

Our Mathematical Senses

The Geometry Vision

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Lecture - 12

Video 3A: three views of a box

So now we've used vanishing points to solve some drawing challenges. So let's continue with those and see if we can use them to draw three-dimensional objects in perspective. So we'll start with a box. So far we've used vanishing points to draw lines on the ground plane, like these railway tracks. But we haven't drawn lines that lie off of the ground. So that's why I want to look at boxes, which do involve lines on the ground plane, but also involve lines that are off of the ground plane, like these ones here.

So how do we draw a box in perspective? To do that, let's do a quick perspective drawing 101. To stand in for a box, I'm using this sponge here, this rectilinear sponge. I want to point out that any box has three dimensions. Length, height, and of course depth, which we couldn't see when it was in this orientation, but if we tilt the box a little, we can see this axis there, this depth axis.

If we tilt it even up a little bit, we can nicely see all three of these dimensional axes. So a box has three dimensions, three dimensional axes, and from this view we can see them all nicely. In fact, there's correspondingly three ways this box can be oriented with respect to the picture plane. So it could be facing the picture plane front on, like a full face of the box could be parallel to the picture plane, that's this first view. It could be that no face of the box is parallel to the picture plane, but one edge of the box here, well not just one edge, all of these vertical edges are parallel to the picture plane, that's the second way it can be oriented.

Or it could be that none of the edges are parallel to the picture plane. In this box here, none of the dimensional axes are parallel to the picture plane, which is a third way that

our box can be oriented with respect to the picture plane. There's special terminology that artists have for these three orientations. The first is called one point perspective because there's a single vanishing point on the horizon that the edges of the box that are not parallel to the picture plane are going to converge to. The second is called two point perspective because although you can't see them in this image, there's now two vanishing points that various edges of the box are going to converge to.

These edges are going to converge to a vanishing point somewhere around here, and these edges are going to converge to a vanishing point somewhere way out here somewhere. But there's going to be two vanishing points given this orientation. Finally, this is called three point perspective because there's going to be three different vanishing points that the various edges of your box are going to converge to. Once again, we're going to get a vanishing point somewhere out here, another one somewhere out here, and another one which is very hard to see in this picture, but it's actually up. This edge and this edge are now slowly converging to each other.

If we just keep going up from here, we'll eventually get to that third vanishing point. Let's just go through one point perspective, two point perspective, and three point perspective a little more carefully. Going first one point perspective, basically that means two of the dimensional axes are parallel to the picture plane. The remaining edges converge to that single vanishing point. To draw a box in one point perspective, start by just drawing a square or rectangular face anywhere on your picture plane.

Figure out where you want your vanishing point to be, and then just connect all the points to your vanishing point. You'll have to choose where you want your boxes to end, but it's pretty easy to draw boxes in one point perspective. By the way, to draw this line which is parallel to this line, or this line which is parallel to this, I'm using measuring devices and stuff now. To do this, you're not required to only use a straight edge. What about two point perspective? Remember, in two point perspective, one of the dimensional axes is parallel to the picture plane.

The remaining two dimensional axes will converge to two distinct vanishing points on the horizon line. To draw a box in two point perspective, you need to pick your two vanishing points and pick an edge somewhere on your picture plane. Then just connect the end points of your edge to your vanishing points and pick where you want your box to end and fill in those lines. There's your box in two point perspective. Let's do another example, which is lower down below the horizon line.

Here's our edge. We connect it up to our vanishing points and then we pick where we want our box to end. Again, we have to connect those points up to our vanishing points,

but we get our box quite easily that way. That's two point perspective. Finally, there's three point perspective in which none of the dimensional axes are parallel to the picture plane.

In this case, the remaining edges converge to three distinct vanishing points. One, two, three. To draw a box in three point perspective, you start by drawing just a point somewhere on the picture plane as well as your three vanishing points. Once again, it's just a matter of connecting everything up. Connect this is going to become our corner point of the box.

Connect it to our three vanishing points. Then choose places where you want your box to end and connect those end points as well to your vanishing points. Finally, you'll get your box in three point perspective. I know this was kind of fast. The best way to understand it is to try it out yourself.

Why don't you try out these techniques? I'm sure you can create some interesting drawings based on boxes drawn in perspective and oriented in various ways. To help you get started, the next video gives a hands-on tutorial of how this particular image was drawn.