

## Theatrical Lighting Equipment & Design

### A." My Intro - Lecture 1

- " Native New Yorker
- " Theatre – Dance – TV – Special Events
- " Lighting designer and stage manager
  - " Touring theatre & dance companies in the U.S. & Canada
- " Technical Director
  - " Times Square Studios
  - " BMCC
  - " GN Playhouse, Long Island
- " Production Supervisor
  - " B'way – Shakespeare for My Father
  - " NYC Fashion Shows
  - " Lincoln Centre Out-of-Doors
- " Production manager
  - " Bolshoi Ballet
  - " Kirov Ballet
  - " Phillipian Dance Co
  - " Chinese Acrobats
- " Art Director
  - " Tina Turner
  - " Gloria Leonard
    - " Editor of High Society – (Porn Magazine)
    - " Interview format
- " Stagehand
  - " B'way
    - " Gershwin Theatre
    - " Princess Theatre
    - " Nederlander Theatre
    - " Shubert Theatre
  - " Off B'way
    - " Astor Place
    - " Playwrights' Horizons
    - " Promenade Theatre
    - " Equity Library Theatre
  - " TV
    - " ABC-TV
    - " CBS-TV
    - " Ed Sullivan Theatre
  - " Misc
    - " Dance Theatre of Harlem
    - " Studio 54
- " **CHANGE TO ORGANIZATIONAL CHART**

### B." OVERVIEW OF LECTURE SERIES

- " Lighting Equipment
  - " History & development of lighting equipment
- " Dimming & Distribution
  - " History & development of dimming/distribution
- " Control
  - " Advances in computer controlled lighting

## Theatrical Lighting Equipment & Design

- " Special Effects
  - " A quick look at special effects
- " Safety Issues
  - " Keeping cast, crew & audience safe
- " Lighting Positions
  - " Where to hang your lights/effects
- " Color
  - " Additive & subtractive colors
- " Design Concepts
  - " Breaking down a script
  - " How to think like a designer
- " Design Tools
  - " CAD drawing, Light Wright & other tools

### C." LIGHTING EQUIPMENT

1. Pre-Electric Lighting
  - a. Natural light
    - i. Greek Amphitheatre – 2000 BCE      4000 Before TV
    - ii. Shakespearean – 1500 CE      450 Before TV
  - b. Candles – 1600 CE      350 Before TV
  - c. Oil lamps – 1700 CE      250 Before TV
  - d. Gas lamps – 1800 CE      150 Before TV
2. Electric Light
  - a. Thomas A. Edison
    - i. Not the inventor but the perfector of the electric light bulb
    - ii. Consolidated Edison
    - iii. Light bulb pix
3. PC Lens
  - Metal box w/PC lens
  - 6" & 8"
4. Fresnel lens
  - a. First used in a lighthouse - 1822
    - o Augustin-Jean Fresnel (May 10, 1788 – July 14, 1827)
  - b. 3" Inky
  - c. 6", 8" & 10"
    - o Larger sizes used for movies, TV & film
  - d. Barn doors
  - e. **Web address @ bottom of page (Create email list @ end of lecture today)**
5. Scoops 1-1.5kw
  - Parabolic floodlight
6. Beam Projector
  - Parabolic reflector redirects light into parallel beams like sunlight
7. Strip/Cyclorama/Ground row lights
  - a. Multi-circuit lighting (3 & 4 circuit)
  - b. R-40 150-300w
  - c. MR-16 25-75w – narrow to wide
  - d. Flippers – Sheet of metal hinged to edge of strips – Acts as barn door
  - e. **Used strips on booms in wings for dance lighting <- Chinese Acrobats**
8. Ellipsoidals
  - a. Ed Cook
    - **Electrician to Florenze Ziegfeld**

## Theatrical Lighting Equipment & Design

### ○ Ziegfeld Follies – B'way

- Theatre in Germany used ellipsoidal design as houselights
- Co-inventor with Joel Levy: The LEKO; the first ERS

- |    |                               |     |        |              |                       |
|----|-------------------------------|-----|--------|--------------|-----------------------|
| b. | 4 ½ x 6 ½ - 750w              | 50° | S4 ETC | 575w or 750w | 1kw lamp<br>burns gel |
| c. | 6 x 9 – 750-1kw               | 36° | S4 ETC |              |                       |
| d. | 6 x 12 – 750-1kw              | 26° | S4 ETC |              |                       |
| e. | 6 x 16 – 1kw                  | 19° | S4 ETC |              |                       |
| f. | 6 x 22 – 1kw                  | 10° | S4 ETC |              |                       |
| g. | New lens tubes: 90°, 70° & 5° |     |        |              |                       |

### 9. PAR's

- Tin cans & car headlights
  - Studio 54: Burned hand on PAR – Thought it was a low voltage unit
- Single units - Theatre
  - PAR56 WFL MFL NSP VN5P 500-1kw
  - PAR64 WFL MFL NSP VN5P 500-1kw
- 6 PAR cans on a stick – Rock & Roll
  - PAR56 WFL MFL NSP VN5P 500-1kw
  - PAR64 WFL MFL NSP VN5P 500-1kw
- LED PAR's
  - Hi light output
  - Lo heat
  - 50,000 Hours MTF
  - DMX controlled

### 10. TV Lights

- Key, Fill & Backlight

  - LED Camera
  - Softlight Incandescent
  - Softlight Florescent

### 11. Follow Spots

- Lime light
- Carbon Arc
  - Changing out carbons – 2 pliers @ 20 secs
- Xenon (Internal short arc)
- Halogen (Quartz light)

### 12. Moving Lights

- Pan, tilt, zoom, color, intensity, gobos, strobe, shutter, iris, effects
- 20-30 channels per light
- Vari-Lites
- Studio Spots
- Martin MAC 500
- Digital Video Projections

### D." DIMMING & DISTRIBUTION

- Salt water dimmer
  - 10-0 Off to Full
  - First seen by me in early '70's in Rio show
- Resistance dimmer
  - 10-0 Off to Full
  - 12 plate 6kw / 14 plate 3kw Road boards
  - A/B switchboxes to double dimmer use
  - Used in my first B'way design: Chinese Acrobats

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3. Autotransformer
  - a. 0-10 Off to Full
  - b. 3-6 kw
  - c. First used in TV (1950's)
  - d. Off B'way standard through the early 1980's
4. SCR
  - a. When this technology came to TV the early SCR's created problems with noise in the audio and video equipment. The solution was separate power for the lights and video.
  - b. 1.2kw - 2.4kw - 3.6kw - 6kw - 12kw
  - c. High Density SCR dimmers for touring
5. Power Distribution
  - a. 120 vac
    - Hot – neutral – ground
  - b. 220 vac
    - Hot – hot – ground
  - c. Amps \* Volts = Watts
6. Cable
  - a. Single Circuit
    - 12 awg = 4.0mm<sup>2</sup> = 20 amp @ 120 vac / 10 amp @ 220 vac
    - 14 awg = 1.5mm<sup>2</sup> = 15 amp @ 120 vac / 7.5 amp @ 220 vac
  - b. Bundled cable
    - Custom assembled for each production
    - A Chorus Line: Bundled cables melted from heat of years of use. Had to be hack-sawed apart when show first closed on B'way.
  - c. Multi-cable
    - 6 & 12 circuit cables
      - Original 12 cir multi-cable weighed over 2 kilos per meter
      - Socapex 6 circuit weighs less than 1 kilo per meter
    - Break-Outs & Break-Ins
      - Staggered vs. Straight
  - d. Plugs
    - Edison (common household) plug
    - Stage pin
    - Twistlok
    - Cam-Locks
    - Socapex
7. Switch boxes
  - a. A/B
    - 20 Amp
    - Children of a lesser G\_d
      - New switchboxes made with silent levers using mercury contacts (Show had a deaf theme and contained long pauses without any verbal dialog except "signing".)
8. Patch panels
  - a. Mechanical telephone-type patch panel
  - b. Incorporated into High-D racks

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### E." CONTROL – Lecture 2

1. Pre-electronic
  - a. Hand levers
    - Broom sticks used as master fader
  - b. Mechanical interlocks
2. Electronic
  - a. Multi-scene preset boards
    1. Ed Sullivan Theatre
      - 10 Scene preset electronic dimmer system
  - b. Strand
    - Strand Light Palette
      - " Original full Light Palette had bug in its program
        - All channels to full in 30 Secs. Only way to stop it was a hard re-boot which also causes a blackout.
    - Century C-Card
      - " This "card" was really the size and shape of a shoe box but contained the information for one preset. These cards could be removed from its holder when not in use. Made it possible to have more complicated lighting cues.
  - c. Kliegl
    1. Soft patching – connecting dimmers to channels
      - Performer
      - Performer II
  - d. ETC
    1. Macros – Complex programming simplified
      - Micro-Vision
      - Vision
      - Obsession
      - Expression
      - Express
      - Insight
      - Eos
      - Congo Jr.
  - e. Flying Pig
    - Software programs using standard PC
      - Whole Hog 2 & 3
      - Hog2PC
      - USB to DMX widget plus software
  - f. DMX
    - The Pocket DMX Console
    - USITT protocol
  - g. Opti-splitters & Universes
    - Isolates lighting console from DMX devices
    - 512 channels per Universe
  - h. DMX Digital Devices
    - Wireless DMX
      - Transmitter
      - Receivers
      - Dimmers

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### F." SPECIAL EFFECTS & TECH TOYS

1. Rosco's Keystroke
2. Color scrollers
3. Fog/Dry Ice Machines
  - a. Drum barrel style machine
  - b. PeaSouper
  - c. Tiny Fogger
    - Dance Theatre of Harlem: Dancers passed out lying in dry ice fog before a dance
4. Hazers
  - Use it to make light beams more visible
5. Flash Powder
  - Storage considerations for photo flash powder
    - Regional theatre: Overloaded flash pot sent its cover through the ceiling.
  - Binary powders
6. Black Light
  - Wildfires used in Universal's Islands of Adventure: The Cat in the Hat Ride
7. Gobos
  - a. Standard
    - Steel
    - Glass
    - rotators
  - b. Custom designs
8. Star drops
  - a. Fiber-optics with lamp box
    - Separate light and motor control
  - b. LED drop
    - Full DMX addressable drop
9. Electric Candles
10. Strobes
  - a. Solo machines
  - b. Strobe cap for S4 ETC
11. Mirror balls
  - Focused light from a moving light with a gobo can be reflected off each mirror segment.
12. Break Away Bottles

### G." Specialty Tools & Toys

1. Spot Dot
2. Gator Grip Universal Socket
3. Stage pin spreader & tester
4. Flashlight
5. Leatherman (Multi-Tool)
6. Focusing glass
7. Light Meter
8. Laser Pointer
9. Light Pen

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### H." LIGHTING POSITIONS - Lecture 3

1. F.O.H.
  - a. Cove
  - b. Balcony rail
  - c. Box booms
  - d. Truss & chain motors
    - Straight
    - Curved
    - "T" pattern
2. On Stage
  - a. Over-head
    - " Suspended pipes
      - Rope & sandbags
      - Counter-weight
    - " Pipe ends
    - " Tail downs
    - " Ladders
  - b. Booms & bases
    - 20 Kilo base
    - Steel plate w/ lag-down holes
  - c. Accessories
    - Side arms
    - Scenery rings
  - d. Roving bases
    - With sand bags
    - Dance
  - e. Foot lights & ground rows
    - Dance
    - Musicals
    - Legitimate (Comedy or Drama)
  - f. Practicals
    - On set
    - Built into scenery
  - g. Under hung/Over hung
  - h. High hats/Color extenders

### I." COLOR

1. Qualities of Light
  - a. Intensity
    - Refers to the 'strength' of a light source.
  - b. Form
    - Light provides objects with a sense of form.
  - c. Color
    - All light is colored. White light is simply a mixture of all visible wavelengths.
  - d. Direction
    - The direction of light is one of the most important attributes in stage lighting design. All light has direction. A bare candle radiates light in all directions. A spotlight radiates light in a very specific direction.
  - e. Movement
    - Movement in lighting generally means any change in intensity, color, form or direction.

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2. Objectives of Lighting
  - a. Visibility
    - Good visibility is essentially selective. But its purpose is to reveal things. This varies from comedies to dramas to musicals (concerts).
  - b. Naturalism
    - Providing a sense of time and place
  - c. Composition
    - How the scene looks as an overall picture.
  - d. Mood
    - Transmitting the emotional value of the scene
3. Additive & subtractive color
4. Rosco Gels
  - a. Color media originally made from gelatin and colorants
    - **Washing gel**
  - b. Dye impregnated Polyester film used today
5. Lee & GAM filters
6. Frosts
  - a. Half hamburger frost
  - b. Directional frost
7. Color correction filters
  - a. Color temperature orange
  - b. Color temperature blue
  - c. Color correction for follow spots

### J." SAFETY ISSUES

1. Hazards
  - a. Loose cables on deck
  - b. Moving scenery/tracks
  - c. Traps
2. Glow tape
3. Safety cables on all equipment above 2 Meters
4. Z-Tex (Fire retardant materials)
  - Replaces Asbestos
5. Running lights
  - Cast & crew
6. Cue lights
  - a. Set moves
  - b. Actor entrances
    - **I blew a cue for a cast member's entrance on first SM job.**
7. Emergency lights
  - Power outages
8. Ghost light
  - Tradition as well as safety
9. Infrared light & video camera
  - Stage manager can see action/set-up in totally dark stage
10. Rigging
  - a. Chain Motors
  - b. Hardware
  - c. Spansets
11. Rope & knots
  - a. Hitch

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- b. Bowline
- c. Cleat
- 12. Standard stagehand tools
  - a. Screw drivers
    - Phillips
    - Flat blade
  - b. Pliers
    - Snub nose
    - Needle nose
  - c. Crescent wrench
  - d. Flashlight
  - e. Hammer
  - f. Gloves
  - g. Tape measure
  - h. Knife
- 13. Specialty – Electrics
  - a. Diagonal Cutters
  - b. Lineman's Pliers
  - c. Volt meter
  - d. Electrician's tape
  - e. Spot Dot

### K." DESIGN: CONCEPT – [Lecture 4](#)

- " In the mid '70's B'way designers created a method of directly connecting a designer's vision with a playwright's words.
- " An interpretation of a script as seen through the mind of the designer based on emotion. These emotions are translated into the revelation of form, mood and overall composition of each scene of a show.
- " The Studio & Forum of Stage Design
  - o" Lester Polokov
  - o" John Gleason
  - o" Tom Skelton
- 1. Reading the script
  - Read it multiple times until you KNOW the script
    - o" Circle words that have meaning for you
      - o" Words that jump out at you
      - o" Words that emote
    - o" Find the lead characters
    - o" Establish time of day for each scene
    - o" Note obvious cues
      - o" Light switch turning on/off
      - o" Blackout/Fade out at end of scene
    - o" Pencil in potential cues in script
- 2. Examine the scenic design
  - o" Plan view
  - o" Sectional view
  - o" Scale model
  - o" Color palette
- 3. Basic choice of color spectrum
  - o" Comedy – Less saturated hues

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- " Musicals – More saturated hues
- " Pinks, ambers, straws, sepias, CTO, lavenders, blues & CTB
- 4. Decide on your point of view
  - a. Develop a visual or graphic image that represents your concept/POV.
    - " John Gleason – Herzl concept
    - " Tom Skelton – Jewel lighting concept
    - " DHB – No Exit concept
  - b. Make your world “real” by justifying your design choices through your concept.
- 5. All decisions about color and angle must connect with, and be supported by, your concept/POV.
  - a. **In normal, day-to-day living, light goes almost completely unnoticed. A designer must learn to “see” light in all its qualities. They include intensity, form, color, direction and movement.**
- 6. Splitting the stage into areas
  - splitting areas into:
  - " Moods
    - " By color
    - " By gobo
  - " Specific locations like entranceways
  - " Specials
- 7. Lighting to accent practicals"
- 8. Setting your Channels"
  - Area"
  - Colors"
  - Specials"
  - Fx"
  - Scrollers"
- 9. Magic Sheets"
- 10. Lights & Angles"
  - Single light from front"
  - Single light 45° Front-side"
  - Two lights 45° Front-side"
  - Backlight"
  - Downlight pool"
  - Add in additional unit @ 45° for afternoon sunlight"
  - Add in additional unit @ 30° for sunrise/sunset"
  - TV"
    - Key"
    - Fill"
    - Backlight"
    - Use of Screens"

### L." TOOLS FOR DESIGN

1. AutoCAD
2. Vectorworks
3. Drafting by hand
  - T-square
  - 30-60° Triangle
  - 45° Triangle
  - Lighting template
4. Death Trap

## Theatrical Lighting Equipment & Design

- Plot
- 5. Shakespeare for My Father
  - Plot
  - Associated paperwork
- 6. Lightwright 4.0
  - Prior to the PC all paperwork was done by hand – multiple times!
  - John McKernon
    - Electrician friend from Off B'way
- 7. Beamwright 4.0
- 8. TV Lighting samples