How has technology improvements impacted on filmmaking?

Technology

Introduction

Film as a medium is relatively young compared to the other media such as painting, theatre, literature and etc. Nevertheless, in relatively short period of time, film with its ability to tell different stories and trigger various emotions has quickly established itself as a powerful and influential art form that is loved by masses. As Douglas Trumbull, a film director and special effects supervisor responsible for effects in movies like 2001: SpaceOdyssey, Blade Runner and Star Trek: The Motion Picture, states:

''<.. I feel that all movies are technical by their nature, it a technical art-form – it's a photographic optical art form. It's not like painting or sculpting or writing poetry or literature – it's technical..> ''

Douglas Trumbull, 2011[1]

From the very first recorded images film as an art form depended ontechnologyand its sophistication. With various technological improvements and inventions filmmakers got more and more tools that they could use to tell their story. This essay is going to discuss how technology improvements had an impact on and shaped film production and industry. Why inventions like digital cinema and digital workflow had such a huge impact that revolutionised the way the movies are made, displayed and even perceived by the audienceHow and why digital cinema is expanding and being embraced not only by the independent productions but by high-budget studios as well?

Previous Filmmaking Methods

For the art forms such as painting orpoetrymost of us, given a pen and paper, would be able to write some kind of poem or draw a picture. Filmmaking is inherently a much more complicated process. Without a dedicated piece of equipment that is able to record images for display – films would not be made. To fully understand the benefits of the technological inventions such as, for example, non-linear editing systems or ability to film on a digital format one needs to know the history and understand what technology and practices were in place before such inventions.

For the most part of the filmmaking history the images where acquired by film cameras that used a film as a medium to store the pictures.

<.. In photographic cinema, light reflected from the scene creates an image by triggering chemical changes on the film stock. Those changes register in the molecular structure of the emulsion..>

David Bordwell & Kristin Thompson, 2008[2]

Over time four main standard film formats were established – super 8mm, 16mm, 35mm and 70mm film, with millimetres representing how wide the film strip is. Usually a bigger size format brings a better image quality, thus, the 35mm format established itself as a standard format for theatrical releases.

''The 35mm film gauge has been associated with the theatrical distribution of motion pictures since the Classic Hollywood Studio Systems. The cost and

limited access to equipment put 35mm filmmaking out of reach to industry outsiders.

Vincent Lobrutto, 2002[3]

Throughout the most of the cinematography history, film (being an analogue photography medium) offered an unmatchable picture quality and was the main medium used to acquire images that would be suitable for cinematic release. Although the technology in digital cameras was constantly improving, until late 1990's the film picture quality was superior compared to the digital video.

<.. One frame of 35mm motion picture film can contain the equivalent of over 12 million pixels (picture elements). This creates extremely high resolution and detail. One frame of broadcast quality video (not HD) can display about 350, 000 pixels..>

David Bordwell & Kristin Thompson, 2008[4]

However, shooting on film offered filmmakers an amazing picture quality – that came with the price. One of the biggest issues for any production that wants to use film as their recording medium is the amount of finances required to shoot and develop the film.

<.. A feature-length film is a very long ribbon of images, about two miles for a two-hour movie. <..> Because each shot usually exists in several takes, because the film is shot out of story order, and because the master-shot/coverage approach yields so much footage, the editor's job can

be a huge one. A 1OO-minute feature, which amounts to about 9000 feet of 35mm film, may have been carved out of 500, 000 feet of film..>

David Bordwell & Kristin Thompson, 2008[5]

''<.. What cost so much on ''El Mariachi'' was the film stock because I wanted to shoot film, I've borrowed the camera, I've borrowed just about everything else but the film – I had to buy it. Develop it.. And then transfer it.. So those coasts would all be gone (from the budget)..>'' [Robert Rodriguez talking about filming his first feature film – ''El Mariachi'']

Robert Rodriguez, 2010[6]

That is why the costs of film stock and its development were out of reach for most of the independent filmmakers (Robert Rodriguez being a great exception).

Film Limitations

Shooting on film also meant a lot of workflow limitations. One of the few examples would be the limitations of the medium itself. Since the pictures were being exposed on film, they had to bephoto-chemically developed in the laboratory before any reviewing could take place. Meaning that while the production crew was filming the scenes they had no 100% guarantees that the exposed images would have no errors. Slightest mistakes, like a peace of hair on the film-gate or a not correctly sealed film magazine, would mean that the acquired footage might be technically faulty and useless in the edit. Pre-digital film post-production workflow would also have loads of limitations. As even tasks like colour correction would require a photochemical

treatment that would eventually be based on intelligent guesswork rather than knowledge on how the final outcome will look like.

The Dawn of Digital Technology

With an introduction of Digital Intermediate in 1970's (when film is scanned and digitised in order to alter the imagery in post-production and the exposed back on film for release) and a huge spread in 1990's, the film industry started to incorporate more and more digital technology into the workflow. The ability to transfer film scans into computer meant that imagery could now be manipulated in a non-linear and non-destructive fashion, which led to the huge benefits for the production. With the first photorealistic Computer Generated creatures developed and animated in 1993 (Jurassic Park) and the first completely Computer Generated feature-length film being released in 1995 (Toy Story), the film industry was starting to discover the true potential of digital technology.

In late 1990's, digital technology in cameras was developed to the point where Hollywood's A-list director George Lucas decided to use a prototype of the digital SONY HDW-F900 camera for his next feature film Star Wars: Episode II.

''The tests have convinced me that the familiar look and feel of motion picture film are fully present in this digital 24P system and that the picture quality between the two is indistinguishable on the large screen'' George Lucas, Digital Camera Use Finalized, http://www. starwars. com/episode-ii/bts/production/news20000409. html

George Lucas, 2000[7]

Robert Rodriguez was another famous Hollywood director who saw the benefits of digital technology and decided to incorporate it into his new movie-making tools:

He rented two soundstages and converted his garage into a post-production suite with 10 monitors, editing equipment, and a storyboard machine. Spy Kids 2: Island of LostDreamswas shot entirely with hi-def digital cameras and edited at Troublemaker (Rodriguez newly set-up studio). The title credits for Spy Kids 3-D: Game Over begin with this: " A Robert Rodriguez Digital File." The revolution was in full swing.

Wired, 2005[8]

The Benefits of Digital Filmmaking

Although in an ideal world movies would be made without having any kind-of restrictions, however, the reality is that every project has a budget that it needs to fit to.

It should never be forgotten that " Hollywood" is, first and foremost, aboutmoneyand profits. The term art can usually be heard only on the night of Academy Award presentations. Bastian Cleve, Film Production Management, Third Edition p. 56

One of the biggest reasons why digital technology was embraced so quickly was its cost factor and the ability to cut corner in ''typical filmmaking''. The ability to lose the expenses of purchasing a film stock and its development

meant that a huge peace of budget now could be invested somewhere else or the project could be completed for less money. This became a huge factor for independent productions as the ''look'' of filmic picture became much more accessible. Not only that, but by using digital cameras the whole filmmaking process in its essence could be simplified and various costs that were attached to the film workflow could be lost. For example, the camera crew in digital production could be much smaller as everything is being recorded to the tape or digital storage device and less people and effort is required to handle that type of medium.

Then there is the fact that the newer digital cameras like CANON 5D, RED ONE or RED EPIC are much more sensitive to the light than standard film cameras. This brings huge benefits when it comes to shooting in dark environments etc. As Greg and Colin Strauses, the Directors & Producers of their independent feature film, states:

A lot of the movie was shot on ISO 2000 – that's four times the sensitivity of your standard ISO 500 35mm film stock that we would use for the night time shots. The thing that was revolutionary to us was that at 2000 ISO it opens up a whole new type of photography, and basically it enables the available light night time exterior in urbanenvironment– you don't have to light the entire city. You don't have to light up the sides of the buildings, you don't have generators and crews pre-rigging and pre-lighting scenes.. <…> you could use an iPhone now as a key-light on your talent..

Greg Strause, 2010[9]

Although at first it might seem that the ability to use less light for filming might not have much importance, in reality the ability to shoot night-time scenes without hiring a lighting department etc. might result in huge budget savings, or even the final material look that, otherwise, the production would not be able to afford.

Having less people working on set might not only be easier for the management but could also save production money. This might also have an impact on the final feel and the aesthetics of the movie. As established before in this essay – filming something for a feature film, for example on the 35mm film, is not a one man's job. In order to keep the production rolling fast there is a need for a crew. Camera crew, lighting crew, production assistants will all add up to the number of people working on-set. While at first this might not look as a big issue but the more people there is on set the more coordination everyone needs and the more pressure the director faces to make quick decisions that would allow the production to move on.

Steven Spielberg described this process greatly when he was asked in theinterviewabout his early days of the 8mm filmmaking:

<.. Actually, it was great when I flashback to being kid and making my 8mm movies its always at the time when I'm making a big 35mm movie where there is too many people and there is too much noise and I lose all the intimacy of being the director and all becomes a big mish-mash of big collaboration – which it needs to be...>

Steven Spielberg, 1998[10]

The crew size and people involved on-set could also affect the actors' performance. Working with a big crew, simple things, such as moving from set to set or changing camera positions, can become a long and complicated process that could impact actor's performance. If he or she needs to deliver an intimate or emotional piece then it can be much harder if the actor needs to wait before the whole camera crew moves in order to change the angle as the moments when actor is into his/her role could be lost.

By using the new digital technology it is possible to cut down drastically or even resign the crew – and still keep the production value high. By using the lightweight camera like RED EPIC, Canon 5D or any other digital format it is possible to shoot projects fully guerrilla style if needed and have the images completely fulfilling the quality level that is required for a theatrical release – something that would have been impossible with, for example, the 35mm film camera before.

A great example would be Gereth Edwards who wrote, filmed, directed and produced visual effects for his recent feature film ''Monsters'' that has been theatrically released all around the world.

''It was a road movie really… we all fitted in the back of the van – it was very guerrilla. I was filming myself, we had a sound man, line producer and a Spanish equivalent and that was essentially the crew for most of it''

Gereth Edwards, 2010[11]

The Monsters film project is really interesting on many levels and is a perfect example of what can be achieved even with a small crew and digital

technology. One thing that certainly stands out with this project is that it was shot while travelling through South America without any locked story. While filming the scenes, the director had a rough idea on what his film is going to be about but the rest of the story was left for improvisation.

''<.. We would jump-out, pick a scene, maybe have a conversation – maybe not.. Because its often be more realistic if even the actors would not know what's going to happen..> ''

While traveling the crew would record everything that they thought might be useful for the final edit. While one could argue that this type of filmmaking goes against any kind of film school or managing rules, the fact that Monsters was made in this way and got international theatrical release, illustrates the possibilities that digital technology has brought to the table. That type of filmmaking would be extremely expensive and probably impossible in the pre-digital era as even things like changing film magazines every so often (as standard 400 feet film magazine would hold only around 5 minutes of footage) would been a huge issue in that type of production. However, by shooting everything guerrilla style the Director managed to create a documentary feeling in the piece and that arguably helped to blend all the visual effects better and portray the sci-fi story in the more realistic fashion. It is interesting how the digital medium directly influenced the style that the filmmaker could establish in his work and how a totally different approach had to be taken should the project had to be done on film.

The Russian Ark is another great example that showcases how filmmakers managed to use new technology that they got available to them and produce

something in the style that was never done before. By using a Sony digital film camera and recording the footage onto a dedicated high-speed RAID drives the filmmakers managed to record the Russian Ark film in one 96 minutes long un-interrupted steadicam shot (Russian Ark: The Masterworks Edition DVD). Yet again this type of approach could not be taken if the project would have been shot on film simply because of the format's technical limitations (even if the required film length magazine would be invented the size and weight of it would have been unbearable for the steadycam operator).

It is interesting to see that digital technologies helped to rediscover some of the old technologies such as Stereo Filmmaking as well. One of the reasons why Stereoscopy failed to establish itself as a mainstream medium in 1950 was exactly because of the film's technical limitations. At the time, in order to achieve a stereo effect it was necessary to use two film projectors running simultaneously – one for each eye. The two projectors had to project matching images at once on a frame-by-frame basis or, otherwise, the viewer would be introduced to the eye-strain[12]. For a viewable 3D display appropriate projectionist skills were required in order to match and run the film frames correctly. However, even if the projectionist tasks were completed successfully there was still the fact that the film was an analogue medium that had inherited flaws that were really presentable in a 3D screening. Every processed film roll had a different film-grain texture (especially noticeable in older stocks) and essentially even the two copies of the same film would not look identical. Then there was the fact that both copies of the film degrade (gathering dust and scratches) over time

differently, which meant that after some usage the differences between the two film roles would only increase. As a result, the pictures would not line-up and the viewers' brain would still try to solve the 3D effect from the two radically different pictures that would result in a headache. Since digital technology in its essence is based on numbers and mathematical codes the exact replication of the material becomes not such a big issue.

Post-production is another area where digital technology brought astonishing changes. Previously mentioned Gereth Edwards is a great illustration of how the digital post-production can be used to its full potential. Edwards shot over 100 hours of footage that was roughly edited together by an editor Colin Goudie on a laptop while traveling[13].

Edwards not only wrote, directed and shot his movie by himself he also produced visual effects and completed around 250 visual effects shots that were made as the filmmaker states himself: ''<.. in my bedroom..>''. By working on his personal computer from his house he managed to produce cinematic release level imagery in the time of five months.

The Downside

Although a lot of filmmakers including high-budget Hollywood filmmakers quickly adopted all the new digital technology and techniques, some people are still sceptical about it. A good example would be the creator of Cloverfield and Star Trek – J. J. Abrams, who is heavily known for his ''get everything you need in-camera'' approach:

''I don't mind shooting some stuff on greenscreen and we of course did <..> but the problem with me and greenscreen is that it's like when you are recordingmusicthe last thing you want to do is say we will fix it in the mix – you want to get it right when you're are recording it! Greenscreen is inherently fix it in the mix process...<..> it limits you in a lot of ways because you're not able to completely understand themotivationof all the light and what surrounds the actors... The actors themselves have to make it up and there is odd disconnect and I think all these things add-up to this bizarre sort-of unreality..''

J. J. Abrams, 2009[14]

Then there is another side of the medal of how easy it is to use new cameras and technology nowadays in the digital world. Filming in the pre-digital era the footage that was filmed on the day was pretty much the image that the viewer was going to see at the cinema. Naturally much more time was spent by the creators planning and preparing for the shoot as everyone wanted to shoot the best possible images on the day. The digital post-production workflow now allows to delay a lot of final decisions that used to be made before the actual principal photography, or on set to the very last minutes of the final delivery (colour correction, set design and etc).

The reality is that more and more production workflow is now based on how to better accommodate the post-production process. For example, the colour filters that used to be heavily used in the pre-digital era are almost out of fashion as most of the colouring is now done in the post-production suite, where the director can try out and apply hundreds and hundreds of different

looks to their film. While at first it seems like a very positive idea to have as much control of the final product as possible to the very end of the filmmaking process, it has some downsides as well:

Unfortunately this miracle <..> to manipulate and fine-tune just about everything have resulted in furious production schedules and frantic, free-and-easy shooting with a ''damn the torpedoes '' attitude. This hectic pace has led to the phrase ''fix it in post'' and is one of the factors in the high cost of movies today.

Mark Sawicki, 2007[15]

The ability to endlessly manipulate images in the post-production can be used as a great tool to furthermore enhance the image quality of the final picture that the audience is going to see. From adding extra actors on-set to wire removal and greenscreen replacements the post-production facilities got a reputation of the ''magical'' ability to do anything with the footage. Naturally these services often started to be used to fix or cover mistakes that were made in production or even pre-production stages.

Right now we got movies that are out of control. The directors really don't understand digital effects they just assume that somebody will be able to fix in post, no matter how many mistakes they going to make. <..> If you talk to any post production house you will see that they get stuff that is nothing but dismally screwed up…

Douglas Trumbull, 2011[16]

A ''screwed up'' term could probably be used not only to describe the technical side of some of the filmmaking nowadays. While one could think that fewer technological limits and faster workflows could potentially allow filmmakers to concentrate more on the aspects of storytelling and create new original movies, however, the reality is rather different. Many of the Hollywood studios would rather use already tested stories and storytelling methods and concentrate more on the quantity rather than the quality of the projects.

<.. let's look ahead to what's on the menu for this year [2011]: four adaptations of comic books. One prequel to an adaptation of a comic book. One sequel to a sequel to a movie based on a toy. One sequel to a sequel to a sequel to a movie based on an amusement-park ride. One prequel to a remake. Two sequels to cartoons. One sequel to a comedy. An adaptation of a children's book. An adaptation of a Saturday-morning cartoon. One sequel with a 4 in the title. Two sequels with a 5 in the title. One sequel that, if it were inclined to use numbers, would have to have a 7 1/2 in the title.

Captain America, Cowboys & Aliens, Green Lantern, and Thor; X-Men: First Class; Transformers 3; Pirates of the Caribbean: On Stranger Tides; Rise of the Apes; Cars 2 and Kung Fu Panda 2; The Hangover Part II; Winnie the Pooh; The Smurfs in 3D; Spy Kids 4; Fast Five and Final Destination 5; Harry Potter and the Deathly Hallows Part 2

Mark Harris, 2011[17]

http://www. gq. com/entertainment/movies-and-tv/201102/the-day-the-movies-died-mark-harris? currentPage= 1

It is strange and at the same time quite interesting to see that with all the filmmaking improvements that were made over the last few decades with the storytelling arguably having no limits, the mainstream cinema is dominated by remakes and stories that were already told many times before.

Conclusion

With the consumers' level equipment getting cheaper and more sophisticated every year, the independent filmmakers are quickly chasing high-budget studio films in terms of the images' quality and ''expensive look''.

As Francis Ford Coppola, who is considered as one of the most influential Hollywood's film director, states:

" Cinema is escaping being controlled by the financier, and that's a wonderful thing. You don't have to go hat-in-hand to some film distributor and say, ' Please will you let me make a movie?"

Scott Kirsner, 2008[18]

The fact that by spending less than 1000? it is possible to get a camera and in theory match the picture quality of a Hollywood's blockbuster film is on its own exciting. Technology brought the ability for the independent filmmakers to have an opportunity to really explore the filmmaking and do things that

were possible only for high-budget productions before. The high-budget productions, on the other hand, are forced to think of new ways to create and present films that would still fascinate the viewers and attract them to the cinemas. With the 3D technology being heavily promoted by major studios and various other techniques being explored in cinemas, like wind and smells effects (Avatar Goes 4D in Korea, http://www. variety. com/article/VR1118014803? refCatId= 19), it seems that filmmaking yet again might be lifted by the technology to the new heights. As Douglas Trumbull stated:

''I think we really need to open it up. We are no longer limited by mechanical movements, celluloid film and sprocket plastic. We are all digital now and so let's reconsider what movies are.''

Douglas Trumbull, 2011[19]

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