a guide to 3D
Introduction

3D graphics is fast becoming an integral aspect of creative design. Traditional print-based design work is becoming increasingly 3D. 3D design is also a critical tool for architecture and product design. In addition, you can also find 3D on the Web, in video games, educational CD-ROMs, and even in corporate presentations.

In the past, the high costs of 3D hardware and software have made it prohibitive for the 3D-curious to explore this new world. However, recent technological advances have made 3D tools more intuitive and affordable. Still, to the 3D neophyte, the thought of sitting down with a big, complicated manual and a full-blown 3D application seems like a daunting proposition.

Have you been searching for an easy way to learn about the basics of 3D? A painless way to integrate 3D into your designs? If you are a web or print designer, chances are the answer is "Yes"! And Vertigo has the solution for you. We’ve prepared this Guide to 3D, which explains in non-technical language the basic concepts of the three dimensional world. Once you understand these principles, you will have the foundation for exploring a whole new dimension. And it’s not as hard as you think — after all, we live, work and breathe in 3D space!

This guide is brought to you by Vertigo Technology. We know about 3D. For the past 10 years, we have been enabling customers like Sony, BBC, CNN, Walt Disney Studios and Time Warner Interactive to create award-winning 3D graphics and film special effects. Our new suite of 3D tools brings this same technology to you, right inside Adobe Photoshop and Adobe Illustrator. Vertigo software makes it easy to learn the basic concepts of 3D in an intuitive, interactive, and fun way. So let’s get started.
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3D - What does it mean?

The term 3D refers to three dimensions: width, height, and depth. These dimensions are represented by a coordinate system with three axes:

X axis (width)  Think of the x axis as moving along the horizon. On your computer screen this translates as moving left and right.

Y axis (height) The y axis represents the vertical directions. On your computer screen the y axis translates as up and down movement.

Z axis (depth)  Traditional layout and design applications such as Adobe Illustrator and Adobe Photoshop utilize the x and y axes. Three-dimensional applications also utilize a third axis: the z axis. Think of the z axis as moving forwards and backwards in your scene, or moving in and out of your computer screen.

The space in which you work in 3D is called the world. Any location in the 3D world can be indicated by its numerical values on each axis. The 3D world is infinite; you can move anywhere along the x, y, and z axes.

When applied to computer graphics, the term 3D is a technique that uses the calculation power of computers to represent images with width, height and depth, and display them on a two-dimensional computer screen (your monitor).
Setting the scene

Working with 3D is much like working in a photography studio where you have a model or group of models, lighting, and a camera. To get the picture you want, you position your models, adjust your lighting, then move your camera until you've got just the right view.

Picture your workspace as a studio into which you bring your 3D models and build a scene. You can add lights and position them to get the look you want. There's even a camera — in fact, everything you see in the 3D world is seen through the lens of a virtual camera. Imagine you're looking through a virtual camera when working in 3D. By moving the camera and changing your camera view, you move through 3D space.
A 3D model is essentially a skeleton made up of many polygons. A polygon is a flat, closed plane bounded by straight lines. The point at which two or more lines meet is a vertex. A simple shape, such as a box, can be created using just a few polygons, while a more complex shape, such as a detailed model of a human being, may require thousands and thousands of polygons.

Although polygons are flat, they can be used to build curved surfaces, such as the sides of the letter "O." By using large numbers of very small polygons, you can approximate the curvature of a surface. The more polygons you use, the smoother your model appears. However, the more polygons used to create a model, the more information the computer has to calculate, and the longer it will take to render an image and move your model in your workspace.

Most 3D models start with primitives, which are basic solid objects such as cubes, spheres and cones. You can use these simple forms as building blocks to create more complicated models. You can also create more complex shapes by deforming these primitives, using polygons in combination, or creating free-form 2D drawings, then extruding and shaping them.
Surface Characteristics

How a model looks depends partly on which surface characteristics have been applied to it. Surface characteristics include textures and colors you apply to a model to give it a particular look. For example, a model can look like it's made of clouds, wood, or plastic, depending on which surface characteristics have been applied. A wireframe rendering of a model shows only its skeleton, leaving out the surface characteristics.

Other types of surface characteristics include transparency and translucency, so that your model's surface interacts with lighting effects. Models can also be given glowing-type attributes, so that they seem to give off light from within, or reflective attributes, so that they seem to act like a mirror.

The artist's success in achieving a good sense of realism depends greatly on the surface characteristics applied to a model. Some objects are almost exclusively defined by their surface characteristics. This simple sphere is transformed into a glass ball, a banded ball, a puff of clouds, or a ball made of rocks depending on the textures applied.
Lighting is one of the most important aspects in a 3D scene. Just as we need light to see the world around us, a 3D world needs light to illuminate its scene. Without light the components of your virtual world cannot be perceived visually. Proper lighting controls are necessary to appreciate the shapes, colors, and textures of your 3D designs.

Let’s return to the analogy of the photography studio. When beginning a shoot, a traditional photographer spends quite a bit of time adjusting lighting parameters in order to get the most from the model. Proper lighting brings out subtle features in the model’s face and presents them in a pleasing way; the translucency of the skin, delicate bone structure, brightness and sparkle in the eyes can all be showcased. A poorly planned lighting arrangement, on the other hand, may result in dark shadows around the eyes, dull skin tone, and flattening of fine facial features.

Good lighting is also crucial as it helps to tie together all the elements in your scene and create an overall mood or feeling. Proper lighting parameters contribute to the unquantifiable but distinct concept of “atmosphere”.
There are many different types of lighting controls, which produce a variety of realistic lighting effects, including shadows, reflections, and refractions.

Ambience is the overall lighting in a scene. It has no definite source and does not come from any particular direction, so it’s dispersed evenly throughout the scene. Most 3D programs allow you to adjust both ambience color and intensity. If you set your ambience color to be blue, your model will have an even, bluish cast. The intensity level determines exactly how blue your model appears.

Point light comes from a light source and radiates equally in all directions from the source, like light from a bare light bulb.

Directional lights, such as spotlights, let you stipulate various controls such as direction and angle. Aiming a directional light at a model helps it to stand out in the scene and increases dramatic effect.

Some types of lighting allow for special effects like gels or masks. Gels let you modify the color or effect of a light. Masks cover part of the light source and help determine the shape of the cast light.

Lights can be virtually any color. The color of a light affects how a 3D model looks. For example, if you shine red light on a white model, the area the light hits appears red.
Everything in the 3D world is seen through the lens of a virtual camera. When you move around in the workspace, you're actually changing the point of view of the camera.

You can use the virtual camera to look at your model from varying points of view, and also to position and orient your model properly in the 3D world.

A virtual camera can do practically everything a traditional cinematographic camera can do. The terminology remains the same:

- **pan** - rotation of the camera around its y-axis
- **dolly** - movement of the camera along its x-axis
- **boom** - movement of the camera along its y-axis
- **tilt** - rotation of the camera around its x-axis
- **truck** - movement of the camera along its z-axis
- **roll** - rotation of the camera around its z-axis
To see an image of a 3D model, you need to render it. Rendering is like sending film out to be developed. The computer takes all the information about your model, such as its shape, surface appearance, position, lighting, and relationship to the camera, then generates an image.

Rendering creates a two-dimensional image (such as the one you see on your screen) from three-dimensional data. The computer generates an image by calculating information such as a model’s geometry, surface characteristics, lighting, and where it is in relation to the camera. The more information the computer has to calculate, the longer it takes to create an image. For example, an image with five lights takes longer to render than an image lit by only two lights, and a scene with 5 models takes longer to render than one made of two models. Similarly, a model with a high polygon count takes longer to render than a model with a small number of polygons.

**Working Render**

A working render is the image you see while you actually work. A working render is interactive, which means your 3D image is constantly being rendered as you work. You can immediately see the effect of any changes you make to your scene, such as moving the model, lights, or camera.

Most working renders will generate a wireframe render or shaded render. A wireframe render shows only the skeleton information with no surface characteristics. A shaded render gives a model a very basic surface, such as a solid color or a simple texture. Using a wireframe working render usually speeds up your results, as the computer has less information to calculate.
A final render is the final image you generate. It is determined by which renderer you choose. Many renderers allow for added detail, such as shadows and antialiasing. Aliasing occurs when the details of an image are smaller than the size of the individual pixels used to represent the image. This usually results in jagged edges on your images, especially those with diagonal or curved profiles. Anti-aliasing reduces this jagged look by appropriately blending the colors of the pixels that make up the edges of a model.

Your final image can have a variety of different outputs depending on the renderer you choose. Some renderers give you photorealistic detail, while others may give you interpretive and artistic results, such as cartoon-like images.
Getting started

So there you have it. 3D really isn't the great mystery you thought it was. Now that you know the basics you can get started right away. Here at Vertigo we’ve developed a series of easy-to-use 3D tools that introduce you to many of the concepts discussed in this guide. Better yet, they're all accessible as plug-ins right inside your favorite design applications, Adobe Photoshop and Adobe Illustrator. Tryout versions of these Vertigo products are available from our website.

For Photoshop

Vertigo 3D HotTEXT lets you instantly create 3D text, flow it along your custom 3D path, add a texture or color, light your scene, and render your 3D text into a Photoshop layer. The award-winning LightWorks renderer comes standard with Vertigo 3D HotTEXT to help you create Hollywood-quality 3D content for print, web or multimedia applications.

Vertigo 3D Dizzy instantly brings 3D models to Adobe Photoshop with the click of a mouse. You can change the size, orientation and position of your 3D model, plus add custom lighting effects to your scene. Vertigo 3D Dizzy features the Photorealistic LightWorks renderer, or for artistic flair, the ThinkFish LiveStyles renderer.

For Illustrator

Adobe Illustrator 7 users can now flow 3D text along 3D paths from inside Illustrator. Vertigo 3D Words places the 3D text as vector-based 3D objects ready for the Illustrator toolbox. Just type in your 3D text, select a font, add a color, choose a 3D path, then orbit your 3D world to select the right view.

Vertigo 3D PopArt lets you create 3D objects from 2D art. Vertigo 3D PopArt's fully integrated palette looks and feels like Adobe Illustrator. Position, light, and add depth to 2D objects for instant 3D, and can be reconverted back to 2D at any time.

We’re making 3D easy to understand, and easy to use. Because life is 3D.

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