A LINE ON LIFE

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Visual Depth Cues: Near or Far?

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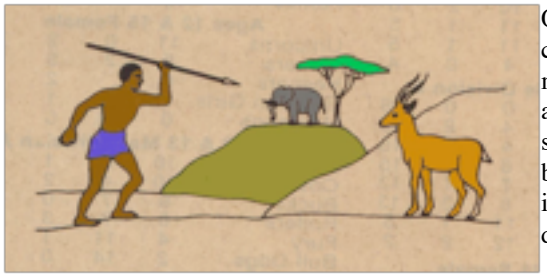
When you look around, why do some objects appear closer and other objects seem farther away? (Some wise guy might say, "*Because they are further away*.")

You can tell the relative distance of objects, because of two major types of visual depth cues – monocular and binocular. **Binocular cues** require the use of both eyes, while **monocular cues** only need one eye. We will only discuss monocular cues in this column.



One monocular cue is **relative size**. If a familiar object casts a smaller image in our eye, we assume it has not merely shrunken. It is merely farther away. In the adjacent illustration, you assume the man is aiming the spear at the antelope rather than a tiny elephant. This is because you are familiar with elephants, allowing you to interpret the smaller image as an indication of greater distance.

However, a second monocular cue helps you perceive depth in this illustration. **Interposition** or **overlap** is when the image of one object partially covers the image of another. In this case, both the man and antelope are perceived as being closer than the hills, because they block part of them out. Likewise, those two hills overlap the center (green) one, blocking portions of it from view. This contributes to our perception that the elephant is much farther away than the antelope.

Linear perspective is another monocular cue. When parallel lines recede in the distance, they seem to converge. To test this out, all you need to do is look down a street, a highway or railroad tracks. (Because this is a monocular cue, don't forget to close one eye.)

Shadowing is another monocular cue for depth. There are two types of shadows – attached and cast. An **attached shadow** is on the object, while a **cast shadow** is projected on another surface by the object. In the next figure, the first ball (1) does not seem solid. It is perceived more as a flat circle. By adding shadows (2), it appears more like a solid ball resting on a surface. If the cast shadow is no longer attached to the image of the ball (3), the ball appears to be floating above the surface.

Although there are other monocular cues, the last one to be discussed is **relative motion** or **motion parallax**. If you are riding in a vehicle, this cue becomes very evident. When you look out of a side window at a right angle to your direction of travel, objects will seem to move past at different rates. Close objects will seem to move very quickly in the opposite direction to your travel. Those farther away seem to move past more slowly. (If you are in a car, please let someone else drive if you are going to watch this.)

However, motion parallax is a little more complex than this. To some extent, the effect changes depending on your object of fixation within your visual field. Objects close to your **fixation point** – the object you are looking at – will move *little or not at all*. In contrast, those between you and your fixation point will seem to move in the *opposite direction* to your travel. At the other extreme, objects beyond your fixation point will seem to move *along with you*. (This is why some small children believe that the moon is "*following*"

them. When they walk in one direction, the distant moon seems to go along with them. Even if they reverse their direction, the moon will still seem to move with them.)

With these and other monocular cues, one-eyed people can walk, drive and even fly airplanes. Although it is better to have both eyes, one eye is enough to tell whether something is nearer or farther away. In another article, we tell you why two eyes are better than one.