

4.2

What Lenses See

The performance characteristics of a lens refer to its vista, what it can and cannot do, and how it generally behaves in common production practice. Because the camera normally processes only visual information that the lens can see, knowledge of the performance characteristics—how it sees the world and how it influences the aesthetic elements of a picture—will aid you greatly in composing effective shots and in many other production tasks. This section explores these concepts.

► **HOW LENSES SEE THE WORLD**

Field of view, distortion of objects and perceived distance, movement, and depth of field of wide-angle, normal, and narrow-angle lenses

HOW LENSES SEE THE WORLD

Although all television cameras use zoom lenses, it might be easier for you to learn how various zoom positions influence what you see in the viewfinder by describing three zoom positions as though they were fixed-focal-length lenses. Fixed-focal-length lenses (also called prime lenses) have a specific focal length that cannot be changed. They are normally classified as (1) wide-angle, or short-focal-length, lenses; (2) normal, or medium-focal-length, lenses; and (3) narrow-angle, or long-focal-length, lenses, also called telephoto lenses.¹

1. When HDTV cameras are used for electronic filmmaking, the director of photography sometimes uses prime lenses instead of zoom lenses to ensure maximum picture resolution.

Now let's adjust a zoom lens to correspond to the wide-angle, normal, and narrow-angle focal lengths and observe their performance characteristics. These include (1) field of view, (2) object and distance distortion, (3) movement, and (4) depth of field.

WIDE-ANGLE LENS

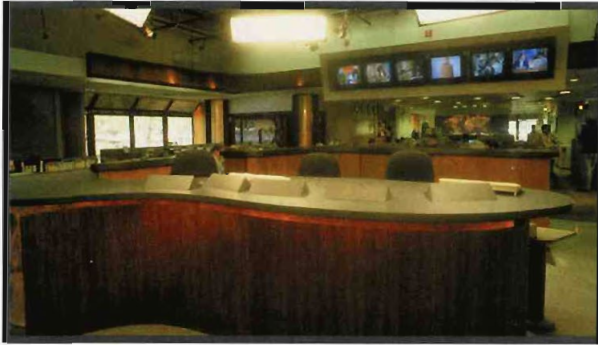
As you recall, you need to zoom all the way out to achieve the maximum short focal length, or wide angle, of the zoom lens.

Field of view The *wide-angle lens* affords a wide vista. You can have a relatively wide *field of view*—the portion of a scene visible through the lens—with the camera rather close to the scene. When you need a wide vista (long shot) or, for example, when you need to see all five people on a panel and the studio is relatively small, a wide-angle lens (wide-angle zoom position) is mandatory. The wide-angle lens is also well suited to provide pictures that fit the horizontally stretched 16 × 9 HDTV aspect ratio.

Object and distance distortion A wide-angle lens makes objects relatively close to the camera look large and objects only a short distance away look quite small. This distortion—large foreground objects, small middleground, and even smaller background objects—helps increase the illusion of depth. The wide-angle lens also influences our perception of *perspective*. Because parallel lines seem to converge faster with this lens than you ordinarily perceive, it gives a forced perspective that aids the illusion of exaggerated distance and depth. With a wide-angle lens, you can make a small room appear spacious or a hallway seem much longer than it really is. **SEE 4.19–4.23** Such distortions can also work against you. If you take a close-up of a face with a wide-angle lens, the nose, or whatever is closest to the lens, will look unusually large compared with the other parts of the face. Such distortions are often used purposely, however, for emphasizing stress or psychological conditions or for stylistic special effects. **SEE 4.24**

Movement The wide-angle lens is also a good dolly lens. Its wide field of view de-emphasizes camera wobbles and bumps during dollies, trucks, and arcs (see chapter 5); but because the zoom lens makes it so easy to move from a long shot to a close-up and vice versa, dollying with a zoom lens has almost become a lost art.

Most of the time, a zoom will be perfectly acceptable as a means of changing the field of view (moving to a wider or closer shot). You should be aware, however, that

**4.19 WIDE-ANGLE LONG SHOT**

The wide-angle lens (zoom position) gives you a wide vista. Although the camera is relatively close to the news set, we can see the whole set.

**4.20 WIDE-ANGLE DISTORTION: TRUCK**

The wide-angle lens intensifies the raw power of this truck. Note that the apparent size of the front grill is greatly exaggerated through the wide-angle lens.

**4.21 WIDE-ANGLE DISTORTION: EMPHASIS ON FOREGROUND OBJECT**

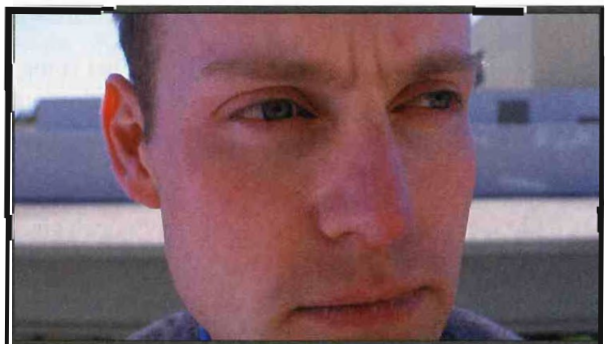
Shot with a wide-angle lens, the telephone and the right hand appear unusually large.

**4.22 WIDE-ANGLE DISTORTION: DEPTH ARTICULATION**

Shooting through a permanent foreground piece with the wide-angle lens creates a spatially articulated, forceful picture.

**4.23 WIDE-ANGLE DISTORTION: LINEAR PERSPECTIVE**

The length of this hallway is greatly exaggerated.

**4.24 WIDE-ANGLE DISTORTION: FACE**

This face is greatly distorted because the shot was taken with a wide-angle lens at a close distance.

there is a significant aesthetic difference between a zoom and a dolly. Whereas the *zoom* seems to bring the scene to the viewer, a *dolly* seems to take the viewer into the scene. Because the camera does not move during the zoom, the spatial relationship among objects remains constant. The objects appear to be glued into position—they simply get bigger (zoom-in) or smaller (zoom-out). In a dolly, however, the relationships among objects change constantly. You seem to move past them when dollying in or out.² Be sure to recalibrate the zoom when you reach the end of the dolly so you can zoom in and out from the new position without losing focus. **ZVL4** CAMERA → Camera moves → dolly | zoom | try it

When people or objects move toward or away from the camera, their speed appears greatly accelerated by the wide-angle lens. The wide-angle zoom position is often used to accelerate the speed of a car or a dancer moving toward or away from the camera.

ENG **EFP** When covering a news event that exhibits a great deal of movement or that requires you to move rapidly, you should put the zoom lens in its extreme wide-angle position. As you recall, the wide-angle position will reduce camera wobbles to a great extent and make it much easier to keep the event in the viewfinder. Also, the great depth of field helps you to keep the pictures in focus. The disadvantage of the extreme wide-angle position is that you need to move the camera quite close to the action if you want a closer look. ◀

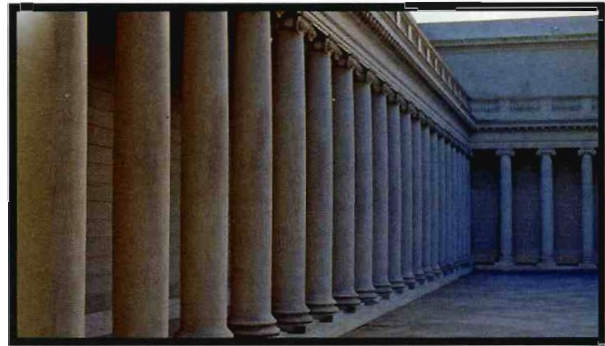
Depth of field The wide-angle lens generally has a great depth of field. When zoomed all the way out, you should have few focus problems, unless you work in low-light conditions (which requires a large aperture) or are extremely close to the object.

NORMAL LENS

The zoom position for a normal focal length lies somewhere in the midrange of a zoom lens, perhaps a little more toward the wide-angle position.

Field of view The *normal lens* offers a field of view (focal length) that approximates that of normal vision. It gives you the perspective between foreground and middleground that you actually see.

Object and distance distortion Whereas the wide-angle lens makes objects seem farther apart and rooms



4.25 NORMAL LENS FIELD OF VIEW AND PERSPECTIVE

The normal lens gives a field of view that approximates normal vision.

seem larger than they actually are, the normal lens or the midrange zoom positions make objects and their spatial relationships appear more like our normal vision. **SEE 4.25**

When shooting graphics such as charts that are positioned on an easel, you should put the zoom lens in the midrange position. These are the main advantages: (1) You can quickly correct the framing on the card by zooming in or out slightly or by dollying in or out without undue focus change. (2) You are far enough away from the easel to avoid camera shadows yet close enough so that the danger of someone's walking in front of the camera is minimal. (3) By placing the easel at a standard distance from the camera, a floor person can help you frame and focus on the card with minimal time and effort.

Movement With the normal lens (midrange zoom positions), you have a much more difficult time keeping the picture in focus and avoiding camera wobbles, even when the camera is mounted on a studio pedestal. When carrying an ENG/EFP camera or camcorder, this lens position makes it hard to avoid camera wobbles even when standing still. If you must have such a field of view, put the camera on a tripod.

Because the distance and the object proportions approximate our normal vision, the dolly speed and the speed of objects moving toward or away from the camera also appear normal. But again, such movement may cause focus problems, especially when the object gets fairly close to the camera.

Depth of field The normal lens has a considerably shallower depth of field than the wide-angle lens under similar conditions (same *f*-stop and object-to-camera distance). You might think that a very great depth of field would be the most desirable condition in studio operations because

2. See Herbert Zettl, *Sight Sound Motion*, 4th ed. (Belmont, Calif.: Thomson Wadsworth, 2005), pp. 272–74.

it shows everything in focus. But a medium depth of field is often preferred in studio work and EFP because the in-focus objects are set off against a slightly out-of-focus background. The objects are emphasized, and a busy background or the inevitable smudges on the television scenery receive less attention. Most important, foreground, middleground, and background are better defined.³

Of course, a large depth of field is necessary when there is considerable movement of camera and/or subjects. Also, when two objects are located at widely different distances from the camera, a great depth of field enables you to keep both in focus simultaneously. Most outdoor telecasts, such as sports remotes, require a large depth of field, the principal objective being to help the viewer see as much and as well as possible.

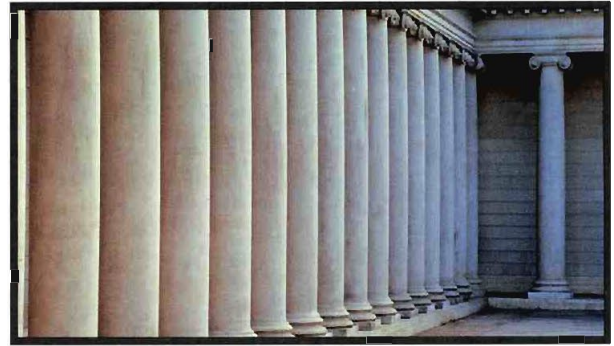
NARROW-ANGLE, OR TELEPHOTO, LENS

When you zoom all the way in, the lens is in the maximum narrow-angle, long-focal-length, or telephoto, position.

Field of view The *narrow-angle lens* not only reduces the vista but also magnifies the background objects. Actually, when you zoom in, all the zoom lens does is magnify the image. You get a view as though you were looking through binoculars, which, in effect, act as telephoto lenses. **SEE 4.26**

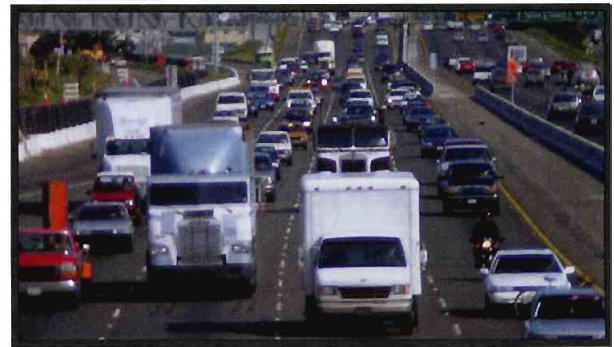
Object and distance distortion Because the enlarged background objects look big in comparison with the foreground objects, an illusion is created that the distance between foreground, middleground, and background has decreased. The long lens seems to compress the space between the objects, in direct contrast to the effect created by the wide-angle lens, which exaggerates object proportions and therefore seems to increase relative distance between objects. A narrow-angle lens, or telephoto zoom position, crowds objects on-screen. This crowding effect, called aesthetic *compression*, can be positive or negative. If you want to show how crowded the freeways are during rush hour, for example, use the zoom lens in the telephoto position. The long focal length shrinks the perceived distance between the cars and makes them appear to be bumper-to-bumper. **SEE 4.27**

But such depth distortions by the narrow-angle lens also work to a disadvantage. You are certainly familiar with the deceptive closeness of the pitcher to home plate on the television screen. Because television cameras must remain



4.26 NARROW-ANGLE LENS FIELD OF VIEW AND PERSPECTIVE

The narrow-angle (telephoto) lens compresses space.



4.27 POSITIVE AESTHETIC COMPRESSION WITH NARROW-ANGLE LENS

With a narrow-angle lens, the background is greatly enlarged and the distance between the cars seems reduced. The feeling of a traffic jam is heightened.

at a considerable distance from the action in most sporting events, the zoom lenses usually operate at their extreme telephoto positions or with powerful range extenders. The resulting compression effect makes it difficult for viewers to judge actual distances. **SEE 4.28**

Movement The narrow-angle lens gives the illusion of *reduced speed* of an object moving toward or away from the camera. Because the narrow-angle lens changes the size of an object moving toward or away from the camera much more gradually than does the wide-angle lens, the object seems to move more slowly than it actually does; in fact, an extreme narrow-angle lens virtually eliminates such movement. The object does not seem to change size perceptibly even when traveling a considerable distance relative to the camera. Such a slowdown is especially

3. Zettl, *Sight Sound Motion*, pp. 165–67.



4.28 NEGATIVE AESTHETIC COMPRESSION WITH NARROW-ANGLE LENS

This shot was taken with a zoom lens in an extreme long-focal-length position. Note how the pitcher, batter, catcher, and umpire all seem to stand only a few feet apart from one another. The actual distance between the pitcher and the batter is 60½ feet.

effective if you want to emphasize the frustration of someone running but not getting anywhere. Added to the compression effect (shown in figure 4.27), the drastic reduction of the perceived speed of traffic will certainly emphasize the congestion. **ZVL5** CAMERA → Picture depth → perspective and distortion | try it

You cannot dolly with a narrow-angle lens or with a zoom lens in the telephoto position (zoomed in); its magnifying power makes any movement of the camera impossible. If you work outdoors, even wind can be a problem. A stiff breeze may shake the camera to such a degree that the greatly magnified vibrations become clearly visible on-screen.

In the studio the telephoto position may present another problem. The director may have you zoom in on part of an event, such as the lead guitarist in a rock performance, and then, after you have zoomed in, ask you to *truck* (move the camera sideways) past the other members of the band. But this movement is extremely difficult to do in the telephoto position. What you can do is zoom out before trucking to minimize the wobbles.

Image stabilization As you recall, to control the slight image jitter caused by narrow-angle zoom positions, some professional cameras have an image stabilization device built-in, very much like the ones in most consumer camcorders. Some lenses have optical stabilizers; others correct the problem electronically. Both systems reduce

and often eliminate subtle image shifts caused by minor camera shakes.

ENG EFP When you have to walk, or perhaps even run, with the portable camera for a news story or other type of electronic field production, however, put the zoom lens in the wide-angle position. Even with the best image stabilizers, the pictures will be rendered useless by the inevitable camera wobbles when moving the camera in the telephoto position. ◀

Depth of field Unless the object is far away from the camera, long-focal-length lenses have a shallow depth of field. Like the compression effect, a shallow depth of field can have advantages and disadvantages. Let's assume that you are about to take a quick close-up of a medium-sized object, such as a can of soup. You do not have to bother putting up a background for it—all you need to do is move the camera back and zoom in on the display. With the zoom lens in a telephoto (narrow-angle) position, decreasing the depth of field to a large extent, the background is sufficiently out of focus to prevent undesirable distractions. This technique is called *selective focus*, meaning you can focus either on the foreground, with the middleground and the background out of focus; on the middleground, with the foreground and the background out of focus; or on the background, with the foreground and the middleground out of focus. **SEE 4.29 AND 4.30**

You can also shift emphasis easily from one object to another with the help of selective focus. For example, you can zoom in on a foreground object, thus reducing the depth of field, and focus on it with the zoom lens in the telephoto position. Then, by refocusing on the person behind it, you can quickly shift the emphasis from the foreground object to the person (middleground). This technique is called *racking focus* or, simply, *rack focus*.

ZVL6 CAMERA → Focusing → rack focus | try it

The advantage of a shallow depth of field also applies to unwanted foreground objects. In a high-school baseball pickup, for example, the camera behind home plate may have to shoot through the chain-link backstop. But because the camera is most likely zoomed in on the pitcher, or on other players performing at a considerable distance from the camera, you work with a relatively shallow depth of field. Consequently, everything fairly close to the camera, such as the chain-link fence, is so out of focus that it becomes virtually invisible. The same principle works for shooting through birdcages, prison bars, or similar foreground objects.



4.29 SELECTIVE FOCUS: FOREGROUND IN FOCUS

In this shot the camera-near person is in focus, drawing attention away from the two people in the background.



4.30 SELECTIVE FOCUS: BACKGROUND IN FOCUS

Here the focus and attention are shifted from the camera-near person (foreground) to the two people farther away.

MAIN POINTS

- ◆ The performance characteristics of wide-angle, normal, and narrow-angle lenses (zoom lenses adjusted to these focal lengths) include field of view, object and distance distortion, movement, and depth of field.
- ◆ A wide-angle lens (zoom lens in the wide-angle position) offers a wide vista. It gives a wide field of view with the camera relatively close to the scene.
- ◆ A wide-angle lens distorts objects close to the lens and exaggerates proportions. Objects relatively close to the lens look large, and those only a short distance away look quite small. The lens makes objects seem farther apart and makes rooms look larger than they actually are.
- ◆ A wide-angle lens is ideal for camera movement. It minimizes camera wobbles and makes it easy to keep the picture in focus during camera movement. It also exaggerates the perception of object speed toward and away from the camera.
- ◆ The normal lens gives a field of view that approximates that of normal vision. The normal lens (zoom lens in the mid-range position) does not distort objects or the perception of distance. It is used when a normal perspective is desired.
- ◆ When a camera is moved with the lens in the midrange (normal lens) zoom position, camera wobbles are emphasized considerably more than with a wide-angle lens. The shallower depth of field makes it harder to keep the picture in focus.
- ◆ A narrow-angle lens (zoom lens in the telephoto position) has a narrow field of view and enlarges the objects in the background. Exactly opposite of the wide-angle lens, which

increases the perceived distance between objects, the narrow-angle lens seems to compress the space between objects at different distances from the camera. It slows the perception of object speed toward and away from the camera.

- ◆ The magnifying power of a narrow-angle lens prevents any camera movement while on the air. Narrow-angle lenses have a shallow depth of field, which makes keeping in focus more difficult but allows for selective focus.

ZETTL'S VIDEO LAB



For your reference, or to track your work, each *Video-Lab* program cue in this chapter is listed here with its corresponding page number.

- ZVL1** CAMERA → Zoom lens → normal | wide | narrow | try it **73**
- ZVL2** CAMERA → Exposure control → aperture | f-stop | auto iris | try it **76**
- ZVL3** CAMERA → Focusing → focus ring | depth of field | great depth | shallow | rack focus | auto focus | try it **78**
- ZVL4** CAMERA → Camera moves → dolly | zoom | try it **84**
- ZVL5** CAMERA → Picture depth → perspective and distortion | try it **86**
- ZVL6** CAMERA → Focusing → rack focus | try it **86**