Moving Image Theory

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Introduction

Computer Graphics can be defined as

''The pictorial representation and manipulation of data by a computer''

(Google online, No Date)

The term computer graphics broadly covers all display aspects in computer except Text. Today proportion of keyboard inputs is decreasing as most of the things are controlled by icons and pictures. (Graphics.cornell.edu online, 1998)

"A picture is worth a thousand words" is a famous saying and says about the benefits of representing data in a visual context. (lss.leeds.ac.uk online, No Date)

In the process of enhancing Computer Graphics Imagery, there was a crucial kick which gave birth to still images that is known "Animation". Earlier the animation was created by hand drawings. Modern time and development in computers has resulted into a new era of Computer Animation.

Computer Animation – an impeccable combination of Art, Science and Technology has resulted into a total new world of Virtual Reality. From the generation of cartoons on paper the technology of Computer Graphics has evolved into generating high quality movies like AVTAR. This is possible only with the help of advanced computer graphic applications. Thus, it can be concluded that with the advancement in technology, artistic and creative concepts have got a stronger base to flourish. Now the art has intertwined with the field of computers like never before.

Parallel to this, the field of Artificial Intelligence is also evolving and emerging like never before. As the field of Graphics intertwined with the field of computers, animation was influenced by Artificial Intelligence. This led to more sophisticated techniques for creating animation such as user interactive games and computer animation packages. Creating huge battle sequences, forest, smoking volcanoes, crowd simulation, and particle simulation would not have been possible without the aid of Artificial Intelligence. These things were quite useful in giving a new dimension to the visuals of the movies. At the same time with incorporating artificial intelligence into game engines, computer games were made more challenging for their human participation. They also aided in giving life to the characters in the game.

Behavioral Animation

The integration Artificial Intelligence and Computer Animation led to the development of a new procedural animation model known as Behavioral Animation. Behavioral Animation is a method which gives ability to simulate autonomous entities like organisms and living beings. Here the individuals are able to perceive their environment and to communicate with other surrounding individuals. They execute some actions on themselves or environment depending on the circumstances. (Donikian and Rutten, 1995)
Based on three dimensional computational geometry, Reynolds made a computer model of coordinated animal motion such as bird flocks and fish schools in 1986. These generic simulated flocking creatures are called as boids. Motion of an individual boid depends on the basic flocking model consisting of three simple steering behaviors. (Reynolds, No Date)

This led to the development of software like “Massive” which is capable of generating crowd behaviors and autonomous agent driven animation for a variety of industries, such as film, games, television, architecture, transportation, engineering, and robotics.(Massivesoftware online, No Date). It was developed by Stephen Regelous. He had developed this for creating huge war scenes of the movie “Lord of the Rings Trilogy”. Later he had released it in the open market after the development of the Trilogy. (Macavinta, 2002)

In Massive, agents have its own brain which defines their behavior Capability of agents is influenced by body types, clothing and the weather which resembles to that of real people. Agents use fuzzy logic to respond to surrounding situations. Every agent has many of brain nodes, such as their combat node, which has rules for their level of aggression. When an animator uses agents for simulation, they're allowed to act with respect to their brains. Each agent makes decisions from its point of view when properly genetically engineered. (Macavinta, 2002)

On the other hand Artificial Intelligence also leads to the development of more sophisticated game engines with number of automated features using “Game AI”. Fast technical progress and increased processing power of home computers are also responsible for the development of applications with artificial intelligence in computer games.

Artificial intelligence is being used in computer games from a long time. In the earlier stages, the developed systems were controlled by sets of rules written directly in the code or in the

behavior scripts interpreted. Engines also offer some reusable components which can be manipulated so that the game can be brought to life. (Software Developer's Journal , 2006)

Game engine consist of Loading, displaying, animating models, collision detection, physics, graphical user interfaces, and also portions of a Game's artificial intelligence.

A game engine called euphoria, created by Natural Motion is based upon the principle of Dynamic Motion Synthesis. This technology enables to animate 3D characters on a fly involving full simulation of the 3D character including their body, muscles and motor nervous system. Instead of using animations that are predefined, each and every action and reaction of the characters are generated real-time. They are unique every time even when the scene is replayed. Though the current video game use limp "ragdolls" for animations, Euphoria has its own set of a typical complex method used to animate physical bound objects within the game environment. (Onyett, 2006) (Naturalmotion online, No Date)

Use of Behavioral Animation in Movies and Games

As stated by L. Manovich (2001) in his book “The Language of new media”, effects in movies are most often used invisibly to fool the audience into believing that the shots were produced with the live actors at the location. Now a day’s enormous amount of digital fabrication is used in movies, which is almost impossible to distinguish. These digital fabrications gives the director a freedom of showing fantasy, fiction, horror by introducing characters like alien, mutants, robots, etc. They also give them a freedom of showing effects like cities rumbling to dust, meteor shower on cities, aliens invading earth.

Movies like The Matrix Trilogy, Lord of the Rings Trilogy, Gladiator, Troy and many other have show great battle scenes. It is never viable to make these scenes with full live action. Most of the time directors end up using a mixture of live action and computer graphics imagery. Popular movie like “The Lord of the Rings Trilogy” had a narrative that would not have been able to convey without the aid of Computer Graphics Imagery.

As mentioned on Wired Online (2002) by Macavinta, C.

“T*o bring J.R.R. Tolkien's books to life, gathering 70,000 or so tall, broad-shouldered extras, dressing them in elaborate armour and choreographing them slaughtering each other was out of the question. And that was just one scene from the prologue to The Fellowship of the Ring*”.

The battle between the Last Alliance and the forces of Sauron that begins the film "Lord of the Rings: Fellowship of the ring" is a combination of live action and CG. Director of the movie Lord of the Rings Trilogy Peter Jackson asked Stephen Regelous(creator of software Massive) to work on the first part of Lord of the Rings know as The Fellowship of the ring (Museumstuff online, No Date)

Peter wanted Regelous to come up with software that can generate huge epic battle scenes. Regelous knew that the illusions created by 2D Billboards would have been exposed when employing the radical 3-D moves Peter Jackson is famous for. Over a time of several years he came up with the software called Massive. (Museumstuff online, No Date)

In an interview of Joe Letteri (a visual effects supervisor for Lord of the Rings Trilogy) talked about the complexities involved in producing those huge battle epics scenes. He also stated that creating an army consisting of 200,000 orcs (characters in the movie) was not possible with only live actors. They had used digital doubles and massive agents along with live actor to overcome this challenge. As mentioned in an interview with Peter Jackson, they had used the program massive extensively to create those huge epic battle scenes. (Wade, 2003)

An article published at CNN Online (2001) sates that Peter Jackson had created a cinematic history with the release of "The Fellowship of the Ring". Creating this cinematic history would not have been possible without perfect executions of those huge epic battle shots.

When audience look at these battle scenes they do not differentiate between real and CG. An article on BBC Homes Online (2001) by Pierce states that

"*For the first hour, The Fellowship of the Ring is a flawless introduction to the world of Middle-earth, expertly outlining the back-story and evoking a tangible sense of danger as Frodo the hobbit (Wood) sets out on his quest to destroy the all-powerful one ring - sought-after weapon of the Dark Lord Sauron*."

From the above example, it's clear that Massive was used for creating huge battles scenes, in which each character has their own unique way of walking, attacking, fighting style, and essentially their own culture clearly justifies how behavioural animation is used invisibly to make audience involve in the movie.

As stated by L. Manovich(2001) in his book "The Language of new media", effects are sometimes used explicitly to get audience involved. Music Videos, Games, Medical simulation, Scientific visualization, Space Simulation, etc. tend to use these effects explicitly to get the audience near to the realty.

Audience may or may not perceive a technique or where and when is it being used but at a subconscious level they know that something is happening. For example, in game like “Age of Empires”, the game user knows that the character will move from one place to another when issued the command to move but they may or may not be aware that the character is moving due to the set of algorithms assigned in the game engine. So the digital moving image technique is used explicitly in such of situation to get audience near to the reality. (https://mybu.bournemouth.ac.uk/bbcswebdav/xid-909635_1)

Some of the popular games are open ended and do not follow a finite path or an ultimate goal. The story of such games depends on the decisions taken by the player. The game called Grand Theft Auto, developed by Rockstar Games is a classic example of this. The game is famous for its open world gameplay which gives more player interactivity. Above this it has features like character personalization and car customization.

The specialty of this game is the artificial intelligence being used by the game. Features like the pedestrians respond to the player character depending on his behavior. For example if the player character starts hitting a pedestrian on the street depending on their nature they might fight back or might start shouting for help or might run away. Even the pedestrians react to his shooting in public places and flee for their life. Even the player character clothing and behavior with his girlfriend makes him earn respect amongst his fellow recruiters and street friends. The game also has a feature of gang war. They are initialized when the player character enters other gang areas and kills three or more of their gang members.(Gta-sanandreas Online, No Date)

The newer version of this game known as Grand Theft Auto 4, has taken the game up to a next level with implementation of euphoria and a more improved artificial intelligence. Here the reaction of pedestrians depend on the kind of weather, clothing and has been more circumstantial then the previous version. This game also contains morality choices which alter the story line of the game.(Kolan, 2008) (Joshi, No Date)

From the above example, it becomes clear that in these kinds of games the user knows that the other characters in the game are going to act and behave depending on the behavior of the user character. The user might not know the technique involved behind it but is aware that something is happening in the game, depending on the player character (controlled by the user). So here the technique of Behavioral Animation is explicitly used to get the audience involved into the game.

Similarities and Dissimilarities on the use of Behavioural Animation in production of “The Lords of the Rings Trilogy” and “Grand Theft Auto”

Behavioural animation in the movie The Lord of the Rings Trilogy is used to create those epic battles scenes by driving the animated CG characters with the help of artificial intelligence.

Here this is done by using the software called Massive. The animation of the CG characters may be key frame animation or motion capture data. Here the artificial intelligence is used to generate agents whose motions changes with the change in circumstances. Here the focus is on the specific behaviour of the characters with respect to a small domain. For example in the scenario of LOR, domain is “War scene” and focus is on the motion of the characters. The advantage of these is that it leads to creating more number of agents in the available computing power, since their domain is small.

While in games like GTA, artificial intelligence is used to control the behaviour animation aspect of the other characters depending on the behaviour of the player character(controlled by the user). Here it done by using artificial intelligence algorithms in the game engine.

To add more reality, game animation engines like Euphoria have been used to give real-time motion following the rules of physics. Unlike movies (LOR) here artificial intelligence is used to focus on a wider aspect depending on the game concept. For example in the game, Grand Theft Auto, artificial intelligence is used to control game environment along with the detailed behavioural aspects of the characters. Artificial intelligence is also used to show the general behaviour of the bots (pedestrian). Here all other characters present will behave with respect to the behaviour of the player character (controlled by the user). Here there is a direct relation between the motion detail of the characters and the processor power needed to show that detail. More the detail- more processing power will be involved.

Conclusion

Computer Graphics Imagery has entered in almost all domains of media, may it be movies, games, music videos, documentaries, medical simulation, scientific visualization, etc. Movies like Avatar, Day After Tomorrow, Armageddon, Independence Day, Volcano would not have been possible without the existence of different digital moving image techniques like Modelling, Texturing, Lighting, Animation, Compositing, Rendering, etc.

Movie named “The Lord of the Rings Trilogy” would not have come into existence without these techniques. It had set a new bench mark in the field of Computer Graphics Imagery. Most of the scenes of these movies were digital fabricated.

Games like Grand Theft Auto that is famous for its open game play due to the existence of Artificial Intelligence in its game engine. Most of the features provide in the game try to make user totally involve into the game.

As seen in examples listed above it can be said that, advancement in the technology is directly affecting the field of graphics. New emerging technologies are taking it to new heights. Though digital moving image technique has varied uses in the different fields of graphics, it is the varied use of these techniques that accounts for its rich diversity and ability to be used in any manner (explicitly or invisibly) for involving the audience to the utmost extent. To involve the user or audience completely one may have to use these techniques explicitly or invisibly depending on the circumstances and situations in their respective application areas.

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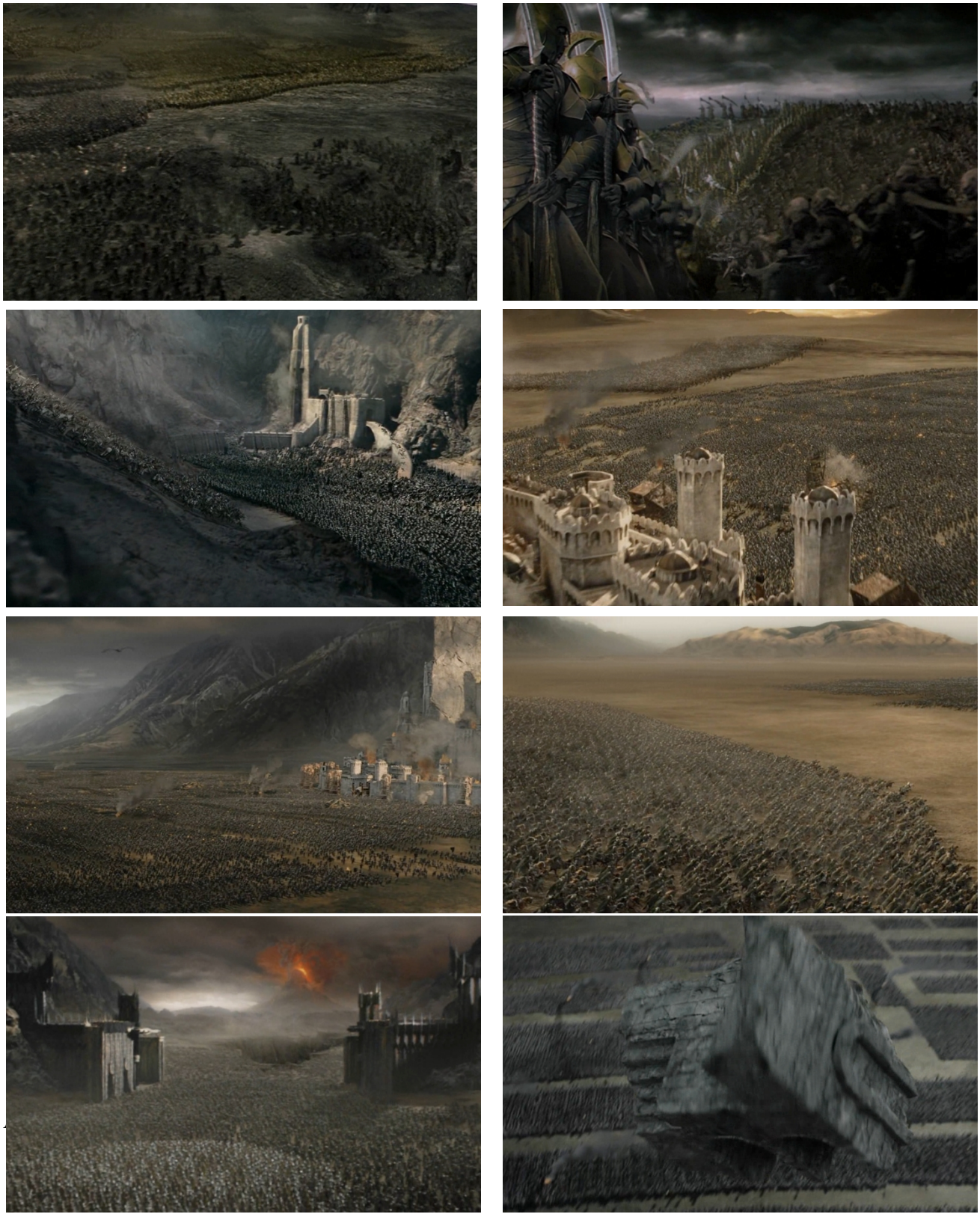
Appendices- 1

War scenes from “The Lord of the Rings Trilogy”



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Appendices- 2

Game Scenes from “Grand Theft Auto”

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