Depth Cues

The eight depth cues

Humans have eight depth cues that are used by the brain to estimate the relative distance of the objects in every scene we look at. These are focus, perspective, occlusion, light and shading, colour intensity and contrast, relative movement, vergence and stereopsis.

The first five have been used by artists, illustrators and designers for hundreds of years to simulate a 3D scene on paintings and drawings. The sixth cue is used in film and video to portray depth in moving objects. However it is the last two cues that provide the most powerful depth cue our brains use. The best 3D programmes and movies combine as many of these eight depth cues to make a more convincing 3D image.

1. Focus

When we look at a scene in front of us, we scan over the various objects in the scene and continually refocus on each object. Our brains remember how we focus and build up a memory of the relative distance of each object compared to all the others in the scene.

Out of focus

Out of focus

In focus

In focus

2. Perspective

Our brains are constantly searching for the vanishing point in every scene we see. This is the point, often on the horizon, where objects become so small they disappear altogether. Straight lines and the relative size of objects help to build a map in our minds of the relative distance of the objects in the scene.

Vanishing point
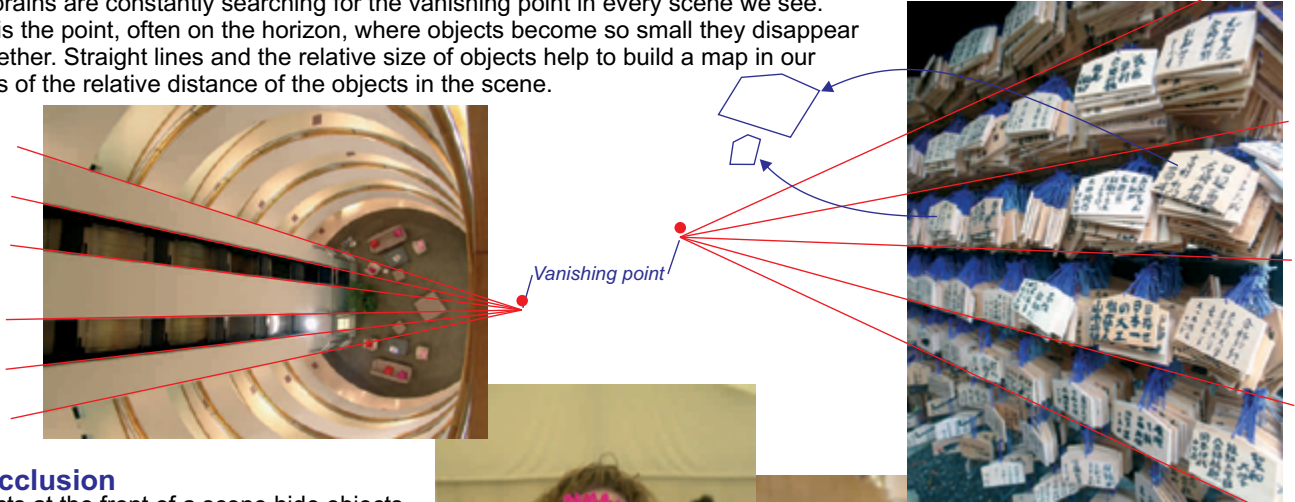
3. Occlusion

Objects at the front of a scene hide objects further back. This is occlusion. We make assumptions about the shape of the objects we see. When the shape appears broken by another object we assume the broken object is further away and behind the object causing the breakage.
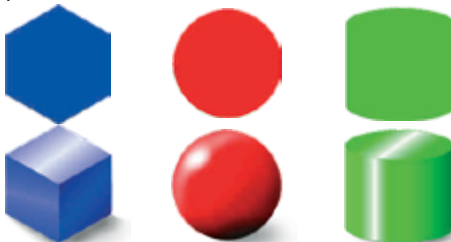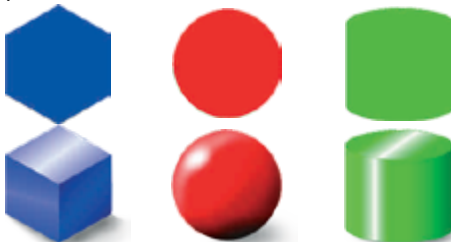
4. Lighting and shading

Light changes the brightness of objects depending of their angle relative to the light source. Objects will appear brighter on the side facing the light source and darker on the side facing away from the light source.

Objects also produce shadows which darken other objects. Our brains can build a map of the shape, and relative position of objects in a scene from the way light falls on them and the pattern of the shadows caused.
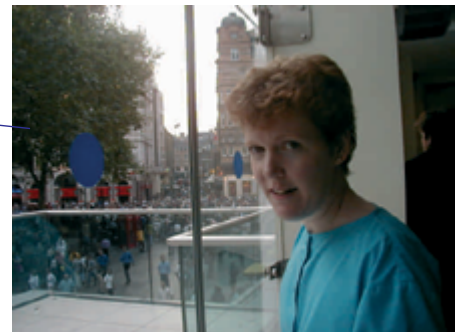
The flower obscures the face, therefore the flower must be in front.

Teacup obscures the teapot

Simple shapes with no shading.

Same shapes with shading gives a powerful sense of depth.

The light on the left and shadow on the right provides a very strong sense of 3D shape and form.

5. Colour intensity and contrast

Even on the clearest day objects appear to lose their colour intensity the further away that they are in a scene. Contrast (the difference between light and dark) is also reduced in distant objects. We can build a map in our minds of the relative distance of objects from their colour intensity and the level of contrast.


Unsaturated colours

Saturated colours

6. Relative movement

As we walk through a scene, close objects appear to be moving faster than distant objects. The relative movement of each object compared to others provides a very powerful cue to their relative distance. Cartoonists have used this to give an impression of 3D space in animations. Film and television producers often use relative movement to enhance a sense of depth in movies and television programs.

Note : Unfortunately, it is impossible to show this depth cue on a static poster.

7. Vergence

Vergence is a general term for both divergence and convergence. If we look an object in the far distant both our eyes are pointing forwards, parallel to each other. If we focus on an object close up, our eyes converge together. The closer the object, the more the convergence. Our brains can calculate how far away an object is from the amount of convergence our eyes need to apply to focus on the object. Film and video producers can use divergence as a trick to give the illusion that objects are further away, but this should be used sparingly because divergence is not a natural eye movement and may cause eye strain.

Interoccular distance or inter-pupillary distance (about 65mm)
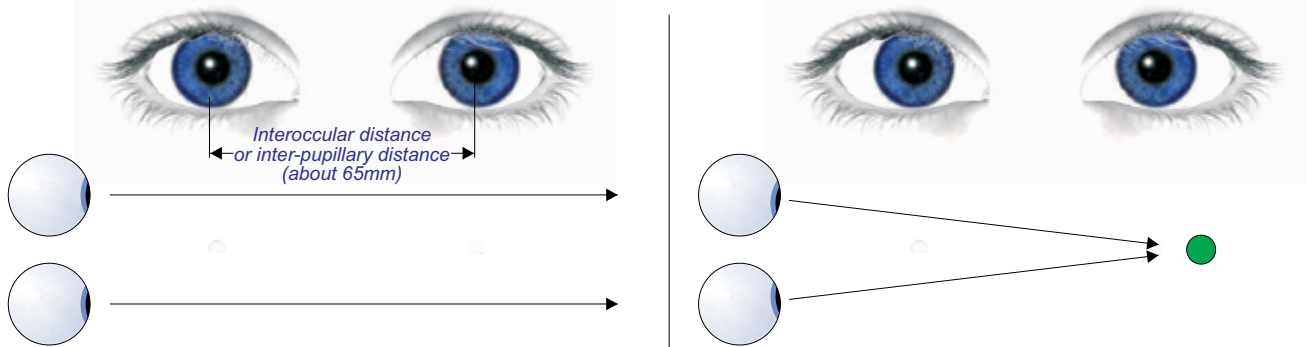
8. Stereopsis

Stereopsis results from binoccular vision. It is the small differences in everything we look at between the left and right eyes. Our brains calculate which objects are close and which objects are further away from these differences.

The statue appears slightly to the right in the left eye image when compared to the buildings behind from the right eye image. The brain interprets this as the statue being nearer than the buildings.