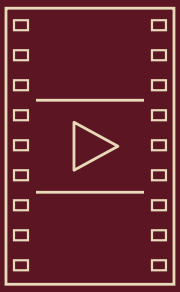
INDUSTRIES OF INDIA

THE MOVIE

Shadow, Celluloid, Stream



KETINENI RAMARAO

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PROLOGUE

The Horse That Left the Ground

On a June morning in 1878, on a dirt track at Leland Stanford's stock farm in Palo Alto, a racehorse named Sallie Gardner ran past a wall of twelve cameras and settled an argument that nobody could settle with the naked eye. Stanford, the railroad baron and former governor of California, held the view that a galloping horse, at some point in each stride, took all four hooves off the ground. The received wisdom of painters and horsemen said otherwise: the legs splayed, but the animal kept contact. Eyes could not decide it. A gallop is over too quickly for the organ that evolved to watch it.

Eadweard Muybridge, a photographer with a theatrical past and a talent for machinery, strung twelve cameras along a ten-metre stretch of track and stretched threads across the horse's path. Each thread tripped a shutter. What came back from the darkroom was a row of stiff little silhouettes, and in the middle of the row the answer: a horse suspended in the air, all four feet tucked beneath its body.[1]

The pictures travelled around the world as a curiosity. What mattered was not what they showed but what they were: time, sliced into pieces too thin for any human to have seen, fixed onto a surface that could be carried, studied, printed, sold. Muybridge had not made a movie. He had made the movie's raw material - motion converted into a series of stills - and within a few years he was touring with a machine he called the zoopraxiscope, projecting those phases back into motion from painted glass discs, making the horse run again for lecture-hall audiences who had paid to see it run.[2]

That is the whole subject of this book in one morning's work. A question nobody could answer unaided. A machine built to answer it. A material that could hold the answer. An audience willing to pay to look. Everything that follows - the laboratories and studios, the chemistry and

the lawsuits, the palaces and the servers - grows from that arrangement: the world is too fast for our eyes, so we built a way to slow it down, slice it, store it and show it back, and then we built one of the largest industries on Earth around the showing.

The movie is usually told as a story of artists: directors, stars, movements, masterpieces. That is one of its stories, and this book honours it. But the deeper story, the one that explains why the industry looks the way it does, is a story of things. A strip of plastic coated in silver. A claw that pulls the strip down one frame at a time and holds it still in a beam of light for a fortieth of a second. A lens that squeezes a wide world onto a narrow ribbon. A projector booth, a patent pool, a box office, a hard drive in a refrigerated warehouse, a fibre cable under an ocean. Follow the things, and the art comes into focus on its own - as does the strange modern fact that the most successful storytelling machine ever built now lives mostly on the same screens as spreadsheets and video calls.

Three materials carry this history, and they give the book its spine. The first is shadow: the projection of a likeness onto a surface, a trick older than cities, which taught audiences to sit in the dark and watch a wall. The second is celluloid: the flexible strip, invented for still photography and requisitioned by motion, which decided the movie's shape, its dangers, its economics and even the size of the screen in your pocket. The third is the stream: the river of digits that replaced the strip, dissolved the theatre's monopoly, and turned a century-old industry inside out in less than twenty years.

The horse left the ground in 1878. It has not landed yet.

Reel One

Before the Movie

Long before film, people were already sitting in the dark watching pictures move. The movie was not invented in 1895. It was assembled, over centuries, from a shadow, a lantern, a spinning disc and a bet about a horse.

CHAPTER 1

The First Projection Was a Shadow

> *The oldest cinema has no screen, no projector and no film. It needs a fire, a wall, and someone willing to sit still in the dark. Everything the movie became is already there.*

Start further back than any machine. Put a lamp behind a hand and a wall in front of it, and the wall shows a shape that is not the hand but is unmistakably of it: enlarged, flattened, obedient. Shadow play is a technology so simple that no civilisation had to invent it twice. It simply appears wherever people shelter from the night. What civilisations did invent, independently and elaborately, was the art of making the shadows worth watching.

The shadow theatre of Java and Bali - wayang kulit, flat leather puppets worked by a single master puppeteer, the dalang, against a cloth lit by an oil lamp - is a full dramatic system: epics that run all night, a fixed canon of characters each known by silhouette, music, an audience that may watch either the shadows or the puppeteer, the way a film audience may think about the actor or the performance. Turkey and Greece had Karagöz, the hunchbacked everyman whose oiled-parchment shadow plays carried satire from coffee house to coffee house across the Ottoman world. China claims the form's own origin legend, in which a Han dynasty court magician conjured the shadow of a dead concubine to console her emperor - a story that is almost certainly myth and completely accurate: from the beginning, projection has been a technology for making absent people present.

The other ancient ancestor is a box, or a room, with a hole in it. The camera obscura - the darkened chamber - was described in principle by Mozi in China in the fourth century BC and analysed properly by Ibn al-Haytham in eleventh-century Cairo: light from a bright scene, admitted

through a small aperture into darkness, paints an inverted image of the scene on the wall opposite. By the sixteenth century Giambattista della Porta was describing it as entertainment, and by the seventeenth, painters in the Dutch Republic were using portable and room-sized camera obscuras to study light and perspective. A lens tightened the image; a mirror set it upright. The result was something uncanny: a moving, coloured, perfectly detailed picture of the living world, on a wall, indoors.

Both ancestors teach the same lesson, and it is the lesson this book keeps returning to. The audience for projected images did not need to be created by the movie industry; it had existed for centuries, trained by shadows and lantern shows to accept a flat wall as a window. The movie's inventors did not have to persuade anyone to watch. They only had to give the watching crowd something better than a shadow.

There is one more thing the shadow teaches, and it is less comfortable. A shadow is a copy that owes everything to its original and asks nothing of it. The history of the movie - of its economics, its labour, its eventual collision with computing - is in part the history of that relationship: the image as a thing that can be taken, kept, duplicated, sold and, in the digital century, manufactured without an original at all. But that argument is a long way off. In the dark, by the fire, the only question is the one every audience since has asked: what happens next?

CHAPTER 2

The Lantern That Summoned Ghosts

> *Two hundred and fifty years before the first movie, the magic lantern had already invented cinema's format: a paying crowd, a darkened room, a bright image, a showman, a story. It even invented the blockbuster genre - horror.*

The magic lantern is usually credited, as a description, to the Jesuit polymath Athanasius Kircher, who published an account of the device in 1646; the first working instrument was very likely built around 1659 by Christiaan Huygens, the Dutch astronomer better known for Saturn's rings and the pendulum clock. Huygens's lantern - a lamp, a concave mirror, a painted glass slide, a lens - survives in his notes as a sketch of a little dancing skeleton that removes its own skull. The first projected moving image in European history may therefore have been a death joke.[3]

For its first century the lantern was a savant's toy and a churchman's marvel. Then it met the market. Travelling showmen discovered what Kircher's readers had only suspected: put a bright, enlarged, impossible image in front of strangers, and strangers will pay. The glass slides grew elaborate - slipping slides in which one glass layer moved across another so a ship rocked, a windmill turned, a rat ran down a sleeper's open mouth. The lantern dissolved between slides with paired projectors, an effect audiences called the dissolving view, which is the direct ancestor of every fade in every film.

The form found its showman in Étienne-Gaspard Robert, a Belgian entertainer who performed as Robertson. In the 1790s, in a disused Capuchin convent in post-revolutionary Paris, he staged the phantasmagoria: the lantern hidden behind or beneath the screen, the projector mounted on wheels so the ghost could rush at the audience as

it swelled, slides of the recently guillotined, smoke, thunder, a bell. Spectators were informed that the dead would appear, and the dead, obligingly, appeared. Robertson was showman enough to patent his moving projector and businessman enough to tour the act across Europe. Flemish exhibitors like the Courtois family carried lantern spectacles from fair to fair, programmes mixing "Italian nighttime scenes" - virtual travel to places the audience had only heard of - with the phantasmagoria's ghosts.[3]

Everything in that sentence is a film-industry job description. The roadshow, the genre picture, the spectacle engineered for effect, the sequel, the international tour. The lantern even produced the first media celebrities: operators whose names sold tickets.

What the lantern could not do was the one thing the crowd now wanted. Its pictures were magnificent and they moved, but they did not move like life. The painted ship rocked because a showman slid a piece of glass. The ghost lunged because Robertson pulled his projector backwards on rails. Nobody had yet made the wall show the world itself, caught unposed and in motion. For that, the image had to stop being painted by hand - and that required two more inventions: a mechanical way to chop time into stills, and a chemistry that could trap each slice before it escaped.

CHAPTER 3

The Toys That Explained the Movies

Before anyone could photograph motion, parlour toys had already solved the other half of the problem: how a row of still pictures becomes movement inside a human head. The official explanation for that trick turns out to be wrong, and the wrongness is worth a chapter, because the movie has been lying to your brain from the first frame.

The nineteenth century's optical toys were scientific instruments that escaped into the nursery. The thaumatrope - the "wonder turner", a card with a bird on one side and a cage on the other, spun on strings until the bird sat in the cage - was popularised by John Ayrton Paris in 1825. In 1833, working independently and almost simultaneously, Joseph Plateau in Ghent and Simon Stampfer in Vienna produced the phenakistiscope: a disc with figures drawn in sequence around its rim, spun before a mirror and viewed through slits, so the drawn figures appeared to perform their little loop endlessly. Stampfer's design for a viewing cylinder became, by 1834, William Horner's drum-shaped daedaleum, and by 1866 the parlour fixture every Victorian household knew as the zoetrope - the "wheel of life". In 1877 Charles-Émile Reynaud's praxinoscope replaced the slits with a ring of mirrors and made the illusion bright enough for a crowd.[4]

Ask a textbook what makes these toys work and it will say "persistence of vision": the eye retains an image briefly, so successive stills blur into motion. The phrase dates to the 1820s and is still repeated everywhere. It is also, as an explanation, almost entirely wrong. The retina does smear images together - that is why sparklers write trails in the dark - but smearing is the opposite of what a movie needs. If the eye simply blended frames, twenty-four frames a second would look like porridge. What actually happens is stranger and more useful: the visual system detects that an object in frame two occupies nearly the position of an

object in frame one, and constructs motion from the difference. Psychologists call this apparent motion; Max Wertheimer demonstrated the cleanest version of it in 1912 with two flashing lights and nothing moving at all, and his "phi phenomenon" helped found Gestalt psychology. The film theorist David Bordwell spent a brisk essay in 1990 reminding his field that persistence of vision is a myth, and the myth persists anyway, because it is simpler than the truth.[5]

The truth matters to this book for two reasons. First, it means the movie is not a recording trick played on a passive retina; it is a collaboration. The projector supplies twenty-four stillnesses per second and the brain builds the motion, for free, out of its own machinery. The entire industry rests on a feature of perception that no inventor designed and no patent could ever own.

Second, it sets the terms of every technical decision that follows. A frame rate is not a natural constant; it is a negotiated settlement between the brain's appetite for smoothness and the budget's appetite for film stock. Silent cameras cranked at sixteen to eighteen frames a second. Sound demanded twenty-four, and twenty-four ruled for seventy years - not because eyes prefer it, but because it was the slowest speed that carried acceptable audio, and slowest meant cheapest. When audiences later rejected high-frame-rate experiments like forty-eight frames per second as looking "like television", they were defending a habit, not a law of physics. The movie has always been, in this precise sense, whatever the crowd's brain agreed to believe.

CHAPTER 4

The Photographers of Time

> *Between the parlour toy and the movie stands a generation of men - they were nearly all men, and the archive records it - who aimed cameras at time itself. None of them meant to found an entertainment industry. All of them did.*

Muybridge's Palo Alto sequences were science, funded by a rich man's curiosity about his horses. The story has a pleasing symmetry: Étienne-Jules Marey, France's great physiologist of movement, had published The Animal Machine in 1873, arguing that the bodies of animals obeyed mechanical laws that instruments could trace; Stanford read the English translation, doubted its drawings of the gallop, and hired a photographer to check. When Muybridge's plates appeared in La Nature in December 1878, Marey saw at once what photography offered physiology - and what twelve cameras could not give him. He wanted the whole motion from one vantage point, on one plate.[1]

His answer, in 1882, was the fusil photographique, the chronophotographic gun: a rifle-shaped camera whose rotating plate caught twelve exposures a second as the marksman tracked a bird. It is the most honest ancestor the movie camera has - a weapon, built to shoot things too fast to see. Marey went on to replace the plate with rolls of paper film and, later, celluloid, recording runners and fencers as sequences of ghosted, overlapping phases: motion studies, not stories. He had no interest in projection. He had dissected time and did not much care to sew it back together.

The sewing back together - the projection of photographed motion to a paying public - had a different champion, and cinema history's first mystery story. Louis Aimé Augustin Le Prince, a French chemist and painter working in Leeds, England, patented a sixteen-lens camera in

1886 and then did something better: he built a single-lens machine and, in October 1888, used it to film his wife's family dancing in a Leeds garden. Roundhay Garden Scene runs about two seconds and survives to this day; Guinness recognises it as the earliest surviving film.[6] Le Prince was preparing to exhibit his process in America when, in September 1890, he boarded a train in Dijon and vanished - body never found, luggage never recovered, suicide and murder and fraternal conspiracy all alleged and none proved. Edison's lawyers later fought Le Prince's widow over his patents. History awarded him the priority and forgot to award him the industry.

The pattern of these years is worth naming, because it repeats for a century. The scientists solve the capture of motion and lose interest in the show; the showmen inherit the technology and lose interest in the science; and the inventors in the middle - the ones who wanted both, like Le Prince - tend to disappear, literally or financially, before the money arrives. The movie industry was built, from the start, on other people's breakthroughs.

CHAPTER 5

The Show That Beat the Cinematograph

Three years before the Lumière brothers' famous evening, a paying audience in Paris was already watching projected moving pictures with colour, characters and plots. They were drawn by hand, and their inventor ended his life destroying his own machines.

Charles-Émile Reynaud took his praxinoscope - the mirrored improvement on the zoetrope - and asked the question that makes industries: not "how do I show a twelve-frame loop?" but "how do I put on a show?" His Théâtre Optique, opened at the Musée Grévin wax museum in Paris on 28 October 1892, projected long strips of hand-painted gelatin frames - hundreds per strip, connected by flexible bands - onto a full screen before a seated audience, with characters, stories, and a piano score composed for the show. His Pantomimes Lumineuses included Pauvre Pierrot, often cited as the first animated story ever screened publicly. Between 1892 and 1900 Reynaud gave more than 12,800 performances to over half a million visitors.[7]

Every element of a cinema programme was present: the ticketed show, the darkened hall, the original score, the star character, the repeat trade. What was absent was photography. Reynaud's images were painted, and painting does not scale. Each new programme cost him months of brushwork; each strip frayed in the mechanism, and he sat up nights repairing them.

So when the Cinématographe arrived in 1895 - cheap to feed, because the camera made new images as fast as the world supplied them - Reynaud's painted theatre collapsed almost at once. He lived until 1918, long enough to see the industry founded on his format grow enormous, and long enough to smash his Théâtre Optique with a hammer and throw most of his painted strips into the Seine.

His chapter closes the prehistory with the moral the whole book keeps meeting. The movie did not win because it was the first projected moving picture. It won because it was the first projected moving picture with a supply chain: a camera that harvested reality instead of a studio that manufactured images by hand. The difference between Reynaud and the Lumières is not art. It is production economics. One artist with a brush versus one machine that never stops copying the world.

And yet notice what the audience paid for in both cases. Not realism, exactly; Reynaud's crowds came for painted clowns. What they paid for was the same thing the shadow-play audience paid for: the dark room, the bright wall, the suspension of the ordinary. The technology keeps changing underneath that contract. The contract has not changed since the fire and the cave.

Reel Two

The Material

Movies exist because a priest in New Jersey wanted better Sunday-school pictures. The strip of celluloid that Eastman sold and Goodwin patented decided everything the movie would be - its width, its length, its look, its smell, and the particular way it burned.

CHAPTER 6

The Priest and the Ribbon

> *The single most consequential material decision in the history of movies was not made by Edison or the Lumières. It was made by a clergyman who wanted an easier way to show Bible pictures, and by a plate-coating company in Rochester that wanted to sell film by the mile.*

Photography before 1888 was a darkroom that walked. The wet-plate process required the photographer to coat a glass plate with collodion, sensitise it in silver nitrate, expose it and develop it within minutes, which is why the first era of photography is full of tripods, tents and wagons. Gelatin dry plates removed the urgency but kept the glass. What nobody had was a flexible, transparent support: something that could hold an emulsion, bend, and roll.

Hannibal Goodwin, an Episcopal priest in Newark, New Jersey, went looking for it because glass plates made poor lantern slides for his Sunday school. His recipe - nitrocellulose dissolved in nitrobenzene, thinned with alcohol, cast onto glass and peeled off as a clear, tough skin - was exactly the thing photography needed. He filed for a patent in 1887. George Eastman's company, then working on the same problem for its first Kodak camera, filed too, and the Patent Office declared an interference between them. Goodwin won the priority, though not in time to enjoy it: he died in 1900, and his estate's suit against Eastman Kodak ended in 1914 with a settlement reported at five million dollars - one of the largest patent payments of the era, for the invention underneath everything in this book.[8]

Eastman's genius was less the chemistry than the system. The 1888 Kodak camera came loaded for a hundred exposures; when they were done, the customer posted the whole camera back to Rochester and it

returned reloaded, with prints: "You press the button, we do the rest." Roll film turned photography from a craft into a retail business. And in 1889 Eastman began selling transparent nitrocellulose roll film as a product in its own right.[9]

That ribbon is the movie's true raw material. Everything Edison's laboratory did next - and everything the industry became - was done to a strip of this plastic. The movie's fundamental economics were visible already in the Kodak slogan: the money was not in the machine. The money was in the consumable the machine consumed. A century of film-stock duopoly, of patent pools, of print costs and processing laboratories, and eventually of memory cards and cloud storage bills, flows from a priest's wish for a lighter lantern slide.

CHAPTER 7

Nitrate: The Beautiful, Dangerous Base

For more than fifty years every movie you could see was printed on a material chemically indistinguishable from a propellant. Nitrate gave the movies their silvery look, their first catastrophe, and a preservation crisis that is still not over.

Nitrocellulose is cotton treated with nitric acid. In one form it is guncotton, an explosive; in another, it is the world's first practical plastic, the base of celluloid collars, combs, billiard balls - and film. Eastman introduced cellulose-nitrate roll film in 1889, and cellulose-nitrate motion picture film followed in 1895, the year of the first projected shows.[9] It was nearly perfect: clear, strong, flexible, dimensionally stable. It was also flammable in a way that requires emphasis. Nitrate carries its own oxygen. It burns underwater. A single reel in a closed can, once lit, cannot be smothered; it burns to ash and poison gas, and decaying nitrate can ignite itself.

The industry learned this in public, early. In May 1897, at the Bazar de la Charité in Paris - a charity bazaar for the Catholic aristocracy - a cinematograph show in a wooden annex caught fire, and 126 people, many of them titled women, died in the panic.[10] Projection booths everywhere acquired their enduring form in response: metal-lined, shuttered, with the projector behind fireproof ports and the projectionist as a licensed safety officer as much as a showman. The booth was a fire regulation before it was a workplace.

The reel that haunted archivists most, though, burned quietly, by itself. In July 1937, in a 20th Century-Fox storage facility in Little Ferry, New Jersey, gases from decaying nitrate, heat and poor ventilation combined into spontaneous combustion; the fire took more than forty thousand reels of negatives and prints, and with them most of the silent films Fox

had made before 1932.[11] The vault fires of the era - Fox was the biggest, not the only - are a large part of why roughly three-quarters of American silent features are lost.[12]

And yet the archives that kept nitrate cold and dry discovered the paradox: properly stored, nitrate is stable for a century or more, and projectionists and cinematographers still speak of its image - the dense, silver-rich blacks - the way winemakers speak of pre-phylloxera vines. Safety film, cellulose acetate, existed from the 1920s for narrow amateur gauges, but the industry did not fully retire nitrate for 35 mm production until about 1951, when Kodak at last made an acetate base studios trusted.[9] By then the movies had spent fifty-six years as the only mass medium that could burn down its own archive while you watched it.

CHAPTER 8

The Emulsion

> *The base is the movie's skeleton; the emulsion is its retina. A soup of silver salt and gelatin, a tenth the thickness of a hair, decided what films could see - which faces, which skies, which nights - and quietly rewrote acting, lighting and make-up around its chemistry.*

Coat the nitrate ribbon with gelatin carrying crystals of silver halide and you have film. The physics is simple to state and miraculous in practice: a few photons strike a crystal a few atoms wide and mark it; the developer multiplies that mark a billion-fold into metallic silver. Billions of such marks make the image. No other analog technology approaches that amplification, and it is why film could record a candlelit face decades before electronics could.

What the emulsion could not see shaped what movies looked like. Ordinary early stock was blue-sensitive only - "orthochromatic": skies burned to white, blue eyes went pale, red lips and ruddy faces went black. Actors wore yellow and green make-up not from vanity but so their faces would photograph. The fix was dye sensitisation, extending the emulsion's response through the spectrum; panchromatic stock, sensitive to all colours, had existed experimentally for years and became standard in the studios around the late 1920s - just as sound arrived and the hot, hissing carbon arcs gave way to quieter incandescents, whose warmer light the new stock happened to love. The look of classical Hollywood, the deep grey-eyed glamour of the 1930s, is a dye chemistry.

Every generation of emulsion moved the boundary of what could be filmed at all. Faster stocks in the 1960s let cameras leave the studio for the street - the French New Wave's handheld exteriors are an emulsion story as much as an aesthetic one. Kodak's research line through the century reads like a ledger of permission: film at dusk, film by practical

lamp, film in available darkness. Cinematographers talk about stocks the way drivers talk about engines, because the stock was the instrument's temperament - its grain, its contrast, its palette - and the world's archives are, physically, these layers: a few microns of gelatin holding the twentieth century's memory of itself.

The emulsion also fixed the industry's industrial geography. Coating film at commercial quality and consistency was a black art concentrated in very few hands - Kodak in Rochester, Agfa in Germany, Fuji in Japan, and handfuls of specialists - which meant every film production on Earth depended on a small club of chemical plants. When digital capture later bankrupted that dependency, the shock reached far beyond photography; chapter 26 counts the wreckage.

CHAPTER 9

Thirty-Five Millimetres

The most durable standard in entertainment history is a width chosen around 1889 by an engineer cutting Kodak stock in half. Thirty-five millimetres ruled for over a century, and the reason it ruled is the reason industries form: everyone needed the other guy's film to fit their machine.

William Kennedy Laurie Dickson, the Edison laboratory's brilliant camera man, needed film for the peephole machine he was building. What he did, around 1889, was wonderfully unheroic: he ordered Eastman's roll film at 1 3/8 inches - 34.8 millimetres - punched four rectangular perforations along each edge per frame, and declared the result his gauge.[13] Competitors chose otherwise: the Lumières' Cinématographe ran 35 mm with a single round perforation per frame, and the 1890s sprouted rival widths - Le Prince's 54 mm paper, Prestwich's 60 mm, the Veriscope's 63 mm - each with its own cameras, printers and projectors.[13]

The chaos could not last, because projection is a network. A theatre owns a projector; a distributor owns prints; the two must mate. By the first years of the twentieth century the trade converged on the Edison dimensions - 35 mm wide, four perforations per frame on both edges, a frame four perforations high - and the international congresses of 1907 and 1909 in Paris ratified what the market had already decided. For the next hundred years a reel shot anywhere could, in principle, be shown everywhere. No other consumer medium has ever enjoyed a standard so complete or so long-lived; the smartphone industry changes its connector more often.

Standards freeze in more than width. The four-perf frame fixed the image's proportions - roughly four by three, the 1.33:1 that the sound era

trimmed to the Academy ratio of 1.37:1, unchallenged until the widescreen wars of the 1950s.[14] It fixed the frame rate's economics: at twenty-four frames a second, ninety minutes of film is over two and a half kilometres of stock, and every frame rate argument for a century has been an argument about the cost of that ribbon. It fixed the camera's mechanics: the sprocket, the claw, the registration pin, all designed around holes punched a quarter-inch apart.

And the standard bred a family. Narrower stock for amateurs: 16 mm in the 1920s, 8 mm in 1932, Super 8 in 1965 - always on safety base, since amateurs could not be trusted with nitrate.[9] Wider stock for spectacle: 65 mm and 70 mm for the roadshow epics and, eventually, for IMAX. Each gauge carried its own economics of image quality against cost, and its own culture: 16 mm became the gauge of documentary, schools and avant-garde; 35 mm the professional world's currency; 70 mm the Sunday best. The number 35, chosen by one engineer with a knife, organised them all.

CHAPTER 9a

Sidebar: A Field Guide to Gauges

Gauge	Arrived	Home base	Character
70/65 mm	1950s (revived 1890s widths)	Roadshows, IMAX, prestige shoots	The Sunday suit: five times 35 mm's frame area
35 mm	1889-1909	The professional world, 1909-2013	The currency: four perforations a frame, everywhere[13]
16 mm	1920s	Documentary, schools, avant-garde	Always safety stock; the reporter's and artist's gauge[9]
8 mm / Super 8	1932 / 1965	Home movies	The family's memory; never nitrate[9]

Gauge	Arrived	Home base	Character
9.5 mm	1922	European amateurs	Centre-sprocket curiosity with a devoted following
28 mm	1912	Pathé's home market	Safety-first: Pathé sold it on non-flammable stock

Each gauge is a complete little industry: cameras, magazines, printers, projectors, labs, repair benches and collectors. The narrow gauges built the world's visual memory - family reels, war footage, classroom films - and today they are the archives' problem and treasure, since the last manufacturers of many of these machines have been gone for decades.

Reel Three

The Machine

A movie camera is a clock that eats film. A projector is the same clock running backwards into a beam of light. Between 1891 and 1905 these machines went from laboratory curiosities to the engines of the first global entertainment industry.

CHAPTER 10

Edison, Dickson and the Peephole

The first commercial movie machine showed films to one person at a time, through a brass eyepiece, for a nickel a peek. Edison's laboratory built the modern industry's prototype and then nearly threw away the business, because the boss thought projection was a fad.

Thomas Edison's interest in motion pictures was, characteristically, a side effect of another product. Having made his name and fortune on the phonograph, he announced in 1888 that he intended "an instrument which does for the Eye what the phonograph does for the Ear" - and handed the problem to William Kennedy Laurie Dickson, a young experimenter who became, in the opinion of most film historians, the actual inventor of practical motion pictures at West Orange. Dickson's answer was a pair of machines: the Kinetograph, a bulky camera feeding Eastman's new flexible film past the lens at speed, and the Kinetoscope, a cabinet in which one viewer stooped to watch a fifty-foot loop run past a shuttered lamp.

To feed the machines, the laboratory built the world's first film studio in December 1892: the Black Maria, a tar-paper shed whose roof opened to the sun and whose whole frame rotated on a pivot to chase it.[15] There Dickson and his colleagues turned out films by the dozen - strongmen, dancers, a boxing cat, and Fred Ott's Sneeze, a few frames of an engineer sneezing, deposited for copyright in January 1894 and now the oldest surviving copyrighted film.[15] The product went commercial on 14 April 1894, when the Holland brothers opened the first Kinetoscope parlour at 1155 Broadway, New York: five machines in a row, twenty-five cents for the lot, about $120 taken on day one without advertising.[16] Parlours spread across America and Europe within the year.

The business had a fatal shape, and the shape is the point. The Kinetoscope sold solitude: one viewer, one loop, one machine. Every additional customer required another cabinet, another motor, another film loop - hardware multiplying with the audience. Edison's accountants liked this; machines were what Edison sold. When projection arrived, the great inventor dismissed it, reasoning that showing a film to a whole crowd at once would exhaust the novelty - a rare case of an entrepreneur correctly forecasting that a new technology would destroy his margins and wrongly concluding it could therefore be stopped.

Projection won because its economics ran the other way: one machine, one print, a thousand viewers. But the Kinetoscope years had already fixed the industry's basic metabolism - a studio mass-producing short subjects, a distribution arm, exhibition hardware, per-view pricing - and had already provoked the patent wars that would shape the next twenty years. Edison never forgave the projector, and spent the following decade suing it.

CHAPTER 11

December 28, 1895

> *The birthday the movies celebrate is not a patent date or a laboratory first, but a public show in the basement of a Paris cafe. That choice of birthday tells you what the industry thinks it is: not an invention, but a place where people sit together.*

Antoine Lumière, a Lyon photographic manufacturer, saw a Kinetoscope in Paris in 1894 and told his sons the future was projection. Auguste and Louis Lumière - Louis was the engineer of the two - answered with the Cinématographe: a wooden box of about five kilograms that served as camera, printer and projector in one, hand-cranked, gentle on film, using a single round perforation per frame. They showed it privately through 1895 - to a congress of photographers in Lyon in June, to industrial congresses through the autumn[17] - and then, on the evening of 28 December 1895, in the Salon Indien of the Grand Café on the Boulevard des Capucines, they put on the first public paying show: ten short films, about twenty minutes, thirty-odd spectators at one franc each.[17]

The programme was deliberately ordinary: workers streaming out of the family's own factory gates, a baby being fed, blacksmiths, a gardener soaked by a boy stepping on his hose. No ghosts, no painted Pierrots. What stunned the room was the world itself, moving: leaves stirring in the background, smoke drifting, waves arriving. Later tradition supplied a panic at L'Arrivée d'un train - audiences fleeing the oncoming locomotive - but no contemporary account records it, and the story survives because it flatters the medium's own mythology: the image so real it overrides the body. The real astonishment was calmer and stranger. The wall showed life continuing without the watchers, and the watchers found they could not stop watching.

Louis Lumière is reliably reported to have called his invention "an invention without a future."[18] The remark is quoted against him, but read as an engineer's forecast it is half right: he saw no industry in it, only a scientific instrument with a novelty window, and he redirected the family genius to colour photography, where the Lumières' autochrome plates genuinely changed the world. Meanwhile the novelty he misjudged conquered the planet in months. Lumière operators fanned out across every continent through 1896, shooting local views and screening them to crowds who had never seen motion on a wall. By the time the decade turned, the movie show existed from Bombay to Buenos Aires.

Between Edison's parlour and the Lumières' basement sits the whole strategic lesson of the medium. The peephole scaled with machines; the screen scaled with prints. Whoever owned the means to show the same thing to everyone at once owned the industry, and for sixty years that meant whoever owned the theatres - until a later chapter, when it meant whoever owned the servers.

CHAPTER 11a

Sidebar: What Was on the Programme

The ten films of 28 December 1895, as listed in the Lumière catalogue, ran to roughly twenty minutes in total and set the template for a century of cinema programming - actualities, comedy, spectacle:[17]

1. La Sortie de l'usine Lumière à Lyon - workers leaving the family factory
2. La Voltige - trick riding
3. La Pêche aux poissons rouges - fishing for goldfish
4. Le Débarquement du congrès de photographie à Lyon - delegates arriving
5. Les Forgerons - blacksmiths at work

6. Le Jardinier - the gardener and the boy with the hose
7. Le Repas de bébé - a baby being fed
8. Le Saut à la couverture - a blanket-toss acrobat
9. La Place des Cordeliers à Lyon - a Lyon square, bustling
10. La Mer - the sea, bathers

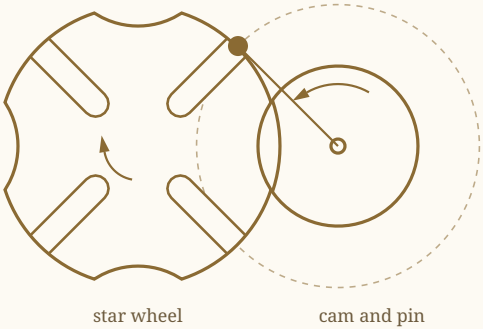
No story in the modern sense, and every modern genre in embryo: the documentary, the home movie, the comedy short, the spectacle of nature. The programme's real subject was the audience's own world, given back to it as something worth a franc.

CHAPTER 12

The Clock That Eats Film

Every movie projector hides a small miracle of mechanical disobedience: film must move through it continuously, and stand perfectly still, twenty-four times a second. The device that performs this contradiction is the industry's beating heart, and most of a century of projectionists spent their lives listening to it.

Feeding film past a lens at twenty-four frames a second is easy. Making each frame stand stock-still in the gate, exactly framed and lit - then jump forward one frame in the dark - is not. The solution nearly every projector uses is the Geneva movement, known everywhere by its prettier name, the Maltese cross. A pin on a continuously turning cam reaches into a slot in a four-pointed star wheel and drives it through exactly ninety degrees; a raised locking disc on the same cam then mates with the star's curved flanks and holds it rigid until the pin comes round again.[19] The star turns in well under half of each cam revolution, so the film spends most of every cycle standing still before the lamp. Continuous motion in, jerked motion out. At sound speed the whole cycle lasts about forty-two milliseconds: the film's hop is hidden by a rotating shutter that closes over the light while the film moves, and because twenty-four glimpses a second still flicker to the eye, the shutter's blades flash each standing frame a second time - forty-eight flashes a second, or seventy-two on a three-bladed machine.[20] The star's sprocket translates each quarter-turn into exactly four perforations - one frame of travel. The result, in a healthy machine, is the most famous sound in film culture that is not actually in any film: the soft, even chatter of the intermittent.



The Geneva or "Maltese cross" movement: the cam's pin enters a slot and drives the star wheel through ninety degrees, then the locking disc holds it for the rest of the turn. Shown at the moment of engagement.

Around the intermittent grew a small ecology of cleverness. Film arrives from the reel in a smooth pull and leaves into the take-up in a smooth wind, while the gate needs jerks; the mismatch is absorbed by the Latham loop, a slack bend of film above and below the gate, an 1895-vintage fix that Edison bought in 1896 and wielded in court until nearly every projector on Earth used it.[21] The loops are why a projector's threading looks like a seamstress's handiwork, and why every projectionist ever trained learned to count frames of slack by fingertip.

Light was the other half of the craft. For decades the source was the carbon arc: two carbon rods across a gap, struck like a match and burning at the temperature of the sun's surface, fed by the projectionist who trimmed the rods as they burned down. Xenon lamps, arriving from the 1970s, put the sun in a sealed quartz envelope and let one operator tend a whole multiplex. The booth itself remained what nitrate had made it: a fire-shuttered cell above the gods, from which - in the words of a third-generation New York projectionist - the operator served as "EMT" to film, mechanics, lamps, platters and sound, any of which could fail mid-show.[22]

The machine's perfection is precisely what the digital chapter mourns. For a hundred years the audience's experience was manufactured

nightly, by hand, by a skilled person threading a clock. When the clock became a server and the projectionist an IT shift, something real was lost - and something real was gained: no more scratched prints, no more jitter, no more reels shipped by van. Industries are allowed to trade romance for reliability. They usually do.

CHAPTER 12a

Sidebar: A Projectionist's Day, Nitrate Era

Arrive an hour before the first show; inspect every print for torn sprocket holes and bad splices - a break mid-reel in the nitrate era is a fire risk, not an embarrassment. Thread projector one for the first feature, projector two for the second half; there is no platter yet, so every twenty-minute reel is a changeover, and the changeover is the craft's test: watch the corner of the screen for the cue marks, the little circles the laboratory punched into the last seconds of the reel. First circle, start the incoming machine's motor; second circle, open its dowser and close the other's. Miss it, and the audience sees white leader and hears the crowd's opinion of you.

Between reels: trim the carbons in the arc lamp, because the sun in the lamphouse burns its rods down a finger's width a show; empty the water from the cooling lines; rewind the outgoing reels by hand or motor, checking every foot. Keep the booth's steel shutters oiled and the fire extinguishers where the inspector wants them - the booth exists because the stock you are handling can burn underwater, and the licence on the wall says the city knows it.[22,9] Then do it again at two, at five, at eight. The show, as the trade said before the industry forgot why, must go on.

CHAPTER 13

Nickels and Lawyers

Between 1905 and 1915 the movie went from fairground novelty to the cheapest mass entertainment on Earth, and then to its first great corporate battle: a patent trust that tried to own the entire industry, and the independents - and immigrants, and outlaws - who broke it.

The nickelodeon was a real-estate idea before it was a film idea: take a vacant shop, add chairs, a screen, a projector and a piano, charge five cents where vaudeville charged twenty-five to fifty, and run the show all day.[21] The first purpose-built one is credited to Harry Davis and John Harris in Pittsburgh in June 1905.[23] Within three years there were thousands; within five, a significant fraction of urban America went weekly or more. The nickelodeon made the movie democratic - priced for factory workers, immigrants and children - and in doing so made it suspect: reformers found the dark rooms, the mixed crowds and the working-class leisure alarming, and the industry's long history with censors begins in the nickelodeon's dark.

Demand that large needed feeding, and feeding it was chaos: dozens of producers, cameras of dubious legality, prints duped and stolen. Order arrived in December 1908 as the Motion Picture Patents Company - the Trust - pooling the Edison, Biograph, Vitagraph and other patents, licensing ten producers, and declaring everyone else an outlaw.[24] The Trust controlled stock through Eastman Kodak, controlled distribution through its General Film Company, and sued infringers with energy. It was, in form, exactly the vertical monopoly later antitrust law existed to prevent - and it provoked exactly the rebellion that law would later reward.

The independents' weapons were three. Geography: they decamped west, eventually to a Los Angeles suburb where Trust subpoenas arrived

slowly and the Mexican border, for a quick escape with the cameras, lay near. Courts: in 1915 the Trust was itself found illegal under the Sherman Act, and expired. And publicity: the Trust companies, fearing salary inflation, refused to name their players, and audiences wrote letters to "the Biograph Girl" anyway. Carl Laemmle, an independent with a nose for leverage, lured the Biograph Girl - Florence Lawrence - to his IMP company in 1910 and then staged her death in a street accident, took out advertisements denouncing the rumour as a lie, and named his new star in print.[25] The star system, the most powerful economic force in the industry's history, began as guerrilla marketing against a patent pool.

The Trust's defeat settled the industry's constitution for forty years. The business would belong to whoever controlled production, distribution and exhibition together - but as private studios in competition, not as a licensed pool. The men who won that war, Laemmle and Zukor and the Warners and Fox, built the empires of Reel Five. First, though, the movie itself had to grow up: to learn to tell stories, to speak, and to turn colour.

Reel Four

Learning to See and Speak

In three decades the movie acquired its grammar of cuts, a voice, colour and a wide screen. Each addition was a technology, a cost crisis and an artistic argument, in that order.

CHAPTER 14

The Invention of the Cut

> *The first films were theatre caught by a fixed camera: one vantage, one take, one minute. The movie became an art the day somebody stopped the camera on purpose - and a language the day somebody joined two pieces of film and discovered the join meant something.*

Georges Méliès came to film as a stage magician who owned a Paris theatre, and according to a folklore too perfect to discard, discovered his signature effect by accident: filming a street scene, his camera jammed, and when he restarted it, the passing bus had become a hearse. Stop the camera, change the world, start again: the stop trick. From that jam flowed double exposures, superimpositions, dissolves and the entire vocabulary of cinematic illusion, assembled in the glass studio he built for the purpose.[26] His A Trip to the Moon (1902) - fourteen minutes, dozens of tableaux, a rocket in the Man in the Moon's eye - was the first film that feels like a film: narrative, spectacle, international stardom for its maker. It was also so widely pirated, especially in America, that Méliès opened a New York office largely to defend it. The industry's first hit and its first piracy crisis are the same object.

Edwin S. Porter at Edison's studio took the next step in 1903 with The Great Train Robbery: fourteen scenes, twelve minutes, a robbery, a pursuit, a posse - scenes joined in sequence, action carried across cuts, and a famous closing shot of a bandit firing at the audience that exhibitors could place at the beginning or the end as they pleased.[21] D. W. Griffith at Biograph systematised the grammar between 1908 and 1915: the close-up for intimacy, cross-cutting for suspense, the iris, the tracking shot - and applied the grammar, notoriously, to The Birth of a Nation, a technical triumph and a racist poison whose success taught the industry both the power of the feature film and the danger of forgetting what it is for.

The Soviets turned the cut into a theory. Lev Kuleshov's workshop demonstrated that the same neutral close-up, joined to a plate of soup, a dead child or a reclining woman, read as hunger, grief or desire: the audience manufactures the emotion from the sequence, not the shot. Sergei Eisenstein built Battleship Potemkin (1925) on that insight, and its Odessa Steps sequence remains the textbook case of meaning assembled from collisions. Between Porter's chase and Eisenstein's massacre, the movie had acquired its defining discovery: the unit of film is not the image but the transition. Everything the art form knows - suspense, montage, the flashback, the match cut - is a variation on the splice.

That discovery also explains the industry's permanent insecurity. A technology whose meaning is assembled in the viewer's head is a technology anyone can learn, any country can adopt, and any rival can extend. There would be no enduring patent on grammar. The moats would have to be built elsewhere: in stars, in distribution, in theatres, in rights.

CHAPTER 15

The Movie Finds Its Voice

Sound did not arrive as an artistic choice. It arrived as a balance-sheet decision by a fourth-place studio betting its survival, and it retired an entire workforce - actors, musicians, projectionists - inside five years.

Experiments in talking pictures are as old as the Kinetoscope; what failed for thirty years was not the idea but the engineering of synchronisation and amplification. Warner Bros., a minor studio hungry for an edge, bet on Western Electric's sound-on-disc system and marketed it as Vitaphone: the camera's film and a sixteen-inch shellac disc, locked together electrically, the disc sized so that one side lasted exactly one reel - eleven minutes at the now-standard twenty-four frames per second and ninety feet per minute.[27] Don Juan (1926) premiered with a synchronised orchestral score and effects, no dialogue. Then, on 6 October 1927, at Warners' Times Square theatre, The Jazz Singer gave the audience Al Jolson's voice from the screen - "Wait a minute, wait a minute, you ain't heard nothin' yet" - and the silent era effectively ended that night.[28] It was not the first talking picture; it was the first successful synchronised feature with talking, and after it there was no going back.[29]

The conversion was industrial trauma at speed. Studios rewired soundstages, wrapped cameras in soundproof booths and later in blimps, and hired sound men wholesale from the telephone and radio industries - the first great migration of electrical engineers into film. Theatres bought new equipment by the thousand; a show in a small town in 1930 already assumed the audience would accept nothing silent. Sound-on-disc gave way to sound-on-film - the optical soundtrack, a strip of varying light printed beside the frames and read by an exciter lamp and photocell - which survives, in digital disguise, on prints to this day.

And it fixed twenty-four frames per second as the world's speed. Silent cameras had drifted between sixteen and twenty frames; any of them would have done for the eye. Sound needed a steady, higher rate for intelligible audio, and twenty-four was the slowest speed that satisfied the soundtrack - the cheapest acceptable speed, once again.[27] The human cost ran alongside. Careers built on pantomime evaporated; some stars' voices betrayed their personas; the studio orchestras and theatre pianists - tens of thousands of musicians who had accompanied every screening - lost their employment to a strip of grey sound printed on the film itself. The movie's voice was bought partly with their silence.

The pattern is the one this book keeps finding: a technical fix, adopted for cost, becomes an aesthetic; the aesthetic becomes tradition; tradition becomes what audiences defend as natural. Nobody chose twenty-four frames as the look of cinema. A 1927 engineering compromise chose it, and a century of emotion has flowed through the choice.

CHAPTER 16

Colour, the Long Way Round

Audiences saw coloured movies within a decade of the first shows, and the industry still needed half a century to make colour ordinary. The delay was not chemistry alone; it was that colour had to be cheap before it could be normal.

The first colour was labour: armies of young women in Parisian workshops tinting each frame with brushes and stencils, four or five dyes per print, Méliès's fairies and devils glowing in hand-painted hues. Tinting and toning - dyeing whole scenes blue for night, amber for candlelight - gave silent cinema a second grammar that modern restorations have had to rescue from black-and-white memory. It was gorgeous, and it did not scale.

The first natural colour process to work commercially was Kinemacolor, developed by George Albert Smith in England from Edward Turner's patents: successive frames through alternating red and green filters, projected back through the same alternation at thirty-two frames a second. Proved on Smith's children in a garden in July 1906, demonstrated in May 1908, premiered commercially at the Palace Theatre in 1909, it travelled as far as the Delhi Durbar of 1911 before its flaws - fringing, eyestrain, special projection - and a patent verdict killed it.[30]

The durable answer arrived as a company with a monopoly temperament. Technicolor's founders, Herbert Kalmus and Daniel Comstock, burned through a two-colour process before delivering the machine that defined Hollywood colour: the three-strip camera, its prism splitting the image onto three black-and-white negatives, and the dye-transfer printing process - adapted from two-colour work in 1926 to three-colour in the 1930s - that printed cyan, magenta and yellow layers

onto a blank like lithography.[31] The colours were engineered rather than captured, and that is exactly why they still look the way they do: The Wizard of Oz and Singin' in the Rain are the output of a printing press for images. Technicolor controlled the cameras, the labs and the consultants - including Kalmus's ex-wife Natalie, whose colour advice was contractually unavoidable on set.

Colour's victory came only when it could be ordinary. Eastman Kodak's Eastmancolor, introduced in 1950, put all three colour records on one strip that any standard camera could shoot and any lab could process; the last American film shot with the three-strip camera was Foxfire in 1954, and dye-transfer printing ended in Hollywood in 1975.[31] Television's colour transition in the 1960s finished the job: by the 1970s, black-and-white had inverted from default to deliberate statement. The arc is the book's recurring economics again. The artist's medium is whatever the supply chain makes cheap; colour became cinema's native tongue on the day it stopped requiring a special camera, a special lab and Mrs. Kalmus's blessing.

CHAPTER 16a

Sidebar: The Tinting Bench

The first colour department of the film industry was a room of women with brushes. From the late 1890s, specialist workshops - Pathé's at Vincennes employed hundreds - coloured release prints frame by frame: a print was run past a magnifier, each frame held still while a colourist applied dye with a fine brush, four or five colours per scene, hundreds of frames per minute of screen time. The industrial refinement was the stencil: for each colour, a separate print was cut away, frame by frame with a pantograph needle, to make a mask through which the dye could be rolled. A feature-length stencil set was weeks of cutting.

The economics were terrible and the results could be extraordinary - the hand-coloured print of A Trip to the Moon, rediscovered and restored in

the 2010s, shows rockets in copper and moon-people in acid green. Tinting's logic survives everywhere colour is still "printed" onto film rather than captured: in Technicolor's dye-transfer matrices[31] and in the modern colourist's node tree. The bench is gone; the instinct - somebody, deciding shot by shot what colour the world should be - is now a darkened suite with a panel of trackballs.

CHAPTER 17

The Wide Answer

> *The screen changed shape in the 1950s not because directors asked for more width, but because television had the old shape. Every aspect ratio since has been a negotiation between art, hardware and the fear of the living room.*

The post-war crisis had two engines. Admissions fell from the 1946 peak of about ninety million Americans a week to forty million by 1960 - suburbs, cars, babies and, decisively, television, which sold 7.3 million sets in 1950 alone and cut film-going among owning families by a fifth to a third.[32] Hollywood's reply was to weaponise everything the television set could not do: size, depth, colour, event.

Cinerama fired first in 1952: three synchronised projectors wrapping a deeply curved screen around the audience, seven-track sound, travelogues that put viewers on rollercoasters. It was a sensation and a nightmare - three prints, three booths, visible seams - and it proved the commercial thesis at once: people would leave home for scale. 3-D followed the same year and burned out by 1954 on glasses, eyestrain and cheap exploitation.

The winner was elegance. CinemaScope, licensed by 20th Century-Fox from the French inventor Henri Chrétien, put an anamorphic lens on an ordinary camera to squeeze a wide image onto standard 35 mm film, and a matching lens on an ordinary projector to unsqueeze it: one camera, one print, one projector.[33] The Robe opened at the Roxy in New York on 16 September 1953 with a picture more than twice as wide as the old Academy frame, and the industry converted within two years.[34] Paramount countered with VistaVision, running film horizontally for sharpness rather than width; the market standardised on the

anamorphic compromise and the 'scope ratios, 2.35:1 settling in as cinema's signature shape.

The shape war never ended - it moved. Television went widescreen; phones went vertical; directors like Christopher Nolan and Quentin Tarantino revived 65 mm and 70 mm as premium artefacts; IMAX built a business on being the biggest rectangle of all. Through it all, the ratio on your ticket remained what it was in 1953: a promise that the image is wider than your living room can make it. The screen's geometry is, and has always been, the industry's marketing department drawn in light.

CHAPTER 18

The Palace

> *The machine had a home, and in the 1920s the home became the attraction. The movie palace - three thousand seats, a Wurlitzer, a sky painted on the ceiling - was the industry's real-estate empire and its most durable piece of marketing: the building itself promised that the world on the screen was grand.*

The nickelodeon sold a show; the palace sold an evening. Beginning in the 1910s, exhibitors like Balaban and Katz in Chicago and Samuel "Roxy" Rothafel in New York built theatres as destinations: marble foyers, uniformed ushers, orchestras in the pit, prologue stage shows before the feature, organs rising out of the floor. Rothafel's Roxy, opened in 1927, seated over five thousand. The chains that owned these rooms - and the studios that bought the chains - anchored their vertical integration on them: the palace was the flagship retail of the dream factory, the place where block-booked product met the public at full price.

The palace also sold, without irony, cool air. Chicago's Central Park Theater, built by Balaban and Katz in 1917, was among the first mechanically air-conditioned public buildings in America, its CO2 refrigeration system marketed as boldly as its pictures; the New Empire in Montgomery, Alabama, had installed a refrigerating machine the same year.[35] "Twenty degrees cooler inside" was a summer box-office strategy before it was a comfort: the movies, historians of air conditioning note, taught the American public to expect cooled air, and the summer blockbuster's ancestry begins as much in refrigeration as in sharks.

The palace era peaked with the studio system and died with it: post-war audiences moved to the suburbs, the great rooms were carved into twins and triplexes, and the survivors became landmarks, churches or rubble.

Its descendant is not the multiplex - Durwood's efficient boxes - but the premium screen: the IMAX auditorium, the Dolby Cinema room, the recliner-and-dinner format, all attempts to rebuild what Roxy understood in 1927, that in the theatrical business the room is part of the film.

Reel Five

The Dream Factory

Between 1915 and 1950 a suburb of orange groves became the most famous industrial district on Earth. The studio system turned the movie into a vertically integrated manufacturing business - and the government took it apart.

CHAPTER 19

Why Hollywood

The movie capital of the world was chosen by weather, wages and lawyers. Hollywood was not a place the industry grew; it was a place the industry moved to for industrial reasons, and then sold to the world as a dream.

In 1910 the American film business was eastern: New York, New Jersey, Chicago. Camera film in those years was slow and lights were weak, so photography wanted sunlight - reliable, strong, year-round sunlight. The trade press in 1911 advertised that Southern California offered 320 shooting days a year.[36] Around the sun gathered everything else: within a short radius of Los Angeles a unit could find sea, desert, mountains, orange groves, Spanish missions and a city doubling for anywhere; land was cheap enough to build whole streets on; and Southern California was the country's open-shop capital, where carpenters and electricians cost a quarter to a half less than in New York.[36]

And it was far away. The Motion Picture Patents Company's subpoenas ran through New York offices; a production unit in California was days of train travel from process servers, and the folk memory - embroidered, as the historians point out - has outlaws beating it across the Mexican border with the cameras.[36] The migrants included most of the men who would found the great studios: Laemmle, Zukor, the Warners, Fox, Goldwyn, Mayer. Many were immigrants or sons of immigrants - furriers, glove salesmen, junk dealers, nickelodeon operators - locked out of respectable American business and therefore free to build an unrespectable one. The industry they created in the orange groves was the first major American industry to be built from scratch by the recently arrived, and it sold the country its own image back to it.

By the mid-1910s the migration was decisive. Feature films needed capital, stages and permanent companies, and the infrastructure compounded: labs, prop houses, costume departments, a labour pool of carpenters and extras. Hollywood the suburb gave its name to Hollywood the system - a rare case of a place name becoming a global industrial category, like Detroit for cars, except that the product was dreams and the factory was a fenced lot with a water tower.

CHAPTER 20

The Factory That Made Stars

> *The studio system is best understood as a factory whose raw material was talent and whose finished product was not films but stars - manufactured, contracted, insured and amortised like any other capital asset.*

Adolph Zukor drew the blueprint. His Famous Players company put stage celebrities in features; he bought Paramount, a distributor, in 1916-17 to guarantee his films a route to market; and by 1922 he was buying theatres, so that Paramount's product was guaranteed an audience.[37] That stack - production, distribution, exhibition under one roof - is vertical integration, and by the end of the 1920s five companies had it: Paramount, MGM, 20th Century-Fox, Warner Bros. and RKO, the "Big Five", with three smaller producers - Universal, Columbia and United Artists - making the oligopoly of eight that ran Hollywood's golden age.[37]

Inside the gates the factory metaphor was literal. Metro-Goldwyn-Mayer, formed in 1924 when theatre magnate Marcus Loew merged Metro, Goldwyn and Louis B. Mayer's companies to feed his Loew's circuit, boasted "more stars than there are in heaven" and ran Culver City like a plant: story departments feeding scripts to units, contract players assigned to pictures, a school for children, a police force, a hospital, barbers and backlots with a permanent European street and a permanent jungle.[38] Actors signed seven-year contracts with options the studios alone could exercise; morals clauses policed private life; publicity departments invented biographies. The star, Florence Lawrence's invention weaponised, was the studio's depreciable asset and its marketing department in one.

The machine's economics rested on block booking: an exhibitor who wanted the A-picture with the star took the studio's year of B-pictures,

newsreels and shorts, sight unseen. Theatre ownership plus block booking meant the majors could not fail at their own box offices. It was a beautifully closed system - financing secured by distribution, distribution secured by theatres, theatres secured by stars, stars secured by contracts - and it produced, at its peak, hundreds of features a year and an audience of most of the American public, weekly. The product was uneven by design; the system did not need every film to be good, only every Friday to be occupied.

It also made some of the century's enduring art, which is the paradox nobody has fully explained. The conveyor belt gave a generation of craftspeople - directors, cinematographers, designers, composers - thousands of hours of paid practice, and out of the practice came Casablanca, Singin' in the Rain, Citizen Kane. Kane is the emblematic case: RKO handed a twenty-five-year-old radio director an unprecedented contract, and the system built to manufacture stars delivered its greatest critics' darling. Factories are not supposed to do that. This one did, regularly - right up until the government decided the factory was a trust.

CHAPTER 21

The Code

> *For three decades the world's largest film industry made its product under a written list of things it was not allowed to show. The list was voluntary, absolute, and adopted to keep the government out - the movie's recurring bargain with the societies it entertains.*

The movie was legislated against almost from birth. The nickelodeon's dark rooms worried reformers; municipalities and states built censorship boards, each with its own scissors; and a national industry selling one print to fifty markets could not cut a different film for every board. Hollywood's answer was self-regulation: the Motion Picture Producers and Distributors of America, formed in 1922 under Will H. Hays - a former Postmaster General hired to launder the industry's image after the scandals of the early twenties - and, in 1930, the Motion Picture Production Code, a catalogue of prohibitions on crime, sex, profanity, mockery of clergy and more.

The Code had no teeth until the box office demanded them. Facing boycotts organised by the Catholic Legion of Decency, the studios agreed in June 1934 to the Production Code Administration: from 1 July 1934, no film from a member studio could be released without a Seal of Approval, and the fine for breaking the rule was real money.[39] For the next thirty years, American screens lived inside the Code's imagination: kisses timed, married couples in twin beds, crime never paying, endings morally balanced. The constraint shaped the art, as constraints do - the innuendo-laden wit of 1930s comedy and the allusive darkness of film noir are both children of censorship, the style that grew in the space the rules left.

The Code died of competition: television and foreign imports, bound by different rules, showed audiences what they were missing, and by 1968

the studios replaced prohibition with description - the ratings system of G, M (later PG), R and X, evolving into today's G, PG, PG-13, R and NC-17.[39] Every national industry cut its own version of the same bargain: Britain's BBFC certificates, India's CBFC and its scissors, China's system in which there is no rating at all because everything released is supposed to be suitable - and therefore much is simply not released.[40] The form of the bargain varies; the bargain does not. A medium this powerful is never left entirely alone.

CHAPTER 22

Paramount, 1948

> *On 3 May 1948 the Supreme Court told the five richest studios that they could no longer own both the factory and the shop. It is the single most important legal event in movie history, and it quietly expired only in 2020.*

The case had been building since the independent exhibitors of the 1930s complained, with justice, that they were serfs in their own theatres: forced by block booking to take the majors' whole annual output blind, shut out of first runs by clearance rules, and undercut by studio-owned palaces. The government's antitrust suit reached the Supreme Court as United States v. Paramount Pictures, Inc., 334 U.S. 131 (1948), and the industry lost on essentially every front.[41]

The decrees that followed did two things. They broke the stack: the five theatre-owning majors had to divest either distribution or exhibition - the theatres went, spun into new companies - and distribution divorced exhibition could never again be vertically fused without court approval. And they outlawed the machinery of the closed market: block booking, circuit dealing, resale price maintenance on tickets, and the overbroad clearances that froze independents out.[42]

The effects took a decade to unfold and then looked like a revolution. Freed from guaranteed outlets, the studios cut their contract stables and their output; freed from the studios, exhibitors could program anything, and foreign films, independent productions and art houses found American screens. Production reorganised around the package: a star, a director, a script, assembled film by film by talent agencies - Lew Wasserman's MCA above all - that grew into powers rivalling the old moguls. The studio lot survived as landlord and financier. The weekly-

attendance habit did not survive television, but the decrees had already severed the industry's safety net before the storm hit.

The coda belongs to our century. Reviewing the decrees in 2019-2020, the Department of Justice concluded that their world was gone - the majors no longer owned theatres, metropolitan audiences had choices, and new distribution platforms the 1948 court never imagined had multiplied - and in August 2020 it moved to sunset the Paramount Decrees entirely.[42],[41] The timing had a black humour: the seventy-year wall between making movies and showing them came down just as streaming made the distinction moot. The industry of 2020 had reintegrated vertically through servers instead of theatres, and no decree contemplated the server.

CHAPTER 23

The Other Cinemas

Hollywood never made most of the world's movies. From the silent era onward the majority of films - and often the majority of film-goers - lived elsewhere, in industries that grew on the same technology and entirely different economics.

The Lumière operators who fanned out in 1896 did not export an American art; they exported a French machine, and cinema was international from its second year. Europe owned much of the early industry - France's Pathé was the world's largest producer before 1914 - and the First World War, which halted European production while American exports continued, did more to make Hollywood dominant than any artistic advantage. Each national industry thereafter built its own grammar: German Expressionism's shadows, Soviet montage, French poetic realism, Italian neorealism's stolen streets, Sweden's Bergman, Japan's golden age of Kurosawa, Ozu and Mizoguchi, whose local industry was among the world's largest throughout the 1950s.

The volume story of the modern industry, though, belongs to places the awards conversation mentions least. A UNESCO survey found that in 2006 India produced 1,091 feature films - the world leader - while Nigeria's video-film industry released 872, and the United States 485.[43] India's output is spread across a dozen language industries of which Hindi cinema is merely the most famous abroad; its economics run on songs, stars, and vast domestic scale. Nigeria's Nollywood is the more radical case: a feature industry built without studios, without celluloid and, at the time of that survey, almost without cinemas - shot on video, sold in markets, with about 99 per cent of screenings in informal settings.[43] Nollywood proved that the movie, as a form, needs none of Hollywood's infrastructure: a camera, a cast, a generator and a market stall will do.

China built the opposite extreme: the world's largest exhibition infrastructure, thousands of screens a year added through the 2010s, a box office that briefly became the world's biggest in 2020 - and a quota system limiting imported films, which made the Chinese market both the industry's great prize and its great negotiation.[44]

The lesson of the world map is that "the movie industry" is a plural. Hollywood dominates the export of spectacle because spectacle travels without translation; national industries dominate their domestic screens wherever language and stars are local; and the single global constant is the one this book keeps returning to: a dark room, a bright image, and a public willing to pay for the arrangement. The machinery of that arrangement - the cameras, the film stock, and now the servers - is what the next reels follow as it changes underneath every national cinema at once.

CHAPTER 24

The Blockbuster Rebuild

After the studios lost their theatres and their audience to television, a generation of film-school directors and a new kind of release strategy rebuilt the business around the event picture - the movie as national appointment.

The old system died slowly through the 1950s and 1960s. Audiences halved; palaces closed or were carved up; the studios sold their backlots and their old films to the same television networks that were eating them, and discovered, to their surprise, that the enemy paid well. Into the hollowed-out industry walked a new kind of director - Coppola, Scorsese, Spielberg, Lucas - raised on film history and free of the assembly line, and for one brief season around 1970 the studios, no longer sure what the audience wanted, let them make personal films on studio money.

The season ended with a shark. Universal opened Jaws in June 1975 on more than four hundred screens at once - saturation booking borrowed from exploitation pictures like The Trial of Billy Jack, which had opened on a thousand screens in 1974 - backed by national television advertising, something no prestige picture had done.[45] It became the first film to gross $100 million, then $450 million worldwide, and it rewrote the industry's calendar: summer, once a dumping season, became the season; the opening weekend became the verdict; marketing budgets began to rival production budgets. Two years later Star Wars proved the other half of the template: the film as licensing engine. George Lucas kept the merchandising rights the studio valued at little, Kenner famously sold empty boxes for Christmas 1977 because the toys could not be made fast enough, and the revenue financed the sequels outright.[46]

Exhibition rebuilt itself to match. Stanley Durwood's Parkway Twin - two auditoriums in a Kansas City shopping centre, opened 12 July 1963, both initially playing The Great Escape - answered a real-estate constraint and accidentally founded the multiplex: more titles per site, shared lobby and staff, the hit subsidising the risk.[47] The twin became the six-plex, the six-plex the stadium-seated megaplex, and by the 1990s the single-screen theatre was a nostalgia act outside the big cities.

The rebuilt machine was bigger than the studio system ever was - and narrower. A business fed by block bookings of forty films a year became a business betting on a dozen tentpoles, each carrying sequels, toys, soundtracks and foreign sales. The middle of the market - the adult drama, the modest comedy - began its long migration away from theatres, first toward home video, which is where the next reel begins: in the living room, with a rented cassette.

CHAPTER 25

The Festival and the Statuette

Two institutions stand outside the factories and shape what they make: the prize that the industry gives itself, and the festival circuit where films without franchises are bought, sold and crowned.

The Academy of Motion Picture Arts and Sciences was founded in 1927, in part as a company union to keep labour organising out of the studios - a useful reminder that even the industry's self-celebration began as strategy. Its awards were first handed out on 16 May 1929, at a private dinner in the Hollywood Roosevelt Hotel before about 270 guests, with the winners announced three months earlier; Wings took Best Picture, the only silent film ever to do so.[48] From that dinner grew the industry's largest annual marketing event: an Oscar nomination measurably moves box office and careers, and the modern "awards season" - campaigns, screenings, consultants - is a fourth distribution window disguised as a meritocracy.

The festivals are the market's other face. Cannes, founded in 1939 as France's answer to a Venice festival captured by fascists and finally held in September 1946, established the template: competition premieres for prestige, a market in the basement for commerce.[49] Berlin and Venice anchor the calendar's start, Toronto and Telluride launch the awards race, and Sundance - begun in 1978 as the Utah/US Film Festival, moved to a ski-season Park City on Sydney Pollack's advice that Hollywood would beat down the door of the only festival at a resort - became the discovery market of American independent film.[50]

Between the statuette and the festival pass runs the entire economics of the non-franchise film: the low-budget picture premiered to critics, bought in a midnight bidding war, platformed through awards season into the conversation. It is the path that made the reputations of

everyone from the Coen brothers to Bong Joon-ho, and it is under the same attention pressure as the rest of the business - the festivals still crown the films; it is the distribution after the crown that has changed hands to the streamers.

Reel Six

The Second Material

For a hundred years a movie was a thing: two and a half kilometres of silver and plastic. Between 1975 and 2015 the thing dissolved into digits - first in the camera, then in the laboratory, then in the booth. The reel's name outlived the reel.

CHAPTER 26

The Movie in the Living Room

Television was supposed to kill the movies. Instead it taught the industry the lesson that defines its modern economics: a film is not a two-hour event but a catalogue item that can be sold over and over, in window after window, for decades.

The sequence began in surrender. The 1950s studios, bleeding attendance, licensed their old libraries to the television networks and discovered that yesterday's product was today's prime-time programming; the "ancillary" market was born, and it kept growing. Cable added HBO in the 1970s, which paid studios for the first window after theatres. Then the cassette arrived.

The videocassette recorder was built for time-shifting broadcast television; the industry first met it in court - the studios sued Sony over the Betamax, and lost in the Supreme Court in 1984 - and then discovered it was the most profitable accident in their history. The format war settled on VHS, and a Dallas data-services entrepreneur named David Cook opened the first Blockbuster store in October 1985, scaling the neighbourhood rental shop into a national chain of thousands of blue-and-yellow storefronts.[51] By the 1990s, home video revenue for a hit routinely exceeded its theatrical gross: the cinema had become, in part, an advertisement for the rental.

DVD, launched in the United States in 1997, accelerated everything. The Consumer Electronics Association certified it the fastest-selling consumer electronics product in history: about 349,000 players in its first year, more than a million in its second, over three million in 1999, with a hundred and ten million discs shipped.[52] The disc was a collector's object, with commentaries and box sets, and for a decade the studios' richest profit centre was a five-inch polycarbonate wafer sold through

Wal-Mart. It also, not coincidentally, trained a generation of customers to think of movies as a postal and retail product - an inventory of discs shipped by mail. Two men in California were watching that habit very closely; chapter 27 belongs to them.

The living-room decades fixed the industry's windowing logic: theatrical, then home video, then pay cable, then broadcast - each window priced separately, each defended by contract. That logic was the movie's first experience of being software: the same file, sold at different prices at different times. The stream did not invent the window. It only collapsed all the windows into one app.

CHAPTER 27

The Electronic Image

The camera that replaced film was invented by accident, by two Bell Labs physicists trying to build computer memory. Forty years later their chip ate an entire chemical industry.

In 1969, George Smith and Willard Boyle at Bell Labs, chasing a new kind of semiconductor memory, sketched the charge-coupled device: a chip that shuttles packets of electric charge, pixel by pixel, to a readout - which is to say, a chip that counts photons in a grid. It won them the 2009 Nobel Prize in Physics, and it made the electronic photograph possible.[53] Through the 1970s and 1980s the CCD, and later the CMOS sensor, improved along the semiconductor curve - the same curve as computers - while film improved along the slow curve of chemistry. The moment the two curves crossed, the outcome was decided; the only question was when the movie business would admit it.

Television admitted it early: electronic news gathering killed 16 mm newsfilm in the 1970s. Cinema resisted longest, partly from aesthetics - early video was harsh, shallow, pale - and partly from the economics of installed film infrastructure. The first high-profile digital features, the Star Wars prequels shot on Sony's early HD cameras around 2000-2002, were treated as experiments with mixed reviews. The acceptance machine arrived from two directions. From below: the RED One in 2007, a raw-recording 4K camera priced like a car rather than a house, which swept up commercials, independents and directors like David Fincher and Peter Jackson. From above: the ARRI Alexa in April 2010, whose sensor rendered highlights with a patience cinematographers called "filmic", and which within a few years became the default camera of high-end features and television worldwide.[54]

The industry's own tally marks the crossing precisely. In 2011, ARRI, Panavision and Aaton - the three great names of film cameras - all stopped making 35 mm cameras.[55] In January 2012, Eastman Kodak, the company whose roll film had started everything, filed for Chapter 11 bankruptcy.[56] The material that had built the movies survived only as a boutique choice: Kodak still coats motion-picture film today, a handful of major directors still insist on it, and the image of a "real" film camera now works as a marketing claim. That is what a mature transition looks like - the old material turning into a luxury good.

CHAPTER 28

The Pixel Learns to Act

Computer imagery entered the movies as a screensaver for a spaceship console, became a water tentacle, then a liquid man, then a dinosaur - and then, in 1995, an entire world. Within a decade the trick had quietly become the medium's largest craft department.

The early steps were laboratory curiosities: a two-dimensional computer-animated sequence in Westworld (1973), wireframe displays in Star Wars (1977) - fittingly, inside the story, as a rebel briefing screen - and the ambitious, expensive, half-computer world of Tron (1982), which audiences shrugged at. The field's patron institution formed in 1975, when George Lucas assembled what became Industrial Light & Magic to solve Star Wars; ILM then served as the industry's research lab for two decades, converting effects from optical-printer craft to computational science one problem at a time.[57]

The ladder of proof ran through water and metal. The Abyss (1989) gave a seawater creature a human face - a few minutes of screen time that took the field a year. Terminator 2 (1991) made the liquid-metal T-1000 the film's selling point. Then Jurassic Park (1993) put photorealistic, breathing dinosaurs into daylight, and the industry understood instantly that the era of rubber suits and stop-motion armatures had closed. The telling statistic: even in 1995, the CG in Jurassic Park amounted to about six minutes of running time.[58] Computers had won the argument while still supplying only cameos.

Two years later came the other shoe. Toy Story (1995), the first fully computer-animated feature, built every one of its 1,560 shots from about four hundred mathematical models, rendered frame by frame on a farm of 117 workstations consuming 800,000 machine-hours for seventy-seven minutes of film.[58] The render farm - the air-conditioned warehouse of

servers that is animation's soundstage - became permanent infrastructure. Meanwhile the middle of the pipeline digitised too: the digital intermediate, demonstrated on O Brother, Where Art Thou? (2000), in which the whole film, shot on ordinary negative, was scanned, colour-graded scene by scene in a computer, and printed back to film.[59] Within a decade, nearly every feature passed through a DI, and the colourist inherited powers that cinematographers of the photochemical era could only dream of.

The economics followed the semiconductor curve with a lag. Effects shots that cost millions in 1993 cost thousands by 2010; whole industries - previsualisation, motion capture, virtual camera, simulation of hair, water, crowds - industrialised the craft into a global vendor system centred on a few great houses and their tax-subsidised satellite cities. The paradox at the centre of modern spectacle: as the imagery became technically unbounded, the business model concentrated on the few franchises that could support thousand-shot budgets, and the VFX vendors themselves became notorious for thin margins, a craft adored by audiences and squeezed by its only customers.

CHAPTER 28a

Sidebar: Inside a Render Farm

A modern animated or effects-heavy film is computed, not exposed. The render farm that replaced the rostrum camera is a refrigerated warehouse of servers - thousands of CPU and GPU nodes - working through the night on frames queued by the day's work. The arithmetic has not changed in principle since Toy Story's 800,000 machine-hours for 77 minutes:[58] a photoreal frame of modern animation can still take hours of compute, multiplied by 24 frames a second, multiplied by every revision a director orders. Render farms are why effects facilities sit near cheap power and why "the render" remains the one deadline in filmmaking that cannot be charmed - only bought, in megawatts and servers.

CHAPTER 29

The Last Print

For a century, showing a movie meant shipping a heavy can of film to a building with a skilled person upstairs. Between 2005 and 2014 the can became a hard drive, the booth became a server rack, and an entire craft profession and chemical industry went with them.

Digital projection needed three agreements before it could happen: a standard, a financing scheme, and a trigger. The standard came from the studios themselves, who formed Digital Cinema Initiatives in March 2002 to write an open specification - the format of the Digital Cinema Package, the encrypted hard-drive-or-satellite "print" - so that no single vendor could own the booth the way the Trust once owned the camera.[60] The financing was the Virtual Print Fee: since a film print cost a studio well over a thousand dollars per screen while a DCP cost nearly nothing, the studios paid the savings back to exhibitors as a per-booking fee to retire the loans on their new projectors, typically over five or six years.[61] The trigger was Avatar (2009), whose 3-D premium made digital screens pay; conversion went from a quarter of US screens in 2009 to two-thirds by early 2012, with 64.5 per cent of American screens - 25,570 of 39,641 - digital, and the world's screens following the same curve.[55]

Then the end came quickly. In 2011 the last 35 mm cameras stopped being manufactured; in 2012 Kodak entered Chapter 11; in January 2014 the Los Angeles Times reported that Anchorman 2 had been Paramount's final 35 mm release and The Wolf of Wall Street the first major film distributed entirely digitally - the first studio to stop shipping film altogether.[62] Europe's conversion, tracked by UNIC, reached 93 per cent of screens in 2014.[63] A delivery system that had changed little since 1895 - reel, can, van, booth, projectionist - ended in about five years.

What was gained is easy to list: no scratches, no jitter, no splice repairs, no prints decaying in transit; satellite and network delivery; 3-D, high frame rates and event cinema as software choices. What was lost deserves a paragraph of respect. The release print was a physical ledger - each venue's copy individually accountable, individually paid for - and its disappearance dissolved the print-traffic depots, the labs, and the projectionist's booth as a workplace of craft. The multiplex booth today is quiet: a playlist, a key delivery message in an email, a lamp module swapped on schedule. The Maltese cross chatters in a few repertory houses and museums, where audiences now pay a premium to hear it.

And a new dependency arrived, one the next reels follow: when the print became a file, the file became streamable, and the theatre's hundred-year monopoly on first sight of a movie became a business decision instead of a physical fact.

CHAPTER 30

The Editor's Machine

Digital conquered the cutting room before it conquered the camera or the booth. The computerisation of editing - the movie's signature craft - is the quiet case study of how the second material took the whole industry: one workstation at a time.

For most of the century, editing was literal: the editor ran the workprint through a Moviola or a flatbed Steenbeck, chose the frame, cut it with a splicer, and joined it with tape or cement. The tools were mechanical, tactile and - crucially - linear: to try a different structure was to take the film apart and rebuild it. The cut was a commitment.

The break came at the 1989 NAB show, where a little-known startup called Avid sold five systems and gave the industry the non-linear editor: pictures stored on disk, any frame reachable instantly, any sequence rearranged without touching the original.[64] The Moviola's cut became an undo command. Directors and editors moved over through the 1990s - The English Patient's Oscar for editing in 1997 is usually cited as the craft's acceptance signal - and the cutting room became a software business: Avid at the high end, Adobe's Premiere and Apple's Final Cut below, Blackmagic's DaVinci Resolve rising from the colour suite to take the low end and then the middle.

The deeper change was conceptual. Once the edit lived in a computer, everything else followed it in: sound editing, visual effects, colour, titling, delivery. The "offline" and "online" suites converged into a single timeline carrying the entire film as data, and the DI - demonstrated on O Brother, Where Art Thou? in 2000 - became the final assembly step of a film that had never had to exist as a physical object until somebody chose to print it.[59] The editor's machine, arrived first, turned out to be the trojan workstation for the rest of the pipeline.

Reel Seven

The Stream

The third material is not a material at all. When the movie became a file that could flow through the same wires as everything else, a century of carefully priced windows - theatre, disc, cable, broadcast - collapsed into a single monthly fee.

CHAPTER 31

The Envelope and the Algorithm

Netflix began as a better Blockbuster - DVDs by post, no late fees - and carried inside its business plan, from the start, the intention to abolish the post. The red envelope was a trojan horse for the stream.

Reed Hastings and Marc Randolph founded Netflix in Scotts Valley, California, on 29 August 1997, entering a home-video market worth about $16 billion.[65] The founding myth has Hastings stung by a forty-dollar late fee on Apollo 13; the reality was more analytical. DVDs, newly launched that year, were light enough to mail cheaply and durable enough to survive the post - the founders reportedly tested the idea by mailing a CD to Hastings's house - and a national postal inventory could hold far more titles than any storefront. The subscription twist - a flat monthly fee, keep the disc as long as you like - removed the rental industry's most resented feature and aligned the company with the customer instead of the clock.

The machine underneath the envelope was the interesting part: regional warehouses automating a disc's round trip in a day or two, and a recommendation engine that turned browsing into prediction, so that the long tail of catalogue could be rented as easily as the hit. By February 2007 the company had shipped its billionth DVD.[65] But Hastings had always said the discs were a bridge. On 16 January 2007 Netflix turned on "Watch Now": about a thousand films, streamable in a browser, against seventy thousand on DVD.[65] The studios licensed the service their second-run content without alarm - it looked like cable with extra steps.

The flywheel that followed is now business-school scripture: streaming subscriptions funded more content, more content funded more subscriptions, and the recommendation data told the company what to buy and what to make. The moment the tail wagged the dog came on 1

February 2013, when Netflix released all thirteen episodes of House of Cards at once - a reported hundred-million-dollar bet on original programming, binge-released, marketed by data.[66] The rental company had become a studio; the studios, a few years later, would all become rental companies. The envelope, its work done, was retired in 2023 after twenty-five years.[67]

CHAPTER 31a

Sidebar: The Red Envelope Machine

At its peak around 2010, Netflix's DVD service had roughly twenty million subscribers and ran a logistics operation most retailers would envy: dozens of regional warehouses, each sorting returned envelopes, inspecting discs, and re-shipping the next title in a subscriber's queue within a day.[67] The queue was the product: a ranked list of everything you meant to watch, managed by you, fed by a recommendation engine that learned from every rating. The envelope's barcoded sleeve told the warehouse where it came from; the discs were sleeved, checked and shipped at a pace of millions a week. It was the last great physical-media business, and it was designed, by its own founder's account, as the bridge to the business that would kill it.[65]

CHAPTER 32

The Stream Eats the Windows

Between 2019 and 2022 every major studio launched its own Netflix, the windowing system of a hundred years collapsed in a single pandemic year, and then Wall Street ended the party and asked who was actually making money.

The streaming wars opened formally on 12 November 2019 with the launch of Disney+, priced aggressively and stocked with the deepest catalogue in entertainment; Apple TV+ arrived the same month, HBO Max and Peacock within the year, and Paramount+ after.[68] The majors pulled their films from Netflix to stock their own shelves, and the industry reorganised itself into vertically integrated streamers - production, distribution and exhibition in one app, a structure the Paramount decrees had forbidden when exhibition meant theatres. The economics were deliberately ruinous: billions a year in content spending to buy subscriber growth, on the theory that the last few services standing would own the century.

Then the pandemic detonated the remaining structure. With theatres closed, Disney put Mulan on premium streaming and, in December 2020, Warner Bros. announced its entire 2021 slate - Dune, The Matrix 4 and the rest - would debut on HBO Max the same day as in cinemas.[69] The ninety-day theatrical window, the exhibitors' century-old moat, shrank to zero overnight; it has since re-formed, but at weeks rather than months, and permanently negotiable.

The reckoning came in 2022. Netflix reported its first subscriber losses in a decade, the market repriced every streamer, and the industry's question changed from "how many subscribers?" to "where is the profit?" Netflix could answer: it pointed to more than five billion dollars in annual operating profit while rivals lost money, stopped forecasting

subscriber counts, launched an advertising tier and cracked down on shared passwords.[70] The wars ended in consolidation logic: fewer services, ads back in the mix, prices rising toward the cable bundle the streamers were meant to have killed. The bundle, like the Maltese cross, turns out to be a mechanism that reassembles itself in every medium.

What streaming did to the movie itself is subtler. A film on a service competes with everything, including last night's episode; the mid-budget drama largely left theatres for streaming; the theatrical market concentrated further into franchise events. The movie did not die. It split into two businesses sharing a name: the global spectacle that still opens in four thousand theatres, and the endless catalogue that flows into the living room. The next chapter counts the year that split was stress-tested to breaking.

CHAPTER 33

The Year the Theatres Went Dark

In March 2020 the world's cinemas closed, and the industry got a live experiment in what the movie is worth without its founding technology: the shared dark room. The answer came back: about twelve billion dollars' worth, out of forty-two.

The numbers of the collapse are worth keeping exact, because they are the largest controlled experiment in the medium's history. Global box office fell 71 per cent in 2020 to $12.2 billion; North America dropped 80 per cent to $2.25 billion; and China, the first market closed and the first reopened, became the world's largest market for the year at $3.1 billion - the first time in the sound era that Hollywood's home market was not the centre of the business.[44] The recovery told its own story: $21.3 billion globally in 2021 as theatres reopened,[71] and then a slow climb against a changed habit. By 2025 the global box office reached an estimated $33.55 billion - up 6 per cent on 2024, within a per cent of 2023, and still 16 per cent below the 2017-2019 pre-pandemic average.[72]

Inside the climb, two contradictory truths. The shared room still works when the film is an event: in July 2023, Barbie and Oppenheimer - a pink comedy and a three-hour biopic about the atomic bomb, counter-programmed into a single internet holiday - opened together to a combined $536.7 million worldwide in one weekend, with Oppenheimer alone taking $82.5 million domestically on the back of premium screens.[73] And the room struggles with everything in between: the mid-budget film that once filled weeknights now opens on a service.

The industry's other pandemic-era convulsion was internal. In 2023 the Writers Guild struck for 148 days and the actors' union for 118, halting production worldwide, over streaming residuals, transparency and - for the first time in a major entertainment contract - artificial intelligence.

The writers' settlement required disclosure when material given to a writer is AI-generated, barred companies from using AI to replace credited writers, and forced the streaming companies to open their viewing data.[74] Three months after the contracts, OpenAI demonstrated Sora, generating plausible video from a sentence; an industry survey that year found three-quarters of entertainment executives expecting AI to eliminate, reduce or consolidate jobs, with nearly 204,000 positions projected to be affected within three years.[75] The strikes were the workforce's answer to a century-old pattern this book has watched from nitrate to digital: every new material arrives as a cost saving, and the argument about who the saving belongs to is the industry's real sequel factory.

By 2025 the shape of the settlement was visible. Theatres kept the spectacle end of the business, premium-priced and event-driven; streaming kept the catalogue and the weeknight; the window between them stabilised at a few weeks. The movie survived its dark year. It came out the other side smaller in seats, larger in reach, and permanently changed in where it lives.

CHAPTER 34

The Screen the Movie Lives On

> *The last great change of material is not in production or distribution but at the point of contact: the screen itself. The movie was built for a wall of silver; it now ends its journey on glass panels the size of a hand, in resolutions its inventors could not have photographed.*

The living-room screen has eaten every previous display technology and kept the appetite. Cathode-ray tubes carried broadcast for half a century; the flat panel - plasma, then LCD, then OLED - turned the television into furniture's thinnest piece and raised the home picture past what many theatrical prints ever resolved: 4K HDR in the lounge is, pixel for pixel, beyond the 2K DCP that converted the multiplex. The phone added the second shift: more moving-image hours are now watched on handheld glass than on any other device class, much of it vertical - the first aspect-ratio revolution to come from the audience's hardware rather than the industry's.

The industry's response is the same one it gave television in 1953: differentiate what remains. Premium large formats, laser projection, Atmos, recliners - the theatrical pitch is no longer "see it first" alone but "feel it here". And the phone's answer is the franchise's other half: the clip, the trailer, the moment, cut for a vertical feed and functioning as the trailer for the trailer. The movie now lives on every screen and commands undivided attention on fewer of them; the engineering of attention, which the movie once owned outright, is now the most contested technology on Earth.

Reel Eight

The Industry Today

The business the materials built now sits in an unusual shape: five legacy studios and one insurgent streamer on one side, a wounded exhibition sector on the other, and the largest technology companies on Earth hovering over both.

CHAPTER 35

The Companies

A century after the Big Five, the industry is again a small club - but the club now includes a company that started by posting DVDs, and the studios' owners increasingly treat films as one division among parks, cables and games.

The majors of the 2020s, in brief. The Walt Disney Company is the largest entertainment enterprise on Earth, but the films are not the centre of it: in fiscal 2025 Disney's Entertainment segment - studios, television and streaming - brought in $42.5 billion of a $94.4 billion whole, while the Experiences segment, the parks and cruises the movies feed, earned more operating income than Entertainment and Sports combined.[76] The studio is, by design, a character factory for the rest of the machine. Universal sits inside Comcast, paired like Disney with theme parks. Sony Pictures is the one major without a general streaming service, happily supplying everyone. And the consolidation that began with the Trust has not stopped. Paramount, the descendant of Zukor's original stack, was sold in stages and, on 7 August 2025, completed its merger with David Ellison's Skydance - the industry's oldest name passing to the son of Oracle's founder.[77] Four months later Netflix agreed to buy Warner Bros. Discovery's studios and streaming business for $72 billion; Paramount Skydance countered with a bid for the whole company, competition authorities in nearly seventy jurisdictions approved, a last-minute emergency plea to the US Supreme Court was denied the evening before closing, and on 6 October 2026 Paramount completed the acquisition - the Warner library, HBO and the Burbank lot folding into Zukor's old stack, the combined company taking the Skydance name.[78],[79],[80] The eight-company oligopoly of the golden age keeps narrowing.

And then Netflix: over 325 million paid memberships at the end of 2025, about $45.2 billion in revenue, an operating margin near 30 per cent - a

company that did not exist in the industry in 2007 and is now the measure every studio is compared against.[81]

Exhibition consolidated the same way. AMC Theatres, Stanley Durwood's Kansas City outfit grown global, leads North America with over 7,300 screens; Regal, owned by Cineworld - which survived a 2022 bankruptcy and a 2024 restructuring - adds over 8,000 screens across ten countries;[82] PVR INOX, formed by the 2023 merger of India's two largest chains, runs 1,743 screens in the world's highest-volume film market.[83] The premium end is its own duopoly of experience: IMAX, 1,829 screens by the end of 2025 with an order backlog, sells immersion and gets a disproportionate share of event grosses;[84] Dolby sells its Atmos sound and Vision projection through Dolby Cinema rooms inside other chains' buildings.

Beneath the brands sits the equipment layer the audience never sees: ARRI and Sony in the camera department, RED now under Nikon; Barco, Christie and Sony in the booth; IMAX and Dolby in the premium format; and in the walls of every modern production, the render farms, LED volumes and cloud renderers of the effects pipeline. The map the industry began with - a chemical company, a camera maker, a studio, a theatre - survives, but every cell in it has been replaced, some twice.

CHAPTER 35a

Sidebar: The Booth Today

The modern projection booth is a server room with a window. The DCP arrives by satellite, fibre or couriered hard drive; the theatre's library management system ingests it, builds playlists - trailers, policy cards, the feature - and schedules them across every screen from one screen. Each feature is encrypted and plays only with a Key Delivery Message, an emailed certificate valid for a specific projector and a specific window of dates: the studio's grip on the print, recreated in cryptography. The projector itself is a Texas Instruments DLP chip or a Sony SXRD panel behind a xenon or laser light source, monitored remotely, lamp hours

logged like an aircraft engine's. The projectionist's successor is the multiplex's technician, covering a dozen screens the way one person once covered one.[61],[22] The Maltese cross is gone from the building, and so is the fire shutter; what remains is the queue of start times, running, as always, against the audience's evening.

CHAPTER 36

The Economics of a Movie

> *A movie is a peculiar product: nobody knows if it works until it is finished, it cannot be discounted while it is new, and it is sold to its own audience one ticket at a time. The industry's whole financial architecture is a set of defences against these three facts.*

The first defence is the portfolio. No studio bets on a film; it bets on a slate, on the actuarial hope that one Avatar carries nine disappointments. The second is the window, the century-old practice of selling the same film repeatedly - theatre, premium rental, home video, pay television, broadcast, now subscription streaming - each window monetising the film at a different price to a different willingness to wait. The third is the split: the exhibitor and distributor divide the ticket, conventionally around half to the theatre, sliding week by week toward the studio on long-running hits.

The fourth defence is the franchise, and it has largely won. A film whose characters are pre-sold - whose audience exists before the marketing does - converts the unknowable product into a renewable asset, and so the modern slate concentrates: tentpoles costing $150-300 million to make, and often that again to market, against the certain knowledge that most theatrical profit comes from a handful of titles a year. The apex of the system is a single film's lifetime total: Avatar's $2.92 billion, the highest-grossing release in history.[85] Below the apex, the arithmetic is humbling. A $200 million film needs roughly half a billion dollars in worldwide ticket sales before anyone calls it profitable, once the exhibitor's half, the marketing and the distribution fees are accounted - which is why studio greenlight meetings are the industry's true creative bottleneck.

The living-room business runs on inverted arithmetic. A streaming service does not sell a film at all; it buys and makes films as retention weapons, priced into a monthly fee, judged by whether a subscriber stayed. The box office gross - the industry's public scoreboard for a century - has no equivalent on the services, whose viewing figures are private, partial and, after the 2023 strikes, contractually shared with creators at least a little.[74] A film can now be a commercial success that no outsider can verify.

What has not changed since the Kinetoscope parlour is the unit of value: hours of human attention, purchased in the dark or on the couch. Every financial instrument in this chapter - the slate, the window, the franchise, the subscription - is a different machine for harvesting the same crop.

CHAPTER 36a

Sidebar: A Tentpole's Ledger

A representative modern tentpole, in round numbers, is a company in itself. Negative cost - getting the film finished - runs $150-300 million: development, the star package, a hundred-plus shooting days across three countries, thousands of VFX shots from half a dozen vendors. Prints and advertising adds roughly the negative's own weight again: global marketing for a major release is routinely estimated in the $100-200 million range, before the distributor's fees. Against that, the revenue line: the theatrical gross, of which the exhibitor keeps conventionally around half; premium rentals and sales; the licensing of the film into the studio's own streaming service - an internal transfer whose size nobody outside can audit. The break-even folklore of the trade - a film needs two to two-and-a-half times its negative cost in worldwide gross - follows straight from the split. It is why a $2.92 billion Avatar is not just a hit but an industry event,[85] and why the greenlight meeting, not the camera, is where movies are really made.

CHAPTER 37

Bottlenecks

> *Every industry has its constraint - the thing that cannot be bought, copied or scaled. The movie's bottlenecks have moved over the century: silver, then theatres, then capital, then rights. Today the binding constraint is the oldest one of all: two hours of a person's life.*

Start with attention. The industry's competition is no longer other movies but everything the screen can do: games, social video, sport, the group chat. The post-pandemic box office plateau - a global business stuck around sixteen per cent below its late-2010s average[72] - is not primarily a pricing problem or a quality problem; it is a habit problem, the weekly cinema reflex broken by the dark year and not fully re-formed. Theatres respond with premium formats and events; studios respond with franchise certainty; both responses narrow the filmography they feed.

Capital is the second constraint, and it concentrates the art. Tentpole economics - a $150-300 million negative cost plus a comparable marketing spend, needing half a billion in grosses to breathe - mean that only a handful of companies can play at the top table, and they rationally choose pre-sold characters over originals. The counterweight is the cheap camera and the streamer: production capability has never been more democratised, distribution never more open - and attention never harder to buy at any price.

The third constraint is access to the two great market anomalies. China, the market that became the world's largest in 2020, admits only about thirty-four foreign films a year on revenue-sharing terms - fourteen of them required to be premium-format - through two state-owned importers, capping the foreign share at twenty-five per cent of the gross.[40] And everywhere, the audience's shadow supply: piracy. An industry-sponsored 2019 study put the cost of global online video piracy

to the US economy alone at a minimum of $29.2 billion a year; treat the figure as an interested party's estimate, and it still marks the scale of the leak in a business whose product, since the print became a file, can be copied perfectly for free.[86]

The last bottleneck is the industry's own history of transitions. Each material change - sound, colour, digital, streaming - was adopted as a cost saving and arrived as a labour shock, and the 2023 strikes showed the pattern running at full force over AI before the technology was even in production.[74] The constraint beneath all the others, then, is legitimacy: the industry's ability to keep its craftspeople, its audiences and its regulators convinced that the next material is a better deal than the last. Nitrate burned; celluloid faded; files rot; the deal is what has to survive.

CHAPTER 38

Dependence and the Lost Reels

Humanity now spends billions of hours a year watching acted stories on screens - a dependence closer to a utility than a hobby. And the record of that dependence is in worse shape than most people know: the majority of everything filmed before 1930 is gone.

Dependence is easiest to measure in the raw numbers the industry itself reports. Netflix alone accounts for ninety-six billion hours of viewing in half a year;[81] a billion and a half people hold streaming subscriptions;[71] before any of it, the theatrical habit had already spent a century as the world's default evening out. The movie is where the modern world keeps its shared stories - the reference points strangers use to talk to each other, the dreams a culture recognises as its own. Governments understood this before critics did: every major power of the twentieth century built or censored a film industry, and the order in which nations appear in this book's chapters is close to the order in which they understood the screen as an instrument of influence.

Against that dependence stands the archive's quiet catastrophe. The Library of Congress's 2013 study found that only 14 per cent of American silent-era features survive complete in their original 35 mm form; another 11 per cent survive only in foreign versions or smaller gauges; about 75 per cent of the era's creative record is simply lost.[12] The causes are this book's materials reading their own obituaries: nitrate's self-igniting decay, as at Little Ferry in 1937, where forty thousand reels - most of Fox's silent output - went up in one night;[11] acetate's slower "vinegar syndrome", which curls and reeks its way through the safety film that replaced it;[87] and, for most of the century, an industry that saw last year's print as clutter, not heritage.

Preservation's answer is industrial in its own right. The Library of Congress's Packard Campus in Virginia stores 1.2 million moving-image items in a former Federal Reserve bunker, with below-freezing vaults for masters and 124 purpose-built nitrate vaults - the largest such facility in the western hemisphere.[88] Archives worldwide scan, migrate and emulate against digital rot, discovering that a DCP on a dead hard drive is more fragile than a reel from 1915. The deepest irony of the digital material is that it made everything recordable and nothing permanent by default: preservation is now a subscription that must be paid forever.

And still the reels return. Lost films surface in garden sheds, estate sales and mislabelled cans - each rediscovery a reminder that the movie's first century survives mostly by luck. The second century's survival will have to be designed.

CHAPTER 38a

Sidebar: Found in a Shed

The archive's best stories are recoveries. In 2008, a curator at the Museo del Cine in Buenos Aires identified a 16mm duplicate negative of Metropolis as something no archive believed survived: Fritz Lang's original cut, carrying about 25 minutes of footage unseen since the Berlin premiere of January 1927 - a 35mm nitrate export print, sold to Argentina before the distributors cut the film down, and reduced to 16mm in the 1970s just before the nitrate original was destroyed. The 2010 restoration, scanning the scratched, flickering dupe at 2K, reintegrated whole subplots; the new footage is still visibly scarred, which the restorers chose to leave as its own historical record.[89] Their postscript belongs in every preservation argument ever made: do not throw your originals away, even when you think you have copied them. The copy is never as good as tomorrow's technology would have made it.

EPILOGUE

The Next Reel

The LED volume is the newest version of the oldest idea in this book. On a Manhattan Beach soundstage in 2019, Industrial Light & Magic built the first StageCraft volume for The Mandalorian: walls of high-resolution LED screens, driven by a game engine, throwing a photoreal world around the actors while the camera captured it in place - no location, no green screen, the desert shipped to the stage as light.[90] It is the Black Maria chasing the sun, inverted: instead of rotating the building to find the light, the light is rendered to order, and the building never moves.

Behind it comes the stranger material. Generative video systems - OpenAI's Sora and its rivals - can now conjure plausible footage from a sentence, and the industry's own surveys expect the technology to touch nearly every production job.[75] The pattern of this book suggests what happens next, in order: the new material is adopted first where it saves money (advertising, previsualisation, background plates); it produces one public scandal and one unignorable masterpiece; the guilds write it into contracts;[74] and within a decade it is invisible infrastructure, as ordinary and as argued-over as the DI suite.

What does not change is the arrangement discovered by the fire, priced by the lantern show, industrialised by the nickelodeon and globalised by the stream: people will pay, in attention and in money, to sit in the dark - or the modern equivalents of dark - and watch a world that is not theirs move on a wall. The materials that deliver that arrangement have been replaced twice in 130 years, and will be replaced again. The arrangement itself has never yet been replaced. That is the movie's real monopoly, and it is older than the movie: the human brain's readiness to build motion, and meaning, out of stillness and light.

The horse, in other words, is still running. Watch it closely enough and, frame by frame, it tells you everything.

APPENDIX A

A Chronology of the Movie

Year	Event
1646	Athanasius Kircher publishes a description of the magic lantern; Huygens likely built a working one around 1659.[3]
1790s	Robertson's phantasmagoria terrifies Parisian audiences with projected ghosts.[3]
1825-1877	The optical toys: thaumatrope (1825), phenakistiscope (1833), zoetrope (1866), praxinoscope (1877).[4]
June 1878	Muybridge's Palo Alto sequences settle the galloping-horse question; first chronophotography.[2]
1882	Marey's chronophotographic gun records motion on a single plate.[1]
1887-1889	Goodwin patents flexible nitrocellulose film; Eastman sells nitrate roll film (1889).[8,9]
October 1888	Le Prince shoots Roundhay Garden Scene in Leeds, the earliest surviving film.[6]
28 Oct 1892	Reynaud opens the Théâtre Optique at the Musée Grévin: hand-painted projected stories, 12,800 shows to 1900.[7]
Dec 1892	Edison's Black Maria, the first film studio, built at West Orange.[15]
14 Apr 1894	First Kinetoscope parlour opens in New York; 25 cents for five peeps.[16]
28 Dec 1895	Lumière brothers' first public paying screening, Salon Indien, Grand Café, Paris.[17]
May 1897	Bazar de la Charité fire kills 126 at a Paris cinematograph show.[10]

Year	Event
1902–1903	Méliès's A Trip to the Moon; Porter's The Great Train Robbery.[26],[21]
June 1905	First nickelodeon opens in Pittsburgh.[23]
Dec 1908	The Motion Picture Patents Company - the Trust - is formed.[24]
1908–1909	Kinemacolor, the first successful natural colour process, demonstrated and premiered.[30]
1910	Carl Laemmle names Florence Lawrence: the star system begins.[25]
1910s	Production migrates to Southern California; Zukor builds the first vertically integrated studio.[36],[37]
1924	MGM formed by Loew's triple merger.[38]
6 Oct 1927	The Jazz Singer premieres; the sound era begins.[28]
1930s	Three-strip Technicolor and dye-transfer printing define Hollywood colour.[31]
9 Jul 1937	Fox's Little Ferry vault fire destroys most of its silent library.[11]
1946	US weekly attendance peaks at about 90 million.[32]
1948	United States v. Paramount: divestiture and the end of block booking.[41]
1950	Eastmancolor introduced; colour becomes ordinary.[31]
1952–1953	Cinerama, 3-D and then CinemaScope answer television.[14],[34]
12 Jul 1963	Durwood's Parkway Twin opens in Kansas City: the multiplex is born.[47]
1969	Boyle and Smith invent the CCD at Bell Labs.[53]

Year	Event
1975-1977	Jaws invents the summer blockbuster; Star Wars invents the modern franchise.[45],[46]
1984-1985	Sony wins the Betamax case; Blockbuster founded in Dallas.[51]
1989-1993	CG milestones: The Abyss, Terminator 2, Jurassic Park.[57]
1995	Toy Story, the first fully computer-animated feature.[58]
29 Aug 1997	Netflix founded as a DVD-by-mail service.[65]
2000	O Brother, Where Art Thou? pioneers the full digital intermediate.[59]
2002-2005	Studios form DCI and write the digital cinema specification.[60]
16 Jan 2007	Netflix launches streaming.[65]
2009-2012	Avatar drives digital conversion; film camera production ends (2011); Kodak files for bankruptcy (2012).[55],[56]
1 Feb 2013	House of Cards: the streaming original arrives, all episodes at once.[66]
Jan 2014	Paramount ships its last 35 mm prints; distribution goes all-digital.[62]
2019	Disney+ launches; the streaming wars begin; The Mandalorian debuts the LED volume.[68],[90]
2020	Global box office falls 71 per cent to $12.2 billion; China is the year's largest market; Paramount Decrees sunset begins.[44],[41]
2023	Writers' and actors' strikes; Barbenheimer weekend; Netflix ships its last DVD.[74],[73],[67]
2025	Global box office reaches an estimated $33.55 billion; Skydance completes its merger with Paramount.[72],[77]

Year	Event
Dec 2025	Netflix agrees to buy Warner Bros. Discovery's studios and streaming business.[78]
2026	Paramount's rival bid for the whole of Warner Bros. Discovery prevails; the acquisition is completed on 6 October and the combined company is renamed Skydance.[79]

APPENDIX B

The Companies: A Directory

The organisations below anchor the industry as this book goes to press (late 2026). The map changes quickly; treat this as a dated snapshot.

Studios and streamers

- **The Walt Disney Company** (Burbank) - the largest entertainment group; fiscal 2025 revenue $94.4 billion across Entertainment, Sports and Experiences.[76]
- **Netflix** (Los Gatos) - the largest streaming service; over 325 million paid memberships and about $45.2 billion revenue in 2025.[81]
- **Warner Bros.** (Burbank) - the 1923 studio, its library, HBO and the Max service; since 6 October 2026 part of Skydance, the renamed Paramount Skydance.[79]
- **Universal Pictures** (Universal City) - inside Comcast, paired with Universal's theme parks.
- **Sony Pictures Entertainment** (Culver City) - the major without a general streaming service; also a leading camera and projector maker through Sony's professional divisions.
- **Paramount** (Hollywood) - Zukor's 1916 stack, merged with Skydance on 7 August 2025;[77] completed its acquisition of Warner Bros. Discovery on 6 October 2026, the combined company renamed Skydance.[79]
- **Amazon MGM Studios** - the 1924 studio inside the retailer, since Amazon's 2022 acquisition of MGM.[38]

Exhibition

- **AMC Theatres** (Leawood) - North America's largest circuit, over 7,300 screens; descended from Durwood's multiplex pioneers.[47]

- **Cineworld / Regal** (London / Knoxville) - 672 sites and 8,188 screens in ten countries as of December 2023; restructured after a 2022 bankruptcy.[82]
- **PVR INOX** (Mumbai) - India's largest chain, 1,743 screens as of May 2025, in the world's highest-volume production market.[83]
- **Cinemark** (Plano) - the third major US circuit, with a large Latin American footprint.

Premium formats and equipment

- **IMAX Corporation** (Toronto) - 1,829 screens worldwide by end of 2025; the premium large-format standard.[84]
- **Dolby Laboratories** (San Francisco) - Atmos sound and Dolby Cinema rooms; noise reduction to laser projection across six decades of the industry.
- **ARRI** (Munich) - cameras and lighting since 1917; the Alexa defined digital cinematography from 2010.[54]
- **RED Digital Cinema** (now under Nikon) - the 2007 disruptor that priced 4K raw capture for independents.[55]
- **Barco and Christie** - the dominant digital projector manufacturers; Sony the third.
- **Industrial Light & Magic** (San Francisco) - Lucas's 1975 effects house; from optical printing to the StageCraft LED volume.[57,90]

APPENDIX C

A Working Glossary

Academy ratio The 1.37:1 frame standardised in the sound era; the shape of the classic Hollywood screen.[14]

Anamorphic A lens system that squeezes a wide image onto standard film and unsqueezes it in projection; the basis of CinemaScope.[33]

Block booking The studio-era practice of licensing a year's films to a theatre as one blind bundle; outlawed by the Paramount decrees.[42]

Digital Cinema Package (DCP) The encrypted file bundle that replaced the release print; specified by the studios' DCI consortium.[60]

Digital intermediate (DI) Scanning a whole film, grading and finishing it digitally, then outputting to film or files; standard from the 2000s.[59]

Emulsion The light-sensitive layer of film: silver halide crystals in gelatin, a few microns thick.

Intermittent movement The mechanism - usually a Geneva or "Maltese cross" drive - that advances film one frame at a time and holds it still in the gate.[91]

Latham loop The slack loops isolating the intermittent from the reel's steady pull; Edison's 1896 patent purchase that armed the patent wars.[21]

Nitrate Cellulose nitrate, the first film base: beautiful, tough and self-oxidisingly flammable; phased out of 35 mm production around 1951.[9]

Persistence of vision The venerable but misleading explanation for film motion; the actual mechanism is apparent motion - the brain constructing movement from successive stills.[5]

Virtual Print Fee (VPF) The levy by which studios' print savings financed exhibitors' digital projectors.[61]

Window A period of exclusive availability - theatrical, home video, pay TV, streaming - through which a film is sold repeatedly at different prices.

Vitaphone Warner Bros.' sound-on-disc system; its sixteen-inch 33 1/3 rpm discs, matched to an eleven-minute reel, prefigured the LP.[27]

APPENDIX D

The Movie by the Numbers

Figures are quoted as their sources state them, including the sources' own rounding; forecast years are labelled as forecasts.

Global box office

Year	Global box office	Note
2019	$42.5 billion	Pre-pandemic peak era.[44]
2020	$12.2 billion	Down 71%; China the year's largest market at $3.1 billion.[44]
2021	$21.3 billion	Reopening year.[71]
2023	about $33.9 billion	Implied by Gower Street's 2025 estimate (2025 down 1% on 2023).[72]
2025	$33.55 billion (estimate)	Up 6% on 2024; 16% below the 2017-2019 average.[72]

The wider market

- Combined global theatrical plus home/mobile entertainment: $99.7 billion in 2021, up 24% on 2020; $328.2 billion including pay TV.[71]
- The 2019 equivalent reached a record $101 billion (MPA).[92]
- Streaming subscriptions worldwide: 1.3 billion in 2021, after passing one billion in 2020.[71]
- Netflix, 2025: over 325 million memberships; revenue about $45.2 billion; operating margin 29.5%.[81]
- Disney, fiscal 2025: revenue $94.4 billion - Entertainment $42.5 billion, Sports $17.7 billion, Experiences $36.2 billion.[76]

Records and firsts

- Highest-grossing film: Avatar, $2,923,706,026 worldwide.[85]

- First film past $100 million: Jaws (1975).[45]
- First public paying screening: Lumière Cinématographe, 28 December 1895, Paris.[17]
- Earliest surviving film: Roundhay Garden Scene, Louis Le Prince, Leeds, 1888.[6]
- First fully computer-animated feature: Toy Story (1995); about 800,000 machine-hours to render.[58]

Production volume (UNESCO survey, 2006)[43]

Country	Feature films
India	1,091
Nigeria	872 (all on video)
United States	485

The archive

- American silent-era features surviving complete in original 35 mm: 14%. Lost outright: about 75%.[12]
- Reels destroyed in the 1937 Fox vault fire: over 40,000.[11]

APPENDIX E

Filing The Movie on the Map

The Industries of India library files every book on the GICS tree - the Global Industry Classification Standard - which is the map of industries, never the subject of a book. The Movie's home is:

Communication Services (50) - Media & Entertainment (5020) - Entertainment (502020) - Movies & Entertainment (50202010), the sub-industry covering the production, distribution and screening of movies and the streaming of entertainment content.[93]

A movie touches dozens of neighbouring industries, and this book has walked through many of them: the chemicals of film stock and emulsions (Materials), the cameras, projectors and LED walls (Capital Goods and Technology Hardware), the sensors and render farms (Semiconductors and Software), the theatres (Real Estate, Consumer Services), the boxes, discs and cables of the living room (Consumer Durables, Retailing), and the subscription services that now carry the product (Movies & Entertainment itself, alongside Interactive Media & Services). As the library grows, those cross-references become hyperlinks: the movie's reel touches Copper (every cable and motor), Glass (every lens and screen), The Transistor (every sensor and server), and The Shipping Container (the hundred years of cans of film that once toured the world by sea).