

THE RISE AND INFLUENCE OF DIGITAL IMAGING BY MOTION CAPTURE IN MOVIES AND VIDEO GAMES

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Introduction

In this essay I take a look back of the technology of digital imaging. I also want to analyse current techniques by discussing examples of digital imaging in films: motion capture. I finish with a look into the future how this might impact filmmaking for movies and video games. For this essay I will address the development and take a look into how it works nowadays, instead of going too much into details of the technical specifications. I would rather like to take this opportunity to discuss digital imaging and how it influenced the way we make movies.

I chose this topic because I wanted to learn more about the current technique of motion capturing, thus making it my main subject in this essay. I will start off by talking a bit about the more important developments in the history of digital imaging.

What is digital imaging?

Digital imaging is basically the creation of digital images from a physical scene. Digital imaging has to do with the processing, storage, printing and the display of such images.

A look back on digital imaging

Digital imaging is something of the last 100 years. The first digital image was produced in 1920 by Harry G. Bartholomew and Maynard D. McFarlane. They named it after themselves: The Bartlane Cable Picture Transmission System [1]. The system consisted of a series of negatives on sinz plates that were exposed to varying lengths of time and therefore producing a variety of densities. The images that were generated this way were sent through submarine cable lines between London and New York. They could be transmitted in less than three hours. The images consisted of five grayscales and were mainly used for digitizing newspapers.

In 1957 Russell A. Kirsch developed a digital image scanner [2]. It was able to trace variations of intensity over the surfaces of photographs. The system scanned on a grid of 176 x 176 pixels. It only scanned for one bit of information per pixel, that means it only gave black and white imagery. The picture was created by scanning multiple times on

different thresholds, and therefore getting more information about the grayscales between the black and white. In figure 1 you can see the very first digitally scanned image, Russell A.'s son Walden.



Figure 1: Pioneering digitally scanned image of Russell A.'s son Walden, 1957

The same kind of technique is still used nowadays for photo scanners.

In the early 1960s Frederick G. Weighart and James F. McNulty at Automation Industries managed to capture digital images in real-time by using X-ray imaging called digital radiography [3]. This approach makes use of X-ray sensors to obtain an image. The advantage of this technique is that it bypasses most of the chemical processing and can be interpreted directly digitally. Digital radiography uses a digital image capture machine, which directly gives an image preview.

The different developments above led to scanning ideas that were the basis of the digital camera. Early cameras took long to capture images and were not really suited for film or customer use. The techniques were used in telescopes and the first camcorders in the 1980's.

The production world changed drastically since the development of the first digital image. Nowadays we have computer that are able to render full fledged 3D images and environments, thus making it way more customer-friendly. The rise of the internet really proved itself as one of the main adopters of digital imagery.

Motion capture

I would like to take a step back and look at the overall technique that is developed in the last couple of years. Using the same principle that is developed for scanning digital images, I would like to look into motion capture. Motion capturing is the same as digital imaging, but focusses more on movement of objects or people. It is used in military, entertainment, sports, medical applications and robotics. I would like to discuss at the entertainment field, with the focus on movie and videogame production using motion capture.

Motion capture for entertainment often uses human actors performing actions and using that to animate digital character models in 2D or 3D. This can be done all over the body and can have surprisingly rich data. A motion capture setup can be implemented in many ways. The easiest way of capturing is simply making a video and use it for mimicking a characters' actions that way.

The first example uses this approach. It is not really motion capture, but more motion duplication. In 1985 the team behind Prince of Persia shot a video of a men to perform actions. The guy climbs, jumps, runs and falls [4]. These videos were used to mimic the 2D game character in Prince of Persia.



Figure II: Motion duplication of Prince of Persia, 1985

Another more advanced version of motion duplication is Peter Jackson's The Lord of the Rings: Two Towers in 2002. The world famous character Gollum was performed by Andy Serkis on the scene [5]. Andy wore a white suit and was interacting with the real people on the set. This gave the movie a way to realistically make a computer generated character, using Andy's performance as a basis. The recorded video was used to create the facial expression and

of Gollum.



Figure III: Andy Serkis' performance in Peter Jackson's The Lord of the Rings: Two Towers, 2002

The two examples above use video footage and start editing from there. It looks interesting in the scope of motion capturing, but it is only using a flat video as source to create digital images. With the use of sensors a performer can be captured in 3D, allowing animators to put in whatever skin they want and animate that, instead of recreating everything with a cheat sheet next to them as a reference.

One of the more newer examples of this that really takes it to a next level is the Head Rig, developed in 2009 for James Cameron's Avatar [6]. The Head Rig is a helm that has a face camera attached on it, locking on the face of the actor. No matter how the actor moves the camera will provide data about the facial expressions. The idea was already thought about in 1995 by James Cameron, but was never realized until the creation of Avatar in 2009. The setup used the helmet combined with green dots to distinguish every interaction of the eye, jaw, lips, teeth and tongue. The Head Rig can be seen in figure IV.



Figure IV: The Head Rig used in James Cameron's Avatar

Motion capture nowadays got to the point where we can get full 3d performances from actors captured. These performances can either be for video games or movies. This technique allows performers to just perform and developers to put whatever skin on it they want. It kind of feels like an make-up overhaul after the scene is filmed. In 2013 a video game called Beyond had all of its cutscenes and animations done in a studio with live action actors [7]. The game for

dozens of hours of footage that were shot using the same technique Avatar did in 2009.

How motion capturing can change what we know of filming

Motion capture is like adding an extra layer to work with for editors. If done properly the data of a motion capture can be directly interpreted in a 3D environment. The performers give the movement, look and feel, while the editors are able to set the whole world around them. We do not have to go out in the open to perform, we can do it in studios. We still have to do the make-up for performers, only now they are with dots and sensors for the capturing. With this technology you are capable of getting the pieces right in a computer, instead of editing one version of footage. It is a whole other approach that will rise in the coming years.

With a grain of salt

Of course we cannot overlook some critical aspects of the technology. For now most of the development is still experimental and often requires professional hardware to actually get a good reading. We still have to use special cameras, suites and other gear to make this technique work.

The technology is taking big steps and we might get to the point where movies are so perfectly looking that it does not really feel like a performance anymore. More and more people will just do small scenes and might not even interact properly with their environment of the set. One of the things we have to keep in mind is that the actors should be the ones that are performing, they are the skeleton of the character, the heart and soul. Movies already do the impossible, we might risk getting too many films that are being 'too perfect' for us to accept it is real.

The industry is also pressuring developers to apply the technique perfect, so most of the examples we see nowadays are well done, but a lot of the motion capture projects get scrapped because of inconsistent readings, tight schedules or other issues.

The future of motion capture

If all things mentioned before are already possible, what more can we expect of this technology?

The current way motion capturing is done is with markers. It is just like digital imaging, where you human is the scanned object for multiple frames or scans. Whether it is the body, the face or just the silhouette. A thing of the future might be markerless performers, we would not have the need for weird suites and helmets that can only limit a performers freedom.

In this essay I focussed on the entertainment segment of motion capture, but one can only imagine what big interest the military, health care and natural sciences would have in the field of motion capturing. Motion capturing is now in the hands of big studios and even indie studios, although quality is still an issue. With today's projects we are only scratching the surface of the possibilities, let us hope that in a couple of years from now we can have performers who can be directly part of a fully rendered 3D movie or game with the help of motion capturing.

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