

Bi-Level Technologies

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John Howells

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ABSTRACT

Professor Mark Lemley advances a thesis that “the canonical story of the lone genius inventor is largely a myth” and describes a selection of pioneer inventions to support his thesis. We show that Lemley has many of his facts wrong. We examine his assertions and set the record straight in the pioneer invention cases of Edison, the Wright brothers, the Selden automobile patent vis-a-vis Ford, Watt and the steam engine and Fleming and penicillin. We are concerned with the errors in alleged historical and legal facts in what Lemley calls “lessons of history” and “realities of innovation” because these are used to argue that the patent system does not work as patent theory suggests. We show that Lemley’s major thesis that these inventions were made “near-simultaneously” by others has no basis in fact and show that patent law inherently ensures that patent protection is not extended to near-simultaneous inventions. We illustrate that the lessons of history, when informed by consultation of relevant patents, legal decisions and patent law not only do not support Lemley’s central thesis, but offer valuable insights into how America’s historical patent system and innovation work together to foster development.

Introduction

In a forthcoming article in the *Michigan Law Review*,¹ Professor Mark Lemley advances a thesis that “the canonical story of the lone genius inventor is largely a myth”.² In the short time since its initial publication, his article appears to have some scholarly impact as it received numerous citations by others.³ Lemley asserts that surveys of “hundreds of significant new technologies show that almost all of them are invented simultaneously or nearly simultaneously by two or more teams working independently of each other”⁴ and that “[i]nvention appears in significant part to be a social, not an individual, phenomenon”.⁵ Lemley also draws, from his constrained view of the historical record of significant inventions, a conclusion as to the exclusive patent right – that “[c]entral control doesn’t seem desirable given the actual history of important inventions”.⁶ He contends that “[w]here we have given strong control to a single patent owner, the result has generally been reduced improvement and delayed commercialization”.⁷ Lemley therefore concludes that current patent theory is lacking and offers his alternative theory, that patent rights encourage patent races, but given his findings he qualifies this theory so that “patent racing cannot alone justify a patent system”.⁸

We show that Lemley has many of his facts wrong, misstates the holdings of several court cases, and mischaracterizes the commercial realities that surrounded implementation of these technologies. His inferences and conclusions regarding patent law are therefore highly questionable.

¹ <http://www.michiganlawreview.org/information/about/articles>. See Mark A Lemley, *The Myth of the Sole Inventor*, to appear in MICHIGAN LAW REVIEW, 110, (2011). Available at <http://ssrn.com/abstract=1856610>, July 21, 2011, p. 1-104.

² *Id.* at 13.

³ As of this writing, Lemley’s paper has been cited in five [articles published on SSRN](#).

⁴ Lemley, (2011), at 1.

⁵ *Id.* at 1.

⁶ *Id.* at 64, 82.

⁷ *Id.* at 82.

⁸ *Id.* at 2.

What is “invention”?

To someone unversed in patent law and its language, Lemley’s thesis may have a superficial attraction. For in his paper, Lemley often abandons the precise language of the law he knows so well to theorize about invention and patent law in favor of drawing upon the naïve language one finds in the history of science literature or the common stock of English words and concepts. Many of his counterfactual conclusions and questionable policy suggestions result from this effort – particularly the policy conclusions that flow from his analysis, such as the following,

“The result is a real problem for classic theories of patent law. If we are supposed to be encouraging only inventions that others in the field couldn’t have made, we should be paying a lot more attention than we currently do to simultaneous invention. We should be issuing very few patents—surely not the 200,000 per year we do today. And we should be denying patents on the vast majority of the most important inventions, since most seem to involve near-simultaneous invention”.⁹

We believe Lemley’s evidence does not support his case: we show that none of his examples we examine were near-simultaneous inventions. Lemley’s major thesis that these inventions were made “near-simultaneously” by another has no basis in fact. How did Lemley arrive at such a conclusion? By flip-flopping between different definitions of the concept of “invention” – one used in naïve common parlance and one used in patent law – and by invoking an alien-to-patent-law concept of “multiple, simultaneous invention.”

First, the very encapsulation of his thesis as “the myth of the sole inventor” depends on the reader accepting on faith a naïve model of invention in which, he alleges, “sole inventors” are responsible for great inventions such as “the light bulb,” “the steam engine,” “the automobile” and “the airplane.” Lemley then uses this naïve model as a straw-man, to be repeatedly knocked down by reference to “historical facts”. In contrast, in patent law, the word “invention” is far more precise – a discrete idea that can be encapsulated in words (a patent claim), that distinguish the precisely-defined “invention” from the prior art, to a degree that is both novel and nonobvious. The two are surely related: important technologies that lead to new products (“the light bulb,” “the steam engine,” “the automobile” and “the airplane” in the naïve sense) almost always arise out of one (or a small number of) specific critical “inventions” (in the patent law sense) that unlock the field. Typically, once that critical idea is conceived, it takes a series of implementation and improvement inventions to turn that idea into a mature commercially viable product. While a team develops the product, each key *idea* originates with a single inventor (or small *identifiable* group of *joint* inventors). And this precise definition of “invention” is a good fit for the real process of invention.

Hence, under patent law’s formal definition, the word “invention” refers to a single idea—Edison’s “high resistance filament”, the Wright brothers’ “wing-warping,” Watt’s steam engine “condenser,” etc. The invention is the set of embodiments conceived and disclosed by the inventor in enough detail such that they are capable of being practiced. It is impossible to identify and *verify* a particular invention without having identified a specific claim of the invention by its inventor or by historians who allege such invention. The invention is described in a patent and it is *claimed* by claim(s) at the end of the patent. Throughout his article Lemley avoids reference to patent numbers or claims and abandons his extensive knowledge of the meaning in patent law of “invention” – the canon that one must look to the claims in a patent to identify the “invention” and that “the claims made in the

⁹ *Id.* at 5.

patent are the sole measure of the grant.”¹⁰ Lemley does not use this accurate tool, despite his recognition of this principle elsewhere.¹¹

Second, Lemley appears to mistake a real world phenomenon of *distinct* but related inventions in the same field of technology as near-simultaneous inventions of the *same* thing, which he asserts are “the vast majority” of important inventions.¹² Lemley provides no evidence to support his “vast majority” proclamation. But closer examination of the real world of inventions shows that simultaneous invention is extremely rare: (a) only about 50 proceedings per year out of 460,000 patent applications filed per year (0.01%) are instituted to resolve patent rights regarding independent applications by multiple inventors claiming the *same* invention (interferences),¹³ and (b) only an estimated 0.7% of U.S. patent applications include an applicant declaration for antedating a reference that may describe a near simultaneous invention or reference that anticipates a claimed invention or otherwise renders it obvious.¹⁴ Moreover, defendants in patent infringement lawsuits have substantial economic incentive to discover other, unnamed, (simultaneous) inventors because a patent that does not name an inventor that actually invented the invention *claimed* in the patent may be held unenforceable. Yet, courts find such circumstances in only 1% of reported patent infringement cases.¹⁵ At this point the reader might wonder: if such events are so rare, how was Lemley able to find all these examples of important inventions that he alleges were made independently and nearly simultaneously by multiple inventors? We show below that contrary to his assertions, none of his examples we reviewed were in fact inventions made simultaneously by others.

In part, Lemley supports his assertion that invention is a social, not an individual, phenomenon by citing a 2010 article by Schoenmakers and Duysters who have misinterpreted the actual reason and meaning of patent citations to conclude that key inventions “are largely based on extensions of existing knowledge”.¹⁶ But the citations in patents to earlier existing sources *per se* prove nothing as to whether existing knowledge was merely extended or whether entirely new knowledge was created. Rather, the invention claimed in the patent must be *distinguishable* from the sources cited in the patent because the claimed invention must be patentable *over* the cited prior art. In fact, the invention claimed in the patent may well be a *major radical inventive step over* the cited prior art references. The citations provide *absolutely no clue* as to the magnitude of that step or whether the invention is merely an “extension of existing knowledge.” Here again, Lemley’s inferences from such irrelevant papers are wholly unwarranted.

Set aside for a moment Lemley’s framework for analysis and consider the “evidence” he marshals in its support. Here we are concerned with the pervasive errors in alleged facts cited in his “lessons of history” and “realities of innovation.” We use a selection of his pioneer invention cases to illustrate that the lessons of history, when informed by consultation of relevant patents, legal decisions and

¹⁰ *Aro Mfg., Co. v. Convertible Top Replacement Co.*, 365 U.S. 336, 339 (1961).

¹¹ Mark A Lemley, *The Changing Meaning of Patent Claim Terms*, 104 MICHIGAN LAW REVIEW, 105, 117 (2005). (“The claims of a patent are central to virtually every aspect of patent law. The claims define the scope of the invention, and their meaning therefore determines both whether a defendant’s product infringes a patent and whether the patent is valid.”).

¹² Lemley, (2011), at 5.

¹³ USPTO, BPAI Process Production Report for FY 2010.

At <http://www.uspto.gov/ip/boards/bpai/stats/process/fy2010sepb.pdf>

¹⁴ Dennis D Crouch, *Is Novelty Obsolete? Chronicling the Irrelevance of the Invention Date in US Patent Law*, 16 MICHIGAN TELECOMMUNICATIONS TECHNOLOGY LAW REVIEW, 18 (2009).

¹⁵ University of Houston Law Center, *U.S. Patent Litigation Statistics*, <http://www.patstats.org>, (in only 18 of 1778 cases reported for the period 2005-2009, courts found in favor of defendants who asserted defenses under 35 U.S.C. § 102(f) or § 102(g) – wrong inventorship, subject matter derived from another, or prior invention by another.)

¹⁶ Lemley, (2011), at 8.

patent law not only do not support Lemley's central thesis, but offer valuable insights into how patents and innovation work together to foster development.

Edison

Lemley finds Edison to be a primary case illustrating the “myth” of the sole inventor. He alleges that, “Edison didn't invent the light bulb; he found a bamboo fiber that worked better as a filament in the light bulb developed by Sawyer and Man”.¹⁷ That's right; Lemley has convinced himself that,

“Sawyer and Man invented and patented the incandescent light bulb; indeed, when Edison built his improved incandescent light bulb Sawyer and Man sued him for patent infringement”¹⁸

While Lemley's statement is not literally false, he omits five key facts – facts that are clearly set out in the cases and references that Lemley himself cites, facts that change the entire analysis, facts that if omitted do not allow fair presentation.

First, although Lemley cites a Supreme Court case in 1895¹⁹ as a source for this statement, he neglects to inform us of the decision reported in that case: it affirmed a lower court's 1889 decision holding the Sawyer & Man patent invalid.²⁰

Second, Lemley does not mention that Sawyer & Man asserted in this case against Edison their patent No. [317,676](#), filed on January 9, 1880, more than two months after Edison applied for his key patent No. [223,898](#). And Lemley neglects to tell us that Sawyer & Man never got a fibrous carbon filament light bulb to work before Edison's invention.²¹

Third, Sawyer & Man's patent was invalid for overreaching what they actually invented (which we call § 112 ¶ 1 “written description” today). The lower court observed that Sawyer & Man unsuccessfully attempted to capture features of Edison's lamp:

“It is very clear to us that, in the original application for the patent sued on, the applicants had no such object in view as that of claiming all carbon made from fibrous and textile substances as a conductor for an incandescing electric lamp. Nothing on which to base any such claim is disclosed in the original application. We have carefully compared it with the amended application, on which the patent was issued, and are fully satisfied that, after Edison's inventions on this subject had been published to the world, there was an entire change of base on the part of Sawyer and Man, and that the application was amended to give it an entirely different direction and purpose from what it had in its original form.”²²

Fourth, Sawyer & Man stood on essentially the same ground as Edison vis-à-vis the prior art: lamps by electric incandescence were known since 1845 – years before Sawyer & Man or Edison's inventions. Technology advances then were insufficient to make electric incandescent lighting commercially feasible. The lamps experimented with at that time had operating life of only a few hours as the carbon incandescent rods were consumed or had to be reattached often. Sawyer & Man's improvements were directed at having a lamp filled with an absorbent of carbonic acid gas, a spring-loaded feeder feeding a vertical carbon pencil upwards as it was consumed and a design for cheap carbon pencil renewal with easy sealing and exhausting of air.²³ Despite these improvements,

¹⁷ *Id.* at 4.

¹⁸ *Id.* at 26-27.

¹⁹ *Consolidated Electric Light Co. v. McKeesport Light Co.*, 159 U.S. 465 (1895).

²⁰ *Consolidated Electric Light Co. v. McKeesport Light Co.*, 40 F. 21 (C.C.Pa. 1889).

²¹ *McKeesport*, 40 F. 21, 28 (C.C.Pa. 1889) (“We are not satisfied that [Sawyer & Man] ever produced an electric lamp with a burner of carbon made from fibrous material, or any material, which was a success.”).

²² *McKeesport*, 40 F. 21, 26 (C.C.Pa. 1889).

²³ William E. Sawyer and Albon Man, U.S. Patent No. [205,144](#), (June 18, 1878).

and even after Edison's invention, "many of the [Sawyer & Man] lamps failed to last more than a few hours".²⁴

Fifth, the electrical resistance of these lamps was typically only a few Ohms and thus required large currents to power them, rendering power losses through long distribution wires prohibitive. Lemley also neglects to tell us that Sawyer & Man's light bulbs could not be used effectively more than a few feet away from a generator, and therefore had little commercial practicality.

Edison's invention was directed at solving these problems in a context of a full system for electric lighting, as he was the first to recognize that lamp resistance must be made much larger – several hundred Ohms – for it to have a chance of commercial success. He achieved this by finding ways for making extremely thin *high resistance* carbon filaments, which could only operate in extreme vacuum. And that, in turn, required Edison to invent a new way of constructing the bulb, to have all components sealed inside a single glass vessel, and to mold the vessel around leading-in wires that had to pass through the glass. The results were spectacular as his lamps had an operational life span of about 1000 hours,²⁵ about one hundred times longer than that of Sawyer & Man's or any other prior art lamp.

Edison's thin carbon filament of high resistance was a departure from the direction every other inventor was pursuing and had critical advantages in a practical electrical illumination system over the prior art lamps employing thicker low resistance carbon rods such as that of Sawyer & Man. First, the Edison filament's relatively small current draw permitted use of small diameter (less costly) powering wires and enabled networks of many lamps to be electrically connected in parallel, making the continuous operation of each lamp independent of the others. Second, a collateral advantage not immediately appreciated by Edison's contemporaries, was that the very low current draw by Edison's high-resistance filaments placed much less critical demands on the conductive interface and contact integrity of the bond between the carbon filament and the platinum leading-in wires. The practical significance of these advantages were apparently missed by many lamp developers including Sawyer & Man, even years after Edison's patent issued, as they persisted in futile attempts to solve problems inherent only to thick carbon incandescent rods of low resistance that drew high currents and incurred high rate of erosion.²⁶ A few years after Edison's patent issued Sawyer continued to insist that the resistance of the carbon incandescent rod must be kept as low as possible and so he confined his attention to short, thick carbon rods.²⁷

Edison's '898 patent had been held valid and infringed in 1891, affirmed on appeal in 1892.²⁸ The courts held that Claim 2 of the patent recited a fundamental invention covering the accused lamps, namely, an incandescent lamp composed of a carbon filament, hermetically sealed in an all-glass chamber exhausted to a practically perfect vacuum, and having leading wires passing through the glass. No other lamp before Edison's invention was constructed this way and Edison's invention was held patentable over the prior art, including that of Sawyer & Man. Referring to those having knowledge in the art of incandescent lamps, Judge Wallace, who rendered the 1891 decision, wrote about Edison's invention as follows:

²⁴ WILLIAM E. SAWYER, *ELECTRIC LIGHTING BY INCANDESCENCE AND ITS APPLICATION TO INTERIOR ILLUMINATION*, D. Van Nostrand, New York, (1881), at 86.

²⁵ ARTHUR A. BRIGHT, *THE ELECTRIC LAMP INDUSTRY*, Macmillan, New York, (1949), at 134.

²⁶ For example, in the two-year period *following* Edison's patent grant, futile continued attempts to solve problems arising only in the usage of low resistance thick carbon pencils were evidenced by the patent applications of: Sawyer (Pat. No. 227,386) for an improved roller contact mechanism for the carbon pencil; Man (Pat. No. 227,118) for a method of preventing the occurrence of an electrical arc in the carbon pencil-to-conductor connection; Sawyer and Street (Pat. No. 241,430) for multiple carbon pencils, one of which is renewed in a bath of hydrocarbon while the other is being burned in open air.

²⁷ BRIGHT, (1949), at 52.

²⁸ *Edison Elec. Light Co. v. United States Elec. Lighting Co.*, 47 F. 454 (C.C.S.D.N.Y. 1891), *aff'd* 52 F. 300 (2d Cir.1892).

“Read by those having this knowledge, the radically new discovery disclosed by the specification is that a carbon filament as attenuated before carbonization as a linen or cotton thread, or a wire seven one-thousandths of an inch in diameter, and still more attenuated after carbonization, can be made, which will have extremely high resistance, and be absolutely stable when maintained in a practically perfect vacuum. It informs them of everything necessary to utilize this discovery and incorporate it into a practical lamp.”²⁹

It was only after Edison’s invention that electric incandescent lighting developed in any *meaningful* way. This is independently evidenced by the number of U.S. patents issued in the incandescent lamp classes. Only 13 were filed in the 28-months period from June 1877 when Sawyer filed for his U.S. patent 194,500 to November 1879, when Edison filed for his ‘898 patent. In contrast, over 100 patents in the relevant classes were filed in the 28-month period after Edison’s invention.³⁰ It was Edison’s invention that unlocked the field.

Lemley is misinformed when he asserts that “modern incandescent light bulbs operate on Sawyer and Man’s principle”.³¹ All incandescent lamps today use Edison’s high-resistance filament principle; none use Sawyer’s and Man’s low resistance spring-loaded carbon rods principle; Lemley appears equally in the dark (pun intended) when he contends that Edison’s advance was merely the first use of bamboo filaments;³² when he summarily concludes without any support that “Edison did not invent the light bulb in any meaningful sense”;³³ and that “Sawyer and Man invented ... the incandescent light bulb”.³⁴

Lemley’s broader conclusions fall away as well. There was no candidate for an invention simultaneous with Edison’s invention. Thomas A. Edison is the sole inventor named on U.S. Patent 223,898 – the pioneer patent of electric incandescent lighting; his invention was not a “social phenomenon” and Lemley adduces no evidence that others conceived the critical combination of high-resistance low current filament principle and high-vacuum, sealed bulb design. The “social” trend around Edison of inventing electric incandescent lighting by the brute force of high currents led nowhere for 35 years. One can only speculate how much longer it would have taken someone else to come up with Edison’s idea had it not been for Edison’s reliance on the patent system and the revenue it protected to support his research and development over the two years that he spent on inventing his incandescent electric lamp.

Having attempted to support his assertion that “Edison did not invent the light bulb in any meaningful sense,” Lemley contradicts himself when he later writes, relying on a secondary unsubstantiated historical account by Bright, that “Edison’s... light bulb ... patents were sufficiently broad that they shut down any further efforts to innovate by others until the core patent expired.”³⁵ Anyone who could believe this should have suspected that Edison had actually invented *something fundamental* – something “in a meaningful sense” after all. This contradictory assertion by Lemley also turns out to be untrue. For example, by avoiding the use of single piece all-glass bulbs, the Westinghouse Company, Edison/General Electric’s principal independent competitor, developed the commercially-viable “stopper lamp”, which, like other manufacturers’ non-infringing

²⁹ *Edison Elec. Light Co. v. United States Elec. Lighting Co.*, 47 F. 454, 460 (C.C.S.D.N.Y. 1891).

³⁰ Ron D. Katznelson & John Howells, *Inventing Around Edison’s Incandescent Lamp Patent: Evidence of the Role of Patents in Stimulating Downstream Development*, forthcoming (2011) (Figure 3 data based on incandescent lamp classes identified in Appendix A.)

³¹ Lemley, (2011), at 26-27.

³² *Id.* at 26. Bamboo filaments were nowhere mentioned in Edison’s pioneer 223,898 patent. Edison’s first claim to bamboo filaments were made in Pat. No. 251,540, which he filed in August 6, 1880. There is no record of this latter patent having been asserted against any party.

³³ *Id.* at 25.

³⁴ *Id.* at 26.

³⁵ *Id.* at 65.

lamps, successfully evaded the claims of Edison's '898 incandescent lamp patent.³⁶ During the term of Edison's patent, Westinghouse was able to produce and ship 250,000 non-infringing stopper lamps to light up the Chicago World's Fair in 1893.³⁷ Spurred by court decisions,³⁸ a substantial surge in designs-around the Edison claims ensured that Edison/General Electric's competitors could operate and innovate unhindered by the Edison lamp patents.³⁹ Edison did not "shut down" the field, he unlocked it.

The Wright Brothers

Lemley presents the Wright brothers as another example of the "myth" of the sole inventor and writes that, "[t]he Wrights invented only a particular improvement to flying machines, albeit a critical one".⁴⁰

"Only a particular improvement" was the ability to fly: no inventor prior to the Wrights had achieved sustained manned flight and no inventor after the Wrights achieved sustained manned flight without infringing their patent; even a case cited by Lemley on another point admits this (but he neglects to mention this).⁴¹ Lemley neglects to mention that years of efforts by the flight experimenters Lilienthal (whom Lemley credits with early inventions of flight) and by Pilcher had produced gliding machines that killed them both.⁴² Attempts were made to fly aircraft that did not infringe the Wright patent and they crashed, injuring the pilot;⁴³ Paulhan attempted a design-around the Wrights' patent which ended in both of his planes crashing.⁴⁴ It was the Wright's invention that secured three-dimensional stability in the air and so unlocked the field.

Lemley uses the Wrights to illustrate his assertion that most invention occurs "simultaneously" and, "both the Wrights and Curtiss, among others, were engaged in a conscious race to be the first to achieve powered flight".⁴⁵ What kind of "conscious race" could it be where the Wrights had finished and won the "race" before Curtiss had even contemplated entering it? The Wrights' famous U.S. Patent No. 821,393 was applied for March 23, 1903 and granted May 22, 1906. However, as a motorcycle engine maker, Glenn Curtiss' expertise was only in motors, not flight. Curtiss' first attempt to enter the field was when he attempted to *sell his motors* to the Wrights in May 1906.⁴⁶ His second attempt came when Alexander Graham Bell first approached him to contribute

³⁶ BRIGHT, (1949), at 90, 119-120, 132.

³⁷ QUENTIN R. SKRABEC, GEORGE WESTINGHOUSE - GENTLE GENIUS, Algora Pub., New York, (2006), at 140.

³⁸ Katznelson & Howells, (2011) (Figures 3, 4).

³⁹ *id.* at Section 4.

⁴⁰ Lemley, (2011), at 32.

⁴¹ *Wright Co. v. Paulhan*, 177 F. 257, 258 (CCSDNY. 1910) (Wright's invention's "importance cannot be overestimated, as it is shown that long before the Wright invention a method was sought by which equilibrium in mechanical flying could be secured and maintained. Not only the conception of the idea of securing and maintaining equilibrium in the air, but the appliances- the dynamic cause to achieve the result- originated in the minds of the patentees, and took shape and form in the evidently simple method of slightly turning up and down the lateral ends or margins of the planes, thus securing different angles of incidence. The unsurmountable obstacle with which prior inventors in this art struggled for years was the precipitate unbalancing or upsetting of the apparatus and such prior flying machines were therefore incapable of flights with any appreciable degree of success. The affidavits indicate that the patentees did not use the means or identities of prior flying machines, but solved the problem of maintaining equilibrium or lateral and front and rear balance by the introduction of new and practical elements and became pioneers in the field of flying machines of the so-called heavier than air type.").

⁴² JOHN ROBERT MCMAHON, THE WRIGHT BROTHERS: FATHERS OF FLIGHT, Little Brown & Co. Boston, (1930), at 260.

⁴³ *Only 15 Airships for Field Service*, NEW YORK TIMES, April 22, (1914), at 6.

⁴⁴ HERBERT ALAN JOHNSON, WINGLESS EAGLE: US ARMY AVIATION THROUGH WORLD WAR I, University of North Carolina Press, Chapel Hill, NC, (2001), at 105.

⁴⁵ Lemley, (2011), 84-85.

⁴⁶ TOM D. CROUCH, BISHOP'S BOYS - A LIFE OF WILBUR AND ORVILLE WRIGHT, W. W. Norton & Company, New York, (1989), at 313.

his motor expertise to Bell's flying kite experiments in 1907.⁴⁷ Furthermore, Curtiss' biographer quotes Bell in a 1907 speech admitting that the "race" had been won by the Wrights, "The actual problem of the navigation of the air has already been solved by the Wright brothers".⁴⁸

Lemley leaves the precise relation between the Curtiss achievement and the Wrights obscure and so tends to diminish the Wrights' achievement; "Curtiss improved the design of the wing by using ailerons, movable portions of the wing that had been developed *years before* [our emphasis] by a consortium of others, including Curtiss and Alexander Graham Bell".⁴⁹

"Years before" leaves the crucial issues of priority and scope unclear. In fact, "years before" was *not* before the Wrights' invention. Bell's and Curtiss's independent "kite-flying" experiments ended in failure and when they turned to design conventional aircraft they were forced to ask for the Wrights' help in 1908, two years after the Wrights' patent had been granted and years after successful flying by the Wrights – and they were given that help because the Wrights believed their technical aid was covered by their patent.⁵⁰ Lemley does not mention that the improvement of wing ailerons by Bell, Curtiss and other co-inventors was patented in U.S. Pat. No. 1,011,106, filed in April 1909, more than *six years after* the Wrights' invention. When Curtiss achieved flight it was after the Wrights' patent had been granted and by means of deploying the ailerons for lateral stability, a device encompassed by the scope of the Wrights' patent. When Curtiss began manufacturing aircraft for sale he would not take a Wright license and was found to infringe the Wright patent in *Wright Co. v. Herring-Curtiss Co. et al.* 204 F. 597, 598 (WDNY 1913), *aff'd* 211 F. 654 (2nd Cir. 1914).

Lemley's downplay of the Wrights' achievement results in self-contradictory assertions when he writes without a source, "[t]he Wright Brothers were the first to fly at Kitty Hawk, but their plane didn't work very well, and was quickly surpassed by aircraft built by Glenn Curtiss and others—planes that the Wrights delayed by over a decade with patent lawsuits. And on and on."⁵¹ If Glenn Curtiss "quickly surpassed" the Wrights' plane, how could Curtiss also have been "delayed by over a decade with patent lawsuits"? It can't be both – which is it? In fact, contrary to several unsubstantiated allegations, there was no delay of Curtiss or any aircraft development by the Wright patent; aircraft production in the U.S. grew from 45 per year in 1912 to about 2,150 per year in 1917 – when the aircraft patent pool was established.⁵² Even though the Wright Company won their litigation, they never obtained effective and enforceable injunctions against Curtiss to put him out of business or delay him. For example, in the years immediately after the Wright Company's court victory over Curtiss, between August 1914 and June 1915, the Curtiss Aeroplane Company increased its workforce from 150 to 2000⁵³ – and it was not making motorcycles.

Stable, safe airplanes were not a "social invention." The key invention that unlocked the field came from two brothers, in one conceptual leap. Contrary to Lemley's conclusions, there was neither "simultaneous invention" nor "reduced improvement and delayed commercialization" in early American aeronautics.

⁴⁷ CECIL R ROSEBERRY, GLENN CURTISS: PIONEER OF FLIGHT, Doubleday & Co., New York, Garden City, (1972), at 71.

⁴⁸ *Id.* at 71.

⁴⁹ Lemley, (2011), at 32.

⁵⁰ CROUCH, (1989), at 352-353.

⁵¹ Lemley, (2011), at 4.

⁵² Department of Commerce Aeronautics Branch, *Airplane Production, 1909 - 1928*, 1 AIR COMMERCE BULLETIN, NO. 5, September 2, p.6, (1929).

⁵³ *Curtiss Aeroplane Gets \$15 million Contract*, WALL STREET JOURNAL, December 16, (1915), at 6.

Selden's patent on the automobile

Lemley finds it necessary to assert, with no source in support, that it is commonly thought that Ford was the inventor of the automobile, “Think of the invention of the automobile and it is hard to avoid thinking of Henry Ford. His mass-production model turned automobiles from individual, hand-crafted devices into mass-market products”.⁵⁴ But once one sets aside the naïve definition of the word “invention” in favor of patent law’s analytically-rigorous definition, the first sentence in the quote above is belied by the second. Ford’s invention was mass-production, not the automobile. This information is readily available in the historical sources that Lemley uses to knock down his imaginary myth.⁵⁵

Paradoxically, Lemley introduces a “myth” about enforcement of an automobile patent against Ford when he writes “George Selden, a patent lawyer, was granted a broad patent on a combined internal combustion engine with a carriage in 1895, having delayed his own patent for years in the PTO. Selden enforced that patent against others in the industry, including Ford, until the patent was ultimately invalidated on appeal in 1911”.⁵⁶

If we turn to the patent claims in Selden’s U.S. patent [549,160](#) five of the six claims refer to the engine as “a liquid-hydrocarbon gas engine of the compression type”. The reader would note that the actual claims nowhere use the modern term that Lemley used to describe the scope of the patent, “internal combustion engine.” Indeed, the central question addressed by the appeal court reviewing the infringement suit judgment against Ford in 1911 (the Selden patent was *not* successfully enforced against Ford) was whether the language of the claims should be construed broadly to capture the internal combustion engine then in general use. The answer was “no”:

“...the case apparently presented is the ordinary one in which a patentee claims a broad invention and describes what he considers to be the best mode of applying it, but is not confined to that method. And if the prior art permitted such a patent in this case it might well be that it would be valid. But the prior art did not permit such a patent. Every element in the claim was old, and the combination itself was not new. Combinations of noncompression gas engines with the other elements had been in use, and Brayton had employed a ‘liquid hydrocarbon engine of the compression type’ in a vehicle.”⁵⁷

The owners of the Selden patent had long argued that the claims should be *interpreted* to encompass the internal combustion engine and thus the field of automobile manufacture, but many had refused to accept this interpretation, including Henry Ford. Lemley asserts that the Selden patent was found invalid on appeal, but this too is wrong. The appeal court sustained the validity of the patent, but construed the claims narrowly to automobiles using Selden’s improved, but then obsolete Brayton engine – an external combustion engine.⁵⁸ “Who invented something depends on your definition of ‘something.’”⁵⁹

⁵⁴ Lemley, (2011), at 28.

⁵⁵ JAMES J FLINK, *AMERICA ADOPTS THE AUTOMOBILE, 1895-1910*, MIT Press, Cambridge, MA (1970); ALLAN NEVINS, *FORD: THE TIMES, THE MAN, THE COMPANY*, Scribner, New York, NY (1954).

⁵⁶ Lemley, (2011), at 29.

⁵⁷ *Columbia Motor Co. v. C.A. Duerr and Co.* 184 F. 893, 901 (2nd Cir. 1911).

⁵⁸ *Columbia Motor Co. v. C.A. Duerr and Co.* 184 F. 893, 907-908 (2nd Cir. 1911) (“It is sufficient to sustain the claim to hold that the combination embraced a novel element. The claim is held to be valid as covering a combination in a road locomotive of the different elements with a liquid hydrocarbon compression engine of the Brayton type; the limitation to this type being read into the claim by the specification to save it from invalidity.”)

⁵⁹ It is ironic that Lemley ignores an imperative which he cites in Paul Rako’s article entitled “Who invented something depends on your definition of ‘something.’” Lemley, (2011), 44.

Watt and the steam engine

Lemley begins by asserting that “James Watt is famous as the inventor of the steam engine”.⁶⁰ This is the naïve notion of “invention.” The precise notion under patent law, however, is that Watt’s inventive contribution was the separate condenser, an improvement on the Newcomen steam engine. This can be read in the second of Watt’s patent claims in British patent No. 913, granted April 1769.⁶¹ “the steam is to be condensed in vessells distinct from the steam vessells or cylinders.” The significance of Watt’s invention was that it enabled the main steam vessel to remain at high temperature and so saved much fuel otherwise used to reheat it. Lemley does not cite the patent or its claims but nevertheless asserts that Watt “patented the engine...”⁶² then Lemley flips to a more precise notion of the invention, “What Watt and his co-inventor Boulton in fact contributed was not the concept of the steam engine, but a particular implementation of that engine”.⁶³ There is still no mention of the actual invention or patent.

Lemley contends that “[i]n fact, however, Watt is not the first one to have come up with the idea”;⁶⁴ he cites a historical source by Miller as evidence for the existence of “one very similar patent cited against Watt, in particular”.⁶⁵ Lemley provides neither information on the patent at issue nor on the litigation history, where we should expect the validity of the Watt patent to be put to the test. The fact that a “similar patent” was cited against Watt is far from a proof of a “simultaneous invention” of the same thing. Dickinson and Jenkins (1927) review the outcome of the two actions for infringement brought under the Watt patent that established its validity; “...the juries in both trials gave verdicts in favor of the patentees. They found that Watt was the inventor, that the invention was new and useful, had been infringed and that the specification was of itself sufficient to enable a mechanic acquainted with the fire-engines previously in use to construct fire-engines producing the effect of lessening the consumption of fuel and steam upon the principle invented by Watt”.⁶⁶ Lemley is silent about the English courts’ decision contradicting his contention of “near-simultaneous invention” alongside Watt.

Lemley also refers to what he calls a common story that Watt used his “broad patent on the basic concept to control the development of steam locomotion for decades, arguably delaying the development of that technology by others”.⁶⁷ This “common story” appears most uncommon to us; in principle the patent controlled the implementation of the separate condenser, not the independent inventive contribution of others to steam engine development.

Then, on the same page, Lemley proposes that “the subsequent development of steam engines was arguably driven by the Boulton-Watt patents”.⁶⁸ What these plural “Boulton-Watt” patents were is not stated but the idea that patents “arguably” “drive” development is a return to the mainstream theory and understanding of patent practice. In short, although Lemley proposes two “arguable” outcomes they are contradictory – the patent is “arguably” responsible for downstream development delay and “arguably” drives downstream development. Lemley does not resolve the contradiction.

⁶⁰ *Id.* at 14.

⁶¹ This patent is famous; retrievable at http://de.wikipedia.org/wiki/Datei:James_Watt_Patent_1769_No_913.pdf.

⁶² Lemley, (2011), at 14.

⁶³ *Id.* at 14.

⁶⁴ *Id.* at 14.

⁶⁵ *id.* at 14; DAVID PHILIP MILLER, JAMES WATT, CHEMIST: UNDERSTANDING THE ORIGINS OF THE STEAM AGE, Pickering & Chatto, London, UK (2009).

⁶⁶ HENRY WINRAM DICKINSON & RHYS JENKINS, JAMES WATT AND THE STEAM ENGINE, Moreland Publishing, Oxford, UK (1927), at 324-327.

⁶⁷ Lemley, (2011), at 14.

⁶⁸ *Id.* at 14.

The issue of downstream development delay can be resolved if one carefully studies the history of Watt's steam engine: many infringing steam engines were built, but Boulton and Watt relied on informers to identify infringers who were then not closed down, but required to pay royalties.⁶⁹ Absent evidence to the contrary, licensing under patents constitute the *prima facie* evidence that no downstream development block occurred. Improvements, alleged or real could be and were built, but if they used the separate condenser, they infringed Watt's patent and were required to take a license.

Contrary to Lemley's assertion, there was neither "simultaneous invention" in the steam engine technology nor "delaying the development of that technology."

Fleming's "Discovery" of Penicillin

If Edison, Watt, Ford and the Wrights are allegedly examples illustrating the "myth" of sole invention, Lemley admits that "Every rule has exceptions. There are a few examples of significant inventions that really do appear to be singletons".⁷⁰ But in such cases Lemley has found another problem with patents:

"We can draw useful lessons about the value of central coordination in encouraging ex post behavior from the exceptional cases in which an inventor did come up with something new, *and accordingly obtained substantial patent rights*. Those lessons are not encouraging for granting broad exclusivity. First, singleton invention does not necessarily lead to quick commercialization... Alexander Fleming published his results in 1929, but it was more than a decade before anyone began to exploit that idea".⁷¹ (Emphasis added)

But according to Lemley's source, MacFarlane, there were *no patent rights* in penicillin.⁷² We wonder how Lemley convinced himself that there were useful general lessons pertaining to "broad exclusivity" and "substantial patent rights" in this case when Fleming did not have a patent. Furthermore, it may have been "more than a decade" between Fleming's publication of the results of his experimental work on penicillin and the exploitation of "that idea": but for this assertion Lemley cites an internet site.⁷³ However, reliable scholarship indicates that Fleming dropped any idea of penicillin as a human antibiotic therapy after only a few months experimental work in 1929.⁷⁴ MacFarlane's analysis is based on a scholarly study of Fleming's published papers, recorded comments and unpublished penicillin research notes. Since, contrary to Lemley's belief, Fleming did not discover in 1929 the human antibiotic therapy we know today, there was no decade of delay before "that idea" was commercialized. With no patent and no delay, no "lessons" for broad exclusivity can be drawn from this case.

Lemley pursues a non-problem

Throughout his article, Lemley argues for patent grant calibration policies that are necessarily based on *ex post* subjective characterization of inventions:

"If our pioneering inventors are in fact engaged in normal science, tinkering with the work of those who came before rather than inventing something wholly new, the traditional incentive case for patent protection is weakened dramatically".⁷⁵

⁶⁹ DICKINSON & JENKINS, (1927), at 305.

⁷⁰ Lemley, (2011), at 46-47.

⁷¹ *Id.* at 64.

⁷² GWYN MACFARLANE, ALEXANDER FLEMING - THE MAN AND THE MYTH, Chatto and Windus, London, (1984), at 205.

⁷³ <http://inventors.about.com/od/pstartinventions/a/Penicillin.htm>.

⁷⁴ MACFARLANE, (1984), at 137.

⁷⁵ Lemley, (2011), at 54.

However, Lemley proposes no way to know *at the time the invention is made* and filed for patent protection (based on the “traditional incentive”) whether an inventor is merely “tinkering” or rather “inventing something wholly new”.

The patent system works by granting patents on many patentable inventions including those that often take years to establish their significance. For example, as we describe in more detail elsewhere,⁷⁶ in 1894 before Edison’s carbon filament patent expired, the chemist Jonas W. Aylsworth had attempted “tinkering with the work of those who came before” – Rudolf Langhans and Alexander De Lodyguine – and constructed a non-infringing incandescent filament from non-carbon materials. He “tinkered” with a new process for coating filament cores with various metals merely intending to make new lamp filaments and obtained two lamp filament patents on his inventions (U.S. Pat. Nos. 553,296 and 553,328). These patents were of no value during their life because Aylsworth’s solution for his intended use did not meet with commercial success. Yet, in the course of this “tinkering” he invented “something wholly new” – his process became the first in the new field of Chemical Vapor Deposition (CVD) used in many industries including more recently in the semiconductor industry. According to Lemley’s thesis, as a “tinkerer” (who had not published his work), Aylsworth should not have been incentivized by “the traditional incentive,” i.e., he should not have been granted patents (that were useless but harmed no one), and society would have been impoverished for some time by not receiving his pioneering disclosure in the new field of CVD.⁷⁷ It is entirely unclear what indicia or legal mechanism would Lemley propose to separate *ex ante*, *at the time the invention is made*, the “tinkerers” from those inventing “something wholly new”.

For “near simultaneous inventions,” Lemley similarly argues for *ex post* patent grant calibration policies that are incapable of implementation *ex ante at the time the invention is made* and filed for patent protection. Furthermore, he does not provide any indicia or legal method to determine which inventions should be denied patent protection because they “involve near-simultaneous invention” and which should be patented because they are “inventions that others in the field couldn’t have made”.⁷⁸ In fact, it turns out that such legal method to identify *ex ante* the “inventions that others in the field couldn’t have made” already exists in patent law, but Lemley ignores it; it is called “nonobviousness” and it is codified in 35 U.S.C. §103.

Nonobviousness has been a core patentability requirement in American patent law since the time that Thomas Jefferson served as the first patent examiner. Since then, and prior to the codification of nonobviousness in § 103 in 1952, Congress has been made aware of the legal tests for determining invention and nonobviousness and those were specifically directed at the very purpose of granting patents only to “inventions that others in the field couldn’t have made.” For example, during the House Subcommittee on the Judiciary hearings in 1949, the U.S. Department of Justice submitted the following test for nonobviousness:

“The test of invention is not whether the contribution is useful — utility is a *sine qua non* of patentability in any event — but whether it represents something which would not likely have become available to the public, at least for a long time, but for efforts inspired by the patent system and its rewards”⁷⁹

⁷⁶ Katznelson & Howells (2011) (Section 3.1.1.4 “Non-carbon filament lamps”).

⁷⁷ ANTHONY C. JONES & MICHAEL L. HITCHMAN, CHEMICAL VAPOUR DEPOSITION: PRECURSORS AND PROCESSES, Royal Soc. of Chemistry, (2009), at 2, (Aylsworth is credited for his early introduction of more robust CVD process using metals that others have not worked on before).

⁷⁸ Lemley, (2011), at 5.

⁷⁹ *Test For Determining Invention*, HEARING BEFORE THE HOUSE SUBCOMMITTEE NO. 4 OF THE COMMITTEE ON THE JUDICIARY, 81st Cong. 1st Sess., p32 (June 22, 1949), Statement of John C. Stedman, Department Of Justice, at 32 (Also explaining that “[a]dherence to traditional concepts requires that patents be granted in such cases as, for example,

Judge Giles Rich, who was one of the drafters of the 1952 Patent Act, explained the principles behind § 103 in much the same way and said that it is designed to distinguish between improvements produced “by the expected skill of ordinary workers in the arts and by the unobvious developments which would not occur spontaneously from the application of such ordinary skill. The former improvements are never patentable. Why? Because they will be made anyway, without the ‘fuel of interest’ which the patent system supplies.”⁸⁰

Thus, through proper application of obviousness, the patent law already provides the indicia and tools to deny patent grants for inventions that are likely to arise near-simultaneously by multiple inventors – tools that Lemley alleges are missing. Indeed, evidence that near simultaneous inventions occurred is considered by the courts as one of the secondary factors for determining obviousness.⁸¹ Because inventions that “as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art”⁸² are not entitled to receive patent protection, near-simultaneous inventions rarely arise as candidates for patent protection. The Patent Office statistics we cite above and the fact that none of Lemley’s examples turn out to be near-simultaneous inventions demonstrates this point. Lemley is simply chasing a made-up and non-existent problem.

This being so and given our analysis of pioneer inventions above that showed these to be emphatically not of simultaneous inventions alleged by Lemley, the reader may at last wonder what is the nature of the sources that Lemley takes on trust in support of his general assertion that there is an “overwhelming prevalence of simultaneous invention”⁸³ Not surprisingly, they too turn out to lack factual support for actual near simultaneous inventions. We set aside the two sociology of science works by Merton and by Lamb & Easton cited by Lemley, as these explicitly address scientific discovery and not invention in the precise patent law sense. Despite the parallelism between scientific discoveries and “invention” that one finds in folklore, these papers do not provide any evidence directly pertinent to the existence of simultaneous *patentable inventions*.

Lemley cites two other works that allegedly provide numerical empirical support on inventions. First there is the patent citation analysis by Schoenmakers and Duysters discussed above and as we explain above, has no relevance as an indicator for “simultaneous invention.” Second, Lemley cites Ogburn and Thomas who document “148 instances of simultaneous invention”⁸⁴ We inspected Ogburn and Thomas’s 148 “inventions” and found that, like Lemley, these authors never looked at patents or even determined if there were any patents to identify *actual* specific claims of invention.

Fully 111 of Ogburn and Thomas’s “inventions” were actually scientific discoveries where no patentable inventions were identified, leaving 37 technological candidates for simultaneous

where the Patent Office (and the courts) are reasonably satisfied that, but for the inventor's efforts, the particular contribution for which a patent is sought would not have been made available to the public for such a long time to come that the public, through its Government, is warranted, in the public interest, in giving to him the rights afforded by a patent.”)

⁸⁰ Giles S. Rich, *The Principles of Patentability*, 42 J. PAT. OFF. SOC'Y 75, 81 (1960)

⁸¹ *Concrete Appliances Co. v. Gomery*, 269 U.S. 177, 184 (1925) (Independently made, simultaneous inventions, made “within a comparatively short space of time,” are persuasive evidence that the claimed apparatus “was the product only of ordinary mechanical or engineering skill.”); *Geo. M. Martin Co. v. Alliance Machine Systems Intern. LLC*, 618 F.3d 1294, 1306 (Fed. Cir. 2010) (agreeing with the district court that near-simultaneous invention constitutes evidence of obviousness.); *Ecolchem, Inc. v. Southern California Edison Co.*, 227 F.3d 1361, 1379 (Fed. Cir. 2000) (“The issue of simultaneous invention is directly tied to the level of knowledge attributable to one of ordinary skill in the art.” Evidence of simultaneous invention as a “secondary consideration factor favors obviousness.”)

⁸² 35 U.S.C. § 103.

⁸³ Lemley, (2011), at 7.

⁸⁴ *Id.* at 8.

inventions.⁸⁵ Of these 37, eight were listed because multiple individuals had “claimed” to have invented the listed invention; Ogburn and Thomas provided no information on the *specific claimed* inventions that permits analysis to ascertain whether simultaneous invention occurred in any of their listed “inventions.” For example Ogburn and Thomas’ No. 138 is “Flying machine. Claimed by Wright (1895 – 1901) Langley (1893 – 1897) and others”.⁸⁶ Here, Ogburn and Thomas call claimed “inventions” the early failed experimentation by the Wrights prior to their actual invention of 1903 and the failed experiments by Langley. The fact that Ogburn and Thomas identify “inventions” by a range of dates spanning several years rather than a specific claimed invention date is indicative of their misapprehension of invention and their flawed analysis.

Another example is No. 109 “Incandescent Electric Light. Claimed by Starr (1846) and Jobard de Clangey (1838)”.⁸⁷ But in this case, Ogburn and Thomas do not even have the full historical data to recognize that Starr’s U.S. patent application was rejected as being obvious in view of the prior art,⁸⁸ providing yet another demonstration that “obviousness” in patent law inherently precludes patents for near-simultaneous inventions. Moreover, Edison is not even recognized for the fundamental advance that he made.

With Ogburn and Thomas’ naïve notion of invention, early experimentation in a field with no identifiable *claims* of invention *is* the “invention” in their mind. Their method is to identify *any* early work of a group of experimenters in a given field, whether consequential or not, as simultaneous “invention.” With this method, there is little prospect that the remaining 35 candidates for simultaneous invention are (a) *actual* patentable inventions and (b) are near simultaneous. It follows that Lemley’s assertion that there is evidence for “an overwhelming prevalence of simultaneous invention.” should not be taken as a serious statement of fact. It should not be taken on trust to query the operation of the patent law.

Conclusion

While we cannot fault Lemley for not having the technical background on the specific inventions that he writes about, his work is the demonstrable result of the absence of such knowledge, knowledge that could be obtained by consultation with competent technical sources on the subject or simply by reading the reliable sources among Lemley’s cited sources. Throughout his essay Lemley retains the straw-man model of the naïve view of invention that serves only to muddle his analysis. His historical evidence is often self-contradicting and at times plain wrong in its facts. Although the issue is how the patent system and pioneer inventions work, he does not cite relevant patents, their claims, and their litigation histories to determine the facts. And this matters, because he uses his “evidence” to make the serious suggestion that real world patent law produces the wrong incentives. Our analysis shows that there is no evidence in the cases presented to support such a suggestion. Perhaps a key reason for Lemley to have misconstrued the actual intended incentives of the patent system is his view that it is merely intended to encourage invention and disclosure. But the *direct* purpose of the patent system that Lemley ignores, and from which the other incentives naturally flow, is to encourage *investment* in new inventions *once they have been made and disclosed*. According to our Constitution, substantial incentives for risky *investments* in new inventions are provided by granting exclusive rights – rights that, by definition, only one party can receive. The patent system is therefore designed to select the *earlier* of “near-simultaneous” inventions *that is nonobvious*; contrary to Lemley’s unsupported assertions, the evidence show that, under this system, simultaneous invention is extremely rare. We examined some but not all of Lemley’s cases, but

⁸⁵ William F Ogburn & Dorothy Thomas, *Are Inventions Inevitable? A Note on Social Evolution*, 37 ACADEMY OF POLITICAL SCIENCE, 93-98 (1922).

⁸⁶ *Id.* at 98.

⁸⁷ *Id.* at 97.

⁸⁸ *Early History of the Electric Light*, SCIENTIFIC AMERICAN, Vol. XL., No. 3. p40 (Jan 18, 1879)

because of the fundamental contradictory nature of his assertions with the operation of patent law, those we examined gave us no reason to think that his other cases would fare any differently under similar scrutiny.

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John Howells is Associate Professor at Aarhus School of Business, Aarhus University, Denmark.

Ron D. Katznelson is the President of Bi-Level Technologies, Encinitas, CA.

<http://bitly.com/Lemley-Critique>

