An evening at home with the Telephone Herald, Newark, New Jersey, 1912. (*Literary Digest*)

3

Locating the Body in Electrical Space and Time

Competing Authorities

> The young ladies of Frankford . . . have recently discovered that by holding a piece of tin against the iron foot-rests driven into the wooden poles of the Suburban Electric Light Company they receive a weak electric shock, and almost every evening a group gathers around the poles that are not situated on the main thoroughfares and enjoys the fun for hours . . . One pretty miss was heard to remark, after her first experience, "Oh, I thought I was squeezing a handful of pins." "Yes," said another, "it's something like being kissed by a young man with a bristly moustache."
>
> —*Philadelphia Record,* 1891

In any culture codes for bodily communication are conventionally elaborated and, like other codes, require skillful manipulation. The body is the most familiar of all communicative modes, as well as the sensible center of human experience, which lives or dies with it. Upon it, all other codes are inscribed to a greater or lesser extent. There is no form of communication that does not require the body's engagement, though printed and written messages may involve a smaller direct range of its perceptual and motor capacities than oral-gestural messages do. In addition, strange experiences are often translated and made familiar by comparisons with the body, and by categories of classification derived from the body's experience. The body is a convenient touchstone by which to gauge, explore, and interpret the unfamiliar, an essential information-gathering probe we never quite give up, no matter how sophisticated the supplemental modes available to us.

The body is also squarely at the critical juncture between nature

and culture. It *is* nature, or in any case man's most direct link to nature, capable of opposing and resisting it at least for a while, either its own or that external to it. The inscription of cultural codes upon the body is perhaps the principal means of detaching it from nature and transforming it into culture. The body and its actions, therefore, have a richly ambiguous social meaning. They can be made to emphasize perceived distinctions between nature or culture as the need arises, or to reconcile them. Because men use what is known to them to make sense of what is not, a deep inquisitiveness about the relationship between electricity and the human body was part of the process of becoming socially acquainted with that novel and mysterious force in the late nineteenth century. And though electricity might be discussed either as an extension of nature or of the body, or as something opposed to and outside them, it was defined in any case inescapably with reference to them.

The object of this chapter is to explore the relations between these constructed points—nature, the body, and electricity—in the imaginative worlds of popular and expert culture, and to examine the body as a communications medium, that is, as a mode for conveying information about electricity, and as a symbolic focus for hopes and anxieties entertained by experts and laymen about its significance. Though these two communities were organized by broadly different modes for sharing, discussing, and verifying information about electricity, both raised fundamental questions about it by exploring its relation to the body. Would electricity enhance and preserve life, and would it bring culture into greater harmony with nature? Or would it bring death and destruction, and further estrange what some regarded as a deteriorating relationship between culture and nature?

The Authority of Bodily Experience

Communities are conveniently defined by who talks to whom, what modes of discourse are acceptable, and what topics are discussed. As the organizing center of speech, gesture, and sense perception, the body was the principal cognitive instrument of laymen unskilled in the critical apparatus of literate experts. Its appeal lay in its apparent intimacy with nature, which made it seem particularly reliable. To laymen who embraced the body as a source of knowledge, nature was marvelous, with a marvelousness that did not have to be explained but was accepted as a gift. In popular science, or science as laymen understood it, the body was a reference point against which the whole world could be measured to make it comprehensible. When the *Electrician* declared that popular science appealed to the senses, it referred to a way of knowing quite unlike the controlled observational posture of empirical investigation.[1]

Popular electrical literature of the late nineteenth century attempted to anchor knowledge of electricity in sense perception and in nature experienced as a personal ally or enemy, a partner in a special and even magical oral-gestural dialogue. Men and nature were thought to be intimately in touch, and nature was thought to respond directly to human action and desire. The electrical press told many stories of ignorant bumpkins "wandering" into telegraph offices, as though vaguely aware of their operations, to "see it go"—to be convinced of electrical reality by concrete, immediate, sensible demonstration, rather than by abstract generalization. In such stories, the naïve inquirer might first attempt to determine if he were being trifled with, since electrical communication was not corporeally manifested in the expected way. While the mechanism of the telegraph was not transparent to immediate observation and required an abstract theory of the sort that scientists understood to supply the explanation of its operation, the wanderer nevertheless had seen it work with his own eyes. "Even then," went a typical story in this genre, "he could hardly be convinced, but he concluded that 'it was the durndest thing he ever saw.' "[2]

Expert culture, as we have seen in a preceding chapter, created its familiar electrical world out of formal theories and other print-based techniques of disembodied reasoning with specialized literate formulas and procedures. In scientific and technical literature, expert authority rejected immediate sensory judgment, or direct experience of nature, as naïve empiricism. In expert culture, nature was not a partner but a phenomenon for study, an object of mastery and conquest, something apart from man and understood through a screen of studiedly abstract models and theories rather than directly, that is, in dialogue. Amos Dolbear, an inventor in telephony, professor at Tufts University, and well-known scientific popularizer, dealt with the "all-embracing mystery of electricity" in a typically expert way in *Popular Science Monthly*. Though conceding that the nature of electricity still "befogged" even scientists, he also declared that the same scientists knew "pretty thoroughly what to expect from it" not by reason of vivid, one-time sensible proofs of the kind demanded by wandering *naïfs*, but because "it is as quantitatively related to mechanical and thermal and luminous phenomena as they are to each other."[3] The task remaining to science

was to state the nature of electricity "in terms common to other forms of phenomena." To achieve the most widely generalizable abstraction was the goal of scientific knowledge. Like the scientist, the wanderer also hoped to establish the status of electricity by comparing it to the already familiar, but this was an implicit and unstated, rather than explicit, epistemological requirement; moreover, what counted as familiar to experts and laymen were different things. The layman's theoretical requirements were concealed in his sense of what was unalterably tangible. The irrefutably palpable circumstance was a good deal closer to the wanderer's sense of truth made firm. The scientist's faith in empirical demonstration was distanced from sense experience by layers of theoretical consideration that doubted the trustworthiness of appearance *a priori*.

Morally formulated divisions between oral-gestural and written modes are long-standing in Western culture. They run as deep as the philosophically constructed polarity between body and mind in behalf of which they are now and again summoned to do battle.[4] At the same time, practices associated with both modes, and with the rationales that justify them, are deeply ingrained and widely accepted. By the late nineteenth century, popular education, mechanized printing, and cheap paper had created a mass reading public accustomed to the habits of print, even if the form these habits took did not always satisfy the guardians of high culture. In parallel fashion, the community of science, self-defined by its practice of specialized literacies, was dependent on modes of apprentice training and demonstration that very nearly constituted a mimetic oral craft tradition. The association of popular culture with orality and expert culture with print literacy, in which the body is at greater remove from the phenomenon under study, was not, therefore, an absolute division, but one of relative emphasis. Because of the pragmatic command by both communities of a range of modal styles, both scientists and laymen on occasion embraced the logic of whichever tradition they were most skeptical of. At other times, the differences in the world each tradition accepted as real created tension between an oral tradition of bodily immediacy and the sifted abstractions of a skilled literacy.

To do battle with nature, experts were armed with special technical equations, observational techniques, goals for control, and formal conventions for constructing the knowledge they extracted from it. These conventions protected experts from unwelcome association with popular oral-gestural epistemologies. Experts were not, however, satisfied to talk only to themselves. Not only did their periodicals spend a great

deal of time monitoring popular opinion on the subject of themselves and electricity; when they sought to present themselves to the larger world, their talk was laced with appeals to religion and magic, modes of experience vastly admired in oral-gestural culture. On these occasions, technical terms acquired priestly connotations, which experts probably were not sorry to see them acquire. And though laymen, or nonspecialists with popular views of electricity, clung to many of the oral-gestural beliefs and conventions that had always served them, they also wished to be part of and to count in the magical world experts dangled before them, and so they appropriated whatever notions of electrical terminology and expert procedures seemed serviceable. A single example may illustrate. "Fear," wrote one Dr. Cunningham in 1834, identified only by an expert title that conferred more than demonstrated literate authority, "is due to escape of electricity from the body, and joy to its entrance."[5] The same commentator held that electricity was responsible for the kinky hair of Negroes, the movement of the planets, and large feet among the inhabitants of the Northern Hemisphere. These "facts" placed bodily phenomena at the center of intellectual concern about electricity, and identified this set of propositions as a popular epistemology in which all things were connected, nothing could be accidental, and nature was powerful. While this epistemology was also recognizably scientific, connections among things in popular science were magical and direct; in expert science, they were theoretical, hierarchical, and provisional. Popular science respected the active power of nature, as expert science, which sought to organize and subdue it, could not. But experts gave credit to nature for having the final say about the worth of their theories. Dr. Cunningham's claims were given a scientific cast by their application to remote things (planets) as well as proximate bodily ones (large feet). As in science, a parsimonious explanation was offered for complex events, though the explicit connections required for a truly scientific explanation were absent, and not only absent but resisted, since connections in scientific explanations were often as mysterious to laymen as if they in fact were magic.

Nature as an Object of Expert Conquest

The nature behind electrical phenomena scientifically understood was complex and abstract, requiring training in abstruse vocabularies and apprenticed indenture to puzzling ideas. "We know little as yet concerning the mighty agency we call electricity," conceded William

Crookes in an article on the "possibilities" of electricity in *Fortnightly Review* in 1892, while presenting an impressive collection of arcane theories as to its character. "The only way to tackle the difficulty is to persevere in experiment and observation."[6] A single path to electrical knowledge required the disciplined denial of bodily perception much beloved by scientists, and was justified by its object, the conquest of natural vicissitude and the annihilation of interval in both action and communication across space and time.*

New modes of communication that vaulted across these boundaries signified human triumph over nature, increasing with each scientific advance. These triumphs made scientific investigators and technical experts creators in their own eyes of a new millennium, separated from a past in which men had possessed neither mastery of nature nor the enviable understanding of it that abstract knowledge had given them. Nature was the base line from which human civilization had emerged by progressively subjugating the natural. It offered the strongest possible contrast against which to measure and evaluate technological achievement with pride or, if one were so disposed, with alarm.

In expert epistemology, nature was messy. Technology was the great orderer. "The real calamity in a thunderstorm," explained William Crookes, commenting on natural unharnessed electricity, "is not that the lightning may kill a man or a cow, or set barns or stacks on fire. The real calamity consists in the weather being upset." The practical electrician should aim at "nothing less than the control of the weather" for the sake of agricultural productivity. Practically speaking, Crookes did not wish "to reduce our rainfall in quantity, but to concentrate it on a smaller number of days, so as to be freed from a perennial drizzle."[8] What he called "amending the ways of Nature" justified an expert, or adversarial, relationship to it.

What was messy was dangerous. In a speech to electrical engineers in 1890, Stevens Institute president Henry Morton suggested that

*The importance of bodily perception was often acknowledged by experts. Speculating on the possible existence of sentient beings with different sense organs than those of humans, Crookes wondered if such beings might have eyes sensitive to special vibrations of "electrical and magnetic" phenomena which would offer them "a different world from our own. . . . Glass and crystal [to them] would be among the most opaque of bodies. Metals would be more or less transparent, and a telegraph wire through the air would look like a long narrow hole drilled through an impervious solid body. A dynamo in active work would resemble a conflagration, whilst a permanent magnet would realise the dream of medieval mystics and become an everlasting lamp with no expenditure of energy or consumption of fuel."[7] Released from the strict bodily discipline of human science, the world of phenomena would be beautiful indeed.

the future of civilization hinged on the conquest of natural electricity. "Intelligently managed and controlled, the most powerful . . . agencies become the most efficient protectors and servants of man, and . . . aid him in his mission of subduing and utilizing nature," Morton declared. Without such servants, men would be "reduced to the lowest condition of savagery," helpless against "blind" nature.[9] Nature was the abyss ready to swallow culture. The threat of retribution by nature against technological order was always subtly present, as in a *New York Tribune* account of the reliability and safety of telephone service in the midst of an alarming winter storm:

> "I was stopping at a country house on an island near Stamford. It was blowing a furious gale of sleet and snow. The water was dashing madly against the rocks and the great trees about the house were swaying in the blast. All nature seemed to be in the wildest commotion, but the wires held fast, and when I rang up a friend in New York and his quiet voice came to me all the way through the wild night without a change in its tone it did seem almost marvelous."[10]

What was chaos could not assume the character of a dialogue with man, but was an unruly, unreliable, deadly force to be subdued. In such circumstances, the message from man to nature was not sent with any expectation of reply, but forcibly imposed. The desire to coerce nature pushed the expert off his peg of lofty disinterest and suggested the deeper emotional pull of the body even in expert science. The *Pall Mall Gazette* reported that the inventor Monsieur Rauspach had conducted experiments with an electrically charged prod on three lions, a boa constrictor, and an elephant, several of nature's most exotically dangerous creatures. Readers were treated to full details of how the animals were made to submit. The proud lions "were seized with trembling and growled fitfully." The twenty-foot boa constrictor "became at once paralyzed and remained motionless for six hours afterward. When he recovered he showed signs of numbness for three whole days." Touched merely on the tip of his trunk, the elephant "set up a series of wild cries, and became so enraged that the tamer feared the brute would break its heavy iron chain."[11] *Popular Science News* reported in 1897 that electricity had been used to "conquer" a recalcitrant horse. "In one case a very high-spirited and valuable animal, but extremely vicious and balky, was cured in one hour with the aid of a three-volt dry battery."[12]

Richard L. Garner, a naturalist interested in the habits and "speech" of the great anthropoid apes in the African wild, designed a special

electrified steel cage and lived in it many months, keeping nature at a technologically remote distance. His "fortress in the jungle" was a depot for supplies and a "place of safety from the wild beasts that prowl through the forests at night." It contained a phonograph, photographic instruments, several telephones (connected to what was unclear), and an electric battery good for three hundred hours. Prior to an expedition to the French Congo in 1892, Garner explained to readers of the *North American Review* that by means of a small switchboard

> I shall be able to fire my flash light at night or to snap my kodak in the daytime, and to operate my telephones if necessary. In case of danger or unexpected attack, by the use of my switch-board and by means of a Stilltion coil, I can charge the entire cage with electricity, developing an alternating current of about 300 volts. In leaving my cage with its contents for any length of time I shall simply charge it in this manner with electricity, in order that in my absence my meddlesome neighbors may be induced to let it alone.[13]

Another experiment described "a large, ugly spider that had been feasting on flies for two months," hopelessly befuddled by a tuning fork set to vibrate against its web, which was conceived by the experimenter as a kind of primitive telephone network. Expecting a buzzing fly, the investigating spider could not decode the source or content of the odd message. The strong god-playing element in this story paid homage to belief in the superiority of technologized intelligence. Man with his tools knew better than nature; he had foiled and humbled it, laughed at its ignorance, and made it run to do his bidding.[14] In each of these expert tales, the underlying fabulous and mythic encounter between nature and the magic wand of human invention—a melodramatic, magical confrontation full of the stuff of fairy tales—was disguised in the vocabulary of scientific knowledge and achievement, which doubtless made it convincing to its audience. Monsieur Rauspach's experiments, for example, had been reported to the Academy of Sciences.

While technology held the line of civilization and kept savage nature at bay, no reciprocal moral sense constrained men from using technology against nature. Nature damaged or threatened by electricity was evidence of human triumph over instinctual forces. It was said that electric lights on the Capitol Building presented an untidy appearance because of the

> billions of insects which have been drawn thither by the brilliancy of the electric lights . . . whose skeletons are either hanging on the walls, held fast by a death grip, or are piled up in heaps all over the recesses of the roof. May flies, beetles, crickets, earwigs, dragonflies, grasshoppers, caddis flies, bees, wasps, ants, hornets, skippers, horned midgets, gnats, mosquitoes, and every species of insectoria known to the surrounding swamps and woods of the district.[15]

Nature encroaching on civilization was sacrificed at civilization's altar, repulsed by a deadly weapon at the center of civilized accomplishment. If nature repulsed or inconvenienced mankind—if centipedes, "those 'horrid thousand-leggers,'" terrified the ladies—it could be gleefully noted that electric lights rapidly dispatched "the ugly little bodies," and that with this application of the miracle fluid "there is, apparently, no end to the uses of electricity."[16]

In the late 1890s, a series in the *American Electrician* detailed uses of electricity by power station technicians for "sport." Contributors described their amusement when streams of electrified water were turned on stray dogs, occasionally electrocuting them, when wires were wrapped around chunks of meat to bait serenading cats that were shocked into entertaining leaps and somersaults, and when dynamite was electrically detonated to destroy an unluckily located nest of yellow jackets.[17]

But what would it mean if the weapons of control turned against the controllers? At the dangerous edge of civilized behavior, electricity could be an ominous symbol of projected anxieties, a signifier not of order but of instincts indulged at peril. With President Porfirio Díaz and members of his cabinet in attendance, the first use of electric lights at the bullfight in Mexico City in 1887 threatened to pitch the excitement of that volatile drama too high. Ten arc lights mounted for the occasion seemed to make the bulls wilder than usual, and "the gaudy uniforms of the matadors fairly blazed."[18] The same year, extensive advertising promised that the annual Bull Circus at Nîmes would be conducted beneath electric lights. When the lights failed at the beginning of the performance, the enraged audience rioted and made a bonfire of the circus fittings before troops managed to restore order. On such occasions, electric lights seemed to lend power to instinctual forces straining the fabric of civilization.[19] Another reversal of the expert-conquest theme was stories in which man had so mastered nature that the line between nature and man's artful transformation of it was no longer clear, and nature seemed more sensibly depicted in the image of human creation. In the spring of 1887, for example, it was said that the appearance of Venus in the early evening sky confused observers

who inquired of the *New York Sun* whether the object in question was not an electric light sent up in a balloon by the ingenious Mr. Edison.[20]

Nature in Dialogue

If experts believed that electricity could be known only by experiment and observation—procedures not for speaking to nature, but for capturing her secrets in order to force her into technological servitude—those committed to the epistemology of bodily authority believed that nature revealed herself to those who waited for her to speak in her own language. Electricity, X rays, and wireless were not the exclusive property of science, but had been there all along for those with eyes to see their manifestations. In 1896 the *Buffalo Courier* reported that Dr. John T. Pitkin of that city believed that X rays were frequently exhibited in nature. The doctor was quoted as having "seen through a tree during an electrical disturbance."[21]

Folk wisdom affirmed natural miracles that science was expected to witness and verify rather than explain, since explanations suggested that things were other than they seemed, and folk wisdom accepted events as given. Scientific terminology lent an air of up-to-date credibility to remarkable things seen with one's own eyes. Readers of the *Telegraphic Journal* of London learned the "well-authenticated fact that certain flowers such as marigolds, sunflowers, and poppies have been seen at rare moments to emit little flashes of light," especially during the hottest months, after sunset or before sunrise, and during drought—a phenomenon solemnly attributed to the inductive effect of atmospheric electricity.[22] *Popular Science News* reported that Maurice Depres, an electrical engineer in Cordova, Spain, had witnessed a shower of electrified rain on a warm and windless day when the setting sun had been overcast with dense clouds. Soon after dark, as lightning flashed, "great drops of rain fell, which crackled faintly on touching the ground. From each of them sparks darted towards the walls, trees, and soil they fell upon" for a brief time.[23] In Hungary an American "professor" had succeeded, he said, in bottling fresh lightning for local farmers to put on their fields to stimulate rain whenever their crops needed a drink.[24]

A view that natural manifestations were part of a dialogue between man and the world saw nature's retreat before technology as a threatening development, and not as a positive sign of man's mastery of chaos. In rural Iowa, where farming required a partnership with nature, a local newspaper wondered what would happen to the cows

each night when the electric light was introduced. Would they know how to sleep? "Is there a town over the broad earth where cows run loose under electric lights?" Pondering the unseemliness of this hybrid of nature and technology, it added, "A town with electric lights and cows running loose in it would be a spectacle for gods and men, resembling a savage clothed in a silk hat."[25] The *Milwaukee Sentinel* complained that electric lights constituted "a very bad and wholly unnecessary imitation" of daylight, as though "Nature made a very grave mistake in instituting darkness, and the arts of men are engaged in efforts to correct Nature's blunder. The planets are too far off to afford any useful light, the stars are useless, and the moon is too irregular in its habits as a luminary."[26]

Discomfort with the menace of electrical technology was elsewhere manifested in apocalyptic theories of disaster. One of the most popular was that excess charge accumulating in the world posed a growing danger to man and nature. "What would that class of theorists do with electricity without that poor, bamboozled and bedraggled word 'charged?' " wondered the *Electrical Review* in 1886. "It is made to do duty on every occasion, when there is uncertainty, perspecuity [sic] or indefiniteness. The ground, the wire, the machine, the air, the clouds, are constantly 'charged.' "[27] Suggestions were put forward that the amount of lightning in the air was increasing as a direct consequence of the spread of telegraph, telephone, and electric light wires across the country. The *New York World* editoralized:

> The proposition is advanced that pretty much everything that will hold electricity is becoming more or less charged. Fears that have not yet assumed a definite expression are entertained by many observing people to the effect that too much of the subtle fluid is being manufactured and kept in store to be consistent with the public safety. It is thought that much leakage is involved and that the earth, especially in the case of large cities, and the houses are being more or less saturated with it. It is time to call a halt before this thing goes any farther. With telephone, telegraph, and electric light plants on the increase, and the electric motor still to come, the situation is serious and demands prompt attention.[28]

A slightly different hypothesis elaborated by a certain E. Miller of Kingston, Missouri, also gives the flavor of popular misgivings:

> The iron rails as they lay on the ties are great conductors of electricity, and so are the wire fences. These are the disturbing elements. This unusual electricity is collected by nature in large and positive bodies, we

> know not where. When the rain cloud comes up, these bodies of electricity are attracted to them in such ponderous masses that the clouds cannot neutralize them, and sometimes change the course of the clouds, and then we have a cyclone; or sometimes they take the same course as the wind, and then we have a hurricane or straight wind, as they are called. But the disturbing element is all the same.[29]

Miller advised that requiring railroads to put down ground rocks six feet in length at two- or three-hundred-foot intervals, and requiring farmers to put down ground wires at the same intervals along their fences, would eliminate tornadoes in the state of Missouri. From Bishop Turner of the African Methodist Church of Georgia, Kentucky, and Tennessee came a related warning concerning the spread of electric light. "While admiring the invention of the white man in controlling electricity," *Electrical World* reported,

> he claims that the subjection of God's agent is carried too far in making it light the world. He predicts that the unbalancing of the air currents which electrics are causing will in a few years, if they increase in numbers as fast as in the past five years, cause whole cities to be blown away at a time, and floods unlike any save Noah's. All the floods, hurricanes, cyclones and other atmospheric disturbances taking place in the heavens and upon earth are due to the work of electric lighting companies, says the reverend bishop.[30]

Not even those "best able to express an opinion," scientific experts, had a proper explanation for tornado activity, the *World* harrumphed in scorn. The bishop must hold gas stock or be under contract to the gas interests of his diocese, speculated the editors, who could only thus explain one who did not admire the white man's invention enough.

The electrical press was equally disdainful of a physician's estimate, obnoxious to them for its quasi-scientific statistics, that the peril to human health from electricity was "three to five fold greater than it was fifty years ago." Disparaging and lumping together Negroes, literature, and superstitious magic at a stroke, the press claimed this theory would "do honor to a colored revivalist, or one of the witches of Macbeth."[31]

Expert ridicule rarely deterred cosmic tragedians. In 1888 the Reverend A. C. Johnson prophesied that the very days of the earth were numbered by man's extravagant production of the lightning. "In just 32 years from now," reported one account of this prophecy, "the electricity stored in the earth will come in contact with the heated matter inside and blow the whole world up." The spokesorgans of expertise sarcastically suggested avoiding this little explosion by tapping the reserve of stored electricity for telegraph and streetcar service.[32]

Other observers couched their concerns in more scientifically imitative, though not necessarily accurate, terminology. A British observer accepted an upset in the equilibrium between electricity and the rest of nature as a plausible explanation for a stretch of abnormally wet weather in 1892. "Electricity," he explained, "is a *palpable* substance, universal in extent, in the earth and in the atmosphere, and upon it apparently depends the fertility of the earth and the vitality of the atmosphere."[33] Unfortunately, the commentator continued, mankind's constant manipulation of electricity endangered earth and air alike:

> We force the electricity out of the earth by both chemical and mechanical power, and having used it according to our will for illumination, motive power, or other purposes, *throw it into the atmosphere,* which, being already replete, cannot absorb it. It will therefore be naturally attracted to the oxygen and hydrogen gas, and united with them turn them into water, and thus descend again to the earth, after having at once weakened the fertility of the earth and the vitality of the air.

Recurring in all these expressions of popular concern was the fear that man was throwing nature wildly out of balance in his manufacture of electricity, and that nature would sooner or later redress that balance. If man misused the cosmic order, the cosmos would take its revenge. Nature might be pacified if man were to revere it as an equal partner instead of disdaining it as a slave to man-made science. The alternative possibility, that tragedy loomed over clumsy human efforts to prize loose the secrets of the universe, weighed heavily on the popular imagination.

At the opposite end of the scale from predictions of cosmic disaster, but with a still more powerful hold on popular thought, were reports of electrical accidents daily occurring in plants and in the streets. In the public perception, electrical accidents were an increasing risk of urban life. When these reports were picked up by the technical press, experts commented on the errors and exaggerations that often accompanied them in order to argue that the ignorance they perpetrated was a more serious social danger than any physical threat from electricity.[34] This approach also strengthened the case experts never tired of making for greater expert control over electricity, which the Kentucky Court of Appeals described as "the most powerful and dangerous element known to science" in an accident-case ruling. Electricity, the court added, was "a force which no one except experts can understand."[35]

What made accidents more fearfully compelling to popular audiences than any expert reassurance or irritation to the contrary were vivid and grotesquely detailed descriptions of what these accidents did to the body, that most informative of instruments for conveying to laymen what electricity was really like. "How a 2,500 Volt Shock Feels" was a typical title in *Popular Science News,* for the experience of an electrical engineer who had lived to tell the tale.[36] A Texas lineman who survived a 500-volt shock described it in memorable terms:

> Just as the shock came, it seemed to me like a blinding flash of lightning had come and its lurid flame had struck and remained in my eyes. I then felt myself reaching upward and as though I was going to fly, this, I suppose, must have been the sensation caused by the contraction of my muscles. Then I felt as though I was soaring away, just as one feels when put under the influence of ether or chloroform. Then all was blank and I knew no more until I felt a pricking sensation in all of my members. I then felt a strong tase of brimstone in my mouth, just as I am told that those who are struck by lightning experience always.[37]

Gruesome and serious injuries were reported from thunderstorms, from handling electrical materials, and from pranks upon or by the unwary.[38] *Western Electrician* reported how a lightning storm had electrified a swing bridge in Chicago: "A driver urged his horse out upon the bridge in spite of the blue flames that were playing along the iron rods. The animal was hardly upon the structure before the electricity leaped up through the iron calks of its shoes and it went down in a heap, stone dead."[39] Unfathomable mysteries caused other accidents. "It is said that in the dry atmosphere of the elevated plateaus of the Sierra Nevada and Rocky Mountains the human body becomes highly charged with electricity; and two serious accidental explosions which took place recently are attributed to this cause," reported the *Telegraphic Journal* of London.[40] "These are the days," commented the *Electrical Review,* "when numerous more or less excited individuals see balls of fire the size of watermelons running along telephone and telegraph wires and exploding with a loud noise and sulphuric smell."[41]

The Current of Life, the Paradise of the Body

As easily as it mobilized social anxiety, the inscrutable ether inspired visions of Edenic abundance, a paradise of the body. Scientific, lay, and religious observers were struck by the thought that because of its

greater versatility and efficiency than steam, electricity might be used to indulge every frivolous whim as easily as to fill every basic need. Popular attitudes were as suspicious of the body as a source of pleasure as science was suspicious of the body as a source of knowledge. This created moral perplexities. If humanity in an electrical age would not want for food or shelter, then electricity must be a gift of God's grace. But what was the moral status of the "electric cocktail," described in 1877?

> "Electrical cocktail" is the latest. A flexible lead from the electrolier ends in a platinum curl. A trifle of sugar is added to the liquid, the platinum curl lowered into it and current turned on to make the curl red hot. A small amount of the alcohol and sugar is decomposed, i.e., carbonized, and the resulting burnt sugar is said to be very delicate. It promises to be a fashionable winter beverage, and can be made cold or hot.[42]

Or what of electric ornament? The twentieth triennial exhibition of the Massachusetts Charitable Mechanic Association in Boston in 1898 featured candelabra made by tipping "the branches of the antlers of one of the most perfect bucks' heads that the writer has ever seen" with incandescent lights manufactured by the Buckeye Electric Company of Cleveland.[43] "Flash" jewelry from Paris exhibited in New York in 1884 included hatpins and brooches studded with tiny, glittering electric lights mounted like jewels. One expert journal strained to discover some utilitarian function for this extravagance of electrical ingenuity:

> The practical use we see in these jewels is that, in returning home late at night, they afford a ready means of brilliant illumination, which would aid in the finding of a lost object, or one's way, and also the way to the key-hole, etc. It is said that the walking-stick, provided with a large diamond, affords sufficient light to read a newspaper by. If set with say a white gem on one side and a red one on the other, it may be used for signalling to a distance, while the switch would enable a communication to be carried on by means of the Morse alphabet.[44]

The electric pushbutton, another luxury artifact, symbolized a streamlined consumer electricity capable of delivering instant gratification. "I press the Dictionary button, and the Dictionary tells me whatever I want to know," explained a John Kendrick Bangs character in a fiction story for children.[45] Real pushbuttons were marketed more prosaically. Western Electric Company of Chicago peddled a modest dining-room pushbutton in 1890. Its claim to versatility was that it

could be attached to the edge of a table, a side panel, or a chair, to call the servants.[46]

For elites, pushbuttons often symbolized popular desires for dangerously superficial pleasures; for laymen, pushbuttons often signified a world in which decisions about technology were taken beyond the control of ordinary people. The five-penny American magazine *Yellow Kid* featured an 1897 cartoon of a gnomish, slender man with a frown on his small worried face beneath an overdeveloped, egg-shaped, bespectacled, bald cranium. Leaning on a cane to support his fragile weight, the little man impatiently pushed a button with one disproportionately swollen finger. "An average man of the drear future," read the caption beneath, "when everything is done by pressing a button."[47] The socially and professionally conservative British journal the *Electrician* admonished: "It seems to us that we are getting perilously near the ideal of the modern Utopian when life is to consist of sitting in armchairs, and pressing a button. It is not a desirable prospect; we shall have no wants, no money, no ambition, no youth, no vices, no individuality."[48]

Traditional utopias of perfectly deployed technology knew no shortages of basic necessities of food, clothing, and shelter. Neither were there excessive desires in these utopias, no cultivation of acquisition, or pursuit of novelty for its own sake. Provision for need in utopia should not make gluttons or sybarites of its citizens. In an electrical age, however, men might want what was bad for them and be able to have it. The paradise of fulfillment might lead them to greater avarice, and not to contentment and self-restraint. Electric frivolity suggested the possibility of bodily self-indulgence on a grand scale.

Perhaps this was why religious authors viewed the extension of the Gospel to barbarous savages with enthusiasm while the electric distribution of the Word to their own parishioners filled them with unease. In Tunbridge Wells, England, efforts to enlarge the flock of a Congregational church beyond the sanctuary to sixteen telephone subscribers, including physicians, druggists, clerks, "an invalid lady who has been obtaining consolation from the telephone for several months," and "some lazy club men," were viewed with deep suspicion by local churchmen. Only the invalid lady received the benefit of the doubt; the rest were suspected of harboring the "spirit of experiment" or a desire for "entertainment," or attempting to "arrange the length of the sermon *à discretion*." If the physicians could spare the time from their patients, what kept them from being present "in bodily form" in church? The critics concluded:

> Whether it is worth while to turn the telephone into a preacher for [invalids], while serving as a medium for luxurious ease and novelty, and a promoter of church absenteeism, is a question which each reader may answer for himself. . . . We may seriously question . . . if that ingenious instrument will hasten by one second the dawn of the world's Millennium Day.[49]

Beyond this peril to piety, what purpose would religion serve if the burdens of life for which it was a solace ceased to exist? The belief that the pain and struggle of existence would be rewarded only in eternal life, and that poverty was blessed, was not first challenged in the nineteenth century by electricity. But the possibility that electric technology would turn extravagant luxuries into the furnishings of daily life made its challenge to traditional religious values more insistent. Electricity raised the specter of earthly affluence as it did not seem to have been raised before.

Electrical theology sketched two broad apologetics for the prospect of unlimited prosperity. In the first, electricity was a gift of God, created for His purposes and conferring obligations on men to further those purposes by using it wisely. Lack of respect for the Deity's property, the sin of the original fire-stealer Prometheus, and the sin as well of Adam and Eve, was the cause of a number of evils in the world, among the most serious of which was loss of faith. An apocryphal story circulated about Michael Faraday, the discoverer of electromagnetic induction. It was said that Faraday had been "put away" from the small Sandemanian congregation attended by generations of his family because his scientific researches had unsettled his belief. The congregation prayed for their lost sheep's spiritual return, and their prayers were answered. One day the man honored by "all the world" returned and confessed with tears in his eyes. The Sandemanians "considered it a terrible thing for a good man to devote himself to such doubtful subjects as electricity, instead of reading the Bible and being satisfied with things as they were."[50]

To keep men mindful of God's goodness in creating electricity, the Bishop of Aix, France, consecrated a new electric light plant to God's work in 1896. He observed with regret that authors on electricity frequently overlooked its supreme Author. Electricity had its foreordained part to play in God's plan to establish His spiritual kingdom at the end of time:

> And man has appropriated this terrible fluid; he has imprisoned it in his apparatus; he has made a circle of wires around the globe; he has placed

> his wires at the bottom of the sea, which has thus been tamed to his service one time more. He has said to the lightning: "Behold the road thou shalt follow, thou shalt go where I command, and stop when I wish; thou shalt carry my thoughts to the farthest islands. I will condemn thee to the most prosaic uses; thou shalt light our streets, our houses, our shops, our churches; thou shalt serve us for rapid coursers on our roads and on the seas; and we are not yet arrived at the limits of the benefits of thy power, which has no equal in the masterpieces of creation.[51]

The Reverend L. Osler of Providence, Rhode Island, preached "in words that burn" that God had reserved the discovery of practical uses for steam and electricity to "these closing days of this world's history, when the King's business would require haste."[52]

A different religious interpretation of electricity avoided the moral dilemmas of electrical prosperity by proclaiming all electrical progress a spiritual triumph. Electrical science was treated as an extension of religious revelation. This approach did not subordinate the physical universe to its creator, but identified *all* forces in the universe, including electricity, with God Himself. By fusing scientific and religious vocabularies, electrical pantheism also skirted the conflict in which superior truth was claimed separately for faith and science by their respective devotees. A characteristic metaphor of reconciliation in this uneasy equilibrium was the statement of one amateur student of electricity that "the Deity is the omnipotent magnet."[53] In a speech to the New York Electric Club, electrical entrepreneur Erastus Wiman put forward an appealing synthesis of faith and science:

> Once there came to this world a Saviour, whose life was a strange admixture of good to the body and good to the soul. When He left this world, that which was good for the soul He left behind; and the gospel of kindliness, the spirit of doing unto others as you would be done by, and all the great and glorious influences of Christianity were inherited by poor humanity that sadly needed them. It was supposed, however, that He had gone and taken with Him the power of curing, and that no longer would the miracle be performed, no longer would the touch cure, and that the influence which on earth He used was lost to mankind forever. But it may not be so. That power we speak of tonight, that marvellous power which is so subtle, which is so mysterious, is equally miraculous. It is available for us all, is with us still, a revelation to us. We should thank God that we live in an age and in a time when, with these electrical minds that are before me now, we are daily discovering

> new uses for that power, and among them not the least the power to mitigate human suffering and prolong life.[54]

Even the Bishop of Aix's notion of electricity as God's gift struck a pantheistic chord by describing electricity as immanent in all creation: "It is everywhere, and there is no being which it does not lurk in; it is in my hand, in my gestures, in my voice, upon my tongue, in my entire system, and in this sheet of paper. It is as the invisible soul of the material world."[55] This description by a member of the clergy was not unlike that of Heinrich Hertz, one of the most respected of scientific authorities. In an 1889 address to a Heidelberg medical congress, Hertz prophesied that electricity would soon be understood as a pervasive cosmic phenomenon:

> We shall see henceforth electricity in a thousand circumstances where we did not suspect it before; each flame, each luminous atom becomes an electric phenomenon. Even when a body does not give off any light, provided only it radiates heat, it is the source of electric actions. The domain of electricity thus pervades all nature—it pervades ourselves; in fact, is not the eye an electric organ?[56]

The power of electricity was sometimes compared to the power of the sun, whose limitless capacity to sustain life was an old and potent motif. Solar energy and the wireless transmission of electric power were both utopian dreams of the late nineteenth century. Electrical entrepreneur Wiman predicted that electricity would one day be gathered directly from the sun, with no intervening devices.[57] A nearly mystical vision of wireless power as a life force equivalent to the sun came from Amos Dolbear, who believed that

> One may . . . see how life might be maintained without foods of any kind in an organism adapted to absorb energy from space about it as a piece of matter gets warm in the sunshine, for it is beyond peradventure that all space within our ken is saturated with energy, that electrical energy is present in every nook and corner of creation and that there is no point in space where an abundance is not to be had if the demands of life should depend on it.[58]

With the intensity of personal acquaintance with revealed truth, some observers were certain that electricity contained the divine power to bestow life. If other elusive powers had been harnessed by the labor of intellect, why not this Olympian craft, which seemed also to lie within the grasp of unfolding scientific knowledge? Immortality, like

the telephone, could be invented. And if electricity could not yet stave off death forever, at least it could prolong life or, as a very last resort, rescue those in a state of suspended animation who were mistaken for dead. A widely reported invention for this purpose was the electrical grave-annunciator. In 1891 William H. White of Topeka patented a device that could be attached to the hand of any doubtful corpse to signal electrically to those aboveground in the event of belated revival. In another system, the coffin was filled with compressed air, so that the slightest movement would activate an electric alarm button.[59] More elaborate arrangements were possible with the advent of wireless telegraphy. *Answers* reported in 1899 that a California millionare "is to be interred, according to his express instructions, in an open coffin; and above his head, within easy reach, is the tiny sensitised vial which, should he awake, will flash outwards and upwards from the silence and darkness of his mausoleum the news of his resurrection."[60]

In sum, efforts to ally electricity with technology for the purpose of extending technological control spurred attempts in other quarters to reconcile electricity and nature. A common solution made the human essence electrical and one with the universe, and held that electricity was the life force immanent in the whole material and immaterial world. In this case, man could not separate himself from nature to rule it, because he was of it. Another solution was to identify the power of electricity with the sun, the great life-giving force beloved alike by science and myth, or to invest electricity with the secret of life, which might yet be discovered. This last view cleverly unified scientific and religious authority, always at odds over the status of electricity. But its secularization of traditional religious themes caused as much theological unease as its metaphysical leaps brought indignant scientific disclaimers.

The Electrically Transformed Body

An important set of themes about electricity and the body pondered the body physically, medically, or culturally transformed by efforts to use electricity as a healing agent. In popular superstitions surrounding persons who seemed possessed of special electrical powers, and in discussions of electrocution and fantasies of electrical warfare, electrical ornament made the body it embellished an object of cultural focus and fascination, and a powerful medium for messages of civic, sexual, or class status.

Electrical Healing

Popular belief in the existence of a mysterious vital force at the root of life was receptive to the notion that this force was most likely magnetic or electrical, that experts would soon harness the powers of electricity to cure bodily ailments, and that particular diseases and forms of distress were traceable to electrical imbalances of one kind or another. A legitimizing step by experts was to create a mythic past and purpose for medical electricity, part of a historically continuous scientific enterprise to redeem the body. The first appearance in English of the word *electricity,* according to Park Benjamin, was in a 1650 translation of an earlier treatise on the curative effects of magnetism written by John Baptista van Helmont, a Flemish physician, chemist, and Rosicrucian.[61] Galvani's discovery a century and a half later of "animal electricity" (which he declared the basic life force after finding that electric current caused a frog's severed leg to kick as though alive) was frequently recalled as an early medical experiment.

Heroic figures were said to have performed early cures with electricity. The French revolutionary hero Marat had restored the sight of a blind man with electricity, according to one tale.[62] Somewhat less prophetically, during a severe yellow fever epidemic in Jacksonville, Florida, in 1888, a Kentucky physician suggested to the surgeon-general of the army that the "delicate and subtle" atmospheric poison of yellow fever might be dissipated by strong electric light. He recommended erecting a row of large army tents along the center of a Jacksonville street set on either side with electric lights "so intense as to repress the poison and stay the destroyer."[63] The electric light was also introduced into the body for medical purposes. "Who could ever have dreamed that the electrical current manufactured by the public lighting companies conveyed along the streets would be switched off on special wires to go into the very mouths of people," marveled the *Philadelphia Inquirer* in 1889.[64]

Reports on medical experiments with electricity were a commonplace of electrical literature. In 1889, a London physician reported that the growth of a cancerous tumor had been arrested by several months' treatment with electricity.[65] Successful treatments for diabetes, gout, rheumatism, and obesity with high-frequency currents, said to work by "augmenting organic combustion," were reported to the French Academy of Sciences in 1896.[66] St. Luke's Hospital in New York underwrote experiments to introduce electric current into the lungs in sufficient quantity and strength to kill tuberculosis bacilli.[67] From time

to time researchers discussed whether drugs could be introduced into the body on the model of wireless transmission.[68] Belief in the healing benefits of electricity for humans was extended to other forms of life. Sir William Crookes reported that efforts to increase crop production by means of electrical stimulation not only seemed to give "increased vigour to the life of higher plants, but tend to paralyze the baneful activity of parasites, animal and vegetable."[69]

With the example of expert medical interest in electricity before it, popular culture accepted electricity as the active therapeutic agent in pills, soaps, teas, potions, lotions, apparel, and jewelry of all kinds. Quack nostrums boasted miraculous electrical properties, like the snakebite remedy promoted by Patrick Cunningham of Richmond, Kentucky: "When the snake's fangs strike this liquid in the human body, an electric current is generated, which drives the poison in the reptile's body through every blood vessel in its system, causing almost instant death."[70] When researchers at Vanderbilt University announced in 1896 that X rays caused hair loss, a French entrepreneur guaranteed by this means "to remove the mustaches and whiskers with which some French women are adorned."[71]

Customers of a London wigmaker could buy a special battery apparatus that, placed in the lining of a silk hat, diffused a current "all over the wearer's head" to cure nervous headaches and neuralgia, and to alleviate baldness.[72] Less specific in its claims was a sign in a shop-window in a small English country town: "Try our electric tea—good for the nerves."[73] Electricity "improved even the bath," reported *Science Siftings* in 1896:

> A battery has been patented consisting of a source of electrical energy placed inside a cake of toilet soap. The device is reputed to be intended for curative applications of electricity to the human body. The inventor says that his invention is based on the fact that the chemical decomposition of soap is such that when dissolved in water it produces a liquid having an exciting effect upon certain metallic electrodes placed in proximity to form an electrical battery. In other words, you soap yourself and get an electric shock.[74]

A special basement room in the Capitol Building in the late 1880s was fitted out for congressmen to indulge what the *Electrical Review* described as "quite 'the fad' nowadays" of taking their electricity:

> An electric apparatus has been fixed up in the engine-room in the basement and daily the members avail themselves of the opportunity to get freshened up. A board, with a tooth-piece of copper, is placed beneath the great belt of the large engine-wheel, and the electricity thus generated is carried off by a wire attached to the board, which is long enough to be grasped by one who sits in a chair near-by. The circuit is completed by the person holding the wire grasping a small brass chain attached to the railing around the engine's wheel. The system is thus filled quietly with electricity. The members say it is splendid after they have been out to receptions and suppers all night, or after they have exhausted their brain power by speechmaking or listening. A great many members take electricity, and some go to the basement of the Capitol for it every day during the season.[75]

Virility, long associated with terms like *force* and *energy, strength* and *vigor,* which also described electrical properties, was an area ripe for electrical theorizing and therapeutic promise. A durable popular whimsy that the secret of eternal youth must be connected to electricity was transferred with special intensity to sexuality. The mysteries of both sex and electricity, deepened by ignorance of the physiology of one and the physics of the other, made these two natural allies in the hands of skillful ad men.

The "Heidelberg Electric Belt" sold by Sears, Roebuck and Company promised to make a new man of its wearer in a month. To recruit customers, Sears rented the entire available stock of half a million "nervous debility" letters held by letter brokers. These were letters responding to ads that offered remedies for various real or imaginary male ailments. Each correspondent received a fifty-seven-page electric belt catalogue.[76] The Harness Electric Belt and Suspender, the British counterpart of the Heidelberg Electric Belt, was the object of a determined campaign of exposure by *Electrical Review, Science Siftings,* and sister publications that hoped to make an example of it as a fraud. The Medical Battery Company, manufacturers of the Harness Belt, and its spokesman, Dr. Tibbets, countered with libel proceedings against the *Electrical Review* in 1892, which were ultimately unsuccessful.[77] Harness advertising was widely distributed through periodicals such as *Answers,* the flagship periodical of the Harmsworth publishing empire, a powerful channel to British mass readership. Typical of Harness advertising was the claim "It cannot fail to restore impaired vigour, and speedily renew that vital energy, the loss of which is the first symptom of decay."[78]

Electrical corsets were available for women, less to augment their sexuality than to control it. "If one of these articles is pressed by a lover's arm it at once emits a shriek like the whistle of a railway engine," one inventor promised. He claimed to have married off three

daughters "owing to the publicity" thrust by this device on their hapless suitors.[79] In keeping with Victorian conventions of feminine modesty, electrical advertising for the treatment of female troubles did not dwell exclusively on sexual maladies, but promised to cure a variety of ailments that suggested the delicate health attributed to genteel women in this era. Much of this advertising had a religious cast. One ad that appeared regularly in *Comfort,* a popular women's magazine, capitalized on the notion of wireless transmission as well. For the convenience and privacy of bedridden *Comfort* subscribers across the United States, Professor S. A. Weltmer of Nevada, Missouri, self-proclaimed "Wizard of the West," possessed the power of curing patients at a distance. Following "in the path made by Him who was born at Bethlehem," Professor Weltmer achieved his cures with the Method of Magnetic Healing, practiced "without drugs or the surgeon's knife."[80] Constipation, indigestion, poor circulation, liver, stomach, and heart trouble, eczema, female trouble, ulceration, and general debility had all been cured by Weltmerism after every other medical route had been exhausted.

Electrical phenomena were also regarded as a source of bodily distress and disequilibrium. "As civilization advances," the *British Medical Journal* reported in 1889, new kinds of diseases were produced by "novel agencies which are brought to bear on man's body and mind."[81] One of these new conditions was "aural overpressure," to which even "strong-minded and able-bodied men" were susceptible because of the "almost constant strain of the auditory apparatus" in persons who used the telephone for "a considerable portion of each working day." Sufferers from this malady, some of whose ears were also irritated by the "constantly recurring sharp tinkle" of the bell, experienced nervous excitability, buzzing in the ear, giddiness, and neuralgic pains.

In 1890 it was reported that the telephone had driven a Cincinnati citizen insane. The victim had always been "excessively nervous." The constant ringing of a telephone in his office finally drove him mad. His symptoms were peculiarly manifested. "He rushes into drug stores, rings up the central and calls for his departed sweetheart."[82] He was not alone. Mrs. Mary Winsgate of Illinois, refined, well dressed, and possessed of a low voice, had given the following testimony to the judge who committed her:

> "I must find Edison today; he's the telephone man, isn't he? He has stuck telephones all over my house and one on the gate, and they keep ringing all the time, day and night so nobody can rest or sleep. Sometimes I think it is the door-bell, and when I go to the door there is a little red-headed woman who slaps my face and runs away without saying anything. There is a black flag on my house right now. What is it there for? I pay taxes and nobody has the right to put a black flag on my house. We're all metalized—everything's metal in my house. I'm metal and so is my son, and there's a battery in the basement which has charged every one of us."[83]

A man in the Hudson County insane asylum in New York began to hear voices speaking to him. Upon hearing a real voice through the telephone, he became violently insane and smashed the instrument to pieces. Subsequently, he claimed to have a telephone in his stomach, through which someone periodically talked to him.[84] Other electrical media were accused of affecting the "nerves." Electric light was blamed for producing a special form of ophthalmia. Prince Bismarck was said to have succumbed to nervous debility from the telegraph, which condition precipitated his withdrawal from the Prussian ministry.[85]

Special Powers of the Body and the Body Inscribed

Just as the power of witchcraft was imputed to exceptional or marginal individuals in other cultures, in popular electrical culture superstitious fear and respect were accorded those whose bodies were said to be invested with special electrical powers. In 1886 the *Electrical Review* reported the story of eleven-year-old Willie Brough of Turlock, California, whose neighbors in the San Joaquin Valley believed he could set objects afire by gazing intently at them.[86] After five unexplained fires had broken out in Willie's schoolhouse one afternoon, the schoolmaster forbade his return and declared Willie a victim of supernatural agencies. Social pariahs, Willie's family moved to a remote cottage in the cottonwood timber across the valley. Investigation determined that Willie, "an extremely nervous boy . . . with a largely developed head," was actually "overcharged with electricity." Sparks appeared when he snapped his fingers, and Willie admitted seeing sparks fly around him in the darkness of his bedroom.

Such faculties were thought to result from unusual encounters with lightning, or with some other powerful electrical force. This was the explanation given for the strange powers of Henry Luegeman, a Bennetsville, Indiana, farmer struck by lightning while peeling tanbark:

> Whenever a storm is about to approach Luegeman becomes highly charged. Flies which happen to alight upon him drop to the floor dead, while such things as small particles of iron or steel cling to his fingers.

> During a recent storm he drew the blade of a case-knife between his forefinger and thumb, which so thoroughly magnetized it that heavy iron particles could easily be raised with it. When placed in a dark room thousands of tiny sparks are emitted from the man's body, and his eyes shine as brightly as if they were incandescent lights. Luegeman claims that he feels no inconvenience from his peculiar gift, but will go near no moving locomotive or heavy iron machinery in a storm for fear of being drawn against it and killed.[87]

Extraordinary encounters with electricity were magical partly for their capriciousness. Anyone might be selected by nature for a first hand experience as profound as anything trained men of science could devise and reserve to their own exclusive realm of experience. Such experiences also seemed superior to the plodding efforts of experts to capture predictable phenomena in their elaborate nets of explanation. Remarkable encounters with nature required no learned preparation, and bestowed a special mark of esteem, being born of a terror and dread no scientific investigation could approach. *Popular Science News* reported that Mrs. Charles Conover of Nanuet, New York, sitting in a piazza chair during a severe thunderstorm, had been shocked into unconsciousness for seven hours. The village doctor who examined her claimed that the shock had turned her heart upside down, in spite of which she was as well as ever.[88] A New Salem, Vermont, family, roused from slumber by a terrible crash of lightning, discovered that their cat had been electroplated with silver stripped from a Revolutionary sword hanging over the sofa where the cat had slept.[89]

Electrical miracles elevated humble people and gave them powers surpassing in popular estimation those of scientists and engineers, and experience that qualified them to dispute even received scientific authority. In 1889, H. M. Stevens of Boston advanced the opinion, much under debate because of a bill pending in New York to permit electrical executions, that electricity could not kill a man. Stevens told a *New York World* reporter that while inspecting an electric light plant, he had grabbed both the positive and negative brushes of a dynamo carrying fifteen hundred volts. Two doctors working on his "cold, stiff, and pulseless body" for three hours had been unable to revive him because he was, in his own words, "full of electricity and insulated." An attendant suggested putting him on the damp floor so that "the electricity could run out." This was done, the electricity "ran out," and "Mr. Stevens rapidly recovered and grew fat, but remained a sort of dynamo, and still is very sensitive when thunderstorms are approaching."[90]

People did, of course, die from electrical shock, and the gruesome manner of their going was presented as a bizarre and exceptional fate laced with magical and strange occurrences. Consider this account from *Popular Science Monthly* of 1873:

> Sometimes one struck by lightning is killed outright on the spot, the body remaining standing, or sitting; sometimes, on the contrary, it is thrown to a great distance. Sometimes the flash tears off and destroys the victim's dress, leaving the body untouched, and sometimes the reverse is the case. In some instances the destruction is frightful, the heart is torn apart and the bones crushed; in others the organs are observed entirely uninjured. In certain cases flaccidity of the limbs occurs, softening of the bones, collapse of the lungs, in others, contractions and rigidity are remarked. Sometimes the body of the person struck decomposes rapidly, but at times it resists decay.[91]

Camille Flammarion, a popular writer known for stories about visionary future worlds, was said to have "devoted considerable time to the study of the effects of lightning on men, animals, and other objects." Flammarion had collected a number of anecdotes about occasions on which natural electricity had acted with fantastic perversity. Such stories confirmed the mystery of nature and its presumed delight in thwarting scientific efforts to understand it, not to mention the superior virtue of those who refrained from every temptation to pierce the veil. Several of these stories, doubtless selected with an eye to their tingling entertainment value, were summarized in *Popular Science News*:

> During August of last year a young man was struck by lightning and carried a distance of 50 yards without being in the least conscious that anything unusual had happened to him until the lightning threw him against the wall of a house, where he received a slight wound in the knee. Two cows, which were 200 yards from him when the bolt fell, were killed.
>
> Three soldiers are said to have sought refuge under a lime tree during a storm, and all three were struck by lightning and killed as they stood side by side. Though dead, they maintained their erect position, but their bodies, when touched, crumbled away into dust.
>
> Two peasants were preparing to eat their breakfast, when suddenly the dishes were thrown to the ground, the bread, cheese, and fruit vanished from the table, and they were covered with straw.
>
> On another occasion a man walking through Nantes was suddenly enveloped by lightning, yet remained uninjured. When he reached home, however, and opened his purse, which had contained two pieces of sil-

> ver and one of gold, he found that the gold piece had vanished and in its place was a silver piece. The lightning had, in fact, pierced through the leather of the purse and had covered the gold piece with a coating of silver taken from the other two coins.[92]

Soldier companions, slapstick straw-covered peasants, and foot travelers bearing modest worldly treasure in leather purses were colorful stock fairy-tale characters, in spite of the illusion of truthfulness created by the provision of realistic detail: the specification of the kind of tree beneath which the soldiers perished, the name of the city where lightning had transformed gold, the exact month and year and the specific distance that lightning had lifted the fortunate young man in order to spare him. Other fairy-tale elements were disguised in the vocabulary of scientistic explanation. Fate capriciously awarded life, death, fortune, and humiliation, but in terms acceptable to scientific realism. No trickster deity had robbed the traveler of his gold; it had only been silver-plated in exceptional circumstances. Magic remained, but was set down in a scientifically bounded world.

The public's fascination with freaks whose bodies exhibited mysterious electrical powers was not lost on carnival promoters and fast-buck entrepreneurs. Testimony alleged to come from the very mouth of a certain Johnny Norton, advertised as "Bonnell's Traveling Electric Boy" during the 1880s, recalled the successful and lucrative deception he had perpetrated. For exhibitions, Johnny stood in a stall separated by a counter from customers who passed one at a time in front of him along a narrow passageway. Concealed beneath the cocoa matting they walked across, and beneath the floor of Johnny's stall, was a continuous strip of zinc. One battery pole was located beneath the matting at the point where customers stood to greet the Electric Boy, the other beneath the Electric Boy's feet. Each customer who touched the Electric Boy completed a circuit, and both Johnny and the customer received a shock.

> It was surprising what intelligent people were duped by this trick. Why, I was kept shaking hands and being fingered from morning until night. Many's the two-dollar note I received from doctors and others for a couple of drops of my blood for analysis. In fact, my arms were covered by scars made by scientific dupes boring for my electric gore. One evening three or four young students came in to unmask me. One of them made a wager that he would electrify the audience the same way if he was in the box. I immediately invited him in, and he accepted the challenge. I then retired, but before doing so I pressed a hidden button that cut off my wire. He, of course, failed, and ignominiously retreated after being guyed unmercifully by those present. This proved me genuine to the satisfaction of every one in that town, and I became famous. There was lots of fun in the business, but I had to give it up, as the constant strain caused by the battery was too much for me.[93]

Theatrical stunts in which electricity was made to spark alarmingly were common in traveling lectures from patent medicine scams to scholarly presentations. Nikola Tesla, a Croatian émigré to the United States, whose investigations of high-frequency, high-voltage currents were instrumental in the development of alternating current systems, and who dreamed all his life of achieving wireless transmission of electric power, was premier among these traveling lecturers. Tesla was well known for a visually spectacular trick of passing hundreds of thousands of volts through his body "while flames flashed from his limbs and fingertips" by means of a special induction coil named for him.

"The mere description of Tesla's actual experiments reads like an impossible fairy tale," declared the *New York Sun* in admiration. "Those who have felt the 'shock' from a small battery of a single cell will be astonished to learn that Tesla passes through his body a current 200,000 times as 'strong,' and yet lives to repeat the experiment."[94] "Who could fail to be carried away by the ingenious enthusiasm of the lecturer, or remain unimpressed in the face of the weird waving of glowing tubes in the suitably darkened room, and the mysterious voice issuing from the midst of an electrostatic field?" wrote the sober *Electrician*.[95] Tesla had received the recognition of the scientific community for inventing the rotary-field generator, which he exhibited before the American Institute of Electrical Engineers in 1888. Despite this and other reputable scientific work, he was frequently criticized for making science sensate rather than cerebral. He was often extravagant in predicting fabulous inventions that he never delivered. Even the popular press treated him by turns as a visionary and a fraud.

Enhancement of the human body was a typical spectacular function of electric light. Tesla used it to glamorize science at a level of corporeality impressive to the most untrained lay mind. Women's bodies were also decorated with electric light, logically extending their conventional cultural adornment and no less frequently their cultural objectification. In 1884 the Electric Girl Lighting Company offered to supply "illuminated girls" for indoor occasions. Young women hired to perform as hostesses and serving girls while decked with filament

lamps were advertised to prospective customers as "girls of fifty-candle power each in quantities to suit householders."[96] The women were fed and clothed by the company, and customers were "permitted to select at the company's warehouse whatever style of girl may please their fancy." "Electric girls" embodied both personal servant, potent status symbol of a passing age, and electric light as ornamental object, a dazzling display of opulence that signified status in a new one. Divorced from the body, impersonal electricity would in time banish personal servants and make electric lighting essential and functional for all classes, instead of a badge of conspicuous consumption for one. In Kansas City, employees of the Missouri and Kansas Telephone Company organized a public entertainment in 1885 in Merchants' Exchange Hall that was graced by "an electric girl, placed on exhibition" along with a model switchboard and telephone exchange.[97] And William J. Hammer, Edison's talented electrical effects designer, dressed his small daughter May as the "Goddess of Electricity, with tiny Edison lamps in her hair," earrings, breastpin, and a wand tipped with a star containing a tiny lamp, at a lavish New Year's Eve party at his Newark home.[98]

Some entertainers adapted the electric spectacle to adorn their bodies in performance. Before an astonished audience in Sheldon, Iowa, in 1891, Miss Ethyl J. Davis of the Ladies Band Concert and Broom Brigade rendered a tableau of the Statue of Liberty, reported in detail by the local newspaper:

> Miss Davis stood on an elevated pedestal, her upraised right hand grasping a torch, capped with a cluster of lamps, which alone would have been sufficient to illuminate the entire room. A crown with a cluster of lamps, and covered with jewels, and her robes completely covered with incandescent lamps of various sizes and colors completed the costume. The lights in the hall were turned down and almost total darkness prevailed. As the contact was made bringing the electric lamps into circuit, the entire hall was illuminated with a flood of light which almost blinded the spectators, and Miss Davis, standing revealed in the glaring light, certainly presented a picture of unparalleled brilliance and beauty.[99]

"The Greatest Event in the history of Brookings, South Dakota," was the decription given by local newspapers to a Merchants' Carnival held in 1890 at the Brookings opera house, where various industrial enterprises were represented by appropriately costumed ladies. One of these was Mrs. E. E. Gaylord, wife of the manager and electrician of the Brookings Electric Light Company. To represent that up-and-coming branch of commerce, Mrs. Gaylord wore

> a crown of incandescent lamps and her dress was decorated with the same ornaments. The lamps were all properly connected, the wires terminating in the heels of the shoes. On the floor of the stage were two small copper plates connected to a small dynamo. When Mrs. Gaylord reached the plates the 21 lamps of her crown, banner and costume instantly flashed up and she stood clad in "nature's resplendent robes without whose vesting beauty all were wrapt in unessential gloom."[100]

Decorating the human body with electric light was something more than an arresting item in the catalogue of novel electrical applications, precisely because the universality of the physical body offered a secure reference point for cultural experiments with new and strange technologies. The body was a known medium upon which to inscribe religious, civic, scientific, class, or sexual messages with the new instruments of electricity; conversely, electricity glamorized the body, whose very familiarity robbed it of some of its impact as a message medium. The electric light as bodily embellishment, a human-scale variation on the electric light as public spectacle, was a communications phenomenon of the first order. It appeared even in jewelry. Luxury "flash" jewelry from Paris was described in 1888:

> Electric jewelry usually takes the form of pins, which are made in various designs. One such trifle copies a daisy, and has an electric spark flashing from the center, another is a model of a lantern in emerald glass, while a death's head in gold, with a ray gleaming from each eye, is a third. The wearing of electric jewelry necessitates the carrying about of an accumulator [battery] which represents a spirit flash, and is generally stowed in a waistcoat pocket. Brooches are made occasionally for ladies' wear, but as women have no available pockets, a difficulty arises with regard to the battery.[101]

Most such ostentation was the preserve of the wealthy rather than the poor, the avant-garde rather than the outcast. In Paris, "the reigning queen of fashion . . . the young Marquise de Belbeuf, a charming creature with a decided taste for the bizarre and eccentric in dress," wore a device that made her the center of attention on social occasions: "It is her fancy to enter a ball-room crowned with a wreath of autumn blossoms, not too bright in colors, and with a bouquet of similar flowers in her corsage. Presently she touches a secret spring and both wreath and bouquet are brilliant with electric light."[102]

If electricity for bodily embellishment was considered a fashion statement in Europe, the same impulse was regarded with condescending amusement when indulged by less admired cultures. Accounts of

the fascination of nomadic Persian tribes with the wire that extended British telegraphy from England to India by way of Persia were offered to Anglo-American audiences to illustrate the futility of furnishing European technology to uncivilized peoples. Europeans saw only that native societies did not share their appreciation of the physical connection of the telegraph to European civilization, or grasp the notions of property and rationality that Europeans projected on electricity. Nor did they reflect on how their interpretations of encounters with indigenous groups always justified the imposition of colonial power on subject peoples who were deemed base, petty, and deserving of domination, or that the single most important lesson subject peoples were expected to learn from electricity was that European culture was superior to their own.

One account in this genre came from the pen of Thomas Stevens, a British telegraph operator stationed in Persia, where the nomads were fond of "embellishing their charms of person" with thick bracelets of telegraph wire. Copper and silver greatly appealed to them, but as unsophisticated primitives, they had no objection to bracelets of baser metal, especially if, in accord with Stevens's view of primitive psychology, these could be obtained "without pay." Nomads in the know "went strutting about the country wearing a wealth of telegraph wire bracelets that made the eyes of their less lucky tribes bulge with astonishment." Since obtaining the bracelets required only "climbing up the Ingliz poles and hacking off the wire," the new fad spread quickly among the Elianites, Susmanis, and Bactiaris. This unlimited boon to the nomadic economy was carried into increasingly remote regions, until the British finally appealed to the shah to protect the line. " 'Very good,' said the king of kings, blandly, 'it shall be stopped.' Orders were sent out to cut off the hands of people who were found wearing telegraph wire bracelets. This had the desired effect, and to-day the telegraph wires are as safe in Persia as in any country."[103]

Vanity, greed, and a narcissistic preoccupation with the circumscribed world of the savage body seemed to Britons to have supplanted the opportunity that they, as bearers of advanced civilization, had offered benighted peoples to lift their horizons to a level of British enlightenment made universal. If Britons regarded the despotism the shah exercised over the bodies of his subjects as barbaric, they also tolerated it with an amused nod to *noblesse oblige* which required at least a show of respect for the principle of authority, no matter how brutally administered, so long as European goals were accomplished.

Machine versus Man

Still another set of comparisons between electricity and the body counterposed them to each other by asking whether men were fundamentally different from electrical machines after all. Arguments on this score were ultimately concerns about the status of the souls and bodies of men in a mechanical world, and fantasies of a contest for supremacy between automation and evolution. Perhaps evolution and automation were separate but competitive races moving in the same direction; alternatively, perhaps men would be evolutionarily transformed in the process of adapting to an automated environment. That men might become different creatures because of changes in their lives made by machines was in some sense the concern to which every discussion of the future of electrical technology was addressed. Nineteenth-century observers were especially interested in how men might change their biological constitutions or their ways of waging war in response to machine imperatives, and both experts and laymen wondered how man measured up to electricity conceived as a supernatural or supercultural form. Perhaps electrical machines were cultural artifacts superior to man himself. Perhaps they were debased cultural forms. Or perhaps they were a highly advanced form of nature, destined to drive man from his fragile position in the cosmos, rather than to help him establish its security.

Automation and Evolution

The man-machine link found expression in metaphors and clichés that likened electric circuitry to human social organization, and in analogies between electricity and the circulatory and nervous systems. In a paper before the British Association in Ipswich in 1895, A. R. Bennett compared commerce to the lifeblood of a nation. It was as if, he explained, roads, railways, and waterways were "the arteries through which this blood is conducted, while telegraphs and telephones may be compared to the nerves which feel out and determine the course of that circulation, which is a condition of national prosperity."[104]

Comparisons between men and machines were drawn in both directions. Men were depicted as not quite perfect machines, and machines were endowed with nearly human features. In a souvenir issue of *Western Electrician* marking the arrival of the twentieth century,

inventor Forée Bain described the human body as a machine whose efficiency would be dramatically improved by electricity:

> The old machine has a very low efficiency. The digestive organs and the organs of assimilation, which are the boiler plant, have an efficiency much lower than a steam boiler plant. The fact is that the old machine consumes too much vital energy in preparing the fuel (food) for assimilation. Nearly all of this work can be done by artificial means, and as this is a chemical process and as electricity promotes and hastens chemical activity, no doubt this agency will be utilized as an assistant to the natural forces of the body.[105]

The precision of human physiology, on the other hand, inspired fantasies of machines that closely resembled men and might be much like them. Visions of a world in which machines would replace men had existed long before the introduction of electricity. But now automata powered by electricity were built, as well as imagined. Many of them provoked a fascination like that aroused by human beings whose bodies were believed to possess special electrical powers. Nine years before he transmitted the world's first radio broadcast of speech and music, Reginald Fessenden described in the *Journal of the Franklin Institute* the construction of a doll with a simple short-term "memory" based on the principle of elastic hysteresis in metals.[106] When the doll's spring-controlled hand encountered an open flame, it would "remember" the flame for short intervals and withdraw the hand from subsequent presentations.

The electrical centerpiece of William J. Hammer's New Year's Eve party of 1885 was an electric automaton named Jupiter. To the strains of Professor Mephistopheles' Electric Orchestra, Jupiter presided over a supper of gourmet electrical dishes. Promptly at midnight,

> the thunderbolt pudding exploded, the sheol pudding blazed forth red and green fire, illuminating the room; the telegraph cake clicked messages, bells rang inside the pastry, incandescent lamps burned under the lemonade, while the coffee and toast made by electricity was rapidly "absorbed." The magnetic cake disappeared, the wizard pie vanished, Jupiter raised a glass labeled "Jupiter Lightning" to his lips and began to imbibe.
>
> The effect was astonishing. His eyes turned green, his nose assumed the color of a genuine toper, the electric diamonds in his shirt bosom blazed forth in all their glory and he shouted phonographically, "Happy New Year! Happy New Year!"[107]

A more attractive automaton was promised for the World's Fair. This would be a facsimile of Madame Patti, the famous opera diva,

and would "embody her smiles, gestures and movements of the eyes." More wonderful still, a concealed phonograph loaded with cylinders would reproduce the prima donna's voice.[108] George Moulton of Bridgeport, Connecticut, was said to have invented a walking mechanical boy that "distorts its features to such an extent as to frighten the average woman, and makes as much noise as a railroad train."[109] The boy had a "colossal" head in proportion to his four-feet-eight-inch stature. Arrayed in Scotch tweed, he grasped a two-wheeled cart for transporting passengers. One arm was fitted with a start-stop switch, and the other with a steering rudder. Moulton claimed that his boy could push a man fifty-seven miles to New York in eleven hours. The first public exhibition of the boy was dramatically staged. Before a fascinated audience, two locomotive headlights were focused on a black curtain. The signal was given:

> At once a whirring noise issued from behind the black curtain. It was followed by the clanking of chains, the buzzing of machinery, and a din of banging and thumping that was deafening. The curtain parted and the mechanical boy walked in, pushing a cart. The head upon the figure was turning from one side to the other, and the facial contortions were ludicrous. The tin eyelids gave the eyes a singular appearance that startled some of the spectators. The boy began a circuit of the hall, lifting his feet and marching with a 19-inch tread.[110]

In the middle of the performance, a coil of wire sprang out from between the boy's legs and wrapped around one of them. Though his progress was halted, his head continued to turn and grimace alarmingly.

We are already familiar with the purpose of such performances. They represented still another effort by experts and showmen joined in various marriages of convenience to capitalize on the entertainment value of magic and the respect accorded it by the uninitiated. By using a magical framework of astonishing effects to present the latest scientific and technological achievements, experts hoped to win over their audiences and persuade them that experts made the best magic of all.

Electricity and Death

The sobering prospect that machines masquerading as obedient servants might absorb or conquer the creative striving that made human achievement possible and remarkable took a variety of forms. One was the fear of a level of prosperity at which the social division of labor might cease to impose clear class markers upon which an ideology of deserved individual fate, so important an organizer of social order,

could be based. A more dreadful prospect was the ultimate dystopian possibility. In discussions of the newfangled war and weaponry that electricity was assumed to be on the point of introducing, there were occasional predictions that the entire race would meet destruction in an electric bloodbath that would turn back on its human perpetrators. "The historian who writes of the future war will turn the pages of Greek legends and smile sadly at Jove's smiting the lightning," prophesied an article titled "Visions of 1950" in *Technical World* magazine in 1911. Along the lines of the theme that electrical experts were inheritors of a glorious tradition, the article continued:

> The old War God hurling his thunderbolts will seem impotent beside man wielding the forces of nature for weapons. Magazines exploded without warning by darting, invisible, all-penetrating currents of electricity; devastating waves of electricity, or of some more powerful force, flashing over hundreds of miles consuming all that comes within their scourging blast. Guns, explosives, and projectiles will sink into the past, even as have the bow and arrow, giving place to howling elements clashing under man's direction.[111]

That all human life might be laid waste by mindless robotic instruments of destruction was at the other end of the imaginative scale from the optimistic hope that electricity would offer eternal secular life. Prophets of electric apocalypse differed as to whether this fate was a tragic consequence of the inevitable intraspecies struggle that was the flaw of the human condition, or whether in the last days men would find themselves victims of the machine as the unfathomable, hostile Other. Speculation about the role of electric power in future warfare appeared in a variety of forms, from popular fiction to official military reports. The bulk of military opinion reported in electrical journals was well represented in an 1890 memorandum from Lieutenant Bradley W. Fiske to American military authorities proposing that civilian support corps undertake all electrical work required for military operations. The next war, "when it does come," editorialized the London *Electrical Review* in behalf of Fiske's recommendations, "will be one in which science, and especially science, will play a most important part."[112]

Actual as opposed to fantasy developments in electrical warfare were mostly in the realm of communications rather than destructive weaponry. Searchlights and internal telephone and telegraph communications systems constituted most military applications of electricity in the late nineteenth century. These offered interested observers a taste

of more extravagant possibilities. In 1884 the American navy fitted out the frigate *Trenton* with its own incandescent electric light plant and arc searchlight for sweeping the surface and depths of the ocean for enemy ships and torpedoes. By 1890 electricity was considered a strategic military element:

> The faithful servant of man now not only guards the vessel from the inventions of the enemy, but aims and fires the guns, illuminates the sights that the aim may be sure, discharges torpedoes, measures her speed, is the most successful motor for submarine boats, and renders possible a system of visible telegraphy by which communications may be flashed against the clouds and understood at a distance of sixty miles.[113]

Military systems of telephone and telegraph communication were updated with new wireless technology. In 1898 all the forts in New York harbor were equipped with dynamos for searchlights, one of which was the sixty-inch searchlight used atop the Manufacturer's Building at the Chicago World's Fair. Other Atlantic coast forts, including Philadelphia, Boston, and Savannah, also undertook plans for electric defense.[114] In 1905 *Telephony* reported that the U.S. government planned to buy thirteen hundred telephone sets for military use in the coming fiscal year, five hundred to be used in the field and the remainder in coastal defense forts.[115]

A favorite imaginative sport of popular magazine writers and readers was to spin out hypothetical military scenarios in which some electrically ingenious device secured a strategic battlefield advantage. A writer for the *New York Evening World* described armies furnished with high-potential dynamos and engines capable of delivering a volley of electric shocks "of infinite variety" to approaching enemies.[116] Inspired by this idea, a reader suggested:

> Would not a shell containing bottled electricity be a terrible weapon of war? Say an iron shell, steel pointed or all steel, lined with lead and containing electricity as a storage battery does, the shell to be so made that the impact will set free the electricity. Would not a shell carry enough to do great harm to an ironclad?[117]

The *pièce de résistance* of conjecture about military applications of electrical technology was the fantasy of anonymous combat with remote-controlled automatic weapons, the ultimate in warfare at bodily remove. Even before Marconi's demonstration of wireless telegraphy in late 1896, the work of scientists like William Crookes and Oliver Lodge in detecting electrical oscillations at a distance had attracted

popular interest and inspired a host of prophecies about wireless rays of destruction. One of these appeared in *Lightning* in 1896, announcing a new invention that would work "revolutionary effects on the art of modern warfare," and featuring the useful imprecision of detail that offered the most fertile ground for imaginative development:

> The precise details of the invention are for the present unpublished, but this much may be said. . . . By means of a readily portable apparatus, mechanical energy developed by powerful steam engines . . . is converted into wave energy in the luminiferous ether that pervades all space. This in turn by ingenious arrangements can be propelled in a continuous stream in any given direction, and caused to concentrate, or focus, at any desired point even many miles distant. There the energy is liberated with an enormous evolution of heat and a volcanic disruptive force that immediately annihilates every person and everything within an area that can be enlarged to any desired extent by a slight motion of the directing mechanism.
>
> So far as is at present understood, nothing can arrest this terrible though impalpable beam of destruction.[118]

Marconi's success several months later added shape and detail to contemporary visions of an ultimate weapon. Items that embroidered narratives of destruction on otherwise recognizable accounts of the new Marconi method of wireless signaling were widely published:

> [Marconi] claims to have discovered the means of blowing up the most powerful ironclad or torpedo at a distance of some twenty miles without the help of explosives of any description, his only stipulation being that the object of attack has a powder-magazine, and is heavily coated with metal—the thicker the better.
>
> His plan is this: He sets two spear-shaped wires on some high elevation, such as a turret or masthead. These are connected with a powerful dynamo fixed on the ground. So soon as the ironclad is sighted the points of the wire are focussed towards it, and the dynamo is set in motion. The electric waves discharged from the wires sweep through the air until attracted by the ironclad, which acts as an electric accumulator. After a few minutes, varying in length with the strength of the dynamo, the charge on the ship is so great that sparks begin to fly from all quarters, and particularly inside the powder-magazine, with its iron walls. The result need not be told.[119]

Not even wireless telegraphy was the culminating technology for mantic visions of destruction, however, since the emotional power of such phantoms attracted whatever the frontier technical advance of the moment seemed to be. When the Swedish inventor Axel Orling was

credited with devising a shore-controlled electric torpedo powered by light waves in 1899, many popular periodicals reported that torpedoes steered by electromagnetic waves had already been secretly invented by Edison, Marconi, or Tesla.[120] An 1892 issue of *Answers* featured an item from an imaginary news report of 1992, impressed on phonograph cylinders and "read out" to the public: "As a result of the awful slaughter by artificial lightning sustained by both France and Germany in the recent, and what will probably prove England's last war, a Congress of nations will meet in Berlin to-morrow to arrange for a settlement of any future dispute by national arbitration."[121]

The terrible prospect of weapons invulnerable to pain and targeting victims without compassion inspired heartfelt doubt that rational men would allow their use. Against weapons that answered only to mechanical impulse and not to human fear or courage, men would be helpless. Since no victory could compensate for total destruction, war must cease forever. The age of peace was a historical necessity. By extension, some imagined it to be a historical inevitability. Invoking the serviceable pushbutton, R. F. Gatling, father of the Gatling gun, expressed his faith in horror as a deterrent at an inventors' convention in Washington, D. C., in 1891: "If someone could invent a powerful electrical machine that would kill whole armies by the mere turning of a switch . . . there would not be a monarch in the world who would go to war. He could not force soldiers to enlist if every man was certain of meeting death."[122]

Utopian authors painted world after world in which men had achieved this insight. *Answers* portrayed a millennial London, its traditional habits of communication, travel, and association transformed by electricity, where war was banned because of the simple knowledge, related by the Genius playing host to a nineteenth-century time traveler, that the power possessed by his society would depopulate whole provinces in a day if channeled into death and destruction.[123]

Edward Bulwer-Lytton's *The Coming Race,* published in 1871, described a future organized around a mysterious natural force called Vril, which closely resembled electricity in its physical properties. Its social achievements were the hopes Bulwer-Lytton's contemporaries attached to electricity. Vril was versatile and powerful:

> It can destroy like the flash of lightning; yet, differently applied, it can replenish or invigorate life, heal, and preserve, and on it they chiefly rely for the cure of disease, or rather for enabling the physical organism to re-establish the due equilibrium of its natural powers.[124]

The destructive powers of Vril defined the limits of social coercion. As an instrument of war Vril rendered pointless all superiority in numbers, military discipline, and technical skill:

> The fire lodged in the hollow of a rod directed by the hand of a child could shatter the strongest fortress, or cleave its burning away from the van to the rear of an embattled host. If army met army, and both had command of this agency, it could be but to the annihilation of each. The age of war was therefore gone.[125]

In sum, the image that appeared in many crystal balls trained on the future of war was a vision of dramatic technological change. But the collective response to this vision was startlingly passive. The unacceptable prospect of electric war would simply compel men to lose all appetite for it. Men aware of the consequences of pressing the electric button would choose peace.

Nikola Tesla gave this construction an unusual twist in a June 1900 *Century* magazine article, in which he argued that earlier advances in weaponry had not frightened men out of their bellicosity because no serious effort had been made to detach human passion from warfare. Tesla proposed to accomplish this by using electric technology to reduce the number of individual soldiers. For wars between man and man, he would substitute contests between machine and machine. If the work of war could be automated, war could be dehumanized—a result its twentieth-century inheritors can appreciate the full irony of. The mechanization of battle and the elimination of bloodshed would make "interested, ambitious spectators" of nations, a condition in which peace could be sustained.[126] To be a satisfactory and convincing surrogate for the grand exercise of human passion, a robot of war would have to perform its work "as though it had intelligence, experience, reason, judgment, a mind!"[127]

Like many of his contemporaries, Tesla believed that technology would act on fundamental habits of thought and practice, that it would transform deeply held social attitudes and inaugurate a new stage of human history. Despite the variety of their predictions about the direction of this change, Tesla and other observers had hit upon two central features of the social format of twentieth-century electric media: the remote connection between actual events and the audience observing them and an elaborate culture of vicarious experience.

Fiction writers were fascinated by the theme of remote warfare. In a Christmas story by John Kendrick Bangs, war was a profitable spectator sport at Madison Square Garden. A story in the British *Daily*

Mail portrayed twentieth-century war between Britain and Germany as a game in which organized verbal assault had replaced the usual physical confrontation. The humorous *casus belli* was the slogan "Made in Brighton," which Germany had stamped on its own cups, plates, mugs, and other souvenir goods. Battle artillery consisted of brazen trumpets. To the small end of each was attached a wire connected to a phonographic magazine. When its handle was turned, "voice force" was hurled through the air in the appropriate direction. As the belligerent armies met on the field, "Down with the German sausage-eaters!", "The British Bulldog Mangles the Eagle!", and other cries of abuse filled the air. The German gunners were considered the fiercest soldiers, "the guttural German voices and the uncouth German words being so eminently suitable to this form of attack."[128] Equipped with "the very latest" in speaking trumpets, the English infantry had a technological advantage and managed to win the war. Each force poured in "volley after volley of abuse, satire, epigram, and apt quotation, and here the superiority of the English made itself apparent."

Closer to home, concerns about using electricity for base purposes fueled a controversy in the late 1880s about whether electricity should be the agent of society's severest penalty against individuals. The focus of the debate was a bill introduced in the New York State legislature to execute Albert Kemmler, a convicted murderer, by electricity. After a sensational deathwatch in the press, the world's first electrocution ended Kemmler's life at Auburn prison on August 6, 1890. Press accounts dwelled on the grislier details provided by eyewitnesses, including the stench of the badly burned corpse where contact between Kemmler's body and the electrodes had been imperfectly made, and the convulsions and horrible sounds that were said to have issued from the dying man, who required two separate charges of electric current to be dispatched.[129]

Expert journals reprinted a broad range of expert and popular opinion, from expressions of outrage and revulsion to warm assurances that electrocution was efficient and humane in expert hands. The *Medical Record* questioned the notion that "to harness the lightning and bore it through a human body is thought to be one of the advances of the nineteenth century."[130] "The age of burning at the stake is past," editorialized the *New York Press*, "the age of burning at the wire will pass also."[131] A related objection held that electrocution was an ignominious and degraded application of electrical science.[132] Electricity was "too beautiful to be subjugated to such work as that," declared the editor of the French engineering periodical *Électricité*.[133] In re-

marks to the Electric Club, C. F. Brackett, a Princeton professor, deplored the "degrading of an agent which has done so much and is accomplishing more for the advancement of civilization than almost any other discovery in the history of the world."[134]

Many engineers and electrical entrepreneurs feared that any public association between electricity and death would endanger the industry's future. To use electricity to end life, Dr. Otto Moses of Lowell, Massachusetts, explained to a *New York World* reporter, "will certainly impair its value greatly for domestic purposes. If we make it an instrument of death, women and others will oppose its introduction into the household."[135] Precisely that result had been the object of a publicity campaign by Thomas Edison and his associates to discredit the alternating current distribution system of their rival, George Westinghouse. Much of the testimony that alternating current was an efficient means of killing people, and therefore the best possible instrument for electrocution, was orchestrated from the Edison camp, to the vast chagrin of George Westinghouse.[136]

Other experts were convinced of the comparative humanity of electrical execution, though they believed that simple bungling had made Kemmler's death unnecessarily protracted. With that bizarre mixture of attention to public awe of scientific magic, especially its most dreadful manifestations, and concern for craft precision, the editors of *Scientific American* had proposed the use of electricity for capital punishment as early as 1876, citing the deterrent effect of the superstitious folk regard for "death by lightning." The instrument they suggested was a powerful Ruhmkorff coil and a battery sturdy enough to last from execution to execution, all equipment to be operated by a "competent electrician" to avoid error.[137] Dr. Louis Balch, an electrical expert, favored the appointment of a certified professional to attend all executions and have charge of all electrical apparatus. "Had it been entirely in charge of scientific men," he declared, the Kemmler execution would have been smooth and flawless.[138]

Perhaps the most general question any epistemology addresses is the nature of the relationship between man and the world, what kind of world it is in which man finds himself, what counts as eternal verity and what is variable contingency in that world, and what level of control is possible in it. These were issues that gave conceptual anchor to discussions of electricity in both technical and popular literature, although different modes of inquiry cast electricity as either an extension

of the natural world or its technological master. Attitudes about nature and the body provided scientists and laymen with distinct but flexible epistemologies for classifying and interpreting electrical phenomena.

The enormous range of discussion about electricity, nature, and the body attempted to locate electricity, a force of unknown dimensions, by means of the most familiar of all human landmarks, the human body. At issue was the relationship of electricity and technology to a larger natural and moral order, and the status of the human body as a probe and a point of reference for making strange electrical phenomena familiar. Specific cases addressed in popular and expert literature included intelligent electrical automata and electrical "freaks," or persons believed to possess special powers by virtue of unusual encounters with electricity; mythic encounters between embodied natural forces and the genie of human inventiveness; the moral propriety of electrocution; electricity as a healer or as a transmitter of bodily maladies; perhaps the destroyer of mankind or, alternatively, the key to life itself. Much of this debate was a competition between knowledge derived from oral-gestural modes, in which nature was treated as an ally with whom mankind was in direct dialogue, and knowledge based on formal, print-based theories that regarded nature as an object of conquest.

89. "Burglary on Party Line," *Telephony* (Chicago), Jan. 1906, pp. 54–55.
90. *Electrical Review*, Apr. 2, 1892, p. 77.
91. Ibid., Feb. 27, 1892, p. 1.
92. Ibid., Apr. 2, 1892, p. 81.
93. "Secret Photography to Crack Crimes," ibid., Sept. 22, 1888, p. 3.
94. "The New Phonograph," *Scientific American*, Dec. 31, 1887, p. 422.
95. "Telegraphing from the Grave. And Some Other Startling Possibilities," *Answers* (London), May 27, 1899, p. 48.
96. *Telegraphic Journal* (London), May 15, 1878, p. 208.
97. *Electrical Review*, Aug. 25, 1888, p. 7.
98. Ibid., Feb. 27, 1892, p. 5.
99. Speech by C. J. H. Woodbury, "The Barbarians of the Outside World," New York Electric Club, Apr. 21, 1887, reprinted in "The Electric Club's Annual," *Electrical Review*, Apr. 30, 1887, p. 2.
100. "Experimental Messages Which Flashed Through Albany," *Electrical Review*, Feb. 11, 1888, p. 1.
101. *Electrical Review* (London), June 15, 1889, p. 6.
102. In *Democracy and Liberty*, quoted in *Electrician* (London), June 5, 1896, p. 166.
103. "Prince Bismarck's Lament," *Electrical World*, Jan. 3, 1885, p. 1.
104. Ibid.
105. "The New Orleans Exposition," *Electrical World*, Feb. 20, 1884, p. 257.
106. "Views, News and Interviews," *Electrical Review*, Aug. 27, 1891, p. 1.
107. "Telephones for the London Police," *Electrical Review*, July 7, 1888, p. 4. Quoted from the *Electrician*.
108. *Telegraphic Journal* (London), Dec. 1, 1879, p. 386.
109. "Electricity as Executioner," *Telegraphic Journal* (London), Jan. 15, 1876, p. 32. Quoted from *Scientific American*.
110. "1993. Glimpses of 100 Years Ahead," *Answers* (London), Feb. 4, 1893, p. 190.
111. *Lightning* (London), Jan. 5, 1893, p. 1.
112. *Electrical World*, July 19, 1884, p. 19.
113. *Lightning* (London), June 27, 1895, p. 447. Quoted from the *Daily Chronicle*, Mar. 2, 1895.
114. "The Telephone," *Electrical Review*, Sept. 15, 1888, p. 15.
115. *Electrical World*, Sept. 26, 1885, p. 127. Quoted from the *New York World*.
116. *Electrician* (London), Dec. 27, 1889, p. 185.
117. *Proceedings of the Third Meeting of the National Telephone Exchange Association* (New York: American Bell Telephone Company, 1881), p. 82. I am indebted to Milton Mueller for this example.
118. Ibid.

119. "'Not Quite So Free, Please,'" *Electrical World*, Jan. 3, 1885, p. 8. Quoted from the *Scotsman*, Dec. 9, 1884.
120. "Telephone Cranks."
121. *Electrical Review*, June 16, 1888, p. 7.
122. *Electrical World*, Apr. 11, 1885, p. 141.
123. *Electrical Review*, Nov. 2, 1889, p. 1.
124. *Electrical World*, July 4, 1885, p. 1.
125. "Telephone War in Washington," *Western Electrician* (Chicago), Feb. 19, 1898, p. 109.
126. See also "Removal of Police Telephones in Chicago," *Western Electrician* (Chicago), Feb. 1, 1890, p. 53, which reports that the Chicago Telephone Company removed fifteen telephones from various city departments a year after installing them because there was no appropriation to pay the bills that had come due. Further: "It appears that these instruments . . . were not used for official business exclusively, in fact, this formed a very small portion of the service. . . . The instruments that were removed were used chiefly by the newspaper reporters and persons in the vicinity of the police stations."
127. *Electrical Review*, Mar. 7, 1891, p. 43.
128. "The Drug Store System," ibid., Oct. 20, 1888, p. 7. Quoted from the *Evening Journal*.
129. "A New Telephone Idea," *Popular Science Monthly*, May 1897, p. 156. This article reports that in 1897 "Washington druggists" paid $100 to $125 for the telephone. Those who paid a special rate of $140 were permitted to offer free use of the telephone to their patrons.
130. *Western Electrician* (Chicago), July 29, 1899, p. 76.
131. *Electrical Review*, July 20, 1889, p. 4.
132. *Western Electrician* (Chicago), Jan. 20, 1900, p. 42.
133. *Electrical World*, Jan. 24, 1885, p. 38.

3 Locating the Body in Electrical Space and Time

1. "Popular Science," *Electrician* (London), May 29, 1891, p. 102.
2. "Telegraphy Puzzled Him," *Electrical Review*, Mar. 23, 1889, p. 7.
3. "What is Electricity?", *Telephony* (Chicago), Sept. 1905, p. 221. Quoted from *Popular Science Monthly*.
4. Classic statements of this presumed division are found in, among others, Jack Goody, *The Domestication of the Savage Mind* (Cambridge: Cambridge University Press, 1977). For a critique of this dichotomy, see Carolyn Marvin, "Constructed and Reconstructed Discourse: Inscription and Talk in the History of Literacy," *Communications Research* 11 (Oct. 1984): 563–94, and Harvey Graff, "Reflections on the History of Literacy," *Humanities in Society*, Fall 1981, pp. 391–92.

5. Quoted in Park Benjamin, "The Possibilities of Electricity," *Forum*, Dec. 1889, pp. 391–92.

6. William Crookes, "Some Possibilities of Electricity," *Fortnightly Review* (London), Feb. 1892, p. 173.

7. Ibid., p. 176.

8. Ibid., pp. 180–81.

9. Henry Morton, "The Dangers of Electricity," speech to the twelfth convention of the Electric Light Association, held Aug. 19–21, 1890, reported in *Western Electrician* (Chicago), Aug. 30, 1890, p. 105.

10. "Stories of the Telephone," *Western Electrician* (Chicago), June 10, 1899, p. 330. Quoted from the *New York Tribune*.

11. "Lion Taming by Electricity," *Electrical World*, Sept. 27, 1884, p. 108. Quoted from the *Pall Mall Gazette*.

12. "Electricity for a Balky Horse," *Popular Science News* (Boston), Sept. 1897, p. 207.

13. "Electricity in the Jungle," *Western Electrician* (Chicago), July 9, 1892, p. 18. Quoted from the *North American Review*.

14. "The Spider and Its Telephone Wires," *Electrical World*, June 26, 1886, p. 296.

15. "The Electric Light," *Electrical World*, Oct. 18, 1884, p. 151.

16. "The Electric Light as an Insect Destroyer," *Electrical World*, June 6, 1885, p. 229.

17. These are found in James F. Hobart, "Some Electrical Sport—III," *American Electrician*, Nov. 1897, p. 452; "Some Electrical Sport—IV," Dec. 1897, p. 489; and Andrew J. Rodgers, Letters to the Editor, "More Electrical Sport," Mar. 1898, p. 127.

18. "Electric Lights for a Bull Fight," *Electrical Review*, May 7, 1887, p. 8.

19. *Electrical Review*, July 10, 1886, p. 9.

20. Ibid., Apr. 23, 1887, p. 9.

21. Reported in "Miscellaneous," *Western Electrician* (Chicago), Aug. 29, 1896, n.p.

22. *Telegraphic Journal* (London), Sept. 1, 1877, p. 208.

23. *Popular Science News* (Boston), Sept. 1897, p. 207.

24. *Electrical Review*, Nov. 12, 1892, p. 142.

25. *Western Electrician* (Chicago), July 19, 1890, p. 39.

26. *Electrical Review*, Aug. 18, 1888, p. 4. Quoted from the *Milwaukee Sentinel*.

27. Ibid., Oct. 9, 1886, p. 4.

28. Ibid., Mar. 24, 1888, p. 2. Quoted scornfully from the *New York World*.

29. "A Western Scientist," ibid., Feb. 2, 1889, p. 3.

30. *Electrical World*, June 5, 1886, p. 257.

31. *Electrical Review*, Oct. 9, 1886, p. 4.

32. Ibid.

33. *Lightning* (London), Dec. 22, 1892, p. 39.

34. See "Recovery from Alleged Severe Electric Shock," *Electrical World*, June 27, 1885, p. 252, quoting from an article by Dr. A. L. Hummel in *Medical Bulletin*.

35. *Electricity* (London), Dec. 27, 1899, p. 386.

36. *Popular Science News* (Boston), Apr. 1897, p. 87.

37. "Views, News, and Interviews," *Electrical Review*, Oct. 10, 1891, p. 1.

38. See, for example, "Electrical Initiations," *Popular Science News* (Boston), Jan. 1899, p. 14; *Western Electrician* (Chicago), Nov. 26, 1898, p. 300; ibid., Dec. 9, 1899, p. 10; same story in *Electricity* (London), Dec. 27, 1899, p. 386; *Telegraphic Journal* (London), Sept. 1, 1877, p. 209; "Survived an Electric Shock," *Popular Science News* (Boston), June 1897, p. 135; *Electrical Review*, Jan. 26, 1894, p. 4.

39. "An Electrified Bridge," *Popular Science News* (Boston), Sept. 1897, p. 207.

40. *Telegraphic Journal* (London), Sept. 1, 1877, p. 208.

41. *Electrical Review*, Aug. 8, 1885, p. 6.

42. Ibid., Sept. 24, 1887, p. 4.

43. "Exhibits of Electrical Interest at the Mechanic Fair, Boston," *Electrical World*, Oct. 29, 1898, p. 451.

44. "Electric Jewelry," *Electrical World*, Aug. 9, 1884, p. 43.

45. John Kendrick Bangs, "The Imp of the Telephone," *Harper's Round Table*, Nov. 19, 1895, p. 67.

46. "New Dining Room Push Button," *Western Electrician* (Chicago), Oct. 11, 1890, p. 195.

47. "The Buttoned Kid. A Tandem Escapade," *Yellow Kid*, May 22, 1897, p. 3.

48. "Looking Backward," *Electrician* (London), Feb. 11, 1892, p. 366.

49. "Objection to the Telephone as a Missionary," *Electrical Review*, 14(21):6, quoted from *Christian at Work* (London); also, *Electrical Review*, June 15, 1889, p. 6, quoted from *The Telephone*.

50. "Faraday's Religious Life," *Western Electrician* (Chicago), July 18, 1891, p. 36.

51. "An Electrical Dedication," *Electrical Review* (London), June 24, 1896, p. 138.

52. Quoted from *Messiah's Herald* in D. T. Taylor, *A Chariot of Fire. The Cars in Prophecy and History with the Wonders of Rapid Traveling and Significance of the Modern Railway System. A Token of the Nearing End of the Age* (Yarmouth, Maine: Scriptural Publication Society, 1888), p. 160.

53. Edward C. Towne, "Magnetism and Electricity," *Science Siftings* (London), May 13, 1893, p. 25.

54. Erastus Wiman, "Electrical Possibilities as Viewed by a Business Man," *Electrical Review*, June 15, 1889, p. 3.

55. "An Electrical Dedication."

56. Heinrich Hertz, "Identity of Light and Electricity," Sept. 1889, reported in *Electrical Review*, Dec. 14, 1889, p. 7.

57. Wiman, "Electrical Possibilities."

58. "Future of Electrical Development," interview with Amos Dolbear, *Western Electrician* (Chicago), Jan. 9, 1897, p. 24.

59. *Western Electrician* (Chicago), May 8, 1886, p. 7; "An Electrical Grave-Annunciator," ibid., July 18, 1891, p. 35. See also "To Prevent Untimely Burial," *Electrical Review*, Nov. 6, 1886, p. 1.

60. "Telegraphing from the Grave. And Some Other Startling Possibilities," *Answers* (London), May 27, 1899, p. 48.

61. The translated work was "A Ternary of Paradoxes of the Magnetic Cure of Wounds, etc.," Walter Charleton, trans., 2nd ed. (London, 1650). Quoted in Fred de Land, "Notes on the Evolution of Electrical Transmission of Speech," *Telephony* (Chicago), Dec. 1901, p. 212.

62. *Electrical Review*, Apr. 19, 1899, p. 227. Quoted from the *Electrical Review* of London.

63. *Electrical Review*, Oct. 6, 1888, p. 9.

64. "Electricity in Your Mouth," ibid., June 1, 1889, p. 10.

65. "An Aid to the Surgeon," *Electrical Review*, Aug. 10, 1889, p. 1.

66. "Therapeutic Effects of High Frequency Currents," *Western Electrician* (Chicago), Sept. 12, 1896, p. 123.

67. *Western Electrician* (Chicago), Dec. 16, 1899, p. 354.

68. "Future of Electrical Development."

69. Crookes, "Some Possibilities of Electricity," pp. 179–80.

70. "Electricity Finds a Place in Fiction," *Electrical Review*, May 5, 1888, p. 7.

71. "Miscellaneous," *Western Electrician* (Chicago), Aug. 29, 1897, n.p.

72. "An Electrical Hat," *Electrical Review*, Oct. 23, 1886, p. 3.

73. *Electricity* (London), June 26, 1896, p. 307.

74. "More Electrical Quackery," *Science Siftings* (London), Sept. 26, 1896, p. 365.

75. "An Electrical Treat," *Electrical Review*, Feb. 26, 1887, p. 13.

76. Louis E. Asher and Edith Neal, *Send No Money* (Chicago: Argus Books, 1942), pp. 62–63.

77. See "Electric Belts in England," *Electrical World*, Sept. 1, 1894, p. 207.

78. *Answers* (London), June 1, 1895, p. 201.

79. "Views, News, and Interviews," *Electrical Review*, June 6, 1891, p. 195.

80. "The Wizard of the West," advertisement in *Comfort* (Augusta, Maine), Nov. 1899, p. 24.

81. "The Telephone as a Cause of Ear Troubles," *Electrical Review*, Oct. 26, 1889, p. 6. Quoted from the *British Medical Journal*.

82. *Western Electrician* (Chicago), Sept. 13, 1890, p. 147. Another "man who imagined himself a telephone, and who has been trying for a year to shout 'hello!' in his own ear, has been sent to an asylum at Flatbush, Long Island," reported the *Electrical Review*, Feb. 5, 1887, p. 8.

83. "Troubled by Telephone Bells," *Electrical Review*, Mar. 14, 1891, p. 54.

84. "An Electric Crank," *Electrical Review*, Oct. 24, 1891, p. 126.

85. "Prince Bismarck's Lament," *Electrical World*, Apr. 12, 1884, p. 120.

86. *Electrical Review*, Oct. 30, 1886, p. 5.

87. "A Very Good Story of a Living Magnet," ibid., June 9, 1888, p. 11.

88. "Heart Inverted by Lightning," *Popular Science News* (Boston), Nov. 19, 1901, p. 253. Quoted from *Electrical Review*.

89. "An Invention Worthy of Munchausen," *Electrical Review*, Aug. 29, 1891, p. 9.

90. *Electrical Review*, July 6, 1889, p. 15.

91. Fernand Papillon, "Electricity and Life," *Popular Science Monthly*, Mar. 1873, p. 529. Translated by A. R. Macdonough from the *Revue des Deux Mondes*.

92. "The Freaks of Lightning," *Popular Science News* (Boston), July 1901, p. 156.

93. "The Electric Boy," *Electrical Review*, Oct. 8, 1887, p. 7.

94. Quoted by *Lightning* (London), July 6, 1893, pp. 1–2. See also "A New Electric Light," *Popular Science Monthly*, May 1892, p. 137.

95. "Hertzian Waves at the Royal Institution," *Electrician* (London), June 8, 1894, p. 156.

96. "The Use of Illuminated Girls," *Electrical World*, May 10, 1884, p. 151.

97. *Electrical Review*, Feb. 7, 1885, p. 4.

98. "An Electric Supper," *Electrical World*, Feb. 6, 1886, p. 56.

99. "Electricity in Iowa," *Western Electrician* (Chicago), June 27, 1891, p. 367. Quoted from the *Sheldon* (Iowa) *Eagle*.

100. "The Representative of the Electric Light," *Western Electrician* (Chicago), Apr. 12, 1890, p. 210.

101. "Trouvé's Jewelry," *Electrical Review*, June 27, 1885, p. 2. The earliest description of this jewelry I have found is "Electric Jewelry," *Scientific American*, Oct. 25, 1879, p. 263, quoted from *La Nature*.

102. "A Paris Electric Bell(e)," *Electrical World*, Nov. 29, 1884, p. 223.

103. Thomas Stevens, "Telegraph Operators in Persia," *Electrical Review*, Aug. 18, 1888, p. 7.

104. Printed in the *Electrician* (London), Sept. 20, 1895, p. 689. See also "Wireless Telegraphy," *Cram's Magazine* (Chicago), Jan. 1900, p. 229, for another example of the use of organic-electric metaphor.

105. Forée Bain, "Looking Forward," *Western Electrician* (Chicago), Jan. 5, 1901, p. 11.

106. "The Doll with a Memory," *Literary Digest,* Jan. 2, 1897, pp. 271–72. Quoted from a paper by Reginald A. Fessenden in the *Journal of the Franklin Institute.*

107. "An Electric Supper."

108. *Electrical Review,* May 2, 1891, p. 138. Quoted from the *Chicago News.*

109. "A Bridgeport Inventor Builds a Boy Who Walks and Smiles," *Electrical Review.* The Xerox reproduction of this source in my possession unfortunately does not include the date.

110. Ibid.

111. E. I. La Baueme, "Visions of 1950," *Technical World* (Chicago), Dec. 1911, p. 439.

112. *Western Electrician* (Chicago), Dec. 6, 1890, p. 308. Quoted from the *Electrical Review* (London).

113. Remarks by J. J. Davenport, the mayor of Kansas City, at the eleventh convention of the National Electric Light Conference, Kansas City, Feb. 11, 1890, quoted in *Electrical World,* Feb. 22, 1890, p. 125. See also "Electricity in the Navy," *Electrical Review,* June 27, 1885, p. 10.

114. "Electrical Wiring in Harbors," *Western Electrician* (Chicago), Apr. 16, 1898, p. 227.

115. *Telephony* (Chicago), Sept. 1905, p. 221.

116. "Electric Shells in Warfare!", *Electrical Review,* Feb. 16, 1889, p. 4.

117. Quoted ibid.

118. "Edison Out-Edisoned," *Lightning* (London), Feb. 6, 1896, p. 111.

119. "Oh Dear! Another War Terror," *Answers* (London), July 30, 1897, p. 182. Marconi specifically denied that he had made such predictions ("Wireless Telegraphy. Signor Marconi Speaks of Its Value," *Daily Chronicle,* Sept. 20, 1897).

120. *Electrical Review* (London), Mar. 29, 1899, p. 179; "Electricity's Mystery," *Western Electrician* (Chicago), Dec. 10, 1898, p. 332; "A Terrible War Prospect," *Science Siftings* (London), June 25, 1898, p. 142; *Electrician* (London), May 26, 1899, p. 144.

121. "In 1992. Five Minutes with the Future," *Answers* (London), Sept. 3, 1892, p. 258.

122. "Electricity in Warfare," *Western Electrician* (Chicago), Apr. 18, 1891, p. 221.

123. J. J. Woods, "Strange Adventures in the Year 2890; or, A Thousand Years into Futurity," *Answers* (London), Jan. 4, 1890, p. 96.

124. Edward Bulwer-Lytton, *The Coming Race* (London: George Routledge and Sons, 1871), p. 64.

125. Ibid., p. 56.

126. Nikola Tesla, "The Problems of Increasing Human Energy," *Century,* June 1900, p. 183.

127. Ibid.

128. Hugh Tuite, "For Valour. A War Story of the Twentieth Century," *Daily Mail* (London), Oct. 24, 1898, "Daily Magazine" column.

129. See, for example, Charles R. Huntley, "The Execution as Seen by an Electrician," *Electrical World,* Aug. 16, 1890, p. 100.

130. Quoted in "Kemmler's Terrible Death," *Western Electrician* (Chicago), Aug. 16, 1890, p. 84.

131. Quoted ibid.

132. This was the position taken by George Washington, editor of the *Electrical Review,* and reflected in many of its articles. By far the most common argument in the debate concerned whether electrocution could be administered without unusual cruelty and suffering to those marked for punishment. Some argued for electrocution on the grounds that it was more humane than the rope; others countered that if it were indeed more humane, the deterrent value of capital punishment would be diminished.

133. Quoted in "Kemmler's Terrible Death."

134. "Prof. Brackett Opposed to Executions by Electricity," *Electrical Review,* Dec. 28, 1888, p. 4.

135. "The Electrical Execution," *Electrical Review,* Nov. 24, 1888, p. 6. Quoted from "The Electrical Execution," *New York World,* Nov. 16, 1888.

136. Matthew Josephson, *Edison* (New York: McGraw-Hill, 1959), pp. 347–49. See "Postponement of Kemmler's Execution," *Western Electrician* (Chicago), May 10, 1890, for the text of a public statement by George Westinghouse.

137. "Electricity as an Executioner," *Telegraphic Journal* (London), Jan. 5, 1876, p. 32. Quoted from *Scientific American.*

138. *Electrical World,* Aug. 16, 1890, p. 100.

4 Dazzling the Multitude

1. Erik Barnouw has traced a similar theme concerning the magic spectacle as a predecessor of certain elements of cinema in *The Magician and the Cinema* (New York: Oxford University Press, 1981).

2. *Electrician* (London), Oct. 22, 1897, p. 847. Quoted from the *Dundee Advertiser.*

3. Quoted in Fred de Land, "Notes on the Evolution of Electrical Transmission of Speech," *Telephony* (Chicago), Dec. 1901, p. 215.

4. "Edison's Telepathic Machine," *Science Siftings* (London), Dec. 22, 1894, p. 129. R. Famianus Strada, *Prolusiones Academicas* (Rome, 1617; Oxford, 1662). See *Telegraphic Journal* (London), Nov. 15, 1875, pp. 256–57, for the relevant text in Italian and translation from the Oxford edition.

5. "The Electrical Exhibition at Paris," *Electrician* (London), Dec. 3, 1881, pp. 40–41.