

# The Optimist Versus the Troll: Seeking the Patent Truth

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Last revised: July 25, 2013

## **Abstract**

Matt Ridley, the self-identified optimist, opposes patents, while Nathan Myhrvold, the accused troll, defends them. Theoretical arguments and recent evidence are mixed. But patents have provided just rewards, incentives, the democratization of opportunity, and enabling resources for key inventions in the last 300 years, including machines and engines in the original industrial revolution in Britain, more broadly in the United States in the 1800s, and even today in industries such as pharmaceuticals. With the right government policy reforms and entrepreneurial institutional innovations, such as those proposed by Myhrvold, patents can continue to provide such benefits.

(95 words)

## 1. Context and Introduction

DeLong and Summers (2001, p. 33) predict that the 21<sup>st</sup> century promises to be the century of Schumpeter's creative destruction. But for that promise to be fulfilled, wise decisions must be made to reform key economic institutions. Just as the land enclosure reforms were important at enabling the original industrial revolution, intellectual property reforms may be essential for us to continue the rapid rate of innovation of the past 100 or so years. A hundred years ago, Mark Twain suggested that a well-functioning patent system was the most important ingredient for a nation's economic success.<sup>1</sup> Today, DeLong and Summers (2001, pp. 51-54) and many others, agree that reaching the right conclusions on intellectual property can have a high payoff.

In the pages that follow, I aim to identify reforms that will encourage the process of creative destruction. Because I believe patents are more central to that process than copyrights, I will give far much more attention to patents than to copyrights.

## 2. Who Is Optimist, Who Is Troll?

Matt Ridley's *The Rational Optimist* (2010) is a lively and ambitious book, effervescing with useful information and provocative arguments on a wide variety of topics. Ridley's topic is optimism, and to cover all bases, he allows himself to discuss any time and place and issue about which there has been pessimism. So he discusses

human evolution and the Paleolithic experience. He discusses the industrial revolution and global warming. He discusses whether we are happy, and whether Africa can be saved. In addition, he discusses why patents restrain progress and should be abolished.

Nathan Myhrvold is also an optimist, though he has not yet penned a book with “optimist” in the title. He earned advanced degrees in mathematical economics and theoretical physics, and eventually became Chief Technology Officer at Microsoft. He left Microsoft in order to found Intellectual Ventures which invents, patents its inventions, buys the inventions of other inventors, and packages the patents into pools on related areas of technology.<sup>2</sup> For this, he has been branded a “troll,” a label he disputes in his “Funding Eureka!” (2010) manifesto, where he discusses why patents enhance progress and should be encouraged.

Both Ridley and Myhrvold are able and articulate, and so it causes a certain amount of alarm when they strongly disagree on a very important policy issue.

Besides Ridley, many distinguished and thoughtful scholars have doubted that patents enable and encourage invention and innovation. For example, Deirdre McCloskey emphasizes (2010, p. 337) flaws in the British patent system. (And in footnote 9 on p. 454, she expresses the view that since roughly 1900 the process of invention has become “routine” which would also be consistent with a view that patents are not necessary.) In her main rejection of patents, McCloskey relies heavily on a brief but rich article by Mokyr (2009). Mokyr sets up the ‘usual’ account of the role of patents in the industrial revolution, attributes it to Douglas North (1981) and then says “almost everything” (2009, p. 349) about the account is wrong.

McCloskey is in good company (e.g., Cole, 2001a and 2001b; Steven Johnson,

2010) in doubting the efficacy of patents in promoting innovation. But there is more to the Mokyr article than the opening salvo. As Mokyr proceeds, he adds qualification and nuance: he grants that for some industries, such as machinery “innovation would tend to be concentrated in economies in which patent protection was stronger” (2009, p. 352). And there are other issues, besides those raised by Mokyr, that are worth considering.

### **3. The Moral Case: Patents Are Fair**

The basic moral argument for patents is akin to the basic moral argument for property rights more generally. Locke observed (1967) that if you mix your labor with land, you have a right to the land. The fundamental moral intuition behind Locke’s observation can be given the biblical expression that you should only reap what you sow.<sup>3</sup> Ayn Rand observed (1966 p. 125) that “patents and copyrights are the legal implementation of the base of all property rights: a man’s right to the product of his mind.”<sup>4</sup> Recognizing a creator’s exclusive right to their creation, has long precedent: the Sybarites in ancient Greece granted chefs a year’s right to exclusive use of a new recipe (Athenaeus as quoted in Frumkin 1945, p. 143), a precedent that may be closer to the case of patents than it first seems, since Romer (e.g., 2008) has famously and persuasively argued that “recipe” is an apt analogy for a new technology.

Locke also observed that the property right in land was not absolute—it was limited by what Nozick called “the Lockean proviso” (1974, pp. 175-182) that there be as much and as good land left for others to likewise mix their labor with. So Locke’s

defense of property rights in land comes with a practical qualification.<sup>5</sup> If even the property right in land is subject to practical qualification, so, a fortiori, we would expect the more obscure case of intellectual property to be subject to practical qualification.

The libertarian theorist Andrew Galambos is said (Tuccille 1971, pp. 69-71) to have believed the contrary, holding that intellectual property rights were absolute and not subject to practical qualifications. He advocated putting a nickel in a jar every time he used the word “liberty,” the contents of which would eventually be given to Thomas Paine’s descendants. The massive impracticality of Galambos’ position, roundly satirized by Tuccille, amounts to a *reductio ad absurdum* of the position of absolute intellectual property rights.<sup>6</sup>

To further understand the roots of the moral intuition behind property rights, consider the photos below illustrating an experiment with dogs (Range et al 2009). Two dogs who have been trained to shake hands are placed next to each other. (I do not know the dogs’ names, but I like to call the first one “Galt.”) In the first photo, the experimenter shakes hands with Galt. She then rewards him with a piece of dry brown bread. The experimenter then shakes hands with the second dog, and in the second photo gives him a piece of juicy, prime sausage. In the third photo, the experimenter then extends her hand again to Galt, who turns away without extending a paw (though you can see the second, sausage-rewarded dog, starting to lift a paw to indicate willingness to shake hands again).



Figure 1: Dog on left (Galt) shakes hand (and then gets brown bread); dog on right gets sausage after shaking hand; Galt refuses to shake hands after having seen that the other dog gets a better reward for the same action. (Source: Associated Press, 2008, p. 2A)

The moral intuition behind property rights is not just human, it is apparently mammalian!

How does the animal experiment apply to patents? We grant that if a farmer mixes her labor with previously unowned land, it is fair that she own the land. So if an inventor mixes her labor with material objects to create an invention, it is also fair that she own the invention. To do otherwise would be to give the inventor the dry brown bread, while we give the farmer the juicy, prime sausage.<sup>7</sup>

During the last year of his life, Steve Jobs spoke of Apple's patent violation lawsuit against Google:

Our lawsuit is saying, "Google, you f\*\*\*ing ripped off the iPhone, wholesale ripped us off." Grand theft. I will spend my last dying breath if I need to, and I will spend every penny of Apple's \$40 billion in the bank, to right this wrong. I'm going to destroy Android, because it's a stolen product. (Issacson 2011, p. 512; asterisks used in place of letters, by me)

For Jobs, money was not the issue (whether as incentive or enabler). He believed that

they had stolen what was his, and that theft was wrong.<sup>8</sup>

#### **4. The Economic Case for Patents: Incentives and Funding**

Before he was President, Abraham Lincoln was sometimes invited to give a lecture in which he praised the benefits of new technology, and in which he praised the patent system as a motivator of invention (Khan and Sokoloff 2001, p. 244). Maybe introspection was the source of his observation, since Lincoln was the only President to himself hold a patent.<sup>9</sup> The eloquent core of Lincoln's patent praise was carved into the façade of the Department of Commerce building in Washington, D.C. (William Rosen 2010, p. 323):

THE PATENT SYSTEM ADDED  
THE FUEL OF INTEREST  
TO THE FIRE OF GENIUS

Lincoln would presumably be comfortable with one of the two main standard economic rationales for patents. Economists often assume that people are income-maximizers. Patents in such models, would provide limited-time monopolies, and would increase the income of the inventor who holds the patent.<sup>10</sup> The role of patents, in such set-ups would be to provide an incentive for inventors to invent (“the fuel of interest”).<sup>11</sup>

The open source movement, and other critics of intellectual property, argue that this approach assumes and ignoble and inaccurate picture of humans in general, and the inventor in particular. They argue that the motive power of the inventor is the desire to

create. So a better economic argument for patents focuses on patents providing income for inventors that serves, not as a motive for invention, but as a provider of funding that enables invention. I discuss this argument in the paragraphs that follow.

Robert Gordon has strongly argued (2000) that the most important examples of creative destruction occurred during the first industrial revolution, the one that is associated with the application of steam power to manufacturing and transportation.<sup>12</sup>

William Rosen points out (2010) that many of the great inventors of this first industrial revolution were inarticulate tinkerers. They lacked the voice to tell us with credibility and passion, how the money from patents enabled them to continue to invent.

Newcomen may have been a greater inventor than Watt, but we remember Watt because Watt and his friends were articulate, while Newcomen and his friends were inarticulate. (But Watt spoke up, and told the world how important patents were.<sup>13</sup>)

Most modern would-be inventors probably are similarly inarticulate. But they can borrow the voice of one of their creative cousins, the writer Walter Isaacson:

How will writers (or anyone else who creates content that can be digitized, from movies to music to apps to journalism) make a living in an era in which digital content can be freely replicated? That is now my greatest worry as I contemplate the so-called writing life that I hope to continue—and that I hope my daughter and all future generations will continue. (Isaacson 2009b, p. 20)

Another articulate defender of intellectual property as a means to fund creators is Bill Gates. In a famous open letter to the Homebrew Computer Club in 1976, Gates complained that the flagrant copying of software, resulted in software programmers receiving little for their efforts, which:

. . . prevents good software from being written. Who can afford to do professional work for nothing? [Who] can put three man-years into programming, finding all bugs, documenting his product and distribute for free?

(Gates as quoted in Phelps and Kline 2009, pp. 132-133)

Gilder emphasizes (1992) that the main reason for funding entrepreneurs is not to provide them the *incentive* to innovate, the best of them are already driven to do that, but rather to provide them the *enablement* to innovate. Similarly, Gates' friend Nathan Myhrvold<sup>14</sup> emphasizes (2010) that the main reason for funding inventors is not to provide them the *incentive* to invent, but rather to provide them the *enablement* to invent. It should also be added that patents often provide the funds to enable entrepreneurs to turn inventions into innovations. In survey research, high-tech start-up entrepreneurs report that patents are not very important as an incentive (Graham et al 2009, p. 1325), but more often are important as an enabler of funding, not only from angel and venture investors, but even from “‘friends and family’ and commercial banks” (Graham et al 2009, p. 1326).<sup>15</sup>

Maybe because of the poor quality of the patent system, some patents do not exist that would otherwise exist--the erstwhile inventors could not afford the time and equipment to make the patent a reality. An argument that Johnson and the others do not consider is that patents may be useful to provide the resources for inventors to continue to invent more frequently and more ambitiously. (Ambitious inventing is inventing that requires more resources for equipment, staff and the like.)

Additional benefits to patents are sometimes adduced. Mark Blaug, for instance, has argued (2005) that another main standard economic rationale for patents

was to promote the early sharing of knowledge about advances, by reducing the incentive inventors have to keep their inventions secret. At least in the United States in the 1800s, patents often had this effect---helping to spread knowledge of new technologies more widely and quickly. Firms subscribed to journals that summarized relevant new technologies revealed in patent applications (Lamoreaux and Sokoloff 2001, p. 40; Lamoreaux, Sokoloff, and Sutthiphisal 2013, pp. 12-14). Firms also specifically tasked some of their employees to stay informed about new technologies revealed in patent applications (Lamoreaux and Sokoloff 1999, pp. 42-44). A third source of information for firms were patent attorneys who developed specialized knowledge of areas of technology. In addition to helping an inventor draft and file patent applications, a patent attorney also often advised the firm on the merits of new technologies in the firm's industry (Lamoreaux and Sokoloff 2001, p. 40; Lamoreaux, Sokoloff, and Sutthiphisal 2013, pp. 17-19).

The benefit of patents helping to spread information about new technologies, continues to be discussed by current researchers (e.g., Moser 2011; and Winder 2012). Empirical studies of patents have shown other benefits. For example, firms that patent are more likely to survive (Helmers and Rogers 2010, 2011; and Wagner and Cockburn 2010) and are more likely to receive venture capital (Audretsch, Bönte, and Mahagaonkar 2012).

## 5. The Economic Case against Patents: Monopoly Pricing and Barriers to Extending Old Inventions

The most common economic argument against patents rests on the oft-repeated stylized fact that empirically patents have not worked in recent periods, except for pharmaceuticals. We will defer discussion of this claim to a later section in which we look at contemporary evidence on the effects of patents.

Others have presented more theoretical arguments against patents. The oldest of these is that patents create a monopoly and that monopolies result in lower output and increased prices for consumers (e.g., Cole 2001a, p. 113; 2001b, pp. 80-83). These costs from patents may be less severe than the usual theory suggests. For example, Lakdawalla and Philipson (2012) have presented evidence that patent-induced monopoly does not much reduce the output of prescription medicines. They attribute this to firms having a greater incentive to invest in marketing when they have a monopoly due to patents. And Stigler (1968) and other economists have suggested that limited terms for patents can limit the costs borne by consumers.

A more recent part of the case against patents is to point out the high, and increasing, costs of patent litigation (Bessen and Meurer 2008, pp. 131-138 & 259). The direct costs of litigation are substantial, but another cost of litigation is in the substantial loss of stock valuation, often suffered mainly by the defendants. These costs may be justified if they are borne to defend the property of breakthrough inventors. But the costs seem particularly egregious when they are due to lawsuits based on low quality patents. One way in which patents can be of low quality is for them to be

written and approved in a highly ambiguous form, which results in other firms not knowing when they might be violating a patent (Bessen and Meurer 2008, pp. 53-64). Another form of low quality patents are the many business method patents that are for natural extensions of current business practice. Jeff Bezos opposes such patents, even though Amazon has benefitted from holding the business practice patent for the “one-click” purchase button on online sites (Brandt 2011, p. 15).

The rising costs of litigation are sometimes blamed on “patent trolls” (Bessen and Meurer 2008, pp. 159-160). The moniker has negative connotations, but its exact meaning is not clear.<sup>16</sup> Bessen and Meurer adopt (2008, p. 17) a definition that they call “narrow,” but that is in fact too broad: “patent trolls” are “individual inventors who do not commercialize or manufacture their inventions.” This definition is too broad to imply the negative connotation usually associated with “troll.” For example, by that broad definition, Robert Kearns would have to be considered a patent troll. Kearns received a patent for his invention of the intermittent windshield wiper, and sued Ford and Chrysler for patent infringement. Yet Kearns is generally viewed as a hero fighting for justice, rather than as a despicable troll trying to extort ransom from productive firms (see *Flash of Genius*, the 2008 movie on Kearns).<sup>17</sup>

Another “patent troll” by the broad definition, would be Thomas Edison. Edison fully or partially transferred the rights to 20 of his first 25 patents, leading Lamoreaux and her co-authors to conclude “. . . , that Edison depended heavily on [the transfer of patent rights] to finance the early stages of his career.” (Lamoreaux et al 2013, p. 6; ellipsis and bracketed words added) More generally, Hughes’ “golden era for independent inventors” (Hughes 1989, p. 15) from 1876 until World War I, was

due “to the opportunities that the ability to trade in property rights to new technological knowledge allowed them.” (Lamoreaux and Sokoloff 1999a, p. 12)

Contrast Robert Kearns with Efraim (Efi) Arazi, a true “patent troll” in the appropriately narrow sense of the phrase: one who extracts rents from patents without adding value. While at Microsoft, Nathan Myhrvold experienced an epiphany when Efi, a business method patent holder, dropped by Microsoft to extract licensing payments (Phelps and Kline 2009, pp. 10-12). What Efi was doing was very different from what Myhrvold himself was later to do with his Intellectual Ventures---buy high quality patents as a means to provide funding for invention, and to bundle them to make them broadly and reasonably accessible to businesses and investors, without high litigation costs.<sup>18)</sup>

Ridley’s argument (2010) against patents makes the issue one of motivation for invention, rather than funding to enable invention. He claims that most innovators are not motivated by the love of money, and hence will not need patents to motivate them, and anyway patents slow down the promiscuous mating of ideas. Like Ridley, Johnson (2010), and Kelly (2010) also make much of the interaction of ideas. But none of the three consider how the patent system might be made more friendly to the kind of flow and interaction and exaptation<sup>19)</sup> of ideas that they emphasize.

Several analysts argue that the current system severely limits inventors’ ability to use and build upon the intellectual creations of others, and hence stifles creativity and the spread of worthy creations. The problem is widely viewed as so severe that Lawrence Lessig (2001) has gotten considerable traction with his Creative Commons movement whereby intellectual property creators agree to forego their usual copyrights

in the interest of wider dispersion and use of their creations.<sup>20</sup>

The most common alternative to patents that is suggested by economists and others, is some version of the open source approach. Here the argument is that open source is either nobler than intellectual property systems or else results in greater creativity. A version of the open source approach is illustrated by Hippel's (1988, 2005) examples of innovation that arise from tinkering by user communities. Other versions of the approach are discussed by Chris Anderson (2013).

Open source can work for a while under some circumstances. If the open sourcers are independently wealthy, or philanthropically supported, then they can pursue it full-time, as long as they maintain their mission-oriented dedication. But, in the past, property-free utopian communities have collapsed due to a combination of low productivity and the disillusionment of key members. Productivity increases when those who have been productive in the past, are allowed to reinvest their profits, in order to be even more productive in the future. And akin to Galt, the dog, in our earlier example, the productive in utopian communities eventually become disillusioned at supporting the unproductive free-riders in utopian communities. Diverse examples illustrate these claims. Most New Age communes of the 1970s collapses (see, e.g., Beston 2008). Kibbutzim failed, and moved toward incentives (Kerschner 2007). Louisa May Alcott's parents' commune failed (Price 2010, p. 21).

The worst piece of software I regularly use, Movable Type, is open source. Open source can 'work' as long as enough able entrepreneurs, and sacrificing supervisors, remain dedicated to it, as, for example, with "Jimbo" Wales in the case of Wikipedia and Linus Torvalds in the case of Linux ("Informed Reader . . . ," 2007).

But it is rare for this to be done for long, that eventually the sacrificing supervisor becomes less mission-oriented and believes they should have their just reward, or wants the resources to pursue new, perhaps bigger, projects

The case against intellectual property usually does not emphasize the issue of how invention will be funded. But sometimes alternatives are discussed. For physical inventions, a commonly discussed alternative is secrecy. If patents were abandoned, or weakened, then this would skew innovation toward areas where secrecy could be maintained (e.g., away from products where reverse engineering is easy).

But those who criticize patents, and praise collaboration, such as Anderson (2012), Johnson (2010), Kelly (2010), and Ridley (2010), do not suggest that inventors fund their inventions by keeping them secret. Instead, their assumption is usually that the creator will need to self-fund their creativity. Chris Anderson's account of patentless invention implies two possible sources of funding. Sometimes he mentions the importance of an inventor having a "day job" (Anderson 2012, pp. 3, 12, 188-189, and especially 128). Elsewhere he suggests a model he himself is pursuing, in which the inventor combines invention with entrepreneurship, and funds himself with the profits from entrepreneurship. This might work if all good inventors were able and desirous of also being good entrepreneurs. But the record is rife with counter-examples. The steam engine required both the invention of Watt and the entrepreneurship of Boulton. Apple required both the invention of Wozniak and the entrepreneurship of Jobs. (For the latter case, several episodes in Wozniak's autobiography (2006) illustrate the point.) For those inventors who are not independently wealthy, and do not have a lucrative day job, Anderson's approach limits

the extent to which creators can specialize in their creativity and, if they succeed, support themselves on the basis of it.

Economists have long struggled with competing economic considerations that argue for and against patents, and have reached differing conclusions. What if the benefits and costs are roughly equal? In that case, Hall and Harhoff (2012, p. 542) suggest that there is a plausible presumption in favor of retaining a patent system.<sup>21</sup> The argument is that, whatever the merits *ab initio*, once we have a patent system, preserving certainty and expectations makes a case for preserving it, in the absence of a definitive case for abolition.

## **6. What Is the Record of Patents Mattering for Innovation?**

### **a. The Past**

Those who advocate abolishing patents often place overwhelming weight on the failures of the current patent system and show little, if any, interest in the record of past patent systems (e.g., Boldrin and Levine 2013). But the track record of past patent systems is of more than antiquarian interest. If past patent systems were successful at encouraging innovation, then any failure of the current patent system may be due to changes in the patent rules or in the implementing of those rules. If so, then the case is stronger for reform than for abolition.

William Rosen's *The Most Important Idea in the World* (2010) argues that the steam engine was the key invention of the industrial revolution, and that the relatively enlightened patent law of England (compared, e.g., to France) explains why the steam

engine was first developed in Britain, mainly by Newcomen and Watt, (the latter a strong advocate of patents).<sup>22</sup>

Rosen seeks to answer one very, very important question, and works hard to answer that question with careful and thorough research and wide-ranging and wise analysis. His question is why the industrial revolution occurred in the 17 hundreds in Britain? In contrast to Ridley, who reifies ideas, and views their mating and exchange as an inevitable consequence of growing populations,<sup>23</sup> Rosen believes people create and learn and remember and apply ideas, and people need the means to survive, and support their families, and to have the free time and the space and tools to innovate. William Rosen's scope is narrower, and his energy is more restrained, only in comparison with Ridley. For Rosen, Coke's formulation of a clear and broadly applicable patent statute that was put into effect in 1624 (Rosen 2010, p. 52) provided ambitious and innovative craftsmen the means to support themselves and develop their innovations. And Rosen does not just make this a theoretically plausible argument. He gives several examples of modest craftsmen whose key innovations would not have been possible if it were not for the means made available by the British patent system.

Some economic historians have expressed doubts that patents could have mattered much in causing the industrial revolution because of the high costs of obtaining patents, both in terms of time spent in the legal process and in terms of fees. Bottomley has gone far in answering these doubts by documenting the growing importance of patent agents starting in the 1770s (2012, p. 180). The patent agent could represent the patent applicant in some legal proceedings, reducing the amount of time that the applicant had to spend in London (Bottomley 2012, pp. 47-48). And the

patent agents, through their connections with entrepreneurs, manufacturers and capitalists, could help the inventor find funding, both to help fund patent fees and to eventually bring the invention to market (Bottomley 20-12, pp. 49-50 & 180).

For a somewhat later period, Petra Moser's influential work (2005, 2012) on the technological inventions displayed at the Crystal Palace exhibition found that in industries such as machinery, where copying of technology was relatively easy, much of the inventing occurred in countries, such as Britain, with effective patent systems. Conversely, in industries where secrecy was easier to maintain, a higher degree of invention occurred in countries that lacked patent systems, such as Switzerland and Denmark, or in countries with poorly enforced patent systems, such as Bavaria.

Sokoloff, in papers with Khan and Lamoreaux, provides argument and evidence that in the United States, patents provided funding that helped enable more invention, especially, by ordinary citizens (Sokoloff 1988; Sokoloff and Khan 1990; Khan and Sokoloff 1993, 2001, 2006; Lamoreaux and Sokoloff 1999, 2001; Lamoreaux, Sokoloff, and Sutthiphisal 2013).<sup>24</sup> In an elaboration of some of this work, Zorina Khan has shown (2005, pp. 202-207) for the United States that the early patent system provided an important source of income for many inventors (which plausibly could have served either as an incentive to invent, or as an enabler by providing financing for further inventions). She believes that on balance, the effect of patents was to encourage U.S. economic growth, and that the greater accessibility of the patents to ordinary citizens in the United States, than was the case in Britain, helps to explain why U.S. economic growth in the period was greater than Britain's (see also Merges 2007, p. 452).

In nineteenth century United States, a vibrant and productive market for inventions existed in which individual inventors received patents for their works, and then sold their patents to firms interested in developing and manufacturing the inventions (Lamoreaux and Sokoloff 1999, 2000 & 2001; Lamoreaux, Sokoloff and Sutthiphisal 2013). In some cases, the inventors would serve as consultants or employees of the firms set up to develop their inventions. In other cases, as in the United States glass industry in the late 19<sup>th</sup> and early 20<sup>th</sup> centuries, inventors often lived in geographically distant locations from the manufacturers who made use of their inventions (Lamoreaux and Sokoloff 2000). Note that these latter inventors would meet the modern broad definition of patent trolls, and yet there was (and is) no stigma attached to their activities.

Although the most thoroughly documented historical examples of successful patent systems are Britain and the United States, other examples can be found. Nicholas and Simizu (2013) present evidence and argue that a vibrant patent market helps explain Japanese technological development and economic growth during the Meiji period. And in discussing Murmann's extensive (2003) analysis of the evolution of the successful German dye industry in the 1800's, Richard Nelson (2008, p. 5) explains that "German patent law was tightened up (sic) better enabling German firms to protect the new dyestuffs they created."

Just as history provides examples of well-enough-designed patent systems providing incentives, and enabled financing, for important innovations, it also provides examples where an ill-designed, or absent, patent system slowed innovation. Hager (2007, p. 172), for instance, documents how no one went fast to market with sulfa

drugs because they could not be patented, and so no one could profit from them. Patents, and how they are designed, provide incentives and funding that matter.

### **b. Last Several Decades (Since about 1960)**

The current common wisdom among economists is that in recent decades, patents do not seem to matter, except in the chemical and pharmaceutical industries (e.g., Crovitz 2009, p. A13; and the sources cited in Hall and Harhoff 2012, pp. 548-549). This stylized fact is used to argue that patents usually do not matter much, and we might be better off without them. There appears to be little gain in terms of increasing incentives for invention and enabling funding for invention. And this has to be weighed against the pain because patents hamper innovators ability to build upon (mash) other innovators contributions, and because patents increase the cost of new products, and hence slow their adoption.

But there is a better interpretation of the stylized fact: our patent system, as currently implemented, may have, on balance, limited incentive and enabling effects. But this does not rule out the possibility that some patent systems in the past, and a reformed patent system in the future (one adequately funded and efficiently executed), could have substantial incentive and enabling effects in a wide range of industries. And this is more than just an idle theoretical possibility: the success of earlier patent systems at providing incentive effects, provides credible grounds for believing that a reformed system could do so once again.

## 7. Comments on Well-Known Individual Cases

Besides general cases against patents, individual examples can be produced. For instance, Bessen and Meurer (2008, p. 259) imply that the public image of the patent system in the early 1800s suffered because of Eli Whitney's problems enforcing his cotton gin patent. It is true that Eli Whitney did not benefit much from his patent on the cotton gin. But that may be due more to the failure of Whitney's as an entrepreneur, than to the general failure of the patent system. For use of the gin, Whitney demanded a one-third share of any harvest. This exorbitant price, provided cotton growers a strong temptation to pirate the invention, a temptation to which a great many yielded (see Bryson 2010, pp. 395-396). The Whitney counter-example to patents is even more devastatingly undermined, if Charles Morris' substantial circumstantial evidence (2012, pp. 319-325) is correct that Whitney did not even deserve a patent because he was not actually the first to invent the cotton gin.<sup>25</sup>

The inventor and would-be entrepreneur of television, Philo Farnsworth, was a creative thinker who had ideas in many areas, including nuclear fusion. The patent system did not work in his case. The legal dispute was prolonged, with the result, that even though he eventually won, he actually lost. And losing meant that he did not have the resources to pursue his other ideas. Farnsworth had other problems, though, including poor judgment in revealing his inventions to strangers and overuse of alcohol. (for the details of the Farnsworth story, see: Schwartz 2002; Stashower 2002)

John Mason, of Mason jar fame, held a patent and died poor. But he had sold his patent cheap, and his later inventions did not prove useful (Bryson 2010, p. 74). Other cases illustrate the financial hardship that resulted when inventors were unable to

acquire patents. For example, because he could not patent his new plant varieties, Luther Burbank “lived under constant financial pressure” (Maslin 2009, p. C4; see also Smith 2009).

John Gorrie is sometimes described as the inventor of the refrigerator or the inventor of air conditioning,<sup>26</sup> though both claims have been plausibly disputed.<sup>27</sup> But he did receive patents for inventions related to each technology, and he received little benefit from either patent. How much should we blame the patent system in the first half of the 19<sup>th</sup> century? It has been claimed that the patent office was slow in approving his second patent, the one related to air conditioning, and that waiting for the patent contributed to his discouragement. But he had other problems, not directly related to the patent system. Some of these problems were related to bad luck, others to his choices, yet others to his character. He had trouble raising financial backers to develop his first patent. He had the bad luck to finally sell three-fourths stake in the first patent to a backer who proceeded to die without providing for the development of the patent, or for reversion of the majority ownership to Gorrie (Sherlock 1982, p. 114). He was not an effective publicist for his invention (Sherlock 1982, pp. 114-115), and he may not have had the persistence in the face of adversity of, say, a Charles Goodyear or a Steve Jobs.<sup>28</sup> This may have been as much a result of some of his choices, as of his personal character. His main work was as a physician, though he also served in several civic roles, including postmaster and mayor (Sherlock 1982, pp. 45-46); all of which would have left him less time to focus on inventing and on bringing his inventions to the market. And he chose to live in an environment, the antebellum South, whose culture, economy and climate did not lend themselves to

intense inventive activity.<sup>29</sup>

Charles Goodyear was very poor most of the time (Slack 2002). But some of what money he did raise, early on, was due to the hope that he might eventually receive a patent. And most of what money he did eventually receive, arose from the award of the American patent (which may have partly compensated for the unjust award of the British patent to Thomas Hancock who stole the patent based on reverse engineering vulcanized samples that had been sent to him via Goodyear as an overture to a possible business relationship.)

It has been alleged that Alexander Graham Bell stole the patent for the telephone from Elisha Gray (Shulman 2008). But reasons to adopt a more nuanced conclusion can be found in the account of Evenson (2000).

Some unjust or inefficient outcomes have resulted under some patent systems. But often these can be attributed to unfortunate, and reformable, characteristics of the particular patent systems. For example, when Fourneau "stole" Domagk's discovery of the first sulfa drug, by re-engineering it, he was taking advantage of what was then allowed by French patent laws, even though he didn't think the laws were right (Hager 2007, p. 166). A more recent example would be Jeff Bezos taking out the business patent for the "one click" purchase feature, even though he did not believe that business patents should be granted for describing a process that is obvious (Brandt 2011, pp. 8-9 and 15).

Jonas Salk is often quoted for having asked "Can you patent the sun?" (Smith 1990) The implication is that Salk was noble in foregoing the claim to property rights, and others should do likewise. But when Salk said that, lawyers for his organization

had already looked into patenting the vaccine and had concluded that it was not patentable by the standards of the day, due to earlier advances that were sufficiently similar that they took precedence over the Salk version (Smith 1990).

## **8. Improvements Can Strengthen the Case for Patents**

There is a presumption in favor of property rights, for several reasons (innate fairness, incentives, resources to those who use them well). But that presumption can be over-ridden when the costs of enforcement of property rights is too high, or the effects of enforcement too dire. Because of the benefits of property rights, an important goal of government, and of private institution-building entrepreneurs, should be to extend the situations in which it makes sense to enforce property rights.

The history and theory of patents are of interest in part because of their relevance to the debate about whether to scrap or reform the current patent system. That debate centers around some economic studies of the modern patent system that conclude that, outside of a couple of industries, there is little evidence that patents encourage innovation. While admitting the problems with the current patent system since 1982, Jaffe and Lerner (2004) plausibly argue that the wise response is not to scrap the system, but to reform it. Bessen and Meurer (2008) are less sanguine, but also suggest that useful reforms are possible.<sup>30</sup> The exuberant polymath Nathan Myhrvold (2010) has provided an even more ambitious agenda for reforming and extending patents. Promising improvements can take two forms. One is reform of the government patent institutions. Another is private institutional innovation, sometimes

enabled by clever application of advancing technologies. I will discuss both.

### **a. Government Reforms**

Lamoreaux and Sokoloff, who have contributed much to documenting the important role of patents in early United States invention and innovation, are optimistic that if appropriate reforms to the patent system are implemented, the patent system may again play a major positive role in financing innovation in the United States (Lamoreaux and Sokoloff 2007, p. 472). They particularly emphasize implementing the reforms in Jaffe and Lerner's (2004) thorough and much-discussed research on the recent history of the patent system in the United States.

Jaffe and Lerner identify two main changes in earlier patent law that they believe have made the patent system much less effective. One change that they highlight is that since Congress made changes in patent law in the 1990s, the revenue of the Patent and Trademark Office (PTO) is directly related to the number of patents they approve. As a result, the approval rate has increased, which means that more patents are approved that should have been rejected. It turns out that *more experienced* patent examiners are *less likely* to cite prior art and are *more likely* to grant patents (Lemley and Sampat 2012). This is consistent with the perverse incentives that Congress has given the PTO. In the presence of perverse incentives, a huge workload, and indifferent managers, it is easy to imagine how initially idealistic patent examiners would take their jobs less seriously as they gain experience.<sup>31</sup>

So one key reform would be for Congress to directly fund the PTO, and to

increase funding levels. A main use for the new funds would be to hire more and better patent examiners, which should result in both higher quality patents, and a reduction in the patent backlog. One benefit would be the issuance of patents of higher quality, implying, for instance, that a higher percent of patents be issued for inventions that are significant, useful and not an obvious extension of current practice. Another benefit would be to reduce the backlog, thereby increasing the span of time during which an inventor could receive revenue from her invention, and reducing the uncertainty of invention, and thereby increasing the incentive and funding for invention.

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With more and better examiners, decisions would be made more quickly and those patents issued would be issued more quickly. This would make it more reasonable to have a shorter span on patents, as advocated, for example by Posner (2012), and still have the inventor receive most of the return on an infinite-lived patent (see: Stigler 1968). Shorter patent length might also be justified by the faster pace of invention which increases the likelihood that quick leapfrogging would reduce the de facto meaningful (value producing) length of patents---with a quickened pace of invention, more of the value of a patent is in the first few years. So shortening the number of years of patent protection would still provide ownership, reward, and enabling resources for the inventor, while also addressing the concerns that Johnson (2010), Ridley (2010) and others have about removing barriers to the cross-fertilization of ideas. Shorter patents would increase the possibility of exaptation and cross-fertilization, and would reduce the incentive for filing nuisance patents that serve no purpose except to extract rent from manufacturers.

An obvious, though not easily implemented, reform would be to hire and reward better management of the PTO. A recent director of the PTO said of his agency: "There is no company I know of that would have permitted its information technology to get into the state we're in. If it had, the C.E.O. would have been fired, the board would have been thrown out, and you would have had shareholder lawsuits." (Kappos as quoted in Wyatt 2011, p. A1)

Other reforms should be considered after further thought and research. For example, is it better to award patents to the person who is first to invent or who is first to file? And for a patent to remain valid, should it be required that the patent be implemented within a certain period of time?

### **b. Private Institutional Entrepreneurship**

Reforms of the government patent system may bring a renaissance of invention. But another important, and under-appreciated, source of renewal is institutional entrepreneurship in the private sector. Some examples of these are at the idea stage and other examples have been implemented.

Bill Gates, perhaps with assistance from Nathan Myhrvold,<sup>33</sup> wrote in *The Road Ahead* (1995, p. 122) about making tiny micropayments every time a web site is visited.<sup>34</sup> Many of their suggestions in the book have been implemented, but unfortunately, this one is not among them. Micropayments would be small enough to allow the creative cross-fertilization advocated by Ridley (2010), Johnson (2010) and others, while still enabling creators to receive revenues that are their just reward, and

that provide them the means to continue to create. The former *Time* editor and respected biographer, Walter Isaacson, has eloquently defended micropayments on just these grounds (Isaacson 2009a and 2009b).

Micropayments might have been, and could still be. But they would require financial innovations, from an entrepreneurial company such as PayPal, that would be hard to accomplish in the current regulatory environment. One of the sad aspects of Eric Jackson's account of the early years of PayPal is how the company was constrained by regulations lobbied for by rent-seeking incumbent banks that were threatened by PayPal's innovations (Jackson 2004, p. 254).

What Bill Gates advocated for the written word, Steve Jobs achieved for the musical performance.<sup>35</sup> Napster, and like services, had resulted in widespread pirating of music. Music label revenues had plummeted and observers feared that music creation would increasingly be underfunded. Jobs believed that most people wanted to respect property rights, if it was not made too hard for them to do so. So he created the iTunes system that allowed customers to easily pay a small amount for each song they wanted to own. He did this partly by pulling together wonderful hardware and software, but also partly through his effectiveness at convincing musicians and music labels to sign on to his plans. Jobs' most breakthrough innovation was not in the iPod, since somewhat similar mpeg players preceded the iPod. His breakthrough innovation was the creation of the iTunes institution for distributing and making payments for the intellectual property of musicians. One wonders, sadly, whether Jobs might have made similar breakthroughs for the written word, if only his life could have been saved.

Nathan Myhrvold is attempting to do for inventors what Jobs did for musicians,

provide a viable institutional framework in which they can receive funding for their creative contributions (Myhrvold 2010; and Levitt and Dubner 2010, p. 178; Lohr 2010, pp. B1 & B10). Myhrvold believes that a better system for funding individual inventors will result in more invention. Inventors will benefit from having more funding to pursue their creative inventions and society will benefit as well.

Myhrvold's Intellectual Ventures organizes its patents into pools, organized by industry or technology.<sup>36</sup> The pooling serves several purposes. Firms can buy the rights to pools in their area of activity, and thereby increase the probability that they will not be shut out of a key technology. Investors can invest in pools and diversify against the risk they would experience if they invested in a small number of inventions, each of which had a high probability of failure.<sup>37</sup>

Myhrvold argues (2010), and economist Levitt concurs (Levitt and Dubner 2010), that Intellectual Ventures is providing a service for both inventors and technology firms, by helping make the market for inventions more transparent and efficient.<sup>38</sup> His Intellectual Ventures is intended in part to cut off the troll's power to impose huge gratuitous, unexpected litigation expenses. Myhrvold creates industry-related patent pools; firms subscribe, have access and avoid litigation. The pools spread risk, reduce litigation, speed diffusion of invention, and perhaps most importantly, provide enabling resources for inventors.

## 9. Conclusion: The *Real* Optimist Is the So-Called "Troll"

The light bulb is iconic of invention. Thomas Edison, the inventor of the light

bulb, supported himself, his famous lab, and his future stream of inventions, by the revenue generated from his past inventions. He patented early and often—revenues from patented inventions were an important part of what supported him. According to Josephson (1959) when the Edison bulb was being tested, the testers would report to each other “the light still burns.” And when Edison was dying, after visiting his father’s sickroom, Edison’s son would report to well-wishers “the light still burns.” The question of this paper has been whether patents can continue to play an important role in keeping the light of invention burning.

McCloskey (2010) and Ridley (2010), both of whom are usually right, are against patents. But I still am inclined to think that the pros of patents are greater than the cons, or at least will be after suitable reforms. The core of my argument is that, properly done, patents are fair, democratize the opportunity to invent, provide an incentive for invention, and, most importantly, provide resources to inventors that enable continued invention.

The protection of intellectual property is consistent with our ethical principles, our ethical intuitions, and our beliefs about incentives and funding mattering. Patents have often encouraged invention in the past and still sometimes encourage invention. With wise reform of the patent rules, and institutional entrepreneurship, patents can again be more broadly effective at encouraging invention.

I have presented a plausible past and a possible future. Patents sometimes have provided income to inventors, and thus have motivated and enabled further invention. The current patent system has been criticized for delays, costly litigation and for discouraging innovation, except in chemicals and pharmaceuticals. However, the

patent system can once again be an important enabler of innovation, if the system is better funded and more efficiently administered, if we adopt entrepreneurial institutional innovations, such as Nathan Myhrvold's patent pools, and if we reform the patent system rules.

## Footnotes

\* An earlier version was presented to the meetings of the Association of Private Enterprise Education (APEE) in Lahaina on April 15, 2013. I am grateful to Doug Altner and Harry Binswanger for the Rand reference and to Julian Morris for the Kinsella reference. Some research assistance was provided by Nuri Erdogan.

<sup>1</sup> Mark Twain (1917, p. 68). Mark Twain's enthusiasm for the patent system is mentioned in Khan and Sokoloff (2001, pp. 233-234).

<sup>2</sup> He also has received considerable attention for his innovative cooking techniques (Myhrvold et al 2011), and for his technological solution to global warming (see: Levitt and Dubner 2010, pp. 177-199).

<sup>3</sup> "Do not be deceived: God is not mocked, for whatever one sows, that will he also reap." (*The Holy Bible*, English Standard Version, Galatians 6:7-9).

<sup>4</sup> Stephen Kinsella has criticized Rand's defense of intellectual property (2003, pp. 23-27 and passim) in an extended, mainly philosophical, treatise. Space does not permit discussing all of Kinsella's argument. But one of his key points is that property rights should be limited to the material, because "property rights must have objective, discernible borders, and must be allocated in accordance with the first-occupier homesteading rule." (p. 31) But property rights in the material can be just as lacking in "objective, discernible borders" as are property rights in the intellectual. Nozick (1974, pp. 175-182) discusses the ambiguities of the first-occupier homesteading rule; and the legal literature is filled with many other ambiguities in assigning property rights to the material. When Union Pacific owns train tracks that go by Farmer Smith's

wheat, does Union Pacific's property right include the right to run a train that might throw off a spark and ignite Farmer Smith's wheat? (see: Coase 1960, pp. 29-34)

When I buy my house partly because of the view, is the view part of my property right that is violated when my neighbors let their trees grow to block my view? There are all kinds of ambiguities in applying general principles to specific cases, both in cases of material property rights and intellectual property rights. But ambiguity does not justify giving up in hopeless despair.

<sup>5</sup> Many other cases of practical qualifications of property rights arise. I was semi-co-leading a group of about 15 Montessori middle-school students on a hike in the area of Estes national park in Colorado. We were semi-lost in an open area, when a thunderstorm came up. There was a cabin close by with an extensive open, but covered, porch. I directed the students to take cover on the porch. But one of the students was bothered by my direction because there was a "Private Property---No Trespassing" sign on the porch. I told the student that under this circumstance, the owner would likely understand and approve of our using the porch for emergency shelter, so long as we were careful not to do any damage to the porch. I may have added that the owner probably would have used someone else's private property porch under similar circumstances. (I could have used a more sophisticated argument based on Rawls' (1971) conceit of imagining what rules, and exceptions, we would all decide upon behind a "veil of ignorance.")

<sup>6</sup> Even Rand, who generally believed in absolutes, agreed (1966, pp. 127-128) that patents and copyrights raised difficult issues.

<sup>7</sup> Steven Johnson (2010) generally argues that the unencumbered interaction of ideas offers the greatest hope for progress. But even he grants that there may be a moral argument for copyrights and patents: “There are plenty of understandable reasons why the law should make it easier for innovative people or organizations to profit from their creations. We may very well decide as a society that people simply *deserve* to profit from their good ideas, and so we have to introduce a little artificial scarcity to ensure those rewards.” (Johnson 2010, p. 242; italics in original)

<sup>8</sup> The eminent economist and philosopher John Stuart Mill, shared Jobs’ view that the key issue in intellectual property is the immorality of stealing the work of another: “It is generally admitted that the present Patent Laws need much improvement; but in this case, as well as in the closely analogous one of Copyright, it would be a gross immorality in the law to set everybody free to use a person’s work without his consent, and without giving him an equivalent.” (Mill 1909, p. 933)

<sup>9</sup> For “a device to buoy steamboats over sandbars” (Khan and Sokoloff 2001, p. 244).

<sup>10</sup> Acemoglu, Bimpikis and Ozdaglar list (2011, p. 37) several exponents of the argument for patents as creators of monopoly profits that provide incentives for inventions. The earliest of their exponents is Arrow (1962).

<sup>11</sup> The film director Peter Jackson supports the mainstream economists’ argument for protecting intellectual property: “Piracy has the very real potential of tipping movies into becoming an unprofitable industry, especially big-event films. If that happens, they will stop being made,” said Mr. Jackson in an e-mail message from New Zealand, where he is putting the final touches on his version of “King Kong.” “No studio is

going to finance a film if the point is reached where their possible profit margin goes straight into criminals' pockets." (Jackson as quoted in O'Brien 2005, p. 1)

<sup>12</sup> Gordon identifies (2000, p. 57) three industrial revolutions so far. He writes that the "First Industrial Revolution" lasted "from about 1760 to 1830." "The Second Industrial Revolution" lasted from "roughly 1860 to 1900" and is identified with electricity and the internal combustion engine. Gordon asks whether computers and the internet "constitute a Third Industrial Revolution" (with dates yet to be determined).

<sup>13</sup> Rosen (2010, p. 233) quotes from a manuscript defending the patent system, that Watt co-authored with fellow-inventor (and entrepreneur) Richard Arkwright: "The man of ingenuity in order to succeed must seclude himself from Society, he must devote the whole powers of his mind to that one object, he must persevere in spite of the many fruitless experiments he makes, and he must apply money to the expenses of these experiments, which strict Prudence would dedicate to other purposes."

<sup>14</sup> "Nathan Myhrvold is Bill Gates's favorite geek. "I don't know anyone I would say is smarter than Nathan," Gates says. "He stands out even in the Microsoft environment." . . . "Perhaps no one at Microsoft is closer to Gates: . . ." (Auletta 1997, p. 66; ellipses added.)

<sup>15</sup> In their article on smart phone patent controversies, Graham and Vishnubhakat conclude that "the enforcement of patents [is] a reasonable exercise in appropriating value from innovation." (2013, p. 83; bracketed word added) Consistent with the view that patents often increase the funding that enables innovation, is the study by

Webster and Jensen (2012, pp. 431 & 447) that finds that firms whose patent applications are rejected are less likely to proceed to manufacture their invention.

<sup>16</sup> Bessen and Meurer (2008, p. 159) observe that: ““Patent trolls” are one of those great rhetorical confections that, unfortunately, mean different things to different people.”

<sup>17</sup> The first chapter of Seabrook (2008) reprints the article from *The New Yorker* on which Abraham’s *Flash of Genius* movie on Kearns was based. Also supporting the view of Kearns as hero is the summary account in Anderson (2012, pp. 120-122).

<sup>18</sup> Damien, Layne-Farrar and Padilla (2012) have argued that not all “non-practicing” patent holders should be classified as “trolls.” While some non-practicing patent holders (the justly-named trolls) may simply add costs to the process of innovation, others “increase competition, increase innovation, lower downstream prices, and enhance consumer choice.” (2012, p. 73)

<sup>19</sup> “Exaptation” as discussed by Johnson (2010) and Kelly (2010) is the use of an idea or invention for some new purpose different than its original purpose.

<sup>20</sup> Others, e.g., Shapiro and Varian (1999) have suggested that authors should cede some of their rights by making selections of their work freely available, e.g., the first chapter or introduction of a new book. At first glance, this may seem to be akin to the open source movement. But it is really a deeper form of the property rights position. Shapiro and Varian are arguing that an inventor (or author) will ultimately receive a higher return from their property, if they initially give a limited taste of it away for free.

<sup>21</sup> Hall and Harhoff quote (p. 542) from Penrose (1951, p. 40) in support of retaining patents if the benefits and costs are equal. A similar view was expressed by Fritz Machlup: “If we did not have a patent system, it would be irresponsible, on the basis of our present knowledge of its economic consequences, to recommend instituting one. But since we have had a patent system for a long time, it would be irresponsible, on the basis of our present knowledge, to recommend abolishing it.” (Machlup as quoted in Boldrin and Levine 2013, p. 18)

<sup>22</sup> Boldrin and Levine (2008) argue that Watt’s patent of his steam engine, slowed the progress of steam power in Britain during the industrial revolution. Selgin and Turner (2009; and also see Selgin and Turner 2006 & 2011) have presented a credible case that a full account of steam power during the period does not support Boldrin and Levine’s argument. On balance, Bottomley’s evidence and analysis on Boulton and Watt (Bottomley 2012, pp. 126-135, and especially pp. 134-135) supports the account of Selgin and Turner. One of the key points made by Selgin and Turner (2009, pp. 1104-1106) and Bottomley (2012, pp. 134-135) is that the trend line in number of new steam engines shows neither a downward shift during Watts’ patents, nor an upward shift soon after their expiration (as one would have expected if he patents had indeed held back the application of the technology).

<sup>23</sup> Johnson (2010), and especially Kelly (2010), also have accounts that take the advance of technology as inevitable. Even McCloskey, in a rare lapse, endnotes: “MacLeod detects a decline in the prestige of inventors by the early twentieth century, but I would argue that by then the heroism had been routinized.” (2010, p. 454, note 9)

<sup>24</sup> The later articles on the list tend to be more directly supportive of the claim than the first couple, which were more focused on showing that inventive activity in the early United States, as measured by patenting, increased with the expansion of markets.

<sup>25</sup> Morris gives credit to Lakwete (2003) for much of his case against Whitney.

<sup>26</sup> The statue of Gorrie in the U.S. Capitol building is labeled “Inventor Ice Machine” (see back cover of Sherlock 1982) and Becker’s book on Gorrie is entitled *John Gorrie, M.D.: Father of Air Conditioning and Mechanical Refrigeration* (Becker 1972).

Nagengast agrees that “. . . a claim can be made that Gorrie is the father of air conditioning. This claim can be made based on the fact that he was probably the first to propose, scientifically discuss, construct and operate a refrigeration machine for comfort cooling.” (1991, p. S60; ellipsis added)

<sup>27</sup> According to Nagengast “It would be a fabrication to claim that Gorrie is the father or the inventor of mechanical ice making or refrigeration.” (1991, p. S60) Ingel’s book (1952) is entitled *Willis Haviland Carrier: Father of Air Conditioning*, implying that Gorrie wasn’t the main inventor of that technology either.

<sup>28</sup> On the persistence of Goodyear, see Slack (2002). On the persistence of Jobs, see Isaacson (2011).

<sup>29</sup> “It is axiomatic that mechanical invention will flourish naturally in technological environments where the demand for creative pursuit is high and where the inventor has ready access to sophisticated tools, skilled labor and well-outfitted job-shops in which to fashion working models. It comes as a surprise, therefore, to see a high-tech

invention originate in a slave-holding, retrograde agricultural society.” (Gladstone 1998, p. 31)

<sup>30</sup> “We think the historical record is clear---the patent system can perform well, and it can perform badly. The legal and institutional details are critical. So is the economic and technological environment. Like other times in American history, we face a challenge today to improve the performance of the patent system.” (Bessen and Meurer 2008, p. 259)

<sup>31</sup> Sadly, patent examiners are not alone. Schwartz and Sharpe have suggested that in the face of perverse incentives, education and health professionals must become “canny outlaws” if they are to continue to do their jobs well (2010, p. 10 and passim).

<sup>32</sup> Many have complained about the patent backlog, though few have done so with Dale Halling’s level of outrage: “If we heard it took two to five years to obtain title to real property somewhere, we would assume it was a corrupt third world country.” (Halling 2011, p. 118)

<sup>33</sup> Ken Auletta wrote (1997, p. 66) that Myhrvold “was a co-writer of Gates’s 1995 best-seller, “The Road Ahead.””

<sup>34</sup> “Another reason that charging for content doesn't work very well yet is that it's not practical to charge small amounts--or to pay small amounts. It isn't feasible to charge or pay 3 cents to read a news article. This temporary awkwardness will disappear as the Internet evolves. If you decide to visit a Web page that costs a dime, you'll pay the fee as part of a larger bill--just as you pay for all of your telephone service today on a monthly basis. I think we'll see a great deal of content offered at very low prices.

After all, even 3-cent properties can make money if enough people visit them.” (Gates 1995, p. 122) I had assumed that this paragraph might be mainly due to Myhrvold, since he sometimes plays the optimistic “good cop” to Gates’s cynical “bad cop.” (see: Schlender 2010) But early in the year after the release of *The Road Ahead*, Myhrvold “sent out an eight-page missive that attempted to debunk “another poorly thought out Internet pipe dream”---the notion that there was a pot of gold for Microsoft on the Internet because customers would flock to make tiny transactions. He noted that the software to accomplish this was not yet at hand, since authentication and other billing and security issues remained unsolved.” (Auletta 1997, p. 75) A brief article with the same title as the eight-page missive, and presumably based on the missive, appeared in *Slate* in 1998 under Myhrvold’s authorship. But in a 2012 article, Myhrvold seemed open to the idea of micropayments, as a way to save newspapers. So maybe Myhrvold has been conflicted on micropayments, or maybe he has grown more optimistic about solving the billing and security issues. Or maybe, as Auletta has suggested, Myhrvold sometimes functions in the mode of critical “gadfly” (Auletta 1997, p. 67).

<sup>35</sup> The account in this paragraph on Steve Jobs’ achievement in re-imagining the music industry, owes something to Isaacson (2011), but also owes something to personal observations and experiences, as well as to many other sources that have commented on Jobs, the iPod and iTunes.

<sup>36</sup> Myhrvold’s idea is not without historical precedent. Adam Mossoff (2011) has documented how a private patent pool was formed in the 1850s that provided a successful antidote to patent trolls and patent thickets in the sewing machine industry.

(A “patent thicket” has been defined by Carl Shapiro (2001, p. 120) as "a dense web of overlapping intellectual property rights that a company must hack its way through in order to actually commercialize new technology.")

<sup>37</sup> Some experimental simulation results show that patent pools result in more efficient pricing of individual patents within pools, and reduce the chances that pricing mistakes will cause firms to refuse to license the technologically complementary patents.

(Santore, McKee and Bjornstad 2010)

<sup>38</sup> “Intellectual Ventures is an invention company. The lab, in addition to all the gear, is stocked with an elite assemblage of brainpower, scientists and puzzle-solvers of every variety. They dream up processes and products and then file patent applications, more than five hundred a year. The company also acquires patents from outside inventors, ranging from Fortune 500 companies to solo geniuses toiling in basements. IV operates much like a private-equity firm, raising investment capital and paying returns when its patents are licensed. The company currently controls more than twenty thousand patents, more than all but a few dozen companies in the world. This has led to some grumbling that IV is a “patent troll,” accumulating patents so it can extort money from other companies, via lawsuit if necessary. But there is little hard evidence for such claims. A more realistic assessment is that IV has created the first mass market for intellectual property.” (Levitt and Dubner 2010, p. 178)

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