

Basics concepts of 2D and 3D Graphics:

2D Computer Graphics:

2D computer graphics is the computer-based generation of digital images mostly from two-dimensional models (such as 2D geometric models, text, and digital images) and by techniques specific to them. The word may stand for the branch of computer science that comprises such techniques, or for the models themselves.

3D Computer Graphics:

3D Computer Graphics are graphics that use a three-dimensional representation of geometric data (often Cartesian) that is stored in the computer for the purposes of performing calculations and rendering digital images.

EXAMPLE: Human Eyes have 3D Perception and also known as depth perception. With Depth Perception, People see the world in all the three spatial dimensions.

The Visual Cortex: This is located in the one part of the brain. It is responsible for interpreting and processing visual information received from the eyes. The Visual Cortex in each human eye first perceives the three dimensions of space as 2D images.

CONCEPTS FOR BOTH 2D AND 3D:

Both 2D and 3D types of graphics can be created with various software and technics such as Vector graphics, raster graphics, pixel art, 3D Modelling, rendering, animation and more.

- a. **Vector Graphics:** They are digital images created from a series of geometrically defined point lines and shapes. This is done under mathematical equations rather than pixel.
- b. **Raster Graphics:** This is a type of digital image that uses tiny rectangular pixels or picture elements arranged in a grid formation to represent an image.

- c. **Pixel Art:** It is an art form that uses distinct, discrete color elements to create images.
- d. **3D Modelling:** 3D models are used in films, gaming, architecture, product design and more.

APPLICATIONS OF 3D MODELS:

3D models are used in most of the applications like:

1. Entertainment and media: 3D modelling is used extensively in VFX, video games and films and TV. It isn't at all uncommon to see productions that are entirely created using 3D software.

2. Architecture and real estate: Architects and designers utilize 3D modelling to create detailed virtual representations of buildings, interiors and landscapes. These models are very useful in communicating the designer's vision to prospective investors, clients and the public.

3. Product design and manufacturing: 3D modelling is an efficient and environmental-friendly way to develop prototypes, visualize product ideas and simulate functionality pre-production. Designers can refine ideas and make countless iterations before a product is finalized.

4. Automotive and aerospace industries: 3D modelling is used in both the design and testing of vehicles and their components and in the advertising and marketing of them. Many commercials of cars and airliners feature 3D generated imagery that looks so realistic it's nearly impossible to tell they aren't real camera footage. 3D allows for realistic simulations, which can be used in testing an idea or vehicle before it's built.

5. Medical and healthcare: 3D modelling is utilized in medical imaging and surgical planning. Accurate recreations of organs, bones and tissues can be used to aid in diagnosis, treatment planning and aid medical research.

6. Virtual reality (VR) and augmented reality (AR): 3D modelling is essential in creating immersive experiences. VR and AR have several applications and can be used across nearly any industry.

7. Education and training: 3D modelling is used in educational settings to teach concepts in a variety of subjects, from biology, to geography and even history. It allows students and professionals to interact with virtual models and simulations in safe, controlled environments. A great example of this is pilots flying in a flight simulator.

Basics concepts of 2D for Game Avatar:

- 1. SPRITES:** In 2D game characters or avatars are represented as sprites. These are 2D images or animations that can be moved, flipped or rotated to create the illusion of movement.
Sprites are commonly used for characters, Enemies, Items and other game elements. It also has a sprite sheet.
Sprite Sheet is a single image file that contains multiple frames or animations of a sprite. Instead of loading individual images, developers can load the sprite sheet into memory once and then display specific frames or animations as needed. It is a grid of smaller images; each will represent a different frame or animation of a sprite.
Example: Arcade ballon game.
- 2. ANIMATION:** The Characters are made up of multiple sprites arranged in a sequence to create fluid movements. This can involve walking, jumping, attacking, etc.
- 3. PIXEL ART:** 2D and 3D avatars can be designed in pixel art, using grid of pixels to create the characters. This style is common in indie games (Independent games), retro style games. It is a video game that usually

made by smaller development teams or even individuals on their own without financial or technical support from large game publishers.

Example: Mine Craft was an indie game created by solo developer Markus Persson, also known as Notch. The game begins in 2009 and later in 2014 indie status changed to the general game.

Basics concepts of 3D for Game Avatar:

1. 3D Models
2. Texturing: Textures are applied to 3D models to give them color, patterns etc.
3. Rigging and Animation: 3D Avatars are rigged meaning a digital skeleton is placed within the model to enable the movement. Animations are created by manipulating the rig.
4. Character Design: This is a crucial form for avatars to have distinct appearance and personality.