INTRODUCTION

THE HISTORY OF TECHNOLOGY: NEW YORK, 1854

The history of the elevator begins with a piece of theater. From May to October 1854, the mechanic Elisha Graves Otis gave repeated performances at the Exhibition of the Industry of All Nations in New York City, designed to demonstrate the effectiveness of a safety device he had invented. On September 20 of the previous year, Otis founded the E. G. Otis Elevator Company in Yonkers, New York. But having received only one order in his first seven months of business, he was happy to accept an invitation to introduce his apparatus to the public. In the Crystal Palace on Forty-Second Street (an imitation of the Crystal Palace built for the London World’s Fair in 1851), he installed a platform on guide rails on which he had himself hoisted into the air before the onlookers. When the platform had risen to its maximum height, to their horror, he severed its suspension cable. But instead of plunging fifty feet to the ground, the elevator stopped short after only a few inches of travel. “All safe, gentlemen, all safe,” Otis reassured the shocked fairgoers, and then explained his newly developed safety catch: a flat-leaf cart spring attached to the roof of the platform remained flexed as long as the elevator’s hoisting rope was taut, but flattened out as soon as the rope is severed, engaging notches cut into the guide rails and holding the
platform in place. This experiment raised public awareness of the invention and in the following years resulted in numerous orders for freight elevators. Eventually, on March 23, 1857, the first passenger elevator was installed in the retail establishment of the New York porcelain and glass dealer Haughwout and Company.

Otis’s 1854 performance is regarded as the primal scene in the history of the elevator. In every encyclopedia article and handbook of the history of technology, as well as in individual monographs and collections of essays on the topic, this event serves as a demarcation line, dividing the predecessors from the canonical figures, the mere curiosities from the fully developed, production-ready apparatuses. It was only “by executing this stunt, before a gasping crowd, [that] Otis had heralded the birth of the elevator industry,” declared a publication about the development of the firm.1 At first glance, the consensus that his experiment represents a historical caesura, “one of the authentic great moments in architectural history,”2 stands in surprising contrast to the relatively modest scale of the innovation that Elisha Otis presented in 1854 and finally patented in January 1861, three months before his death. For the New York mechanic was by no means the inventor of the basic principle of the hoisting apparatus. His only addition to the machines already in existence was the safety device whose reliability he proved by using himself as a guinea pig.

A glance at the literature on architectural history reveals just how old the practice of vertical transport of goods and people is. In classical antiquity, hoisting devices appeared in the writings of Archimedes and Vitruvius. Isolated examples of passenger elevators also cropped up between the late seventeenth century and the early nineteenth century and are regularly mentioned in histories of technology. The Jena mathematician Erhard Weigel, for example, had a house built around 1670 in which he installed an arrangement of pulleys to convey him from one of its seven stories to another. In her final years, the ailing Austrian empress Maria
Theresa would be lowered into the Crypt of the Capuchins by means of an elevator to pray at the graves of her parents. In 1804, a freight and passenger elevator was built for a six-story cotton mill in Derbyshire, and in 1830, the English diplomat Charles Greville described in his memoirs an apparatus in the palace of the Sardinian royal couple in Genoa: “For the comfort of their bodies he has a machine made like a car, which is drawn up by a chain from the bottom to the top of the house; it holds about six people, who can be at pleasure
Thus one wonders why the history of the elevator should rest on a single, canonical incident despite the multifarious data, a heterogeneity that only increased in the decades preceding Otis’s experiment. From the 1830s on, there was a multiplicity of well-documented elevator installations, both planned and completed, in Europe and the United States. By about 1830, freight elevators had been installed in numerous British textile factories, as one can read in the seventh edition of the *Encyclopedia Britannica*. In European mines, moreover, the transition from hemp ropes and chains to the much greater load-bearing capacity of the iron-wire cable, invented in 1834, led to the rise of so-called rack-transport, a conveyance we can think of as the underground equivalent of a freight elevator. From then on, ore or coal was no longer hoisted to the surface in barrels dangling from a rope, but rather in multistory compartments running on guide rails and capable of carrying a large number of containers. (As we shall see, this development at first had no influence on the vertical transport of the miners themselves.) During the same period, however, there were increasing references to passenger elevators as well. The Bunker Hill Monument in Boston, a 221-foot granite obelisk erected in 1842, contains a steam-powered elevator that can carry six passengers to an observation platform. For the 1853 opening of the Exhibition of the Industry of all Nations (the very fair at which Elisha Otis would demonstrate his invention the following year), the architect James Bogardus planned a 325-foot tower whose top could be reached by a steam-powered elevator. That same year, the New York steel producer Peter Cooper had a nine-story elevator shaft added to the company’s headquarters, although the mechanism was not installed until eleven years later. And finally, *Harper’s New Monthly Magazine* reported in June 1853 the imminent “introduction of a steam elevator” into private homes in New York, by means of...
of which “an indolent, or fatigued, or aristocratic person” could have himself conveyed to the upper floors.4

One thing becomes clear from all these projects and installations: the dispersed and untidy beginnings of the elevator’s history cannot be easily consolidated into a unified foundational narrative. Elisha Otis’s “All safe, gentlemen, all safe” is less the “incunabular maxim of the modern passenger elevator”5 than a single voice in a mighty chorus of mid-nineteenth-century mechanics. So how did his 1854 experiment achieve its unparalleled status? What was so epoch-making about Elisha Otis’s invention if even a recently published official company history states that his elevator in the New York Crystal Palace followed “already existing models”: “a platform set between vertical guide rails and raised and lowered on a rope wound around an overhead drum, the drum turned by belting that looped across the factory floor to the central, continuously turning steam engine.”6

Thus by 1854, both the propelling force and the mechanism itself were already well-known elements of the apparatus. The decisive difference, the detail that transformed scattered instances of the use of hoisting devices primarily for freight into the passenger elevator—an all but obligatory installation in every multistory building—consisted solely of Otis’s invention of the automatic safety catch. As one historian of the elevator put it, “Although people had been building hoists for at least two thousand years before that, their hoists had the serious fault of falling to the bottom should the lifting cable break. But Mr. Otis invented something that no one had ever seen before. He built a hoist equipped with an automatic safety device to prevent the car from falling.”7

In light of the unanimous opinion that the real history of this means of conveyance begins only with Otis’s emergency brake, it is worthwhile to direct our attention to contemporary reactions to the event. In hindsight, the elevator experiment in the Crystal Palace appears to be the celebrated centerpiece of the Exhibition of the Industry of All Nations. In a 1911 biographical sketch in honor of the hundredth
anniversary of Elisha Otis’s birth, his son Charles Otis re-
marked that the demonstration had been “one of the most
interesting and attractive in the Fair,” a judgment that con-
tinued to hold sway in the following decades. Even the most
recent publication on the history of the Otis Company states
that by the end of the fair, the demonstration had “long
since eclipsed the bigger show it was part of.” Apparently,
the public was already aware of the historical dimensions of
the scene.

However, if one sets out to look for evidence of the dem-
onstration in New York newspapers and magazines between
May and October 1854, a different picture emerges. While
the New York Times carried almost daily reports on the Exhi-
bition of the Industry of All Nations following its ceremoni-
ous reopening on May 1 (it was closed during the winter of
1853–1854), including enthusiastic full-page articles about
main attractions such as the hot air balloon ascent from the
fairgrounds on June 9, not a single line was devoted to the
epoch-making event in the Crystal Palace. One must comb
painstakingly through the archives to find any trace what-
soever of the experiment. In its issue of June 10, 1854, in a
sidebar entitled “Crystal Palace Notes,” Scientific American
presented some novelties to be found in the fair’s “machine
arcade.” Between appreciations of a cigar rolling machine
and a whaling harpoon, mention is made of a “new and ex-
cellent platform elevator, by Mr. Otis, of Yonkers, N.Y. . . . It
is worked by steam power, and operates like some of the
elevators in cotton factories. It has a plain platform, which
runs up and down on guides. . . . It is self-acting, safe, and
convenient.” There was no mention of the safety device or
its spectacular demonstration. In the major American daily
newspapers and magazines, the 1854 event showed up only
in two marginal locations. In addition to the Scientific Amer-
ican article, a brief report appeared on May 30, 1854, in the
New York Daily Tribune, which mentioned the daring of the
inventor “who, as he rides up and down the platform occa-
sionally cuts the rope by which it is supported.” No further
contemporary traces can be found (just as there were no obituaries of Elisha Otis in 1861). Thus it is no exaggeration to say that the demonstration in the Crystal Palace, that “authentic great moment in architectural history,” went almost completely unnoticed by the public.

If one sets out to trace the contemporary perspective on the emergence of the elevator in the United States between 1850 and 1880, one is more likely to discover a different foundational narrative. Up to the beginning of the twentieth century, every account of the elevator’s history credits another mechanic with a similar-sounding name, Otis Tufts, with its invention, although he is almost forgotten today. In 1859, Tufts patented an apparatus called a “Vertical Railway” or “Vertical Screw Elevator.” It was the first to have a completely enclosed cab, propelled by a twenty-inch-wide steam-driven iron screw running through its center. In the same year, the only examples ever produced of this slow and costly but extremely safe elevator were installed in the Fifth Avenue Hotel in New York City and the Continental Hotel in Philadelphia. While the proprietors of the Haughwout store had Elisha Otis’s first passenger elevator of 1857 removed three years after its installation because the public refused to accept it, the two elevators built by Tufts remained in service into the 1870s and for a while transformed the hotels into overrun tourist attractions.

It is instructive to realize how definitively the earliest texts on the history of the elevator ascribed the pioneering role to the Boston inventor, hailed after his death in November 1869 as “one of the most successful inventors of the last thirty years.” In 1880, the American Architect and Building News began its extensive article “Notes on Elevators” by remarking how recently these “now indispensable conveniences” were born. “Although steam freight-hoists have been known for forty years, it is about twenty since the first passenger-elevator or ‘vertical railway,’ as it was called, was constructed by the late Otis Tufts. . . . This cumbrous and costly apparatus kept the field to itself for some time.” Two
years later, Sloane Kennedy, writing for *Harper’s Monthly*, made the not quite accurate claim to be the first historian of the new means of conveyance: “The story of the invention of the passenger elevator has never up to this time been told, and the present paper is therefore a new chapter in the history of inventions.”\(^{17}\) He too regarded Tufts’s role as beyond question: “It is to the brilliant genius and energy of the Boston inventor (now deceased) that the credit is due of inventing and constructing the first passenger elevator in the world driven by steam power.”\(^{18}\) The name Elisha Otis appears in Kennedy’s essay only once, in a sentence about “other early inventors and patentees of portions of elevator machinery.”\(^{19}\) His emergency brake, *the* decisive watershed in the canonical history of the elevator, was in 1882 still considered an inessential addition. Otis Tufts was the definitive historical figure, an opinion still held in the following decades. Thus the *New York Times* included the “vertical railway” (not the “elevator”) in an 1891 article on epoch-making inventions of the nineteenth century, and one of the largest elevator manufacturers in Chicago, when queried in 1903 about the early history of his product, answered, “The first elevators for use as passenger lifts, of which I have any knowledge, were the screw-elevators built by Otis Tufft [sic], of Boston, in 1859.”\(^{20}\)

We need to grope our way back to the turning point at which a figure like Otis Tufts slipped into the background and the currently accepted foundational narrative began to take hold. When and why did an experiment that for fifty years was perceived as a subsidiary anecdote at best metamorphose into an epoch-making moment? How is it that for decades, all research on the history of the elevator referred to an event for which, because of the absence of contemporary interest, there is hardly any evidence? (In fact, it was falsely dated time and time again: according to Jeannot Simmen and Uwe Drepper, Otis’s experiment took place “in the New York Crystal Palace in 1853,”\(^ {21}\) and Jean Gavois also wrote that “Otis demonstrated his safety elevator
... in 1853.”22) Without doubt, the ex post facto valorization of this primal scene has to do first and foremost with the business interests of the world’s largest producer of elevators. From the 1870s onward, Otis Brothers and Company, the business founded by Elisha Otis’s two enterprising sons, developed into the leading manufacturer of elevators. With the founding of the Otis Elevator Company in 1898, it absorbed its fourteen leading American competitors.23 In addition to its monopoly of elevator production, the company was also intent on establishing historiographic hegemony over the apparatus. It is no accident that the historical account that first places the experiment in the Crystal Palace at the center of the elevator’s history was written by Elisha’s son Charles. In 1911, he declared his intention to replace the “kindly intentioned but somewhat inaccurate notices”24 honoring the hundredth anniversary of the worldwide enterprise’s founder with the true story. His account included
a minute depiction of the demonstration that had excited so little notice in 1854 and declared it to be the birth of the passenger elevator. Otis Tufts, on the other hand, put in an appearance as a mere epigone who adopted the promising invention of Elisha Otis and wheedled the hotel owners of New York and Philadelphia into buying his shoddily constructed machines (Charles Otis mentioned a serious accident in the Continental Hotel, an incident for which no other evidence exists).

The influence of this text on the historiography of the elevator is obvious from the fact that after 1911, there was hardly a mention of the elevator’s origins that did not begin by repeating the story of the event in the Crystal Palace. At the same time Otis Tufts, whose contribution to elevator construction was by no means restricted to the exotic “Vertical Screw Elevator,” was downgraded to a transient bit player of the early years. The most important producer of the conveyance was now regarded as its inventor as well, and one can trace how this narrative was cemented in place in the course of the twentieth century—especially, of course, by the Otis Company itself, whose publications in any case constitute a considerable part of the historical literature. On the 125th anniversary of the founding of the E. G. Otis Elevator Company, the firm even printed up a facsimile newspaper with imaginary historical articles, thereby creating out of whole cloth the contemporary interest in Otis’s experiment that in truth did not exist. Under a masthead reading “New York, 1854” and in a layout reminiscent of the New York Times, one could read about a “young inventor” presenting his safety elevator “in a daring exhibition before thousands of viewers.” “This reporter noted that as the platform went up, without question, everyone in the hall stopped to see what would happen next.” This “anniversary edition” also contained a striking iconographic embellishment of the event: next to the article was an illustration that was often reproduced in subsequent years. It purported to supply an impression of the excitement in the Crystal Palace.
According to the historian of the Otis Company, this illustration was based on a sketch made during the demonstration by an artist for the New York Recorder.\textsuperscript{28} In all the older literature about the experiment, however (including that issued by the Otis Company itself), the event was sketched in a significantly more modest way. We are justified in assuming that the most famous and by now “official” illustration of the experiment was in fact drawn in 1978. The teeming, astonished onlookers as well as the assistant who has just severed the suspension cable are inventions of the recent past.

It is no surprise that the largest manufacturer of a technical apparatus has an interest in retroactively claiming credit for its invention. In the course of the last hundred years, however, the stage-managed event in the Crystal Palace was so consistently and unanimously depicted as the elevator’s primal scene that there had to have been more at work in this consensus than just a public relations strategy of the company. It had to do, rather, with the question of how to construct a foundational narrative in the history of technology. If it is precisely this event among the dozens of possible candidates between 1840 and 1860 that establishes itself as the elevator’s beginning, if after half a century of neglect it still retains the power to suppress competing dates, then one has to wonder what has made it so persistent. One answer lies perhaps in the way Otis’s invention is presented. The theatricality of the demonstration (however unimpressed contemporary witnesses may have been) places this contribution to the elevator’s development above the crowd of equally important but less dramatic turning points, such as the first installation of guide rails in a factory or the first construction of a completely enclosed cab. The concentrated format of a public demonstration satisfies the yearning for a clean, unambiguous beginning, a yearning endemic to the historiography of technology. The dramaturgy of the experiment in the Crystal Palace also contributes to this outcome: Otis focused his demonstration of the innovation on a radical moment—the assumed fatal severing of the

cable—and thus accommodated the interest of historians in locating the beginning in a single, visible moment. One must pay attention to the widely reproduced illustration of the experiment, drawn long after the event. It attempts to encompass precisely the historical moment: the cable has been severed, the witnesses freeze, yet the platform does not fall. Why then has the demonstration at the New York industrial exhibition established itself as the primal scene? Not because it is in fact clearly identifiable as the beginning, but rather for aesthetic reasons—because it makes the beginning tellable. Otis provides an appropriate narrative for the birth of the elevator, a classically Aristotelian narrative, in fact: the hero’s rise into the air in the Crystal Palace moves toward a literal peripeteia, a tragic reversal—until the safety catch interrupts his fall.

The epochal status of the event, at any rate, illustrates the discursive mechanisms by which the “origin of a technical fact” comes into being, to use the words of the historian of science Ludwik Fleck. In his study of syphilis research around 1900, Fleck spells out how years of collective and anonymous work on serological experiments were retroactively attributed to a single investigator. A process of countless laboratory corrections and adjustments that in the end led to the reliability of the test was transformed into a datable act, an individual invention (the “Wassermann reaction” of 1906) in order to ensure a clear historical narrative. The “straight path to knowledge,” which Fleck’s discourse analysis exposes as a fiction, is preserved by all histories of the elevator that begin in the Crystal Palace in 1854; out of the “thinking collective” of mechanics in the middle of the nineteenth century, a single name and a single event are distilled. But the closer one examines this seemingly clear distillate, the cloudier it becomes.

INVENTING THE MULTISTORY BUILDING

In the second half of the nineteenth century, at the beginning of the restructuring process known as the era of
urbanization, the architecture of residential and commercial buildings changed in fundamental ways. Up to that point, a building as a rule represented a self-contained, straightforward entity with at most one or two stories above the ground floor. As the autonomous sphere of an extended family and the domestic servants included in its collective, the “house” evoked, for instance, that sentimental image of the “integral house” that the cultural historian Wilhelm Heinrich Riehl attempted to breathe life into one last time in his well-known work *Die Naturgeschichte des Volkes* (*Natural History of the German People*) of 1854. But what appeared there as the evocation of a lifestyle already in the process of dissolution—in view of the first “sad, bleak apartment blocks of our large cities”—lost its significance entirely by the end of the century. Riehl’s defense of an economic and social community under one roof became irrelevant to the extent that the house intended for a single family all but disappeared in the burgeoning cities, to be replaced by a new type of building.

In several respects, the new five- or six-story tenement houses that became a defining architectural feature of European cities between 1860 and 1900 began to extend and diversify the image of the house. For one thing, their vertical extension led naturally to the individual building being divided into a multiplicity of units housing a great variety of residents, a practice that dismembered the model of an “integral house” once and for all. For another, this extension pointed in a less visible direction: the simultaneous appearance of advances such as central heating, sewerage, intercoms, elevators, and, a little later, electricity ensured that from the 1870s on, the interior of the building was crisscrossed by a complex of pipes, cables, and shafts. Beneath the visible surface there arose an invisible network that organized the circulation of energy, data, and people. In the end, this process of mechanization and electrification made it necessary for the formerly independent unit of the house to become networked with its surroundings, for only the
connection to external power sources and centrally regulated reservoirs and generators ensured the functionality of its technical installations. The demarcations between the individual buildings of a residential neighborhood became more and more porous.

The elevator played a major role in this profound reorganization of the building. Even the creators of the first multi-story structures in New York and Chicago emphasized that above a certain number of floors, this means of conveyance was the basic prerequisite for further increases in building height. The installation of the elevator propelled the expansion and diversification of the building, and not just in the obvious sense that it is what made buildings of more than five or six stories possible in the first place. In the form of a cab closed to view from outside and moving through the middle of the building, it created a novel, hermetically sealed conduit. One of the most important characteristics of modern apartment and office buildings is that they consist to a large extent of previously unknown semi-public spaces such as stairwells and corridors. Suddenly, in the traditionally encapsulated family sphere of the residential building, it was possible to encounter strangers almost anywhere, and such encounters became even more focused in the elevator. Wilhelm Heinrich Riehl saw the incipient decline of the “integral house” in the contraction of the once generously proportioned communal spaces of urban middle-class houses “to a tiny corner.”  

The multistory apartment and office buildings that were standard by the end of the nineteenth century no longer had such spaces. The floor plan was divided into private residential or commercial parcels on the one hand and spaces devoted solely to traffic circulation on the other—a fragmentation vehemently criticized a century after Riehl by Gaston Bachelard in *The Poetics of Space*: “In Paris there are no houses, and the inhabitants of the big city live in superimposed boxes.” And precisely that fact raises a question that we will revisit in the following chapters: to what extent did the appearance of the new architectural
element “elevator” (a shaft that in equal measure domesticates and obscures verticality, a conveyance in which for the first time one can reach the upper levels of a building without the slightest effort, a cab that irritates its occupants with its cramped interior but is invisible from the outside) determine the organization and perception of multistory buildings or, especially in European cities, massively re-shape an already existing order?

Emerging in New York in the 1850s, the elevator became established at different rates of speed in Europe and the United States. In the United States it was already a standard feature of large East Coast hotels by the early 1860s, and by 1870 was installed in New York’s Equitable Life Building (its first use in a multistory office building), but this means of conveyance remained almost unknown in Europe well into the late 1860s, at the most occurring as a purely hand-operated device for moving freight between floors in a factory. Only with the development of the extremely safe hydraulic elevator first exhibited at the 1867 Paris World’s Fair (with its cab attached to a piston located below ground level, which pushed the elevator upwards when filled with water under pressure) did the apparatus begin to find widespread use in France and soon thereafter in Germany. For instance, the acceptance of the hydraulic technique led to the installation of passenger elevators in Berlin hotels and commercial buildings in the 1870s. The earliest articles on elevators in engineering and construction journals, however, revealed how unusual the device still was. An 1874 article titled “Hydraulic Elevators for Passengers and Light Freight” in Berlin, for example, listed every single building equipped with the new conveyance. “Up to now,” according to an 1887 monograph, “the number of passenger elevators installed in Berlin is small. The majority are in hotels, a smaller number in buildings with many offices, etc., and finally, a very small number in purely residential buildings.” In large American cities of the time, there were hardly any multistory residential or commercial buildings that could get by without an
elevator. In Germany, by contrast, the vertical transportation of people remained an exception well into the 1890s, when elevators operated either directly or indirectly by hydraulics were replaced by installations with electric drives.  

Besides this difference in the speed with which elevators proliferated, there was also a difference in their location within buildings. In New York, Boston, and Chicago, the elevator soon functioned as the core of the building. From the 1870s on, every new multistory building was constructed around an elevator shaft. Open stairwells retrofitted with elevators, even today still frequently to be found in apartment buildings in Paris or Vienna, virtually disappeared in the United States by the end of the nineteenth century. Thus in large American cities, the verticality of the buildings was determined much sooner by the conduit of the elevator. In Delirious New York, Rem Koolhaas provides a particularly vivid image of this essential status of the elevator shaft when he describes the demolition of the old Waldorf-Astoria Hotel, beginning in 1929, and the start of construction on the Empire State Building on the same site. At a time when very few German buildings existed with a floor plan clearly determined by the elevator, it had long been utterly standard that the elevator shafts constituted the center of a building in the birthplace of this means of transport. “The destruction of the Waldorf is planned as part of the construction. Fragments that are useful remain, such as the elevator cores that now reach into the as yet immaterial floors of the Empire State.” The supervising architect even mentioned the elevators in his autobiography, as quoted by Koolhaas: “We salvaged four passenger elevators from the old building and installed them in temporary positions in the new framework.”

The inseparable link between the rise of the elevator and the vertical extension of the building, especially in the United States, is well documented in the literature on the history of high-rise buildings. As early as 1891, a New York architectural historian noted, “The perfection of elevator
work is the one fundamental condition for high buildings,” and in the first monograph on the origin of the skyscraper, Francisco Mujica writes this lovely sentence: “The entire history of skyscrapers contains an homage to the inventors of the elevator.” This homage would need to point out that in the 1850s and 1860s, it would have been perfectly possible to construct hotels and commercial buildings with more than the prevailing six-story limit, but hotel guests or renters could not be expected to climb an even greater number of stairs. The author of an 1897 article addressed the increasing lack of space in the business districts of Manhattan: “Limited as to the ground, business sought in the air. It had to be done; but how? To pile up more stories on the sixth was useless, since no one would climb up to them. The problem became mechanical, and the financier and the architect were as helpless as the mason.” The solution to the problem took the form of an automatic means of conveyance: “The passenger elevator was the solution. . . . It was to be to modern building what the steam-engine is to transportation, a revolutionary agent.”

In New York around 1875, the elevator enabled an increase in building height to about eleven stories. A series of insurance and newspaper buildings were constructed during those years and dubbed “elevator buildings,” enshrining their *sine qua non* in their very name. Eleven or twelve stories, however, was their vertical limit, since for any additional stories the walls of the lower floors would have to be so massively expanded and stabilized that any gain in space and rent would be negligible. “There came a time,” continued the same article on the commercial buildings of Manhattan, “when to go higher with the solid masonry method was to lose more income at the bottom than was won on the top.” This dilemma was famously solved at the beginning of the 1880s, in the wake of the great Chicago fire, by the development of steel frame construction, which greatly increased the potential number of floors by transferring the load-bearing function of masonry walls to a steel
skeleton. For a period of ten to fifteen years, the elevator machinery itself—the previously obligatory hydraulic apparatus—suddenly seemed to be the limiting factor. Thanks to steel frame construction, it would already be possible to construct a fifty-story building, but the hydraulic technique imposed a limit of eighteen to twenty floors. “To build higher than that would be entirely uneconomic, due to the slowness of elevators and the excessive space occupied by them and their voluminous machinery.” In the end, it was electrically powered elevators with their more modest space requirements and improved speed (from 5 feet per second of hydraulic elevators to 9.8 to 16 feet per second within a decade) that cleared the way for almost limitless increases in building height, a jump whose extent is suggested by the fact that in the 1890s, the highest building in the world was the twenty-story Masonic Temple in Chicago, but the Woolworth Building, completed in 1913, stood at fifty-five stories. In the twentieth-century literature on the history of architecture, there have been frequent debates about which element—the elevator or steel frame construction—was decisive for the rapid increase in vertical expansion. Even if one doesn’t adopt the consistent position of the earliest historian of the skyscraper, who accords the elevator exclusive credit for this development (“It is the elevator that is the initial cause of the skyscraper. Steel skeleton is a consequence of the elevator”), there is no question of the fundamental role played by this means of conveyance. No one has expressed this more succinctly than a German commentator on the opening of the Woolworth Building: “It must be admitted that the possibility of a fifty-five-story building is founded primarily on the perfect operation of passenger elevators. (Climbing to the top floor on steps with risers of 4.7 inches would take about ¾ of an hour!)”

It is not the ambition of this book to be either solely a study of technical and architectural history or an intrinsically literary study that extracts the “motif of the elevator” from fictional texts. Rather, it will attempt to use a
heterogeneous corpus of texts that includes novels and plays as well as legal regulations, articles from professional construction engineering journals, medical treatises, and handbooks of public hygiene to come to grips with what one might call the “imaginative organization” of the building within a particular time period. Among my questions are these: How was the collective image of multistory residential and commercial buildings changed by the element “elevator” in the decades before and after 1900? What effect did the technical apparatus have on the conceivability and expressability of what happens inside the buildings, about the distribution of spaces and people? With Michel Foucault, one could call this enterprise an “archeology” of utterances about the building with respect to the elevator. In discrete cross-sections through the strata of legal, scientific, and artistic utterances, primarily between 1870 and 1930, this work hopes to illustrate the multifarious ways the elevator disrupts familiar standards for the organization and perception of buildings and how its appearance puts
its stamp on the principles of building codes as well as the concerns of the hygiene movement and the topography of the urban novel. Precisely because this book is concerned not just with the history of architectonic artifacts but also with the processes of historical imagination, it is essential that its textual material include both works of fiction and nonfictional documents. The structures and limitations of an epoch’s topographic imagination leave traces in equal measure in building codes and the spatial conceptions of literary texts.

I am interested in the preconditions for the possibility of judgments or fantasies about the building, and a basic impulse for this book is the suspicion that the elevator fulfills the function of such a precondition, that one can understand it as a “technical apriority” for utterances about multistory buildings. This assumption, however, has consequences for how one treats the historical material and even how one understands historiography itself. The more we direct our attention to the preconditions for what is expressible, the more problematic becomes any reconstruction of “historical truth,” any recounting of “what actually happened.” On the contrary, in place of the most complete possible duplication of the past, we must attempt to extract those things about an epoch that it could not tell about or reflect upon itself—since for contemporaries they were far too self-evident, constituting as they did the unshakable foundation of their own words and deeds. Thus the following analyses will not necessarily be concerned to uncover the intentional core of scientific or literary texts, but will focus rather on what one might call their “unconscious” (to use a parlous term), those unspoken parameters of perception and imagination that can reveal themselves in the most marginal places—in the introduction to a monograph, for example, or in a dependent clause in a building description. In this context, it is important to always keep in mind the imaginative category of the multistory building before the advent of the elevator, a time that could not yet conceive of
a vertical shaft running right down the center of a building. For this study stands exactly at the divide between the old and the new organization of a building, a divide that opened up around 1900.

One look at how the chapters of current histories of technology are organized or how informational material is presented in historical museums reveals that the way technical innovations become established continues to be portrayed as a chronicle of triumphant progress, an unbroken series of adjustments and improvements: an apparatus that is at first imperfect and exotic becomes progressively improved, right down to the present day. Half a century ago, Georges Canguilhem countered such a strictly teleological perspective by directing attention to a completely different kind of knowledge. Although he was addressing historians of science, his words apply equally to the history of technology:

The history of science is not a retrospective history of progress nor the depiction of outmoded stages leading to today’s truth. Its aim is rather to investigate and illuminate the extent to which concepts, attitudes, or methods that appear outmoded today represented progress in their own time and the extent to which, as a result, the outmoded past remains the past of an activity that must still be called scientific. For our study of the elevator, this involves repeatedly highlighting those historic turning points when what is today obsolete or taken for granted made its first appearance and began to unleash its disruptive power. This is precisely the reason the primary emphasis of this book, with the exception of its final chapters, will be on the early history of the new conveyance, the time before 1920 or 1930. In the early years, the recalibration of the building’s system was clearly evident. What Sigfried Giedion once said about the chronicler of “anonymous history” in Mechanization Takes Command is particularly relevant for someone writing about an object that is so omnipresent and unspectacular today (at most, only capable of provoking irritation by its spatial constriction): “He has to see objects not as they appear to
the daily user, but as the inventor saw them when they first took shape. He needs the unworn eyes of contemporaries, to whom they appeared marvelous or frightening. The following pages will attempt to restore to the elevator, an object that has become dull and inconspicuous in the twenty-first century, the luster of strangeness.

ACCIDENTS

With respect to Otis’s 1854 experiment in the Crystal Palace, there is another decisive circumstance besides the element of theatricality. The detail that the New York mechanic added to already existing elevator designs was an element of safety and the prevention of accidents. We must return to the sequence of events in the demonstration, about which Rem Koolhaas writes, “Otis introduces an invention in urban theatricality: the anticlimax as denouement, the non-event as triumph.”

The sentence structure of a description of the experiment by an Otis Company historian illustrates this pattern: “Those who had morbidly anticipated a leg-breaking crash, however disappointed, were nevertheless impressed with the effectiveness of the Otis safety — when, as a matter of fact, nothing happened.”

The caesura marked by the strategically placed dash is followed by the punch line: nothing happened. Thus at the beginning of elevator history stands the elaborately staged prevention of a catastrophe, and when one asks why this experiment is retrospectively anointed a historic moment, one has to consider the central role played by the potential for accidents in the early years.

It was not just that the very first Otis safety elevator was installed in New York in the wake of a fatal accident involving the preceding apparatus (two workers died because the platform was equipped only with a manually operated catch mechanism, whose activation at the moment the cable broke would have required extraordinary presence of mind). In the articles on passenger elevators in German and American journals of construction and engineering
between 1870 and 1900, it is repeatedly evident that the topic of accident prevention was at the forefront of concern. Paradigmatic for the approach to this new means of transport was Franz Reuleaux’s assessment in his engineering report on the introduction of indirect-hydraulic Otis elevators in Germany: “The question of the safety of an elevator whose purpose is to transport passengers is without a doubt the most important of all.”57 The possibility of an accident served repeatedly as a catalyst for both technical improvements in the apparatus and the development of legal ordinances.58 The problematics of accidents has been extensively studied in the last few years. The lack of forewarning stands in the way of portraying them, while their identity “gets lost between the poles of what precedes and what follows”59—that is, between statistical prognoses and traumatic consequences. This is particularly evident in the case of the elevator, in contrast to a train or airplane. Its enclosed shaft makes the moment of the accident impossible to witness, an invisible phenomenon. The result is the complete absence of graphic depictions of elevator accidents.

What is responsible for the development of such an acute sensitivity to potential accidents in the early years of the elevator? There are two answers to this question. First, it is a reflection of the quarter century dividing the establishment of the railroad from that of the elevator, the horizontal from the “vertical railways.” People were completely unprepared for the shock of the first large-scale railroad disasters. An “accident” in this sense was a completely unknown type of occurrence and led to both a semantic adjustment in the meaning of the word itself and fundamental changes in medical diagnostics and the legal system. By contrast, the extraordinary precautions surrounding the introduction of elevators attest to the fact that in the decades after 1850, the destructive potential of modern means of transportation had completely permeated the collective imagination. Second, the fear of a cable breaking and the cab plunging to the ground is connected to another field
in which the dangers of vertical transport had long been known, namely, mining.

Beginning in the late Middle Ages, when mineshafts in Europe first reached depths of more than just a few yards, mechanisms begin to be developed to bring the mined ore up to the surface. For centuries, cable winches powered by human, equine, or hydraulic power—and from the 1780s also by steam engines—managed the vertical transport of freight. As mentioned above, from the late 1830s, that
transport took place using baskets attached to rails running up the mineshafts, a technical ensemble that one could call a freight elevator. In the mid-nineteenth century, at the time of the first aboveground elevators in buildings, the depth of mineshafts in the upper Harz and Ruhr regions already reached more than two thousand feet, and one can best understand how high the risk was of an accident caused by a cable break by the fact that until 1859, German mining regulations prohibited the transport of people by cable. Miners were forbidden to ride into or out of the mine in the baskets meant for freight transport. In the slanting and more shallow shafts, miners used stairs and simple ladders. In the deeper, vertical shafts, so-called man engines were in widespread use from the early 1830s. These were steam-driven pairs of reciprocating ladders moving up and down past each other in such a way as to allow the miner quick access into the shaft. The reason for this method was lack of confidence in the reliability of the cables. What the inventor of the iron-wire cable, the upper Harz mining engineer Wilhelm Albert, said in 1834 about the hemp cables and chains in use up to then—“Not a quarter year went by without hundreds of cable breaks . . . being recorded”—did not improve much in the following decades, as shown by the annual accident statistics in the Zeitschrift für das Berg-, Hütten- und Salinenwesen (Journal of mining, smelting, and saltworks). According to a “Statistical Study of Mineshaft Cables” commissioned by the Royal Central Mining Office in Dortmund, as late as 1872 no less than 19.3 percent of all 114 transport cables under its jurisdiction had suffered a sudden break during that year. As a consequence, when the Prussian Bergpolizei (mining constabulary) in 1859 became the first such authority in Germany to permit on principle the transportation of miners in ore baskets because the increasing depth of the shafts made the use of man engines difficult, the safety regulations were extensive. Paragraph 7 of the Dortmund police ordinances for mines, for instance, stated that, “before being used for human transport, the
cable, its attachment to the receptacle, as well as the latter itself, must receive a thorough daily inspection of their durability by a responsible and capable person assigned to the task, before whose eyes the cable must be slowly wound and unwound down the shaft.” And paragraph 11 required that “no worker may be forced to use the cable and a refusal to do so can never constitute grounds for dismissal.”64 In the 1860s and 1870s, most other German states followed Prussia’s example, and one can trace in the pages of the Zeitschrift für das Berg-, Hütten- und Salinenwesen how extensive was the catalog of ordinances that every mine owner had to comply with if he wanted to obtain police permission to transport miners by cable.65

What this glance at the history of vertical transport in mines makes clear is that the remarkable focus on the possibility of a cab falling in the early years of the elevator was largely due to the precarious nature of the cables in mines and became more and more acute in the course of the nineteenth century. That the staged prevention of a fall, the presentation of an automatic braking device, retrospectively became the primal scene of elevator history is inseparable from this deeply ingrained mistrust of the cable, reinforced by numerous mining accidents. The suspension of containers for vertical transport represented a latent danger, and for an invention such as the passenger elevator to become accepted above ground, it first had to explicitly guarantee the safety of the unstable principle of suspension. It is important to note, however, that this “trauma of the cable” was more pronounced in Europe than in America. Since there was hardly any industrial mining to speak of in the United States before the first California gold rush in 1849,66 the elevator cable was regarded with considerably less suspicion than in Germany, England, or France. How far-reaching the consequences of these differences in mining history were for the spread of the aboveground means of conveyance can be seen above all in the fact that the steam-powered elevators suspended from two to four cables that were standard
in the United States until the rise of the Otis hydraulic elevator were used in Europe solely for carrying freight. Not until the direct-hydraulic technique dispensed entirely with the suspension principle of the cable did the passenger elevator begin to catch on. Here the cab is mounted directly on the drive piston. Ludwig Hintz gave a characteristic summary of this development in his *Handbuch der Aufzugs technik* (Handbook of elevator technology): “The feeling of not hanging in the air on cables but standing on a column—of having a support directly beneath you that goes right down to the ground—had something very reassuring for apprehensive souls.”

When one tries to clarify the role played by mining in the early history of the elevator, one finds an interesting simultaneity under and above ground. The prevention of a cab fall by a reliable catch mechanism—according to an Otis Company history an accomplishment that “promised to make the hoist safe for the first time in 2,000 years” was also one of the central concerns of European mining engineers in the mid-nineteenth century. The voluminous *Leitfaden zur Bergbaukunde* (Guide to mining engineering) of 1873 stated in retrospect that between 1850 and 1870, “There is hardly anything in mining engineering that produced a greater number of experiments and inventions than the search for a catch mechanism to protect transport in mines from the danger of a broken cable.” Apparently the first ore baskets to be equipped with an automatic catch mechanism went into operation in an anthracite mine in Liège, Belgium, in 1848, and in the quarter century that followed, countless variations and improvements were made to this safety device in European mining centers. Their complete reliability became all the more essential with the increase in the use of the cable to transport personnel as well as ore. The basic design of these safety devices was identical to that of the Otis elevator in the Crystal Palace. As a German mining engineer described it in 1868, “All known catch mechanisms so far follow the same principle: in the case of a cable break,
the transport receptacle is designed to lock onto the rails or onto a special rod.31 (In fact, the inventor of one of these devices, a mining technician named Philipp Lohmann, demonstrated the reliability of his catch mechanism in 1867 in exactly the same daring way as Elisha Otis thirteen years previously. He “was so convinced of the reliability of his invention that he placed himself and his wife on the platform and then severed the cable.”72 In contrast to the New York event, the spectacle in the municipal park in Essen did not become a date of world-historical significance but was consigned instead to oblivion, except for this mention in a 1902 history of mining in Westphalia.)

The Otis Company archives give no hint as to whether in the early 1850s Elisha Otis might have had knowledge of the achievements of European mining engineers. There is no documentary evidence of a relation between the beginnings of the elevator in New York—with the apparently singular invention of the catch mechanism—and the world of mining. In Germany, however, this relation is evident and frequent, and not just in the early dread of the suspension cable that hindered the introduction of passenger elevators. In the 1870s and 1880s, one can observe a productive relationship between underground and aboveground vertical transport, for during this time, building elevators also profited from the intensive efforts of mining engineers to improve the catch mechanism. One must again call to mind the fundamental difference in the number of subterranean and aboveground shafts in Germany. Around 1880, the highest elevator-equipped buildings did not exceed 80 feet, while the depth of shafts in the largest mines was already close to 2,600 feet. The cable-mounted ore baskets reached a speed of 26 to 33 feet per second at this time,73 while even the most modern hotel passenger elevators still moved between floors at a speed of 1.6 feet per second.74 Against the background of these comparative statistics, it is clear that the safety of aboveground elevator cabs could be quickly perfected. In the mines, the engineering challenge was to
develop complex catch mechanisms that would gradually decelerate the furious plunge of an ore basket following a cable break so as not to endanger the stability of the guide rails or the safety of the miners. To reliably secure a building elevator moving at a speed twenty times slower, the techniques available at the time were completely adequate. In the Zeitschrift für das Berg-, Hütten- und Salinenwesen one occasionally finds evidence of the perspective of mining engineers on cab safety above ground. As professionals, they had a hard time taking this topic seriously. After witnessing the demonstration of an advanced catch mechanism developed explicitly for building elevators, one of them commented succinctly that the mechanism “may be appropriate for hotel elevators and shafts of negligible depth.”

In the view of a professional mining engineer, aboveground elevator shafts were nothing but insignificant “shafts of negligible depth.”

As a consequence of this wealth of knowledge about how to ensure the safety of ore baskets in mines, the focus of elevator accident prevention clearly shifted around 1880. The subsiding concern about a cab falling after a cable break was more and more overshadowed by another worry, namely, people falling into inadequately secured elevator shafts. Optimized catch mechanisms, even activated by nothing more than increased cab speed or excessive stretching of the cables, ensured the safety of elevator use from the 1880s on. Statistics in construction journals and the brochures of elevator manufacturers both demonstrate that travel in an elevator was many times safer than travel by horizontal means of transportation, and that even using a stairway carried greater risk for pedestrians. In any event, all published reports agreed that in Europe before the First World War, there was in fact only a single elevator accident in which the passengers were killed explicitly by the fall of the cab, and this incident did not even involve the cable suspension so long regarded with suspicion. It was the otherwise highly reliable direct-hydraulic technique that precipitated the worst
An elevator accident in history in the Grand Hotel in Paris on February 24, 1878, a mishap in which three people died. A broken casting connecting the piston to the undercarriage of the elevator at first caused the cab carrying the building superintendent, the elevator operator, and a guest to be pulled to the top of the shaft by the counterweight. There the cab’s overhead suspension was ripped from its mounting and the cab plunged to the ground in free fall.

The really dangerous part of an elevator installation, however, was less the cab itself than the access to it. The sliding doors that are obligatory today and “when they open disappear somewhere in the wall” did not appear until after the Second World War; in the 1880s, manually operated hinged or folding doors of wire mesh on each floor still frequently misled careless passengers wishing to enter the cab into opening them and falling into the shaft. The Berlin elevator manufacturer Flohr boasted in a 1900 company publication of being the first to find a solution to this problem and portrayed the risky situation in the early years as follows:

Until the year 1886 [when Flohr elevators were first equipped with a shaft door-locking mechanism], all elevators were manufactured with unsecured entrance doors. The frequent mishaps that resulted—people falling into the shaft through entrance doors that were too easy to open or being struck and killed by an arriving elevator—made the coordination of the shaft doors with the elevator cab an urgent necessity, so that they could open only when the cab had reached the same height as the doors, and on the other hand, would only allow the cab to resume its travel once they had closed.

The reliable establishment of such “coordination” between cab and shaft doors represented the most urgent task of safety engineering in elevator manufacture in the early twentieth century. In the mechanically functioning hydraulic elevators of the 1880s and 1890s, this linkup usually consisted of a shackle that barred the door on the inside as soon as the cab left the floor in question. As one can regularly read in the news section of construction and engineering
journals, however, this method was notoriously unreliable and led again and again to fatal falls into the shaft. This “most urgent problem” of elevator safety, “the elimination of the possibility of operating the elevator with the shaft doors open as well as the elimination of the possibility of opening the doors while the elevator is in motion,” Kennedy, Sloane W. “The Vertical Railway.” *Harper’s Monthly*, November 1882 was not solved until the late 1890s with the advent of electric controls, for electric contacts established a reliable link between the door’s locking device and the position of the cab, as Ludwig Hintz explained in his 1908 *Handbuch der Aufzugstechnik*:

The principle of all these door-locking devices consists in installing contacts on the door that are connected to the power line of the cab controls or, less frequently, of the motor, in such a way that the contacts are only closed, thus completing the circuit, when the door is shut, and that when the door is opened, the circuit is broken.

With the almost universal adoption of electrically powered elevators by the early twentieth century, all traces of this kind of accident disappeared. The threat to users of an elevator shaft becoming a deadly abyss in the middle of a building in the absence of a door-locking device was eliminated for good by the simple binary nature of an electric circuit: closed or open. For that reason, elevator fatalities in the twentieth century occurred primarily as workplace accidents. By the time of a 1911 congress for domestic hygiene in Dresden, Germany, a speaker could say, “As statistics show, elevator accidents can be traced without exception to recklessness or carelessness during installation or repair.” The only monograph on this subject ever published in Germany was intended only for potential elevator personnel. Georg Urban’s *Unfallverhütung im Fahrstuhlbetrieb* (Accident prevention in elevator operation), published in the middle of the First World War and addressed to the large number of “young, untrained, and female workers” in hotels and offices in wartime Germany, listed the dangers that could
occur during installation, servicing, and repair of the machinery, when all safety devices were turned off. The eventuality that a passenger could be the victim of an elevator accident was hardly even mentioned in Urban’s work. Its central concern (on fifty-two of its seventy-four pages), always with reference to workplace accidents, continued to be the improvement of the automatic locking devices for the shaft door. The protection of elevator workers prompted the author to invent a device that was destined to play a part in countless action and horror movies: the trap door in the ceiling of the cab. Apparently for the first time in the history of the elevator, Urban demanded that the “ability to open the roof” be obligatory, allowing installers and service personnel to work in the interior of the shaft without risk of accident.\textsuperscript{37}