
C H A P T E R 3

SPACE

Space is a complex visual component. It not only defines the screen where all of the other visual components are seen, but space itself has several complex levels or sub components that we need to understand. To simplify our discussion, this chapter on space is divided into two parts. Part One defines the four basic sub components of space and Part Two describes all of space's secondary properties.

P A R T O N E

THE PRIMARY SUB COMPONENTS

Let's begin by examining the space of the screen because it is upon this screen that all of the visual components will exist.

The physical nature of the screen is strictly two-dimensional. A screen is a flat surface that can be measured in height and width but practically speaking has no depth. This is true for any screen surface, from a computer or television to a movie screen.

The real world that we live in is three-dimensional, having height, width, and depth. Our challenge is to portray a three-dimensional world on a two-dimensional screen surface and have the result look believable. We'll expect a viewer to watch the two-dimensional pictures and accept the images as realistic representations of their three-dimensional world.

How can we take a two-dimensional screen surface and create pictures on it that give the illusion of three-dimensions or depth?

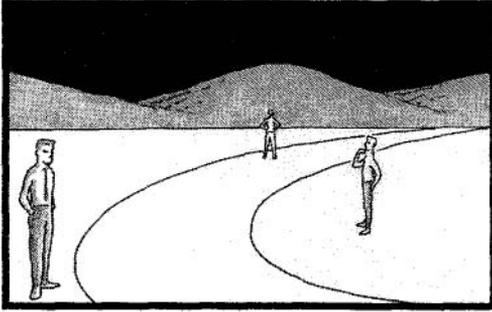
We're not talking about 3-D movies or holograms (although the latter is truly a three-dimensional picture). We're talking about normal pictures on a computer, television, or motion picture screen that look three-dimensional even though they're being shown on a flat screen surface.

The first step in understanding the visual component of space is to explore the four basic types of space: deep space, flat space, limited space, and ambiguous space.

DEEP SPACE

Deep space is the illusion of a three-dimensional world on a two-dimensional screen surface. It's possible to give an audience the experience of seeing a three-dimensional space (height, width, and depth) even though all of the depth is illusory. The depth is not actually there; it can never be there because the screen upon which the picture exists is flat.

Our ability to fool the audience into thinking there's depth on the screen when there's no depth at all comes from our knowledge and use of depth cues.



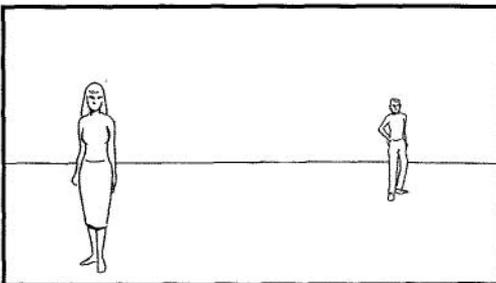
We could describe this picture as three people standing along a road that winds towards some distant mountains. Our description is correct, but it's also entirely wrong. In the real world we know that the road goes into the distance, because we could walk down the road and see its three-dimensional path. Here, the same road is being shown to us on a flat piece of paper (or a flat screen) and the depth isn't real; it can't be real because the page in this book is only two-dimensional, it's absolutely flat. This book page has no depth, yet we believe that the road winds into the *depth* of the picture. This means that there's something about this two-dimensional picture that convinces us we're seeing depth where there's no actual depth at all. That something is called a depth cue.

THE DEPTH CUES

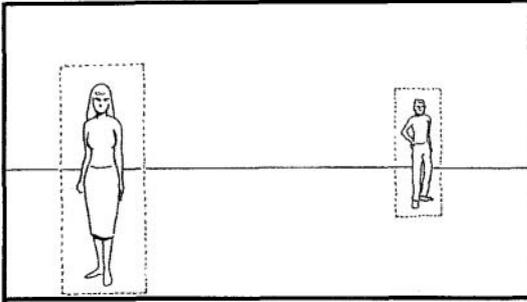
Let's define and describe each of these depth cues. *Depth cues* are visual elements that make the audience feel they're seeing depth when there's no real depth at all.

Size Difference

As an object of known size gets smaller in the frame, it appears to get farther away. As an object of known size gets larger, it appears to get closer.



In this drawing, we believe that the larger person is closer to us and the smaller person is farther away. Their sizes are different, so one person must be closer to the camera. Of course, in reality they're both exactly the same distance away from us because they're on the same flat surface (this page).

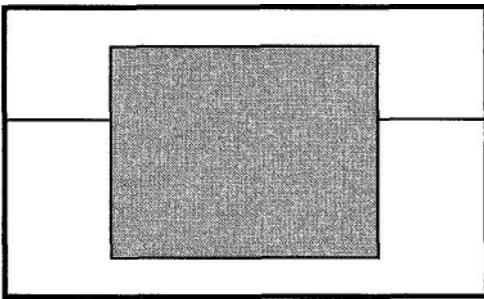


The two people have been staged on two separate planes indicated by the dotted lines. One is on the MG (midground) plane and the other is on the BG (background) plane.

This concept might seem simple and obvious, but size difference is an extremely important and basic depth cue. It's a way to create illusory depth in a picture. If you watch Orson Welles' *Citizen Kane* (1941) you'll see that the staging of actors and the illusion of depth revolves around this basic principle. In fact, this depth cue is sometimes called "staging in depth."

Perspective and Convergence

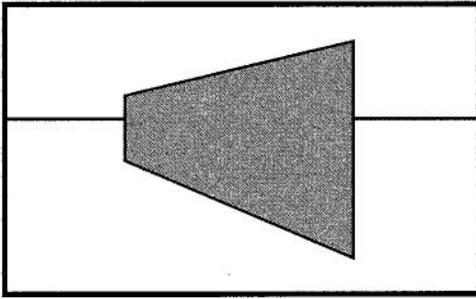
We can talk about perspective in two ways. We can discuss drawing with it and we can discuss recognizing it in the real world. *Perspective* occurs when we represent a three-dimensional world on a two-dimensional surface. *Convergence* can be defined as "parallel lines of a single plane meeting at a vanishing point," but this definition sounds meaningless. To make convergence useful, we need to understand some simple terms and look at some picture examples.



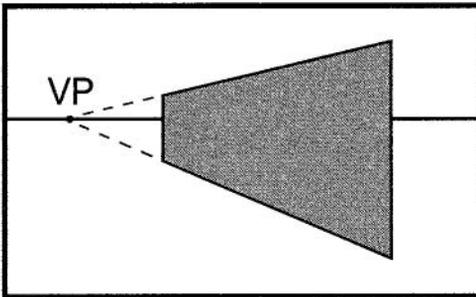
Here's the two-dimensional plane that we introduced in Chapter 1, "The Visual Components." Notice that the plane's top and bottom lines are parallel and that its left and right side lines are parallel. We call this plane a *frontal plane*. You could think of it as a large, flat wall.

For our purposes, perspective comes in three basic types: one-point, two-point, and three-point perspective. These three types of perspective form a visual progression from simple to complex. Now let's examine each one.

One-Point Perspective: Let's begin with the simplest type of perspective that may already look familiar to you.

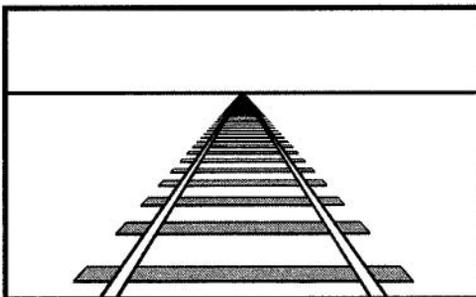


If we change our view of the frontal plane, the depth cue of perspective and convergence will appear. The top and bottom lines of the frontal plane are no longer parallel. We've created a longitudinal plane, an extremely important cue to illusory depth. The longitudinal plane appears to exist in depth. One side of the plane looks farther away even though it really exists on a flat paper surface.



The lines along the top and bottom of the longitudinal plane appear to meet or converge at a single point on the horizon called a vanishing point or VP. Usually the vanishing point appears on the horizon, although it can be anywhere, as we'll see in three-point perspective.

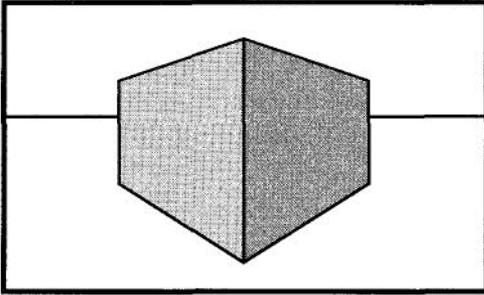
A classic example of one-point perspective occurs when we stand in the middle of a railroad track and look down the track towards the horizon.



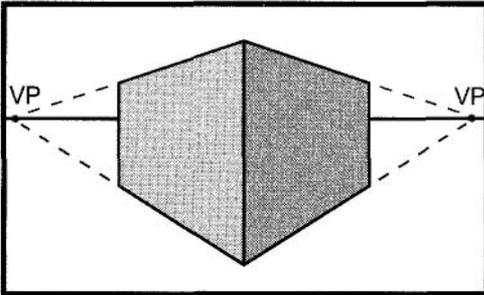
The rails of the track appear to meet or converge at a vanishing point on the horizon. The rails never actually meet; they always remain parallel, but they appear to converge towards the vanishing point. We equate this convergence with distance. The more the rails converge, the farther away they seem.

Convergence occurs in the real world and in the screen world, but in the screen world it happens on a two-dimensional surface, and therefore we call it a cue to illusory depth. The railroad tracks seem to go into the depth of the shot, but there is no depth on a flat screen.

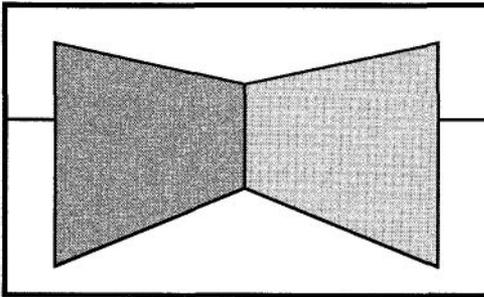
Two-Point Perspective: If we think of one-, two-, and three-point perspective as a progression, the next most complex level is two-point perspective, which uses two vanishing points instead of one. There are several ways that two-point perspective can be produced.



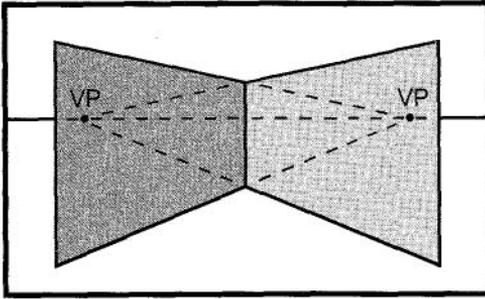
Two longitudinal surfaces can generate two vanishing points.



In this first example there are two longitudinal planes, each with its own vanishing point. Commonly, this occurs when we look at the corner of a building. The top and bottom lines of each longitudinal plane converge to a separate vanishing point.

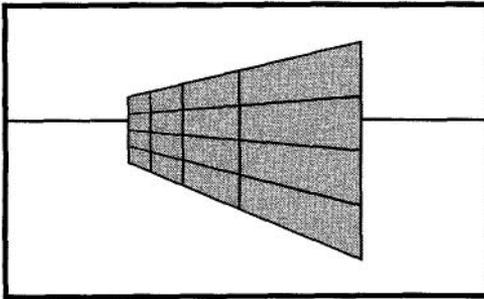


Inverting the two longitudinal planes reveals a second example of two-point perspective. This occurs when we look into the corner of a room.

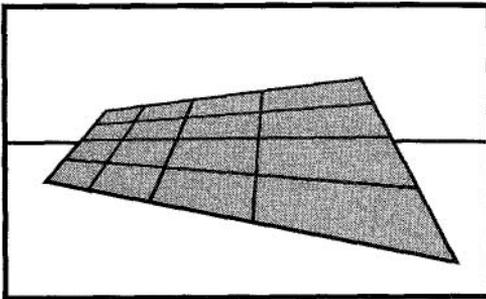


Although the vanish points are hidden behind the longitudinal planes, there are still two vanishing points here.

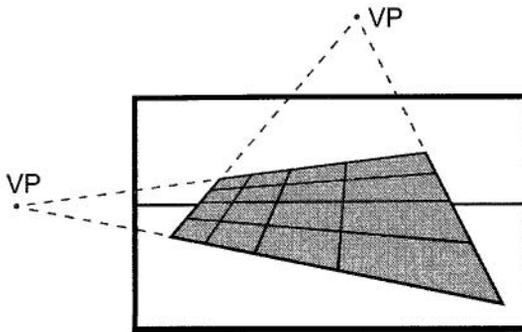
Two vanishing points can also appear on a single longitudinal plane. To illustrate this, let's redraw the one-point perspective longitudinal plane.



Additional lines have been added to the plane to make the convergence more obvious, but the longitudinal plane still has only one vanishing point.

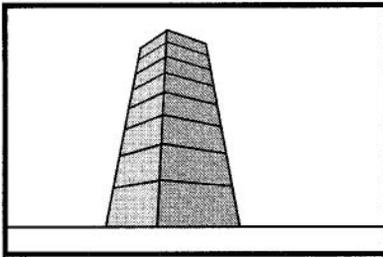


If we tip the longitudinal plane away from us, or move our view closer and lower, the plane is not only angled, it's also tilted. None of the lines on this longitudinal plane are parallel.

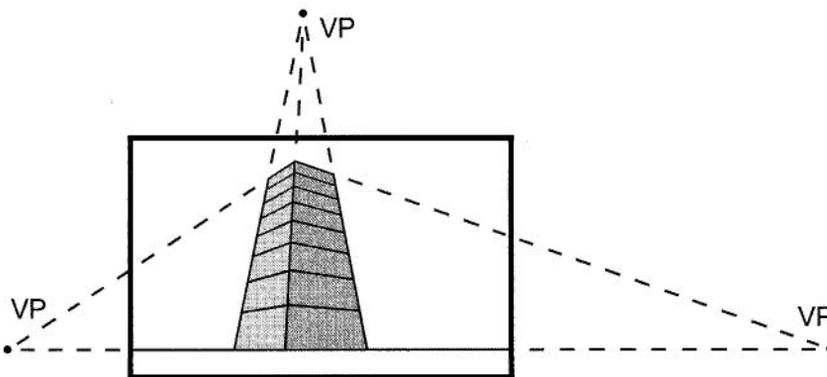


There are two vanishing points. The plane's top and bottom lines converge to one vanishing point located to the left of the frame. The left and right lines converge to a second vanishing point located above the frame.

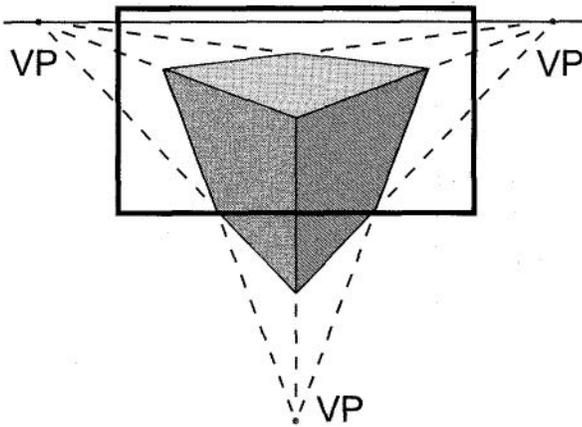
Three-Point Perspective: Finally, we have three-point perspective, which is more complex than one- or two-point perspective.



This is a view of a tall building. There are now three distinct vanishing points.



One vanishing point will appear above the building. The second and third vanishing points will appear along the horizon line to the building's left and right.

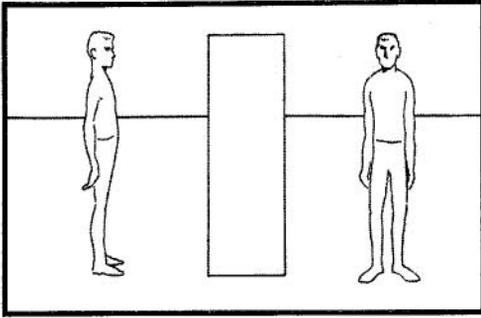


This shot also illustrates three-point perspective, but the viewing position is high above the building. This would be your view if you're in a helicopter coming in to land on the building's roof.

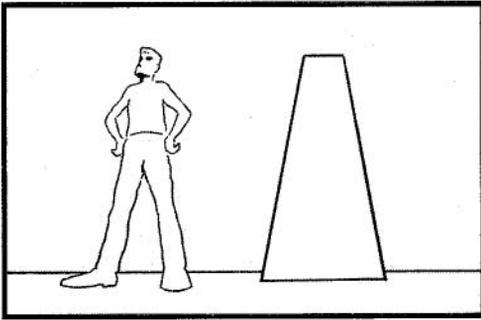
All things being equal, the more vanishing points the greater the illusion of depth. One vanishing point will create the illusion of depth in the screen world, but adding a second or third point will give the audience a greater sense of illusory deep space. Remember that no matter how many points you add there isn't any real depth. These drawings and every picture you've seen exist on a flat, two-dimensional surface. All of the depth is illusory.

What about adding more vanishing points? It's possible to have four, five, twenty, or more vanishing points in a shot. If this were a drawing class (and it isn't) we'd spend time discussing multiple point perspective, but we're not interested in drawing perspective, we're interested in recognizing it in our viewfinders. More importantly, an audience watching a film doesn't notice more than three vanishing points. In a drawing or painting, a viewer might become aware of multiple vanishing points because there's unlimited viewing time to notice these details. A film audience doesn't have control over viewing time and can't sense additional vanishing points beyond three. This limitation is an advantage for the filmmaker because it means there are only three levels of illusory depth possible when using perspective and convergence.

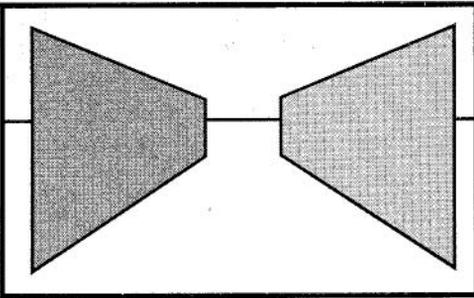
Actors can also be looked at as a longitudinal or frontal plane.



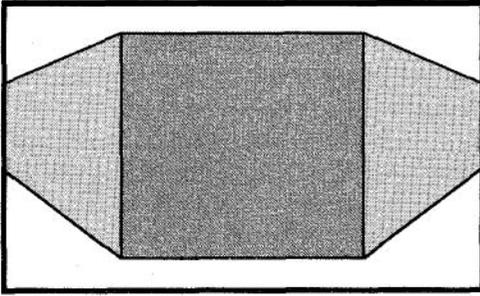
The front, back, and profile views of an actor are like planes, so creating depth cues with them is easy.



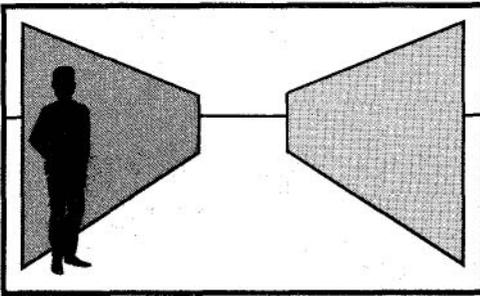
In this shot, the camera is lowered and tilted up turning the actor into a longitudinal plane. The same thing would happen if the camera was raised and tilted down to look at the actor.



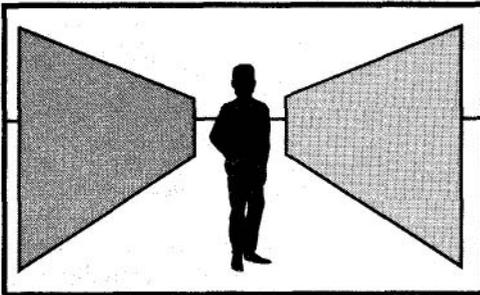
When the vanishing point is on screen or nearly on screen, the audience's attention will usually be drawn to that point. Notice how your eye is drawn to the on-screen vanishing point between the two walls.



If the vanishing point is out of frame, it loses its ability to attract the audience's eye.



In this shot your eye is drawn to the actor, but it is also drawn to the vanishing point between the two walls. If our intent is to keep the audience's attention on the actor, we may have created a problem.



In this shot, your attention will go to the vanishing point located directly behind the actor. The vanishing point helps keep your attention in place on the actor.

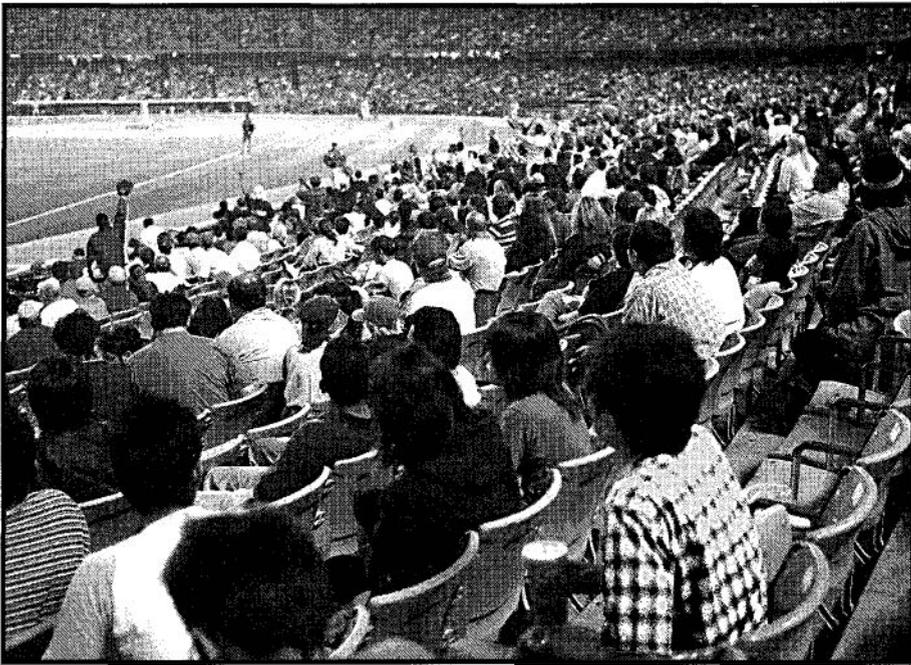
Does this mean that actors must always be located on the vanishing point? Absolutely not. It's just important to know that vanishing points will usually attract an audience's attention.

Textural Diffusion

Every object has texture. A plain plaster wall has a smooth texture and a wool sweater has a nubby texture. Every object will also have a color. Our ability to see depth due to differences of detail in texture and color is called *textural diffusion*.

Imagine you're attending a soccer game and the stadium is packed. You're sitting in the very last row behind the goal area. As you look at the fans in the seats nearby, you can easily distinguish the individual textures and colors of each person's face, hair style, clothing, and other aspects of appearance.

When you look across the stadium, to the fans sitting in the seats opposite yours behind the other goal, you can only see hundreds of little dots of color. Individual details of color and texture are blended together because you are too far away to see them.



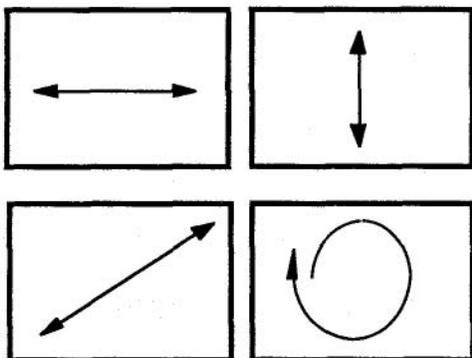
This photograph illustrates textural diffusion. Objects with less detail appear farther away. We equate a loss of texture, detail, and individual color with distance.

Movement

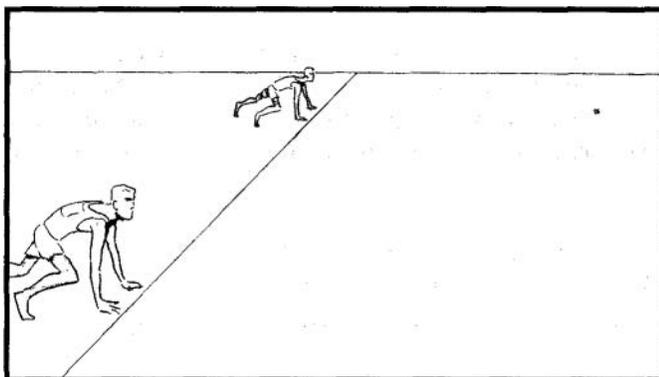
Movement is an extraordinarily important way to create illusory depth. In this discussion of depth cues, we'll discuss two things that can move: an object in front of the camera or the camera itself. Later, in Chapter 7, "Movement," we'll expand this idea, but for now we're limited to movements of the object or the camera.

Object Movement: Object movement can give the viewer a sense of illusory depth. An object can be anything in front of the camera—an actor, a car, an animal, a crowd, it makes no difference.

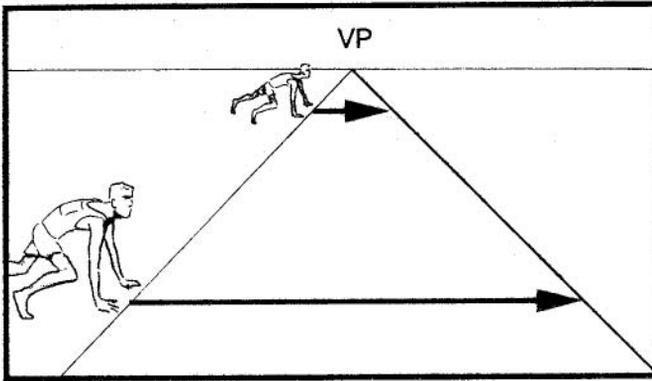
There are only two ways that an object can move in relation to the camera. The object can either move *parallel* to or *perpendicular* to the picture plane. Remember that the picture plane is the two-dimensional "window frame" within which pictures exist.



Movement parallel to the picture plane means movement up and down, left and right, diagonal or circular. A single object moving parallel to the picture plane creates flat space, which we'll discuss later in this chapter. But two or more objects moving parallel to the picture plane can produce the illusion of depth. This depth cue is called *relative movement*.

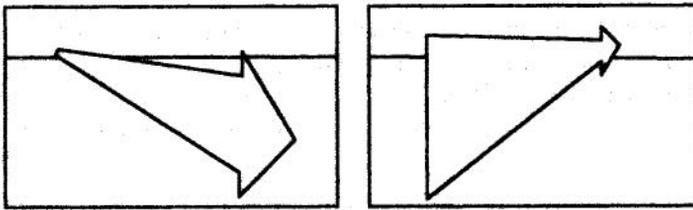


This example of relative movement shows two runners at a starting line. Both of them will run through the frame parallel to the picture plane, and both will run at exactly the same speed. Even though they begin running at the same time, the FG runner will appear to travel across the frame much faster than the BG runner.



Using a vanishing point, we can accurately predict how much further the FG runner will appear to move even though both runners will actually travel the same distance. The apparent difference in speed and distance traveled produces the depth cue.

We can also create illusory depth when an object moves perpendicular to the picture plane.



Objects that move towards or away from **the** camera are moving perpendicular to the picture plane. **As** an object moves toward or away **from** the camera a number of depth cues appear. Imagine a speeding train of one hundred cars moving towards you at 80 mph. As the train approaches, you'll notice a number of depth cues:

1. *Size difference.* The engine is larger than the cars behind it.
2. *Textural diffusion.* As the train approaches it gains detail.
3. *Object movement.* As the train approaches it appears to speed up.

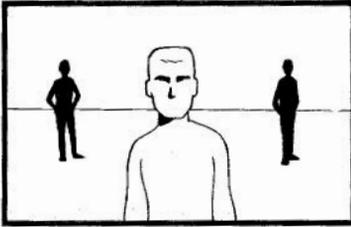
In fact, as the train roars by at 80 mph, the engine seems to be going much faster than the caboose, which is still far away. Of course, both ends of the train must be traveling at the same speed, but the more distant train cars appear to be moving more slowly.

As an object of constant speed moves perpendicular to the picture plane towards the viewer, it will appear to speed up. Conversely, an object will seem to slow down as it moves away from the viewer. This change in apparent speed is the depth cue produced by movement perpendicular to the picture plane.

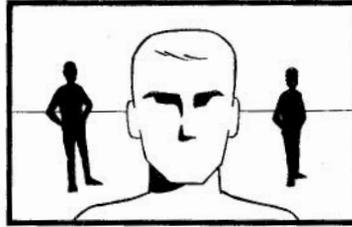
Camera Movement: There are three camera moves that will give us a greater sense of depth. It doesn't matter how the camera is being moved (by dolly, crane, hand-held, special mechanical rigs, etc.), the same basic principles apply.

A *dolly in* and *dolly out* can be described as physically moving the camera closer or farther from an object. By *dollying* the camera in and out, we'll give the viewer a greater sense of illusory depth.

Why does a dolly create depth? Let's say we're staging a shot with one actor in the foreground and two actors in the background.

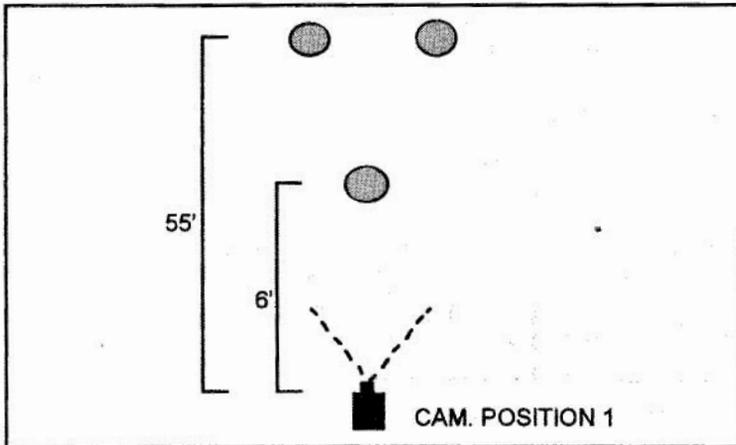


CAM. POSITION #1

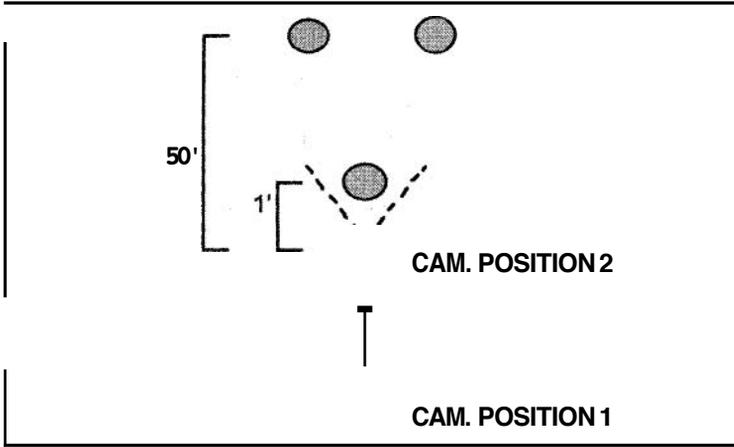


CAM. POSITION #2

As we dolly in, the FG actor will get larger faster than the two actors in the BG. Why? The answer lies in understanding the relative distances of the actors from the camera.



Here's an overhead view or ground plan map that will explain the answer. The camera begins 6 feet from the FG actor and 55 feet from the BG actors.

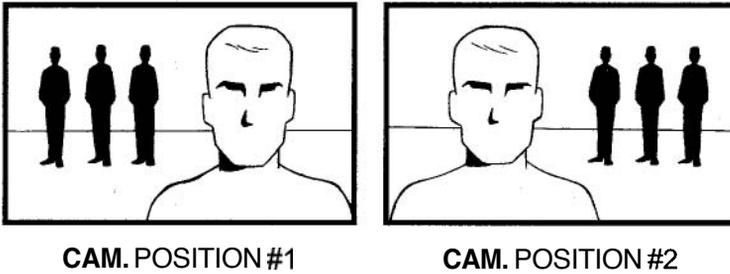


The camera dollies in 5 feet. Now we're only 1 foot from the FG actor, but we're 50 feet from the BG actors. The FG actor went from 6 feet to only 1 foot from the camera, so we'd expect to see a huge size change. The BG actors went from 55 feet to 50 feet, so their size change is minimal, because they're still so far from the camera.

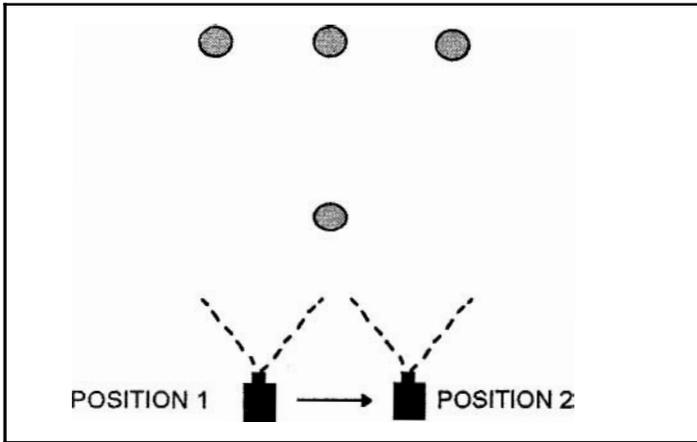
This relative difference in size change (the FG object gets larger faster than the BG object) is a cue to illusory depth.

Conversely, when we dolly out (or away from the subject) the FG actor will get smaller quickly and the BG actors will barely change size at all.

We can also create illusory depth with a camera movement when we dolly left and right, often called a tracking shot.

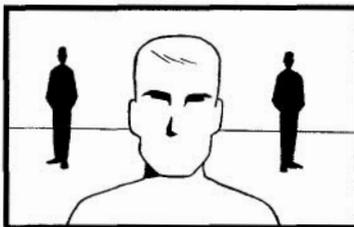


As the camera dollies or tracks from left to right, the FG actor passes the camera faster than the three actors in the BG.

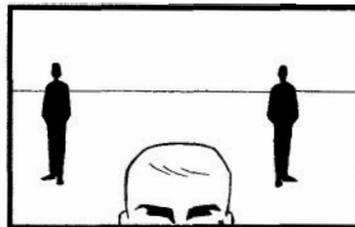


There's relative movement between the faster moving FG and the slower moving BG objects. An audience interprets the faster moving FG and the slower moving BG as a depth cue.

The third type of camera move that produces illusory depth is a boom or crane shot. It means that the camera is moved up or down. The principle is identical to the tracking shot, but instead of moving horizontally, the camera moves vertically.

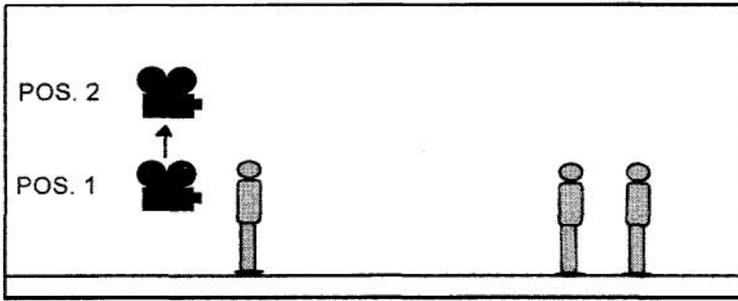


CAM. POSITION #1



CAM. POSITION #2

As the camera cranes up, the actor in the FG will move quickly out the bottom of the frame and the two BG actors will move more slowly. As the camera cranes down, the FG actor will come into the frame quickly, but the BG actors will barely move.



It's exactly the same kind of relative movement we saw with the tracking shot, but instead of generating horizontal relative movement, the crane shot produces vertical relative movement.

Aerial Diffusion

Aerial diffusion has visual characteristics similar to textural diffusion, but it occurs for different reasons. Aerial diffusion depends on particles in the air. These particles can be dust, fog, rain, smog, smoke, or anything suspended in the air that obscures our view of the distance.

Aerial diffusion will cause three things to happen visually. First, the aerial diffusion will cause a loss in detail and texture. Second, the aerial diffusion will change the shot's contrast, and third, the aerial diffusion will change the color of objects to the color of the aerial diffusion itself.

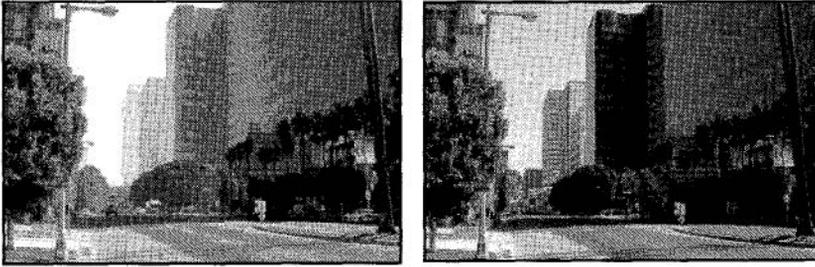
If you imagine a long, straight street in a large city we can see how aerial diffusion works. On a clear day where there's no aerial diffusion in the air (no smog, fog, rain, mist, etc.) we might say that the city looks "sparkling" or "clear." What we're describing is the wonderful detail and the individual colors and textures that we see when there isn't any aerial diffusion present. The same visual clarity occurs in rural areas where there's no smog.

Now imagine the same street scene on a rainy day with mist and fog covering the city. Looking down the same street, the visual quality is completely different. The buildings no longer have their individual textures and colors. The aerial diffusion (mist, fog, and rain) is now diffusing our view of the city and the scene will look different. The details of the buildings will be gone. You'll also notice an overall lack of contrast. Very bright and very dark building colors will be replaced with grays. Distant buildings most effected by the aerial diffusion will appear even farther away than they really are.

Imagine another weather condition on the same street. Instead of rain, the aerial diffusion will be caused by a brown industrial smog. As we look down our city street, the detail and texture of the buildings will be obscured by the smog, but the buildings will also take on a brown color. The farther away a building is, the more it will be changed from its own color to the brown color of the aerial diffusion.

For aerial diffusion to work as a depth cue, the viewer must see an object unaffected by the aerial diffusion and another object affected by the aerial diffusion in the same shot. It's the comparison between the two that creates the depth.

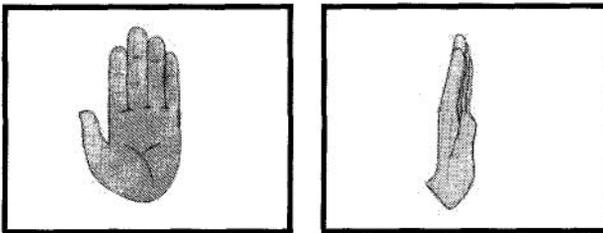
The loss of detail in objects due to aerial diffusion makes them seem more distant. This is similar to textural diffusion but not the same thing. Textural diffusion relies on actual distance to produce a loss in detail. Aerial diffusion does not rely on actual distance but rather on particles in the air that obscure the detail, texture, and color of objects.



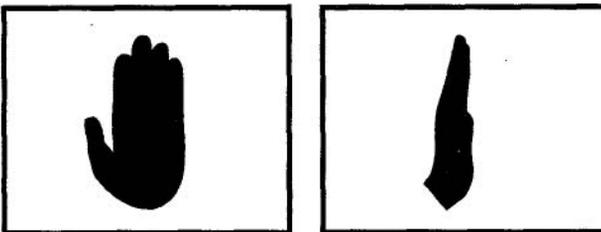
This pair of photos illustrates a scene affected and unaffected by aerial diffusion.

Shape Change

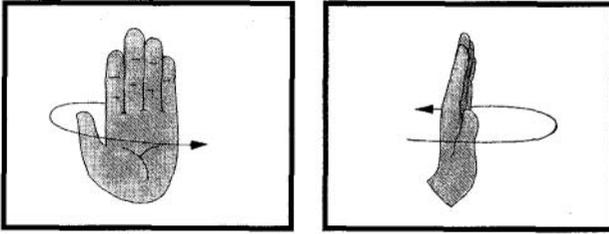
When an object changes shape, we perceive the change as a cue to illusory depth. Shape change can occur in moving objects or stationary (nonmoving) objects.



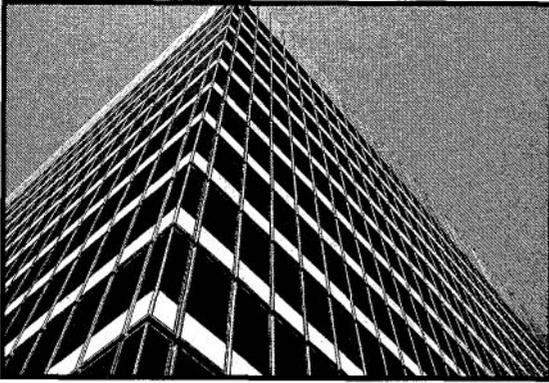
Here are two drawings of a hand.



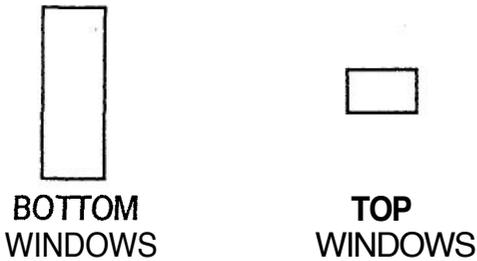
If we reduce the hands to silhouettes, we'll see that each is a very different shape. How can the same object have more than one shape?



The hand can change shape by rotating or turning in space. If an object can rotate, there must be a third dimension that allows the rotation to occur. Remember, in the two-dimensional screen world the third dimension is only an illusion because the screen surface is two-dimensional and flat. As an object rotates and changes shape, we perceive illusory depth.



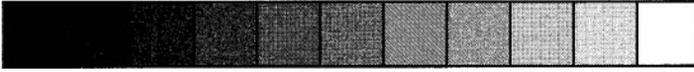
This picture of a building creates deep space because it shows a longitudinal surface, size difference (the windows get smaller), and because the windows change shape. We assume all of the windows are actually the same size and shape even though they appear to change.



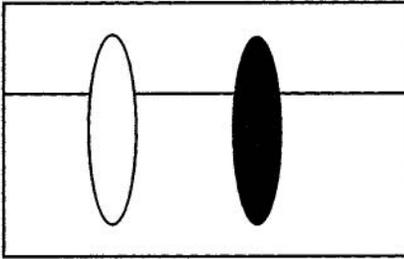
The bottom windows appear tall and rectangular, and the top windows appear as short, squat rectangles. This change in shape is a cue to illusory depth.

Tonal Separation

Tone refers to black & white and the gray scale.



The gray scale contains no color. It's a series of steps from black to white. This depth cue deals with our perception of lighter and darker objects. Usually lighter objects appear closer and darker objects appear further away.



Even with two objects of identical size, a viewer will usually feel the brighter object is closer or larger and the darker object is farther away or smaller.

Color Separation

Color can be a depth cue. For now we'll use color terminology in a very simple way. We can divide colors into two basic groups: warm and cool. The warm colors are red, orange, and yellow, and the cool colors are blue and green. Chapter 6, "Color," will explain the complexities of color more fully.

Color separation means that warm colors appear closer to the viewer and cool colors appear further away.

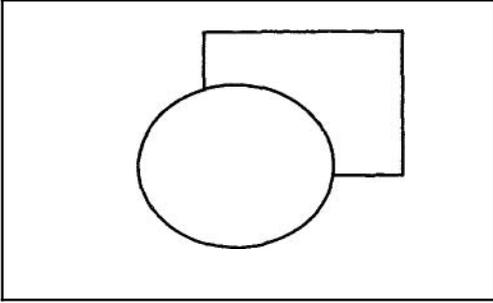
See Color Plate 1.

The red square will seem closer and the blue square will appear further away even though both squares are the same distance from the viewer.

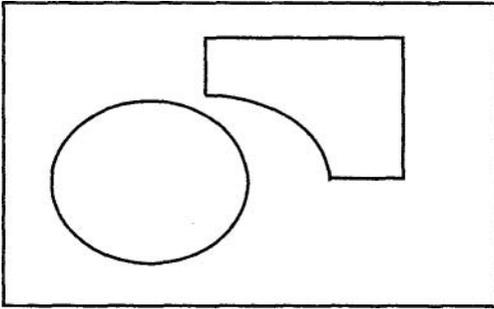
There are many theories about why this happens. Researchers believe it's linked to our physiological and psychological responses to different wavelengths of light. Whatever the reason, the perceptual fact exists, and we can use it when creating illusory deep space on a flat screen.

Overlap

When one object overlaps another, it creates illusory depth.



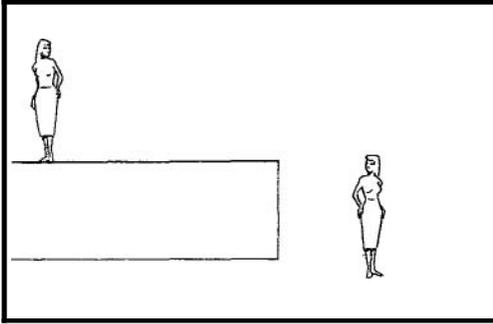
In this drawing, the square appears behind the circle because the circle covers or overlaps part of the square. If one object overlaps another there must be enough depth for an object to get behind another. The overlapping creates depth.



We would be surprised if we pulled these two shapes apart and the square had a piece missing. It would mean that the square was never behind the circle but was laying next to it on a flat surface. But that is a visual trick. Real overlap produces illusory depth.

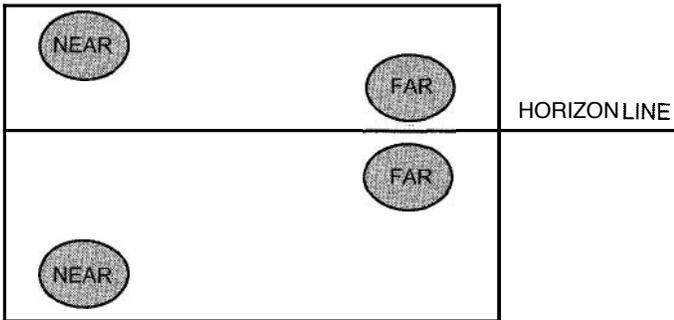
Up/Down Position

Generally speaking, we perceive objects higher in the frame as farther away and objects lower in the frame as closer.



Even though these two figures are the same size, a viewer will perceive the higher figure to be farther away and the lower one as closer.

If there is a horizon line in the frame the up/down position depth cue becomes more complex.



Objects closer to the horizon will appear more distant, and objects farther from the horizon will seem closer.

Below the horizon, objects higher in the frame appear farther away. The opposite is true when objects appear above the horizon where objects lower seem farther away and objects high in the frame appear closer.

Focus

Focus refers to the sharpness of anything in the picture. Focus is not an object we manipulate in front of the camera but the result of optics and lenses. We can photograph objects in sharp focus or blurred. A depth cue is only useable when it is in focus. Once an object goes out-of-focus, it loses its deep space characteristics and becomes flat. The more out-of-focus it gets the more we ignore its depth cues.

DEEP SPACE AND TELEVISION

American NTSC television is somewhat limited in its ability to reproduce deep space. Many of the depth cues needed for the creation of illusory depth fall outside the technical limits of the television system.

1. Conventional television ignores the depth cue of textural diffusion. Television has a limited resolution and cannot adequately reproduce objects with

great amounts of detail. Most objects when reproduced on television have about an equal amount of resolution or detail whether they're in the foreground or the background. A high-definition television system can remedy some of this problem because it doubles the resolution of the picture. Internet video can have a similar problem depending on the resolution of the downloaded image.

2. The television or computer screen's ability to show size difference is inadequate because the average screen is only nineteen inches wide. This physical dimension severely limits the size of large objects and makes small objects difficult to see. These screens are simply too small to adequately display size change.

3. The depth cue of tonal *separation* is difficult for television to reproduce accurately because television has a limited tonal range. Bright whites and dark blacks can't be reproduced because their contrast range falls outside television's technical capabilities. The television system itself can't reproduce black at all. Television reproduces the middle of the gray scale best.

4. Television cannot distinguish between subtle changes of color and tends to reproduce similar, but different, colors as identical. This phenomena is called color localization and occurs in any color reproductive medium. It reduces the depth that can be produced using color separation and textural diffusion.

Television can reproduce animated cartoons with great accuracy because most cartoons don't have details or subtle color variation. Whether the cartoon has been generated using conventional methods or a computer, most cartoons made for television lack detail. Any knowledgeable art director (from animation or live action) knows that details that are necessary in a theatrical film aren't necessary on television because it can't reproduce the details. High-definition broadcasts and Internet transmission will change the resolution capabilities of those media.

FLATSPACE

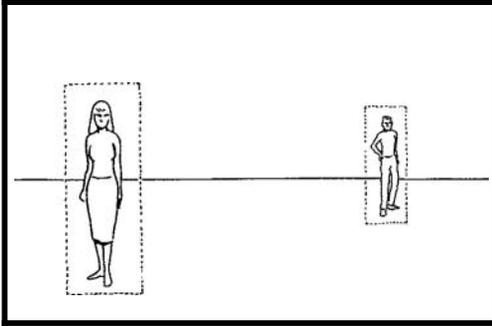
The opposite of deep space is flat space. Deep space gives the illusion of a three-dimensional picture on a two-dimensional screen surface, but flat space does the opposite: it emphasizes the actual two-dimensional quality of the screen surface itself.

FLAT SPACE CUES

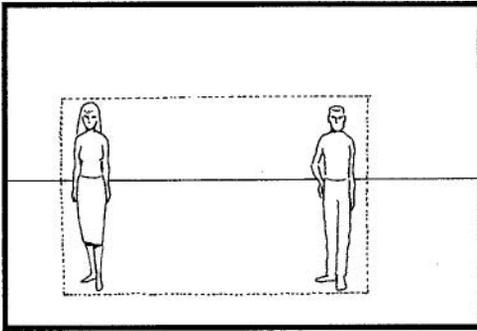
Just as deep space had specific cues to create illusory depth, flat space has its cues. Flat space can also be produced by eliminating the depth cues and in some cases reversing them.

Size Constancy

To emphasize the flatness or two-dimensionality of the screen we want to keep all similarly-sized objects the same size on the screen. In deep space we found that smaller objects appear farther away. Now we want to remove that depth so all of the objects in a shot should be staged on the same frontal plane.



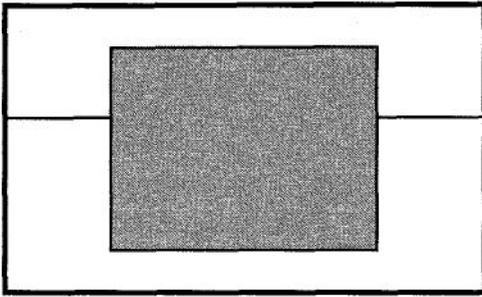
These objects have been staged on two separate planes. Each plane is indicated by the dotted lines. The two separate planes add unwanted depth.



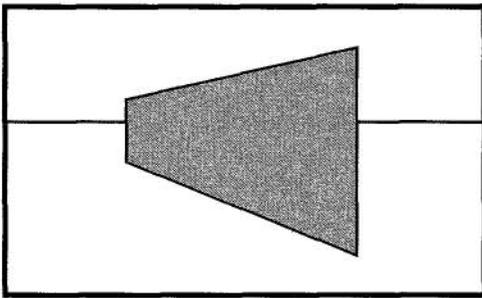
These objects have been staged on the same plane. The single frontal plane created by the staging helps keep the space two-dimensional or flat. Flat space requires us to stage objects on a single plane that is parallel to the picture plane. Television situation comedies and talk shows are excellent examples of flat staging.

Perspective and Convergence

We want to remove all converging lines and all hints of perspective. Planes should be frontal, not longitudinal, so there can be no converging lines or vanishing points.



FRONTAL



LONGITUDINAL

These two drawings show the same plane, but the frontal drawing is flat space and the longitudinal drawing is deep space. The *frontal plane* emphasizes the two-dimensionality of the screen surface. Creating flat space means excluding longitudinal planes.

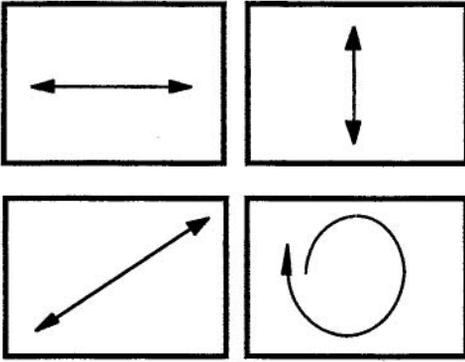
Textural Diffusion

Objects with very little texture will look farther away and objects with lots of texture will look closer. To achieve flat space we want to avoid these differences because they will create depth. To emphasize flat space we want all objects to have the same amount of textural detail. We can produce a flatter space when there's a homogenization or similarity of texture throughout the shot.

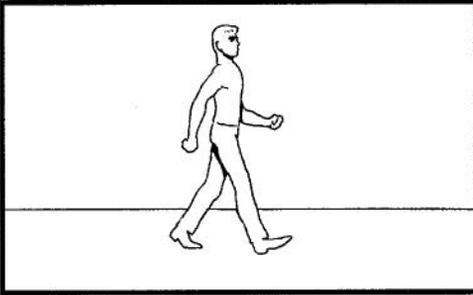
Movement

As we mentioned with deep space, the two things that can move are an object in front of the camera and the camera itself.

Object Movement: To maintain flat space, objects should only move parallel to the picture plane, that is, side to side, up and down, diagonally, or in a circle (in either direction).

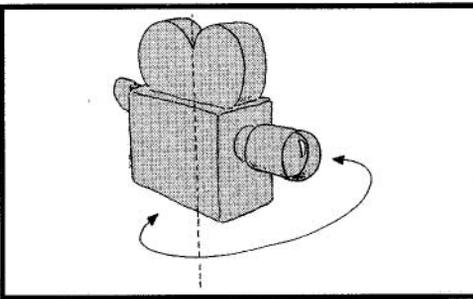


Movement towards or away from the camera will produce deep space cues like size change, textural diffusion, speed change, and so on.



An actor walking parallel to the picture plane creates flat space.

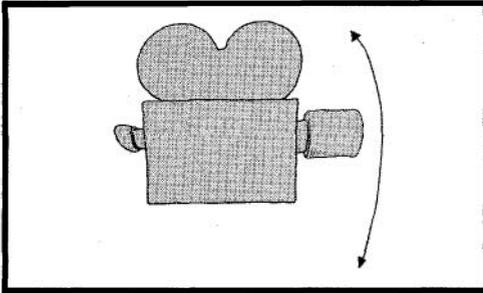
Camera Movement: The camera pan will create flat space.



When we pan, all of the objects in the frame keep their relative positions to one another. Panning means turning the camera to the left or right on its vertical axis.

Try closing one eye and slowly rotate or "pan" your head around a room past an open doorway. Notice how everything in your room and the next room moves at the same rate of speed. Now try it again, but this time instead of "panning" your head, lean from side to side as you look out the open doorway. You'll notice that the doorway moves faster than objects in the next room. This illustrates the difference between the flat space pan and the deep space dolly.

The tilt is the second flat space camera move.



Tilting is camera movement up or down along the vertical axis. Again, close one eye and stand back six feet inside an open doorway. Look down at the ground in front of you and slowly "tilt" your head up to look out the doorway. You'll notice again that everything in view moves at the same rate. This means there's no relative movement. Now look out the doorway and slowly bend your knees into a low crouching position. As you lower yourself you'll notice that the foreground doorway is moving faster than the background. This illustrates the visual difference between a flat space tilt and a deep space crane shot.

True panning and tilting occurs when you use the nodal point of the camera, which is explained in Part A of the Appendix.

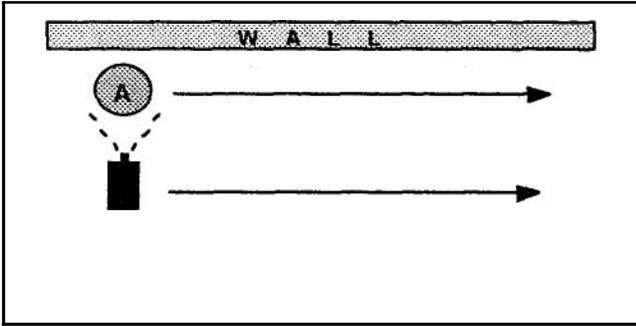
Finally, there's the zoom. A zoom creates flat space. Cinematographers and directors have unusually strong negative opinions about the zoom. Typically they feel that the zoom is a quick, unattractive way to achieve a dolly shot. It's true that a dolly shot will take longer to set up than a zoom, but the difference is not just economical or practical. The difference is also in the type of visual space that the zoom or the dolly produces.

A zoom creates flat space for a number of reasons. Most importantly, the camera is not physically moving, so there will be no relative size changes, no textural changes, and no relative speed changes. A zoom-in makes everything in the frame enlarge at exactly the same rate. The FG, MG, and BG grow larger in unison. This has the effect of flattening the picture because there is no relative movement.

Something else also happens when we zoom. When we zoom in, we're actually altering the focal length of the lens; we're changing from a wider angle to a telephoto lens. As the focal length of the lens increases, the depth of field decreases so areas of the frame will blur or go out-of-focus. As an object blurs, it becomes flat.

Zooms have always been considered unattractive by photographers and directors, but a zoom isn't necessarily bad. If you've designed a flat space movie (something we'll discuss in Chapter 9, "Story and Visual Structure") you should not dolly the camera, you should zoom. A zoom is what you need to maintain flat space.

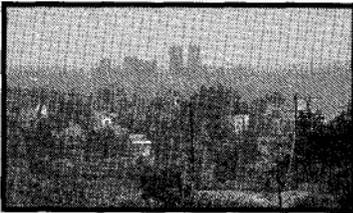
There is one exception to the "no dolly" rule when you're creating flat space. You can maintain flat, frontal space by using a side-to-side tracking shot.



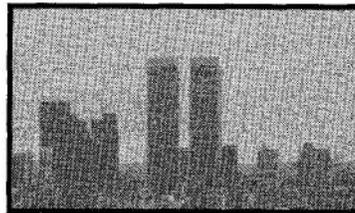
In this illustration, an actor (A) will walk along a wall and the camera will dolly along with the actor. The camera is moving parallel to the frontal plane of the wall, which will keep its surface frontal and flat.

Aerial Diffusion

Aerial diffusion can create flat space if the diffusion has the same visual effect on all areas of the shot. When all objects have the same loss of detail, contrast, and color they tend to blend together and flatten out.



DEEP



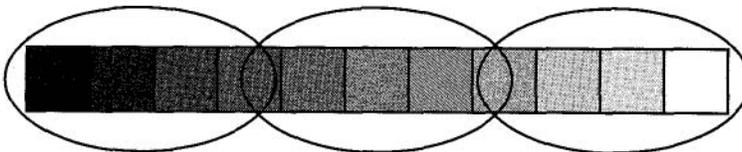
FLAT

Both of these shots contain aerial diffusion, but one is deep and the other is flat.

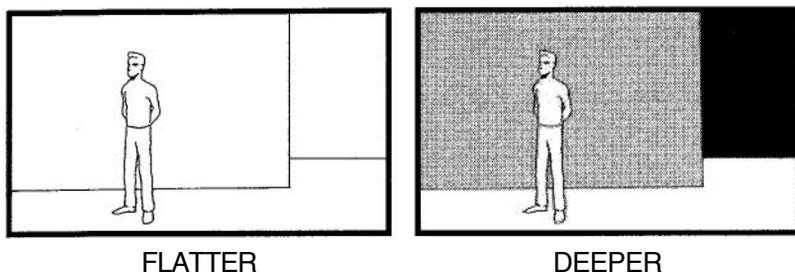
Tonal Separation

Tone refers to the gray scale. Keeping a space flat requires a reduction of the gray scale range within the shot. Remember, brighter objects usually appear closer and darker objects seem farther away.

Reducing the tonal range in a shot to only one third of the gray scale will reduce the tonal depth cues and keep the picture flat.



Practically speaking, flat space can be produced when all of the tones in a shot are confined to only one third of the gray scale.



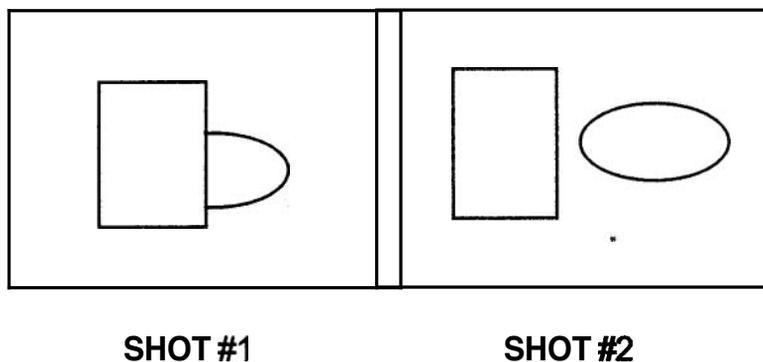
The shot with the lack of tonal contrast is flatter.

Color Separation

Just as the tonal range should be reduced, the warm/cool color range must be limited to help create flat space. Knowing that cool colors (green and blue) recede and warm colors (red, orange, and yellow) advance, we can emphasize flatness by reducing color in our production to all warm or all cool colors. The concept of warm and cool will be expanded in Chapter 6, "Color."

Overlap

Ideally, in flat space there should be no overlap at all because overlap suggests depth.

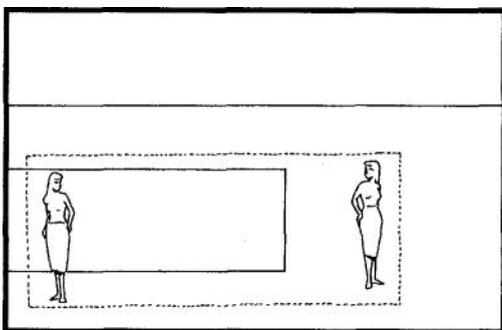


Shot #2 is flatter because the overlap has been reduced. Overlap can be minimized by staging actors and objects next to each other instead of behind or in front of each other.

Completely removing overlap in the creation of flat space is impossible, because every shot has a background and any object appearing in front of that background will produce overlap. We can reduce overlap in the careful arrangement and staging of objects in the frame but its elimination is impossible.

Up/Down Position

The position of objects relative to the frame line can help create flat space.



Keeping all the objects on the same horizontal plane will help flatten the picture.

Focus

Once any object is out-of-focus, it becomes flat. It doesn't matter if the object is in the FG, MG, or BG, it flattens when it becomes blurry. In fact, FG, MG, and BG objects will often blend into one flat plane when they are out of focus. Blurred objects will usually read as flat space no matter what depth cues the objects actually contain.

Reversing the Depth Cues

By reversing certain depth cues we can make them work in an opposite manner and produce flat space.

1. *Tonal Separation.* The depth cue of tonal separation suggests that brighter objects appear closer and darker ones appear farther away. By reversing this rule and putting brighter objects in the BG and darker ones in the FG, the space will flatten. The brighter BG objects will visually advance and the darker FG objects will recede. When the FG recedes and the BG advances, we are flattening the space.

2. *Color Separation.* The same rule applies to color separation. If we put warmer colors in the BG and cooler colors in the FG, the space will flatten. The warmer colors in the BG will advance and the cooler FG colors will recede, creating a flatter space.

3. *Textural Diffusion.* By having more textural detail on objects in the background and less detail on objects in the foreground, it's possible to help flatten the space.

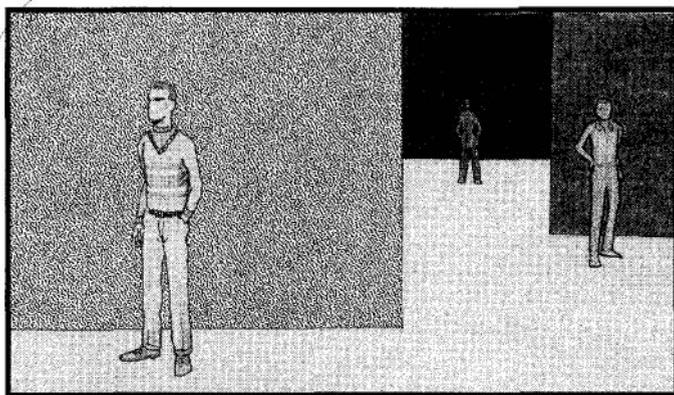
4. *Size Difference.* Since we feel that large objects appear closer and smaller ones seem farther away, we can reverse the depth cue and produce flat space. If larger objects are placed in the BG and smaller ones in the FG, it will tend to flatten the picture.

LIMITED SPACE

Limited space is a specific combination of flat and deep space. Limited space uses all of the depth cues except two:

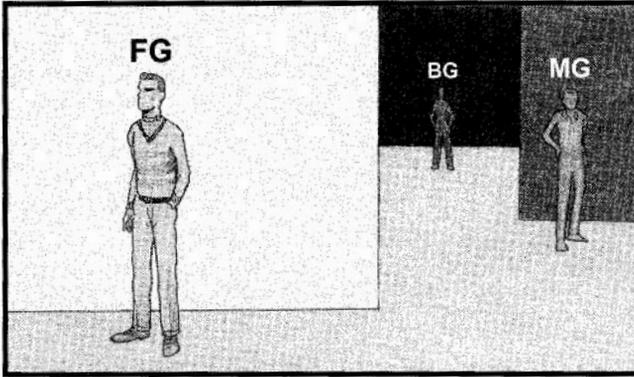
1. *No longitudinal planes.* In creating limited space the deep space longitudinal planes are replaced with flat space frontal planes.
2. *No object movement perpendicular to the picture plane.* Movement towards or away from the camera must be reduced or eliminated. Objects should only move parallel to the picture plane.

Limited space is a challenging spatial plan to follow. Alfred Hitchcock and Ingmar Bergman used it for many of their films.



SHOT #1

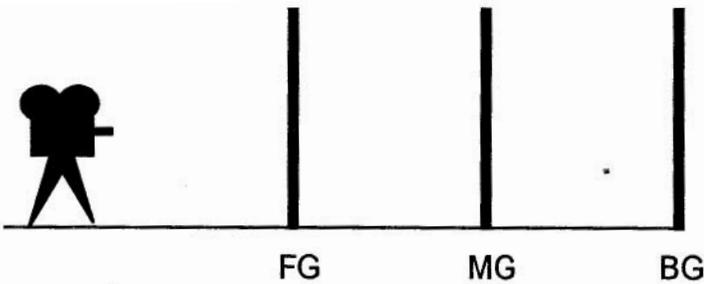
Shot #1 contains many depth cues. There's size difference in the actors. The FG actor and wall will have more textural detail than the BG actor and wall. There's overlap between the actors and the walls. The depth cue of up/down position is also used because BG objects are higher in the frame. There's also tonal separation: the FG is brighter and the BG is darker. But Shot #1 has no longitudinal planes that are normally associated with deep space. They have been replaced with frontal planes.



SHOT #1A

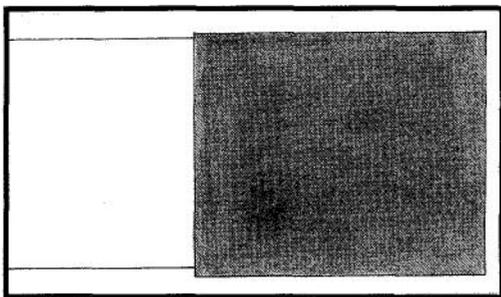
Shot #1A labels the three frontal planes (FG, MG, BG). In limited space, the shot can include as few as two and as many as three separate frontal planes. When there's more than three frontal planes, there isn't enough space to visually separate them. If the shot contains only one frontal plane it produces flat space. Notice how the frontal planes are visually well separated from one another. In order for limited space to work properly there must be as much visual separation between the frontal planes as possible.

The visual quality of limited space is similar to looking through a series of well separated sheets of glass.



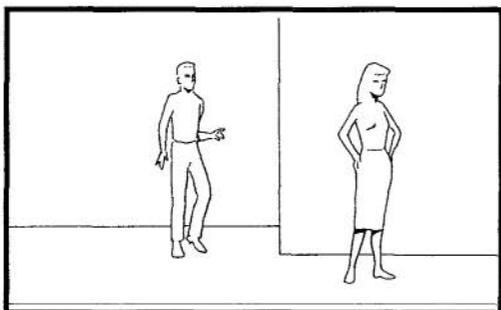
If the glass sheets appear too close together, it produces flat space. If the glass sheets are visually well separated, limited space is produced.

There's a great difference between physical separation and visual separation. Limited space requires both. Two objects may be extremely far apart physically but when the camera looks at them, they may appear to be close together.



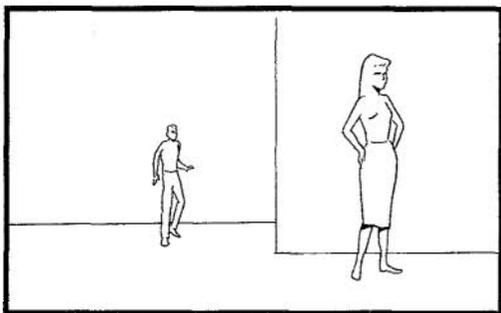
SHOT #2

Shot #2 shows us two walls. The gray wall is only 10 feet from the camera and the white wall is 100 feet from the camera. The two walls have great physical separation, but from the camera's point of view the two walls look very close together. They have no visual separation. The two walls appear to be next to each other. Shot #2 is flat space.



SHOT #3

Shot #3 is not limited, it's flat. Although there is minor size change and frontal planes are emphasized, the visual distance between the two walls is too small.



SHOT #4

In Shot #4 the frontal planes are visually separated. The different sizes of the two people tell us that there's one wall in the foreground and another wall, visually well separated, in the background. Shot #4 is a good example of limited space. It uses many depth cues, but the longitudinal planes have been replaced by frontal planes.

AMBIGUOUS SPACE

Ambiguous space is produced when the viewer is unable to understand the actual size of objects in the frame or when the viewer finds the space of the shot unrecognizable.

Most of the time our shots are not ambiguous. Most pictures contain enough visual information that tells us what we're looking at, the actual size of the objects in the frame, and where the camera is in relation to them. We'll call this kind of picture *recognizable space*. But sometimes the cues to size and space are unreliable and ambiguous space is created.

Ambiguous space can use any combination of flat and deep space cues. We can produce ambiguous flat, deep, or limited space.

The ambiguity can be created using:

1. Lack of movement.
2. Unfamiliar shapes.
3. Tonal and texture patterns (camouflage).
4. Mirrors and reflections.
5. Objects of unknown size.
6. Disorienting camera angles.

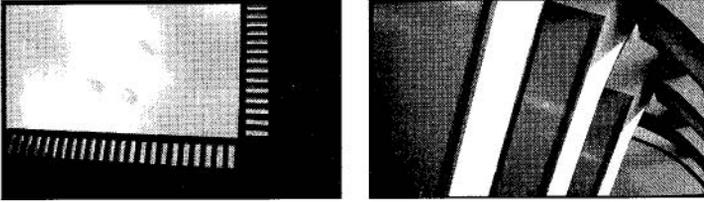
Imagine a horror film where a camera moves down a staircase into a dark basement. On the way down the steps, the space becomes ambiguous. The shadows and light patterns become too abstract to tell where you are, how big the basement is, or what you're actually looking at. The space has become ambiguous because the size and spatial relationships have been made unreliable through tonal pattern and unfamiliar shapes.

Ambiguous space is difficult to maintain. As soon as a person or object of known size enters the frame, it usually gives the audience enough information about the space, and the ambiguous nature of the shot vanishes leaving us with recognizable space.

Of course, we don't have to be in a dark basement to produce ambiguous space. Looking up or down an elevator shaft could create ambiguous space. The shot may contain many depth cues (one-point perspective, shape constancy) but the location might be unfamiliar to the viewer and not contain anything that reveals the actual size of the shaft or the camera orientation.

Imagine a flat, white plaster wall with strange shadows moving across it. It may be ambiguous space. It will appear flat, but there's no definitive information about the actual size of the wall or our relationship to it. Are we looking down at a white floor, up at a white ceiling or across at a white wall? Until something familiar moves into the shot, we may have ambiguous space.

Ambiguous space can also be created by purposefully confusing the physical relationship of objects. The true relationship of objects in the shot may not be revealed until something in the shot or the camera itself changes position.

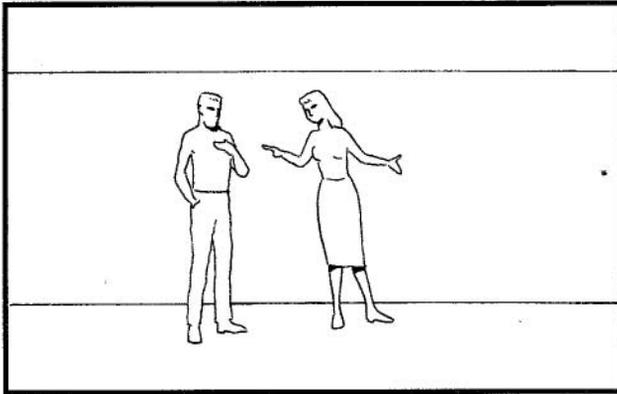


These two shots illustrate ambiguous space.

Interestingly, we find there are certain emotional values already attached to ambiguous space, something we can't say about deep, flat, or limited space. Ambiguous space is often used in horror and mystery films. It usually generates anxiety, tension, or confusion in an audience.

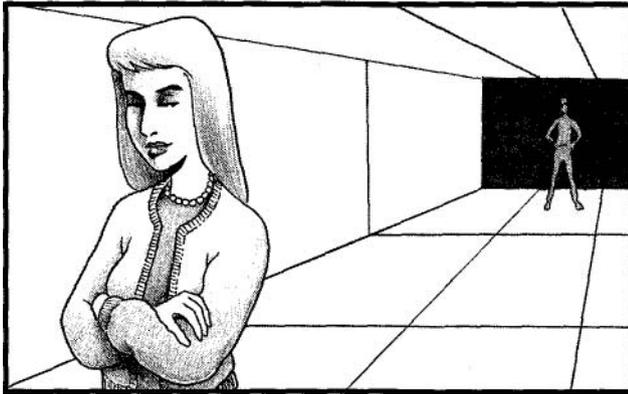
COMPARING THE FOUR SPACE TYPES

We've now discussed four ways to arrange the space of a shot: deep, flat, limited, and ambiguous. If we're going to stage a scene of two people standing in a hallway, we now have four distinctly different ways to produce the space for that shot.



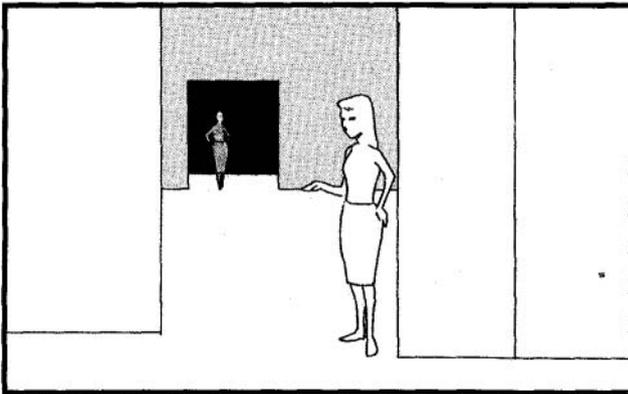
FLAT SPACE

The first version is the flat space rendition of the shot. The walls are frontal and there are no longitudinal planes or converging lines. The actors are staged on the same horizontal plane, and they're the same size. They also have the same amount of textural detail, and any movement will be parallel to the picture plane. The camera will zoom or dolly parallel to the frontal wall plane.



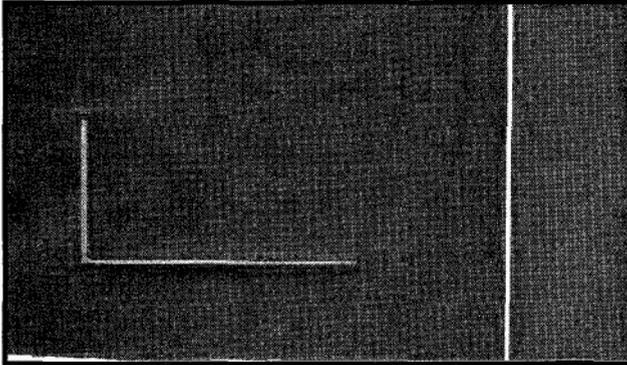
DEEP SPACE

In the second version, we've produced deep space. The shot still exists on a two-dimensional surface, but it has illusory depth. There are several longitudinal planes, one-point perspective, shape change, size difference, textural diffusion, tonal separation, up/down position, and the camera will crane down and dolly in as the foreground actor walks perpendicular to the picture plane.



LIMITED SPACE

The third version produces limited space. The depth cues in this shot include size difference, textural diffusion, up/down position, and tonal separation, but there are no longitudinal planes and the actor's movement will remain parallel to the picture plane.



AMBIGUOUS SPACE

In the fourth version, we have the same shot of two people in the hallway but now the space is ambiguous. The lights are off in the hall, some stray light from a doorway illuminates part of a wall, the camera is low to the floor, and our two actors are somewhere in the dark. It's ambiguous because it's impossible to tell the actual size and spatial relationships in the shot. Where are we in the hallway? How close is the door? Is there a door? Are we upside-down? The ambiguous space has made things unreliable, creating a unique sense of the location.

Each of these four versions of the hallway shot brings the script to life, but each version has visual characteristics that are unique. The best spatial choice for your production will be based on your analysis of the script. You may feel that deep space best visualizes the ideas in your story. Perhaps you think flat space would tell the story best. You might discover that a combination of flat and deep space is necessary to visualize the difference between the characters. You might decide that ambiguous space is best for parts of your production because of its specific effect on the audience. Whatever your choice, you should understand that there are four basic types of visual space and that each has its own visual characteristics. We'll learn how to apply these spatial ideas to visual structure in Chapter 9, "Story and Visual Structure."

CONTROLLING SPACE DURING PRODUCTION

Let's stop defining space and look at a practical situation. Tomorrow you're going to direct a scene and you've decided to use deep space. How can you create deep space on the set?

1. *Emphasize longitudinal planes.* Any wall, floor, or ceiling can generate a longitudinal plane if the camera is in the correct position. You'll want these planes to be as longitudinal as possible, which dictates where you'll put the camera. Keep frontal planes out of the shot because they're too flat. By recognizing the longitudinal planes on your location or set you'll be able to find the vanishing points and include them in the shot if you want. The creation of longitudinal planes and vanishing points is probably the most important way to create deep space.

2. *Stage movement perpendicular to the picture plane (towards or away from the camera).* Some directors call this "staging in depth." This staging will help emphasize size difference and produce illusory depth.

3. *Take advantage of the tonal separation depth cue.* Ask the cinematographer to light the scene in a contrasty manner and make objects in the foreground brighter than objects in the background.

4. *Move the camera.* Get a dolly, lots of dolly track, and a crane. To create deep space, you'll want to keep the camera moving as much as possible. Dollying in and out, tracking left and right, and craning up and down will help produce deep space. You can move the camera without a dolly. Hand-hold the camera or use special rigs and harnesses to help you move the camera smoothly.

5. *Consider using a wide-angle lens.* A wide-angle lens has a wider field of view and a greater ability to include more depth cues in the shot. Wide-angle lenses also have a greater depth of field than other lenses. Depth of field refers to the area in front of the lens that is in acceptably sharp focus. Objects must be in focus if they're going to read as depth cues.

Now let's assume that you're going to shoot a scene using flat space. You can create the space by taking advantage of the flat space cues.

1. Eliminate the perspective of longitudinal planes and emphasize frontal planes.

2. Stage the actors parallel to the picture plane. Keep movement parallel to the picture plane. This is sometimes called "flat staging."

3. Ask your cinematographer to light the scene more flatly and condense the gray scale. It will be important to reduce tonal contrast. The production designer should have condensed the brightness level of the sets and reduced the general tonal range to any third of the gray scale. The color range should be limited to all warm or all cool colors. Reversing the depth cue of color and tonal separation will further enhance the flat space. Remember, warm colors and brighter backgrounds appear to advance, and cool colors and darker foregrounds tend to recede.

4. You won't use a dolly or crane for camera movement unless the dolly moves parallel to frontal planes. A tripod and a zoom lens will be fine because you only need to tilt and pan to maintain flat space. Your crew will appreciate the convenience a dolly provides, but it isn't needed for production. Zooming will keep the space flat, but if you hate the zoom lens then don't zoom.

5. Consider using telephoto lenses that will exclude depth cues because of the lens's narrow field of view. The longer lens will force you to stage objects further away from the camera, eliminating the depth cues of size difference and textural diffusion. When objects are the same size, the picture looks flatter. Don't be fooled into thinking that a telephoto lens flattens the image. See Part B in the Appendix for a complete explanation of lenses and space.

6. A shallow depth of field will allow the backgrounds to go out-of-focus. Blurred objects create flat space.

Part One of this chapter has outlined the basic types of visual space. But space is a complex visual component. In Part Two we'll discuss some secondary properties of space.