

light and power meaning and value and incorporating it into our existing cultural systems of meaning. These representations may be viewed by some as little more than charming curiosities—quaint period costumes in which the important work of invention and industry building was accidentally clad. But the accounts I will give in this book argue that these representations, which created meanings and accommodated novelties to existing sets of beliefs and social institutions, influenced people to understand and participate in the electrification of all domains of life. It is the representations that go between minds, creating meanings and accommodating novelties to existing sets of beliefs and social institutions.

Certainly, tangible objects (light bulbs and power plants) and the tangible benefits of clean, safe light provided individuals with material experience of the technology. But even the tangible is experienced within social meanings, institutions, and activities. Electrical light and power emerged within and were supported by a social matrix. Light could not just appear through the mute work of a few mute technologists. It had to emerge as part of the drama of human meanings.

The drama of the construction of electrical power and light was both prominent and significant, both highly visible and highly consequential. Some significant actions require only the cooperation of a small number of people and can be carried out in a quiet corner of the stage until their consequences start proliferating, transforming the very nature of the stage. But other actions, from early on, require the involvement and cooperation of many actors, mediated through multiple channels of communication. Because of the many communications that are entailed, such enterprises become socially visible early on, in many different locations and many different ways. The creation of a system of light and power required visibility in order to harness the support and the force of the legal, financial, corporate, technological, public, and civic systems.

Edison and the people around him necessarily and willfully spoke to the discourses around them to create presence, meaning, and value for the emergent technology in the laboratory, in patent offices and law courts, in financial markets, in the boardrooms of newly created companies, in city halls, in newspapers, and in the consumer marketplace. These venues are saturated with language. Newspapers are the daily world gathered into words and pictures. Government and law are notorious for their verbosity. Finances and corporations do their business over meeting tables and on paper. Consumers are wooed through pamphlets, advertisements, publicity, and fast-talking salespeople. Even the laboratory and the shop

floor are socially bound through diagrams, instructions, plans, reports, questions, orders, confirmations, and records.

The material technology of electrical power and light, once produced, had persuasive force and compelling priorities of its own. The night lit up at the flick of a switch argued for itself, electrocution of beast and man signified electricity's terrifying power, and regular delivery of light was one means of persuading consumers to pay their monthly electric bills. Edison was savvy enough as a rhetorician to use all these material arguments. But, as a walk through the technology section of a library or the files of an electric company will reveal, the production of these physical arguments required the cooperation of many people, aligned through words and pictures. Within those representations the physical technology takes on meanings and force that it would not have on its own, mutely. Lightning may terrify a herd of wild animals, but those animals do not turn the lightning into an instrument of the gods to foster social order, nor do they understand the lightning to be related to chaff clinging to rubbed sulfur, nor will they invent machines to produce charge and send the charge through wires into every home so that they may read books at night and watch television.

Technologies emerge into the social configurations of their times and are represented through the contemporary communicative media. This book examines the emergence of many of the social and communicative arrangements that shaped and transformed the world in which Edison and his colleagues acted: the American patent system, newly large cities, large-circulation newspapers, technological professions, transformed universities, national markets, large corporations, financial investment, and commercial display.

In Edison's day, even more than today, talk was a major medium of sharing information. Many of the social systems I will be considering were still relatively small and local, and much work was of the face-to-face kind. But the late nineteenth century was also was a period in which more extensive systems grew and began to leave substantial documentary trails. The rise of professions brought specialized literatures and training documents. The development of government bureaucracies meant burgeoning files. Broad investment in financial markets made financial news a valuable commodity. Big corporations left increasing numbers of letters, reports, memos, and forms. During this period, so many actions were carried out on paper that we can examine the documents not just as fragmentary remains of activities (like potsherds of ancient civilizations), or as documentary

records of non-literary events (like medieval chronicles of royal doings) but as the actual media of social action. An exchange of letters was indeed the interaction itself. More of the work was carried out on paper in some areas (such as the legal system) than in others (such as the laboratory). In some cases, the vanished spoken words leave us with questions: What meanings and values were exchanged between the Edison Electric Illuminating Company of New York and the New York City Board of Aldermen over dinner one night in December 1880, for example. But for the most part the documentary record provides a deep picture of the communicative interactions through which Edison and his colleagues gave electrification meaning and value.

I have already referred to Edison's colleagues and collaborators. He may have started as a freelance inventor working after hours in a telegraph office, but he rapidly developed a series of networks, collaborators, employees, agents, and allies who stood at the intersection of many forms of communication. Thomas Alva Edison became Edison, Incorporated. Many individuals were involved in the nurturing and the spread of the representations of Edison's project. In some instances it is possible to separate the communicative work of Edison the individual from those of the larger enterprise, but in others it is not; and sometimes there is, for the purposes of this book, no point in making such distinctions.

Many of the communicative actions examined herein show clear signs of careful forethought, strategic planning, and art. Others seem spontaneous, more the results of momentary circumstances than of design. That is the way with all communication and representation. We communicate responsively and reactively. Even when we write with planning and reflection, our range of conscious attention is limited and our writing is directed toward a communicative landscape we have only partly articulated. Indeed, the purpose of studies such as mine is to bring more of the dynamics of communication to consciousness.

I will not always try to discern what people thought they were doing, or whether they knew what they were doing or had just done. Evidence of reflections is rare in the Edison papers, and there is limited profit in reading the minds of actors long dead. I will keep my attention focused on what the texts accomplished in the environments to which they seem to have been responsive. To contain the task, I will focus primarily on material directly related to the introduction of light in the period 1878–1882. Rather than attempt comprehensive coverage of all the material, I have chosen representative texts that reveal the rhetorical activity of the discourse.

In chapter 1 I recount the immediate reactions of various publics to Edison's announcement of incandescent lighting in order to establish the story and to reveal some of its multidimensionality. In chapters 2–7 I explore how Edison established meaning and value for his project in the several meaning systems that would bear on its success: news, finances, laboratory, patents, engineering, and the market. These chapters are organized as historically parallel, each reaching back to the formation of the relevant discursive systems and continuing forward to examine Edison's intervention. In chapters 8–11 I examine the tension between what Edison produced materially and how he represented the technology symbolically; together these chapters provide a chronological narrative of invention and development in the period 1878–1882. In chapters 12–15 I consider how the new material and social realities of incandescent light created new and enduring meanings in several domains, and I follow a number of separate but parallel trails into the ensuing years.

While researching and writing the book, I grappled with many ideas about rhetoric, technology, and society. In the text, I have not put these theories in the foreground; rather, I have tried to use them to give shape to the story. Nonetheless, I think the story has some important consequences for theories of rhetoric, social organization, and technology studies; I try to make these visible in the concluding chapter.



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*The Opening Scene*



# 1

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## *Edison's Front-Page Story*

Edison's first announcement of interest in electric lighting was a front-page newspaper story, and electric light became the most prominent technological story of a technological age. Many other specialized dramas were played out in other discursive venues—finances, law, corporations, the laboratory, the technological press—but these were energized and supported by public attention in the press and were then reflected back onto the journalistic stage—until the United States saw itself as a society powered by electricity, and electricity flowed through all activities of daily life.

### *Electric Light before Edison*

By 1878, when Edison entered the field of electric lighting, arc lighting (produced by a spark in the gap between two carbon electrodes) was already an established technology. Humphrey Davy had demonstrated the possibility of electric arc lighting in 1801, and in the 1840s means were invented to maintain appropriate distance between quickly consumed electrodes. In 1862 the Dungeness Lighthouse in Kent, England, was converted to arc lighting in the first successful application of the technology. By the late 1870s Paul Jablochhoff in Europe and Charles Brush in the United States had produced commercially viable arc systems for lighting streets and large public spaces. In 1878 arc lighting illuminated Paris and London streets and John Wanamaker's department store in Philadelphia. In 1880 arc lights were mounted on large towers to illuminate the entire city of Wabash, Indiana. Arc lighting, however, was too bright for homes or offices. The gentler incandescent electric lighting, produced by a glowing filament, promised to compete with gas lighting, which was in place in almost every city in Europe and the United States in the 1870s. No viable system of incandescent lighting existed, however, before Edison took interest in the problem, despite more than 30 patents by various inventors dat-

ing back to 1841.<sup>1</sup> Finding a filament that would reach sufficient temperature to glow without burning or melting was the main challenge.

### *Edison's Entry into Lighting*

Until August of 1878, Edison had taken no more than passing interest in arc or incandescent lighting. Only a few passing experiments were recorded in his notebooks, among many other preliminary explorations.<sup>2</sup> Edison's early career as an inventor was primarily devoted to telegraphy, but in 1876 his interests turned to telephony. The telephonic investigations led serendipitously to the invention of the phonograph in late 1877. This startling invention brought Edison fame, news attention, and a hectic demonstration schedule.

In July of 1878, Edison took a break from his work to accompany a scientific expedition to the Rocky Mountains to measure a solar eclipse. On August 26 he returned to his laboratory at Menlo Park, New Jersey, talking of producing electricity from the great western falls. The next day he began preliminary investigations into lighting while still pursuing other projects. On September 8 he took a day trip to Ansonia, Connecticut, to see William Wallace's new arc lighting system, with its powerful generator. According to a September 10 account, which appeared in both the *Sun* and the *New York Mail*, he was "enraptured."<sup>3</sup>

Back at Menlo Park on Monday, September 9, Edison excitedly began a series of experiments. He immediately wrote his first electrical lighting patent caveat<sup>4</sup> and wired Wallace to send one of his generators.<sup>5</sup> Shortly thereafter he granted an interview to a *Sun* reporter in which he claimed to have solved the problem of the incandescent lamp. The story ran on Monday, September 16, under the headline "Edison's Newest Marvel. Sending Cheap Light, Heat, and Power by Electricity."<sup>6</sup> By Tuesday, Edison's lawyer, Grosvenor Lowrey, had begun financial negotiations for what was to be the Edison Electric Light Company. A preliminary agreement, reached within a month, granted Edison a \$50,000 advance for research and development. Gas stocks took a tumble, and newspaper stories about Edison's marvels proliferated. Edison's mail over the next few months was filled with letters that took his claims as a fact.

All this belief and all this activity hung on one man's premature and optimistic projection of success for an improvement on the unsuccessful work of many others. Although at this point Edison had likely conceived an overall approach that would lead to incandescent lighting and central power,<sup>7</sup>

T. A. EDISON.

Menlo Park, N. J., Sept 13 1878

William Wallace  
Ansonia Conn

Hurry up the machine  
I have struck a big  
bonanza T. A. Edison

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940  
1 Va

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**The Sun.**

MONDAY, SEPTEMBER 16, 1878.

**EDISON'S NEWEST MARVEL.**

**SENDING CHEAP LIGHT, HEAT, AND POWER BY ELECTRICITY.**

**Illustrating One of the Long-looked-For Ideas Suggested by the Prediction of P. du Bois Reymond, on Great Diffusion of an Electric Machine.**

Mr. Edison says that he has discovered how to make electricity a cheap and portable substitute for the gas-light and gas-heat. Many scientific men have worked assiduously in that direction, but with little success. A powerful electric light was the result of these experiments, but the problem of its diffusion into every small house was a harder one. Grassman, Siemens, Brush, Wallace, and others produced at most ten lights from a single machine, but a single one of them was found to be impracticable for lighting small or large houses, mills, and workshops. It has been reserved for Mr. Edison to solve the difficult problem desired. This, he says, he has done within a few days. His experience with the telegraph, however, has taught him to be cautious, and he is exerting himself to protect the new scientific marvel, which, he says, will make the use of gas for illumination a thing of the past.

Mr. Edison, besides his power of originality, has the faculty for developing the ideas and mechanical constructions of others. He visited the Bessemer glass-making factory in this city, and, while examining the component parts of the machinery, made four suggestions so valuable that they have been adopted. While in the mining district of the West, he devised a process of determining the presence of gold below the surface without resorting to costly and laborious boring and blasting. While on a visit to William Wallace, the electrical machine manufacturer in Andover, Conn., he was shown the lately perfected dynamo-electric machine for transmitting power by electricity. When power is applied to this machine, it will not only generate it, but will turn it into light. Although said by Edison to be more powerful than any other machine of the kind known, it will divide the light of the electricity produced into ten or a hundred times their length for general purposes is necessary. Each of these lights is in a cylindrical metal frame capable of holding in a horizontal position two carbon plates, each one inch long, one-eighth of an inch wide, and one-eighth of an inch thick. The upper and lower parts of the frame are insulated from each other, and one of the two spring wires is connected with each carbon. In the centre, and above the upper carbon, is an electro-magnet in the circuit, with an armature, by means of which the upper carbon wires from the source of electricity are placed in the leading coils. The carbon being so set, the current is closed, the electro-magnet sets vibrating and causes the upper carbon to vibrate in a slight light. The light moves toward the opposite end from which it starts, then changes and goes back, always moving toward the plate where the carbons are nearest together. If from any cause the light goes out the circuit is broken, and the electric current ceases to act. Instantly the upper magnet falls, the circuit is closed, it relights, and separates the carbon again.

Edison on returning home after his visit to Andover, studied and experimented with electric lights. On Friday last his efforts were crowned with success, and the result that has since the minds of many scientific men for years was obtained.

"I have it now!" he said, on Saturday, while experimentally turning the handle of a lamp in the dark cell in his laboratory at Menlo Park, and, singularly enough, I have obtained it through an entirely different process than that from which scientific men have ever sought to secure it. They have all been working in the same groove, and when the known law I have discovered and my ideas, whereby the electric wire, they have never thought of it, is so simple. When my lights have been produced by a single electric machine, it has been thought to be a great triumph of scientific skill. With the process I have just discovered, I can produce a thousand wires, ten thousand—ten or one machine. Indeed, the number may be said to be infinite. When the brilliancy and cheapness of the lights are made known to the public—which will be in a few weeks, or just as soon as I can thoroughly protect the process—distribution by insulated hydrogen gas will be discovered. With fifteen or twenty of these dynamo-electric machines recently perfected by Mr. Wallace I can light the entire lower part of New York city, using a few horse power engines. I propose to establish one of these light centres in Nassau street, where wires can be run up over as far as the Cooper Institute, down to the Battery, and across to each street. These wires may be insulated, and laid in the ground in the same manner as gas pipes. I also propose to utilize the gas burners and chandeliers now in use. In each house I can place a light meter, whereby these wires will pass through the house, and these small metallic contrivances that may be placed over each burner. These housekeepers may turn off their gas, and send the meters back to the companies whenever they please. Whenever it is desired to light a lot, it will only be necessary to touch a little spring meter. No meters are required.

Again, the same wire that brings the light to you, Mr. Edison continued, will also bring power and heat. With the power you can run an elevator, a sewing machine, or any other mechanical contrivance that requires a motor, and, in addition, the heat you may cook your food. To utilize the heat, it will only be necessary to have the covers or sleeves properly arranged for its reception. This can be done at trifling cost. The dynamo-electric machine, called a tele-machine, and which has already been described in THE SUN, may be run by water or steam power. At a distance, when used in a large city the machine would of necessity be run by steam power. I have arranged the machine so that the electricity transmitted to the destination to be built a fraction of the cost when obtained in the ordinary way. By a battery of steam power it is, however, a glass changer, and by water power probably an even cost "cheaper."

It has been computed that by Edison's process the same amount of light that is given by 1,000 candle-burns of the unimproved hydrocarbon now used in this city, and for which from \$100 to \$150 is paid, may be obtained for from twelve to fifteen cents. Edison will soon give a public exhibition of his new invention.

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"Edison's Newest Marvel," New York Sun, September 16, 1878 (94: 354).

he would soon abandon the specific approach of thermal regulation of the lamp upon which he had based his immediate claim. It was to be more than a year before he had a working light, and an additional year before a full system was ready. Yet Edison's announcement was taken as credible. His correspondence from this period shows how the meanings people attributed to him were embedded in specific and well-developed systems of communication that made his work seem credible.<sup>8</sup>

### *Scientific Friends and the Public Culture of Science*

The earliest correspondence concerning Edison's new interest in light and power<sup>9</sup> was an exchange with George Barker dated September 5 and 6, the purpose of which was to arrange the aforementioned visit to Ansonia.<sup>10</sup> Barker was a physicist friend who had been part of the summers' solar-eclipse expedition.

Edison's announcement of his perceived breakthrough changed Barker's relationship to him. Barker, who previously had written as a peer requesting aid or discussing possibilities, became a supplicant. On September 16 Barker enclosed a clipping of the *Sun* article in a letter asking whether Edison had any new items available to display at a lecture Barker was to give in January.<sup>11</sup> On October 23 Barker wrote expressing disappointment and upset at not being able to exhibit lamps, as though he assumed the lamps were already working and available for exhibit.<sup>12</sup> In early November Barker renewed the request for the lamps and offered to postpone the lecture if he could have them.<sup>13</sup> He later wrote Edison with an account of the lecture, which he said had gone well despite the lack of the demonstration of the Edison light.<sup>14</sup> This sequence of letters bespeaks the existence of a well-established genre of public lecture, dating back to colonial times.<sup>15</sup> These lectures as education and entertainment depended on the exhibit of the latest wonders. In the nineteenth century there was some move to institutionalize such lectures and to ensure that speakers were legitimate authorities. Barker, a professor at the University of Pennsylvania and a public figure, was clearly part of this system of public edification.<sup>16</sup> Lecturers had to keep in touch with inventors in order to gather material on the wonders that held public attention.

The dependent relationship between the lecturer and the inventor is revealed in Barker's letter of October 23, 1878. Barker begins by addressing Edison as Chevalier de la Legion d'Honneur (referring to Edison's recent award) and thanking him for some information. Then he describes