



Designers: Lighting and Sound

◀ THE MAGIC OF STAGE LIGHTING

*Lighting can define a stage area, create mood, indicate changes of scene and contribute a host of other accomplishments to a theater production. Note in this scene from a production of Edward Albee's *Tiny Alice*, a circle of light in the foreground, and the lights in the model of a building in the rear. Actor Richard Thomas lies prone in the center of the circle in an attitude of crucifixion. The circle of light illuminates him, but also provides a powerful focus for the figure. The lighting designer is Donald Holder. (© Jennifer Lester/Hartford Stage)*

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Summary

In Chapter 5, we explored the work of scene and costume designers. In this chapter, we turn to two other important aspects of theatrical design: lighting and sound. We begin with lighting, which must be coordinated closely with scene design. We'll consider how lighting has been used in earlier periods of theater history, what its aesthetic functions and qualities are, and how a lighting designer works. Next, we discuss sound design and its use. Finally, we'll look at special effects in lighting and sound design.

Stage Lighting

Lighting in Theater History

For the first 2,000 years of its recorded history, theater took place mostly outdoors during the day, one important reason being the need for illumination—the sun, after all, is an excellent source of light.

Since artificial lighting was unavailable, playwrights used the imagination to suggest nighttime, or shifts in lighting. Performers would bring on torches—or a candle, as Lady Macbeth does—to indicate night. Playwrights also used language in place of lighting. When Shakespeare has Lorenzo say, in *The Merchant of Venice* (1596–1597), “How sweet the moonlight sleeps upon this bank,” this is not just a pretty line of poetry but also serves to remind us that it is nighttime. The same is true of the eloquent passage in which Romeo tells Juliet that he must leave because dawn is breaking:

Look, love, what envious streaks
Do lace the severing clouds in yonder East:
Night's candles are burnt out, and jocund day
Stands tiptoe on the misty mountain tops.

Around A.D. 1600, theater began to move indoors. Candles and oil lamps were used for illumination until 1803, when a theater in London installed gaslights. With gas, lighting became more manageable, allowing some control of intensity and color, but it remained crude, primitive, and limited in its effectiveness. In addition, gas and other lighting systems of the time involved open flames and thus posed a constant threat of fire. During this period, there were several tragic and costly fires in theaters, in both Europe and the United States.

In 1879, Thomas Edison invented the incandescent lamp—the electric lightbulb—and the era of technological theater lighting began. Not only are incandescent lamps safe, but their intensity can be controlled by means of rheostats and other devices. Brightness can be increased or decreased, so that the same lighting instrument can produce the full light of noonday or the dim light of dusk. Also, the color of the light can be controlled by putting a colored film over the source.

Beyond the power and versatility of electric light, there have been numerous other advances in controls and equipment over the past 50 years. Lighting instruments have been constantly refined to become more powerful, as well as more subtle, and to throw a more concentrated, more sharply defined beam. Moreover, miniaturization and computerization have been incorporated into lighting more

Peggy Eisenbauer: Lighting Designer

Peggy Eisenbauer is a lighting designer whose credits include concert designs for David Bowie's and Linda Ronstadt's tours, and the Broadway shows Will Rogers Follies; Angels in America; Grand Hotel; Twilight: Los Angeles; Bring in 'da Noise, Bring in 'da Funk; and many others.

I grew up in the New York Metropolitan area, the lucky child of parents who exposed me to the thrill and excitement of live performance. By the time I was 10, I had seen the New York City Ballet, Bill Baird, Ringling Brothers, and

Broadway shows, as well as local concerts and theater. By working in community theater in my high school years, I became familiar with all theatrical crafts and became especially interested in lighting design.

The Broadway production of *Pippin*, with direction by Bob Fosse and lighting by Jules Fisher, was the deciding factor in my choice of career. Jules's unique musicality expressed through lighting design spoke to me, and I tried to see as much of his work as I could. I went on to study lighting design at his alma mater, Carnegie-Mellon University, and met Jules there.

After graduation, and after gaining working experience with other designers on and off Broadway, I saw my dream come true: I assisted Jules on a Broadway project, and we've been working together ever since. Our second production together was Bob Fosse's final musical, *Big Deal*, which opened nearly 10 years to the day after I saw *Pippin*. Our recent joint designs include *Tommy Tune Tonight*; *Twilight: Los Angeles, 1992*; the *Whitney Houston Bodyguard Tour*; and *A Christmas Carol*.

successfully than into any other elements of theater. After all, costumes must still be sewn individually, and scenes on flats must still be painted by hand. Lighting, however, is controlled by electricity and therefore offers a perfect opportunity to take advantage of innovations in electronics and technology. First came resistance systems, then thyatron vacuum tubes, and after that a series of technologies with names such as *magnetic amplifiers* and *silicon-controlled rectifiers*.

Applied to lighting, these innovations allowed for increasingly complex and sophisticated controls. For a large college theater production, 100 to 200 lighting instruments may be hung around and above the stage; for a large Broadway musical, there may be up to 800 or more depending on the type of show and the technology being used. Each of these instruments can be connected to a central computer board, and light settings—the level, direction, and color of the lighting instruments—can be stored in the computer. By pushing a single button, an operator can bring about a shift in literally dozens of instruments in a split second. The resulting flexibility and control are a remarkable tool for achieving stage effects.

Objectives of Lighting Design

The following are the functions and objectives of stage lighting:

1. Provide visibility
2. Help establish time and place
3. Help create mood

4. Reinforce the style of the production
5. Provide focus onstage and create visual compositions
6. Establish rhythm of visual movement

Providing Visibility. The chief practical function of lighting is, of course, illumination or visibility. First and foremost, we must be able to see the performers' faces and actions. Occasionally, lighting designers, carried away with the atmospheric possibilities of light, will make a scene so dark that we can hardly see what is happening. Mood is important, of course, but seeing the performers is obviously more important. At times, a script does call for the lights to dim; in a suspense play, for instance, the lights in a haunted house might go out. But these are exceptions. Ordinarily, if you cannot see the performers, the lighting designer has not carried out his or her assignment.

Establishing Time and Place. The color, shade, and intensity of lighting can suggest time of day, giving us the pale light of dawn, the bright light of midday, the vivid colors of sunset, or the muted light of evening. Lighting can also indicate the season of the year, because the sun strikes objects at very different angles in winter and summer. Lighting can also suggest place—indoor or outdoor light, for instance.

LIGHTING ESTABLISHES TIME AND PLACE

By the use of color, direction, and intensity, lighting can help establish the time and place in which a theater event takes place. Pale light can be dawn or dusk, bright light, midday, and muted light, evening. In the scene here from a production of Shakespeare's Romeo and Juliet at the Trinity Repertory Theatre of Providence, R. I., nighttime is created through the use of lighting. Playing Romeo is Mark H. Dold and Juliet, Tori Signor. The set was by Mark Wendland and lighting by Mimi Jordan Sherin. (© T. Charles Erickson/Trinity Repertory Company)



LIGHTING CREATES MOOD

*No element is more effective at creating mood onstage than lighting. In this scene from a production of Shelley's *The Cenci* at the Jean Cocteau Repertory Theatre in New York City, lighting designer Eve Adamson has placed a bright light up stage to shine through the open doors creating a silhouette and sharp focus for the character standing in its beam. (© Gerry Goodstein)*



Creating Mood. Light together with scenery and costumes can help create a certain mood. Rarely, however, can lighting alone create mood. For example, if a stage is filled with blue light, it might be inviting, romantic moonlight, but it could also be a cold, dark, evil setting. When action, scenery, and words are combined with light, they tell us exactly what the mood is. In general, a happy, carefree play calls for bright, warm colors, such as yellows, oranges, and pinks. A more somber piece will lean toward blues, blue-greens, and muted tones.



LIGHTING CREATES FOCUS

*Lighting helps create focus and powerful visual arrangements onstage. An example is this scene from a production of *Life is a Dream* by Calderón at the Yale School of Drama. The faces of the characters in the center are brightly lit, at the same time that backlighting on the characters casts shadows in front. This is a striking use of lighting effects by designer Matthew Richards. (© T. Charles Erickson)*

Reinforcing Style. With regard to style, lighting can indicate whether a play is realistic or nonrealistic. In a realistic play, the lighting will simulate the effect of ordinary sources, such as table lamps and sunlight. In a nonrealistic production, the designer can be more imaginative: shafts of light can cut through the dark, sculpturing performers onstage; a glowing red light can envelop a scene of damnation; a ghostly green light can cast a spell over a nightmare scene.

Providing Focus and Composition. In photography, the focus has to do with adjusting the lens of a camera so that the picture recorded on the film is sharp and clear. In theater lighting, *focus* means that beams of light are aimed at, or “focused on,” a particular area.

Focus in lighting directs our attention to one part of the stage—generally the part where the important action is occurring—and away from other areas. Lights should illuminate the playing area, not the scenery. If more light is on the scenery than on the performers, the audience’s attention will be drawn to the scenery and away from the actors and actresses. Therefore, the first objective of focus is to aim the light at the right place. A good example of the use

of focus occurs when there is a split stage, with half the action on one side and half on the other side. The lights can direct our attention from side to side as they go down in one area and come up in another.

Composition is the way lighted areas are arranged onstage in relationship to one another—which areas are dimmed, which are brightly lit, and what the overall stage effect is with regard to light. By means of focus, light can create a series of visual compositions onstage. The effects can vary from turning the stage into one large area to creating small, isolated areas.

Establishing Rhythm. Since changes in light occur over a time continuum, they establish a rhythm running through a production. Abrupt, staccato changes with stark blackouts will convey one rhythm; languid, slow fades and gradual cross-fades will convey another.

Lighting changes are timed in coordination with scene changes. The importance of this coordination is recognized by directors and designers, who take great care to “choreograph” shifts in light and scenery, like the movements of dancers.

Elements of Stage Lighting

A *lighting designer* knows which elements or qualities of light will achieve the objectives we have just been discussing. Let’s consider these qualities.

Intensity. First of all, light has brightness, or *intensity*. Intensity is controlled by an electronic device called a *dimmer*, which can make a scene brighter or darker.



LIGHTING AIDS COMPOSITION

Lighting can create arrangements on stage that in themselves are striking visual pictures. These can serve the play by emphasizing certain characters and they can also be aesthetically pleasing and exciting. An example is this scene from a production of Electra at the McCarter Theatre in Princeton. Note the white lighting on the steps, which isolates the figures standing there, and the figure down stage on a slanted white slab. The lighting designer is Paul Pyant. (© T. Charles Erickson)

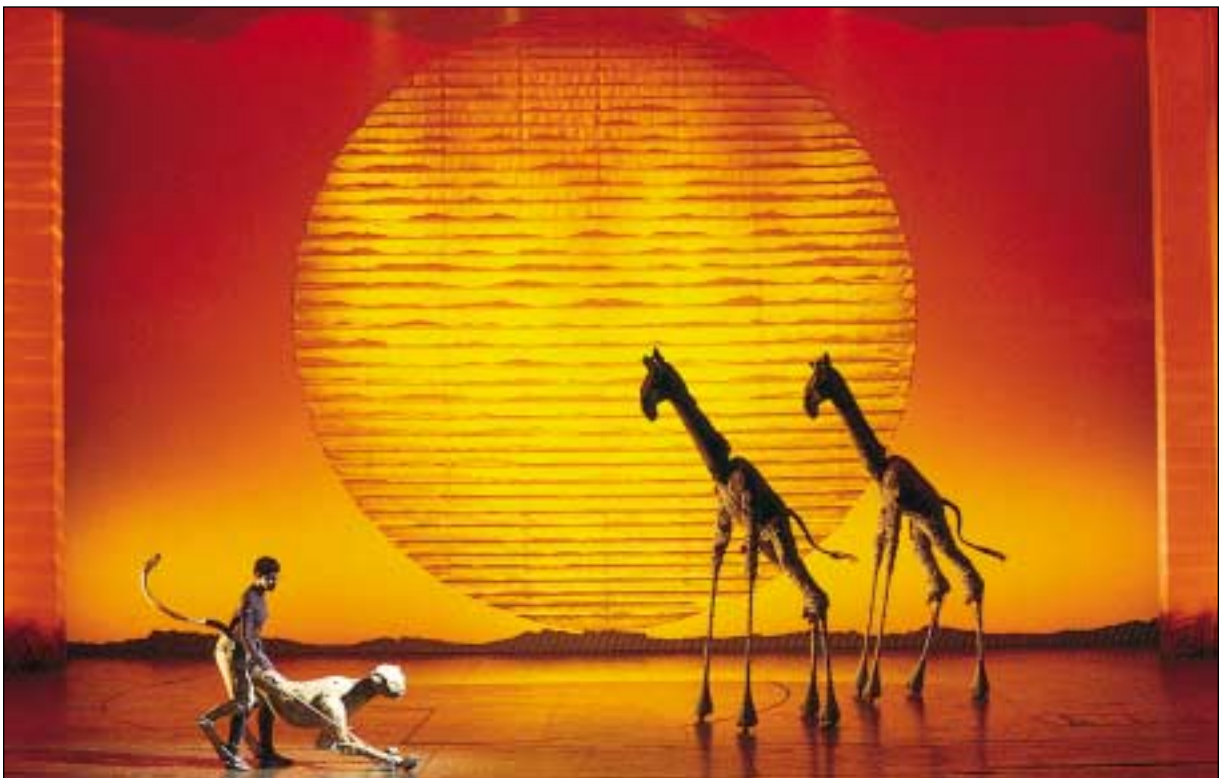
Dimmers allow a scene at night to take place in very little light and a daylight scene to take place in bright light.

Color. Another quality, a very powerful aspect of light, is *color*. Theater lights can be changed very easily to any one of several hundred colors simply by putting colored material in slots at the front of the lighting instruments. This material is usually called *gel*—short for *gelatin*, the cellophane of which it was originally made. Today, however, these color mediums are generally made of plastic mylars and acetates. With modern technology, color can even be changed electronically without gels (the special equipment is described below, in the section on the lighting designer's resources).

Color is mixed so that the strong tones of one shade will not dominate, creating an unnatural appearance. Warm lights (amber, straw, gold) are mixed with cool (blue, blue-green, lavender) to produce depth, texture, and naturalness. One exception to the usual mixing of angles and colors of light, however, would be a scene calling for special effects: for example, we would expect stark shadows and strange colors—such as an eerie blue—when Hamlet confronts the ghost of his father.

Direction. A third quality of light is direction, that is, the way lights are placed on or near the stage so that illumination comes from a particular angle. In earlier days, footlights—a row of lights across the front of the stage floor—were popular. However, because the light source was below the performers, footlights had the disadvantage of casting ghostly shadows on their faces. Footlights also created a barrier between performers and audience. With the development of more powerful, versatile lights, footlights have been eliminated.

Today, most lighting hits the stage from above, coming from instruments in front of the stage and at the sides. The vertical angle of the light beams is close to 45 degrees, to approximate the average angle of sunlight. The lights converge from different sides to avoid the harsh shadows which result when light hits only one side of a performer's face.



COLOR IN LIGHTING

One key quality of stage lighting is color. By the use of gels and other electronic means, an almost infinite variety of colors can be created and combined. Two examples are shown here: a production of the musical *Aida* which shows figures silhouetted against a red background by lighting designer Natasha Katz, and the Broadway production of *The Lion King*, again with figures, human and animals, featured against a red-orange background created by lighting designer Donald Holder. (© Joan Marcus/Walt Disney Theatrical Productions)

Once performers are properly illuminated by lights from the front and sides and from above, other lighting is added—*downlighting* from directly overhead and *backlighting* from behind—to give further dimension and depths to figures onstage.

Form. The *form* or *shape* of light is a fourth quality. It can be a single shaft of light, like a nightclub spotlight, a single beam of moonlight through trees, or general lighting. Light can also create a pattern, such as dappled sunlight through the leaves of trees in a forest. The edges of the light can be sharp and clearly defined, or soft and diffused. To accomplish either kind of definition, light can be shaped by special shutters that close in at the edges and give it an outline as it hits the stage area.

Movement. A fifth quality of light is movement. With various types of dimmers, light can shift its focus from location to location and can also change from color to color. In addition, light can move to suggest changing time of day, sunsets, and so on, providing more information for the audience.

For an example of how these qualities function, consider the lighting for a production of *Hamlet*. To emphasize the eerie, tragic quality of this play, with its murders and graveyard scene, the lighting would be generally cool rather than warm. In addition to lighting from the front of the stage, there might be lighting angled down from above and backlighting to give a sculptured, occasionally unreal quality to the characters. In terms of movement, the lights would change each time there was a shift in locale. This would create a rhythm of movement through the play and would also serve to focus the audience's attention on particular areas of the stage.

The Lighting Designer's Resources

Types of Stage Lights. Among the resources of the lighting designer are various kinds of lighting instruments and technical and electronic equipment. The different types of stage lights include:

1. *Soft-edged spotlights.* The most popular soft-edged spotlight is the *fresnel* (pronounced “fruh-NEL”). The lens of a fresnel spotlight produces a soft-edged beam and allows for a variable beam spread. It is especially useful for area lighting where a feathered or undefined edge is desirable. Many lighting designers use this instrument for top- and backlighting.
2. *Sharp, concentrated spotlights.* The best-known sharp spotlight is the ellipsoidal reflector spotlight, which most lighting designers consider the “workhorse of contemporary practice.” It affords greater control of light than the fresnel and allows for shaping the edges of the beam with shutters. This instrument can also project patterns of light by means of templates. In recent years, the standard ellipsoidal spotlight has undergone revisions that have resulted in a brighter unit using only about half as much energy; there is also a new lens system. A mobile spotlight, which an operator can shift to follow a performer across the stage, is called a *follow spot*.

3. *Floodlights, “scoops,” strip lights, and border lights.* These lights bathe a section of the stage or scenery in a smooth, diffused wash of light.

Lighting Controls. Among the visual elements of theater, lighting is by far the most technologically developed. Lighting instruments can be hung all over a theater and beamed at every part of the stage; and all these instruments can be controlled by one person sitting at an electronic panel, or computer board.

Lighting changes—or *cues*, as they are called—can be arranged ahead of time. In a complicated production (a musical, say, or a Shakespearean play), there may be several hundred light cues. A cue can range from a *blackout* (all the lights are shut off at once); to a *fade* (the lights dim slowly, changing the scene from brighter to darker, or, with a *fade-in*, from dark to light); to a *cross-fade* (one set of lights comes down while another comes up). Moreover, with today’s modern equipment, such changes can be timed automatically so that a cross-fade will take exactly the number of seconds called for and all guesswork is eliminated.

Using contemporary technology, all cues can be prearranged by computer so that during a performance, the operator at the console pushes a button and an entire change occurs automatically.

New Technology in Lighting. Stage lighting has benefited from technological advances that were originally developed for rock musicians and others who perform before vast audiences and for whom light and sound are essential elements. Huge banks of lights are focused on the stage; sometimes there are banks of lights behind the performers, forming part of the stage picture.

To achieve maximum flexibility and control, new instruments have been devised. These instruments, known variously as *automated lights* or *moving lights*, are amazingly versatile, allowing a degree of control that was previously impossible for a single instrument. Moreover, not just one element can be controlled, but three: color, direction, and movement. Without a follow-spot operator, these lighting instruments can *pan* (move from side to side) and *tilt* (move up and down) to create movement and change the angle of the beam and therefore the focus on-stage. And it is no longer necessary to change color by putting a gel over a beam by hand; instead, by means of dichoric filters these instruments can change to any one of hundreds of colors, shades, and hues.

The sharpness and width of the beam, as well as the pattern it projects, can be changed instantaneously in each instrument because both the *iris* (which controls the size of the pool of light) and the *gobo* or template (which determines patterns of light) are variable and changeable. All these adjustments are made not manually but remotely, from a central computer panel by an operator pushing a switch or button. Everything is preset on the computer: each movement of the light, each change in color, each alteration in direction or size of the beam. This is done for what are sometimes hundreds of instruments. At a given moment, at the touch of a button by an operator at the central lighting computer, dozens of lights go off, dozens more come on as they swivel in a different direction and change color—and all of this occurs simultaneously.



DIFFERENT LIGHTING INSTRUMENTS SERVE DIFFERENT PURPOSES

Most lights have three key elements: a lamp that is the source of light, a reflector, and a lens through which the beams of light pass. Shown here are four types of instruments used to light the stage. Upper left is a flood light. Flood lights are employed, singly or in groups, to provide general illumination for the stage or scenery. The light from floods can be blended in acting areas, or used to “tone” setting and costumes. They are also employed to illuminate cycloramas or ground rows. (Selecon) Upper right is a small spotlight known as a fresnel (pronounced “fruh-NEL”). All spotlights illuminate limited areas of the stage with a concentrated beam of light. They precisely define an area that is to be lighted and leave other areas in darkness. The fresnel spotlight has a spherical reflector and a special flat lens on one side and ridges of concentric circles on the other, an arrangement that allows for a thinner, lighter lens that softens the edges of the beam. The fresnel is generally used in positions near the stage. (Selecon) Lower left is a zoom spotlight. Generally this is an ellipsoidal reflector lighting instrument that is more efficient than the fresnel because it can throw a stronger beam of light much farther. Most spotlights of this type have an ellipsoidal reflector that partially surrounds the lamp and sends a strong beam through two plano-convex lenses. It is used when the distance between instrument and stage area is greatest—for example, from positions outside the proscenium opening in the auditorium. (Selecon) The fourth light (lower right) is the newest and most versatile instrument of the group. Sometimes known as an automated light or a moving light, it can do the work that in the past would have to be carried out by several lighting instruments. Rather than having to change the angle of the beam, or its color, or its shape, this light can carry out all these alterations automatically when commanded from a computer. It can change colors (to any one of nearly 1,000 hues and shades), change focus by swiveling in place, and shift beams. All of this is done remotely and has been made possible by advances in the technology of computers, electronics, and other elements. This instrument is particularly useful in elaborate musical productions and is widely used in rock concerts. (Vari *Lite)

The Lighting Designer's Collaborators

A number of people work closely with the lighting designer. When the lighting designer has determined what instruments, colors, and so on will be used, he or she develops a *light plot*—a detailed outline or diagram showing where each instrument is placed in relation to the stage. The designer may have experts assist in drawing up light plots.

When the time comes to put the lights in place, they are *hung*, which means that they are attached to pipes—or *battens*, as these pipes are sometimes called—backstage and in various other places throughout the theater. This requires technicians who are familiar with the instruments and the pipes. These same technicians will assist the designer in focusing the lights. (To *focus* lights, as we have seen, means to aim them at a certain area onstage.)

During a performance, experts are required to *run* the lights—that is, to operate the computer or whatever device executes light changes and light cues. These experts take cues from the stage manager and coordinate their work with the other technical aspects of the production. The *follow spot* (a moving spotlight) requires an operator who aims the beam at the proper person or area of the stage.

Sound Design

Sound—which has become an increasingly important element in theater productions—may be said to include all sound effects, recordings, and electronic enhancement. Audiences have become increasingly aware of sound as such, partly because of concerts by groups who attach microphones to themselves and their instruments and use huge banks of speakers to project their music to the audience.

In recent years, sound, in addition to having its own *sound designer*, has developed its own artistry and technology.

The Sound Designer

A counterpart to designers for visual aspects of theater is the sound designer. Like other designers, he or she reads the script to see what the sound requirements will be. Understandably, the needs of a musical theater production will be different from those of a nonmusical drama. In the former, the orchestra and all singing voices must be heard and carefully blended.

After reading the script and noting all requirements, the sound designer meets with the director to discuss those requirements and to take note of special requests which the director might have. Following this, the sound designer plans how he or she will go about meeting the needs of the production with regard to sound.

Objectives of Sound Design

Basically, the objectives of sound design are twofold: (1) to provide all background or other aural effects called for in the production, and (2) to reinforce spoken and musical sounds.

Sound Reproduction and Sound Reinforcement

Reproduction is the use of motivated or environmental sounds. **Motivated sounds** would be, for instance, a car crunching on gravel, a car motor turning off, and a door slamming—a sequence that could announce the arrival of a character at a house where a scene is taking place. Motivated sounds, then, are those called for by a script. **Environmental sounds** are noises of everyday life that help create verisimilitude in a production: street traffic in a city, crickets in the country, loud music coming from a college dormitory. Such sounds are usually heard as background.

One form of sound reproduction is *sound effects*, which can be defined as any sounds produced by electronic or human means to create for the audience a noise associated with the play.

In earlier years—for several centuries, in fact—various devices were developed to create such sounds. A noise sounding like wind, for example, can be produced by a wooden drum made from slats: when the drum is turned, by means of a handle, it makes a noise like howling wind. For a slamming door, a miniature door or even a full door in a frame can be placed just offstage and opened and shut. Two pieces of wood slammed shut can also simulate the sound of a closing door, and in some cases this device can sound like a gunshot. A gunshot can also be created by firing a gun using blank cartridges. (Real guns—that is, those which fire ammunition—should never be used onstage; and in some states there are also

SOUND REPRODUCTION AND REINFORCEMENT

In the play Side Man, the entire mood is created and carried forward by sound, and the reactions of the actors to sound. The play is about a group of musicians from the swing and jazz eras who have been left behind. In the scene here, the characters reminisce about the past while listening to a recording of a particularly poignant trumpet solo. The performers are Michael Mastro, Frank Wood, and Joseph Lyle Taylor. (© Carol Rosegg)



laws forbidding the purchase of blank guns.) Thunder can be simulated by hanging a large, thick metal sheet backstage and gently shaking it.

In recent years, however, most sound effects are reproduced on audiotape or disks. Virtually every sound imaginable—from birds singing to dogs barking to jet planes flying—can be found on recordings. These are available not only to expensive professional productions but to college, university, and community theaters.

Reinforcement is amplification of sounds produced by a performer or a musical instrument. In recent decades, with the growth of electronics in music, more and more instruments are amplified. In today's theater, this is also true of the voices of actors and singers. We turn now to various types of technology for sound reproduction and reinforcement.

Elements of Sound: Sound Technology

Microphones and Loudspeakers. Speech reinforcement involves using microphones to pick up dialogue and songs. Several types of microphones are used for this. A *shotgun mike* is highly directional and is aimed from a distance at a specific area. A *general mike* picks up sounds in the general area toward which it is aimed. A *body mike* is popular today in musicals. At first, body mikes were small microphones attached in some way to performers' clothing; a wire ran from the mike to a small transmitter concealed on the performer, and from the transmitter the sound was sent to an offstage listening device that fed it into a central sound-control system.

SOUND TECHNOLOGY

The audio side of theater has made great advances in recent years. It has also become pervasive, especially in musical theater. In the musical Rent, for example, each of the principal characters wears a personal microphone—shaped like a telephone instrument—which is connected by a remote arrangement with a central sound control system. The microphones worn by the actors are similar to those worn by rock performers and reflect the influence of that popular form. (© Joan Marcus and Carol Rosegg)



In today's lavish musical productions, the microphone worn by a performer is often a small instrument—hardly larger than a piece of wire—worn, perhaps, over one ear alongside the temple, or under a wig. In some musicals, such as *Rent*, performers wear microphones that resemble a telephone operator's headset.

Microphones not worn by performers are placed in various locations. One position is alongside the downstage edge of the stage, where the footlights used to be located. Another position is in the air, with microphones placed near the overhead lights.

Any type of microphone must be hooked up to an amplifier that increases the electronic energy of the sound and sends it through speakers. Placing loudspeakers is both an art and a science. It is necessary to determine the correct speakers for the size and shape of the theater, and to position them so that they carry sound clearly and evenly into the auditorium—to the upper levels of the balcony, to the side seats, and to the areas underneath the balcony as well as the first few rows of the orchestra. Also, sound must reach the sides and back of the theater at the same time that it reaches the front. One problem in this regard is that sound travels much more slowly than light. The speed of sound is only 1,100 feet per second—which means that for a spectator seated at the back of a large theater, sound from a speaker at the rear of the auditorium will be heard before the human voice from the stage. Developments in digital electronics have led to devices that process, sample, and synthesize sound for various effects; and one useful device addresses this problem, delaying the electronic sound so that it arrives through a loudspeaker at the same time as the much slower live sound.

Placing microphones and speakers in a theater and on the stage is a complicated process. The goal is clear but unobtrusive sound. When electronic sound is not properly modulated, it can become an artificial barrier between performers and audience and can seriously interfere with the actor-audience relationship.

Sound Recordings. The process of assembling sound recordings is similar for professional and nonprofessional productions. First, a list is made of all nonmusical sound effects required. This list is usually developed by the sound designer in consultation with the director, and possibly with a composer: for a show with a great deal of sound or music, there may be both a sound designer and a music composer. Once the list is drawn up, a master recording is made and the sounds are arranged in their order of appearance in the script. This process is called *editing*. When the production moves into the theater, there is a technical rehearsal without performers, during which each sound cue is listened to and the volume is set. When rehearsals with the performers start in the theater, more changes will be made. Depending on the action and the timing of scenes, some cues will be too loud and others too soft; some will have to be made shorter and others made longer.

During an actual performance of a production using sound reinforcement, an operator must sit at a complex console “mixing” sound—that is, combining all elements from the many microphones and from the master sound recording—so that there is a smooth, seamless blend of sound. Also, the operator must make

certain not only that all sound is in balance but that sound does not intrude on the performance or call attention to itself, away from the stage and the performers.

New Technologies in Sound. As with lighting, in recent years we have seen frequent advances and breakthroughs in sound equipment and technology. The new body microphones and a device that delays the delivery of electronic sound have already been mentioned. But there are other developments as well.

Analog reel-to-reel tape decks, which were standard only a few years ago, are now giving way to digital technology such as digital audiotape (DAT), recordable compact disks, minidisks, and direct playback from a computer's hard drive. Sound is now recorded and edited at digital audio workstations, based on personal computers. Such stations allow easier editing of sound, more complex effects, and higher-quality sound. Digital playback systems allow very easy and precise cueing of shows, as well as greatly improved sound quality.

It should be clear that sound is rapidly taking its place alongside other design aspects as a key feature of theater productions.

The Sound Designer's Collaborators

Like all designers, the sound designer has a number of people with whom she or he collaborates. There are technicians who understand the intricacies of sound equipment; there are specialists in the art of hanging and coordinating speakers around the stage and in the auditorium; there are experts at *running* sound in a production. This list includes managing the sound console at the back of the auditorium or in the sound booth. Among other things, this involves handling the complexities of the many microphones required in a large musical presentation; some of these microphones are on the performers and others are in the orchestra pit or offstage. It would detract enormously from a performance if a body microphone were turned on when it was supposed to be off, or if the reverse occurred.

Special Effects in Lighting and Sound

As in scene design, some effects of lighting and sound can seem unusual or even miraculous.

There are several special lighting effects that can be used to create interesting visual pictures. One simple effect is to position a source of light near the stage floor and shine the light on the performers from below. This creates shadows under the eyes and chin and gives performers a ghostly or horrifying quality. Another common special effect is ultraviolet light, a very dark blue light that causes phosphorus to glow; when the stage is very dark, or completely dark, costumes or scenery that have been painted with a special phosphorus paint will "light up."

An effect of slow motion or of silent movies—where the performers seem to be moving in jerks—is created by a *strobe light*, a very powerful, bright gas-discharge light which flashes at rapid intervals. As we saw earlier, technological advances in lighting have made it possible to create even more spectacular effects.



SPECIAL LIGHTING EFFECTS

Both lighting and sound can be employed to create unusual effects. In the scene here, from a production of Shakespeare's Cymbeline, effects of clouds and perhaps the smoke of battle, are added to silhouettes for the characters in the back, and strong focus and composition in the front. The lighting designer is Marcia Madeira and the production was by the Huntington Theatre Company of Boston. (© Richard Feldman)

There are also a number of special sound effects. Sometimes speakers are placed completely around the audience so that the sound can move from side to side. Echoes can be created by a machine that causes reverberations in sound waves. Expanding audio technology also allows for more complex sound effects. Computerized noises and electronic music can be used to create special sounds for various situations, and compact disks give instantaneous access to any element of the sound design. Also, with computerized synthesizers, a few musicians can replace a large orchestra.

Finally, we should add that lighting and sound, like scenery and costumes, are means to an end: they add to and complement the artistic and aesthetic aspects of a production, thereby contributing to the overall experience.

In Chapters 5 and 6, we have looked at the design of scenery, costumes, lighting, and sound. To create theater, these must be coordinated and integrated with acting and directing—and with the text, which we will discuss in Chapters 7 and 8.

SUMMARY

Lighting—historically the last of the visual elements of theater to be fully developed—is today the most technically sophisticated of all. Once the incandescent electric lamp was introduced, it was possible to achieve almost total control of the color, intensity, and timing of lights. Lighting controls have also benefited from computerization; extensive light shifts can now be hooked up to computer boards and controlled by an operator at a console.

Lighting design is intended to provide illumination onstage, to establish time and place, to help set the mood and style of a production, to focus the action, and to establish a rhythm of visual movement. Lighting should be consistent with all other elements. The lighting designer uses a variety of lighting instruments and controls to achieve effects and works closely with a group of collaborators to place lighting instruments in the theater and to see that lighting changes are carried out effectively during a performance.

Another design element in theater is sound. In today's theater, sound is reproduced and reinforced by various means, many of them technologically advanced. For example, sound effects can be created by primitive mechanical means—such as pieces of wood slapped together to simulate a closing door—or by sophisticated computer and digital technology. These techniques are constantly improving and effect the way sound is created, reproduced, and conveyed throughout a theater auditorium.

Special effects in lighting and sound include such things as ultraviolet light, strobe lights, echo effects and computerized synthesizers.

THEATER ON THE WEB



Since the lighting and sound industry is, by nature, extremely technical and tied into the world of electronics and computing, there are many online links to sites that pertain to lighting and sound. Here are just a few.

IATSE www.iaatse.com

The labor union representing technicians, artisans, and craftspersons in the entertainment industry.

Lighting Links <http://waapa.cowan.edu.au/lx>

This site has extensive links to lighting resources including professional lighting organizations, designers, and retailers.

Lighting and Electronics <http://www.le-us.com>

This equipment manufacturer maintains links to safety guides, mathematical formulas for lighting designers and electricians, and a page on which solutions to lighting problems are discussed.

BackstageWorld http://www.stagelight.se/backstage/010_SweB_eng.html

This is a website for people working in the entertainment industry who want information on the latest sound and lighting equipment.

Theater Sound Design Directory and Resource <http://www.show-control.com/tsindex.html>

A comprehensive list of links aimed at sound designers and technicians.

How are the lighting and sound design community and the costume and scenic design community similar? How are they different? Take a look at the IATSE link and compare it with the United Scenic Artists link listed in Chapter 5. At what community is each union aimed? Where are sound designers and technicians mostly represented? Why?