

Evolution of Film Technology

Deyden D'Avanzo Nick Louca Jacqueline Thomas
Timothy Aure

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1. Film Technology

1900s: Color

Before an introduction to Technicolor for films, various methods were used to create color such as hand coloring each frame, stenciling, tinting, and toning. Out of the different ways to create color, tinting was considered the most popular as it was used in 80 to 90 percent of films.¹ This process consisted of dyeing the entire frame of a shot (or sequence) by “immersing the film in a solution of dye which colors the gelatin, causing the whole picture to have a uniform veil of color on the screen”.² Each color would match the scenes mood or activity that was taking place. Common tints that were used were a yellowish-sepia for exterior shots, red for battles, fire or fury and dark blue for scenes lit by lamps and candles.³ According to an article from the New York Times, the tinting and toning effects of King Vidor in *The Sky Pilot* (1921) were “scientifically played upon the varying degrees of [moods]”.⁴ The Method of toning was used over several decades.

1920s: Synchronous Sound

In the mid 20s, sound was invented for film, however the Warner Brothers believed that no one wanted to hear actors talk therefore using the technology to add music to the scenes. This replaced the orchestras that each individual movie theater had and gave the Warner Brothers the power to pick the songs that would be accompanied with the movie. These movies were called a Vitaphone movie, which means “the sound of life”.

In the movie *The Jazz Singer* (1927), the Warner Brothers made this movie with as main character who sings songs and also talks in one scene. After

¹K. Richard, *An Evening's Entertainment: The Age of the Silent Feature Picture* (University of California Press, 1994), 3.

²*Ibid.*, 1.

³*Movies and Film*, 1, <http://www.infoplease.com/cig/movies-flicks-film/condensed-history-color.html>.

⁴Richard, *An Evening's Entertainment: The Age of the Silent Feature Picture*, 1.

1. FILM TECHNOLOGY

seeing the audiences reactions to this scene, they realized that people were interested in hearing actors speak. Suddenly the entire industry rushed into making movies with sound as they realized it wasn't a fad.⁵

Hollywood now made movies with sounds to match certain movements or words occurring in the scene (ie. sound of footsteps corresponds with feet walking). Two different processes could be used to place sound with the scenes, either the sound could be recorded on a tape or magnetic film. When using the magnetic film, to achieve a realistic scene, the timing had to be synced and exactly the same speed as the shots filmed. This allows the shot to seem more realistic.⁶

1940: Greenscreen

The Greenscreen, also known as the bluescreen, chroma key compositing, color keying, and color-separation overlay was developed in the 1930s at RKO Radio Pictures and other studios. Yet it was Larry Mutler who received credit after his Academy winning special effects from *The Thief of Bagdad* (1940). He was also the first to use this technology in Technicolor.

This technique works by layering two images that were shot separately together, then removing the front image to reveal the background image. The background images are shot first and then the actors are filmed in front of the greenscreen. Often they use the color green or blue since its sensitive in digital cameras, therefore making it easiest to remove the image.⁷

1976: Steadicam

The Steadicam was invented by Garrett Brown, however was introduced by Tiffen in 1975. The purpose of the Steadicam was to allow a smooth shot, even when moving over any surface. This prevents any unsteadiness for the cameras shots and absorbs jerks, bumps or shakes, making everything steady. This invention is a combination of the dolly and a hand-held camera, in the end mak-

⁵T. Emily, *A Very Short History of the Transition from Silent to Sound Movies* (2011), 2, http://www.wonderstruckthebook.com/essay_silent-to-sound.htm.

⁶D. Al-hashimi, *Synchronous and Asynchronous sound*, 2, <https://prezi.com/a7nv7aghklai/synchronous-and-asynchronous-sound/>.

⁷*History of the Green Screen*, 2, <http://zephyrphotoworks.com/greenscreenDetail/136>.

ing fluid movements.⁸ We first see the Steadicam in the movie *Bound for Glory* in 1976.

⁸*Steadicam*, 2, <http://www.wikivisually.com/wiki/Steadicam>.

2. VFX in Post Production

Defintion

- **Computer Generated Imagery (CGI):** Is the application of computer graphics to create or contribute to images in art, printed media, video games, films, television programs, shorts, commercials, videos, and simulators.
- **Visual Effects (VFX):** In filmmaking, visual effects (abbreviated VFX) are the processes by which imagery is created and/or manipulated outside the context of a live action shot.
- **Post Production (PP):** Work done on a film or recording after filming or recording has taken place.

VFX and Post Production Technologies weren't heavily used until the 1960s as the first Computer Animated project was created in 1963.

The 1960s

- **Hummingbird (1967):** This becomes one of the first the short computer-animated film.

Jason and the Argonauts and The Begining:

The great skeleton war (1963) was done in complete stop-motion animation, the creator (Ray Harryhausen) was able to bring these skeletons to life in the film. This is very famous in the effects industry that many VFX and CGI artists reflect on today.

The 1970s

- **West World (1973):** This has the very first use of 2D computer animation in Hollywood ever!

Star Wars and The Recession:

This is when effects companies got a side swipe from the industry's recession that nobody saw coming that caused most companies to be forced to shut down in the early 1970s. It actually was not until 1977 when Star Wars first came out and re-vamped the business. Star Wars only introduced some technical advancements in special effects and but it was the astounding amount of effects in the actual film that created uproar (aliens, moving spaceships and planets)

Icon:

This was the creation of Industrial Light and Magic, which is one of the most popular companies to date.¹

The 1980s

- Young Sherlock Holmes (1985): First digitally rendered photorealistic character.

Introduction of CGI and The Spike in VFX:

(Blade Runner, Raiders of the Lost Ark and E.T. the Extra-Terrestrial)

- In the 80s there was a massive spike in VFX. Blade Runner had a futuristic city with flying cars and floating advertisements.
- The film took place in 2019 which was optimistic for its time.²
- Ray Harryhausen comes back with his talent and skills with Clash of the Titans which features more of his stop-motion work.
- The 80s also introduced the first computer-generated images in a movie. Star Trek 2 was the starting film to feature a full on computer-generated scene.

¹Star Wars Leads VES' Top 50 Most Influential VFX List (2007).

²C. Solomon, *Enchanted Drawings: The History of Animation* (New York: Random House, Inc., 1989).

First CGI elements in a movie:

Tron featured long sequences created entirely by a computer.

The 1990s

The 90s became popular with fans only watching films for the VFX.

- 90s were the massive explosion of CGI technology. Jurassic Park is one of the biggest game changers in the industry. Steven Spielberg using directorial shots and cuts alongside a team of experts and mixed CGI techniques with animatronics puppets creates a breathtaking film that gave a new look into future CGI creations and was overly advanced for its time.

CGI Explosion, Toy Story and Jurassic Park:

The biggest advancement in CGI was the first film created entirely by Computer Generation, Toy Story. This becomes the rise of Pixar and the intense want and popularity for 3D animated films. Technology used to create these films helped to clean up the CGI elements mixed into future films.³

Total Recall:

-The first time motion capture technology was used in the film

Terminator 2: Judgment Day:

- -Featured many distinctive visual effects shots, as the liquid metal terminator could morph into any character.
- -Shots like when the terminator was shattered into pieces and the pieces were put back together (VFX)

The 2000s

The 2000s were an iconic move forward in visual effects.

³C. R. I. English, 'Illusions Take Home First Oscars,' 2005,

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- Final Fantasy: The Spirit Within (2001): The very first feature-length digital film to use photorealism alongside live action principles, and performance capture (motion capture) (motion pictures)
- Later that year Lord of the Rings would come out with Gollum, a fully CGI created character that involved the actor dressed in green screen and fully relied on after technology.

Pirates of the Caribbean: Dead Man's Chest:

The most iconic movie of this decade that had award-winning visual effects on Davy Jonesface. They used facial motion capture (FMC) technology to really harness and capture movements.

- This technology was pushed yet again in Avatar (James Cameron) with even more physical advancements in body motion capture (BMC).⁴

Present day

Most films are being shot on green screen stages, leaving the whole film pretty much up to Visual Effects Artists. VFX has become one of the most crucial components of movies today it is even as important as the actors themselves in films like The Avengers or Pacific Rim. VFX used to be seen as a luxury in a film, but now it is becoming more of a focal.⁵

- Since 1989 when Indiana Jones and the Last Crusade and Batman were the top spot, there have only been four films that did not feature Visual FX, or Visual FX not done by the top 6 companies.

TOP VFX Companies:

- -ILM: Industrial Light and Magic
- -SPI: Sony Pictures Imageworks
- -WW: Weta Workshops
- -DN: Double Negative

⁴S. Crabtree, 'Cameron comes back with CG extravaganza,' *The Hollywood Reporter*, 2006,

⁵Joseph Anderson and B. Anderson, 'Journal of Film and Video,' 1993,

-
- -DA: Dreamworks Animation
 - -PIXAR

New Hollywood Visuals: 1975-2015:

- Top 40: #1 Films based on Domestic:
- - Sci Fi/Fantasy/Action-AdventureFX Laden Films: 27/40 (67.5 percent)
- - Animated and Computer Animated: 30/40? (75 percent)
- - 6/7 Star Wars films have been the #1 Film.
- - Lucasfilm/Spielberg/ILM/Pixar= 15/25 (1975-2000) 60 percent
- - In the 1990s 6/10 top films were ILM products + 1 Pixar= 7/10

3. Audio Techonology

The 1920s: The Talkies Era

The 1920's of audio technology in film were noted as The Talkies Era.¹ The name of the era is fitting, because this was time was a transitional period for film, moving from silent movies to sound.

Key Inventions Throughout the Talkies Era

The key invention that introduced sound into films was called the Photo-Kinema, a disc with recorded sound that was played at the same time with the film. Because the audio and video were on two separate devices, it did not always allow for complete synchronization. This is where the movietone sound system came into play in 1926.² The movie tone was essentially a step up from the photo-kinema; the sound was still on a separate disc but allowed for complete synchronization between the film and the audio. The last major invention in this era was also created in 1926 and was called the vitaphone, developed by Bell Telephone Laboratories.³ Much like the movietone and the photo-kinema, the sound was recorded on a separate disc as the film. It was the last major invention to do so.

1930-1974: The Mono Era

Throughout this era, there were multiple attempts to create a better sound for films. With all this experimentation, the sound still managed to be of poor quality, almost resembling a telephone line.

¹A *short history of cinema sound* (October 2013), <http://blog.dolby.com/2013/10/short-history-cinema-sound/>.

²*Ibid.*

³*Vitaphone*, <http://www.uflib.ufl.edu/spec/belknap/exhibit2002/vitaphone.htm>.

Key Inventions Throughout the Mono Era

The first major invention throughout this era was created by Disney, and was called the fantasound.⁴ It was created for the Disney movie *Fantasia*, which was the first film that was recorded and released in mono.⁵

The fantasound was then followed by the CinemaScope, which was created in 1953. At this point, sound was being recorded on magnetic stripes rather than phonograph discs. The last major invention throughout the mono era was created in 1974 and was called sensurround. The invention featured low-frequency sounds that were substantially amplified. With the creation of sensurround being implemented in theatres, the rooms that individuals would watch the movies in would shake due to the amplified frequency.

1975: The Stereo Era

Throughout this short era there was one major invention that changed the way audio would be implemented in movies. This invention was the Dolby Stereo, and was incorporated in the Original *Star Wars* movie in 1977. Dolby Stereo consisted of condensing the four channels of recorded sound to two channels, and then back.

1976-2012: The Multichannel Era

The multichannel era began with what was called 5.1 surround sound. This involved 5 speakers (left, left centre, centre, right centre, and right) as well as a subwoofer. Inventions in the multichannel era continued to expand on the ideologies of creating an exceptional cinema sound.

Key Inventions Throughout the Multichannel Era

Innovation throughout the multichannel era started with an upgrade of the Dolby Stereo, with the Dolby Stereo 70mm making an appearance in 1978. This upgrade allowed for the first full 5.1 surround sound experience. In 1991, Dolby took things to the next level by introducing Dolby Digital in the movie *Batman Returns*, adding an analog backup of their soundtracks.⁶ Years later, in 1993

⁴*A short history of cinema sound.*

⁵*Fantasound* (September 2015), <http://ethw.org/Fantasound>.

⁶*A short history of cinema sound.*

Sony introduced Sony Dynamic Digital Sound. Sony's invention allowed for as many as 8 different channels of sound, compared to the 5 of the Dolby Stereo 70mm. At the time of the introduction of Sony's invention, it was rare that movies had the capability of using all 8 channels. Lastly, in 2010, Dolby introduced Dolby 7.1, adding two more separate channels at the back of movie theatres.

2012-Present: The Object-Based Object Era

The final era of the history of audio technology that was introduced in America. In 2012, Dolby introduced Dolby Atmos, a sound experience so realistic that individuals feel as they are actually part of the movie.⁷

⁷Ibid.

4. Methods of Viewing Film

Motion picture technology stretches far beyond the camera lens, microphone and post production enhancements but, includes the very methods used for viewing the film once completed.

1834

The Zoetrope was invented in 1834 and was a precursor for the development of the motion pictures that we have today. The Zoetrope was not quite a “motion picture” but rather gave the illusion of continuous motion through a series of quickly changing images.¹

1884

The first ever Kinetoscope parlor was opened in New York City. To view a short lasting film (usually about one minute in length). It cost one penny per short film.²

1888

A patent was filed by none other than Thomas Edison for the Kinetoscope. The Kinetoscope was the first motion picture viewing machine where the user would look through a “peep hole” on the top of the viewer to view a backlit film. The Kinetoscope was invented by Thomas Edison and his associate W. Laurie Dickson.³

¹N. Frederik, *Motion Pictures* (January 2015), http://ethw.org/Motion_Pictures res.

²*Ibid.*

³*Ibid.*

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1895

Two brothers Auguste and Louis Lumiere demonstrated a new innovative way in viewing a motion picture for the era. Rather than a single person viewing a film one at a time they projected the film onto a screen where a group of people could view a film at one time.⁴

1896

In 1896 Thomas Edison bought the rights to the “movie projector” invented by the Lumiere brothers and renamed it the Vitascope. Edison then brought it overseas to New York City where he demonstrated the innovation.

1905

Nickelodeon’s started appearing around the United States. Nickelodeon’s served the purpose as practically the first movie theatres where about a hundred or so people would view a film projected on a screen at one time. In 1910 about 10,000 Nickelodeon’s In the United States alone were serving around 20 million film-goers per week. These films typically lasted around 15 minutes in length and the movie house would always provide live music during the film.⁵

1923

Lee De Forest created a sound-on-film process where instead of audio being external from the film the audio which included music, sound effects, narrators etc. it was recorded through an optical means on the film strip itself. This led to the end of live musical performances in theatres during a motion picture. This also led to the United States losing most of their overseas audience due to the language barrier that now was apparent.⁶

Dubbing became very prominent and was very successful in allowing the United States film scene to regain its overseas audience now having movies to be viewing in multiple different languages rather than just the default.

⁴Ibid.

⁵Ibid.

⁶M. Pierre et al., *Motion-picture technology* (January 2016), <https://www.britannica.com/technology/motion-picture-technology>.

1935

Probably the most important technical advancement in the 1930's concerning film was the introduction to colour. These new colour films were shot using a three-strip Technicolor which is a system where a motion picture is captured on three separate strips of film at the same time.⁷

1948

Movie attendance declined from an astounding 90 million annual viewers to 51 million in a single year mainly as a result of people moving to the suburbs and the commonality of a television.⁸

1952-1954

Many advancements in film viewing was created during this time including many widescreen formats. The most successful of which is Cinerama which needed three perfectly synchronized 35mm projectors onto a large curved screen. Stereo was also introduced during this time which gave viewers a greater auditory experience where the audio gave the simulation of spatial distribution using multiple speakers simultaneously.⁹

1961

The first drive-in theatre opened in 1933 but the concept of a drive-in theatre did not gain popularity until 1956 where from the number of drive-ins in the United States grew from 800 to 6000. At this time more people went to a drive-in then a traditional 'hard-top' cinema.¹⁰

1970

A new way to view film, IMAX emerged where you could view film on a screen ten times the size of conventional films. Although popularity grew slowly due

⁷Technology & Innovation, <http://www.mpa.org/technology-and-innovation/>.

⁸Frederik, *Motion Pictures*.

⁹Pierre et al., *Motion-picture technology*.

¹⁰Frederik, *Motion Pictures*.

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to the construction costs limiting the amount of IMAX movies.¹¹

Late 1970's

Movies started to be sold on tapes and on disks then sold/rented out by the public to be viewed in the comfort of the viewers own home.

1987

In the United States video rentals first 'took over' and surpassed the sales of theatre tickets.

1990's

DVD's took over from VHS allowing higher quality video and audio during motion pictures.

2000's-Present

In the present a huge leap from physical form home movies to digital was made. No longer did a majority of the population purchase a physical copy of a movie but instead use cable, satellite and various streaming services such as Netflix and Hulu to view movies.¹²

Truly the advancements in film are astounding and the same can be said from the viewing angle. Coming from a small hole in a box to the click of a button or the swipe of a smartphone is truly astonishing and should not be taken for granted.

¹¹ *Technology & Innovation.*

¹² *Ibid.*

5. Sources

5.1 Bibliography

- Richard, *An Evening's Entertainment: The Age of the Silent Feature Picture*
- *Bound for Glory (1976) - HD Trailer [1080p]*, <https://www.youtube.com/watch?v=kGgW1k9swkE>
- *Steadicam*
- *Green Screen Test - The Balcony (VFX Breakdown)*, https://www.youtube.com/watch?v=xjWv9SV_Gq4
- *History of the Green Screen*
- *The Passion of Anna*, <http://www.tasteofcinema.com/wp-content/uploads/2016/05/THE-PASSION-OF-ANNA-colours.jpg>
- *Greed colours*, <http://www.tasteofcinema.com/wp-content/uploads/2016/05/GREED-colours.jpg>
- *Sky Pilot*, https://upload.wikimedia.org/wikipedia/en/thumb/d/d5/Sky_pilot.jpg/220px-Sky_pilot.jpg
- *Movies and Film*
- Al-hashimi, *Synchronous and Asynchronous sound*
- *The Jazz Singer*, <https://www.youtube.com/watch?v=bkyvstNrKHo>
- *Jurassic Park (6/10) Movie CLIP - They're Flocking This Way! (1993) HD*, <https://www.youtube.com/watch?v=nM-RPO10aPY>
- *Fantasound*

5. SOURCES

- *Technology & Innovation*
- Frederik, *Motion Pictures*
- Pierre et al., *Motion-picture technology*
- *Vitaphone*
- Crabtree, 'Cameron comes back with CG extravaganza'
- *Star Wars Leads VES' Top 50 Most Influential VFX List*
- R. Corliss, *The 25 All-TIME Best Animated Films – Toy Story* (2011)
- *A short history of cinema sound*
- Emily, *A Very Short History of the Transition from Silent to Sound Movies*
- English, 'Illusions Take Home First Oscars'
- Solomon, *Enchanted Drawings: The History of Animation*
- Joseph Anderson and Anderson, 'Journal of Film and Video'