lights is given underneath each light.

and they are not being paid for their work. My school struggles with keeping up with modern rigs as we are unable to afford modern equipment. The main types of modern equipment are Source 4 LEDs and mover lights. On my school's rig, or lighting set-up, I have only 47 lights available for stage lighting, and although 47 lights may sound numerous, it is a small number compared to professional Broadway rigs. **Figure 4** is a high school light fixture accompanied with a concise definition of every light available at my school (**Figure 5)**.

If one compares **Figure 4**, a high school light plot, to **Figure 6**, a light plot from a professional set, they will notice the large difference between lighting rigs available between the two, as well as the different types of lighting and placement of lighting fixtures available between both locations. Clearly, the professional lighting plot hosts over five times the number of lights, making any professional version of *Mamma Mia!* not reproducible at the high school theatre. Therefore, my goal of building our configuration to a professional standard will require research to build my skills as a

lighting programmer. Therefore, my curiosity sparked as I began to ask myself the question: “Based on the theories of professional lighting design, how do I develop lighting playbacks and cues for *Mamma Mia!* using high school rigs and technology?” This question has evolved to become the central focus of my creative process.

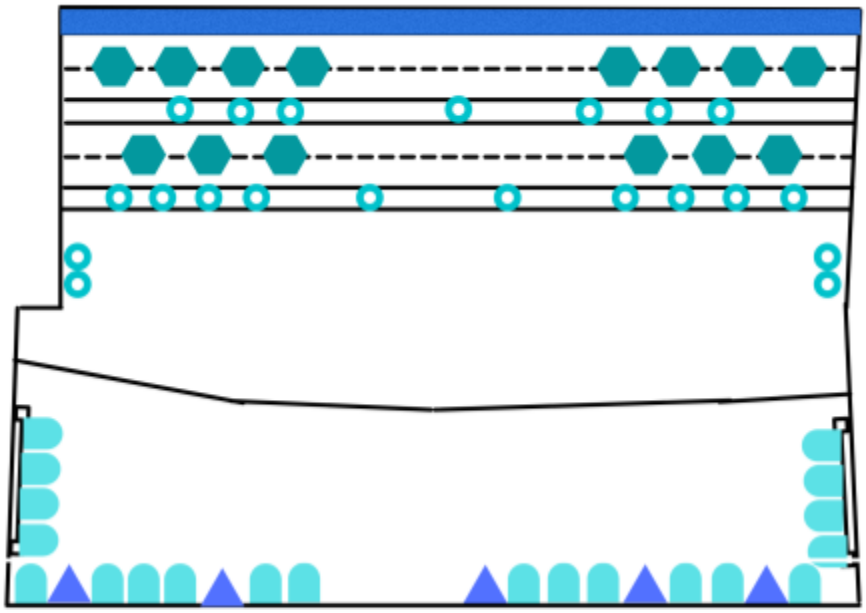

Figure 4, Birds Eye View/Light plot.
Note: Repeated to allow for comparison to **Figure 6.**

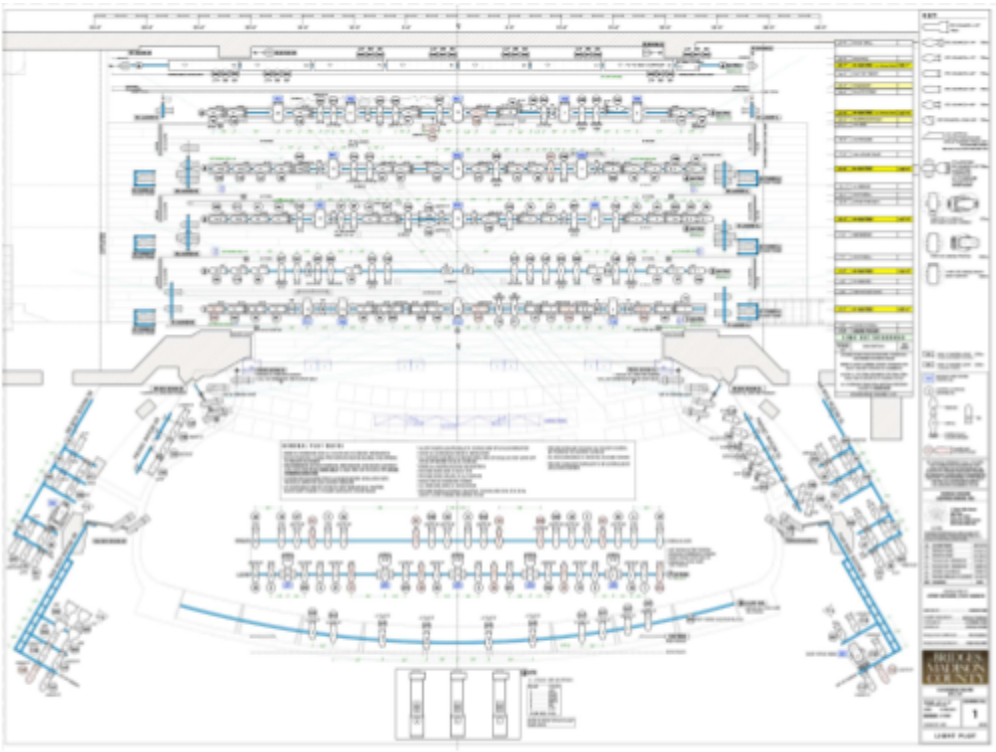

Figure 6, Professional lighting plot for Tony award winner The Bridges of Madison County (*Vectorworks, Inc.*)

Additionally, when referring to theatre in high school, Hobgood states, “Clearly, strategies employed to bring about students interface with art would vary according to the percept of theatre held by any teacher” (Hobgood 175). High school students are mostly held to teachers’ ideals towards art, which in my research I am able to break out of the standard and follow my own decision making supported by experts. If a teacher is not as advanced in theatre lighting as they are in the pedagogy of theatre, then this creates a gap as there is a lack in formal education for students like me who are passionate in the study of lighting design. Therefore, conducting this creative research process will increase my knowledge of how to professionally build lighting playbacks and cues without the equipment or education often provided to professional lighting designers.

CREATIVE APPROACH

My main creative framework was inspired by Evan Shimizu’s work, “Exploratory Stage Lighting Design using Visual Objectives.” My main focus is to analyze, proceed to evaluate, create cues and playbacks used for the musical *Mamma Mia!* at my school (see **Figure 7**, for a visual representation of my creative process based on Shimizu’s framework). Due to the aforementioned gap, I wanted to create my lighting programming at a professional standard while relying on high school equipment. I formulated this approach by applying methods used by professional lighting designers and being able to adapt these to the lighting capabilities and limitations found at a high school theatre compared to a professional setting. My hope is that this approach will not only impact my personal creative process but may also serve as a guide to future high school lighting designers who are interested in elevating their approach to lighting design.

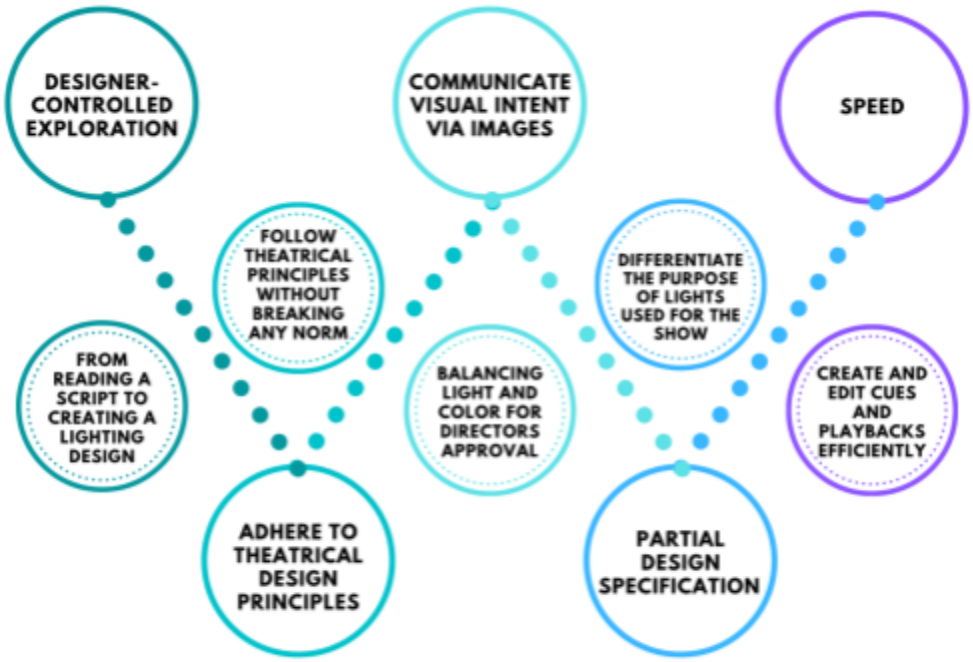

Figure 7, Methodology steps use for cue programing (Shimizu)

Designer-Controlled Exploration

To approach the understanding of a play, one should begin by reading the script. Shimizu cautions against jumping directly into constructing lighting cues, as the script should be the central focus of a light designer's work (Shimizu 419). While doing so, a designer should brainstorm ideas of how lighting capabilities could be implemented. A proper design takes around 3-5 read-throughs of a script. One should firstly focus on reading the script for personal attraction, then the designer should start thinking about the mood, tone, theme, and intent of the author. Finally, the reader should focus on their specific task, which requires the designer to find lighting requirements in the script. For anyone to be able to do a formal job when designing lights in theatre; reading the script is the most critical part of designing as the script holds all the

information needed (Kelly). That is the process a designer must follow in order to transmit designing ideas from the script onto a lighting board.

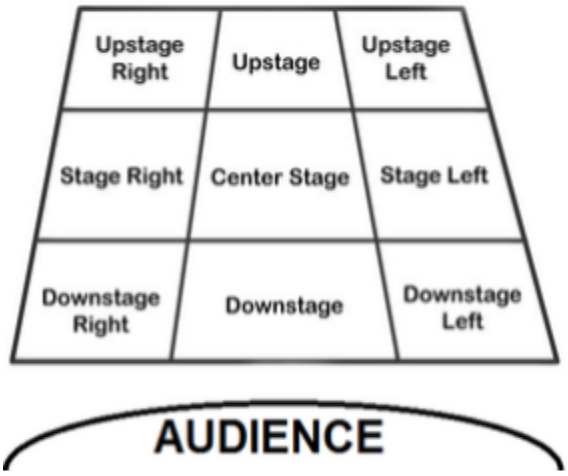

Figure 8, Stage Directions (Flores)

After reading the script and learning the character blocking and movement, one is able to set and align the position of every light zone needed. Lighting zones are areas in which lights are angled (As in **Figure 8** zones are represented by location on the stage) to the stage. By aligning the light one is capable of creating isolation lights for specific zones. With the equipment at my school, the process consists mainly of using ellipsoidal reflector spotlights to create isolation on the cove of my theatre, and parnels to help out with any shadows.

Adhere to Theatrical Design Principles

Once all key lights have been recorded, the remaining lights, also known as fill lights, are used to fill in the dark zones on stage to create a general zone. Shimizu states, "[The operator] should understand relationships between key and fill lights and respect the designer-provided light groups" (Shimizu 419). Fill lights are the remaining lights available to create a General-Wash. A General-Wash is a full stage illumination. Subsequently, I created two light groups, Gen 1 and Gen 2. Gen 1 is a small and more concise zone, and Gen 2 is a complete all-stage light. Gen 1 is mainly used for acting scenes and small movements, while Gen 2 is primarily used for big dancing numbers and all-cast scenes.

Communicate Visual Intent via Images

Having differentiated my key and fill lights and created my General-Washes, I started designing each scene. A major role in lighting design is learning how to balance a light as if many lights put together look like one singular light on; therefore, I began by playing with different light intensities until I was able to find a balance. I used the research about three perceptual dimensions of color by Wilms and Oberfeld, being Hue (Green, Red, Blue), Saturation (Low, Medium, High), and Brightness (Dark, Medium, Bright). According to Wilms and Oberfeld, "The effect of a given color on emotion is not determined by, for example, the hue alone, but by the combination of hue, saturation, and brightness" (896). As I am able to find a middle ground and a combination of the three dimensions to have an effect on the audience.

Color is loaded with symbolism. Individuals relate color to symbols, emotions, and objects, as Kaya states, "The color red has been associated with excitement, orange has been perceived as distressing and upsetting, purple as dignified and stately, yellow as cheerful, and blue has been associated with comfort and security" (Kaya). The majority of the population have an emotional response towards principal hue colors. This idea, along with the information in **Figure 9**, helped me design what colors I used for my creation towards an emotional connection.

Using the recommendations of Wilms and Oberfeld as well as Kaya, I typed in a document the cue number and the kind of light (Such as Gen-Wash, Blue Floor, Down-Center, etc). I was able to move from fill lights to colors as I am able to focus on the emotion being portrayed by the actors on the stage, then I can begin to create cues as I am able to design scenes. As I have all my lights positioned and angled, and color relation to emotion has been set.

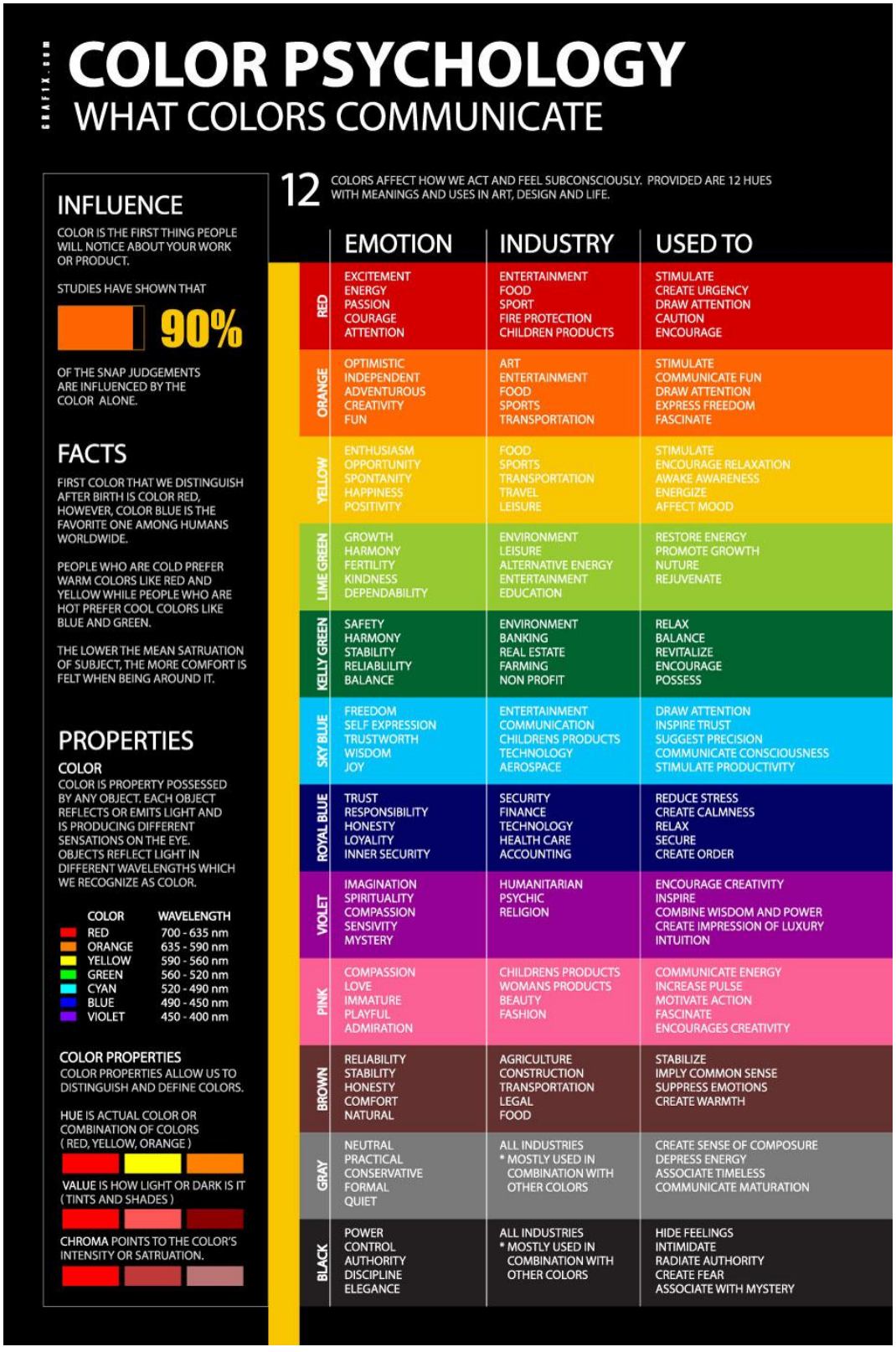

Figure 9, Color psychology chart (Avoleoo)

Partial Design Specification and Speed

For this step, one has to differentiate cues and playbacks away from each other without them affecting one another. Designers' decision-making matters as they are able to control the audience's perspective. Shimizu elaborated on influencing the audience with light control when he said "...a designer may only wish the system to generate changes to a specific stage region, leaving the rest of the stage unchanged" (Shimizu). A designer is able to analyze the intent shown, suggested ideas, and visualize the result while keeping a formal pace. Furthermore, I am capable of working at an efficient pace, by being able to design and edit cues or playblacks rapidly (Shimizu).

CREATION

For my own lighting design, I created a piece of art that was full of color and meaning portrayed through light effects. My creation is divided into a cue sheet along with cue/playback programming. The cue sheet illustrates a cue or playback number filled by the color of the light, a description of the light programmed, and a line on the script, movement, name of song, or setting of the musical to make the light go off. The cue/playback programming includes one-hundred and thirty cues, five playback memories, and two playback sequences. To view this creation in its entirety, please see **Appendix A**.

ANALYSIS

I gained most of my inspiration from professional lighting designer, John H. Purnell, who designed lights for Mamma Mia! in the Annapolis Summer Garden Theater. As Purnell said during an interview, "The "reality" part of the design must convey daytime, sunset, and evening light looks for the Taverna courtyard, beach and dock while keeping the actors well-illuminated" (Green). In this interview, Purnell, emphasizes the importance of being able to differentiate the

different times of day through light in dialogue parts of the show. This is due to the musical being set in a period of twenty-four hours. I also gained ideas from watching other programs' interpretations of Mamma Mia! to help amplify my understanding.

In my analysis, I chose three scenes from the script to elaborate on my interpretation and decision-making for my creation. I portrayed my decision-making via the emotional relationship to color while using isolation control to shift audience perspective. By exploring these techniques, I am able to demonstrate a greater understanding of the importance of my research. In each scene, I will discuss the cue sheet for the specific scene, a certain cue from the scene with a rendering from the audience perspective, a light board perspective, and a birds eye view. To view two additional scenes which were redacted from my analysis due to word count, please view **Appendix B** and **C**.

Scene III, Act I: The Courtyard

In Scene III, the three fathers sing “Thank You For The Music” alongside Sophie, which later leads to Donna being frustrated by their presence as she sings “Mamma Mia” (Johnson 19-26). According to Mumford, “The lighting designer's ideas are now integral to the creation of many new dances; very often these ideas are developed even before rehearsal has begun, and they can influence the making of the choreography” (Mumford 53). As explored in my literature review, I focused on expanding my understanding on lighting dance as I gained knowledge through Mumford’s ideas. Since my creation is done before the rehearsal schedule I am able to work among choreographers and influence ideas through lighting design. “Thank You For The Music” has a slow, beautiful, and melodic start to the song, therefore, I used a slow time in of 10 seconds for cue #26 (**Table 2**) to establish the mood of sweetness. Throughout the scene, there

are many transitions from singing to dialogue which is why I changed the color of the lights in cues #25 through #33 (**Table 2**).

Figure 10, *Mamma Mia!* broadway poster (Harriman-Smith)

The song, "Mamma Mia," embodies the color orange and red through the emotion of playfulness and disappointment (Avoleoo); however, I used the color blue because of the association of the musical poster (**Figure 10**) since the song, "Mamma Mia," is the core of the musical which is set on an island surrounded by crystal blue seas of Greece connecting to Purnell's need to use lighting to establish place (Green). Per Kaluta's recommendations, I created a cue for an isolation on the windows of the set when the characters sing, "Mamma Mia, here I go again, my, my, just how much I missed you." (Johnson 26) towards focusing the audience's perspective on the characters.

#25		G1 + blue	courtyard
#26		G1 + blue	Thank you
#27		G1 + blue	courtyard
#28		G1 + blue	Thank you
#29		G1 + blue	courtyard
#30		G1 + blue	Thank you
#32		ISO SR + blue	Thank you
#33		G1 + blue	courtyard
#34		DSR + blue floor	Time freezes
#35		DSR & SR+ blue floor	Time freezes

#36		DC + blue floor (ISO on window)	Mamma Mia!
#37		DC + blue floor	Yes, I've been
	#3	Windows	Mamma mia
#38		DC + blue floor (ISO on window)	Mamma Mia!
#39		DC + blue floor	Yes, I've been
	#3	Windows	Mamma mia
#40		G1 + blue	courtyard
#41		B/O	Men exit

Table 2, Cue Sheet from Scene 3, Act 1

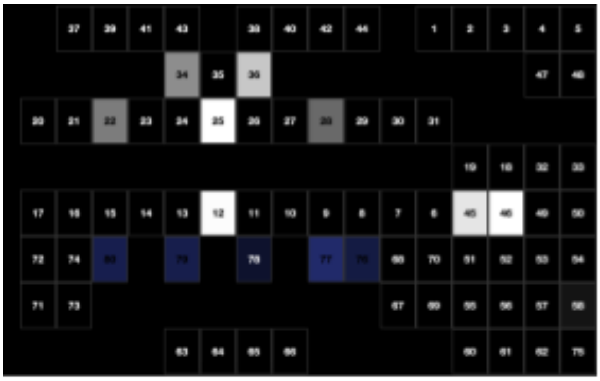

Figure 11, Light board perspective for Cue 36. Light 22, 28, 34, 36 are PAR lights above the stage that represent mock window isolations; Light 25 operates as a ghost light; Lights 45 and 46 are mock side lights. Lights 76 through 80 are LED lights.

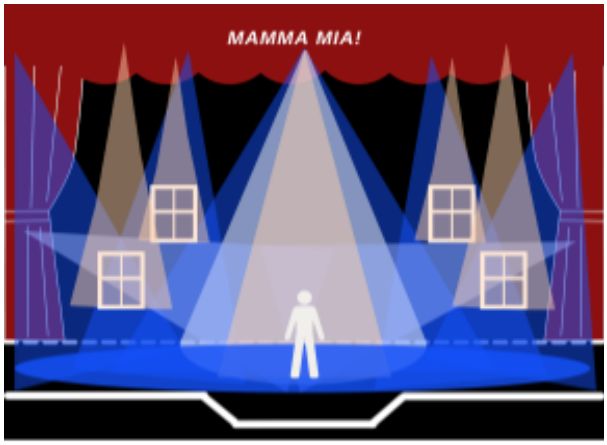

Figure 12, Mock rendering of light effect from audience perspective for Cue 36. Windows on stage and side lighting are mock representations of lights.

Cue #36

This cue (see **Figure 11**) takes place in the middle of the song "Mamma Mia," setting off as soon as the beat slows down and Donna says, "Mamma Mia, here I go again, my, my, just how much I missed you" (Johnson 26). In this cue I wanted to generate the sense of freezing time and

isolate each window on set (**Figure 12**). Using isolations for each window and downstage center, I was able to light each ensemble character singing alongside Donna. This cue is a zero timed in and three second timed out to really capture the audiences' perspective and make the scene flow by not just going back and forth with the timing of lights but easing back into the song to enhance the flow of the song. **Figure 13**, shows I used four PAR lights above the stage to isolate the windows and the location of the side lighting used to shift lights on Donna. I incorporated Mumford's ideas in this cue by talking to the choreographers to have Sophie in the downstage-center area and have ensemble members singing in the windows of the set (Mumford 54).

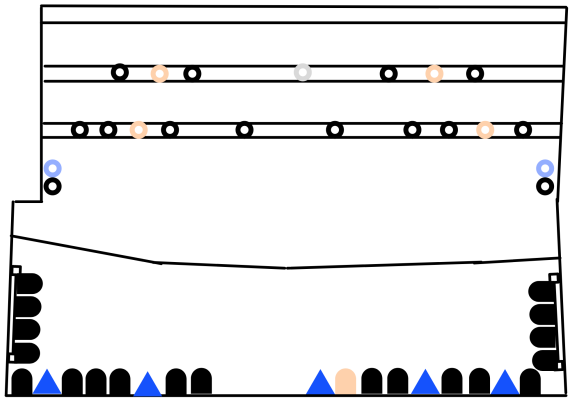

Figure 13, Light plot/Bird's Eye View of Cue 36 with operating lights on. Note: Ghost light is white but I made it a shade of gray for visibility. Lights on the sides of the proscenium are used for side lighting.

Scene IV, Act I: Donna's Room

Scene IV, Act I, the song "Chiquitita" is set in Donna's room as Rosie and Tanya are trying to emotionally support her as friends. According to lighting principles, there should not be any isolations inside houses or colors as that would not happen in a real house (Shimizu 419). In color theory and psychology, the use of a color combined with the perfect balance of brightness and saturation helps the audience create an emotion (Wilms & Oberfeld 905; van Braam). This contradiction, of lighting theory versus color theory, forced me, as the creator, to choose between

the two theories.

For this scene, I chose color theory as the musical *Mamma Mia!* is based on a supernatural story. For the song, "Chiquitita," I used the color pink in cue #43 (**Table 3**) as Donna's friends are being compassionate and encouraging their friend who is feeling sorrow. Later on, they appear to be starting a party singing "Dancing Queen" as I created a playback sequence to resemble the multi-color disco lights of a party.

#42		Gen 1	Donna
#43		MSR ISO + pink	As they move towards the bed
#44		Gen 1	Donna
	# 4	Disco + Gen	Dancing queen
#45		Ghost	End of dancing queen

Table 3, Cue Sheet from Scene 4, Act 1

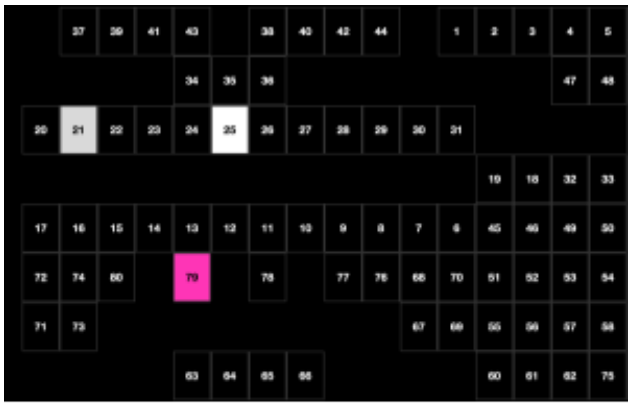

Figure 14, Light board perspective for Cue 43. Light 21 is a PAR light above the stage; Light 25 operates as a ghost light; Light 79 is an LED light.

Cue #43

Rosie and Tanya are cheering up Donna after she finds out her three ex-boyfriends are all on the island. This cue (**Figure 14**) is the start of the song Chiquitita, which involves a pink LED light, a PAR light right above the bed at a 90-degree angle, and the ghost light for backlighting (**Figure 15**). These lights complement each other as I was able to cover the shadows of the stage.

As examined in my literature review, I am able to establish an emotion while following the ideology of color psychology as van Braam said, “Pink is a color that represents hope, but sometimes it can be associated with not seeing the negative aspects of reality” (van Braam) through the use of LED lights. Following Wilms and Oberfeld's ideology of color theory, while balancing *hue* through the use of pink, *saturation* through a dark hot pink, and *brightness* through the intensity level used on each light (896; see **Figure 16**). Channel 79 was at max intensity so that the color pink would not get lost between the use of the other two lights (see **Figure 14** for channel numbers).

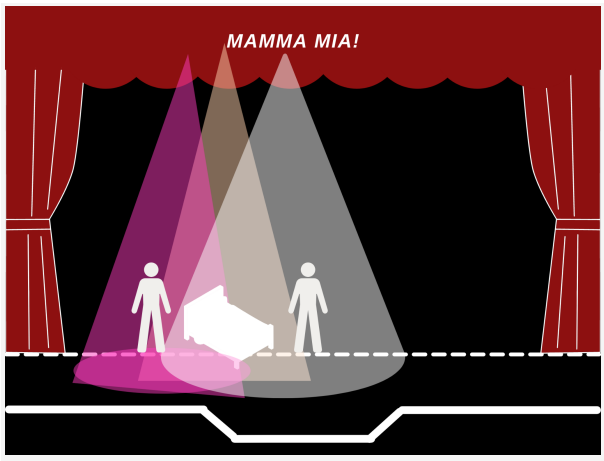

Figure 15, Rendering of light effect from an audience perspective for Cue 43.

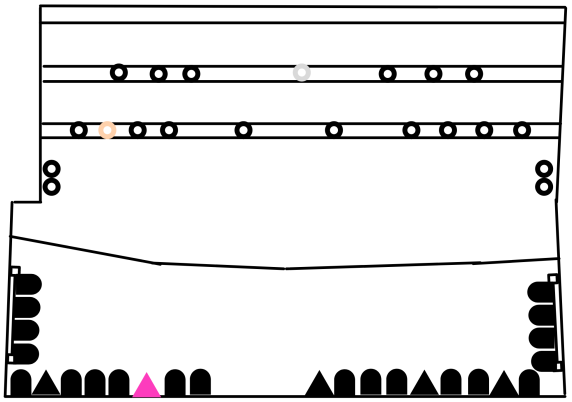

Figure 16, Light plot/Bird’s Eye View of Cue 43 with operating lights on. Note: Center stage ghost light is white but I made the light a shade of gray for visibility.

Scene I, Act II

Scene I, Act II is a nightmare scene which is the most unrealistic part of the musical; therefore, I wanted to create a special image with lights as I had the most technical freedom in this scene. In the scholarly article, “From Candle Light to Contemporary Lighting Systems: How Lighting Technology Shapes Scenographic Practices” Gröndahl said, “If light could be compared

to the artist's camera, paintbrush or chisel, it would be an active agent capable of creating new visions" (Gröndahl 21). Thus, these practices help my research as I am able to open up audiences' perspectives through the use of the art of lighting design.

In the song, Sophie has many movements which required me to create different isolation cues around the stage to not lose the feeling of nighttime (**Table 5**). I could have just brought up a general wash for one of my cues but I would have lost the darkness on the stage. I used the theory of color by Wilms and Oberfeld, to have a dim dark purple background (Wilms & Oberfeld 896), by following the balance of saturation, brightness, and hue. Therefore, I was able to establish the feeling of nighttime. Sophie's emotions demonstrate the nature of blue because "...color blue over other colors tend to be too cautious, anxious, and they are reluctant to give up control" (van Braam). I also added the low green LEDs for texture and changed the main color from purple to blue in this part of the song as she is not in an isolated light and she is letting go as she says, "Under Attack I'm being taken about to crack defenses breaking" (Johnson 53). In this part of the song, Sophie is letting go as she is unable to keep going.

#80		Ghost (Front light) purple F Red cyc	Sophie's nightmare
#81		Ghost (Front light) purple F Red cyc n Floor	Under attack
#82		Zones DSC and DSL purple F	Under Attack
#83		Purple F Red cyc	This is getting crazy
#84		G1 low Green LEDs Blue floor Red cyc	Under Attack
#85		DC purple F (red center) Red floor Red cyc	End of I wouldn't know how

#86		G1 low Green LEDs Blue floor Red cyc	Under Attack
#87		Purp F (small) Red floor (C) DC Ghost (red cyc)	Thinking nothing can stop
#88		B/O	

Table 5, Cue Sheet from Scene 1, Act 2

Cue #80

Cue 80 (**Figure 17**) is focused mainly on the center of the stage as seen in **Figure 18**. I followed my stage directions as said in the script, "a shaft of light hits SOPHIE's bed", therefore I used channels 13, 10, and 8 (**Figure 17**) to illuminate the bed (Johnson 53). As I focus mainly on the bed, I expanded the light pool with three LEDs colored purple and a red cyc to have a bit of light as her fathers approach the bed.

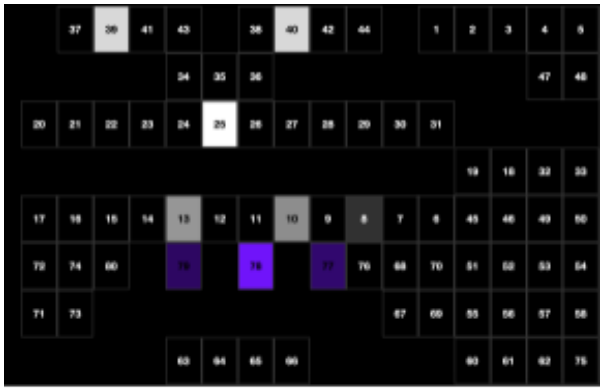

Figure 17, Light board perspective for Cue 80. Lights 39 and 40 yellow cyc; Light 25 operates as a ghost light; Lights 12, 10, 8 are ERS lights on the cove; Lights 77 through 79 are LED lights.

I explored scenographic practices by Gröndahl which helped me elaborate on my artistic design for this cue (Gröndahl 20). Due to the exaggerated colors in this cue, I created a new vision by making light play a role by making the audience see meaning in the lighting. I implemented this practice through the colors purple and red because of color psychology as I

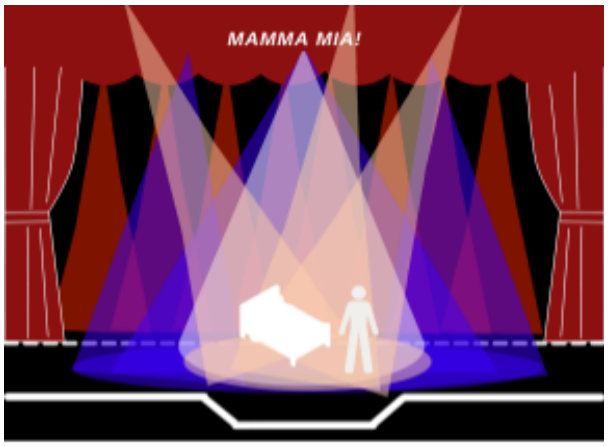

Figure 18, Rendering of light effect from audience perspective for Cue 80.

was trying to resemble the nature of a nightmare. The color red negatively represents the feeling of danger, and the color purple negatively represents the nature of mystery (van Braam). In this part of the song, Sophie stays in her bed and the ensemble has yet to make an appearance, thus there is no need to expand the lights up on the cove (**Figure 19**) to expand the stage.

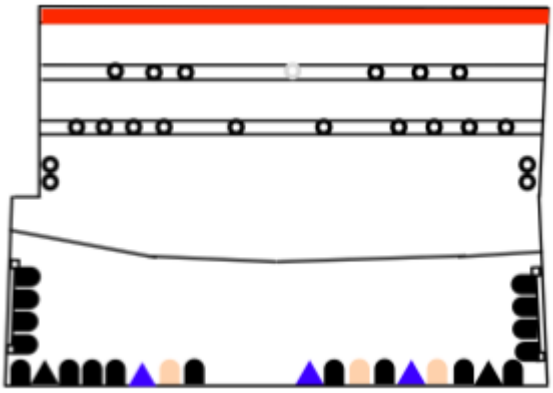

Figure 19, Light plot/Bird's Eye View of Cue 80 with operating lights on. Note: ghost light is white but I made the light a shade of gray for visibility. Red cyc in the back is connected to color psychology.

Creative Limitations

My creative process will not technically end until the very last night of our show. After taking directors' feedback into consideration, I will be required to make adjustments. In *The Perfect Stage Crew,* Kaluta indicates, "During the tech, most of the flaws will become apparent and, hopefully, fixed. Then improvements are made through the dress rehearsals, then you are on, and improvements are still made all the way to closing night" (Kaluta 199). Therefore, when practicing running the show and performing during show nights, I will take notes on any error or significant event that has to be modified.

Additional limitations to my creative approach are: the set not being finished, the actors not being on stage, and lacking official soundtracks. The set, being incomplete, holds back a light designer as one is only capable of imagining what is needed. For example, some cues that I have yet to finish are cue #36 and cue #38. Both cues rely on window isolations and these windows

are not fully built. Once the set design for the show is finished, I will be able to design cues while understanding a character's movement of a set piece that might result in editing the cue.

Cast members not being on stage affects lighting decisions as actors have different skin tones and heights. Different colored LEDs light lighter skin tones compared to darker skin tones. From my experience in prior shows, the color green is problematic as this color makes people of lighter skin tones look sick and nauseous. Additionally, actor placement impacts lighting. For example, an actor who is tall might have to take a step forward so that the light could have the same effect as someone shorter. Stepping forward into an isolation light is also influenced by height as the angle of the light will not light up an actor's face as effectively.

My last limitation is not having the official soundtracks. Not having the official tracks affects the timing of my cues and I am unable to synchronize the timing of light to sound. Additionally, from my experience, most official high school soundtracks are dissimilar from Broadway tracks publically available. This will affect the timing of cues for our high school production, as I have only been able to access Broadway tracks for timing.

CONCLUSION

Throughout this study, I explored the relationship of colored lighting to emotion established by Kaya, van Braam, and Willms and Oberfeld, as well as Shimizu's methodological steps that professional lighting designers follow. My approach was created upon the necessity of amplifying knowledge of lighting operators in the high school setting. This is a necessary step towards improving as high school students will not just design cues and playbacks based on their own knowledge, but rather a new standard created for high school students to follow towards designing a show. My research question: "Based on the theories of professional lighting design and color psychology, how do I develop lighting sequences and cues for *Mamma Mia!* using

High School rigs and technology?", has allowed me to create a professional lighting design for the musical *Mamma Mia!* by using high school rigs.

As stated throughout my paper, this research was focused to help students overcome the gap in professional equipment and a lack of knowledge regarding professional lighting techniques in the high school setting. The new standard of professional high school lighting will lead to students creating more advanced pieces of art when programming cues and playbacks for their respective musicals. My hope is that this paper will help students learn the fundamentals of technical and musical theatre and be able to understand advanced lighting techniques and terminology. Additionally, this paper demonstrates how students can use advanced theories and the methodology of professionals to apply these theories to their respective designs. Finally, my hope is that students will be able to use my research as a template in which they are able to use examples gathered from my analysis and use my creative rationale as a blueprint for future lighting programming using high school rigs.

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APPENDIX A

Complete Cue Sheet for *Mama Mia!*

Cue#	Playback #	Purpose	Line/Movement/Song/Other
	#1	Opening House	N/A
#0.1		Speech	N/A
#0.2		Speech Joke	
#1		B/C	We are in darkness
#2		ISO	I HAVE A DREAM
#3		Stretch ISO	Stands and walks to the post
#4		B/O	Good Luck
#5		Gen 1	Sophie!!
#6		ISO (Red F)	Honey Honey
#7		Zone AB (Red F)	As she moves from spot
#8		Gen 1	So this guy
#9		ISO (Red F)	Honey Honey
#10		Gen 1	Oh my god Soph
#11		Gen 1 (Red)	
1 2		Yellow cyc & Blue Fl (DC)	I heard about you
#13		B/O	Me……
#14		Gen 1 + blue	Scene 2 (courtyard)
#15		Red SR ISO	
	#2	Flash	Ain't it sad?
	#2	Flash	That's too bad
#16		Low G1, DC and Reds	
#17		Red floor DC	AHA AHA
	#2	Flash	Ain't it sad?

#18		Stretch DC red floors	A man like
#19		G1 Reds	So I must
#20		DC & Ghost Reds	My Life will
#21		Gen 2 Purple	
#22		Purple with DC n Ghost	As she is center
#23		Ghost	End of song
#24		B/O	
#25		G1 + blue	courtyard
#26		G1 + blue	Thank you
#27		G1 + blue	courtyard
#28		G1 + blue	Thank you
#29		G1 + blue	courtyard
#30		G1 + blue	Thank you
#32		ISO SR + blue	Thank you
#33		G1 + blue	courtyard
#34		DSR + blue floor	Time freezes
#35		DSR & SR+ blue floor	Time freezes
#36		DC + blue floor (ISO on window)	Mamma Mia!
#37		DC + blue floor	Yes, I've been
	#3	Windows	Mamma mia
#38		DC + blue floor (ISO on window)	Mamma Mia!
#39		DC + blue floor	Yes, I've been
	#3	Windows	Mamma mia
#40		G1 + blue	courtyard
#41		B/O	Men exit
#42		Gen 1	Donna

#43		MSR ISO + blues	As they move towards the bed
#44		Gen 1	Donna
	#4	Disco	Dancing queen
#45		Disco light + ghost	End of dancing queen
#46		Orange G1	Beach
#47		Reds and G1	I wasn't jealous
#48		Orange G1	Beach
#49		Purples G1	I've had a few
#50		Dark blue small G1	Night time
	#5		
#51		DC	After Playback is done
#52		DC Ghost Blues	Wishing every show
#53		G1 blues	So i'll be there
#54		Small Blue DC Ghost	Super trouper (5 second)
#55		Ghost blue floor	Bump of sound
#56		Dark blue small G1	Night time
#57		Dark blue small G1 add yellow cyc	Is there a man
#58		Blue floor and SL	Sorry to drag
#59		Dark blue small G1 add yellow cyc	Is there a man
#60		Blue floor and SR	Fancy Donna with
#61		Dark blue small G1 add yellow cyc	Is there a man
#62		Blue floor and SR	Can I be noisy
#63		Dark blue small G1 add yellow cyc	Is there a man
#64		B/O	

#65		SR blue	Jetty
#66		SR n MSR blue	But sophie
#67		Small Ghost blues disco	People everywhere
#67.1		Small Ghost blues disco / yellow cyc	Glowing in the dark
#68		Add blue SL for the boys disco	And here we go again
#69		G2 purple f blue cyc disco	voulez-vous
#70		SL blue floor	Sophie, I don't
#71		G2 purple f blue cyc disco	voulez-vous
#72		SR blue floor	Oh, my God
#73		G2 purple f blue cyc disco	voulez-vous
	#6	Disco (BND)	C'est
#74		DC Blues and Disco	
#75		B/O	
ACT II	**ACT II**	**ACT II**	**ACT II**
#80		Ghost (Front light) purple F Red cyc	Sophie's nightmare
#81		Ghost (Front light) purple F Red cyc n Floor	Under attack
#82		Zones BC and C purple F	Under Attack
#83		purple F Red cyc	This is getting crazy
#84		G1 Green LEDs Blue floor Red cyc	Under Attack

#85		DC purple F (red center) Red floor Red cyc	End of I wouldn't know how
#86		G1 Green LEDs Blue floor Red cyc	Under Attack
#87		Purp F (small) Red floor (C) DC Ghost (red cyc)	Thinking nothing can stop
#88		B/O	
#89		Night time	Courtyard
#90		Blue cyc G1 n Peach floor (LED)	One of us
#91		Night time	Courtyard
#92		Darker (LED) blue cyc	S.O.S
#93		SL & SR ISO Dark blues	So when you're
#94		Night time	Courtyard
#95		DC plus C plus Ghost blues	So when you're
#96		B/O	
#97		Orange-G1	Beach
#98		Pink G1 and Red cyc	You're so hot
#99		Pink G1 (lower) and Red cyc	Dance break
#100		DC purple F & cyc	I can see
#101		purple F & cyc add G1	Now you're so cute
#102		Pink G1 and Red cyc	You're so hot
#103		Blue & Red Floor Ghost n Cyc	END of song
#104		Orange-G1	Beach
#105		MSR & SR Red	Breakin' up
#106		MSR & SR yellow	Knowing me
#107		B/O	SLOW
#108		G1	Donna's room

#109		Green/blue F g1	I can still recall
#110		Blues g1	And now you're
#111		G1	Donna's room
#112		Orange g1 n yellow cyc	Schoolbag
#113		G1	Donna's room
#114		Blues and G1 yellow cyc	Sleep in your eyes
#115		Blues DC	School bad
#116		B/O	
#117		G1	Donna?
#118		Red F (Small) CH 14/15/35	I don't wanna talk
#119		Red dc	When he leaves
#120		B/O	SLOW
#121		Blue G1	courtyard
#122		Blue F yellow cyc G1	If you change
#123		Blue G1	courtyard
#124		Purp f	As they walk our
#125		Night time	jetty
#126		B/O	
	#10	bows	
#127		Purp n yellow G1	
#128		G1 bows	

APPENDIX B

Redacted Scene from Analysis: **Scene 2, Act 1: The Courtyard**

For Scene 2, I focused on the powerful message by Donna in the song "Money, Money, Money." My goal was to establish the sense of passion; therefore, according to the psychology chart (**Figure A**) the color red is the most appropriate for the sense of passion, I applied this color in cues 15-20 (see **Table Z)**. Throughout the song Donna is located in different parts of the stage where I used Kaluta's ideology to "shape the visual frame" to focus the audience's perspective on Donna (Kaluta). I shaped the stage by designing isolation cues around the stage to focus on Donna; I also did this on cues 15-20.

Due to the request of my director, I created a flash playback to quickly light the stage when the ensemble sings with Donna to create tension within the audience and move their perspective towards the whole stage. By flashing the whole stage I am able to expand the audience's perspective of the stage. Towards the end, I changed colors from red to purple as Donna has an imaginary tone as she uses the word 'If' more often. As seen in **Figure A**, the change of color allows me to shift the audience's emotion from passionate to imaginary.

#14		Gen 1 + blue	Courtyard
#15		Red SR ISO	I work all night
	#2	Flash	Ain't it sad?
	#2	Flash	That's too bad
#16		Low G1, DC and Reds	Money, Money, Money
#17		Red floor DC	AHA AHA
	#2	Flash	Ain't it sad?
#18		Stretch DC red floors	A man like

#19		G1 Reds	So I must
#20		DC & Ghost Reds	My Life will
#21		Gen 2 Purple	Money, Money, Money
#22		Purple with DC n Ghost	As she is center
#23		Ghost	End of song
#24		B/O	

Table Z, Cue Sheet from Scene 2, Act 1

Cue #15

This cue represented in **Figure B**, the start of the song "Money, Money, Money" and the reason for this cue is to continue gathering the audience's attention by using Kaluta's ideology of shaping the stage (Kaluta) by the use of an isolation downstage right (see **Figure C**). Channel 17 is a ERS light with a gel color of R02 and channel 80 is a source 4 LED with a hex color-code of FD2800. I have channel 17 at 70 percent and channel 80 at 100 percent so that the color red could be highly saturated and highly visible. I used the light on the stage right part of the theater for frontal lighting instead of side lighting (see **Figure C**).

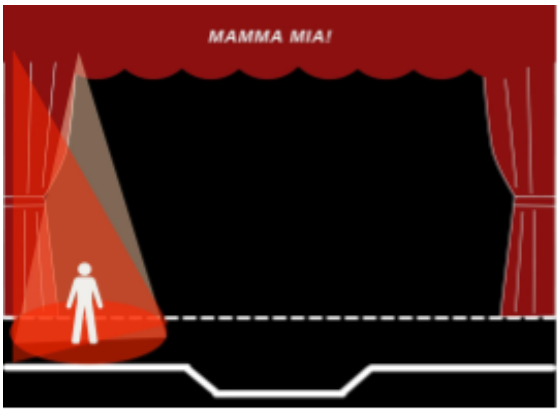

Figure B, Light board perspective for Cue 15. Light 17 is an ERS light on the cove; Light 80 is a LED light.

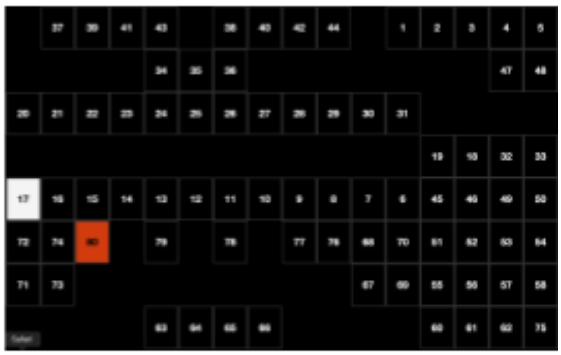

Figure C, Rendering of light effect from audience perspective for Cue 15.

Therefore, I am able to light her whole body and still have the sense of passion through the use of the color red. While creating this isolation light I had to focus on bleeding light. Bleed of light is a large pool of unnecessary light and is avoided by a more narrow angled barrel. This is a simplistic but important light as isolation lights are able to shape the stage the best.

APPENDIX C

Redacted Scene from Analysis: **Scene 8, Act 1: The Courtyard**

For Scene 8, Act 1, I knew based on the script I needed to capture the responsable nature of the three men as they approached Sophie to walk her down the aisle. Therefore, I explored color theory to make sure I captured the aspect of responsibility as I portrayed this to the audience. The color theorist, Hailey van Braam, states that, “In a similar vein, purple has a long-standing association with dignity” (van Braam). This largely impacted my decision to utilize the color purple for the scene. After not being in Sophie's life for 21 years each one of the men want to step up to finally become her father and be part of Sophie's life. Thus, the importance demonstrates the use of the color purple to portray the nature of dignity. Additionally, as this was the last scene of Act 1, I wanted to make sure the audience could picture all the characters clearly. Therefore, I made sure to use isolations when time freezes. According to Shimizu, I am able to convey the audience's emotions by persuading their attention by focusing on a certain area in the stage (Shimizu). Therefore, in cues 70, 72, 74 (**Table Y**), I made sure to use isolation lights with a dim blue floor for the actors that are not being focused on. As a lighting designer I try my best to avoid cues that include decimals, but as I move forward with my creation and I make edits to my cue sheet I have to find space for new cues within the other cues. I try my best to avoid decimals to avoid any confusion with a stage manager and decimals also take longer to say through a microphone. Thus, I used a decimal number to include the cues such as cue #67.1.

#65		SR blue	Jetty
#66		SR n MSR blue	But sophie
#67		Small Ghost blues disco	People everywhere

#67.1		Small Ghost blues disco / yellow cyc	Glowing in the dark
#68		Add blue SL for the boys disco	And here we go again
#69		G2 purple f blue cyc disco	voulez-vous
#70		SL blue floor	Sophie, I don't
#71		G2 purple f blue cyc disco	voulez-vous
#72		SR blue floor	Oh, my God
#73		G2 purple f blue cyc disco	voulez-vous
	#6	Disco (BND)	C'est
#74		DC Blues and Disco	
#75		B/O	
ACT II	**ACT II**	**ACT II**	**ACT II**

Table Y, Cue Sheet from Scene 8, Act 1

Cue #67.1

In this cue (**Figure D**) I wanted to keep the sense of a party as the song "Voulez-Vous" takes place in Sophie's party outside in the courtyard late at night. As said by Purnell, when creating the setting of each scene one must create a different feeling when differentiating time zones in the musical (Green). My inspiration for this cue was based on his creation as I used dark blue color LED lights (**Figure E**). I was also inspired to keep the cue dim as there is no dialogue in this part of the song. I added the yellow cyc because of the correlation between the script as it says, "Your eyes are glowin' in the dark" (Johnson). As well as using the disco light to keep the audience attention towards the theme of a party for this song, and using channel 25 the ghost

light for backlighting to create a small silhouette for the actors and help out to diminish shadows (**Figure F**).

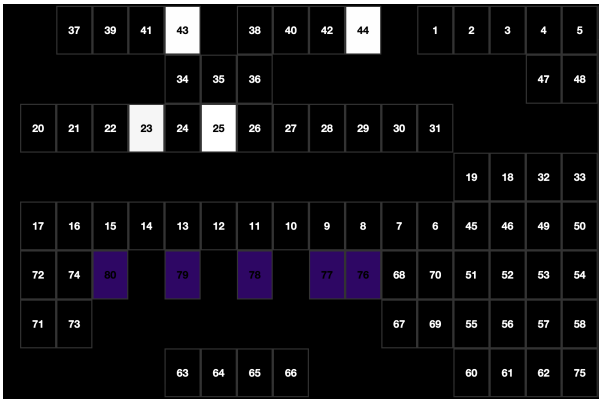

Figure D, Light board perspective for Cue 67.1. Lights 43 and 44 yellow cyc; Light 25 operates as a ghost light; Light 23 is a disco light; Lights 76 through 80 are LED lights.

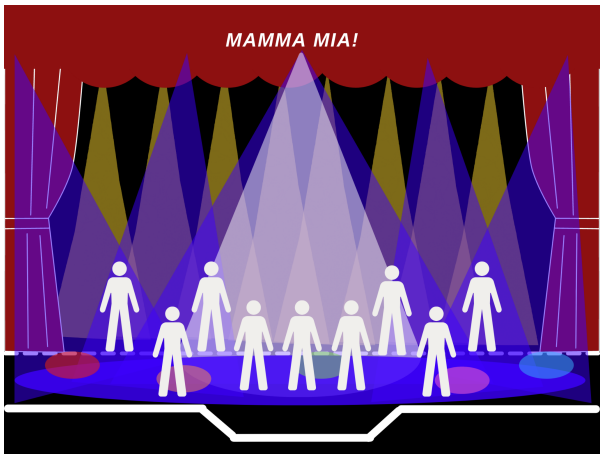

Figure E, Rendering of light effect from audience perspective for Cue 67.1. Note: Dots on ground indicate Ch. 23 as a disco light.

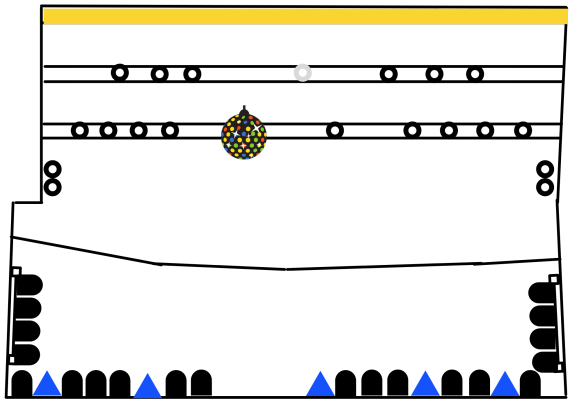

Figure F, Light plot/Bird's Eye View of Cue X with operating lights on. Note: cyc light in back is yellow to connect with lyrics from song in Scene 8, Act 1.