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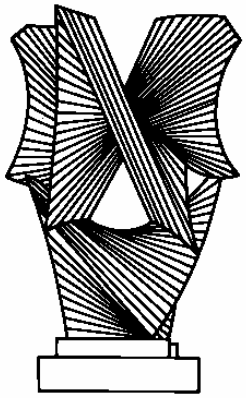

INTELLECTUAL PROPERTY, INNOVATION, AND DECISION ARCHITECTURES

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Much of the debate in modern intellectual property and related fields boils down to a single question: When might the assignment of property rights have anti-competitive consequences? The traditional yet still central economic answer to this question relies on a model of monopoly pricing.[1] It emphasizes a tradeoff between incentives created by property grants against the resulting higher prices and deadweight loses. Under this model, intellectual property grants are desirable to the extent they encourage new product development at a reasonable cost.

This essay proposes a different new way of looking at this central and difficult problem, borrowing from the insights of organizational economics.[2] Intellectual property assignments must be assessed not only by the incentive/cost tradeoff, but by their effects on the *decision architectures* surrounding the property right—their effects on how firms make product innovation decisions. The question is important because different decisional structures for product development can be fundamental to the performance of firms, industries, and even the economy as a whole. For example, different architectures of product development were among the principal differences between the centrally planned economies of Communist countries and market economies.[3]

[†] Associate Professor, University of Virginia, Visiting Professor, University of Chicago. I thank Richard Posner, Randal Picker, Eric Posner, Lior Strahilevitz, Ed Felten, and Luis Garicano for the discussion and ideas that led to this paper. I also thank the participants in the Chicago Intellectual Property and Antitrust Seminar. A related draft was presented at the UCLA law school and the Chicago Law School Ideas Workshop. I thank Wayne Hsiung for research assistance.

[1] See, e.g., Robert Merges, Intellectual Property Rights and the New Institutional Economics, 53 Vand. L. Rev. 1857, 1858 (2000) (discussing deadweight loss analysis and its limits).

[2] Some of the work relied upon includes Raaj Kumar Sah & Joseph Stiglitz, The Architecture of Economic Systems: Hierarchies and Polyarchies, 76 Amer. Econ. Rev. 716 (1984); Raaj Sah & Joseph Stiglitz, The Quality of Managers in Centralized versus Decentralized Organizations, Quarterly Journal of Economics 289 (1991); Paul Milgrom & John Roberts, Economics, Organization & Management 113-125 (1992); David S. Scharfstein & Jeremy C. Stein, Herd Behavior and Investment, 80 American Economic Review 465 (1990); Patrick Bolton & Mathias Dewatripont, The Firm as a Communication Network, 109 Quarterly J. of Econ., 809 (1994); Eric Von Hippel, Democratizing Innovation (2005); Luis Garicano, Hierarchies and the Organization of Knowledge in Production, 108 J. Political Econ. (2000); Mark A. Lemley, The Economics of Improvement in Intellectual Property Law, 75 Tex. L. Rev. 989 (1997).

[3] See Stiglitz & Sah, supra n. 3.

Consider two areas of contemporary controversy where this analysis makes a difference: (1) broadcast spectrum reform, and (2) derivative works in copyright. If government were to assign property rights in spectrum, as first suggested by Ronald Coase, will that promote orderly investment in spectrum-using technologies, or retard the full range of uses that might emerge in a decentralized, non-propertized commons?[4] Second, current copyright law gives the author, among other rights, the exclusive right to authorize follow-on works, like a film based on a novel.[5] Does that centralization of follow-on decisions in the author promote the creation of better films, or inhibit what would otherwise be a desirable competition between several films based on a popular novel? These are hard problems, and just a sample of the situations where the grant of a property right might radically affect the way industry decisions are made.

The economic literature on decision-making architectures can help answer these kinds of questions. It makes an important and useful distinction between hierarchical (centralized) and polyarchical (decentralized) decision architectures.[6] In the former, decisions are made by a few individuals with others providing support. A polyarchy, conversely, is characterized by multiple, potentially competing decision-markers who may undertake projects independently. The key point of this paper is that government's decisions with respect to property assignments can steer decision architectures toward a polyarchical or hierarchical architecture, respectively. In general broad rights or rights held by a limited number of parties promote a hierarchical decision architecture. Conversely, non-assignment of rights leads to the market default: a polyarchical decision-making architectures, where any firm or individual may decide to undertake a new project.

This distinction gives us a new perspective on when intellectual property rights should be assigned, and what their optimal scope is. In general, economists favor decentralized decision structures in economic systems, based on the observation that free market economies perform better than planned, centralized economies.[7] This suggests—even accepting the useful, incentives created by intellectual property—at least one reason to be cautious about the assignment of broad rights. The danger is that centralization of investment decision-making may block the best or most innovative ideas from coming to market. This concern must be weighed against the desirable ex ante incentives created by an intellectual property grant.

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[4] On this debate see Ronald Coase, The Federal Communications Commission, 2 *J. Law. & Econ*, 1 (1959); Yochai Benkler, Some Economics of Wireless Communications, 16 Harvard Journal of Law & Technology 25 (Fall 2002); Stuart Benjamin, Spectrum Abundance and the Choice Between Private and Public Control, 78 N.Y.U. L. Rev. 2007 (2003).

[5] 17 U.S.C. §106(2).

[6] See, e.g., Raaj Kumar Sah & Joseph Stiglitz, The Architecture of Economic Systems: Hierarchies and Polyarchies, 76 Amer. Econ. Rev. 716 (1984).

[7] Fredrick Hayek, The Use of Knowledge in Society, 35 Am. Econ. Rev. 519 (1945).

Despite this presumption in favor of decentralization there are also certain scenarios where hierarchical structures do perform better. Given an initial mixture of good and bad (profitable and unprofitable) ideas, hierarchies will tend to filter out too many good ideas, but make fewer mistakes. Decentralized polyarchies, meanwhile, invest in more bad projects and even outright fiascoes but also more new and innovative ideas. That suggests that in some information environments a more centralized decision-architecture will be optimal. Where technologies are stable and where the industry is flat or in decline, avoiding mistakes is more important, and uncertainty may be more limited, meaning that a hierarchy will produce a more profitable outcome.

Part 1 introduces the distinction between hierarchies and polyarchical decision architectures. Part 2 discusses the relationship between intellectual property and innovation policy. Part 3 asks how the analysis in this paper might influence intellectual property policy.

1. Hierarchies and Polyarchies

Since the 1970s and especially over the last decade, economists have taken great interest in the problems of organizations and the transmission of information within them. One important question across a variety of contexts is how performance is affected by centralization or decentralization of decision-making authority. For example, given a manufacturing firm that must choose among products to invest in developing, will the firm be more profitable if (1) decentralized units decide on products, or (2) every project is approved by a centralized structure before resources are committed?

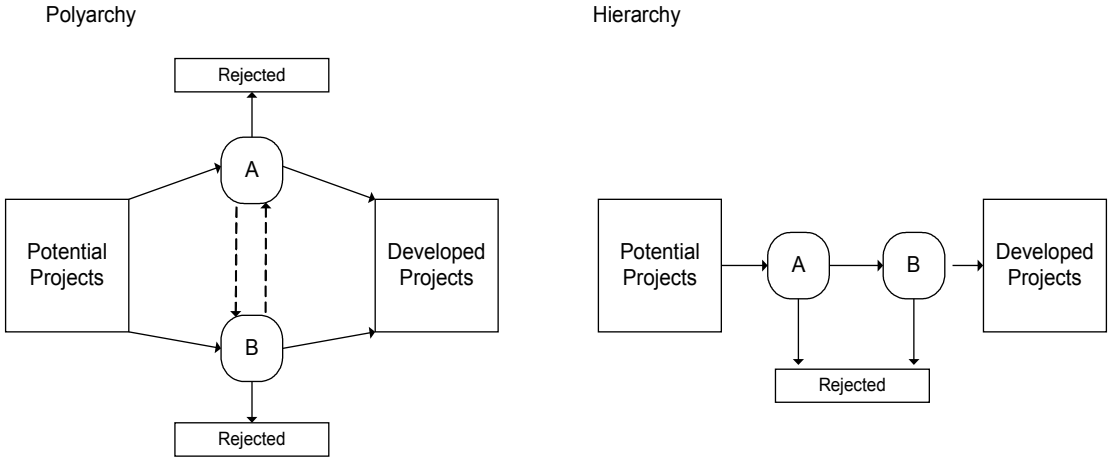
The contemporary economic literature begins with a central assumption that is usually missing from the existing legal literature on intellectual property and innovation. The assumption is that human decisions are fallible.[8] Decision makers act on imperfect information, for a number of reasons, including limited time, and the both the costs and erroneous nature of information transmission.[9] As a result, they often make mistakes. They cannot be certain, in advance, which of a portfolio of new products will be actually be profitable and warrant investment. Product development and innovation, based on this simple assumption, is a highly error-prone exercise.

Based on that premise, economists have distinguished two basic decision-architectures designed to weed out errors: polyarchies and hierarchies, corresponding to decentralized and centralized structures, respectively.[10] A polyarchy is a completely decentralized decision-architecture: any single actor's

[8] See Raaj Sah, Falliability in Human Organizations and Political Systems, 5 Journal of Economic Perspectives 67 (1991) (discussing the assumption of human fallibility).

[9] See Bolton & Dewatripont, The Firm as a Communication Network, supra n. __.

approval of a project is sufficient. Conversely, in a hierarchy, the approval architecture is modeled as a serial decision-making process—all parties must approve a project for it to go forward. The simplest or two-actor versions of each of these decision architectures can be pictured as follows.



As discussed above, a critical assumption is that in both systems, choosing successful products is difficult (this correlates to the real world, where a small percentage of new products succeed).[11] The relevant decision makers make two types of mistakes: they filter out projects that are in fact profitable (what statisticians call Type I errors) and also fail to squash projects destined to fail (Type II errors). The difference then is in the kinds of errors that dominate in a hierarchy and polyarchy, respectively. Under basic assumptions, a polyarchy like that described here will generally approve more projects than a hierarchy.[12] This can be shown intuitively based on the diagram above. If for a given project P, both A and B have a 50% chance of approving it, the polyarchy will approve the project 75% of the time, while the hierarchy will approve it 25% of the time. As a result, the polyarchy will commit less errors of a "missed-opportunity" nature (Type I errors), but more errors of the "bad investment" nature (or Type II errors). The opposite is true for hierarchies: the costs of a hierarchy are greater rejection of projects that should have been accepted.

Given their different capabilities, when will decentralized decision-architectures outperform hierarchies, and vice versa? That question is a topic of

[10] For more detailed models of polyarchies and hierarchies, see, e.g., Sah & Stiglitz, supra n. __; Patrick Bolton & Joseph Farell, Decentralization, Duplication, and Delay, 98 J. Political Econ. 803 (1990).

[11] See Booz, Allen, and Hamilton, New Product Management for the 1980s (1982) (showing that most new products fail). There is a related literature that tries to capitalize on a different mode of innovation to prevent errors, namely, innovations created by "lead users" who as users have particularized information as to how a product might be made better. See Eric Von Hippel, Democratizing Innovation (2005).

[12] See Stiglitz & Saah, supra n. __, 724-725.

growing economic literature only some of which is relevant here.[13] An early but still important answer to this question focuses on the relative scarcity of profitable ideas. In an environment where profitable ideas are scarce, Joseph Stiglitz and Raaj Sah demonstrated that a polyarchy should be expected to outperform a hierarchy (and vice versa).[14] The reasoning followed from the premise: since polyarchies by design reject fewer projects, they manage to capture the few available profitable ideas. Conversely, where good ideas are plentiful, polyarchies create waste by approving too many bombs. A useful corollary is that the performance of a polyarchy or hierarchy depends on the information environment.[15] In a period of great change or uncertainty, the most fruitful line of inquiry may be particularly hard to ascertain, making the ability of polyarchies to turn up innovative ideas particularly useful. Conversely, in a stable business environment, avoiding mistakes and getting things right may be more important.[16]

This work, as we will see, has direct relevance for intellectual property problems.[17] But before exploring those questions we turn first to the traditional framework for understanding the relationship between intellectual property and innovation.

2. Intellectual Property & Innovation

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[13] Other authors have focused on the nature of the relevant information to be transmitted as favoring centralized or decentralized decision-making respectively. Information that might be easier to transmit ("hard" information), like numbers can be handled well by a hierarchy, while "soft" information like a subjective assessment of managerial ability might be better processed by decentralized actors. See Stein, supra n. __, Information Production and Capital Allocation. Patrick Bolton and Joseph Farell have also emphasized the relative quickness of centralized decision-making structures, which seems less important in the intellectual property context. See Patrick Bolton & Joseph Farell, Decentralization, Duplication, and Delay, 98 J. Political Econ. 803 (1990).

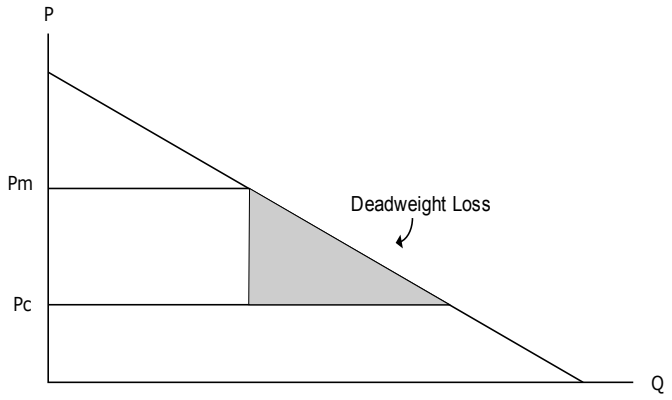
[14] See Stiglitz, supra n. __.

[15] Joseph Stiglitz, Nobel Prize Lecture, Dec. 8, 2001, at 19.

[16] The evolutionary economics literature reaches similar results, albeit based on different assumptions and models that will not be detailed here. Richard Nelson & Sidney Winter emphasized the uncertainty and contingency of technological outcomes—their models predict multiple possible equilibria, rather than a single, predictable outcome. See Richard Nelson & Sidney Winter, An Evolutionary Theoryof Economic Change 14-16 (1982). Firms depend on a set of routines that survive unless the firm dies or manages to mutate its way of doing business. That suggests, as does the decentralization literature, the importance of a trial and error approach to innovation decision-making in uncertain information environments.

[17] In other work, Stiglitz and Saah also showed that hierarchies tend to vary in quality much more than polyarchies. See Stiglitz & Sah, The Quality of Managers in Centralized versus Decentralized Organizations, supra n. __. In other words, a great hierarchical decision-making architecture will perform far better than a polyarchy, but a terrible hierarchy makes the worst decisions of all. (This is similar to the old point that the best monarchy is better than the best democracy, but the worst monarchy is worse than the worst democracy). Polyarchies in this view have something of a leveling effect on the quality of decision-making.

The classic analysis of intellectual property and innovation is a comparison of dynamic benefits and static costs.[18] The benefits of a promise of intellectual property rights are the creation of incentives to invest in the research and development of new products. The static costs are measured as consumer deadweight loss resulting from higher pricing, the result of market power conferred by intellectual property. The optimal assignment of intellectual property rights must balance the incentives created against the deadweight loss. The graph usually used to show the costs of intellectual property is pictured here.



While this model remains the starting point, over the last decade scholarship has progressed to the point that no one believes that it delivers a full picture of the costs or benefits of intellectual property. The scholarship can be divided into three categories: one group emphasizing neglected costs, another, neglected benefits, and a third challenging the model itself. On the costs side, Michael Heller and Rebecca Eisenberg focus on transaction costs made necessary by the collection of rights—what they term an "anti-commons" problem.[19] In patent, a number of authors suggest that firms build patent "thickets" that block their more innovative competitors.[20] On the benefits side, William Landes and Richard Posner emphasize the static benefits of intellectual property, particularly stressing reductions of transaction costs.[21] Douglas Lichtman's work also emphasizes static benefits, including price-coordination functions of intellectual

[18] Richard Posner, Economic Analysis of Law 36-50 (5th ed. 1998).
[19] Heller & Eisenburg, supra n. __.
[20] Carl Shapiro, Navigating the Patent Thicket: Cross Licenses, Patent Pools, and Standard Setting, in Innovation Policy and the Economy (A. Jaffe et al., eds., 2001); Bronwyn Hall and Rosemarie Ham Ziedonis, The Patent Paradox Revisited: An Empirical Study of Patenting in the US Semiconductor Industry, 1979–1995, 32 RAND Journal of Economics 101 (2001).
[21] See William Landes & Richard Posner, The Economics of Intellectual Property (2003); Douglas Lichtman, Property Rights in Emerging Platform Technologies, 29 Journal of Legal Studies 615 (2000).

property, and evidentiary functions of copyright.[22] Clarisa Long has suggested that patents may be a useful and credible way for firms to signal their technological prowess.[23]

Finally, some challenge the economic assumptions underlying the model or address different models. Edmund Kitch is skeptical that the demand curve will have a negative slope, and joined by Robert Merges, questions the assumption that intellectual property rights create market power.[24] Mark Lemley suggests the model fails to direct sufficient attention to how intellectual property law treats improvers, as opposed to the original inventors.[25] Randal Picker's work stresses intellectual property's role in mediating market entry.[26] Finally, in earlier work I have presented a public choice model of intellectual property rights assignment, suggesting that interest groups use copyright to slow or block the market entry of potential competitors.[27]

All of these insights are useful in different ways. This paper, however, proposes a supplementary approach to assessing the costs and benefits of intellectual property rights, as the model in the next section shows.

A Model of Intellectual Property and Investment Decisions

The model presented here assesses intellectual property independent of the costs and benefits central to the monopoly pricing model: incentives to develop products and deadweight losses. It assumes, initially, that both the incentives and deadweight losses are inconsequential in a competitive market.[28] The purpose is to emphasize a neglected consequence—the effect of property assignments on product development decisions in the industries influenced by intellectual property. The central argument is that Government's assignment of property rights can influence the decision-making architecture for the economic system surrounding a given intellectual property grant.

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[22] Douglas Lichtman, Property Rights in Emerging Platform Technologies, 29 J. LEGAL STUD. 615 (2000) (arguing that intellectual property law should encourage price coordination in emerging technology contexts); Douglas Lichtman, Copyright as a Rule of Evidence, 52 DUKE L.J. 683 (2003) (describing sections of copyright as motivated by an evidentiary function).

[23] See Clarisa Long, Patent Signals, 69 U. Chi. L. Rev. 625 (2002).

[24] See, e.g., Edmund Kitch, Elementary and Persistent Errors in the Economic Analysis of Intellectual Property, 53 Vand. L. Rev. 1727 (2000).

[25] Mark Lemley, The Economics of Improvement in Intellectual Property Law, 75 Texas L. Rev 989 (1997).

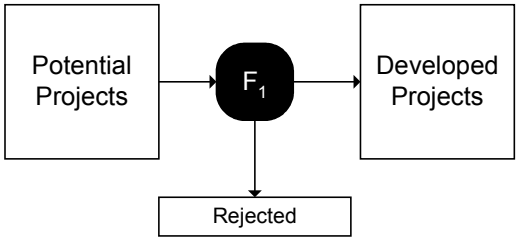
[26] Randal C. Picker, Copyright as Entry Policy: The Case of Digital Distribution, 47 ANTITRUST BULL. 423 (2002).

[27] See Timothy Wu, Copyright's Communications Policy, 103 Mich. L. Rev. 278 (2004).

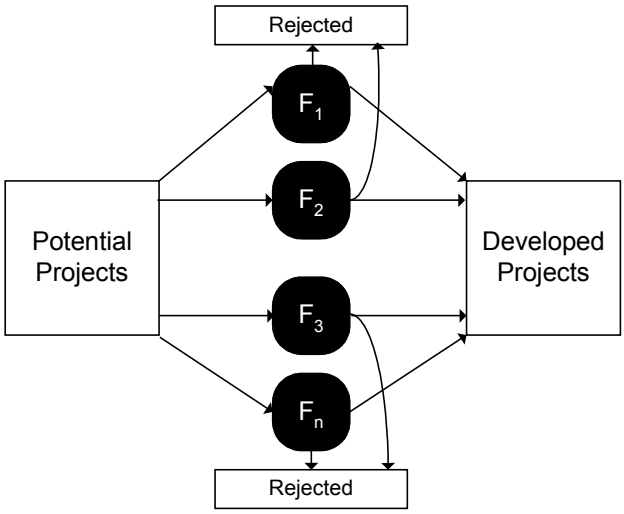
[28] This is an unrealistic assumption, but not for all industries. The assumption is relaxed in Part 3.

Consider an invention I that will be a necessary component for a portfolio of possible products, named $P_1...P_n$. Some of the products will be profitable, others not, but consistent with our assumptions of imperfect information their profitability is hard to know in advance.

The government in our model has two policy options to (1) award a patent to F_1 (the inventor), or (2) not to. The patent in this model gives F_1 an inalienable right to enjoin use of I (that is, it cannot be licensed—like a royal patent in early England).[29] Should government decide to award the patent, the decisional consequence of that decision are as follows. F_1 has the sole authority to decide which of $P_1...P_n$ is profitable and should be developed. While it can solicit advice and so on, the Government, in our model, has through patent mandated that the final decision is F_1's to make. The resulting decision-architecture can be pictured as follows.



Conversely, if government does not award a patent in I, then a set of firms $F_1...F_n$ can decide to develop whatever products $P_1...P_n$ they think are profitable. That decision architecture is pictured here.



[29] The assumption is relaxed, infra.

A natural question is whether policy (1) or (2) will lead to higher profit and better economic performance. The consequence that this model emphasizes is the effects on the decision-architecture surrounding the invention I. The results of the Government's decision will be a wholly different pattern of product innovation and development. The centralized and decentralized decision structures that result will invest in different portfolio of products yielding different economic outcomes. Over time, the history of the industry dependent on I may look very different.

A simple historical example may illustrate the model further. Consider an industry like the late 19th century automobile industry, headed by a promising invention like the automobile.[30] In 1895 the U.S. Government granted a patent in the automobile to a man named George Selden. It decided to allocate the authority in Selden to decide whether any project involving the basic elements of a car (an internal-combustion engine connected to a drive-shaft) would go forward.[31] The Government, by this decision created an initial decisional architecture for the automobile sector: a perfect hierarchy. Selden held the theoretical right to decide what projects to approve or disapprove in the car industry. There are, of course, many ideas as to what a profitable car might be. But Selden had the power to stop the ones he thought would be unprofitable.[32]

At this point we can understand clearly the difference between the present model and the classic model. The idea that patent or copyright can block competition is a familiar part of the classic model. Yet it effect has been understood as a block of *price* competition, leading to deadweight loss. What the model here suggests is slightly different. It emphasizes the blocking of decision-making capacity among potential competitors to the rights holder. That is, the relevance of an intellectual property grant is not only that competitors cannot compete on price, but that they cannot develop projects that they consider think profitable but that the rights-owner does not.

* * *

The model's most unrealistic assumption is that the patent right in question cannot be transferred or licensed. While inalienable rights were indeed the model of the original model of royal "letters patent,"[33] and still exist to some extent, inalienable rights are no longer the dominant model. In U.S. patent and copyright law, the initial allocation of decision-making authority is not a final

[30] This example is also discussed in Robert P. Merges & Richard R. Nelson, On the Complex Economics of Patent Scope, 90 Colum. L. Rev. 839 (1990).
[31] Patent No. 549,160, "Road Engine," issued November 5, 1895.
[32] As Robert Merges and Richard Nelson have documented, the effect of the Selden patent was to slow the development of automobiles for quite some time. See Merges & Nelson, supra n. __.
[33] http://en.wikipedia.org/wiki/Letters_patent

allocation.[34] The rights holder can either create a decentralized-decision structure within his own firm, or license others to use invention I in an open manner, if doing so would yield maximum profitability.

What happens when we relax the assumption of inalienability? This leads to an important analysis of the decisions made by the rights grantee. The question is whether the rights-holder will create either (1) an efficiently decentralized internal structure,[35] or (2) license efficiently to create an optimal decisional structure. A basic insight is that the initial inventor will often but not always create an efficient internal structure or license when doing so would be socially optimal.

First, in the organizational economic literature the challenges of creating decentralized structures within firms have been the subject of some attention.[36] Generally, a system of competing firms better resembles a decentralized decisional architecture than a large firm that has created internal decentralization. The reason is that minimal firm coherence requires uniformity in many practices, such as personnel practices, firm culture and other internal rules. The resulting in-firm decentralization may be incomplete and artificial.[37]

The second question raises a familiar problem in both the intellectual property and telecommunications literature—it is the problem of efficient licensing.[38] In general, we should expect a firm to license its intellectual property to maximize subsequent innovation, because that maximizes the licensing value of the property in the first place.[39] However, there are a number of exceptions to this observation. We can consider two scenarios where efficient licensing may nonetheless not occur.

One may be found where the firm is subject to extensive government pricing regulations. In such a case, a firm may have strong reasons to want to keep its inventions to itself—namely, the prospect of unregulated revenue.[40] If, for example, Bell's central technology (voice) is subject to price caps, it may keep a new technology (DSL) to itself to try and capture the monopoly profits it is

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[34] See, e.g., 17 U.S.C. §201.

[35] The assumption of inalienability is irrelevant to this question.

[36] See discussion in Richard Posner, Preventing Surprise Attacks: Intelligence Reform in the Wake of 9/11 (2005)

[37] [note to readers: my discussion of this is incompletely researched]. See Richard Posner, Preventing Surprise Attacks: Intelligence Reform in the Wake of 9/11 (2005).

[38] Cf. Phil Weiser & Joseph Farrell, Modularity, Vertical Integration and Open Access Policies: Towards A Convergence of Antitrust and Regulation in the Internet Age, 17 Harv. J. L. & Tech. 85 (2003) (discussing scenarios where platform owners license efficiently).

[39] For a discussion of these issues, see Lemley, Economics of Improvement, supra n. __.

[40] Cf. Roger Noll & Bruce Owen, *The Anticompetitive Uses of Regulation*: United States v. AT&T, in THE ANTITRUST REVOLUTION 290 (J. E. Kwoka & Lawrence J. White eds., 1989).

denied in its primary market. This point is related to Baxter's law, which suggests that regulated monopolists, unlike other monopolists, may rationally seek monopoly profits in vertical input industries.

A second exception arises when broad licensing would be optimal for society but nonetheless not in the narrow interests on the rights holder. This can happen when the inventing firm is a dominant firm using the prior technology.[41] For example, in the automobile example, the owner of the car patent might also be a dominant manufacturer of horse-drawn buggies. In that case the manufacturer might want to screen inventions that might challenge the buggy—like passenger sedans—favoring instead inventions that are no challenge to its existing market position, like the tractor. The history of copyright and communications technologies typifies this problem, where the holders of copyright block or slow dissemination technologies of potentially broad social value that threaten an existing market position.[42] Television broadcasters, for example, blocked cable television, and AM radio stations tried to stop FM radio.[43]

This phenomenon might be understood with the help of the neo-Schumpeterian literature's distinction between improving and disruptive inventions.[44] Those in the first category simply make a present business model more efficient—like an automatic transmission for a car, or a record player that plays music more clearly. Disruptive inventions, conversely, threaten the market position of firms reliant on existing technology. The car did not improve but replaced the horse-and-buggy industry, and today, the same may be true of digital distribution's threat to the record industry's model of CD sales. In such cases, broad licensing might be socially efficient, but might also mean the death of the licensing firm—particularly as it may have no comparative advantage using the new form of technology. Since few firms plan for their own death—even when that would be an efficient outcome—the temptation to bury a disruptive invention may be strong indeed.[45]

* * *

We have seen that the relaxation of inalienability leads to us to a discussion of firm-decision making—what firms actually do with the rights granted. In addition, several insights of the model presented here are unaffected by the relaxation of inalienability.

First, where licensing is possible, the effects of a grant of rights may hard to predict, but the effects of non-assignment are more predictable. This matters

[41] See Tim Wu, Network Neutrality, Broadband Discrimination (explaining discrimination in the broadband context); Wu, Copyright's Communications Policy, supra n. __ at __.

[42] See Wu, Copyright's Communications Policy, supra n. __ at __.

[43] See id.

[44] See Tim Wu, Broadband Debate, a User's Guide, 3 J. Telecom & High Tech. 69, 88 (2004).

[45] Id.

both two types of government decisions, (1) subject matters decisions—decisions as to whether to grant intellectual property rights at all, and (2) exceptions—decisions to create limits on the coverage of intellectual property protection within in industry.

Consider first subject matter decisions. Government is often faced with a decision as to whether intellectual property should exist at all, either for an industry or for a type of product or invention. Over the last several decades, for example, the patentability of software, living creatures, and business methods has been controversial.[46] The analysis here shows that these problems can be reframed as a choice about decision architecture for the industry in question. Without any intellectual property rights, absent other barriers to market entry, the result will be a decentralized decision-architecture—the market default.

Two examples can make this point clear. Business-method patents were first authorized by the Federal Circuit in 1998.[47] The court decided that the inventor of a new method of business could obtain a patent just like any other inventor. A major consequence of business method patents, if widespread, is decisional in nature. They can flip the basic decentralized nature of deciding how to run a business and improve it in a given industry. For example, if Federal Express were awarded a patent on its (once innovative) overnight delivery business method, it would become a centralized decision-maker as to the future of overnight delivery services. It is true that having a single courier company eliminates some errors and duplication of resources, but at the cost of suppressing new ideas for improving the overnight courier method.

A second example is broadcast spectrum, reform of which has been under consideration for about a decade in the United States. The question is whether broadcasting at certain frequencies should be propertized—whether some firm should own the alienable rights to, say, broadcast between frequencies X and Y. The impact of the government's decision whether to grant property rights or not will have important decisional consequences. Granting no rights will create decentralized market entry for spectrum-dependent projects or technologies.[48] Any entity willing to make the investment may develop a project that depends on access to spectrum may do so, albeit at the cost of many failed projects. Granting broad or narrow property rights, conversely, makes a hierarchical decision structure possible in the first place. That is, we should expect to see greater screening of spectrum dependent projects or technologies before they are launches. This tells us whether we want a propertized spectrum depends on

[46] See Robert P. Merges, As Many as Six Impossible Patents Before Breakfast: Property Rights for Business Concepts and Patent System Reform, 14 BERKLEY TECH. L.J. 577 (1999) (discussing the evolution of patent's subject matter coverage).

[47] See State Street Bank & Trust Co., v. Signature Financial Group, Inc., 149 F. 3d 1368 (Fed. Cir. 1998), cert. denied 119 S. Ct. 851 (1999).

[48] In a centralized economy, the default option is a hierarchy: decision by a government planner.

how important we think it is that spectrum-dependent projects be carefully screened for their profitability or perhaps other indicia.

Second, even assuming alienable rights the study of decision architectures gives us a new way to understand the relevance of the exceptions to copyright and patent law. These exceptions, like copyright's fair use doctrine have strong decisional consequences. They amount to a governmental decision not to award property rights in a narrow instance, and can therefore force a decentralized decision-architecture surrounding the exception. For example, in copyright the rule of *Sony v. Universal Studios,* exempts devices with "substantial non-infringing uses," like VCRs, from liability under copyright.[49] This rule decides who gets to decide whether a new project that depends on copyrighted works may go forward. It practice, it affects whether a manufacturer like Sony or Tivo may design products independent of the film industry's approval, or whether it must ultimately turn to a centralized industry for permission.[50] A second example is the allowance of "improvement" patents in patent law. Courts have generally allowed later-in-time inventors to receive patents based on significant improvements to an existing invention.[51] Thomas Edison's light bulb, for example, was not the original invention that is sometimes depicted. It was, instead, a significant improvement on previous light bulbs that did not last very long (Edison, however, was granted a very broad patent—this is discussed below).[52] The allowance of patents on improvements has the result of decentralizing decision-making relevant to an initial invention. Though the initial patentee will still own the pioneering invention, it will not automatically own subsequent patents on all related inventions.[53] A third example is the exception for parody in copyright's fair use doctrine.[54] Under U.S. copyright law, parodies of a work may be produced without the permission of the owner.[55] One effect of this doctrine is decisional. Within the industry, this allows parodists to decide independently whether they want to invest in a parody project. The existence of the exception may reflect an intuition that the original author will make poor assessments of the quality of works whose main goal is the degradation of the work and the humiliation of the author.

A final insight is that intellectual property ownership and transfer rules can be used to create desired decision architectures. In U.S. and European

[49] Sony v. Universal Studios 464 U.S. 417 (1984). This rule in presently under consideration by the Supreme Court in *MGM Studios v. Grokster.*

[50] See Randal C. Picker, Copyright as Entry Policy: The Case of Digital Distribution, 47 ANTITRUST BULL. 423 (2002).

[51] See Mark Lemley, Economics of Improvement, supra n. __, at 1000-1013.

[52] See The Incandescent Lamp Patent, 159 U.S. 465 (1895).

[53] Id. at 1009.

[54] See 17 U.S.C. §107.

[55] See Campbell v. Acuff-Rose Music, 510 US 569 (1994) (authorizing parody of song "Pretty Woman.").

copyright some rights are made inalienable—they stay with the creator of the work.[56] Creating broad inalienable intellectual property rights, as the model showed, can force centralization of decision-making. Conversely, creating narrow inalienable rights can create decentralized decision-making. As I have argued elsewhere, authorial rights in copyright under certain conditions can lead to product or industry decentralization.[57]

3. When is the grant of intellectual property rights desirable?

The paper so far has sought to establish that decisions related to assignment of intellectual property rights can centralize or decentralize decision-making relevant to intellectual property-dependent products. But can we say in some general way when either option might be desirable? The organizational economic literature provides some guidance.

To begin, the economic literature has a strong bias in favor of decentralized economic decision-making, reflecting the disastrous economic performance of planned economies. The point, made first by Fredrick Hayek, goes as follows.[58] Centralized economic planning, in a world of perfect information, has clear advantages over decentralized decision making. Ideally, it eliminates duplication: two gas stations on a single street corner, providing the same function, can be seen as wasteful. It also eliminates many of the market failures familiar from the free market—externalities, collective action problems, and so on. So the problem with centralized planning isn't that it *wouldn't* be efficient in the abstract. The problem is that no central planner can possibly have all of the necessary local and national information to make the right decisions. Instead, terrible decisions are made, as in China's Great Leap Forward or Stalin's various five-year plans.

In the high technology field, an example of the perils of centralization comes from Japan's "Fifth Generation Project." In the 1980s, the Japanese government, consulting with experts, predicted where computer technology would be ten years later, and launched a huge national effort to build the predicted technologies, aiming to leapfrog other countries. The project was, unfortunately, centered on a mistaken belief in the importance of parallel supercomputing, and it dismissed other innovations, like the graphical user interface on the Apple Macintosh. The project was an abject failure that damaged the Japanese computer industry. "At the end of the ten year period they had burned through over 50 billion yen.... The workstations had no appeal in a market where single-CPU systems could outrun them, the software systems never worked, and the entire concept was then made obsolete by the internet."[59]

[56] See, e.g., 17 U.S.C. §106A (visual arts rights).
[57] See Tim Wu, Copyright's Authorship Policy (unpublished manuscript on file with author).
[58] See Fredrick Hayek, The Use of Knowledge in Society, 35 Am. Econ. Rev. 519 (1945).

These points offer an important warning for industries regulated by intellectual property. While we may accept that intellectual property offers strong ex ante incentives to innovate (as did the Fifth Generation project), there is a flip-side danger of too much centralization of decision-making. While the risk posed by governmental initiative like Japan's Fifth Generation project may seem foreign, intellectual property policies practiced in the United States have historically created similar consequences. For example, in 1892 the United States granted an exceptionally broad patent to Thomas Edison for his light bulb. The result was to centralize light bulb-decision making in the Edison company for approximately 12 years.[60] The results were not inspiring. Improvement in incandescent lighting became a one-company show, and many competitors were put out of business. Economists who have studied the period note that technological progress in lighting slowed during this period—"the broad Edison patent slowed down progress in the incandescent lighting field."[61]

The danger of overcentralization, of course, can be moderated by numerous policies. First, the early English model of letters-patent is not to be recommended. Allowing licensing and transfers of assigned rights avoids over-centralization, by making property rights a source of revenue. Other measures include recognizing the exceptions and limits, described above, that open decision-making ex poste and lessen the risk of over-centralization. We've seen that allowing improvement patents helps promote decentralization in patent, and that in copyright the fair use doctrine can provide a similar function. Patent's limited term also prevent a single actor from becoming the sole decision-maker for a given invention forever.

The analysis here may, finally, relate to a recurring policy question—when should government assign property rights in a new industry? With the arrival of every industry – automobiles, airplanes, software, computers, internet auctions– there is always the question of when intellectual property rights of some form should attach. Sometimes Government hands out rights early, as in the examples of the lighting, automobile and airplane industries. And sometimes government waits, as in the example of the software industry, which received copyright protection two decades after its origins.[62]

The analysis here favors waiting, for the reasons that follow. An intellectual property regime is most clearly desirable for mature industries, by definition technologically stable, and with low or negative economic growth.

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[59] See http://en.wikipedia.org/wiki/Fifth_generation_computer_systems_project. I thank Ed Felten for this point.

[60] See Merges and Nelson, On the Complex Economics, supra n. __ at 885-888; A. Bright, The Electric-Lamp Industry: Technological Change and Economic Development from 1800 to 1947 (1949).

[61] Id. at 887.

[62] See Nimmer Treatise on Copyright.

The reasoning is simple: in a stable business environment, good results may be achievable through incremental, predictable adjustments. In addition, if by definition profit margins are thin in a declining industry, it will be better to have only the very best projects come to market (stated otherwise, Type II errors may have disastrous consequences).[63] By the same logic, the case for strong intellectual property protections may be at its weakest in new industries, which can be described as industries that are expanding rapidly and where technologies are changing quickly. In such an environment the most promising line of development is by definition less clear. A polyarchical decisional structure may be necessary to uncover the innovative ideas that are the most valuable, at the costs of multiple failures. Stated otherwise, in markets where technologies are changing quickly, we should expect, as the literature suggests, that it would be more expensive if the best products are suppressed. Again, government, by refusing to grant intellectual property rights, can influence this outcome. This basic analysis suggests holding off on the grant of rights on which a new industry may depend.

Do the incentive and deadweight loss effects of intellectual property grants affect this analysis? They do, by fortifying the conclusion just reached. As Stephen Breyer and others have pointed out, the need to provide incentives for product investments depends strongly on the availability of returns from the market.[64] The stronger the market returns, the less government encouragement —in the form of promised intellectual property rights—are needed. Consequently, in a rapidly expanding industry, firms already have strong incentives to bring a new product to market—the returns of the market, and the advantages of being a first mover. Meanwhile, the costs of an over-centralized decision-making structure are greater. As a result, the desirability of intellectual property rights is at its nadir. In a declining and technologically stable industry, the signs are reversed. The returns from the market are weak, so government may need to provide incentives to encourage any investment in product development at all. And as we've seen, a centralized decision-making apparatus may actually be profit-maximizing, because it screens costly errors. The case for strong intellectual property rights is at its zenith. While the full analysis is complex, and the questions ultimately empirical, this paper suggests some reasons to think governments should be patient before assigning property rights in new and expanding industries.

Conclusion

[63] This is a similar argument to Michael Abramowicz's argument for strong rights in copyright in general—prevention of "redundancy." Michael Abramowicz, An Industrial Organization Approach to Copyright Law, 46 William and Mary Law Review 33 (2004). However I think Abramowicz is correct only in the declining market context.

[64] Stephen Breyer, The Uneasy Case for Copyright, 84 Harv. L. Rev. 281 (1971)

The overarching goal of this essay is to focus attention on the importance of the economics of decision-making for intellectual property policy. As the importance of intellectual property-dependent industries increases, scholars and policy makers need a better understanding of how product innovation decisions are made and how property assignments effect such decisions.

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