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SHORT HISTORY OF COMPUTER GRAPHICS IN MOVIES

Today, computer graphics is almost indistinguishable from real video and plays an important role in film industry. The first steps in this relatively recent area are analyzed in the present article.

Films making began at the end of the 19th century, as the need for special effects appeared even then, but the resources of that time were too primitive.

The gradual development of technology has led to the emergence of duplication techniques, installation, etc. By the 1960s, specialists had already learned how to create fairly complex effects without using computers. But the power of computers grew. In the early 1970s, computers were able to process graphics, which interested the representatives of the film industry [1].

For the first time computer graphics to create a separate episode in the film was involved in the film "World of the Wild West" in 1973. This episode lasted a few seconds. To be able to show the picture the way a robot sees it, the studio had to work hard. To do this, the film shots were divided into small square segments, and then the average color of each of them was calculated. Since the studio did not have a color scanner, the amount of work increased several times: the whole process had to be repeated for one black and white frame, as well as for three more that contained red, green and blue colors. The material captured by a conventional camera was processed on a computer (pixelization), and then transferred frame-by-frame back to film. The calculation of 10 seconds of computer graphics required 8 hours of computer time, while the preparatory work took about four months, but the result was a real breakthrough [1, 2].

In 1977, the first episode of "Star Wars" was filmed. Most of the special effects in the film were created without the help of computers. However, the episode

showing the passage of the ship through the Death Star was modeled using computer graphics. Experts used skeleton frame-by-frame modeling - this allowed to draw a rather "realistic" inner surface of the Death Star. Skeleton models for each frame were created manually, the calculation of one frame took at least two minutes [1]. The spectacular battle scenes of the film were created with the help of thumbnails, but it was not possible to achieve the effect of speed or the dynamics of the battle with the help of ordinary cameras. So that the viewer could literally fly between the scenery and ship models, the ILM special effects studio led by John Dykstra borrowed technology from industrial control systems used in assembly shops and created the Dykstraflex automatic shooting control system. With its help, filmmakers could program camera movements on a computer and show the most incredible spans that no operator could make on the screen [2].

In 1982, the first Hollywood film was released, in which computer graphics were widely used - "Tron" by Steven Spielberg. Initially, the director wanted to make a fantastic film exclusively on a computer, without the use of "live" filming. But it turned out that the production of such a film on computers in early 1980s would take too much time, so the creators of the picture decided to break the footage into separate frames, images were superimposed with filters and computer graphics inserts and re-connected video. The "Tron" was filmed on a black and white film, for the storyboard created a slide measuring 60 by 30 centimeters and photographed the slide with a color filter of the desired shade for each frame separately. Three-dimensional (3D) objects were also drawn frame-by-frame, manually. First, a polygonal model of each 3D object was created and then the results were digitized. The rendering of each frame took at least 20 minutes, the result by today's standards looks very modest, but for 1982 it was a breakthrough graphic [1].

In 1985, the first 3D character appeared in the film "Young Sherlock Holmes", it was a knight, "painted" in the usual shooting. It took about six months to create a short episode in which a knight made from fragments of a church stained glass window scared a priest. This achievement is now attributed to the studio Pixar, which was then still part of Lucasfilm [1, 2].

A year later, a short cartoon about two table lamps "Luxo Jr." appeared. This cartoon was created by the animators of the young and not well known studio Pixar as a demonstration of the possibilities of computer graphics. And the experts were really surprised by this cartoon – the quality of graphics for 1986 was just incredible.

By the beginning of the 90s, both mainframes and workstations reached the required performance – finally, the miscalculation of each frame took much less than 15-20 minutes. That time it was possible to create more complex computer effects: for example, the episodes from the finale of the second part of "Terminator", released in 1991, where it is shown how the T-1000 passes through a grid or changes shape, turning into a liquid state, all these scenes were drawn on extremely powerful computers for the early 90s [1].

Pixar studio, which created the first digital character in the cinema, a decade later gave rise to all modern full-length computer animation. In 1995, she released the legendary "Toy Story". Years of experience in the field of creating 3D graphics resulted in the film, loved by several generations of children. It took four years to create the 81-minute picture, 800 thousand machine hours, and a terabyte of disk space.

"The Matrix" by Wachowski brothers became one of the most important films of the last twenty years and an icon of cyberpunk, and arranged a real breakthrough in the field of special effects. The main achievement of Wachowski, in addition to dozens of other bold decisions, was the effect called "bullet time". No operator in the world, live or robotized, can move with sufficient speed to fly around a person until he falls backwards, dodging shots. Therefore, Wachowski used several dozen cameras, each of which was taken one frame to create an effect that had never been seen before.

No matter how many animators work on a computer character, he would not always move on the screen naturally. That is why the technology "motion capture" has become a real salvation for the cinema and the gaming industry. Her loud film debut took place in the second part of the "The Lord of the Rings" by Peter Jackson. Gollum, played by actor Andy Serkis, became the first computer character to actively interact with live heroes. To capture motion, each scene with the

participation of Serkis simultaneously filmed 13 cameras, after which the images were collected in a single 3D model, which has all the main features of the actor.

In 2009, with a technology "motion capture" came on the scene James Cameron with his "Avatar". To make computer characters on the screen look as plausible as possible, the movements of the bodies and faces of the actors, along with the sound, were recorded simultaneously. Such synchronization allowed to create the most realistic computer characters in the history of cinema on that moment.

Another technology that is consistently associated with Avatar is 3D. Certainly, Cameron was not the inventor of 3D films (even in Soviet times such films were shown in the stereo movie), but together with Sony he created a compact 3D camera that made 3D filming accessible to everyone, and also forced most cinemas in the world to replace old film projectors to digital ones with polarized glasses do not distort colors.

Full 3D photography still remains a real headache for filmmakers (especially when it comes to sun glares and close-ups), so many studios prefer to work in 2D, and create a volume effect already at the post- production stage [2].

Nowadays, more and more films are being created using computer graphics. At the same time, computer graphics develops much faster than many years ago and thus gives more possibilities when creating a movie. But there are also disadvantages; the use of special effects becomes a higher priority for film producers than the plot, the play of actors, etc. In this way films become more beautiful but less meaningful. So, computer graphics should be used wisely and not just like that.

REFERENCES

1. Компьютерная графика в кино. [Електронный ресурс]– Режим доступа: https://blog.onlime.ru/2018/11/25/komputernaya_grafika_v_kino – (дата обращения: 15.03.2019).

2. Краткая история спецэффектов в кино [Електронный ресурс].- URL: https://tjournal.ru/tv/53171-cg-history – (дата обращения: 15.03.2019).