**Special effects used in creating 3D animated scenes-part 1**

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**Abstract.** In present, with the help of computer, we can create special effects that look so real that we almost don’t perceive them as being different. These special effects are somehow hard to differentiate from the real elements like those on the screen. With the increasingly accessible 3D field that has more and more areas of application, the 3D technology goes easily from architecture to product designing. Real like 3D animations are used as means of learning, for multimedia presentations of big global corporations, for special effects and even for virtual actors in movies. Technology, as part of the movie art, is considered a prerequisite but the cinematography is the first art that had to wait for the correct intersection of technological development, innovation and human vision in order to attain full achievement. Increasingly more often, the majority of industries is using 3D sequences (three-dimensional). 3D represented graphics, commercials and special effects from movies are all designed in 3D. The key for attaining real visual effects is to successfully combine various distinct elements: characters, objects, images and video scenes; like all these elements represent a whole that works in perfect harmony. This article aims to exhibit a game design from these days. Considering the advanced technology and futuristic vision of designers, nowadays we have different and multifarious game models. Special effects are decisively contributing in the creation of a realistic three-dimensional scene. These effects are essential for transmitting the emotional state of the scene. Creating the special effects is a work of finesse in order to achieve high quality scenes. Special effects can be used to get the attention of the onlooker on an object from a scene. Out of the conducted study, the best-selling game of the year 2010 was Call of Duty: Modern Warfare 2. This way, the article aims for the presented scene to be similar with many locations from this type of games, more precisely, a place from the Middle East, a very popular subject among game developers.

1. **Introduction**

**3D Computer Graphics** is somehow a new field that combines art and technology in a system that has multiple applications. Until recently, the main business target of 3D graphics was represented by movies and video industry. Nowadays, probably there is not a single movie (worth mentioning) made without special effects, partially or integrally generated on the computer [1, 2, 3].

Increasingly often, the majority of industries uses expressions containing 3D sequences (three-dimensional). Graphics can be represented in 3D, 3D sound is played by electronic components, commercials and special effects are designed in 3D [3].

The 3D field is increasingly accessible, gaining new areas of application. The 3D technology goes easily from architecture to product designing. Real like 3D animations are used as means of learning,
for multimedia presentations of big global corporations, for special effects and even for virtual actors in movies [4].

The multifaceted possibilities of this field have started to be deeply explored. Most of the sketchers think that internet is the main element for the development of the aforementioned field. In the coming years, this will become a visual medium (like television) and hundreds of thousands of companies will need high quality graphics for Websites, animated presentations or virtual models of products [5, 6, 7]. The interest for 3D graphic programs grows as they are increasingly better designed. The evolution of special effects technology in 3D animations mirrors the technological development in the twentieth century, from industrial and mechanized to computerized and virtual. Even cartoons begin to leave those times when each image had to be drawn on paper, piece by piece. The place of countless pen drawings was undoubtedly replaced by computer and 3D professional graphics programs. This article aims to exhibit a game design from these days, using special effects and dynamic rendering in the process of scene creation.

2. Computer generated special effects (CGI)

In the year 1900, film producer George Melies was recording a scene on the street when his camera crashed while a cart was passing in front of the lens. While he tried to fix his camera, a hearse was passing on the street. When Melies processed the film frames, he saw, to his surprise, how the cart seemed to transform into a hearse. The freeze frame filming (aka cut-action) was a happy invention, one of the most effective tools for special effects, in the next century. The producers quickly learned how to manipulate the film in order to create illusions [8, 9, 10, 11].

In the year 1940, the process of combining many videos into one was made possible by perfecting the optical effects. Moreover, the creation of complex optical illusions was also possible. The producers could have more easily create matte videos where they were pausing one part of the lens while recording a scene. This way, another imagine could have been placed later on the film frame already left blank [11, 12].

During the past ten years, optical special effects have been replaced with digital processing. Even the bomb technicians who must participate in those scenes with fire and smoke, started to feel the competition of digital effects. Since 1990, it was obvious that movies with special effects should be divided in two parts: B.C. – before computers and A.D. – after digital. Computer generated images began to significantly interfere and alter the art of cinematography. Alongside with the developments in the computer industry, computer generated images will steadily evolve and shape the special effects of the future [13, 14].

3. Special effects in 3D animations

During the construction of special effects, there is a possibility to encounter effects and situations that are hard to make or animate using traditional key-frames. For example, falling leaves carried by the wind in a landscape or the glass that breaks when it reaches the ground, it may take hours to manually animate and the effect of the scene might not be as desired.

To simplify these effects, some techniques that tackle dynamics can be used to replicate the movement of an object influenced by different forces that are exerted. For example, a special effect can be represented by the motion of a leaf carried by the wind and tumbling to the ground. Using „Dynamics” techniques can be easy but frustrating at the same time. Anyway, for most of dynamics simulations, hundreds of options are available. This part from the research report will focus on important things underlying the creation of high complexity special effects.

The particle dynamics can be used in the creation of effects produced by countless elements including fire, fog, dust, explosions, mud or even a swarm of bees [4]. One particle is a point in the 3D space which can be altered by simulated forces, arranged as elements including spheres, clouds, images and undefined surfaces, even some objects like leaves or spaceships.

There are many prefab effects of the particles in order to simulate fire, emit smoke, produce lighting or, the creation of a river flow through a valley, image 1. In general, these scenes are
constituted into a starting point for something more complex, so there is a need to adjust them in order to get the desired effect [4].

Fire produces a device that emits particles containing Gravity, Drag and Turbulence fields, attached to a particle of Cloud type. You can set Density, Radius, Direction and Intensity using the Options menu. The fire can be sending out from a surface, a curve or a directional point. This type of directional point will send out fire particles towards a specified direction of any point from that space.

4. Geometric modelling
If you follow the “checklist”, your paper will comply to the requirements of the publisher and facilitate a problem-free publication process. Geometric modelling is about mathematical representation of curves, surfaces and solids, necessary to define the complex physical elements or the engineering objects. The computational geometry field is associated to geometric modelling and addresses the development, analysis and implementation of computational systems for specific algorithms.

The sphere of objects concerning the engineering field starts from simple machine parts to highly complex structures as ships, automobiles, airplanes, turbines and propeller blades, etc. In case of complex objects, the exterior shape of the surface is projected in order to reduce drag (for example, planes, ships, submarines) or to increase thrust. At the same time, these objects must satisfy other demands in order to accomplish some design requirements (for example, to handle a certain load or to be stable in case of disturbances, etc.). On the other side, there are cases where objects have significant esthetical demands (examples: automobiles, yachts, household products) [13]. Usually, one of engineers’ tasks is to define complex models for engines, automobiles, planes, ships, submarines, underwater robots, offshore platforms, etc., models that are not entirely known beforehand. Consequently, the designing process is commonly iterative and involves:

- Creating the model based on design requirements;
- Analysis for performance assessment of the object;
- Changes for improving the model, followed by the analysis.

These steps may repeat like an iterative cycle till a satisfactory model comes out (even optimal in some cases) and meets all the design requirements, mitigating costs at the same time.

5. Creating the 3D scene
3D representations are obtained following a process of three-dimensional graphical creation using computers and special software programs. These creations can be represented as static images or video clips. The steps in obtaining a 3D project involve: modelling objects from the scene, scene illumination, texturing and rendering.
Further, a game was created using modelling, texturing and animation techniques, specific tools for video games. Considering that games must run in real time, limitations are quite harsh at least comparing to off-line rendering limits (as some rendering engines: Mental Ray, V-Ray, Brazil etc.). Although many times the optimization can be difficult, techniques used can be regarded as standard. That’s why, an object will be formed using a more advanced technique called Sub-D modeling. Included in the final scene, this object is the tank.

As for the animation, from a technical standpoint a relatively simple infrastructure was kept. The turret of the tank was animated and the camera was moving in a three-dimensional way. In the post production stage, the explosion of the projectile destroying the track of the tank was added and synchronized to the scene.

From the artistically point of view, I have decided to create something that can be applied to a game from these days, Call of Duty: Modern Warfare 2. The scene presented in this article is similar with many of the locations from this type of games, like the Middle East place destroyed by this conflict.

Choosing this scene was determined by different technical and artistic challenges. From a technical standpoint, a destroyed building for example is much more difficult to create than a new one. This happens mostly because destroyed buildings have rugged, ruined details. Moreover, this type of destruction is more difficult to create in a 3D program, which is rigid; so any patchy or complex detail needs certain human intervention. The next step was the documentation. To efficiently create this scene, documentation was essential. The architectural style from these places, mood, level of building degradation, all contribute to a compelling scene. After research, the next step was the creation of a mood board, image 2. This term is used for a scene containing the most illustrative images found during the research process, to determine the style and mood. Traditionally, this image collection should be created on a big board, as it is called the moodboard [7, 8, 15].

![Figure 2. Moodboards [16].](image)

With the help of these mood boards, we have tried to identify the key elements of a scene created in a style already proposed at the beginning of this chapter. The evidence of destruction seemed extremely important for me. Knowing that I was not intending to present the scene in the middle of the action, those traces left from a possible conflict were essential for determining the atmosphere of the story. At the same time, the mood boards helped me to maintain the established visual path from the
beginning and not to diverge from the original concept. Likewise, images gathered from the aforementioned game were very helpful, from the technical point of view. In some places, we can easily observe how problems have been solved (for example, concrete or grass).

Considering the shape of this object, starting from a simple box with the size of a sand bag was the easiest way. Going to Sub-Object Edge module, the margin ring was selected and the „Connect” command was pressed in order to unite the margins with a number specified by the user. The creation of two new margins was selected and with the help of Pinch parameter, the margins moved unequally one from another. This process has been repeated on the other margin ring, but this time, a single new row of margins was created.

Going to Vertez module and using Target Weld command, different vertices were united in order to obtain a shape closer to a sand bag. Yet, for adding something more to the shape without supplementing the number of poligons (optimization is very important in games), Cut command was used for creating new vertices, figure 3.

![Figure 3. Sand bag modeling [16].](image)

Thus, having the basic sand bag model, creating a wall was only about placing them (sand bags) one above the other in order to form a wall. Image 4 exhibits a scene of the barriers as they appear in the game (alongside with texture) and an image that shows their wireframe, to easily observe the modelling methods as described.

![Figure 4. Barrier modeling [16].](image)

Using „Move” and „Rotate” tools, these barriers have been arranged in a way to offer credibility for the scene. The barriers have been placed not only to block (their standard function) but also to defend, tying them to the central theme for this level.

6. Conclusions

There are many views stating that 3D animation will increasingly have more impact than it has today. 3D animated scenes offer a wide range of opportunities for direct camera recording. 3D graphics is much more complex using textures, volumes or light schemes. Everything is created using the
computer and the intelligent mind of the graphics editor. 3D programs are spectacular considering the progress in both hardware and software. Illumination and dynamic rendering can be more easily integrated into complex scenes. The onlooker probably won’t notice that some nature landscapes are generated on the computer by the graphics editor. The scope of this article is to concisely present the geometric modelling of 3D elements in the proposed 3D scene. The key for attaining real visual effects is to successfully combine various elements: characters, objects, images and video scenes; like all these elements represent a whole that works in perfect harmony.

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