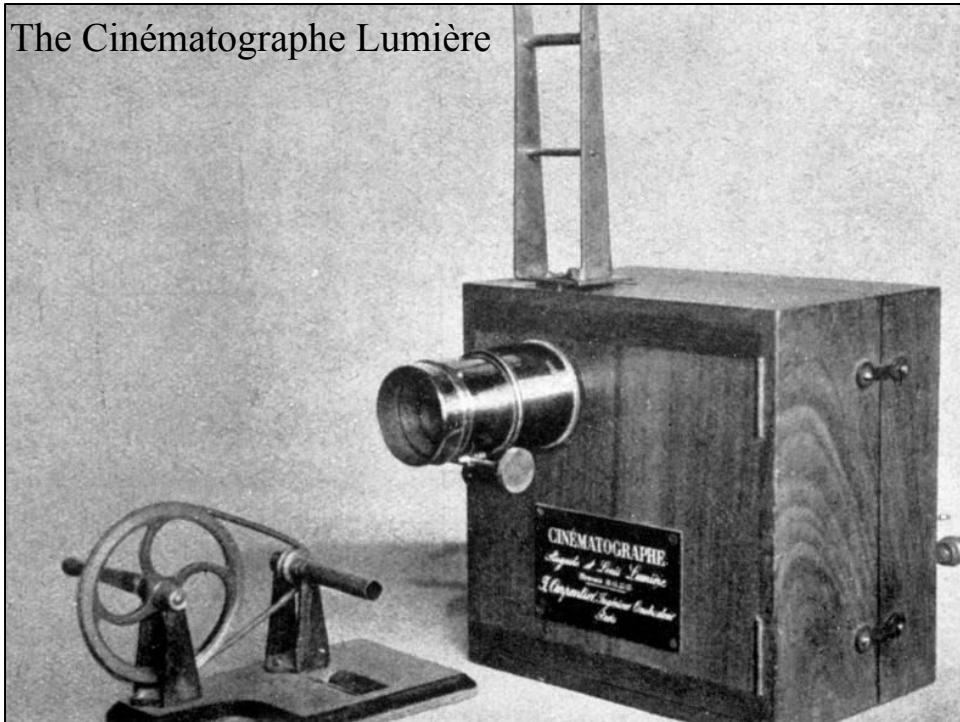




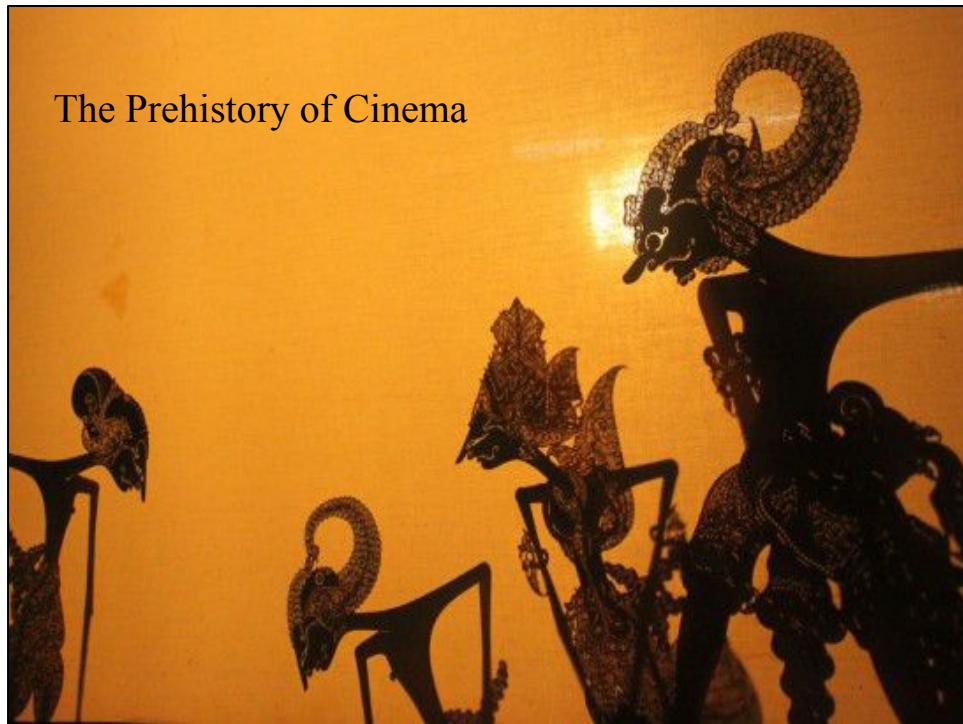
# How Technology Changed the Movies

Chris Breitenbach  
Adult Services

The Cinématographe Lumière



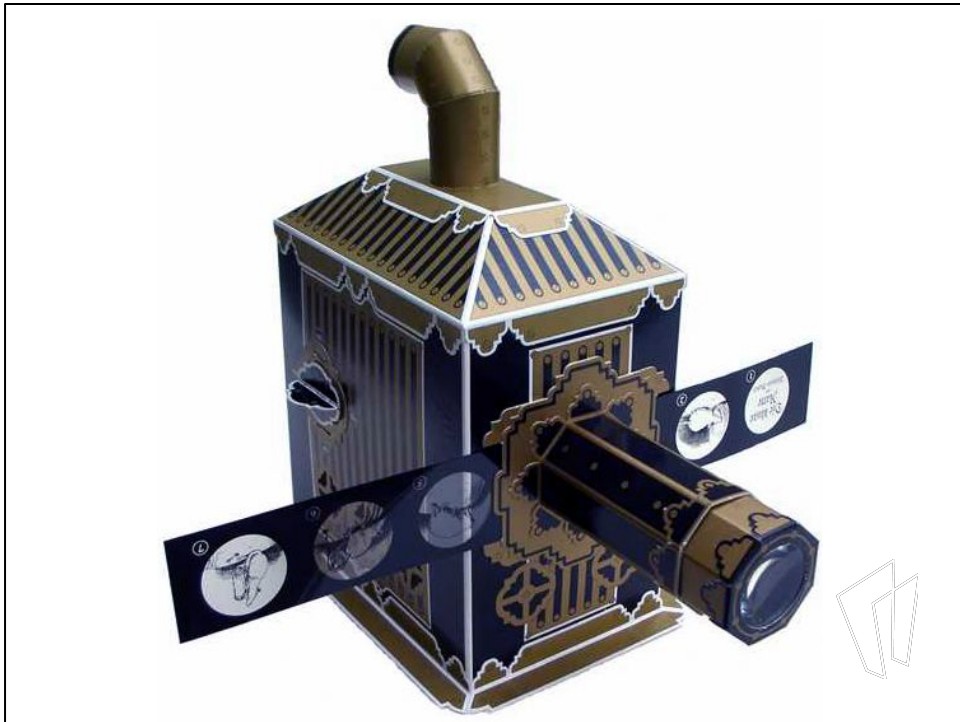
One of the most influential technologies of the past hundred years has been motion pictures. It was introduced at the end of the 19th-century, during what is sometimes called the second industrial revolution. Not only are movies big business, but they are also a large part of popular culture. They have an enormous impact on how people perceive the world and how people behave, as they provide information, elicit empathy, and shape everyday behavior. This entertainment medium and art form began more than a hundred years ago as a relatively simple technology of motion-picture camera and projector. Since then, continual technological innovation has improved the medium, all the while expanding its expressive possibilities.



So, what did screen presentations look like prior to the introduction of filmmaking apparatus? What's the prehistory of cinema? Some historians date it as far back as the twenty-six thousand year old "animated" cave paintings in Spain. More recently, but still dating back hundreds of years, on the Indonesian island of Java, shadow puppets had formed a part of popular entertainment and ceremonies for centuries.

While these carefully handcrafted puppets vary in size, shape and style, two principal types prevail: the three-dimensional wooden puppet (wayang klitik or golèk) and the flat leather shadow puppet (wayang kulit) projected in front of a screen lit from behind. Both types are characterized by costumes, facial features and articulated body parts.

The late 19th century, however, saw a historic transformation of moving image technology and culture.



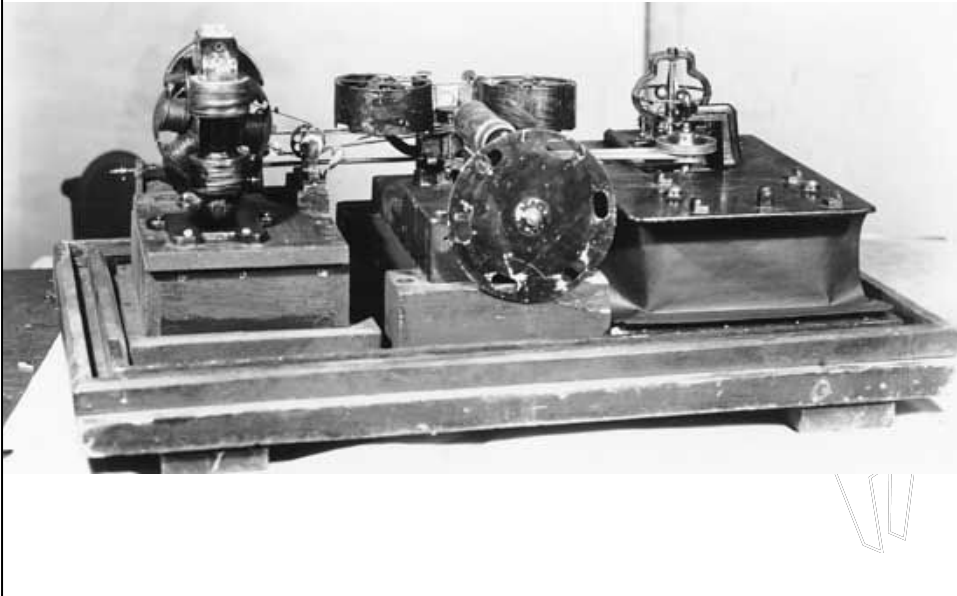
The **magic lantern** is an early type of [image projector](#) employing pictures painted, printed or produced [photographically](#) on transparent plates (usually made of glass), one or more [lenses](#), and a light source. You can think of it as an early version of the slide projector. The magic lantern was in wide use from the 18th century until the mid-20th century, when it was superseded by a compact version that could hold many 35 mm photographic slides: the [slide projector](#). In the early years of the nineteenth century, for example, showmen with lanterns travelled around the country giving shows in the places they stopped. These were known as ‘Galantee’ showmen or ‘Savoyards’, and they would give shows by projecting on walls or white sheets. The subjects would probably relate to Biblical, moral and current events, and the showman would create stories for the children watching.

## Zoetrope



As screen entertainment for public consumption expanded in the years before cinema, so too did devices proliferate for enjoying moving images privately in the home-- small portable units that came with disks or paper strips containing a sequence of images which, when set in motion, gave the illusion of movement. Perhaps the most popular of these was given the name, the Zoetrope--a bowl like device with a strip of drawings around the interior circumference; when the bowl was spun, viewers peered through slots in the sides to watch drawings seemingly in motion. (find video or examples of zoetrope strips.

## The Kinetoscope Camera



The late 1880s saw the pace of cinematic progress quicken. In 1888 George Eastman introduced a box camera with the film roll loaded inside it under the name “Kodak.” Now many people were fiddling with and filing patents in both the US and England in the late 19th-century for motion picture inventions. Not just Thomas Alva Edison, but William Kennedy Laurie Dickson too. It looks like most historians agree the first version of the motion picture camera was a combination of Edison and Williams ideas--that is, the exposure of individual frames through a shutter mechanism--this was called the **Kinetoscope** camera, which was ready to be patented in 1891. These cameras exposed anywhere from 10 to 40 frames per second and set up a template that was in place for the next 100 years (until the advent of digital cameras).



Workers Leaving the Lumiere Factory, 1895

The Lumiere brothers in France came up with their own motion picture camera, the Cinématographe which they found not only could operate as a camera, but could also be used to throw large-sized images onto a screen when it was linked with projecting equipment familiar from magic lantern shows. The Lumière brothers unveiled the Cinématographe in their first public screening on December 28, 1895, at the Grand Cafe on Paris' Boulevard de Capucines. In early 1896, they would open Cinématographe theaters in London, Brussels, Belgium and New York. After making more than 40 films that year, mostly scenes of everyday French life, but also the first newsreel (footage of the French Photographic Society conference) and the first documentaries (about the Lyon Fire Department), they began sending other cameramen-projectionists out into the world to record scenes of life and showcase their invention.



Early cinema, cinema from 1900 to 1910, is sometimes thought as being a type of presentation or exhibition and not primarily what it's known as now, as medium for narrative storytelling. So, for example, early cinema was popular at amusement parks and fairgrounds..audiences were drawn to the spectacle of pictures that moved--it was the novelty period of motion pictures because the primary appeal was simply the astonishment of seeing movement and unusual sights reproduced on the screen. These are now referred to as **Actuality Films**. You can think of them as precursors to the documentary. It relied, for example, on the conventions of the theater. Static shots of people doing things. Of trains coming into stations. Of waves crashing onto shores. Of fire departments in action





Stop Trick - Georges Méliès

**Georges Meleis** (Mil-yeahs) was a successful magician who owned a theater in Paris...he was very into creating, like any good magician, stage illusions. He was also very interested in the latest technology of his day. Most films being made in the late 1890s, as I already mentioned, were non-narrative films that simply shot was in front of the camera. Which is to say, a camera was set up and people entered into a single, static frame, much like theater. Melies wanted to make more complex films. He began to use various “tricks” to create some of the earliest, most rudimentary “special effects.” He took advantage of the technology to play with time.

First motion picture filmed in Hollywood

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The 1910's saw the expansion of American film producers, distributors and exhibitors. The first American film companies were located in New Jersey and New York. Because filmmakers worked outdoors or in sunlit glass studios, poor weather would hamper production. Not surprisingly, during the early 1910s, the Los Angeles area emerged as the country's major production center. It has many advantages: clear, dry weather, a variety of landscapes. This was also a period that saw much by way of technological innovation in the techniques of editing, camerawork, acting and lighting...all serving to tell more complex narratives.

By 1914 the American film industry was well established in Southern California.

Young Cecil B. De Mille's *first* motion picture was *The Squaw Man* (1914) - it was the first feature-length film produced in Hollywood by

a major film studio (it was distributed by Famous Players-Lasky Corporation). It was the first film to use an art director. However, it wasn't the first film to be made in Los Angeles.



D.W. Griffith

**D.W. Griffith and Development of Film Style:** D.W. Griffith is probably the most influential of all directors from this time. He began directing in 1908, and over the next 10 years he helped invent or popularize a variety of film techniques that we still use today. You have to recall, prior to Griffith, many films were just a static camera set up in a light filled room and pointed toward actors who acted in front of the camera like a play. Griffith began using camera techniques like the close ups, flashbacks, cross-cutting between different narratives--the editing technique most often used in films to establish action occurring at the same time, and usually in the same place. In a cross-cut, the camera will cut away from one action to another action, which can suggest the simultaneous nature of these two actions , invisible editing cuts, --the entire invisible art of editing. This clip demonstrates several of Griffith's editing techniques and advances in narrative storytelling.



**The Late Silent Era 1919-1929:** During this period, Hollywood cinema became a stylistic and commercial force. Most of the major studios came into being during this time (Paramount, MGM, Universal, Fox), each creating its own distinct style/system. To give you some idea of films explosion here, during this time the average weekly attendance at American movie theaters doubled from 40 million in 1922 to 80 million in 1928. It was during this time that “special effects” really took off. And no country was doing it better than Germany during this time. UFA was Germany’s largest studio at the time, and Fritz Lang was one of their major directors. Lang made the effects masterpiece *Metropolis* in 1926, a science fiction fable that made stunning use of models, animation, matte painting, rear projection and mechanical effects. Interestingly enough, by 1930 many of Germany’s leading directors and technicians had left for Hollywood. Lang was one of the last to take flight.



**Sound!** So, Warner Bros. had successfully added music and sound effects to some of its films in 1926 and 1927. By 1929, sound had been adopted throughout the American studios, and theaters were quickly being converted. Now prior to this, most silent films were accompanied by live music, ranging from a piano or an organ to a full orchestra. The introduction of synchronized sound is usually dated from 1927, when Warner Bros released the enormously successful *The Jazz Singer*. (start video at 1 minute mark)



**Sound Continued:** All sorts of new technological innovations came about with the advent of sound in filmmaking. The first microphones, for example were omnidirectional, meaning they picked up any noise on the set. Cameras, already big, bulky and loud, had to be placed in soundproof booths. And initially, all sounds for a single scene had to be recorded at once--there was no "mixing" of sound tracks recorded separately. If music were to be heard, the instruments had to play near the set as the scene was filmed.

In the picture you see here, in a Warner Bros sound studio, an exterior dialogue scene for an early talkie is shot. The orchestra plays at the side, and three cameras in booths face the couple on the bench. Note the man on top of the booth, center, moving the microphone slightly to catch the pair's voices. Two additional microphones are suspended above the orchestra.



**1930-1945:** During this time, the studios grew in power. They continued to innovate and create a technological support side to the film industry. So, in regards to sound, easily the biggest technological leap in film, microphone got better, multitrack recording was created to allow music, voices, and sound effects to be registered separately and later mixed into one track. Camera movements became more complex, too, more innovative and dramatic ways to tell stories-- which included what's known as the crane shot...the ability to raise the camera vertically so the operator could pan, tilt or track with ease. Here's an early and perhaps one of the most famous example of a crane shot from *Gone With The Wind*:



Technicolor



**Technicolor:** Undoubtedly the most striking technological innovation of this era was color filmmaking. Silent films would, on occasion employ non-photographic processes that colored the film after it had been shot. But in the early 1930s, Technicolor introduced a new system involving prisms to split the light coming through the camera lens into three strips of black and white film, for each primary color. This technique was introduced publicly in a 1932 Disney short cartoon, **Flowers and Trees:**



## Special Effects!

A matte painting is often a painted glass pane that is used to show a landscape or large set piece. Matte paintings are either filmed on set, where they are framed to look like a physical set piece, or they are combined with live footage in post production. Some of the first new method was pioneered and used in the 1940 version of *The Thief of Bagdad*. But perhaps the most popular examples of matte techniques are found in the Star Wars movies. At least, that's where I found these great examples of technological innovation. There are hundreds of these behind the scenes mini-documentaries of special effects driven films.

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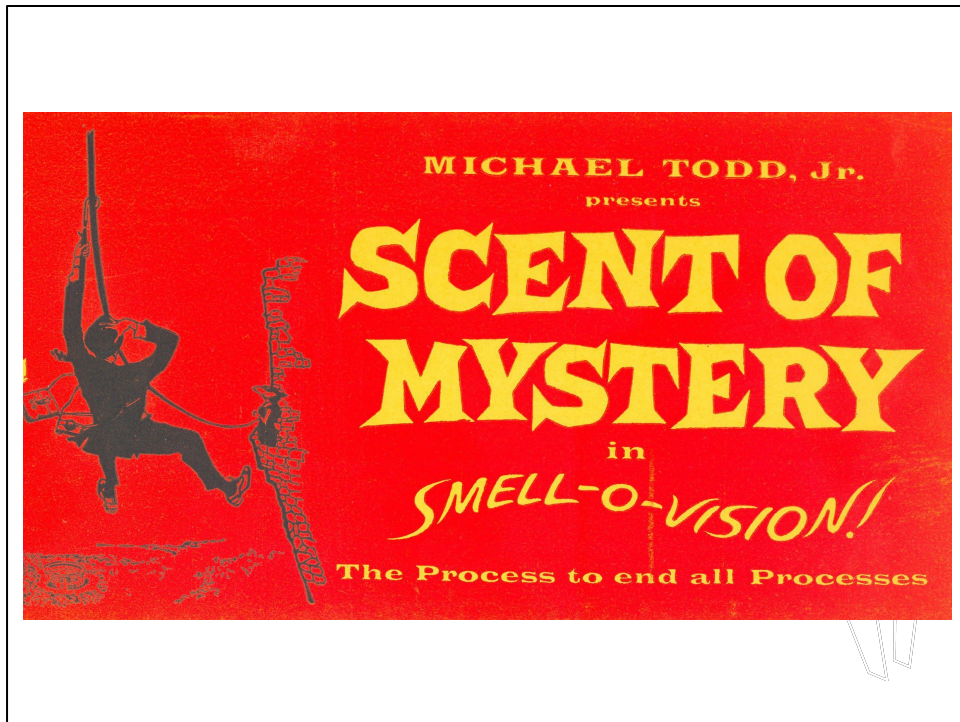
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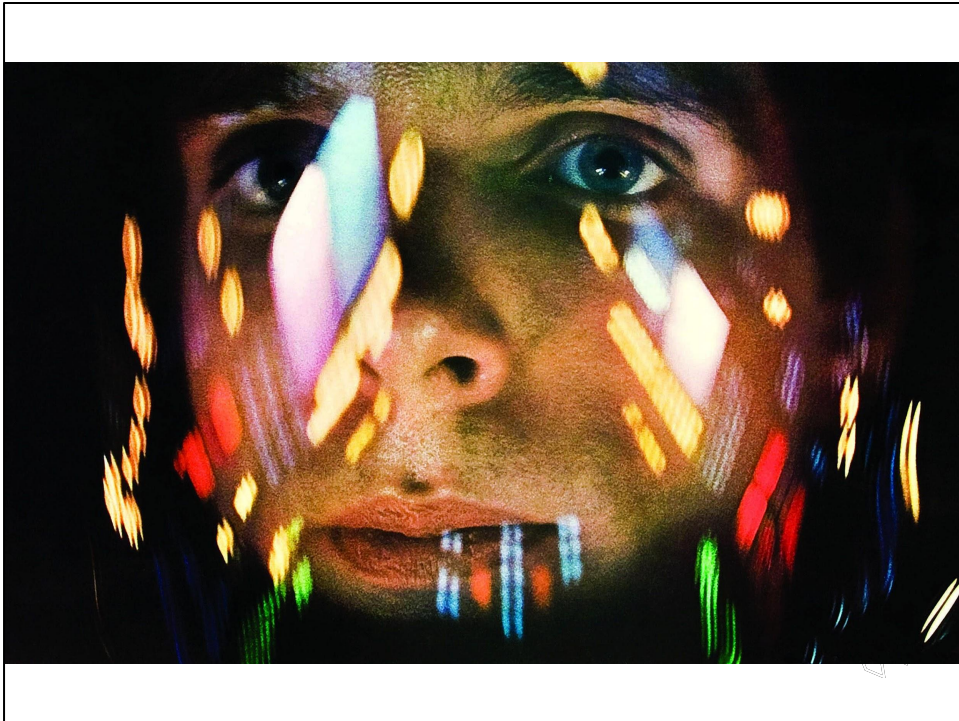
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Postwar Era Film: 1945-1960: Post WWII saw the decline of the Hollywood Studio System. Attendance began to shrink. From 98 million viewers per week in 1946 to about 47 million in 1957. What happened? After the war people adopted new lifestyles, leisure-time activities, primarily television--profoundly changed Americans' moviegoing habits. So how to get folks back?

The television image in the 1950s, when more and more households were bringing tvs home, was small, indistinct and black and white. Film producers began to changing the look and sound of their movies in hopes of drawing people out of their living rooms. So more films in color. And bigger screens. Between 1952-1955 many widescreen processes were introduced. Cinerama, Cinemascope, etc... These wider images required bigger screens, brighter production, and modifications in theater design. Multichannel sound, too. And novelty. Some of the earliest experiments in "3D" films happened during this time. And...



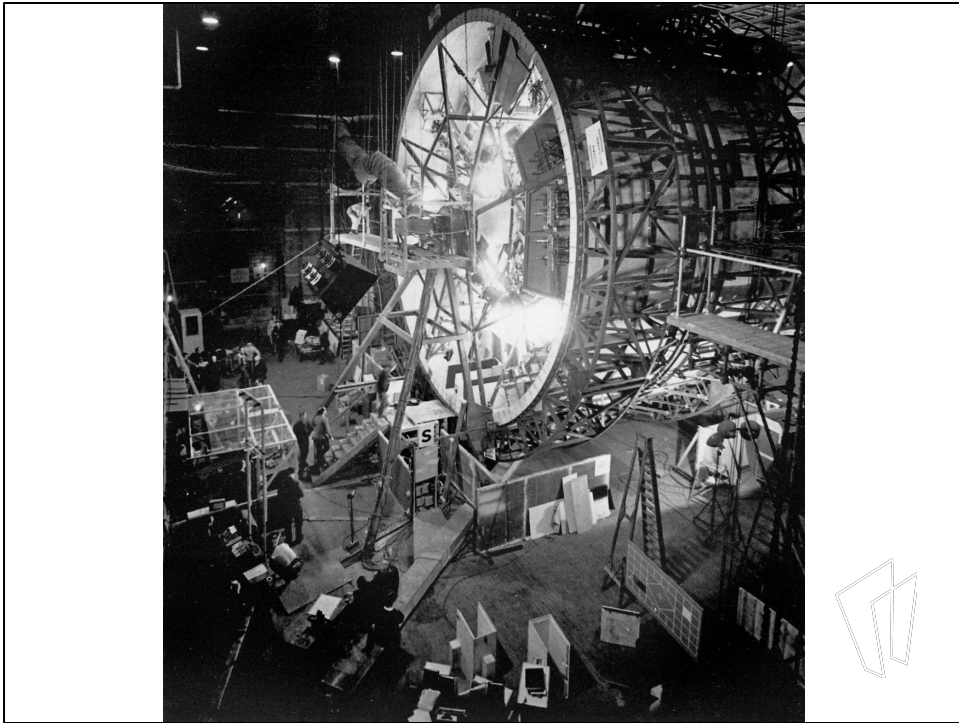
Hollywood introduced novelty too. AromoRama and Smell-O-Vision appeared to largely negative response. In 1960, when the romantic whodunit "Scent of Mystery" opened in Los Angeles, New York and Chicago, audiences were treated to more than just sights and sounds. As the projector droned, a device known as a smell brain pumped 30 different scents—wine, freshly baked bread, pipe tobacco, a salty ocean breeze—through a network of tiny tubes to movie viewers' seats.



1960: Moving into contemporary cinema. One of the biggest leaps in film technology came with Stanley Kubrick's *2001: A Space Odyssey*. Kubrick was a relentless perfectionist, often spending years of pre-production researching and collaborating with others before he felt comfortable moving forward on the production of a film. Making *2001*, a film that was taking place several decades in the future, Kubrick worked tirelessly with leaders in various technological industries to help him envision the future.

Every detail of the production design, down to the most insignificant element, was designed with technological and scientific accuracy in mind. Senior NASA Apollo administrator George Mueller and astronaut Deke Slayton are said to have dubbed *2001*'s Borehamwood, England production facilities "NASA East" after seeing all of the hardware and documentation lying around the studio. Even today, most audiences and critics still find *2001*'s props and spaceships more convincing than those in many more recent science fiction movies. While earlier science fiction films had aimed for a streamlined "futuristic" look, *2001*'s production design

was intended to be as technically credible as possible.



It was not unusual for the crew of 2001 to go to great lengths to create the film's unique sets. The film's most impressive set is that of the interior of the spaceship Discovery. To compensate for the weightlessness of outer space, the ship's crew compartment was envisioned as a centrifuge that would simulate gravity through the centripetal force generated by its rotation. A 30-ton rotating "ferris wheel" set was built by Vickers-Armstrong Engineering Group, a British aircraft company at a cost of \$750,000. The set was 38 feet in diameter and 10 feet wide. It could rotate at a maximum speed of three miles per hour, and was dressed with the necessary chairs, desks, and control panels, all firmly bolted to the inside surface. The actors could stand at the bottom and walk in place, while the set rotated around them. Kubrick used an early video feed to direct the action from a control room, while the camera operator sat in a gimbaled seat.



The ring and the corridor were both built to rotate, independently. The camera was physically connected to the corridor. As the crewman is going down the corridor, the ring is turning and the corridor is not. At a certain point, they switched it, so that the corridor started turning and the ring stood still.

The jogger was always at the bottom. The ring turned underneath him as he ran. The camera (and cameraman!) were connected to the ring, and as it turned, the cameraman kept the camera pointed at the jogger, at the bottom.

Of course, when we view it, we think of the camera as fixed, so we see the jogger go "over our heads"

The achievements of *2001's* effects, which were all done without the benefits of computer technology, are nothing less than amazing. Kubrick held his crew to the highest standards to insure that the film's effects were designed to be as realistic-looking as possible. To insure that every element of an effects scene was as



sharp and clear as a single-generation image, he ruled out the use of many techniques that would have been much faster and less expensive. \$6.5 million of his \$10.5 million budget ended up going toward effects alone, and it was nearly two years after the end of principal photography that film was finally finished.



The biggest player, the most influential during the 1970s was George Lucas. The beginning of the blockbuster film, often heavy effects driven films. And the birth of Industrial Lights and Magic, the powerhouse special effects company. The young Lucas had a very clear vision and aesthetic in mind when he wrote his space fantasy magnum opus, but the technology available was still woefully inadequate to produce such challenging visuals. Lucas had created – in his storyboards at least – a rich environment filled with weird and wonderful creatures, space battles and hunk of junk spaceships leaping through hyperspace. But at a time when computer generated imagery (CGI) was still in its infancy (having debuted in Richard T Heffron's [Futureworld](#) only a year earlier), it quickly became clear Lucas was going to have to build his universe by hand.

The original trilogy (*Episodes IV, V and VI*) produced between 1977 and 1983 set the gold standard for visual effects. John Dykstra, the special effects designer who worked on the original *Star Wars* and was chosen by Lucas to head up the director's visual effects

company, Industrial Light & Magic, has described sitting with a group of friends and building models and robots from scratch in order to achieve the realism Lucas was after.



Special Effects in Star Wars

One of the nice things about Star Wars and its popularity is the wealth of behind of scenes videos you can find. Hours and hours of behind the scenes videos detailing the technology that went into making these movies. Here's a great clip that shows how motion controlled cameras and glass mattes were incorporated into the first Star Wars Episode 4. (Start around 45 seconds).

## CGI: Computer Generated Imagery



In 1970 a new format, **IMAX**, offered a screen size ten times that of conventional films. Because of construction costs, the number of IMAX theaters grew slowly, and production costs limited the number of IMAX movies. Dolby noise reduction, which reduced tape hiss and other noise, was introduced to movies with *A Clockwork Orange* in 1971, and multitrack sound finally became established in cinemas with the arrival of Dolby four-channel sound in 1975. The sound system attracted much notice with "Star Wars" in 1977, and this movie also made use of new special effects, notably "motion control", which was computerized control of both camera and model.

Toward the end of the 1970s movies began to be sold on videocassette and on video disk. There were two competing videocassette formats, Betamax introduced by Sony and VHS introduced by the rival Japanese electronics company JVC, and there were three competing video-disk formats, Philips's LaserVision, RCA's SelectaVision, and JVC's VHD. Video disks did not become popular, but videocassettes did, with the VHS format

outcompeting the Betamax format. Already in the mid 1980s rentals and sales of videos was a huge business, greatly increasing home consumption of movies. Indeed, in 1987 in the U.S., video rentals surpassed ticket sales as the leading revenue source for the movie industry.

Computers became important in film production, especially for computer-generated imagery (CGI). Such computer animation debuted in the movie *Tron*, released by Walt Disney Pictures in 1982. By the end of the decade CGI was lowering the cost of producing certain effects and making possible images that could hardly be created in other ways. The Turner Broadcasting System made use of computer technology in another way when, in 1987, it began offering colorized versions of black-and-white movies.



In the 1990s computer-generated special effects became widespread. The first computer-generated 3-D character appeared in the 1989 movie *The Abyss*. Morphing (the computer technique of changing one image seamlessly into another image) appeared in the 1991 movie *Terminator 2*. The success of *Jurassic Park* in 1993 made clear to filmmakers the value of CGI. The 1994 movie *Forrest Gump* combined, in several sequences, historical footage and live action, and the 1995 movie *Toy Story* was the first commercially released full-length movie created entirely on a computer. Motion capture, a technique of recording physical movements, made digital creations move realistically. The 1999 movie *The Matrix*, in the technique called "bullet time", used computers to create seamless action from multiple stills. Here's a quick video on how they incorporated Tom Hanks' Forrest Gump character into an actual historical episode of the Dick Cavett show. (Robert Zemeckis is another Hollywood director who has been on the forefront of technological innovation in film)

## 21st-Century Film Technology



**Which brings us to the 21st century. An entire program could be based around the technological innovations that have come about over the last 17 years alone. But here is a quick rundown of some of what I think are the most important:**

1. **Color Grading:** You'll notice that a lot of films have a teal or orange tint to them. Or that they're insufferably blue. You can use all sorts of intricate post-production editing software to change the color of a film. This started with *O Brother Where are't Though?* Cinematographer Roger Deakins, rather than use the old school analogue techniques that had been used to give the film an old fashioned yellow tint thought, well, let's just run the whole film thru a computer and do it there. Presto, color grading was created.
2. **Peter Jackson and Weta Digital in Lord of the Rings. Especially the software known as "Massive"** which could simulate large crowd animations. It's a mind-blowing technology in its own right and we could give an entire presentation on it alone. Needless to say, it's become the industry standard for scenes with huge crowds.
3. **Motion Capture Technology:** Andy Serkis in Gollum in Lord of the Rings. In short, motion capture is the technique of copying (capturing) human movements and transforming them into realistic computer simulations. Within the movie industry motion capture is often referred to as "mocap". Avatar, Star Wars: The Force Awakens, the recent Planet of the Apes reboot are all some recent films using motion capture technology.
4. **Digital Backlots:** is a motion picture set that is neither a genuine location nor



1. a constructed studio; the shooting takes place entirely on a stage with a blank background (often a [greenscreen](#)) that will later on project an artificial environment put in during post-production. Digital backlot is more often used in certain genre of films, like sci-fi and comics, in order to achieve what would otherwise be too expensive or outright impossible to build as a real set.--It's also being used in just about every movie/tv show being produced today.
2. **James Cameron's Avatar:** Innovating or evolving **Performance capture, Use of Simul-cam, Digital animation, Head rig for facial capture, Replacement of performance features, A camera system using 3D fusion**
3. **Streaming Technology: What you want, when you want, wherever you want.**
4. **Digitization: Digital filmmaking, digital projection, etc..**

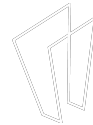
**Sources:**

*Film History: An Introduction (Second Edition)*  
by Kristin Thompson and David Bordwell

*Special Effects: The History and Technique* by  
Richard Rickitt

*Film Art: An Introduction (Ninth Edition)* by  
Kristin Thompson and David Bordwell

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