

Design Course

## Basics of 3D Animation

Fundamentals of Computer Animation

by

Prof. Phani Tetali and Sachin Meshram

IDC, IIT Bombay

Source:

<http://www.dsource.in/course/basics-3d-animation>



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<http://www.dsource.in/course/basics-3d-animation/introduction>

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## Introduction

Animation is nothing more but an illusion of motion from imagery that visually interprets and conveys the message it is basically created for. In literal terms, to animate is to give life to. Animation adds the dimension of time to graphics which increases the amount of information which can be transmitted. To create animation, the animator has to be able to tell how a certain thing needs to move through time and space.

An eye for detail is one of the most important skills that an animator should possess. Along with this the animator should be keen on the knowledge of motion, movement and acting. One should observe the life around and how things move. Taking notes, making sketches and trying to give meaning to what is observed can be more helpful.

The key difficulty is to choose the best communicative tools that will be sufficient for the animator to design. The tools should be automatic enough as per animator's designing requirements. Each and every animation requires different tools and skills to create the real world; hence just one single tool cannot be sufficient for the animator.

Animation is of two types:

- Computer-aided and
- Computer generated

The process of digitizing the 2d traditional animation is called computer-aided animation. Whereas the 3d animation, flash and other software's using computer is computer generated animation.



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## History

Most of the initial and well known computer graphics was created by University of UTAH, funded by DARPA. 'Computer Animation' ages back from the time of computer graphics were into existence. 3D animation is often accredited to William Fetter who invented the phrase "Computer graphics". In 1960, as an employee of 'Boeing' he used computers to generate animation for specific models. While in one of the project he created a 3D depiction of a human body which is famously called as 'The Boeing Man'.

In 1976, the innovative use of computer generated animation was used was used by Ed Catmull and Fred Parke in a movie "Futureworld" in the form of a human hand and face to give a high-tech, science fiction look to the film. It was the first commercial use of such techniques.

The technique has been used in various movies, has become a standard in film, television and video games. This started with a film "Star Wars Episode IV: A New hope" written and directed by George Lucas. The animated movie "Toy Story" premiered in 1995 was the first feature - length 3D animated movie which broke the box office records ensuring that the 3D animation would be a staple in the cinematic community for decades to come.

### References:

[http://www.ehow.com/facts\\_5070359\\_history-computer-animation.html](http://www.ehow.com/facts_5070359_history-computer-animation.html)

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## Basics of 3D Animation

**Introduction:**

Third Dimension (3D) computer graphics is '2 dimensional portrayal of the simulated 3D world'. It is the virtual world we see around us.

Use of 3D animation software can be termed as video capturing of the real world which is full of 3D objects and then generating the series of 2D images rapidly to simulate motion in the form of output.

While transferring 2D image in third dimension; a z-coordinate axis has to be added along with the default ones i.e. x-axis and y-axis. In addition to this, we just don't create objects in 3D; but we have to generate the 2D images of the 3D scene which will resemble the 3D objects.

**Example:** An arrangement of a 3D Coordinate axis.

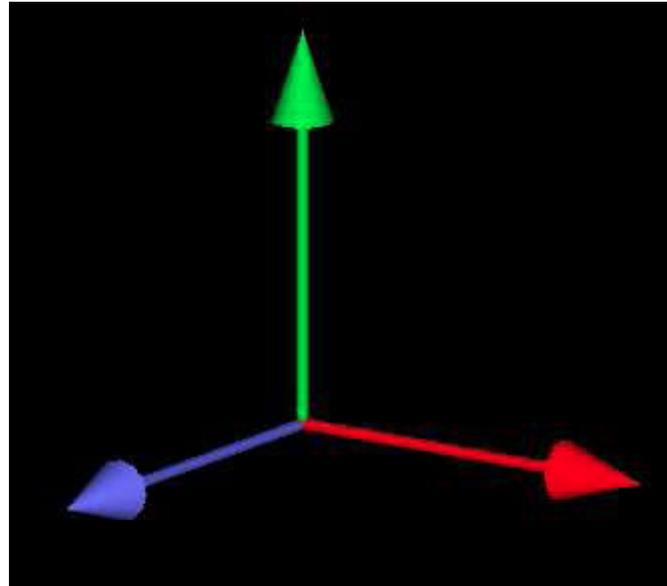


Image axes

It is not difficult to recognize the above image of three arrows in different directions in space. They are just three lines on a 2d surface formed using a thin cylinder and a cone.

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### Co-Ordinate System:

Our first job is to get familiarize with 3D coordinate system. In 3D the x and y axis are arranged in a plane called the xy - plane with z-axis perpendicular to it. But, here the z-axis is divided into two sections by the origin (0, 0, 0). One of the divisions displays the positive z-axis which we have to decide.

The traditional coordinate system recognize xy plane with the screen. The x-axis points towards right in positive direction and the y-axis towards positive upwards. The z-axis is perpendicular to the screen which is the positive direction and the negative into the screen. This is a **right-handed coordinate system**.

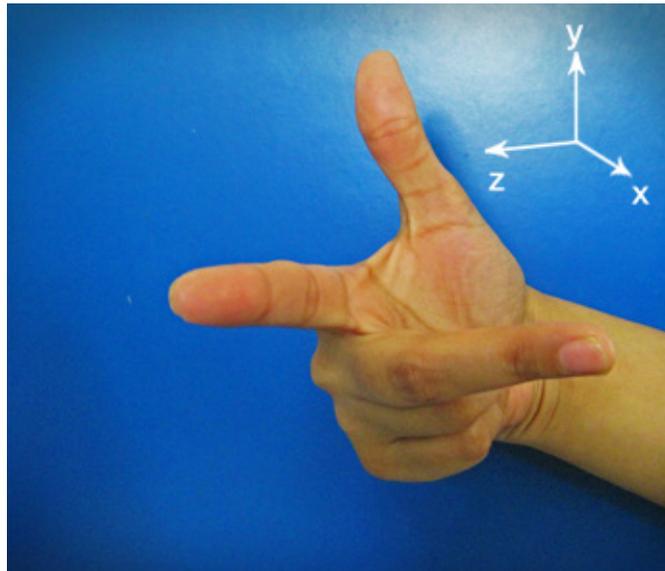


Image right hand rule

If you curl the fingers of your right hand in the direction from the positive x-axis to the positive y-axis, then your thumb points in the direction of the positive z-axis. This is only the traditional coordinate system. For drawing you use a different coordinate system.

There are quite a few co-ordinating systems and these are associated with chain of transforms to one another. The co-ordinates which we use to create an object in 3D world are called the **Object coordinates**.

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In a particular scene; the scale, rotation and position of an object can be altered. The object coordinate system is suitable for the object that is being created. The coordinates which is used to create the complete scene with objects is called the World coordinates. After creating the scene the output can be taken in the form of an image.



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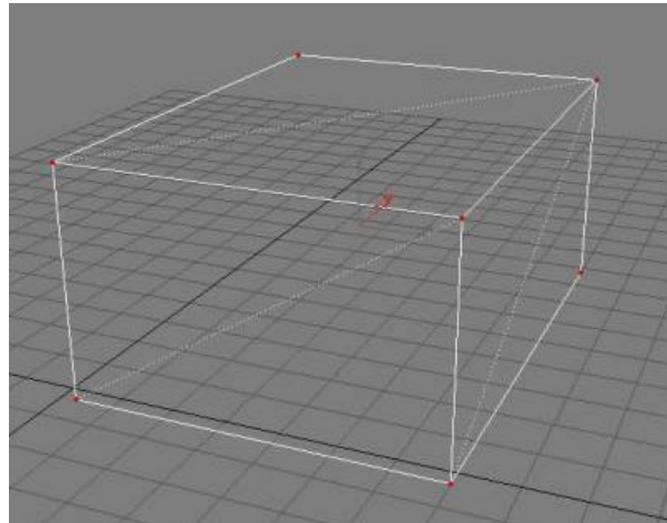
## Objects of 3D Animation

Objects are made up of the following components:

- Vertices
- Edge (Line, Spline or Segment)
- Polygon

### Vertices:

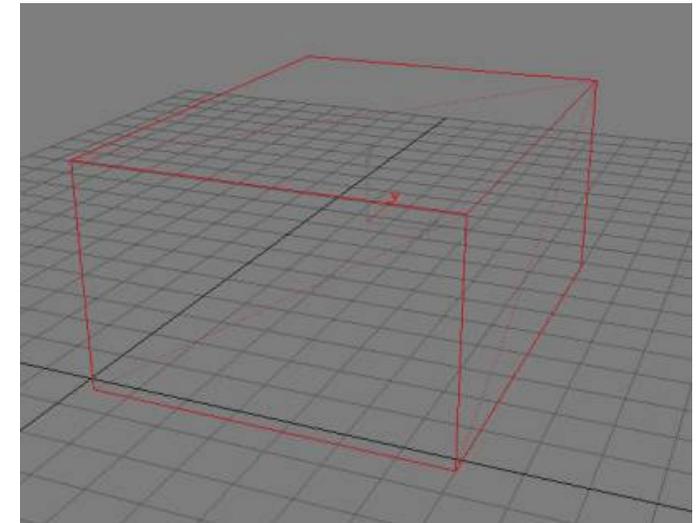
These are the point locations in space with no dimensions, but make the complex objects when grouped with other points.



Vertex

### Edge (Line, Spline or Segment):

An Edge is the set of two points connected by a 2 dimensional line.



Edges

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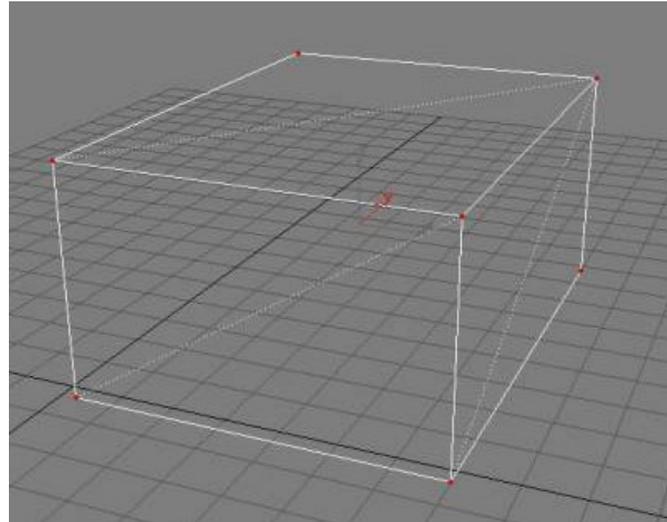
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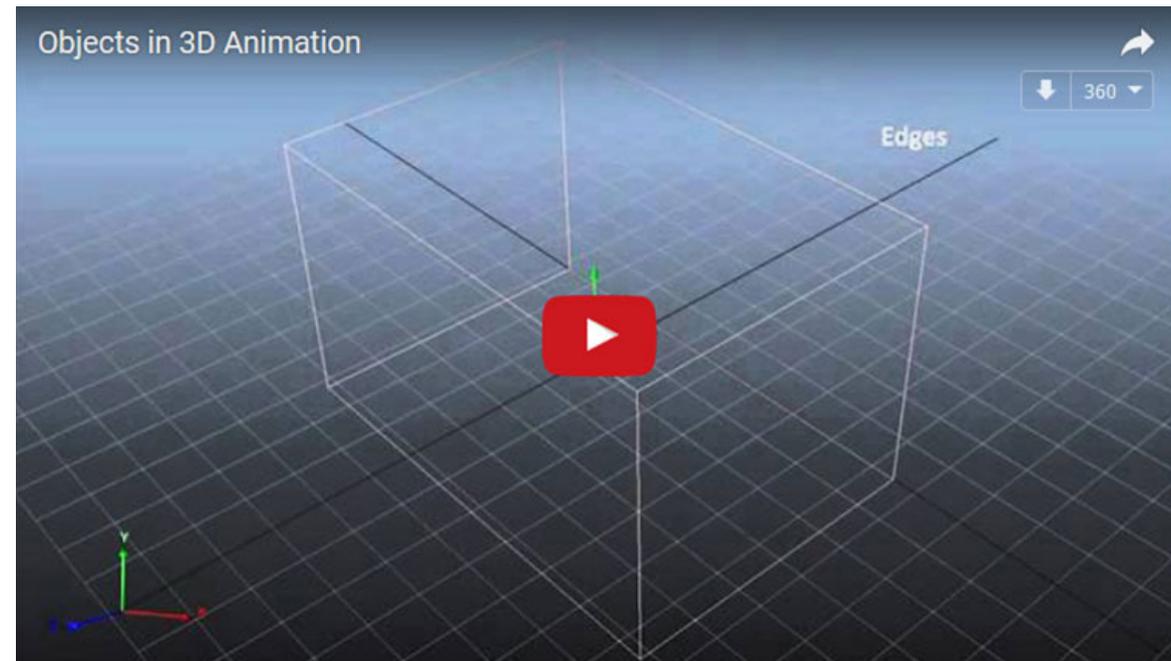
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**Polygon:**

Three or more edges that define a surface is called Polygon.



Polygon



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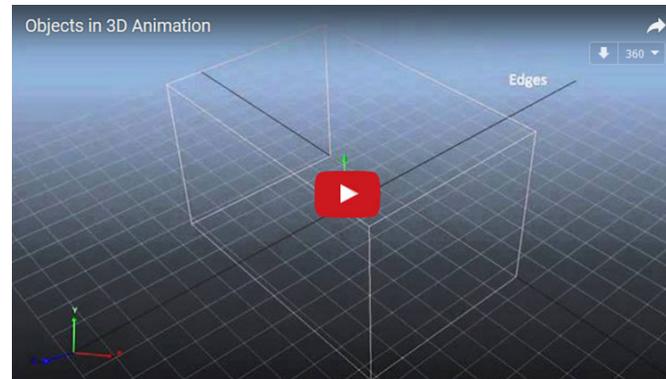
## Video



Introduction



Co-ordinate System



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## Contact Details

This documentation for the course was done by Sachin Meshram at **IDC, IIT Bombay**.

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You could write to the following address regarding suggestions and clarifications:

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