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INNOVATIONS IN LAW AND TECHNOLOGY, 1790–1920

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Law and technology are both critical for understanding the evolution of American society. As such prominent commentators as Thomas Paine and Alexis de Tocqueville have pointed out, U.S. policy has always been distinguished by the central role of law and the judiciary. Meanwhile, its citizens stand out for their innovativeness and willingness to adopt new technologies, to such an extent that some have even characterized the United States as a "republic of technology." This favorable view of invention and innovation was matched by the readiness of the judiciary to accommodate the radical transformations caused by innovations. Some modern observers contend, however, that technology in the twenty-first century is so radically different from previous experience that technological change today threatens the viability of the conventional legal system as a means of regulation or mediation.

The notion that our own era is unique displays a limited appreciation of the cumulative impact of such innovations as the telegraph, steam engine, railroad, radio, hydroelectric power and commercial air travel on American society in the nineteenth and early twentieth centuries. Unprecedented technical progress during that period brought about discrete and measurable changes in the lives, lifestyles, and livelihoods of Americans that, arguably, exceed those of our own time. Less dramatic advances in knowledge and their applications also significantly promoted social welfare. For example, the diffusion of information about hygiene and common medical technologies among households extended life expectancies and improved the standard of living. Technological innovations also affected the scope and nature of the law. Competition policy, medical malpractice, nuisance, trespass and torts, the allocation of riparian rights, and admiralty law all reflected turmoil wrought by technical changes. Advances in forensic science and technology transformed the enforcement and adjudication of criminal law. Organizational innovations influenced the nature of property rights, employment contracts, and liability rules.

Technological change was not limited to domestic issues, for it also facilitated more numerous and more rapid transactions with other nations during peace and war. Indeed, the very boundaries of maritime sovereignty were set by existing technology – the three-mile territorial limit was determined by the maximum distance of a cannon shot. Innovations like submarines, underwater international cables, and manned airplane flights created jurisdictional and third-party effects among nations that the legal system had to address. The legal implications of naval blockades and sanctions changed as newer ships and submarines developed, and the law of agency and bottomry incorporated developments in communications that meant ships at sea were no longer completely cut off from their owners on land. When firms like Singer Sewing Machine and Standard Oil became multinational enterprises, their corporate transformation raised issues of taxation, jurisdiction, and other far-ranging legal dilemmas.

Here we focus on the period between 1790 and 1920. Clearly, technological change was not unknown before this time, but the innovations of the nineteenth century were significantly different from those of previous centuries because their sphere of influence was so much larger. For the first time in American history, innovations in transportation extended the practical boundaries of markets and social interactions, making national and international transactions routine. Moreover, the expansion of communications networks introduced time as a central feature of such interactions and facilitated productivity changes through greater intensity of work and leisure. As a result of both factors, nineteenth-century technologies not only engendered conflicts between transactors but they created a world in which the pace, scale, and scope of third-party effects were potentially much larger. This in turn raised the policy question of how to ensure that technological progress increased net social welfare without causing unrestrained market power or undue redistributive effects.

Although our concern here is the relationship between the law and technology, it is important to realize that legal institutions comprised only one element in a complex network of institutions that functioned as complements or as substitutes to the law. In certain contexts social norms or familial ties served as the most effective moderators of behavior, independently of state-enforced rules, whereas circumstances that required little discretionary decision making were dealt with at least cost through administrative bureaucracies. As Montesquieu and Adam Smith both pointed out, markets can be self-regulating, since the pursuit of self-interest in market-related transactions may be sufficient to ensure that participants in a civil society cooperate in a manner that promotes the common good. Courts in the seventeenth and early eighteenth centuries performed a comprehensive regulatory function that encompassed both the private and public

realms. They monitored and enforced dominant moral and religious codes and imposed restrictions on commerce through price controls, licensing, enforcement of contracts, and property rights. Soon after the first decade of the eighteenth century, as the scale of market activity increased, a division of labor across institutions led to caseloads in civil courts that primarily involved economic transactions to enforce debt contracts. At the outset, therefore, the legal system was well prepared to accommodate the new economic challenges of the nineteenth century.

By the end of the period under review, legal institutions still formed an integral part of American life, but their responsibilities had altered because their domain had been supplemented by an array of associative and administrative institutions. This process of bureaucratization, perhaps because it was more visible than the decentralized decision making of the court system, led some observers to highlight regulation as a twentieth-century innovation. But economic activity in the United States has always been subjected to the public interest: the major change has been in the type of institution that accomplished this task. Indeed, which particular institution prevails – norms, legal system, bureaucratic regulation, government, or market – may be less important than the degree of flexibility exhibited, for institutions that do not respond to social evolution will necessarily become irrelevant. As Thomas Jefferson noted,

> I am not an advocate for frequent changes in laws and constitutions. But laws and institutions must go hand and hand with the progress of the human mind. As that becomes more developed, more enlightened, as new discoveries are made, new truths discovered and manners and opinions change, with the change of circumstances, institutions must advance also to keep pace with the times. We might as well require a man to wear still the coat which fitted him when a boy. . . .

The Framers of the American Constitution had been certain that social welfare would be maximized through the "progress of science and useful arts." They felt that this would be best achieved through a complementary relationship between law and the market. The Constitution and early statutes were carefully calibrated to ensure a democratic, market orientation toward invention. The wish to further technological innovation through private initiative created a paradox: to promote diffusion and enhance social welfare, it would first be necessary to limit diffusion and to protect exclusive rights. Thus, part of the debate about law and technology has always centered on the boundaries of the private domain relative to the public domain. Innovations in printing and publishing added to the complexity of the issue by introducing constitutional questions of freedom of speech. Effective policies toward furthering innovations, whether by statute or common law, required a balancing of costs and benefits that was far more subtle

than a monolithic promotion of the interests of any one specific group in society.

Legal institutions exerted a significant influence on social and economic interactions; technology was no exception. Patents and copyrights, as the subject of federal law, exhibited greater uniformity than if under state jurisdiction and thus facilitated the development of a national market. Intellectual property law had a direct effect on the rate and direction of inventive activity and cultural innovations. As the creators of the intellectual property system recognized, inventors would be motivated to address important needs of society if they were able to appropriate the returns from their efforts. Patent laws ensured the security of private property rights in invention. The attitudes of the judiciary were also relevant, because if courts were viewed as "anti-patent" this would tend to reduce the expected value of patent protection. Legal rules and doctrines influenced who became inventors and the nature of their inventions. For instance, relatively low patent fees served to encourage ordinary citizens to invest in creating new discoveries, whereas an examination system increased the average technical value of patents, fostered a market in inventions, and encouraged the diffusion of information. Technology was also shaped by other areas of property law, as well as by rules regarding contract, torts, crime, and constitutional issues.

The relationship between law and technology was reciprocal for, just as law shaped technology, technical innovations significantly influenced legal innovations. How and why the common law changed constitutes a standard debate in political and legal histories. A classic source of dissension relates to the arguments of scholars who agree that American legal institutions were flexible, but contend that the judiciary was captured by the interests of a small group in society. Morton Horwitz, in particular, admits that the antebellum legal system played a key role in the nascent industrialization of the United States, but argues that judges were biased in favor of capitalists and industrialists, whom they regarded as key to the promotion of economic development. The judiciary reinterpreted existing legal rules in property, torts, and contracts in an instrumentalist fashion to place the burdens of expansion on workers and farmers. In so doing, judicial decisions led to outcomes that subsidized the efforts of industrialists, regardless of the statutes and of legal precedent. Judges assumed the role of legislators to the extent that "judge-made law" should be viewed as a derogatory term. This "ruthless" transformation meant that the economically progressive classes were able to "dramatically . . . throw the burden of economic development on the weakest and least active elements of the population."[1]

[1] See Morton J. Horwitz, *The Transformation of American Law, 1780–1860* (Cambridge, MA, 1977), 101.

The specifics of the subsidy hypothesis have been challenged, but it has proven to be a resilient interpretation of the American experience. Its most recent incarnation is in the form of a mathematical model whose creators claim that regulation in the Gilded Age was an optimal response to the failures of the legal system. Edward Glaeser and Andrei Shleifer argue that large-scale corporations wielded excessive power in the courts, "routinely bribed" judges and juries, and engaged in other legal and illegal tactics to ensure outcomes that were biased in their favor. Consequently, the legal system "broke down." This "subversion of justice" proved to be inappropriate for the needs of the time and was replaced by regulatory agencies, which they allege were less susceptible to the same corrupting influences.

New technologies in the nineteenth century raised questions about the relevance of existing legal rules and ultimately caused changes in the law, albeit with a lag. Since the judiciary is by its nature conservative and technology is dynamic, the legal system potentially could have functioned as a significant bottleneck to innovation. Instead, the common law was sufficiently flexible to cope with new discoveries. This flexibility did not occur because of any preconceived bias toward any particular group in society. Indeed, the United States remained a largely agrarian society well into the nineteenth century, and industrialization depended on an efficient agricultural sector. Instead, we can identify five different mechanisms through which technological change had an impact on the law: technical innovations affected existing analogies, altered transactions costs, increased the speed and scope of transactions, influenced norms and expectations at both the industrial and societal levels, and changed judicial and legislative conceptions of the most effective means to promote the public interest.

In the first instance, courts attempted to mediate between parties to disputes that related to the incursions of new technologies through a process we can regard as "adjudication by analogy." Early on, the law was stretched to accommodate discrete changes by attempting to detect some degree of equivalence across technologies, either by form or by function. Second, however, inappropriate analogies tended to increase the frequency of legal conflicts or appeals, which served as a signal that revisions were insufficient. Under these circumstances, inappropriately reasoned rulings increased the cost of transacting and made it necessary for legal doctrines and legislation to change to encompass the new innovations. The third mechanism was activated by technologies, such as major advances in transportation and communications, that led to a more rapid pace of activity and thereby produced pressures for rapid responses in the legal system. Fourth, judicial decisions attempted to enforce community standards and expectations, which were a function of the current state of technology. Finally, the

judiciary recognized that, to increase overall social welfare, the law must evolve to allow citizens the most effective way of taking advantage of new technological opportunities.

It is undoubtedly true that, as the proponents of the subsidy thesis pointed out, a number of changes in the common law during the nineteenth century benefited corporations, and some decisions were harsh toward frail widows and worthy workers. However, the tendency was not monolithic, and some scholars have even produced evidence in support of the notion that judges interpreted contract law so as to protect employees. Other doctrinal developments, such as the abolition of privity of contract, served to increase, rather than decrease, manufacturer liability. Procedural innovations that benefited low-income plaintiffs included the adoption of contingency fees and class action suits. Moreover, it was also true that overall social advantages could result from outcomes that might seem to be unduly favorable to one party. For instance, advantages to the general public accrued when federal statutes prohibited a few creditors from using state laws to bankrupt a national railroad that was undergoing temporary difficulties during a recession. In the face of such varying outcomes, economic logic may allow us to understand better the general tenor of legal decisions, even though it is obvious that the motivation for legal doctrines or decisions was not limited to economic reasoning.

Technology extends into every facet of our lives, from reproduction to death. So does the legal system. In this chapter, we use investigation of two significant issues to stand for the whole interaction. First we assess the intellectual property laws that the founders authorized in the very first section of the Constitution, indicating the central role they ascribed to law and technology in the future of the nation. The United States created the first modern patent system by statute, and its effectiveness was reinforced by a federal judiciary that ensured property rights were secure and inventors were able to appropriate the returns from their efforts. Copyright law illustrated the difficulties and dilemmas that the legal system experienced in dealing with such new technologies as mimeographs, flash photography, cinematography, piano rolls, phonographs, radio, and "information technology," including the stock ticker and the telegraph. Even the preliminary decision about whether these technologies fell under the subject matter to be protected by the law created deep conflicts that were complicated by constitutional questions about freedom of speech and the needs of a democratic society. Second, we analyze the effect of new technologies – steamboats and canals, railroads, telegraphy, medical and public health innovations, and the automobile – on the common law itself. Technological innovations led to legal innovations, changed the relative importance of state and federal

policies, and ensured a continual debate about the effectiveness of judicial as opposed to bureaucratic regulation.

I. INTELLECTUAL PROPERTY LAWS

The United States from its inception as a nation had the option of drawing on European precedents for its intellectual property system, but chose to pursue very different policies toward both patents and copyrights. The American patent system was distinguished by its favorable treatment of inventors and the inducements held out for inventive activity; the copyright regime was hedged about with caveats and restrictions. The first Article of the U.S. Constitution included a clause to "promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries." George Washington issued a plea to highlight its importance, and Congress quickly complied in 1790 by passing separate patent and copyright statutes.

Patents

The American patent system was based on the presumption that social welfare coincided with the individual welfare of inventors. Accordingly, legislators emphatically rejected restrictions on the rights of American inventors and ensured that the legal system facilitated the operation of a free market. Working requirements or compulsory licences were regarded as unwarranted infringements of the rights of "meritorious inventors" and incompatible with the philosophy of U.S. patent grants. Fees were deliberately kept among the lowest in the world, patentees were not required to pay annuities to maintain their property, there were no opposition proceedings, and once granted a patent could not be revoked unless there was evidence of fraud. As a result, the annals of American invention were not limited to the wealthy, corporate entities, or other privileged classes, but included a broad spectrum of society. In an era when state policies prohibited married women from benefiting from their economic efforts, federal patent laws did not discriminate against women and other disadvantaged groups.

The initial establishment of an examination system was replaced by the 1793 model in which patents were awarded through registration, with disputes being resolved in the district courts. When this system was reformed by statute in 1836, the United States created the world's first modern patent institution. The primary feature of the American system was an examination of patent applications for conformity with the laws. In particular, the 1836 Patent Law formally established a Patent Office that was staffed

by trained and technically qualified employee examiners. The French had opposed examination in part because they were reluctant to create positions of power that could be abused by officeholders, but the characteristic American response to such potential problems was to institute a policy of judicial checks and balances. To constrain the ability of examiners to engage in arbitrary actions, the applicant was given the right to file a bill in equity to contest the decisions of the Patent Office, with the further right of appeal to the Supreme Court of the United States.

The historical record indicates that the legislature's creation of a uniquely American system was a deliberate and conscious process. The basic parameters of the U.S. patent system were transparent and predictable, in itself an aid to those who wished to obtain patent rights. In addition, American legislators were concerned with ensuring that information about the stock of patented knowledge was readily available and diffused rapidly. The Patent Office itself was a source of centralized information on the state of the arts. As early as 1805, Congress stipulated that the Secretary of State should publish an annual list of patents that were granted in the preceding year, and after 1832 it also required the publication in newspapers of notices regarding expired patents.

Technology policy was conducted at the national level, which contributed to the rapid development of a national market for innovations. The designers of the American system of intellectual property envisioned that the federal legal system would be closely integrated with every phase of the life of patents and copyrights from the initial grant, its defense and trade, through to possible extensions. It is interesting to speculate why legal oversight of intellectual property rights was not relegated to the state legislatures, since many of the colonies had passed patent and copyright laws in the eighteenth century. Property rights are worth little unless they can be legally enforced in a consistent, certain, and predictable manner. The value of patents was enhanced because patent issues were litigated at the federal and not the state level, with a right of appeal to the Supreme Court, which contributed to uniformity and certainty in intellectual property. Federal courts from their inception attempted to establish a store of doctrine that fulfilled the intent of the Constitution to secure the rights of intellectual property owners. The judiciary acknowledged that inventive efforts varied with the extent to which inventors could appropriate the returns on their discoveries and tried to ensure that patentees were not unjustly deprived of the benefits from their inventions.

Courts explicitly attempted to make decisions favorable to the promotion of social and economic development through technological change.[2] The

[2] *Ames v. Howard*, 1 F. Cas. 755 (1833).

attitudes of the judiciary were primarily shaped by their interpretation of the monopoly aspect of the patent grant. In *Whitney et al. v. Emmett et al.* (1831), Justice Baldwin contrasted the policies in Britain and America toward the patent contract. English courts, he pointed out, interpreted the patent grant as a privileged exception from the general ban on monopolies. Apart from this proviso, the judiciary had total discretion in interpreting and deciding the ends that would promote public welfare. The patent was seen as a trade-off, a bargain between the inventor and the public with a negotiable outcome. In contrast, in the United States the patentee was not recognized as a monopolist per se, and judges had little discretion other than to fulfill the explicit intention of the Constitution.[3] Numerous reported decisions before the early courts declared that, rather than unwarranted monopolies, patent rights were "sacred" and to be regarded as the just recompense for inventive ingenuity. Supreme Court Justice Joseph Story, the acknowledged patent expert of the antebellum courts, indicated in *Lowell v. Lewis* (1817) that "the inventor has a property in his invention; a property which is often of very great value, and of which the law intended to give him the absolute enjoyment and possession . . . involving some of the dearest and most valuable rights which society acknowledges, and the constitution itself means to favor."[4]

The 1840s saw an increase in the number of patentees resorting to courts of equity to obtain temporary or permanent injunctions against unauthorized users of their inventions. Preliminary injunctions could also be obtained pending common law litigation, if patentees stood to suffer severe losses. But judges were alert to the possibility of unwarranted harm to the defendants whose enterprises could be broken up. Oliver Parker's request for a wholesale injunction against 100 mill owners was disallowed because his patent was within weeks of expiring. The judge was reluctant to issue an injunction that would adversely affect so many enterprises, when the patentee received no benefit from closure of the mills and would later be compensated by the payment of damages if it were indeed proven that the patent was infringed.[5] In the absence of antitrust statutes, equity provided a more flexible channel for mediating between the inventor's exclusive rights and a general monopoly. The plaintiff in *Smith v. Downing* (1850), an assignee of telegraph promoter Samuel F. B. Morse, sought a permanent injunction against the defendants, who operated a telegraph under assignment from Royal E. House. After a detailed exposition of the incremental nature of the development of the telegraph, the court refused the injunction. Exclusive

[3] *Whitney et al. v. Emmett et al.*, 29 F. Cas. 1074 (1831).
[4] *Lowell v. Lewis*, 15 F. Cas. 1018 (1817).
[5] See, for instance, *Parker v. Sears*, 18 F. Cas. 1159 (1850).

patent rights allowed the inventor to benefit from the acknowledged property in his improvement; at the same time, such property did not extend to the entire field, because this would grant the marginal improver a monopoly that would halt general progress in the area. House's telegraph was not only different from Morse's, but technically superior; hence to mandate an estoppel against his ingenuity and the defendants' enterprise would have been an "extraordinary" measure.[6]

One of the advantages of a legal system that secures property rights is that it facilitates contracts and trade. Partly as a result, an extensive national network of licensing and assignments developed early on: in 1845 the Patent Office recorded 2,108 assignments, which can be compared to the cumulative stock of 7,188 patents that were still in force in that year. By the 1870s the number of assignments averaged more than 9,000 per year, and this number increased in the next decade to more than 12,000 contracts recorded annually. Assignments provide a straightforward index of the effectiveness of the American system, since a market for patented inventions would hardly proliferate if patent rights were uncertain or worthless. The secondary market in patent rights was based on the legally valid assumption that the patent embodied some intrinsic technical value. The English system, which initially offered no protection to purchasers who were deceived into buying false patents, encouraged unproductive speculation and deterred the development of trade. In contrast, American legal rulings voided promissory notes and other contracts for useless or fraudulent patents as part of a policy of protecting and securing legitimate property rights.

The judiciary was willing to grapple with other difficult questions, including the appropriate measure of damages when patent infringement likely lowered prices, disputes between owners of valid but conflicting patents, and the problem of how to protect the integrity of existing contracts when the law changed. One such question revolved around the criteria for patentability. The terms of the 1836 Patent Act authorized the grant to "any person or persons having discovered or invented any new and useful art, machine, manufacture, or composition of matter, or any new and useful improvements on any art, machine, manufacture, or composition of matter, not known or used by others before his or their discovery or invention thereof, and not, at the time of his application for a patent, in public use or on sale." The patent statutes required that inventions should be new and useful, but the judiciary treated the utility requirement as merely nominal, since it was the function of markets, not courts, to determine the utility and value of patents. Infringers who tried to undermine the validity of the

[6] *Smith v. Downing*, 1 Fish. Pat. Cas. 64 (Mass. 1850).

original patent on the grounds of utility were reminded that their very use of the item overturned any allegation of lack of utility. Instead, the major issue in any patent lawsuit related either to the novelty of the invention or the extent to which it promoted the progress of useful arts.

To nineteenth-century courts, patentable technology incorporated ideas and discoveries that were vested in tangible form, and "a mere abstract idea" or processes independent of a means of realization could not be treated as the exclusive property of any one person, for doing so would limit diffusion and learning without any measurable social return. When patents were granted for inventions that seemed to be for contracts or business methods, they were uniformly overturned by the courts, unless the idea or principle could be construed as vested in a tangible medium. The Patent Office granted an 1891 patent to Levy Maybaum of Newark for inventing a "means for securing against excessive losses by bad debts," which he assigned to the U.S. Credit System Company. The patent covered a method of computing the industry norm for operating losses and constructing tables that allowed comparisons relative to the industry average. When the owners of the patent brought an infringement claim before the courts, the patent was dismissed as "a method of transacting common business, which does not seem to be patentable as an art." In litigation regarding the validity of an invention for "time limit" transfer tickets for use by street railways, the defendants sought to decry the patent as "a method of transacting business, a form of contract, a mode of procedure, a rule of conduct, a principle or idea, or a permissive function, predicated upon a thing involving no structural law." The Circuit Court admitted that if the defense claim were true, then the patent would have to be invalidated. As another judge had expressed it, "Advice is not patentable." However, it was decided that though "the case is perhaps near the border line, we think the device should be classed as an article to be used in a method of doing business," and as an item to be manufactured, the ticket was patentable.[7]

In *Earle v. Sawyer* (1825) Justice Story rejected the argument that patents required inventive inputs or efforts that went beyond those that could be produced by an artisan who was skilled in the arts. Story was not persuaded by the "metaphysical" notion of patentability, for the standard "proceeds upon the language of common sense and common life, and has nothing mysterious or equivocal in it. . . . It is of no consequence, whether the thing be simple or complicated; whether it be by accident, or by long, laborious thought, or by an instantaneous flash of mind, that it is first done. The law

[7] See *Cincinnati Traction Co. v. Pope*, 210 F. 443 (1913); *Hotel Security Checking Co. v. Lorraine Co.*, 160 F. 467 (1908); *United States Credit System Co. v. American Credit Indem. Co.*, 53 F. 818 (1893).

looks to the fact, and not to the process by which it is accomplished."[8] This commonsense standard was entirely appropriate for an era in which ordinary non-technical craftsmen and women could make valuable innovations based on simple know-how. A departure from this approach occurred when *Hotchkiss v. Greenwood* (1850) proposed that "unless more ingenuity and skill in applying the old method . . . were required in the application of it . . . than were possessed by an ordinary mechanic acquainted with the business, there was an absence of that degree of skill and ingenuity which constitute essential elements of every invention. In other words, the improvement is the work of the skilful mechanic, not that of the inventor."[9]

The frequency of citation indicates that the Hotchkiss ruling long remained an isolated decision, but after the 1870s it became the reigning precedent for decisions that invalidated patent grants on the grounds of non-obviousness and later for the absence of a "flash of genius." Although the purist will view the move toward the more stringent non-obviousness criterion as not strictly in keeping with a democratic orientation, the heightened standards likely functioned as a more effective filter in view of the great increase in technical qualifications and patenting rates occurring among the population during the postbellum period. Another change occurred because early judicial optimism about the coincidence between private and public welfare had begun to wane by the second half of the century. By then, the courts had experienced the tactical use of litigation by patentees and their assignees to protect national monopolies. Justice Woodbury was prompted to dictate, "The rights of inventive genius, and the valuable property produced by it, all persons in the exercise of this spirit will be willing to vindicate and uphold, without colorable evasions and wanton piracies; but those rights on the other hand, should be maintained in a manner not harsh towards other inventors, nor unaccommodating to the growing wants of the community."[10]

The United States differed from the rest of the world in terms of its treatment of foreign inventions and foreign inventors. Most countries had simple registration systems and allowed patents of importation, which allowed their residents to appropriate and obtain patents for discoveries made by residents of other countries. American laws employed the language of the English statute in granting patents to "the first and true inventor." But, unlike in England, the phrase was used literally to grant patents for inventions that were original in the world, not simply within U.S. borders. Although the treatment of foreign inventors by the United States varied over time, its policies were much more favorable toward aliens than those

[8] *Earle v. Sawyer*, 8 F. Cas. 254 (1825).
[9] *Hotchkiss v. Greenwood*, 52 U.S. 248 (1850).
[10] *Woodworth v. Edwards*, 30 F. Cas. 567 (1847).

of other countries. The earliest statutes of 1793, 1800, and 1832 restricted rights in patent property to citizens or to residents who declared an intention to become citizens. As such, although an American could not appropriate patent rights to a foreign invention, he could freely use the idea without any need to bear licensing or similar costs that would otherwise have been due if the inventor had been able to obtain a patent in this country. Nevertheless, numerous foreign inventors (presumably of higher valued discoveries) were able to obtain U.S. patent protection through appeals to Congress. In 1836, the stipulations on citizenship or residency were removed, but were replaced with discriminatory patent fees that retaliated for the significantly higher fees charged in other countries: foreigners could obtain a patent in the United States for a fee of $300, or $500 if they were British. After 1861 patent rights (with the exception of caveats) were available to all applicants on the same basis without regard to nationality. Liberality to foreign inventors was obtained at low cost since, for most of the nineteenth century, the number of foreign patents filed in the United States was trivial relative to the total.

By the end of the nineteenth century, the United States was directing its efforts toward attaining international uniformity in intellectual property rights laws. A significant motivating factor was the success of American patentees in penetrating foreign markets. Americans inventors were also concerned about the lack of protection accorded to their exhibits in the increasingly prominent World's Fairs. Internationally, the impetus for change occurred as part of an overall movement to harmonize legal policies, because the costs of discordant national rules became more burdensome as the volume of international trade in patents and industrial products grew over time. The first international patent convention was held in Austria in 1873 at the suggestion of U.S. policymakers, who wanted to be certain that their inventors would be adequately protected at the International Exposition held in Vienna that year. The conventions also yielded an opportunity for the United States to protest provisions in foreign laws that discriminated against American patentees.

By the beginning of the twentieth century, the United States had become the most prolific patenting nation in the world. Many major American enterprises owed their success to patents and were expanding into international markets; the U.S. patent system was recognized as the world's most successful. It is therefore not surprising that the harmonization of patent laws implied convergence toward the American model, which was viewed as "the ideal of the future," despite resistance from other nations. Countries such as Germany were initially averse to extending equal protection to foreigners because they feared that their domestic industry would be overwhelmed by American patents. Ironically, because its patent laws were the

most liberal, the United States found itself in a weaker bargaining position than nations who could make concessions by changing their protectionist provisions. This likely influenced the U.S. tendency to use bilateral trade sanctions rather than multilateral conventions to obtain reforms in international patent policies. The movement to create an international patent system demonstrated very clearly that intellectual property laws did not exist in a vacuum, but were part of a bundle of rights that were affected by other laws and policies, as well as by the scale and scope of economic activity.

Copyright and Allied Rights

Despite their common source in the intellectual property clause of the U.S. Constitution, American copyright policies provided a marked contrast to the patent system. The subsidy argument is quite implausible in accounting for the differences between patent and copyright doctrines. Copyright differed from patents precisely because the objective of both systems was to maximize social welfare, which led to an underlying rationale that was consistent with economic reasoning. The political rhetoric of copyright has always centered on the creative individual, but then (as now) copyright enforcement was largely the concern of commercial interests. The fraction of copyright plaintiffs who were authors (broadly defined) was initially quite low and fell continuously during the nineteenth century. By the start of the twentieth century less than 10 percent of all plaintiffs in copyright cases were the creators of the item that was the subject of the litigation. Instead, by the same period, the majority of parties bringing cases were publishing enterprises and other assignees of copyrights. Although the judiciary attempted to ensure that the rights of all parties were fairly considered, their major concern was not to benefit publishing companies, but to protect the public interest in learning.

Like other forms of intellectual property laws, the copyright system evolved to encompass improvements in technology and changes in the marketplace. Copyright decisions illustrate how adjudication by analogy economized on legal inputs, but this area of the law also indicates the extent to which judge-made policies were constrained by the statutes. Many of the technological innovations of the nineteenth century were sufficiently different from existing technologies as to make judicial analogies somewhat strained, and they ultimately required accommodation by the legislature. As the Supreme Court pointed out, "From its beginning, the law of copyright has developed in response to significant changes in technology. Indeed, it was the invention of a new form of copying equipment – the printing

press – that gave rise to the original need for copyright protection. Repeatedly, as new developments have occurred in this country, it has been the Congress that has fashioned the new rules that new technology made necessary."[11]

The earliest federal statute to protect the product of authors was approved on May 31, 1790, "for the encouragement of learning." This utilitarian objective meant that, unlike European doctrines that enshrined the inalienable rights of authors, in the United States copyrights were among the most abridged in the world. The primary focus was on widespread access in order to enhance public welfare, and incentives to copyright owners were viewed only as a secondary motive. Registration secured the right to print, publish, and sell maps, charts and books for a term of fourteen years, with the possibility of an extension for an equal term. Major issues in copyright law primarily related to subject matter, duration, and enforcement, all of which expanded significantly during the course of the nineteenth century. The statutes were substantively revised in 1831, 1870, and 1909. The statutory extension of copyrights to musical compositions and plays was quite straightforward, as was the grant of property rights for engravings and sculpture. By 1910 the original copyright holder was granted derivative rights, including translations into other languages, performances, and the rights to adapt musical works. The burgeoning scope of copyright protection that technological advances required raised numerous questions about the rights of authors and publishers relative to the public, and courts continually were confronted with the need to delineate the boundaries of private property in such a way as to guard the public domain.

Although musical works were not protected by the first copyright act, the 1831 statute allowed protection for musical compositions, at that time limited to sheet music. The creation of mechanical means of reproducing music, such as the player piano and the phonograph, raised questions about the relevance of existing copyright rules, in part because the analogy between sheet music and these mechanical inventions appeared remote. *Stern v. Rosey* (1901) dealt with the question of whether an injunction should issue against a manufacturer of phonograph records who had used copyrighted music. The court rejected the notion that copyright protection for music extended to such a different technological transformation. *Kennedy v. McTammany* (1888), which was argued in the Massachusetts Federal District Court, was brought by the copyright owner of a song entitled "Cradle's Empty, Baby's Gone." Judge Colt failed to accept the plaintiff's argument that McTammany's perforated piano rolls infringed on the copyright for the

[11] *Sony Corp. of America v. Universal City Studios, Inc.*, 464 U.S. 417 (1984).

music, because he could "find no decided cases which, directly or by analogy, support the position of the plaintiffs." In 1908 the Supreme Court affirmed this position when it considered the claim brought by a music publishing company against the manufacturer of player-piano rolls.[12]

In 1909 Congress responded by revising the copyright law to give composers the right to the first mechanical reproduction of their music. However, after the first recording, the statute permitted a compulsory license to issue for copyrighted musical compositions: that is to say, anyone could subsequently make his or her own recording of the composition on payment of a fee that was set by the statute at two cents per recording. In effect, the property right was transformed into a liability rule. The prevalence of compulsory licenses for copyrighted material (unlike patents) is worth noting for several reasons: licenses underline some of the statutory differences between patents and copyrights in the United States, they reveal economic reasons for such distinctions, and they demonstrate the use of political compromises among the various interest groups in the music industry.

The advent of photography created a new form of "authorship" that was granted copyright protection in 1865. Photography also offered a ready means of copying books, paintings, and engravings that led to copyright infringement litigation. *Rossiter v. Hall* (1866) dealt with photographic copies that had been taken of a copyrighted engraving of Washington's house that the statutes protected against unauthorized reprints. The defendant argued unsuccessfully that, since photography had not been invented at the time of the statute, it followed that this form of copying was not prohibited.[13] Although the judiciary was reluctant to appropriate the task of Congress and create new policies, at times judges were able to adjudicate cases relating to new technologies by stretching an existing analogy. This was apparent in the development of litigation surrounding movies not long after Edison obtained his 1896 patent for a kinetoscope. The lower court rejected Edison's copyright of moving pictures under the statutory category of photographs, but this decision was overturned by the appellate court:

> To say that the continuous method by which this negative was secured was unknown when the act was passed, and therefore a photograph of it was not covered by the act, is to beg the question. Such construction is at variance with the object of the act, which was passed to further the constitutional grant of power to "promote the progress of science and useful arts. . . ." [Congress] must have recognized there would be change and advance in making photographs, just as there has been in making books, printing chromos, and other subjects of copyright protection.[14]

[12] *Stern v. Rosey*, 17 App. DC 562 (1901); *Kennedy v. McTammany*, 33 F. 584 (1888); *White-Smith Music Pub. Co. v. Apollo Co.*, 209 U.S. 1 (1908).

[13] *Rossiter v. Hall*, 20 F. Cas. 1253 (1866).

[14] *Edison v. Lubin*, 122 F. Cas. 240 (1903).

Technological innovations created new cultural properties to be protected, but many of these also facilitated infringement through mechanical means of reproduction that lowered the costs of duplicating copyrighted works. Congress responded to the creation of new subject matter by expanding the scope of the copyright laws. The legislature also repeatedly lengthened the term of copyright, arguably to support the value of copyright protection in the face of falling costs of infringement. In 1790 the duration of copyright protection comprised 14 years from registration, with the possibility of renewal for a further 14 years; after 1831 the maximum term was 28 years from time of registration with the right of renewal for 14 years; whereas the 1909 statute allowed 28 years plus extension for a further 28 years if the author were still alive. Nevertheless, it is worth repeating that the largely utilitarian rationale of the American statutes ("to promote learning") precluded perpetual grants, and the term of copyright protection in United States was among the most abbreviated in the world. Similarly, the United States offered the most liberal opportunities in the world for unauthorized use of copyrighted material if copying qualified as "fair use."

Technological innovations that facilitated unauthorized copying heightened the tension between public welfare and private interests, leading some to question whether the fair use doctrine and copyright itself could endure. However, it is vital to understand that fair use was not formulated simply as a function of technologies that influenced the ability to monitor use, nor was it limited because courts recognized the (moral or other) rights of authors. Even if monitoring costs were zero and all use could be traced by the author, fair use doctrines would still be relevant to fulfil the ultimate function of property rights in cultural products. Without fair use, copyright would be transmuted into an exclusive monopoly right that would limit public access and violate the Constitution's mandate to promote the progress of science. In short, according to American legal doctrines, fair use was not regarded as an exception to the grant of copyright; instead, the grant of copyright was a limited exception to the primacy of the public domain.

The need to balance public welfare against the right of authors is partly why copyright, according to Justice Joseph Story, belonged to the "metaphysics of the law." It was Story who first outlined the American fair use doctrine in *Gray v. Russell* (1839) and then again in the more frequently cited *Folsom v. Marsh* (1841).[15] Fair use allowed unauthorized use of some portion of a copyrighted work, although exactly how much copying was permissible constituted (and remains today) "one of the most difficult points that can well arise for judicial discussion." Story offered several guidelines in Folsom: "we must often, in deciding questions of this sort, look to the

[15] *Gray v. Russell*, 10 F. Cas. 1035 (1839); *Folsom v. Marsh.*, 9 F. Cas. 342 (1841).

nature and objects of the selections made, the quantity and value of the materials used, and the degree in which the use may prejudice the sale, or diminish the profits, or supersede the objects, of the original work." The fair use doctrine thus illustrates the extent to which policymakers weighed the benefits of diffusion against the costs of exclusion. If copyrights were as strictly construed as patents, it would reduce scholarship, prevent public access for non-commercial purposes, increase transactions costs for potential users, and inhibit the learning that the statutes were meant to promote.

Current and increasingly polarized debates about the scope of patents and copyrights often underestimate or ignore the importance of allied rights that are available through other forms of the law, such as contract and unfair competition. The distinction is important for at least two reasons. First, such allied rights as contract or misappropriation doctrines are likely to be limited to the parties directly involved in a specific exchange, whereas copyright gives the owner broader rights against society; second, private rights are less subject to public oversight. A noticeable feature of nineteenth-century case law is the willingness of the judiciary to extend protection to non-copyrighted works under alternative doctrines in the common law, although the judicial mind in 1915 balked at the thought of extending free speech protections to commercial productions such as movies. More than 10 percent of "copyright" cases were decided using concepts of unfair competition, in which the court rejected copyright claims but still protected the work against unauthorized users using fair trade doctrines. Some 7.7 percent dealt with contracts, which raised questions such as ownership of photographs in cases of "work for hire." A further 12 percent encompassed issues of trade secrets, misappropriation, and the right to privacy.

The development of the right to privacy is especially interesting, since it illustrates the creation of a new legal concept at common law to compensate for the potential of new technologies to infringe on third-party rights. Samuel Warren and Louis Brandeis, in what has been touted as the most effective law review article of all time, argued that "modern enterprise and invention" subjected the ordinary individual to unwarranted suffering that could not be alleviated through existing laws of copyright, tort, trespass, slander, and libel. Instant photographs and "numerous mechanical devices" led to the "evil of invasion of privacy." The concept of a legal right to privacy immediately entered into litigated arguments, and the New York Supreme Court, in *Schuyler v. Curtis et al.* (1891), quoted directly from the law review article, but distinguished between private individuals and public figures who by implication ceded the right to privacy. In a Massachusetts case three years later the wife of the great inventor George H. Corliss tried to enjoin the publication of a photograph of her late husband. The court rejected the plea because her husband was "among the first of American inventors, and

he sought recognition as such," permitting thousands of his photographs to be distributed at the Centennial Exposition in Philadelphia.[16] In 1903, the New York legislature passed a statute that levied criminal and civil liability for the unauthorized use of the "name, portrait or picture of any living person" for "advertising purposes, or for the purposes of trade," and several other states did the same. The first unambiguously successful application of the right to privacy, *Pavesich v. New England Life Insurance Co* (1905), along with some thirty other lawsuits prior to 1920, dealt with allegations that unauthorized commercial use of the plaintiff's photograph violated a right to privacy.[17]

The legal records of patent and copyright disputes yield valuable insights into nineteenth-century society. The significant differences in international patent and copyright laws in particular illustrate the extent to which these policies were market oriented. The United States was a nation of artificers and innovators, both as consumers and producers, and its citizens were confident of their global competitiveness in technology and accordingly took an active role in international patent conventions. Although they excelled at pragmatic contrivances, Americans were advisedly less confident about their efforts in the realm of music, art, literature, and drama. As a developing country, the United States was initially a net debtor in exchanges of material culture with Europe. The first copyright statute implicitly recognized this when it authorized Americans to take free advantage of the cultural output of other countries and encouraged the practice of international copyright piracy that persisted for a century. The tendency to reprint foreign works was aided by the existence of tariffs on imported books that ranged as high as 25 percent.

Throughout the nineteenth century, proposals to reform the law and to acknowledge foreign copyrights were repeatedly brought before Congress. Prominent American and European authors and their publishers supported the movement to attain harmonization of U.S. copyright policies with international law, but their efforts were defeated. From the American perspective, the public interest was not limited to the needs and wishes of a cultural elite. It was not until 1891 when American literature was gaining in the international market that U.S. laws granted copyright protection to foreign residents in order to gain reciprocal rights for American writers and artists. However, the statute also included significant concessions to printers' unions in the form of manufacturing clauses. First, a book had to be published in the United States before or at the same time as the publication date in its country of origin. Second, the work had to be printed here or

[16] *Schuyler v. Curtis et al.*, 15 N.Y.S. 787 (1891); *Corliss v. Walker Co.*, 64 F. 280 (1894).
[17] *Pavesich v. New England Life Insurance Co.*, 50 SE 98 (1905).

printed from type set in the United States or from plates made from type set in the United States. Copyright protection also depended on conformity with stipulations such as formal registration of the work. These clauses resulted in the failure of the United States to qualify for admission to the international Berne Convention until 1988, one hundred years after the initial accord.

II. INNOVATIONS AND THE LAW

American society at the start of the nineteenth century was still overwhelmingly agrarian, but by 1920 the United States had become the world's foremost industrial power. The advent of industrialization and more extensive markets created conflicts between the rights of farmers and mill owners, mill owners and their workers, and enterprises and consumers, all of which required legal mediation. Technological advances and legal change had reciprocal and mutually reinforcing effects. Property laws and contracts attempted to define rights and allocate liability within a changing context. In particular, tort law developed as a distinct body of thought independently of property and contract law, because new technologies, urbanization, and more frequent exchanges among strangers were associated with more accidental injuries and higher transactions costs. At the same time, the costs of injuries created incentives for inventors to direct their attentions to safety devices, such as steam gauges, safety elevators, and more effective railroad couplers, air brakes, and crossing signals. In the entire period before 1860, only 771 patents mentioned safety in the specification, but during the decade of the 1860s some 1,940 patents did so, and in the following decade this number increased to more than 3,021 patents. The courts responded by quickly altering the standards of due care to incorporate existing technological options as long as they were cost effective. Here I consider such changes in legal institutions in relation to specific innovations, including canals, railroads, the telegraph, medical devices, public health systems, and automobiles.

Canals and Railroads

The development of cheap and efficient internal transportation was a prerequisite for economic development in a country as vast as the United States, so it is not surprising that transportation comprised a key element of state policy and private initiative. By 1830, even though state involvement was largely limited to the grant of charters, investors and entrepreneurs had privately funded an extensive network of turnpikes in the Northeast. After the state of New York financed the building of the hugely successful Erie

Canal, numerous other public and private canal ventures were undertaken throughout New England, the Middle Atlantic, and Midwest. The United States also possessed ready access to natural bodies of water, and advances in steamboat technologies increased their importance as a conduit for commerce. Between 1830 and 1860 national steamboat tonnage increased by a factor of ten, and shipping rates on upriver transport fell dramatically. As a result of these technical and price savings, the effective distance between towns and markets was reduced significantly.

In the antebellum period some 650 reported cases involved canals; another 468 dealt with steamboats. Transportation along water routes raised many of the issues that the railroads later would confront, including the nature of state charters, the role and effectiveness of canal commissioners, compensation for injuries to passengers and workers, takings and just compensation, discriminatory prices, taxation, and financing. In the era of canal-building mania, the courts provided well-needed ballast to the airy financial schemes of canal boosters. For instance, *Newell v. People* (1852) held that a New York state statute, which authorized the debt for the Erie Canal Enlargement and the building of the Genesee Valley and Black River Canals to be paid from future canal revenue surpluses, was unconstitutional.[18] Many states, beginning with New York, altered their constitutions to restrict debt financing at both the state and municipal levels, because of their unhappy experience when financial panics adversely affected the funding of canals.

Some of the lawsuits involved conflicts between different cohorts of technologies: could canals and turnpikes block railroads because their charters were drawn up earlier and implicitly conferred exclusive rights that could not be eroded by later technologies? The famous Charles River Bridge decision in 1837 rejected this view because if earlier charters ensured monopoly profits the benefits from subsequent competition and technological change would be reduced or eliminated. Progress also meant that already existing property rights might have to be defined more narrowly. Thus, the old common law rule that property rights in land extended upward and downward without limit no longer applied, and courts allowed railroads and bridges the right to cross privately owned waterways and turnpikes.

New technologies required a balancing of the benefits to be derived from their applications against the harm that is associated with their use. They brought the possibility that economic and social advances could be blocked by hold-outs or by individuals with conflicting interests who threatened to make the transactions costs associated with innovations prohibitively high. The use of eminent domain played an important part in the promotion

[18] *Newell v. People*, 7 N.Y. 9 (1852).

of turnpikes, canals, railroads, and telegraphs by reducing or eliminating such costs. The U.S. Constitution advocated the right of eminent domain to ensure that private property could be taken for public use, as long as just compensation was offered. This clause raised questions about the security of private property, what comprised public use, and how just compensation was to be determined in a non-consensual, non-market exchange.

In the nineteenth-century transportation cases, just compensation for takings was ascertained through mutual agreement, by commissioners in an administrative process, or by a jury. Legislatures determined the extent and constraints of "public use." Their decisions were straightforward in the specific case of canals for transportation or railroads that, though privately owned, offered valuable common carrier services to the general public. In other instances, the benefits to the public were less direct, but this did not entirely rule out the application of the doctrine of eminent domain. In 1832 Jasper Scudder brought a case in equity against the Trenton Delaware Falls Company, which had been incorporated to create water power for some seventy manufacturing mills. Scudder's counsel argued that the corporation was created only for private purposes since the benefits of the water mills would derive solely to private individuals; thus it was inappropriate to allow the use of eminent domain. The Chancellor rejected this viewpoint because manufacturing enterprises, though admittedly private, contributed to employment and general economic prosperity and indeed promised to generate far larger communal benefits than some turnpikes actually produced.[19]

To an even greater extent than canals, railroads quickly gained public approval and became a symbol of American progress. Economic historians rightly caution against an inflated assessment of the role of locomotives in the nineteenth-century economy, given the existence of viable alternatives, but it is undoubtedly true that the significance of railways increased over this period in terms of use, employment, and social impact. Justice Caruthers of the Tennessee Supreme Court lyrically wrote in 1854 that "the common dirt road for wagons is superseded by turnpikes, and these again by the railroad. . . . Blessings innumerable, prosperity unexampled, have marked the progress of this master improvement of the age. Activity, industry, enterprise and wealth seem to spring up as if by enchantment, wherever the iron track has been laid, or the locomotive moved."[20] Other courts demonstrated a similar readiness to ensure that the common law kept up with innovations in transportation.

Approval of any new technology is never universal, however, and many balked at their influence. One such controversy related to the policy of the

[19] *Scudder v. Trenton Delaware Falls Company*, 1 N.J. Eq. 694 (1832).
[20] *Louisville & N. R. Co. v. County Court of Davidson*, 33 Tenn. 637 (1854).

railroads to rationalize the norms for reckoning time. More than 188 railroads adopted standard time on November 18, 1883, and a large number of cities did likewise. However, standard time was not formally recognized by the federal government until 1918, even though Congress adopted standard time for the District of Columbia in 1884. Given the lack of consensus, it is not surprising that a significant number of lawsuits arose to settle the different interpretations of time. Southern courts in particular evinced some hostility to the railroad interests and felt that, according to one Georgia judge, "to allow the railroads to fix the standard of time would be to allow them at pleasure to violate or defeat the law." Similarly, a Texas court quoted "from the American and English Encyclopedia of Law (volume 26, p. 10) as follows: 'The only standard of time recognized by the courts is the meridian of the sun, and an arbitrary standard set up by persons in business will not be recognized.'" As late as 1899, an appellate court upheld the view that solar rather than standard time should be applied.[21]

A more enduring legal legacy arose after the number of tort lawsuits brought against the railroads mounted rapidly after the Civil War. In 1890 more than 29,000 individuals were injured in railroad accidents and 6,335 persons were killed; in 1913 injuries attained the quite astonishing level of 200,308, with almost 11,000 fatalities in that one year alone. Legal historians have attributed the development of tort law in the nineteenth century to disputes regarding the injuries and negative externalities that the railroads generated. Such a claim has to be modified somewhat because both the harms and the legal issues were not entirely unprecedented. The benefits from all improvements in internal transportation came at a higher risk if only because of the growth in the number of transactions. Steamboats proved to be especially hazardous because of fires from sparks and accidents when high pressure boilers exploded. This led to the passage of federal statutes in 1838 and 1852 that attempted to regulate safety and assigned the burden of proof in negligence cases to steamboat owners and captains.

In the debate over the impetus for the imposition of regulations and their efficacy, some economists have argued that, although regulatory policies succeeded in generating and funding useful research, improvements in safety were predominantly due to private initiatives that would have proceeded in the absence of federal regulation. Figure 15.1 shows the annual number of patents granted for railroad safety and for safety-related inventions in general, expressed as a percentage of all patents. The two series are pro-cyclical and behave very like each other until World War I. After this period, railroad traffic was reduced significantly, and patents for railroad safety fell relative to overall safety patents. Both series suggest that investments in

[21] *Henderson v. Reynolds*, 84 Ga. 159 (1889); *Parker v. State*, 35 Tex. Crim. 12 (1898).

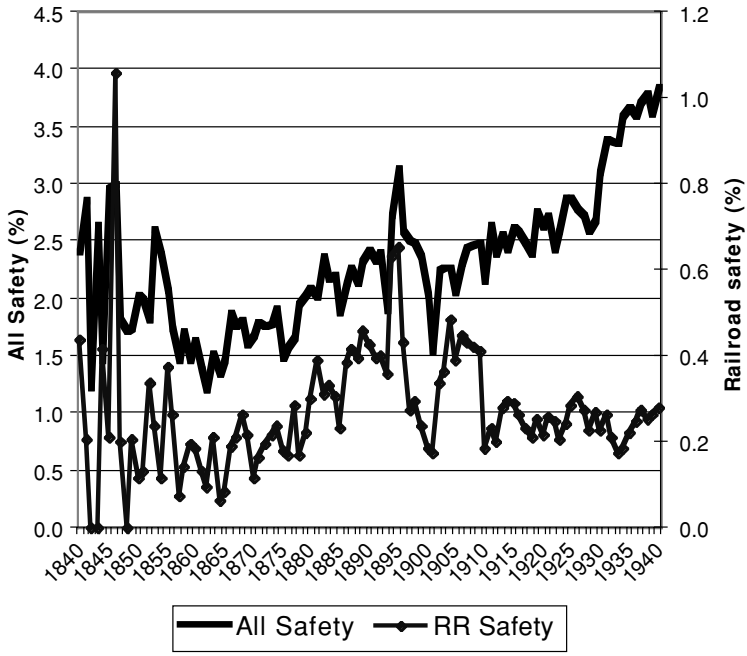

FIGURE 15.1. Safety-Related Inventions in Railroad and All Sectors, 1840–1940 (percent of all patents). Source: U.S. Patent Office Reports, 1840–1940. Notes: Inventions are considered to be safety related if the patent specification includes two or more appearances of variations of the word "safe." Changing the frequency affects levels, but does not substantively affect the patterns.

safety-related innovations were primarily responding to the market rather than to regulation. In particular, Interstate Commerce Commission oversight of the railroads from 1887 and the introduction of federal railroad safety legislation in 1893 do not seem to be associated with spurts in railroad safety patents when compared to safety patents in general. These data bear out the conclusions of researchers who find little impact of regulation on the adoption of such devices as air brakes and automatic couplers. When government intervention succeeded in generating the development of automatic train controls, the innovation proved to be ineffective on both technical and cost bases. The patent data suggest that we should not underestimate market incentives for enterprises to invest in safety and to self-regulate. Railroads were not opposed to safety-related legislation, but they rejected provisions mandating specific devices that might be incompatible with other forms of equipment and might become obsolete quickly.

A number of scholars view legal tort doctrines as presumptively biased against workers and favorable toward employers and enterprises. Such a claim is not entirely supported by economic analysis or the preponderance of evidence. The common law for unintended torts adhered to four rules in deciding liability: industry norms, the fellow servant rule, contributory negligence, and the assumption of risk. The judiciary held enterprises to a standard of care that comprised the norm for the industry and only punished deviations away from the norm. The industry norm criterion, by relying on established community standards, economized on information gathering by the judiciary. The fellow servant rule was first upheld in a railroad case in 1842, which absolved the railroad from liability due to contributory negligence on the part of another employee.[22] A rule of contributory negligence created incentives for workers to monitor each other. This made sense in contexts such as railroad operations in which workers were mobile and had a great deal of discretion: first, many injuries occurred because workers acted without due care; and second, monitoring and enforcement costs for employers were high. Railroads that tried to introduce rules to alter hazardous but convenient habits encountered resistance from workers. After the Civil War several state legislatures limited the use of the fellow servant rule in railroad accidents, and in 1908 the Federal Employers' Liability Act abolished it entirely.

The assumption of risk rule involves the idea that rational individuals will weigh the costs and benefits of their actions, so an employee will engage in a risky activity only if he is compensated for the expected harm either through insurance or through a higher wage premium. Thus, economic analysis supports the nineteenth-century policy that, as long as the employer was not negligent or deficient in safety standards, there was little need for judicial intervention when employees in risky jobs were injured in the normal course of employment. However, it should be noted that this approach depends on the assumption that workers have many alternatives from which to choose and that wages will adjust to reflect a risk premium. The empirical evidence

[22] *Farwell v. Boston & W. R. R. Corp.*, 45 Mass. 49 (1842). Liability rules give incentives for precautionary behavior and also have implications for informational and administrative costs: negligence rules give both parties incentives for efficient precaution, but have higher informational and administrative costs; whereas, a rule of strict liability toward enterprises minimizes transactions costs, but creates little incentive for victims to invest in precaution. If firms are held strictly liable and consumer demand is not very responsive to price changes, firms can increase prices, implying that the cost of injuries will be borne by consumers in general. If consumer demand is responsive to price changes, shareholders in the firm will bear the costs of injuries in the form of lower net earnings, and the firm will tend to overinvest in resources to reduce harm.

on this point is hard to assess because of data inadequacies, but suggests that wages were indeed higher to compensate for risk, although workers were not perfectly compensated for risk-bearing. Moreover, workers who chose to engage in risky activities may have had few alternative opportunities. However, we can further examine the extent to which variation of standards comported with economic logic in the case of passengers and freight.

Although employees might be held to have assumed the risk inherent in railroad or other industrial occupations, this was not true of passengers. Hence, railroads were held to higher standards of care for passengers than for employees, and if a passenger was injured, the burden of proof was on the railroad to show why it should not be held liable. The argument has been made that judges protected passenger safety and the interests of the propertied class above those of the railroads, and it may be expected that, even if this were not so, juries would be more inclined to favor passenger plaintiffs over corporate defendants. In the case of goods to be transported, once the items were conveyed to the train they were completely within the control of the shipper; hence, railroads were strictly liable for freight. Slave passengers could not be viewed in the same liability context as freight, for the "carrier cannot, consistent with humanity and regard to the life and health of the slave, have the same absolute control over an intelligent being endowed with feelings and volition, that he has over property placed in his custody."[23] In short, the legal records do not support the notion that the judiciary was biased in favor of any single party and instead suggest a genuine attempt to generate outcomes that were equitable in every sense of the term.

Improvements in transportation and communications created a national market in which state laws were increasingly discordant and discriminatory. These questions were faced on waterways, when federal admiralty laws were applied to steamships engaged in interstate commerce, but Figures 15.2 and 15.3 highlight the role of railroad litigation in providing the impetus toward federalization.

Some states refused to honor charters of "foreign railroads" that were granted in other jurisdictions; others tried to add to their coffers by taxing interim transactions or imposing restrictions on rates and operations, even though the final destination was in another state. As the figures indicate, the disproportionate appeal to federal courts relative to state courts comprised an integral part of the policies of the railroad companies well into the twentieth century. Their victories in the Supreme Court changed the interpretation of the Constitution, in particular the Commerce Clause, the

[23] *Wilson v. Hamilton*, 4 Ohio St. 722 (1855), discussing *Boyce v. Anderson*, 2 Pet. R. 150 (1829).

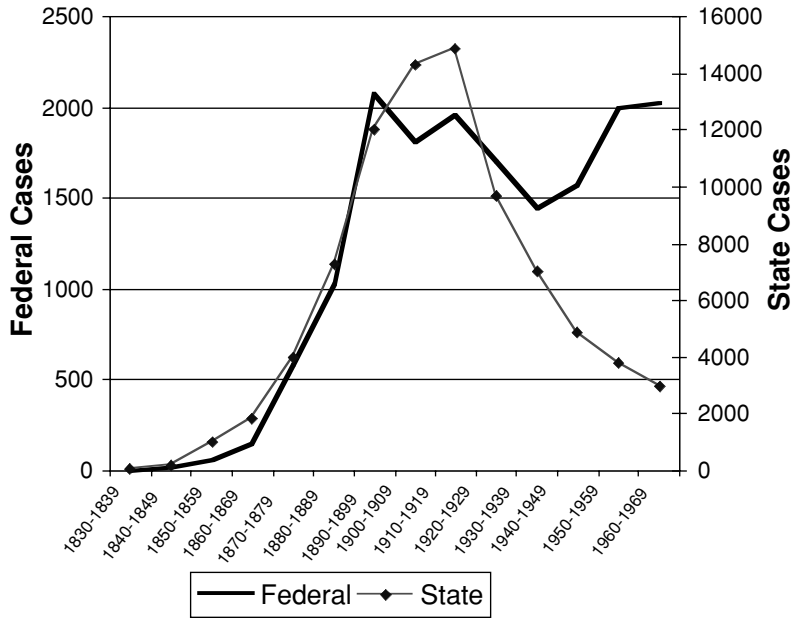

FIGURE 15.2. Railroads: State and Federal Litigation, 1830–1970. Source: LexisNexis database of state and federal reported cases.

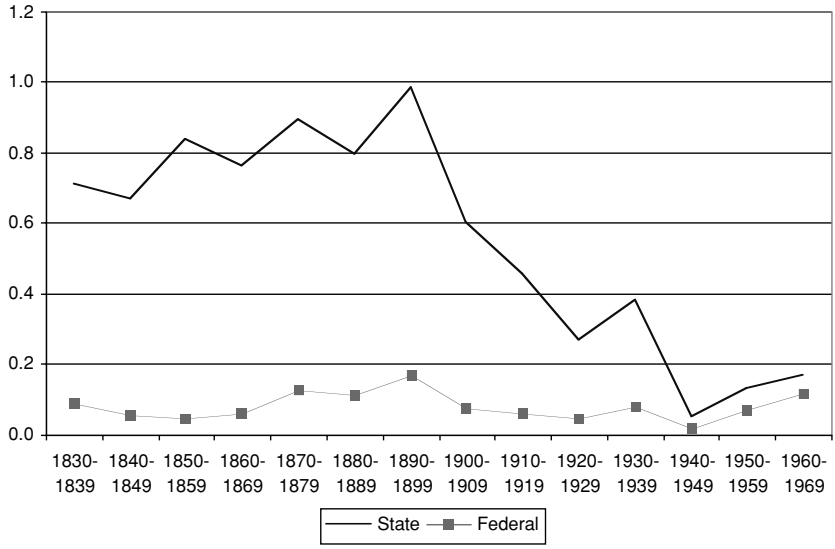

FIGURE 15.3. Railroads: State and Federal Lawsuits Relative to Usage, 1830–1970 (per million miles traveled). Notes and Sources: Usage reflects millions of passenger miles traveled, from the *Historical Statistics of the United States*, series Q274–312.

prohibition of lawsuits against state governments in the Eleventh Amendment, and the Due Process Clause of the Fourteenth Amendment. Railroad companies ultimately succeeded in obtaining legal recognition that the public interest was not consistent with constraints on market expansion that benefited narrowly partisan local interests.

This recognition did not occur instantaneously, but through a long process of appeals. Railroads questioned state regulation of rates in the Granger cases of 1877, but were defeated. The judiciary hesitated to apply the Due Process Clause of the Fourteenth Amendment and conceded the right of the states to regulate rates for undertakings that affected the public interest. However, in the *California Railroad Tax Cases* of 1882, the court agreed that a local tax violated the railroad's due process rights and further was inconsistent with the equal protection provision because the railroad was taxed differently from other enterprises.[24] In 1890, the U.S. Supreme Court ultimately upheld the view that state policy regarding rates was within the jurisdiction of the courts under the "substantive due process" clause of the Constitution. In the 1890s 41 federal cases involved questions of due process that were raised in connection with the railroads; the following decade there were 87, and by the 1920s the number had increased to 449 cases. These decisions enabled the federal judiciary to overrule state policies and allowed them to support private property rights that the state actions would have constrained. Although the Supreme Court abandoned the use of substantive due process to protect private property in the 1930s, the concept endured in other contexts, especially in the struggle to promote civil liberties. The railroads won a second victory with similar long-term implications, this time with respect to interpretations of the Eleventh Amendment that barred federal lawsuits against the states or state officials. In *Ex Parte Young* (1908), the Supreme Court ruled that federal courts could prevent state officials from enforcing policies that conflicted with the Fourteenth Amendment. The decision would have lasting implications for the movement to end racial segregation in schools.[25]

Several other significant legal doctrines were influenced by the public interest nature of the railroads, most noticeably in bankruptcy and reorganization. Federal bankruptcy legislation was intermittent and largely unenforced for much of the nineteenth century until the passage of the National Bankruptcy Law of 1898. State rulings initially followed the English bias toward the rights of creditors, who were generally allowed to levy against and sell distressed property on a first-comer basis. This created perverse incentives for creditors to race to force the firm into bankruptcy even when the corporation might be viable in the long run. Clearly, sectional interests

[24] *Railroad Tax Cases*, 13 F. 722 (1882).
[25] *Ex parte Young*, 209 U.S. 123 (1908).

were not necessarily mutually consistent or appropriate for dealing with interstate enterprises like railroads. The result was a legislative vacuum that became especially problematic during the panic of 1873 when almost a fifth of railroad operations failed. Federal courts were reluctant to grant individual creditors the right to dissolve national corporations at the cost of losing the public benefits of a functioning interstate railroad. Instead, court-appointed receivers kept the railway operating during bankruptcy while the firm was reorganized and financially restructured. Strikes were not tolerated while the railroad was under receivership, and lawsuits could not be brought against receivers during restructuring, although equity courts tried to ensure that existing management did not unduly skew outcomes in their own favor. This gradual shifting of bias toward the rights of debtors was consolidated in the 1898 federal legislation that was enacted after the great depression of 1893. However, railroads themselves were not covered by federal bankruptcy statutes until 1933, when equity receiverships became redundant.

The process of railroad consolidation accelerated after the Civil War and at the same time exacerbated the tensions between state and federal oversight of commerce. As discussed above, railroads appealed to federal courts to mediate, but the figures indicate that the major forces acting on railroad concerns remained at the state level until the end of the century. In 1887 the Federal Interstate Commerce Act superseded many elements of state policies, as did several other federal acts up to passage of the Transportation Act of 1920. At this point, federal regulation influenced content, access, ownership, safety, pricing, consolidations, and operations, not only in the railroad industry but also in other key enterprises, such as electric utilities and the telephone. Despite the rhetoric that accompanied the introduction of federal regulatory commissions, it is worth repeating that regulation had a long common law tradition vested in court rulings toward natural monopolies and other enterprises that involved the public interest. Moreover, judicial oversight was not made redundant by the advent of regulation; instead, regulatory enforcement depended heavily on court decisions. Although much of the historical focus has been on state and federal regulation, we should also speculate about the incentives for firms to self-regulate. Indeed, some have argued that federal regulation was instigated by railroads and electric utilities as a means of reducing competition.

Telegraphy

The telegraph, although not quite a "Victorian Internet," emerged in the 1840s as the first commercially viable means of interstate electronic communication. Telegraphy diffused so rapidly that by 1851 the Bureau of the

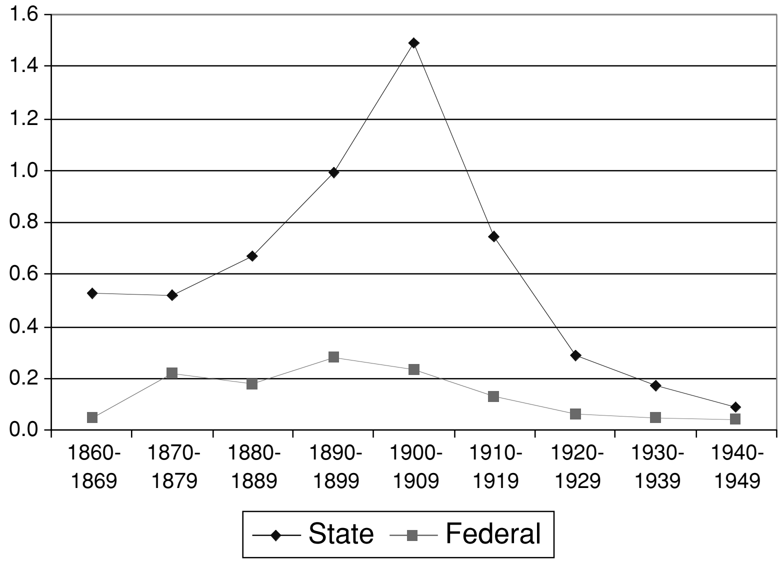

FIGURE 15.4. Telegraph: State and Federal Lawsuits Relative to Usage, 1860–1950. Notes and Sources: Lexis-Nexis state and federal lawsuits. Usage data (millions of messages sent) are from *Historical Statistics of the United States*, series R46–70.

Census reported that 75 companies with more than 20,000 miles of wire were in operation. These small-scale enterprises proved to be inefficient, and a series of consolidations and exits ultimately resulted in the domination of Western Union. In 1870 Western Union alone operated almost 4,000 offices and handled more than 9 million messages. By 1890, its 19,382 offices were dealing with approximately 56 million messages. Diffusion of this form of communication was impressive, but like the twenty-first-century Internet, the applications were predominantly among businesses rather than consumers. Perhaps as a result of this business orientation, the law did not draw an analogy to newspapers or other print media, nor did it raise First Amendment questions about freedom of speech. Instead, the courts and legislature stressed a comparison with postal roads, turnpikes, and railways. The Post Roads Act of 1866 designated telegraph companies as common carriers who were granted privileges including rights of way on public lands and waterways, access to free timber and resources, and recourse to eminent domain. In return, the telegraphs assumed the public interest duties of common carriers analogous to the transportation enterprises.

As the pattern in Figure 15.4 suggests, several common legal issues affected transportation and communications technologies. The Supreme

Judicial Court of Massachusetts argued that, while the telegraph was undoubtedly a valuable means of communication, "Its use is certainly similar to, if not identical with, that public use of transmitting information for which the highway was originally taken, even if the means adopted are quite different from the post-boy or the mail coach. It is a newly discovered method of exercising the old public easement, and all appropriate methods must have been deemed to have been paid for when the road was laid out."[26] It was fortunate for telegraph companies that courts supported the idea that the previously granted rights of use also extended to the newer technology: "If this were not true . . . the advancement of commerce, and the increase in inventions for the aid of mankind would be required to adjust themselves to the conditions existing at the time of the dedication, and with reference to the uses then actually contemplated."[27] An atypical award of $2,500 in damages given for use of a narrow plot of land illustrates the high costs that would have resulted if owners of the telegraph lines had had to contract new bargains with holders of public easements. In states that rejected such analogies, including California, Illinois, Maryland, Mississippi, and Missouri, property owners were able to sustain costly injunctions and compensation for trespass or reductions in the value of their land.

A second consequence was that the most significant doctrines in telegraph cases related to the duties of common carriers. English legal decisions dating back to the Middle Ages raised questions of a duty to serve the public and to charge just rates in so doing, especially in the case of monopolies. According to the Supreme Court of California in 1859,

> The rules of law which govern the liability of telegraph companies are not new. They are old rules applied to new circumstances. Such companies hold themselves out to the public as engaged in a particular branch of business, in which the interests of the public are deeply concerned. They propose to do a certain service for a given price. There is no difference in the general nature of the legal obligation of the contract between carrying a message along a wire and carrying goods or a package along a route. The physical agency may be different, but the essential nature of the contract is the same.[28]

As common carriers telegraph companies were not held vicariously liable for criminal transactions and in some cases were not permitted to refuse messages even if the sender was engaged in suspected illegal transactions.

Telegraph companies that accepted the designation of common carrier and its benefits were obligated to charge reasonable, non-discriminatory rates. This stipulation allowed judicial oversight over competition policy

[26] *Pierce v. Drew*, 136 Mass. 75 (1883). [27] *Magee v. Overshiner*, 150 Ind. 127 (1898).
[28] *Parks v. Alta California Tel. Co.*, 13 Cal. 422 (1859).

well before the antitrust statutes were enacted. Courts adopted an economic definition of discrimination, rejecting charges of anti-competitive behavior if the differences in price were justified in terms of difference in costs. For instance, in *Western Union Tel. Co. v. Call Publishing Co.* (1895), the court held that the telegraph company had not engaged in "unjust discrimination" because it faced different circumstances and costs in meeting the needs of a morning newspaper relative to an evening newspaper, which explained the differential tariffs charged.[29] However, courts varied in their support for quantity discounts, some arguing that this pricing policy suppressed competition and encouraged the creation of monopolies.

The established telegraph law for much of the nineteenth century accepted the common carrier analogy, but quite early on some noticed that the comparison was somewhat strained. The common carrier designation had an important implication for the telegraph company because it implied assumption of liability for the "goods carried." Railroads as common carriers were strictly liable for freight entrusted to their care and thus could be viewed as insurers of goods consignments. Under this doctrine, the liability of telegraph companies for their messages could be enormous, since an error in the transmission of a buy or sell order could amount to many thousands of dollars. At the same time, unlike the value of consignments on railroads or turnpikes, clearly the intrinsic value to the telegraph company of any message was significantly lower than its value to the sender and receiver of the message. To insure against mistakes, the telegraph company required that the message should be repeated at a cost of half the regular rate or else liability was limited to the cost of the transmission. The courts were confronted with disputes that challenged the right of companies to limit their liability in this way, since common carriers were supposed to assume that risk themselves. The stakes increased when businesses began to use abstruse codes or ciphers to protect their confidentiality and to reduce the cost of sending lengthy messages. Cotton exporters who wished to convey the message, "We make firm bid two hundred bales of fully middling cotton at 43–4d twenty-eight millimeters, January and February delivery, shipment to Havre" instead required Western Union to send the words "Holminop, New Orleans, Galeistraf, dipnoi, Granzoso, Liebsesin Dipnoi liciatorum, diomus, grapholite, Gradatos and Texas." In another case, the telegraph operator transmitted the word "chatter" rather than the "charter" of the ciphered message, and the difference between the letter "r" and the letter "t" cost the sender about $1,000, leading to an action against the telegraph company for $1,054 in damages.

[29] *Western Union Tel. Co. v. Call Publishing Co.*, 44 Neb. 326 (1895).

In response, the analogy to common carriers was ultimately rejected. The Supreme Court in the landmark decision, *Primrose v. Western Union* (1894), ruled, "Telegraph companies resemble railroad companies and other common carriers. . . . *But they are not common carriers*; their duties are different, and are performed in different ways; and they are not subject to the same liabilities."[30] Instead of common carriers, some courts treated telegraph messages as bailments. Bailees were not expected to act as insurers, but only to hold to reasonable standards of diligence in completing their task, with damages generally limited to the price of their services. Certainly, in the case of coded messages, it was impossible for the telegraph company to determine the relative importance of the communication and to regulate the amount of care it took accordingly. Western Union was justified in charging higher rates for important messages by requiring that they should be repeated, since "it does not exempt the company from responsibility, but only fixes the price of that responsibility, and allows the person who sends the message either to transmit it at his own risk at the usual price, or by paying in addition thereto half the usual price to have it repeated, and thus render the company liable for any mistake that may occur."[31] This was simply the liability standard that had been set in the classic 1854 English case of *Hadley v. Baxendale*, but its application to the telegraph industry was delayed because of the common carrier analogy.

The advent of the telegraph introduced several other interesting questions in the area of contract law. Previous methods of communication had depended on physical delivery through the postal service, whereas telegraph transmissions could be received within minutes. Time was therefore introduced as an important part of a contract conveyed by telegraph, and charges of negligence were related to slight delays or errors in transmission. Other cases determined that a telegraph message could be regarded as a valid form of contract even if it was not signed in handwriting by both parties. As the California Supreme Court expressed it in 1900, "Any other conclusion than the one here reached would certainly impair the usefulness of modern appliances to modern business, tend to hamper trade, and increase the expense thereof."[32] The development of international cable services further increased market efficiency and the ability to monitor agents engaged in distant transactions. At least one outcome of this was to reduce the autonomy of agents at sea, for the first time constraining their ability while at sea to enter into contracts that would bind the owners of the ship without the owners' previous consent.

[30] *Primrose v. Western Union*, 154 U.S. 1 (1894), my emphasis.
[31] *Camp v. Western Union Tel. Co.*, 58 Ky. 164 (1858).
[32] *Brewer v. Horst & Lachmund Co.*, 127 Cal. 643 (1900).

As with other technologies, conflicts arose because of nuisance and trespass, including claims that electrolysis destroyed water pipes and that the high-voltage electric lines of urban tramcars interfered with telegraph and telephone transmissions. Again, courts avoided assigning fault and instead tried to determine the lowest cost avoider, given the existing state of the arts. The opinion in an 1890 lawsuit between a telephone company and an electric railway effectively described the role of technological advances in determining the standards of liability:

In solving these questions, we are compelled to bear in mind the fact that the science of electricity is still in its experimental stage; that a device which to-day may be the best, cheapest, and most practicable, may, in another year, be superseded by something incomparably better fitted for the purpose. It is quite possible, too, that the legal obligations of the parties may change with the progress of invention, and the duty of surmounting the difficulty be thrown upon one party or the other, as a cheaper or more effectual remedy is discovered. . . . the question of his liability will depend upon the fact whether he has made use of the means which, in the progress of science and improvement, have been shown by experience to be the best; but he is not bound to experiment with recent inventions, not generally known, or to adopt expensive devices, when it lies in the power of the person injured to make use himself of an effective and inexpensive method of prevention.[33]

Public Health and Medical Technologies

Legal doctrines about public health and medicine drew on metaphors that echoed policies toward transportation and communications technologies. Advances in steamboats, railroads, and the telegraph and telephone were presented as the natural object of public policy because they were integral to broad-based economic and social growth. Numerous other innovations such as the water closest or faucets were extolled with less rhetorical flair, but could be interpreted as no less significant to social welfare and thus fell within the proper scope for state law and judicial intervention. Innovations that affected the quality and length of life fell into this category, including those that improved hygiene, sanitation, pollution, and medical techniques and devices. Medical and health issues in particular were at the forefront of contentious legal decisions that related to private disputes and public laws.

In the early nineteenth century it is likely that cures were regarded, as one judge put it, as "in the hands of Him who giveth life, and not within the physical control of the most skillful of the profession."[34] Doctors tended to be trained informally, were unattached to medical networks or hospitals,

[33] *Cumberland Telephone and Telegraph Co. v. United Electric R'y Co.*, 42 F. 273 (1890).
[34] *Grindle v. Rush*, 7 OHIO 123 (1836).

and were accorded little respect. Another judge was reported to have said that, "if there was any kind of testimony not only of no value, but even worse than that, it was, in his judgment, that of medical experts."[35] By the 1890s, however, medicine was regarded as an eminent calling, doctors had acquired significant authority, and even general practitioners appealed to current findings in both science and technology. Health care had become specialized and organized within institutions, and the laboratory comprised an important unit in hospitals as well as for doctors in private practice. The industrialization of medicine occurred partly because of technological advances that provided doctors with a formidable array of new diagnostic tools. By the end of the nineteenth century these included the stethoscope, ophthalmoscope, laryngoscope, microscope, X-ray machine, spirometer, neurocalometer, blood pressure gauge and electrocardiograph. Medical instruments facilitated tests and treatment for notorious diseases like tuberculosis, typhoid, cholera, and diabetes and encouraged the professionalization of nascent specialties such as chiropractic.

Medical malpractice suits became more prevalent relative to population during the period of early industrialization because of shifts in demand and supply factors. Technological innovation affected medical malpractice through its impact on both the demand side and the supply side. The demand for legal redress was partly related to social expectations that were raised by the achievements attained in medical technology and by the diffusion of such knowledge among lay persons. The supply of disputes likely increased because more doctors were available to offer second (and different) opinions and alternative services and because of the rapid adoption and more extensive usage of medical devices. Impersonal mechanical diagnoses and laboratory tests quickly became the gauge of effective treatment, regardless of their actual efficacy. To observers from other countries, American medicine had ironically lost sight of the patient in its obsession with technological advances. This assessment was complicated by the desire of patients themselves for more technological inputs in their medical care regardless of their proven efficacy, so that the battery of tests that comprised the physical check-up became an annual routine early in the twentieth century.

Technological innovations in the field of medicine had varying effects on the propensity to litigate. It was true that they could facilitate more accurate diagnoses and improve the treatment of patients, but it was also possible that innovations led to more uniform standards of treatment that made defective practices more measurable and manifest. It might be expected that some doctors would be accused of malpractice because they were less proficient with new devices or less up-to-date and that current technologies

[35] Supreme Court of Illinois, *Rutherford v. Morris*, 77 Ill. 397 (1875).

might lead to unrealistic expectations. The application of X-rays in medical litigation illustrates the role of new technologies in such disputes. Wilhem Conrad Roentgen first published his discovery of "a new kind of ray" at the end of 1895 in the *Proceedings of the Würzburg Phisico-Medical Society*. Only a few months later the use of X-rays was introduced in the United States and related patents were filed, but ordinary citizens were also captivated by the discovery. Doctors who failed to use the machines, despite the dangers of burns to patients, risked being accused of incompetence and a violation of their fiduciary duty. Less than two years after the invention was introduced, a Midwestern jury was instructed to draw conclusions from X-ray photographs that were entered into the records. Patients retained the services of expert witnesses who used X-ray evidence to prove their case, and doctors countered with their own proofs.

As with other technologies, the law varied its standard of what was acceptable according to current understandings of proper medical care. The courts considered malpractice as a physician's breach of the fiduciary duty to offer competent services through negligence, ignorance, or lack of due care. The physician was initially held to a standard of competence that took into consideration the type of community in which he practiced. In 1824 a dispute in the remote village of Lubec, Maine, involved a patient whose local doctor had allegedly botched treatment of a dislocated joint. The judge felt that it was not to be expected that a doctor in a small rural town would possess the same degree of skill as a European-trained specialist in Boston. Later courts argued that doctors should be held to a nationally accepted standard because improvements in transportation and communications had created a national market, with equality of access to information. Despite this, the locality standard proved to be enduring and was still the norm even in the early twentieth century.

The endogeneity of legal doctrines to technological changes was evident in cases that dealt with medical malpractice, but the converse was also true – that is, medical practice changed according to what was legally acceptable – as witnessed by rules about abortion. In 1849, the Supreme Court of New Jersey outlined the development of the law toward abortions and pointed out that legal precedent uniformly was in agreement that it was acceptable to procure an abortion before the point of "quickening" in the pregnancy. The opinion quoted Blackstone's view that "life begins in contemplation of law as soon as an infant is able to stir in the mother's womb."[36] Even after quickening the removal of the unborn child was deemed to be a misdemeanor rather than murder. In the decades after the Civil War abortion at any stage was outlawed by statute throughout the country and criminalized

[36] *State v. Cooper*, 22 N.J.L. 52 (1849).

as a felony. However, in several states an abortion was still held to be acceptable at any point in the pregnancy if there were valid medical reasons for the procedure to save the mother's life or to prevent serious bodily injury. Thus, the legality of each abortion depended heavily on the interpretation and state of medical knowledge regarding its alleged therapeutic necessity, itself a function of current diagnostic technology.[37]

Public health likewise had long been considered a legitimate concern of the state. From the earliest years of settlement, local governments regulated the provision of food and sanitation, enacted laws to prevent nuisances, and called on formidable police powers to deal with perceived dangers to community welfare. Measures to counter infectious diseases could lead to especially draconian measures, including lengthy quarantines, forcible entry and the seizure or destruction of private property, criminal prosecution, and imprisonment. In 1796 Congress pledged federal support for state measures to ensure effective quarantines. In 1809 Massachusetts introduced the first law to require vaccination against smallpox. In an age of widespread danger of epidemics, many towns used funds from their treasury to pay for preventative measures. For instance, in 1828 the Connecticut town of Salisbury paid $50 to local physicians to inoculate its residents with the cowpox bacillus. Similarly, the Philadelphia City Council in 1798 commissioned the eminent engineer Benjamin Henry Latrobe to design a public water system, to counter fears that contaminated water was responsible for outbreaks of yellow fever. The owners of targets of quarantine – ranging from merchant ships to tenements – were just as likely, however, to find themselves forced to underwrite the expenses.

Public health policy in the nineteenth century was closely aligned with sanitation technology and engineering. The police power of the state to ensure the health and safety of the public was used to enforce the provision of running water and the use of water closets in private properties. These measures led to protests, such as occurred when the City of New York passed an act in 1887 that required tenement houses to provide running water on all floors because of health and safety reasons. The owners of one such tenement (oddly enough, a church) claimed that the costs of installing such facilities were so high as to constitute a taking of private property. And indeed, estimates suggested that the cost of improved sanitation and fittings in homes increased the cost of house construction by $15,000 in the period between 1850 and 1900. The takings argument was rejected by the appellate court, which pointed out that "hand rails to stairs, hoisting

[37] In 1899, medical justifications for abortion included Bright's disease of the kidney, cancer of the womb, and malformation of the pelvis, among others See *Wells v. New England Matrial Life*, 191 Pa. 207 (1899).

shafts to be inclosed, automatic doors to elevators, automatic shifters for throwing off belts or pulleys, and fire escapes on the outside of certain factories. . . . Under the police power persons and property are subjected to all kinds of restraints and burdens in order to secure the general comfort and health of the public."[38]

The U.S. Supreme Court tended to support state health officials acting in the public interest to the extent that it was argued that the state did not have to provide evidence to justify its public health policies as long as they were in accordance with "common beliefs." The dangers of such unfettered powers were illustrated in the eugenics movement that developed toward the end of the nineteenth century. At that time genetic science, studies of evolutionary biology and heredity, and biostatistics and sociology combined to reach the conclusion that the genetic composition of the population should be regulated by statute. These supposedly scientific rationales provided an impetus for policies that ranged from restrictive immigration laws to the forced sterilization of individuals with allegedly undesirable genetic characteristics. In 1896 Connecticut restricted the ability of epileptics and mentally disabled persons to marry, and similar laws were enacted in more than twenty states, including Kansas, New Jersey, Ohio, Michigan, and Indiana. In New York, *In Re Thomson* (1918) examined the constitutionality of a 1912 law passed to permit the sterilization of mentally disabled adults in its institutions. The court ruled that the statute violated the Equal Protection Clause of Fourteenth Amendment, noting that a similar law had been declared unconstitutional by the Supreme Court of New Jersey. Although a number of state judges joined in restricting or overturning such laws, the U.S. Supreme Court affirmed these policies on the grounds of public interest. Advances in medical technology meant that sterilization could be effected readily and safely in males by vasectomy and in females by salpingectomy, rather than by more drastic invasive measures. The Court's approval of compulsory sterilization drew on the public health analogy of compulsory vaccination, which served the public interest as well as the interest of the parties directly involved irrespective of their individual wishes.[39]

[38] *The Health Department of the City of New York, Appellant, v. The Rector, Church Wardens and Vestrymen of Trinity Church in the City of New York*, 145 N.Y. 32; 39 N.E. 833 (1895).

[39] Oliver Wendell Holmes wrote, "The public welfare may call upon the best citizens for their lives. It would be strange if it could not call upon those who already sap the strength of the state for these lesser sacrifices, often not felt to be such by those concerned, in order to prevent our being swamped with incompetence. It is better for all the world, if instead of waiting to execute degenerate offspring for crime, or to let them starve for their imbecility, society can prevent those who are manifestly unfit from continuing their kind. The principle that sustains compulsory vaccination is broad enough to cover cutting the fallopian tubes. Three generations of imbeciles are enough." Only Justice Butler dissented. *Buck v. Bell*, 274 U.S. 200 (1927).

Automobiles

The automobile for some is the icon of the American way of life. As early as 1917 the United States accounted for 85 percent of the world's motor cars. In 1920 only 1 percent of American homes had central heating, but 26 percent owned automobiles; by 1930 this number had increased to 60 percent. The automobile, to an even greater extent than the railroad or other transportation innovations, changed patterns of work, crime, leisure, and residence. As early as 1906, the author of a legal treatise pointed out that, although "many of the cases merely have called for the application of established rules of law, in dealing with the motor vehicle," it was also true that "many branches of the law are being affected by the horseless carriage figuring in litigation. Where the automobile's permeating influence will stop is beyond prophesy. It is certain, however, that the motor car, including everything connected with it, is bound to be the subject of a vast amount of litigation in the future."[40] By 1931, the same treatise ran to twenty volumes, reflecting the rapid increase in both state and federal litigation.

Although litigation increased markedly, the data indicate that federal courts did not play a major role in the public policies that developed toward motor vehicles. We may speculate whether this would have been the case if the interstate highways had been constructed more rapidly or whether the decentralized nature of motor vehicle ownership necessarily encouraged state governance. The common carrier concept was applied to commercial motor vehicles, but analogies from the era of the railroads proved to be of limited relevance and the doctrine was modified almost beyond recognition. Rate regulation of common carrier motor vehicles was viewed as redundant, because the number of alternative modes of transportation ensured that competition protected the public from exorbitant prices. States established commissions to issue licenses or "certificates of public convenience and necessity" that regulated the numbers of carriers, their routes, modes of operation, and ownership issues, such as whether railroads should be allowed to offer vehicular common carrier service. As with all licensing, an argument can be made that, despite the stated objectives, the end result was to limit competition rather than uphold standards that benefited public safety or convenience.

The case of the automobile illustrates the ambiguities of attitudes toward overt constraints on individual behavior as opposed to regulations that affected enterprises in the name of the public. The dual standard toward regulation was evident in responses to measures to deal with automobile torts, which were far more costly than those associated with railroads or mining. The increased use of motor vehicles was accompanied by a disproportionate

[40] Xenophon P. Huddy, *The Law of Automobiles* (Albany, NY, 1906), vi–vii.

growth in harm: in 1920 automobiles caused some 11,000 deaths (half of whom were children); in 1924 this number more than doubled, over 700,000 injuries were sustained, and property damage was substantial. The fatality rate for automobile accidents rose from below five deaths per million persons in 1906 to seventy-two deaths per million a decade later. Fatalities were highest in urban areas, and in 1920 the largest number of fatalities relative to population occurred in Los Angeles, followed by Buffalo, both of which experienced rates that exceeded 200 per million. New York injury rates in 1920 were approximately 25 times that of fatalities, and Boston alone recorded 21,182 injuries in the same year. The majority of automobile accidents were caused by human error rather than mechanical flaws, and terms such as "speed maniac" or "road hog" had already entered the public lexicon at the turn of the century.

Public policy was again required to mediate among competing claims. Efforts included the passage of legislation to provide rules and regulate behavior, appeal to the courts, and enable third-party means of compensating those who were harmed. Safety measures that regulated behavior – drivers' tests and licenses, vehicle registration, age limits, and traffic regulations – were introduced in a slow and haphazard fashion. In the 1920s and 1930s states imposed an inconsistent jumble of regulations on driver behavior, but enforcement was lax and such legislation was not at the forefront of policies toward automobiles. Instead, the state courts were rapidly clogged with disputes brought by victims of "jitneys," taxicabs, trucks, and privately operated vehicles.

As in all tort cases, the issues centered on liability and on compensation. When conflicts appeared between existing and former technologies, judges refused to assign unilateral blame and instead ensured that the lowest cost outcome prevailed. For instance, more than 900 lawsuits dealt with the harm caused by horses frightened by cars. In *Macomber v. Nichols* (1876), the judge declared, "Persons making use of horses as the means of travel or traffic by the highways have no rights therein superior to those who make use of the ways in other modes. . . . Horses may be, and often are, frightened by locomotives in both town and country, but it would be as reasonable to treat the horse as a public nuisance from his tendency to shy and be frightened by unaccustomed objects, as to regard the locomotive as a public nuisance from its tendency to frighten the horse."[41] The standard of the time required the driver of the car to defer to horses, since the latter were more common. When automobiles became the norm, however, the standard shifted to reflect that fact.

A significant legal development occurred when courts overturned the privity of contract doctrine to take into account the circumstances of

[41] *Macomber v. Nichols*, 34 Mich. 212 (1876).

automobile manufacture and the complexity of the vehicle structure. Before 1906 there were no cases involving manufacturer's liability except when the item was held to be inherently dangerous: "The general rule is that a contractor, manufacturer, vendor or furnisher of an article is not liable to third parties who have no contractual relations with him for negligence in the construction, manufacture or sale of such article."[42] In *Johnson v. Cadillac Motor Co.*, the plaintiff was seriously injured by a defective tire on his automobile, which had been sold by a retail dealer. The court held that no contractual relationship existed between the driver and the manufacturer and dismissed the complaint. Judge Coxe, in his dissent from this decision, implied that the buyer of complicated new mechanisms of new technologies could not readily judge their safety as well as the manufacturer:

> The principles of law invoked by the defendant had their origin many years ago, when such a delicately organized machine as the modern automobile was unknown. Rules applicable to stagecoaches and farm implements become archaic, when applied to a machine which is capable of running with safety at the rate of 50 miles an hour. I think the law as it exists to-day makes the manufacturer liable if he sells such a machine under a direct or implied warranty that he has made, or thoroughly inspected, every part of the machine, and it goes to pieces because of rotten material in one of its most vital parts, which the manufacturer never examined or tested in any way. If, however, the law be insufficient to provide a remedy for such negligence, it is time that the law should be changed. "New occasions teach new duties"; situations never dreamed of 20 years ago are now of almost daily occurrence.[43]

Coxe's argument was similar to the decision in *MacPherson v. Buick Motor Co.* (1916), which stated that a manufacturer had a duty of care even to third parties who were not directly involved in contractual relations with the firm. Cardozo rejected the privity of contract defense because the standard approach had to change with the times:

> The maker of this car supplied it for the use of purchasers from the dealer. . . . The dealer was indeed the one person of whom it might be said with some approach to certainty that by him the car would not be used. Yet the defendant would have us say that he was the one person whom it was under a legal duty to protect. The law does not lead us to so inconsequent a conclusion. Precedents drawn from the days of travel by stagecoach do not fit the conditions of travel to-day. The principle that the danger must be imminent does not change, but the things subject to the principle do change. They are whatever the needs of life in a developing civilization require them to be.

[42] *MacPherson v. Buick Motor Co.*, 217 N.Y. 382 (1916).
[43] *Johnson v. Cadillac Motor Car Co.*, 261 F. 878 (1919).

The point was affirmed by the appellate court in Johnson. Drawing on a shaky analogy to a principle that had always been accepted by the common law, the court likened the automobile manufacturer to a producer of poisonous drugs or "imminently dangerous articles" who had a duty of care to the public. However, Cardozo correctly highlighted the extent to which harm could be foreseen: "foresight of the consequences involves the creation of a duty."

Predictability of outcomes was also emphasized in *Chittenden v. Columbus* (1904).[44] When the court imposed a fine of $25 on a motorist who was exceeding the town speed limit of seven miles per hour, the plaintiff protested that the law illegally discriminated against automobiles, since street cars were allowed to go faster. The court disagreed because, unlike automobiles, streetcars ran on set tracks and could thus be avoided more easily by others. If injury could be foreseen, efficiency required that the law offer incentives to avoid such harm by placing liability on those who could avoid it at lowest cost. As Coxe had presciently pointed out, the automobile was such a complicated mechanism it was unlikely that the ordinary driver could detect a structural deficiency, whereas it was readily within the capability of manufacturers to test each part and ensure that it was safe. A corollary of this doctrine was that the federal courts later upheld General Motors' right to stipulate that their dealers should use only GM replacement parts: exclusive contracts of this sort did not lessen competition but ensured quality control, since any defects would have adverse effects on the company's reputation and liability.

Automobiles influenced the rise of enterprise liability and led to legal doctrines that absolved users from responsibility for their actions on the grounds that technology had outpaced their understanding. However, the majority of automobile accidents did not occur because of tortious actions by enterprises, but involved harms caused by negligence on the part of drivers or pedestrians. Several legal innovations were a response to the falling prices for the new technology, which encouraged its diffusion throughout the population. The first automobile owners were wealthy individuals who were likely to hire chauffeurs, which led to legal questions of agency that could be subsumed in the existing law of master and servant. The law of agency had to be modified when the price of cars fell to the point at which ordinary families could afford to purchase vehicles that they drove themselves. The family agency doctrine took into account the likelihood that other family members would be just as likely to drive the car as the owner, and courts held the owner (generally the father) vicariously liable for the actions of the rest of the family. This holding encouraged the owner

[44] *Chittenden v. Columbus*, 5 Ohio C. C. 84 (1904).

of the vehicle to monitor and regulate the actions of family members to ensure that their behavior was consistent with safe use.

Another result of automobile ownership by ordinary families was that insurance comprised an important public policy issue. Plaintiffs, even if successful in obtaining a judgment for damages, were often unable to collect their dues because the impecunious automobile owner had purchased the vehicle on an installment plan and was financially unable to pay. Early insurance companies lacked information to compute and rate risks effectively, so the majority chose to avoid universal coverage and limited their policies to specific contingencies such as theft or fire. The problems for insurance writers, worried that mistaken assumptions about risks would lead to payouts exceeding their revenues, were compounded by inconsistent state and municipal regulations. In some states, insurance liability only applied to commercial vehicles or major urban centers, and some cities like Los Angeles and Cleveland passed local ordinances independently of state laws. Safety advocates turned to the analogy of workers' compensation to lobby for state-sponsored automobile insurance or regulation of the insurance industry. After 1910 the National Workmen's Compensation Service Bureau computed rates for liability and property damage insurance for automobiles. However, lobbyists for state-sponsored insurance plans along the lines of workers' compensation failed to achieve their objectives, and states continued to vary in their treatment of insurance. The major public policy toward automobile torts remains that of third-party insurance or compensation for harm done, rather than incentives for self-insurance or limitations on use.

CONCLUSION

We live in interesting times; but so did the population of the nineteenth and early twentieth centuries. The elevation in standards of living during this period was associated with the rapid diffusion of inventions that transformed the daily lives of ordinary citizens. Technological change was not uniformly benevolent, and it is appalling to modern observers to assess the costs in terms of injuries, mortality, morbidity, and environmental damage. Innovations also had redistributive effects, such as interference with existing water rights, the fall in returns to railroad stockholders when automotive vehicles substituted for passenger and freight transportation, or even the increased benefits to personal beauty that resulted from the rise of service-oriented occupations. The incentives to invent and innovate were influenced by the rules and standards of social and economic exchange, and in turn those rules had to accommodate the new technologies: "the great inventions that embodied the power of steam and electricity, the railroad and the

steamship, the telegraph and the telephone, have built up new customs and new law."[45]

Here I have suggested that one of the reasons for the relative success of the United States during the long nineteenth century was its dependence on an array of institutions that proved to be sufficiently flexible to provide incentives for the creation of technological innovations and also the means to manage their use and consequences in the public interest. These institutions included (but clearly were not limited to) the private market, the political process vested in the legislature, administrative regulation, insurance, and the legal system. I have deliberately highlighted the role of the market economy and that of the common law. President Theodore Roosevelt did likewise in his 1908 address to Congress, noting that "for the peaceful progress of our people during the twentieth century we shall owe most to those judges who hold to a twentieth century economic and social philosophy and not to a long outgrown philosophy, which was itself the product of primitive economic conditions." In short, the democratic market orientation of the American legal system played a key role in the advances of this era.

The United States benefited from the talents of the extraordinary cadre of individuals who comprised the judiciary. Courts confronted a continuous stream of disputes that arose as humankind went about the commonplace business of life and from these unpropitious materials created decisions that were based on analogies drawn from historical experience, logic, and the attempt to serve the community in general. An analysis of law reports supports the notion that the judiciary objectively weighed costs and benefits, and ultimately the decisions that prevailed promoted social welfare rather than the interests of any single group. As Benjamin Cardozo expressed it, "the final cause of law is the welfare of society."[46] American judges understood that one of the best means to protect the rights of customers and to constrain the power of corporations was through market competition. The legal system formed a decentralized method of dispute resolution that was continuously calibrated to the changes that affected society, technological or otherwise. This is not to say that every judge was of the caliber of Joseph Story or Benjamin Cardozo, but a system of appeals assured that "the tide rises and falls, but the sands of error crumble."[47]

Regulation, on the other hand, is too often a function of a unique cataclysmic event – a stock market crash, a fire or train collision that results in much loss of life, a single epidemic or terrorist attack, the sinking of a ship – that grips the public imagination and provides the political impetus for

[45] Benjamin N. Cardozo, *The Nature of the Judicial Process* (New Haven, CT, 1921), 62.
[46] *Ibid.*, 66.
[47] *Ibid.*, 177.

policies that might have been appropriate for that event but subsequently are likely to prove to be ineffective guides for future actions or outcomes. Regulation and "protective" legislation typically came about as a result of political interests, rather than economic understanding, and often constituted a veiled attempt at raising barriers to entry or increasing the costs of competitors and of disdained social groups. Regulatory provisions were most effective when they simply codified the historical tendencies of the common law and ultimately depended on enforcement from the federal legal system. Administrative bodies such as the ICC and the FTC at times were headed by legal practitioners: Brandeis is credited (or blamed) for the establishment of the FTC and SEC, and Cooley was the first ICC Commissioner. Rather than substitutes, the legal system was a valuable and necessary complement to state and federal regulatory systems, but their relative importance varied with time and circumstance.

Although the nineteenth century is frequently characterized as the heyday of untethered competition, one can be impressed with the extent to which new technologies were both enabled and constrained by common law holdings to conform to prevailing conceptions of social welfare. The major innovations considered here – the railroad, the telegraph, medical technologies and public health strategies, and the automobile – were regarded as integral to social progress. Because they were vested with a public purpose, private enterprises were conscripted to serve the needs of the community. It is therefore not surprising that judges such as Cardozo saw the ultimate objective of law to be the promotion of "social utility." From this perspective, neither is it surprising that courts ensured the protection of railroad passengers, consumers, children, debtors, and other classes of society at the same time that they were attempting to provide incentives for the growth of private enterprise.

The advent of each new technology created uncertainty about how the law would be interpreted, which analogies would be applied, and what the prevailing standard would be. This uncertainty likely accounts, at least in part, for the increase in the number of lawsuits that initially occurred, even after adjusting for the scale of use. The courts were typically at the forefront of policies toward technology in the nineteenth century and provided a gauge of legislative needs. Legislation encountered the technologies of the day with a lag and tended to follow signals emanating from the conflicts before the courts. Thus, legal decisions, although statute-bound and based on historical experience, were to some extent forward looking. We can only speculate about the subsequent decline in litigation rates that all of the figures exhibit, but the number of litigated disputes likely fell because of learning by all parties involved, greater certainty about standards, the introduction of new legislation that resolved outstanding issues, or in some

instances as a result of a shifting of oversight from the courts to other institutions.

Patents and (to a lesser extent) copyrights were regarded as fundamental to industrial and cultural progress and protected as such at the federal level from the very beginning of nationhood. As a result, interstate markets developed early on with extensive trade in rights and subdivided rights. Inventors were regarded as public benefactors, because (unlike monopolists) they contributed new improvements that expanded the frontiers of production and consumption. Therefore the law was quite unambiguous in its objective of protecting legitimate patent rights in order to provide incentives for inventive activity and diffusion. However, it was necessary for judges in equity jurisdiction to thwart patent owners who attempted to extend their rights beyond their just bounds to obtain monopoly control over the entire industry. Copyright, on the other hand, provided weaker incentives for new expression and risked reducing public access to knowledge. New technologies presented further dilemmas because they increased the scope and duration of copyright protection and had potentially deleterious effects on the public domain. In the attempt to protect public welfare, legal innovations expanded beyond traditional copyright doctrines to non-copyright holdings under unfair competition, trade secrets, and the right to privacy.

In the context of technological innovations, market integration ran up against the constraints of individual state policies that inhibited standardization and increased the costs of transacting. The first national enterprises – the railroads and the telegraph companies – appealed to the federal courts to apply provisions of the Constitution. Had they failed, the consequences would have been harmful not just for big business and market integration, but for the attempts of social reformers who wished to override the political biases of state legislatures in areas as disparate as racial segregation and abortion. While federalism was a prerequisite for market integration, the converse did not necessarily hold, since general market integration did not preclude state oversight, especially for technologies whose use was predominantly local. During the period under review, roads were largely intrastate and unconnected, making long-distance travel prohibitively costly for most purposes. This comprised at least one reason why the law toward automobile users was predominantly state oriented, and relatively few federal questions arose in the courts. Instead, federal policies were mainly directed toward resolving free-rider problems among states by matching state funding to construct interstate highways.

The automobile industry quickly made important contributions to law, economy, and technology. Despite its prominence, few historians have

addressed the legal implications of the automobile, an omission that is all the more noticeable when compared to the attention accorded to other major innovations such as the railroad. Although the transportation function of both railroads and automobiles was the same, few legal analogies were drawn between them. It might be argued that the railroad's significance in legal scholarship owed to the public need for mitigation of the harms to consumers and workers from accidents and the need to regulate monopolistic railroad strategies. Yet, third-party effects associated with automobiles, in the form of injuries to children and other bystanders, were far greater than in the case of railroads. We may speculate that the different scholarly treatment owes to the difficulty of integrating the automobile into a theoretically coherent model of legal and technological change. The railroad was relatively easy to characterize because it encouraged the development of big business, was conducive to polarized class-based interpretations, and encouraged the growth of federal oversight and administrative regulation. In contrast, even with growing market integration, the automobile was associated with decentralized consumer use, harms to ordinary citizens by other ordinary citizens, few interstate issues, and increased oversight by states and municipalities. The decentralization of activities that occurred with widespread automobile ownership meant that the public would have had to bear the consequences of pervasive regulation. Instead of legal or regulatory measures to significantly limit private use, the scale of harms afflicted by automobile users motivated an institutional shift toward private insurance. Policymakers were reluctant to follow the vaccination analogy that allowed incursions into the private sphere of consumer activities in the name of the public interest.

Effective policies toward innovations required a social calculus that was far more subtle than the promotion of the interests of any one specific group in society. Technological advances altered the costs and benefits of transacting within a particular network of rules and standards, and institutions proved to be sufficiently flexible to encompass these changes. We can gain some insights into the effectiveness of American legal institutions from the experience of developing countries today. In many nations political elites have captured institutions to further the narrow self-interest of these privileged groups. Institutional scleroses, the prevalence of inefficient regulatory bureaucracies, corruption, and inadequate legal systems have resulted in widespread poverty, despair, and the absence of incentives for increased productivity. If the subsidy thesis is correct, and the American legal system early on was captured to promote the interests of a favored few, it is quite unlikely that the United States would have experienced more than a century of relatively democratic economic growth and technological

progress. In short, since the founding of the Republic, institutions have altered as the scale and scope of market and society have evolved, but the central policy objective of promoting the public interest has remained the same. That is, after all, one of the chief virtues of a society that is bound and enabled by prescient constitutional principles.