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EFFECT OF RESEARCH ON LIGHTING FOR MODERN DANCE

A thesis submitted in partial satisfaction
of the requirements for the degree of

MASTER OF ARTS

in

THEATER ARTS

by

Andrew Grabowski

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Abstract

Effect of Research on Lighting for Modern Dance

by Andrew Grabowski

Theatre is made up of a large number of collaborating artists each of which performs a particular function. A degree in Theatre Arts provides a education in every aspect of theatre production from acting to designing to directing. However a Masters degree in Theatre Arts should provide a specialized experience to the student. Within my thesis I created a comprehensive theatrical lighting design for the faculty directed dance piece *Blueprints*. This design is a combination off positioning the individual lighting instruments and providing color and texture to the light. The challenges of this production and the fact that it was my first design for a dance concert provided me with a new experience in my chosen field. Research into the history of lighting design I was able to provide solutions to many of my problems. Though the use of both historical and contemporary lighting styles I have created a clean and effective design. This thesis provides a deep look into my process for the creation of a theatrical lighting design.

Effect of Research on Lighting for Modern Dance

Theatre is synthesis. Effective and successful theatre relies on combining every aspect of design and performance. Although each individual within the profession may not understand every aspect of theatre, analysis of the history of design illuminates the task of the designer. It is therefore the first step in any designer's journey to learn the history and theory as well as the practical application of their chosen art form in the theatre. The next step and the only way to build experience is the act of creating and presenting a design. *Blueprints* is my ninth full lighting design at the University of California Santa Cruz; it has provided me with my first experience of lighting a dance concert. To design this production, a form of theatre new to me, necessitates my personal exploration into the background of traditional lighting for dance as well as encourages me to delve deeper into the foundation of modern lighting. By comparing early modern lighting tools to those at my disposal I have started to develop my style to further encompass a type of theatrical performance I had not previously had the opportunity to explore. *Blueprints* is a four part dance piece directed and choreographed in part by Ted Warburton; the remaining quarters are choreographed by Mandjou Koné, David Herrera, and Cid Pearlman. The show as a whole presents a handful of unique challenges, but each dance piece had its own set of particular difficulties, such as lighting around media, limited work time, and lack of efficacious communication between the choreographers and myself.



Figure 1. The Three Body Problem necessitated the use of side light and UV light to avoid washing out the floor projections.

The Three Body Problem, Ted Warburton's part of the show, is a movement and projection driven analysis of the mathematical three body problem. The dance piece creates a visualization of the interactions of three partials and the effects of their individual gravitational fields. A combination of the constant floor projection and the semi-randomized nature of the music creates a scenario that is very limiting from a practical standpoint; there are few angles of light that will provide full stage coverage while not washing out the projections (See fig. 1).

Next in the show order is Mandjou Koné's segment, an African-inspired piece

based in Malian dance. This piece's final choreography was not hammered out until technical rehearsal and, compounding the difficulties, has a large cast of over 30 people (see fig. 2). Koné's company entirely fills the playing space, each dancer shadowing the rest of the group. It is imperative to counter this shadowing effect through the use of high angle light, rather than sidelight like most of the other pieces, so that performers on the outside of the piece will not draw focus from the performers in the center of the space.



Figure 2. Mandjou Koné's large company filled the stage with thirty performers.

David Herrera's piece is staged after intermission. This was originally part of a show performed in the Bay Area a month before moving to the University of California, Santa Cruz Main Stage. The predicament here stemmed from the fact the

technical staff of *Blueprints* had not seen any of the choreography prior to technical rehearsal. In addition to the design team's personal inexperience with the piece, the choreographer had not fully accounted for the new issues of performing in the Main Stage. This lack of full preparation on both the designers' and director's part made technical rehearsal troublesome. However, as the lighting designers had the advantage of meeting with Herrera's lighting designer from the previous space, we were provided with some useful information, namely, color and needs for dance specific specials. As useful as that information was, there are vast differences between the previous space and the Main Stage, most notably the change from a proscenium to a thrust. I was forced to change the method of cuing lights as well as some of the specific lighting looks due to limitations of both time and space.

Cid Pearlman's piece is being designed by Greg Towle. This break allows me the extra time to focus on refining the pieces I have designed. The addition of Greg Towle into the design team challenged me to incorporate his needs into the light plot. Greg also fills the role of media designer for *Blueprints*, ensuring that our collaboration is crucial for the success of the performance.

The variety of idiosyncratic issues necessitated a simple method of problem solving that could be applied to any dilemma within lighting *Blueprints*. The method I developed for this set of problems first examined the history of theatrical instruments to gain theoretical knowledge and inspiration about how the instrument was used in the past.

Prior to the advent of gas, a theatrical lighting designer was afforded little flexibility. Although historians agree that Greek theatres were developed to make use of the sun during performance, the extent to which lighting was made use of is still a subject of contention.¹ Knowledge of the sun's interaction with live outdoor theatre is important because it illustrates the first and most fundamental function of lighting: visibility.² The audience must be able to perceive the action on stage, therefore action must be lit. Major innovations in the control of lighting would begin when gas gained popularity and economic viability in the 1810s.³ Gas dimming created separation of audience and stage areas as well as allowing for a larger playing space.⁴ Because the gas lights were more intense, one could use fewer, more cost-effective instruments to cover a larger space. I am interested to see during the run of *Blueprints* if there will be audience interaction due to the partial illumination of the audience during one of the segments. Warburton's piece makes use of ultraviolet lighting instruments, an idea conceived by both director and designers. Due to the extremely flooded nature of those instruments approximately a third of the audience will be bathed in the glow of black light. Will the audience interact more with the dancers because they are lit in the same way, despite the lack of invitation to be more vocal or move to the music themselves? Will the performers be distracted? I have already noticed that the dancers are having trouble focusing with the ultraviolet lights on; the inclusion of more

¹ Penzel, *Theatre Lighting Before Electricity*, p. 3

² McCandless, *Syllabus of Stage Lighting*, p. 85

³ Penzel, *Theatre Lighting Before Electricity*, p. 35 and 53

⁴ *Ibid.*, p. 54

standard theatrical lights has been helping the dancers concentrate visually and maintain depth perception.

Historically the next major innovation within gas lighting was the creation of limelight. This instrument's high intensity was attained through the luminous nature of heated quicklime, a light so intense it was being considered for use as a long range surveying tool.⁵ This high intensity light is much like the modern arc source moving lights available for my design and, like limelight, the moving lights have the potential for misuse. An observer of an early limelight follow spot referred to the overpowering nature of the sharp round beam of light,⁶ a description all too similar to a poorly programmed moving light. I have remained conscientious of this potential pitfall to ensure that the intensity of the arc sources do not break the cohesion of the stage aesthetic. Fortunately the modern arc sources at my disposal have the advantage of being dimmable, unlike most limelight.

The increase in efficiency of lighting both through limelight and other gas fixtures created an atmosphere that encouraged innovation in the realm of color. Sir Henry Irving began taking steps in the late 1870s to integrate color mixing into his designs through the use of strategically colored glass placed in front of limelight sources.⁷ Frederick Penzel argues that by creating discrete areas of color on the stage, Irving became “the first to treat light as a creative and expressive medium” (Penzel,

⁵ Penzel, *Theatre Lighting Before Electricity*. p. 56-7

⁶ *Ibid.*, p. 59

⁷ *Ibid.*, p. 60-1

61). However use of sophisticated reflectors and color effects in the courtly masques of the 1600s illustrate that the use of theatrical lighting design can be witnessed long before Irving's employment of colored glass.⁸ The specificity of limelight allowed Irving's design to make use of color to draw focus on particular areas of the stage.⁹ The use of color as a focusing tool has not lost any of its effectiveness since Irving's time, although technological advances have made the process more efficient.

Advancements in technology as applied to theatre do not significantly change the theory related to any individual aspect of the production; but advancements do change the application of the theory. The LED instruments that I used in *Blueprints* simply mix color more specifically than a dichroic glass color mixer or the precursors to that, a painted glass switched at the same time as scenic changes or other brief pauses in the show. The LED instruments and other color changing instruments I made use of during *Blueprints* provide the flexibility to apply color theory directly to the stage without devoting instruments to single colors. In order to understand what color theory to put into place I looked to specific examples from experienced designers.

One of the designers I drew technique from is Jean Rosenthal; her book [The Magic of Light](#) creates a comprehensive look into theatrical lighting in all its forms. Three key factors can be drawn from [The Magic of Light](#) and applied to *Blueprints*. Firstly, I have directly used examples of color theory from this text within my design;

⁸ Graves, p. 168-74

⁹ Penzel, *Theatre Lighting Before Electricity*. p. 60-1

although I have disregarded some of Rosenthal's assertions when they fail to apply to my design. Secondly, Rosenthal's chapter on collaboration has solidified my own personal thoughts on effectively working with other theatrical denizens. Finally, Rosenthal outlines her method for formulating dance lighting, a chapter that developed my understanding of the basics of lighting a form new to me.

Rosenthal's application of color to performance favors subtlety and specificity. Color must be matched to the performer. Rosenthal provides examples of performers and the light that suits them best, such as dancer "Gwen Verdon's red hair [being] made entrancing and delicate by pink or straw colors" (33). I made use of this nuanced matching of color to skin tone during a solo segment of David Herrera's piece; my application of no-color side light at low intensity enhances the physical appearance of the soloist. However I do not adhere strictly to Rosenthal's color suggestions, for instance her assertion that saturated color is "inelegant and totally unsuited" for dance lighting simply does not fit with my aesthetic view of the pieces in *Blueprints* (119).

Collaboration is the group's ground work of the design concept and the application of theories to the concept. Theatre cannot exist without collaboration. Every time a designer works with someone the designer integrates their collaborator's ideas into the design. Merging all of the collaborators' ideas yields a result that is better as a whole. The way in which I collaborate has adapted with each performance I design. Rosenthal provides new insight into a method with which to collaborate:

maintain your essential design concepts but remember that lighting must be an underlying element of theatre, not an overt element. The theory that Rosenthal presents is that if the scenic designer respects the lighting designer's knowledge, the core of the design will stay in the hands of the lighting designer.¹⁰ *Blueprints* requires no scenic design, so I worked closely with the two media designers, Drew Detweiler and Greg Towle who have the most to gain or lose by my design. By collaborating closely with Greg and Drew, the lighting design and media design overlap to create a clean and effective look for each of the dance pieces. The core balance of light and media is attained so neither aspect overwhelms the other.

Rosenthal's third and most serious addition to my repertoire of lighting design is the addition of dance lighting theories. *Blueprints* is not a narrative piece. It changed the basic structure of how I go about lighting. Despite some limited vocal performance, the movement is the core aspect of the performance. As a lighting designer I transitioned from the most expressive part of the actor's body, the face, to the most expressive part of the dancer, their entire body. Rosenthal states that "[t]he dancers' arms, their necks, their faces must be lovely," a clarification of body's form resulting in a stage lighting that captures every aspect of the dance (119).

The creation of a comprehensive lighting of the dancer's form also relies on an understanding of the layout of the thrust stage itself. My use of side light both as key and fill is based on my research into lighting for theater in the round. Jackie

¹⁰ Rosenthal, *The Magic of Light*, p. 35-9

Staines describes the lack of distinction between back and front light in theatre in the round, due to the circular nature of the audience back light for one section will be front light for the section directly across the stage¹¹. I applied this notion of a light serving two purposes to my boom mounted side light. In the final dance of Herrera's piece I made use of the stage left LED instruments to provide key light to the performers on stage left while providing fill light to performers on stage right. The intensity drop off with distance when paired with a cyclorama splitting look allowed each LED instrument to serve double duty. The bisecting effect of this stage look drew focus to the dancers on the edges of the stage rather than the empty space in the center while still providing full stage illumination.

To add to all the challenges of designing a new form of performance I also had to deal with a change in the basic scheduling and set up of technical rehearsal. Blocking had not been solidified before tech, so my light plot did not fully represent the needs of each piece. I was able to see a run through a day before tech. This would usually allow me to tweak my plot to reflect the final placement of actors on stage but none of the pieces I designed presented me with a look that fully reflected the final choreography. Then tech itself was run differently from what I have come to expect from narrative pieces, with a new and to me surprisingly schedule. I was under the impression tech would begin and the team would be able to jump into positioning and writing cues, but the dancers required warm up and set up time before being able to

¹¹ Staines, Jackie. *Lighting Techniques for Theatre-in-the-Round*. p.34-5

tech. Each block of tech was cut down by an hour for this warm up and set up, resulting in a failure to run through the entirety of the piece before the conclusion of the five hour mark. Full runs are the only way to gain a real sense of the timing and comprehensive aesthetic of the dance piece, so without runs many of my personal notes did more harm than good. To counteract this problem I double checked with the stage manager and choreographer that each of my notes was affecting the correct moment, thus avoiding accidental changes.

The next predicament flows directly from this time crunch. The problems that occurred over the course of tech happened at such a rapid rate I had no time to do additional research. The nature of the communication between myself, stage management, and choreographers was so strained that we all became upset with each other. After working with the stage manager I discovered the only way to fully communicate my cues for Herrera's piece was to sit down and watch a filmed run. We, the stage management and design team, had failed to build the syntax required to place cues in a way that was possible to execute. In other pieces there were specific moments that could be cued off of, however the ephemeral nature of Herrera's piece yielded a particular challenge. The choreography of the dance had never been completely solidified within Main Stage due to the fact that Herrera and his company entered the space for the first time during tech.

In retrospect, I should have made the film plan work earlier in the process. There had been a plan in place to receive a DVD filmed at the last performance of

Herrera's piece in the Bay Area, but it was never made available. A higher quality filmed version of the dance would have greatly benefited the designers and stage managers due to the subtle nature of cue requests made by the choreographer. Many of which were impossible to view on the tape due to the small movement and changes. Without seeing the piece any lighting design would be purely speculative, with no concrete moments to call cues.

Without a script or a dance that took cues from music I had no easy map to designing Herrera's piece. The piece was not consistently timed so a stop watch failed to impart useful information. Uniformity of costume provided very little to differentiate the performers. We had to describe borderline esoteric dance maneuvers that had no particular title. A name had to be applied for brevity's sake so we used whatever words we could to accurately describe the movements. The result was a dialog that involved nicknames for particular dancers and shorthand phrases like "weird lift spinny spin" and "down stage lip stick." Another hurdle was placed in our path when we realized that the dancers did not hit consistent marks so the stage manager would doubt if this particular lift, for example, is the lift to take the cue on.

The blessing and the curse of Herrera's piece was the fact that he was working off of the light cues from the Bay Area production of his dance. This was wonderful because he knew what he wanted. This was terrible because he was trying to describe to me what looks he wanted and at what timing. I never received a comprehensive list of looks or a cue sheet from his previous designer, so all I had was the descriptions

from Herrera. No two designers can create the same look without seeing each other's design, making it impossible to create the exact design Herrera wanted.

The only way to learn the lessons I learned with this piece was to do the work and ask myself: 'How could I have been more prepared for this design?' With four very different pieces of dance, performers numbering between four and thirty on stage at a time, and a complete lack of show consistency the difficult nature of this design is very apparent. I needed to understand the starting location and the path to the destination of each dancer in order to formulate a clear picture of what the design would look like in my head. The way I find most efficacious to improve is complete understanding of the movement. Warburton's piece and Kone's pieces were the cleanest designs because I was able to see them the most times.

The distinctive structure of the Main Stage theatre made it far more difficult to efficiently design a light plot. My design experience is rooted the Barn Theater and Second Stage, two very small spaces, each of which has an inventory approximately half the size of Main Stage. Although Second Stage has a less organized grid, the nature of its proscenium creates a more orderly method of focusing and positioning lights. The Barn Theatre has a small stage area yielding less total area to light, forcing the designer to choose each area and each instrument with great care. In contrast, the Main Stage is so large it creates a space that is difficult to visualize and mentally mark out, leading to inefficiency within my design. After designing in Second Stage and the Digital Arts Research Center's Dark Lab the utility gained from each

individual instrument seemed to drop off in the design for *Blueprints*. The fact that I did not make use of ten lights over the course of the show simply highlights that inefficiency.

Although my design did not accomplish every element I had hoped, *Blueprints* has provided a platform for the application of my studies in theatrical lighting. This show has yielded more questions than answers, providing a springboard for further research. Understanding the effects produced by early gas instruments and limelight has allowed me to understand the possible affects of ultraviolet and moving light on stage. Only a handful of the innovations of the past two hundred years went into the research to improve my design, yet in spite of this some of the most defining parts of this show rely on innovations of the past thirty years. I have barely begun to scratch the surface of research into dichroic glass, LED technology, projected media, and moving lights. The research used in *Blueprints*' design simply illustrates the practical advantages of thoughtful research and its practical application to theatrical design.

The conclusion of any design should leave the artist with more questions than answers. *Blueprints* has provided me with a testing ground for the use of angled light and color changing instruments. However my design process still requires a handful of improvements. In the future I must strive to create clearer plans for hanging and focusing the plot. I must also improve the clarity of my drafting skills both on the computer and hand drawn. Clearer planning and drawings will speed up my process

to avoid the time constraints of *Blueprints*. My use of moving lights and ultra violet light should also be inspected. Additional time must be provided for focusing ultra violet light due to its near invisible nature. Automated moving light palates allowed for rapid static focusing but did not efficiently permit visible live moves within the dance. Overall the design presented for *Blueprints* is my most complicated, however in the future I would like to make use of each individual light more effectively. Making use of fewer instruments total for this design would have been preferable.

Appendix 1. Blueprints Channel Hookup

Chan	Unit#	Inst Type	Color	Gobo or accessory	Dim
(1)	1	Source 4 26deg	R69		19
(2)	2	Source 4 26deg	R26		21
(3)	3	Source 4 26deg	R69		26
(4)	4	Source 4 26deg	R26		25
(5)	5	Source 4 26deg	R69		24
(6)	11	Source 4 26deg	R26		223
(7)	3	Source 4 26deg	R69		175
(8)	4	Source 4 26deg	R26		174
(9)	5	Source 4 26deg	R69		359
(10)	10	Source 4 26deg	R26		27
(11)	6	Source 4 50deg	R69		114
(12)	1	Source 4 26deg	R26		177
(13)	3	Source 4 26deg	R69		117

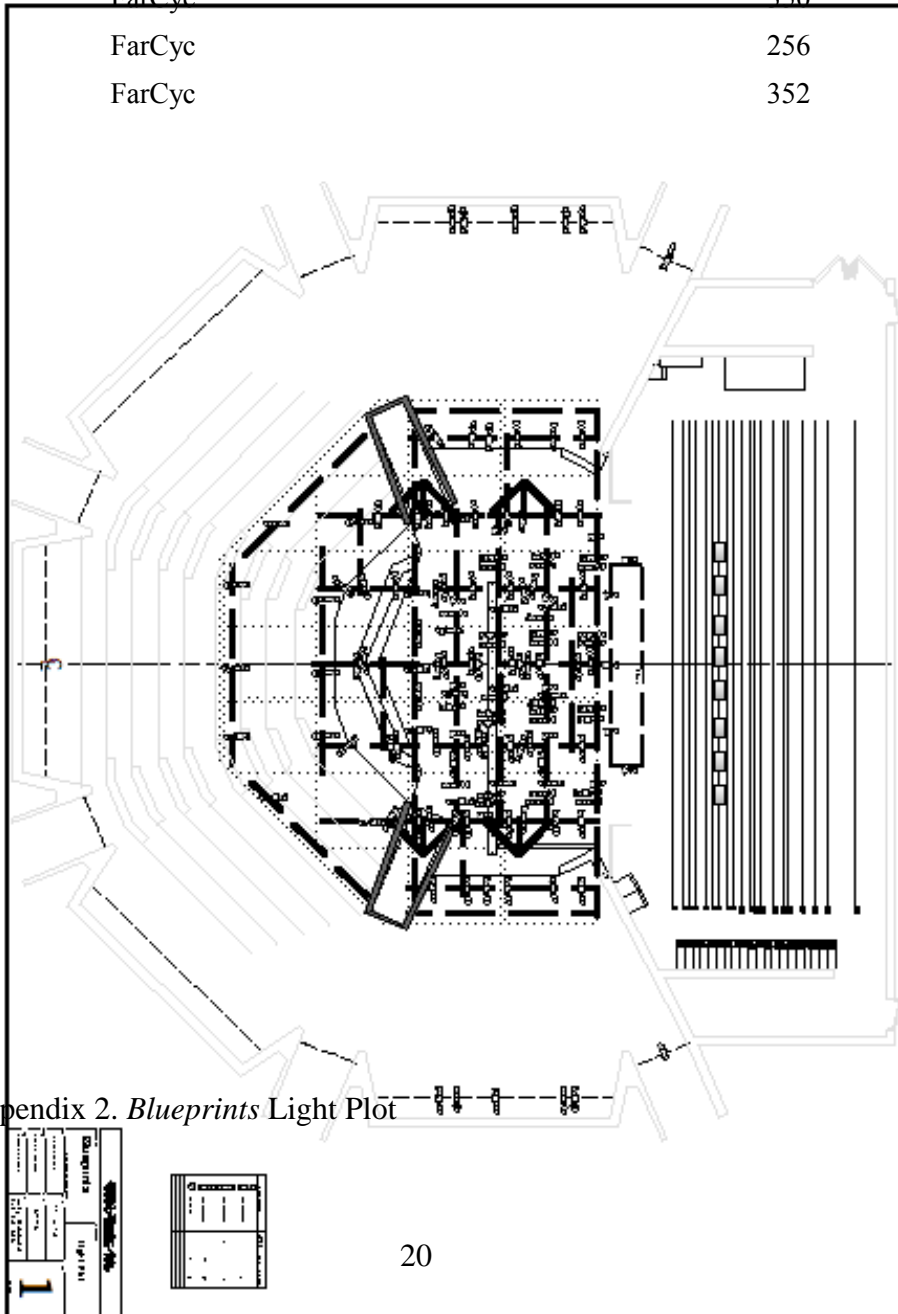
(14)	5	Source 4 26deg	R26		361
(15)		Source 4 26deg	R69		366
(21)	6	Source 4 50deg	L201	Linear City B R740	11
(22)	10	Source 4 26deg	L201	Trusswork R77228	176
(23)	11	Source 4 26deg	L201	Linear City B R740	221
(24)	2	Source 4 26deg	L201	Trusswork R77228	218
(25)	10	Source 4 26deg	L201	Linear City B R740	356
(26)	4	Source 4 50deg	L201	Linear City B R740	369
(27)	8	Source 4 50deg	L201	Trusswork R77228	113
(28)	7	Source 4 26deg	L201	Linear City B R740	185
(29)	10	Source 4 26deg	L201	Trusswork R77228	65
(30)		Source 4 50deg	L201	Linear City B R740	367
(31)	2	Source 4 50deg	L201	Linear City B R740	4
(32)	3	Source 4 50deg	L201	Trusswork R77228	159
(33)	3	Source 4 26deg	L201	Linear City B R740	109
(34)	4	Source 4 26deg	L201	Trusswork R77228	100
(35)	3	Source 4 26deg	L201	Linear City B R740	128
(41)	10	Source 4 26deg	R08	Moonscape R 643	220
(42)	1	Source 4 26deg	R08	Moonscape R 643	178
(43)	11	Source 4 26deg	R08	Moonscape R 643	358
(44)	9	Source 4 26deg	R08	Moonscape R 643	272
(45)	6	Source 4 26deg	R08	Moonscape R 643	31
(46)	6	Source 4 26deg	R08	Moonscape R 643	184
(47)	9	Source 4 26deg	R08	Moonscape R 643	186
(48)	8	Source 4 26deg	R08	Moonscape R 643	124
(49)	7	Source 4 26deg	R08	Moonscape R 643	120
(50)	4	Source 4 26deg	R08	Moonscape R 643	35
(51)	2	Source 4 26deg	R08	Moonscape R 643	108
(52)	3	Source 4 26deg	R08	Moonscape R 643	227
(53)	2	Source 4 26deg	R08	Moonscape R 643	364
(54)	3	Source 4 26deg	R08	Moonscape R 643	281
(55)	2	Source 4 26deg	R08	Moonscape R 643	38

(61)	9	Source 4 50deg	L105	112
(62)	9	Source 4 50deg	L105	222
(63)	2	Source 4 50deg	L105	216
(64)	1	Source 4 36deg	L105	63
(65)	5	Source 4 50deg	L124	10
(66)	5	Source 4 36deg	L105	115
(67)	5	Source 4 50deg	L105	111
(68)	8	Source 4 50deg	L105	182
(69)	3	Source 4 36deg	L105	62
(70)	3	Source 4 50deg	L124	7
(71)	4	Source 4 36deg	L105	181
(72)	4	Source 4 36deg	L105	110
(73)	6	Source 4 50deg	L105	66
(74)	5	Source 4 36deg	L105	61
(75)	1	Source 4 50deg	L124	3
(76)	1	Source 4 50deg	L105	161
(77)	1	Source 4 50deg	L105	96
(78)	1	Source 4 50deg	L105	228
(81)	4	Source 4 50deg	R64	214
(82)		Source 4 36deg	R64	28
(83)	8	Source 4 50deg	R64	273
(84)	7	Source 4 50deg	R64	183
(85)	7	Source 4 50deg	R64	122
(86)	5	Source 4 50deg	R64	215
(87)	5	Source 4 50deg	R07	32
(88)	1	Source 4 36deg	R64	43
(89)	5	Source 4 50deg	R64	64
(90)	4	Source 4 50deg	R64	129
(91)	4	Source 4 50deg	R64	365
(92)	3	Source 4 50deg	R07	373
(93)	3	Source 4 36deg	R64	42
(94)	2	Source 4 50deg	R64	229

(95)	1	Source 4 50deg	R64	106
(96)	1	Source 4 50deg	R64	146
(97)	1	Source 4 50deg	R07	39
(98)	4	Source 4 36deg	R64	41
(101)	1	S4 PAR WFL		95
(102)	2	S4 PAR WFL		189
(103)	3	S4 PAR WFL		187
(104)	4	S4 PAR WFL		363
(105)	13	S4 PAR WFL		368
(106)	1	S4 PAR WFL		158
(107)	3	S4 PAR WFL		179
(108)	8	S4 PAR WFL		102
(109)	13	S4 PAR WFL		105
(110)	8	S4 PAR WFL		275
(111)	1	S4 PAR WFL	R80	
(112)	2	S4 PAR WFL	R80	
(113)	3	S4 PAR WFL	R80	
(114)	4	S4 PAR WFL	R80	
(115)	5	S4 PAR WFL	R80	
(121)	1	Source 4 36deg		Ct
(122)	4	Source 4 36deg		81
(123)	8	Source 4 36deg		357
(124)	11	Source 4 36deg		Ct
(125)	1	Source 4 36deg		Ct
(126)	6	Source 4 36deg		374
(127)	11	Source 4 36deg		236
(128)	16	Source 4 36deg		Ct
(130)	2	Source 4 36deg		Ct
(131)	4	Source 4 36deg		23
(132)	6	Source 4 36deg		230
(133)	9	Source 4 36deg		Ct
(141)	2	Source 4 36deg	R88	94

(142)	5	Source 4 36deg	R88	80
(143)	9	Source 4 36deg	R88	172
(144)	12	Source 4 36deg	R88	130
(145)	2	Source 4 36deg	R88	98
(146)	7	Source 4 36deg	R88	101
(147)	12	Source 4 36deg	R88	234
(148)	17	Source 4 36deg	R88	149
(149)	3	Source 4 36deg	R88	97
(150)	5	Source 4 36deg	R88	235
(151)	7	Source 4 36deg	R88	104
(152)	10	Source 4 36deg	R88	151
(161)		Source 4 26deg		188
(162)		Source 4 26deg		173
(163)		Source 4 26deg		121
(164)	3	Source 4 26deg		93
(165)	6	Source 4 26deg		67
(166)	7	Source 4 26deg		127
(167)	10	Source 4 26deg		131
(168)	4	Source 4 26deg		180
(169)	9	Source 4 26deg		231
(170)	15	Source 4 26deg		150
(181)		Source 4 LED 26deg	LED Color Changing	232
(182)		Source 4 LED 26deg	LED Color Changing	242
(183)		Source 4 LED 26deg	LED Color Changing	252
(184)	5	Source 4 LED 26deg	LED Color Changing	262
(185)	10	Source 4 LED 26deg	LED Color Changing	272
(186)	14	Source 4 LED 26deg	LED Color Changing	282
(191)	2	Source 4 50deg	High End ColorMerge	11
(192)	7	Source 4 50deg	High End ColorMerge	2
(193)	4	Source 4 50deg	High End ColorMerge	9
(194)	2	Source 4 50deg	High End ColorMerge	14
(195)	6	Source 4 50deg	High End ColorMerge	17

(196)	2	Source 4 50deg	High End ColorMerge	5
(197)	2	Wildfire UV		
(198)	5	Wildfire UV		
(301)		FarCyc		258
(302)		FarCyc		351
(303)		FarCyc		253
(304)		FarCyc		350
(305)		FarCyc		256
(306)		FarCyc		352



Bibliography

Graves, R. B. *Lighting The Shakespearean Stage, 1567-1642*. Carbondale: Southern Illinois University Press, 1999. Print.

McCandless, Stanley. *A Syllabus of Stage Lighting*. New York: Drama Books Specialists / Publishers, 1964. Print.

Penzel, Fredrick. *Theatre Lighting Before Electricity*. Middleton: Wesleyan University Press, 1978. Print.

Rosenthal, Jean and Lael Wertenbaker. *The Magic of Light*. New York: Theatre Arts Books, 1972. Print.

Skelton, Tom. "Handbook of Dance Stagecraft." *Dance Magazine* 31.1-6. (1957) Print.

Staines, Jackie. *Lighting Techniques for Theatre In-The-Round*. Cambridge: Entertainment Technology Press Ltd, 2000. Print.