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Video Game Graphics

Abstract: Gaming graphics has revolutionized the world with its awe inspiring graphics. The graphics started with text based graphics. A text game or text-based game is a video game that uses text characters instead of bitmap or vector graphics. Text-based games were a popular form of interactive fiction in the 1980s. Second came vector graphics, vector game can also refer to a video game that uses a vector graphics display capable of projecting images using an electron beam to draw images instead of with pixels, much like a laser show. Thirdly came full motion video Full motion video (FMV) games are video games that rely upon pre-recorded television or movie-quality recordings and animations rather than sprites, vectors or 3D models to display action in the game. We then have 2D graphics having parallel projection, Top-Down perspective, Side scrolling games, pseudo 3D. Fourthly came 3D with fixed 3D, first person perspective and third person perspective. 3D games use Anti-Aliasing, Anisotropic Filtering and Ambient occlusion technology to achieve outstanding graphics.

Keywords: Vector Based, 2D, 3D, Stereo, Virtual Reality.

Introduction:

Text Based

Text games are typically easier to write and require less processing power than games

with graphics, and thus were more common from 1970 to 1990. While many of the earliest computer games (Adventure, Zork) relied on language parsing due to the command line-driven, teletype-terminal mainframe environments in which they were developed, the phrase "text-based" is taken to refer not to the user input (though generally keyboard-based) but rather to exclusive use of the fixed-width character display mode, an important distinction to maintain in light of curses based games such as Rogue and their successors, which employed the characters in the text mode as map symbols rather than as parts of words.

Vector Based

Vector graphics refers to the use of geometrical primitives such as points, lines, and curves (i.e. shapes based on mathematical equations) instead of resolution-dependent bitmap graphics to represent images in computer graphics. Vector game can also refer to a video game that uses a vector graphics display capable of projecting images using an electron beam to

draw images instead of with pixels, much like a laser show. Other uses of these overlays were very detailed drawings of the static

gaming environment, while the moving objects were drawn by the vector beam.

Full Motion Video

Full motion video (FMV) games are video games that rely upon pre-recorded television- or movie-quality recordings and animations rather than sprites, vectors or 3D models to display action in the game

2D

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. 2D includes three topics i.e. parallel projection,

Top-Down Perspective, Side Scrolling games. These 2D games where in trend in early 1990s with games like Commandos, Mario, Grand Theft Auto, etc.

Parallel Projection:- Games utilizing parallel projection typically make use of two-dimensional bitmap graphics as opposed to 3D-rendered triangle-based geometry, allowing developers to create large, complex game worlds efficiently and with relatively few art assets by dividing the art into sprites or tiles and reusing them repeatedly (though some games use a mix of different techniques)

Top down Perspective:-Top-down perspective, also sometimes referred to as bird's-eye view, over world, overhead view or helicopter view, when used in video games refers to a camera angle that shows the player and the area
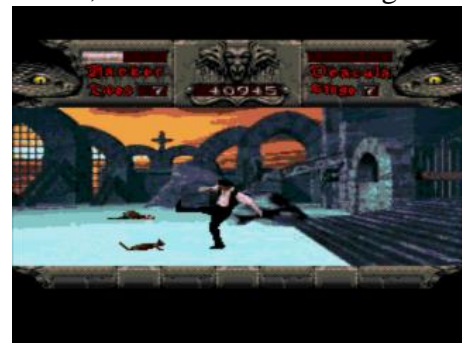
around them from above. However a top down view does not show all the details properly, as the front, and side views are not seen clearly. Some of the games using top down perspective are GTA 1, SimCity, Pokémon, and Rail Road Tycoon.

Side-scrolling game:-A side-scrolling game

or side-scroller is a video game in which the viewpoint is taken from the side, and the onscreen characters generally move from the left side of the screen to the right. Games of

this type make use of scrolling computer

display technology, and sometimes parallax scrolling to suggest added depth. For a side-scrolling applications the vertical resolution of the graphical display region must match the vertical resolution of the background image. Pseudo-3D:- 2.5D ("two-and-a-half-dimensional"), 3/4 perspective and pseudo-3D are informal terms used to describe graphical projections and techniques that try to "fake" three-dimensionality, typically by using some form of parallel projection, wherein the point of view is from a fixed perspective, but also reveals multiple facets of an object. A Pseudo code can be achieved by programming languages like C# and Java. A Pseudo graphics can be achieved by divide your screen into a number of strips and use perspective-projection to calculate the texture-coordinates (scaling and y position inside the road-texture) for each strip. Then to draw the portion of the texture into the strip, resulting in a road that vanishes in the distance.

3D:

3D computer graphics (in contrast to 2D computer graphics) are graphics that utilize a three-dimensional representation of geometric data that is stored in the computer for the purposes of performing calculations and rendering 2D images. 3D computer graphics rely on many of the same algorithms as 2D computer vector graphics in the wire frame model and 2D computer raster graphics in the final rendered display.

Fixed 3D:- Fixed 3D refers to a three-dimensional representation of the game world where foreground objects (i.e. game characters) are typically rendered in real time

against a static background. Its main advantage is to display as much details as possible using minimal resources. Backgrounds in fixed 3D games tend to be pre-rendered two-dimensional images, but are sometimes rendered in real time (e.g. Blade Runner

First Person perspective:-A first-person narrative is a story from the first-person

perspective: the viewpoint of a character writing or speaking directly about themselves. In First person the only things can be viewed is hosts hands, or weapons.

Third Person perspective:-Third person refers to a graphical perspective rendered from a

view that is some distance away (usually behind and slightly above) from the player's character. In third person graphics if the player stands behind the wall the game camera may jerk or end in awkward positions. Developers have tried to alleviate this issue by implementing intelligent camera systems, or by giving the player control over the camera. Here are three primary types of third-person camera systems: "fixed camera systems" in which the camera positions are set during the game creation; "tracking camera systems" in which the camera simply follows the player's character; and "interactive camera systems" that are under the player's control. Examples or this person games are Assassins Creed Syndicate, Dead Space, Quantum Break, etc.

The two of the perspectives i.e. first person and third person in advanced real-time graphics use the some of the following

components below they are:-

Anti-Aliasing: In computer graphics, antialiasing is a software technique for diminishing jaggies - stairstep-like lines that

should be smooth. Jaggies occur because the output device, the monitor or printer, doesn't have a high enough resolution to represent a smooth line. There are basically two types of anti-aliasing modes they are super sampling and multisampling. In multisampling anti-aliasing, if any of the multi sample locations in a pixel is covered by the triangle being rendered, a shading computation must be performed for that triangle. However this calculation only needs to be performed once for the whole pixel regardless of how many sample positions are covered; the result of the shading calculation is simply applied to all of the relevant multi sample locations.

Supersampling is a spatial anti-aliasing method to smoothen the image. The aim of Supersampling is to reduce this effect. This is achieved by rendering the image at a much higher resolution than the one being displayed, then shrinking it to the desired size, using the extra pixels for calculation.

Some of the algorithms used for it are Grid, Random, Poisson disc, Jittered, Rotated Grid. The anti-aliasing samples are FSAA, SSAA, SMAA, MFAA, MLAA, CSAA, EQAA, FXAA and TXAA

Anisotropic Filtering: In 3D computer graphics, anisotropic filtering (abbreviated AF) is a method of enhancing the image quality of textures on surfaces of computer graphics that are at oblique viewing angles with respect to the camera where the

projection of the texture (not the polygon or other primitive on which it is rendered) appears to be non-orthogonal (thus the origin of the word: "an" for not, "iso" for same, and "tropic" from tropism, relating to direction; anisotropic filtering does not filter the same in every direction).

Bilinear filtering is a texture filtering method used to smooth textures when displayed larger or smaller than they actually are. Bilinear filtering uses cells to perform bilinear interpolation between the four texels nearest to the point that the pixel represents (in the middle or upper left of the pixel, usually).

Trilinear filtering is an extension of the bilinear texture filtering method, which also performs linear interpolation between mipmaps. To solve bilinear filtering, trilinear filtering interpolates between the results of bilinear filtering on the two mipmaps nearest to the detail required for the polygon at the pixel. If the pixel would take up 1/100 of the texture in one direction, trilinear filtering would interpolate between the result of filtering the 128*128 mipmap as y1 with x1 as 128, and the result of filtering on the 64*64 mipmap as y2 with x2 as 64, and then interpolate to x = 100.

Ambient Occlusion: Ambient occlusion is a method to approximate how bright light should be shining on any specific part of a surface, based on the light and its

environment. Ambient light is a light type in computer graphics that is used to simulate global illumination.

Variants of ambient occlusion are:-
SSAO-Screen space ambient occlusion
SSDO-Screen space directional occlusion
HDAO-High Definition Ambient Occlusion
HBAO+-Horizon Based Ambient Occlusion+
AAO-Alchemy Ambient Occlusion
ABAO-Angle Based Ambient Occlusion
VXAO-Voxel Ambient Occlusion

Secondary Data: Video games started in 1973 but they were text based. After that vector based graphics came into picture which used geometrical primitives such as line, point, curves. 2D game had more details as compared to vector based games. It had top down perspective, side scrolling and parallel projection. A 2.5D or Pseudo 3D was also created before 3D came into picture. Now coming to 3D graphics, 3D graphics utilize 3 dimensional representation of geometrical data. The components of 3D graphics are fixed 3D were the background is stationary, only character moves. The second one is first person perspective in which only arms of characters are displayed. Last but not the least is 3rd Person perspective, in this we the whole character can be displayed. But had some limitations which were removed using advanced algorithms. However to enhance these graphics three graphic components are very important.1st is Anti-alias smoothens jagged edges to provide best graphics. Anisotropic filtering enhances the image quality by oblique viewing angles with respect to the camera where the projection of the texture. Ambient Occlusion provide lighting enhancements to the 3D graphics

Conclusion: Graphics of video games have changes in years from text based to 3D graphics.

References

www.wikipedia.com

www.whatis.com

www.webopedia.com

www.unity3D.com

www.gamedev.stackexchange.com

www.extremetech.com

www.reddit.com

msdn.microsoft.com