Dilemmas Faced by Creative People in IT

Randall Davis
MIT Computer Science and Artificial Intelligence Laboratory

Position Paper
Princeton University – Microsoft Intellectual Property Conference
May 12 -14 2005

I. Introduction

Academic researchers in information technology face a variety of dilemmas that arise out of intellectual property laws. This papers explores issues that arise from patents, copyrights, trade secrets, and business practices of information technology firms. It is based in part on an informal survey of the experience of members of MIT's Computer Science and Artificial Intelligence Laboratory.[1] Principal investigators in the Lab were asked to indicate how often the course of their research was influenced by the existence (or possible existence) of patents and copyrights, either those owned by others, or the opportunity to get them. The results displayed interesting and fairly consistent responses, citing extensive personal experience. Some of the discussion below is informed by and builds on that information. Given the informality of the survey and its restriction to a single organization, we must of course be cautious in drawing any major conclusions. Nevertheless the comments were informative and serve to illustrate concretely the issues researchers encounter.[2]

This paper is also focused largely on the academic researcher. Several faculty (including the author) have experience in industrial research and commercial startups, where, as they reported and we note below, the situation, issues, and behavior, differed.

Finally, because of the overlap in population and culture, much of the discussion of researchers also applies to the hacker population, i.e., those who approach software development as artisans, rewarded only incidentally (if at all) by money, and seeking a rather different form of reward. For ease of discussion I will refer to "researchers," but mean both populations.

II. Background: Will Work For Egoboo

One of the things that became clear in reviewing the IP practice and experience of academic researchers and hackers was a nagging sense of disconnect between the practices of that population and the traditional model of intellectual property, a difference that arises out of fundamentally different models of motivation. The traditional IP model (in the US at least) is conceived of in terms of an incentive provided by the ability to profit economically in the marketplace. Researchers and hackers, on the other hand, work for reputation, the recognition of their expertise, accomplishments, and contributions.

The whimsical term used to describe this is "egoboo" – ego boost – and it does equally well for researchers and hackers. The hacker mentality has been elegantly described by Eric Raymond in his classic essay on open source software, *The Cathedral and the Bazaar*. In commenting on the social context he notes:

> The "utility function" Linux hackers are maximizing is not classically economic, but is the intangible of their own ego satisfaction and reputation

[1] The Lab is one of MIT's largest, with a total of approximately 820 people, including 93 PIs, 450 graduate students, 90 research staff and visitors, 80 postdocs, 60 staff, and 50 undergraduates.

[2] One interesting result of the survey was the response rate: of the 93 investigators polled, 44 replied to the initial query and 35 to a follow-up. A 47% response rate to any survey is unusual, more so given the volume of email this audience typically gets and their general disdain for surveys. It suggests that the issue is of some concern to the audience.

> among other hackers…. Voluntary cultures that work this way are not actually uncommon; one other in which I have long participated is science fiction fandom, which unlike hackerdom has long explicitly recognized "egoboo" (ego-boosting, or the enhancement of one's reputation among other fans) as the basic drive behind volunteer activity….
> We may view Linus's [Torvald's] method as a way to create an efficient market in "egoboo" — to connect the selfishness of individual hackers as firmly as possible to difficult ends that can only be achieved by sustained cooperation.
>
> [Raymond, 2002][3]

The same drive can be seen in the origins of the earliest scientific journal. The *Philosophical Transactions of the Royal Society* was created in 1665 in order to "create a public registry of scientific innovations," with the hope that this would "tame and police 'scientific paternity' and priority controversies" [Guédon, 2001], i.e., it would become the accepted public arbiter of egoboo.

Nor is the phenomenon limited to these audiences. Consider the reviewers on Amazon and epinions.com, and especially the volunteers who are Microsoft MVPs (Most Valuable Professionals): "The program celebrates the most active community members from around the world who provide invaluable online and offline expertise that enriches the community experience and makes a difference in technical communities featuring Microsoft products."[4] These are volunteers who are in effect working for Microsoft by providing customer support; MVP status is their egoboo. Their contributions can be remarkable – in 2004 the most prolific MVP posted more than 14,000 times, answering questions about Windows XP.

When populations behave this way the result is termed a gift economy or a sharing economy, where goods are distributed without payment. Scientific research generally, and open source software on the web in particular, are largely information and knowledge gift economies. And while the web has (as usual) vastly increased the scale and visibility of the phenomenon, the gift economy surrounding information technology has existed largely since the inception of the field.[5]

Yet egoboo is not the currency of modern IP and gift economies are not the markets that have influenced the current mindset about IP. The original mindset was well put more than two hundred years ago:

> … we must take care to guard against two extremes equally prejudicial; the one, that men of ability who have employed their time for the service of the community, may not be deprived of their just merits, and the reward of their ingenuity and labor; the other, that the world may not be deprived of improvements, nor the progress of the arts be retarded.
>
> *Sayre v. Moore*, 1785

---

[3] As Raymond indicates in passing, the term appears to have its origin in science fiction fan clubs and fan magazines (fanzines). The earliest reference to egoboo appears to be in Richard Eney's 1959 *Fancyclopedia II* (available at http://www.sff.net/people/Diccon/CYINDEX.HTM).

[4] http://mvp.support.microsoft.com/MVPINTRO

[5] The gift economy in universities is under siege in places, see *Who Owns Academic Work*, [McSherry01].

Much the same spirit appeared almost exactly two hundred years later in an important software copyright case:

> …we must remember that the purpose of the copyright law is to create the most efficient and productive balance between protection (incentive) and dissemination of information, to promote learning, culture and development.
>
> *Whelan v. Jaslow*, 1986

While both cases refer generically to reward and incentive, those concepts have come to be viewed almost solely in classic economic terms. Yet as the existence of information gift economies indicates, other motivations are at work. Benkler has studied a variety of motivations for production of IP; [Benkler, 2002] explores nine information production strategies differentiated in part by their concept of reward, only three of which focus on direct economic payoff. Researchers "appropriate the benefits of their investment, *if at all*, through reputational gains, research grants, charitable contributions, teaching positions rationed by publication-based reputation…" [emphasis added].

This difference in motivation produces an important, fundamental tension. As a practical matter, reputation reward and direct economic reward rely on polar opposite mechanisms: reputation depends crucially on sharing and dissemination, commerce depends crucially on the ability to exclude. There is thus a fundamental disconnect and tension here.

The observation that researchers and hackers are intrinsically dependent for their reward on dissemination of their work matters in the limited scope of this paper, as it serves to help explain the problems researchers encounter and how they react to them. It also matters in the larger context of understanding something fundamental about the way academic research and the hacker population contribute to innovation. While the world of commercial IP needs careful consideration in formulating law and policy so as to encourage innovation, so too does the gift economy populated by academic research and hackers. Yet not all that much attention appears to have been given to the issue.[6]

III. Survey Part 1: Patents Don't Seem to Matter

In surveying the faculty, one of the striking results was the extent to which patents just don't seem to matter in daily research life in academia. The investigators were asked roughly how often the existence (or possible existence) of someone else's patent caused them to change the path of their research (i.e., change the focus, work around the patent, etc.), and how often had the possibility of getting their own patent caused them to change the path of their work. In both cases the answers were overwhelmingly "never" (81% and 76%).

The interesting part was why not. One possible (though expensive to test) hypothesis about the first question is that the work being done was sufficiently innovative that it rarely encountered existing patents.

Additional possibilities are raised by two themes encountered in response to the first question, characterizable as (i) a policy we might call Affirmative Ignoring, and (ii) "the law says it's ok." Affirmative Ignoring is the don't ask/don't tell of IT research,

[6] See [Benkler2002a] and [Benkler200b] for exceptions.

suggested by comments like "Except for very celebrated patents, I (and most other researchers) go to *no* effort to uncover potential infringements," and, "[I don't think there's a chance my research infringes anyone, but] even if there were, I would pursue my work for its novel aspects and leave it to others to sort out the IP ownership."[7] The feeling seems to be that progress would be substantially slowed by having to check for infringement, and as the intention was to publish the research result (i.e., gift it to the community), the right thing to do is to press on.

The theme that the law says it's ok is illustrated by respondents relying on their understanding of the research/experimentation exemption ("As I understood the matter, patents don't apply to research, but only to things that are going to be put into practice. Am I wrong about this?").[8] There is also the belief that, at a pragmatic level at least, infringement is a concern only when there is economic benefit ("We figured this [use of commercial code] could cause some problems if any money were actually made…, but decided to go ahead anyway since it's the best technical option. Right now, no money is being made, so no problems yet...").

With respect to securing patents on their work, a theme encountered repeatedly was that dissemination of research was a fundamental goal, and any mechanism that hindered it was to be studiously avoided ("If the code had a restriction, it would not have been commercialized [and disseminated]. The overhead of negotiation would have been too high." And "It would have killed the Internet if its protocols were messed up with patents and licenses.")

There was also experience and emphatic comment on the difficulties that can result from what is to lawyers the routine practice of license negotiation. As one reply put it "How often have I worried about a patent? Never. But if you had asked me 'How often has an IP clause in a potential research grant caused you to tear your hair out and dream of killing lawyers', the answer would have been 'very often.'"

The overall attitude and experience is clearly connected to the academic environment: several respondents with experience in industrial research labs were careful to note a different style in each environment, reporting that they routinely altered research course because of patents (both theirs and others) when working in industry.

Moore's analysis of IT patents [Moore, 2003] is consistent with reduced attention to seeking patents by academic researchers. He argues that IT patents are rarely valuable in the way that, e.g., biomedical patents can be, where a single patent can be a substantial source of royalties. The claim is that factors such as the large number of IT patents needed in a consumer product, the need for short time to market, and the relatively short

[7] In some cases quotes have been sanitized to preserve anonymity, or shortened for exposition.

[8] Apparently the answer is yes, you are wrong about that. While it is an unsettled area of the law, the language from the US Court of Appeals for the Federal Circuit (the nation's patent court) in *Madey v. Duke Univ.*, 2002, was strikingly clear in restricting experimental use: "In short, regardless of whether a particular institution or entity is engaged in an endeavor for commercial gain, so long as the act is in furtherance of the alleged infringer's legitimate business and is not solely for amusement, to satisfy idle curiosity, or for strictly philosophical inquiry, the act does not qualify for the very narrow and strictly limited experimental use defense. Moreover, the profit or non-profit status of the user is not determinative." Indeed, the court noted that the "…legitimate business objectives, [of Duke] includ[e] educating and enlightening students and faculty participating in these projects. These projects also serve, for example, to increase the status of the institution and lure lucrative research grants, students and faculty." Hence because the University as a business could expect to benefit (even indirectly) from the research, its efforts were not "strictly philosophical inquiry," and hence not permissible.

lifespan of IT products all mitigate against the lottery-like winnings that patent-seekers (and licensing offices) dream of. Data on license income at the ten universities with the largest royalty streams show that a only a few licenses generate the great bulk of the income. At Columbia University (the top ranking institution in 1995), for example, 94% of the income was generated by five licenses, and 91% of that income was from biomedical licenses [Moore, 2003]. He suggests in response that everyone's interests would be better served by a liberal licensing policy that relied on a pool of non-exclusive royalty-free licenses (NERFs) to which a sponsor would get access in return for a fixed fee. Such a policy would serve the researchers by getting their work disseminated, as a consequence of non-exclusivity (which in general would produce wider distribution) and the low-overhead licensing mechanism. Licensees are likewise well served by the simple and efficient licensing mechanism.

IV. IP Terms Posed by Industrial Funders Can Be Problematic: NERFS Are Not For Everyone

With reductions in government funding for basic IT research, some departments and labs have looked to industrial partnerships as a means of maintaining a stable level of research support. A difficulty arises here because industrial partners are often not initially convinced of the appropriateness of non-exclusive royalty-free licenses, seeking exclusive rights in an understandable desire to secure competitive advantage.

One effective response involves explaining the character of IT research and IT patents (as per Moore's argument above) and emphasizing that the real value from supporting research comes from the technology transfer and lead-time advantage that arises as a consequence of joint work. To the extent that industrial funders are partners in the work, they will come to understand it far better than by just reading the papers and research reports, and will come to that understanding far earlier than competitors. Given the short lifetime and short time to market for consumer products, and the relative ease of working around most IT patents, lead-time is one of the few reliable sources of advantage. In that context, NERFs seem less threatening, enabling dissemination of the work without undermining the lead-time advantage that accrues to industrial partners.

V. Copyrights and Licensing Terms Routinely Raise Substantial Difficulties

The story with copyrights and code licensing generally is substantially different. In computer science, software is the routine medium of expression for and embodiment of research results; it is both raw material on which research is built and the output. IT researchers are concerned about copyright and licensing terms that encumber access on both ends of this process. Numerous comments mentioned the problems that arise due to lack of access to source code and/or the ability to modify it (e.g., "For anything that involves real development, I restrict myself to software that I am free to modify and redistribute"). There are numerous reported instances where work was slowed down because lack of access to the source meant code had to be independently reimplemented. Licensing constraints on code also prevented some forms of research collaboration. Code (source or binary) that is made available with a "no commercial use" provision, for example, has prevented researchers from collaborating with industrial researchers, even where such collaboration would have been beneficial to all parties.

Licensing constraints on the use of benchmark suites have presented problems because the terms explicitly banned their use to measure performance of commercial machines, yet the manufacturers won't publicly report results on their own machines. The resulting problem of course is the consequent difficulty of determining whether research (e.g., in systems and/or architecture) intended to improve performance is actually succeeding. Researchers have had to resort to writing their own benchmark suites.

Similarly, anything that gets in the way of distributing software created in research was likewise seen as a problem (e.g., "Not being able to distribute my code freely is a show stopper"). The notion that the code should be freely distributable was taken quite seriously, i.e., it needed to be totally unencumbered. Even the GNU General Public License, intended as an antidote to traditional commercial licenses, was viewed as encumbering. Its license terms require that code incorporating GPL'd code be made available under the same terms, i.e., the source be made freely available, effectively preventing use of GPL'd code in proprietary commercial products.[9] The desire by researchers for widespread distribution of research results explicitly includes incorporation into commercial products, without regard for royalties. Impact matters.

One extended reply made a detailed case for the claim that dissemination and impact were inversely correlated with the strictness of the licensing terms. The chronology of 40 years' experience in research and subsequent licensing of software offers an interesting set of lessons:

> RUNOFF, 1964: The idea that you could patent or copyright a program hadn't appeared yet, and I gave the code freely to anyone who asked for it.[10] The program was commercialized by General Electric and IBM (under the name SCRIPT). IBM augmented SCRIPT with GML to create the IBM Document Composition Facility, still in wide use today. RUNOFF also was transformed by Bell Labs into roff, nroff, and troff, which became components of UNIX and thus very widely used. The concept of RUNOFF was picked up (and completely reworked) by Don Knuth in designing TeX. *My reading is that it is fortunate that we didn't have program copyrights or patents at the time. Either one would have reduced RUNOFF's influence on the world to near zero.*
>
> Multics, 1964-1972: By 1970, the idea that you should copyright programs had become current. MIT and Honeywell held a joint copyright on the source code. My reading is that one of the main reasons that Multics had only indirect influence on the world (mostly via technical papers and UNIX) is that Honeywell chose not to market the system aggressively, and neither MIT nor any of the many people who were wildly enthusiastic about Multics could do anything about it. Even today that copyright, now held by Compagnie Honeywell Bull, is still acting as a barrier to a group that would like to revive Multics with an emulator.

[9] "You cannot incorporate GPL-covered software in a proprietary system." http://www.fsf.org/licensing/licenses/gpl-faq.html

[10] The gift economy at work, forty years ago.

> C Gateway, 1978: (Probably the first multi-protocol router) By this time we had figured out that copyrights could impede influence, and our goal was influence, so we developed what may have been the first example of a copyright accompanied with a blanket license that assures that anyone who wishes can use the code without asking. Proteon took advantage of it. *We discussed the topic with the technology licensing office and convinced them that the ideas would go nowhere if a traditional licensing regime were used.*
>
> PC/IP, 1983: (Implementation of TCP/IP for the IBM PC). *We again convinced the technology licensing office that giving it away was the best way to gain influence.* IBM, Sun, Banyon, and FTP software, among others, made it into products. IBM had some trouble because their policy prohibited them from using any code with a copyright unless they had a paper license. Their legal staff eventually concluded that our blanket permission allowed them to use it without a license from us. Again, this product had widespread influence, this time in convincing the world that TCP was not a monster, and it could be implemented using something less than a supercomputer.
>
> X window system, 1989. Project Athena convinced the technology licensing office that *giving it away was the best way to gain influence*, and we reused the C gateway copyright strategy. The X Window system was adopted by essentially every vendor of engineering workstations, essentially eliminating Sun's NEWS and Carnegie's Andrew Window System, both of which were in some ways technically superior, but were copyrighted and required a license. *We attribute the rapid success of the X window system primarily to its copyright strategy.*
>
> Kerberos, 1989. Same starting story as the X window system. This one is taking longer to get to market, but its influence is indicated by Microsoft having adopted it with an "embrace and extend" strategy to create a version that is incompatible with the standard.
>
> [emphases added]

At one level the claim of inverse correlation between dissemination/impact and strictness of license terms is unsurprising – people are more likely to take something when you give it away free and unencumbered. But the widespread commercial adoption of such a thing is not quite so obvious: Why devote the time and effort to using something that's freely available to your competitors as well? One answer historically is that the code provides an platform on which to build, with the competitive product residing on top of the unrestricted code. Distribution also changes the landscape somewhat, raising the bar simply by virtue of providing that freely available platform. To be competitive you must offer something more than that alone.

To return to a central theme, for researchers the goal is dissemination and impact, and making it possible for "anyone to use the code without asking" and without restrictions offers the minimal overhead and minimal friction in the system.

VI. The Changing Nature of Access to Research Literature May Undermine an Important Part of the Model of the University

Two forces at work have had a significant impact on libraries at research universities in the past two decades: the increasing privatization of information and its skyrocketing cost. I discuss each in turn, then make the case that the consequences may be quite profound: these two forces may undermine elements considered fundamental to our conception of a university.

VI.1. Information is becoming increasingly privatized

The trend in information privatization is evident in a number of developments that have:

- increased copyright's term (the 1988 act extended protection by 20 years, both prospectively and retroactively),
- increased its scope (e.g., protection of graphic characters, *Disney v Air Pirates*, 581 F.2d 751 (9th Cir. 1978); the efforts toward database protection),
- placed new barriers in the way of traditional activities (e.g., the DMCA's provisions concerning circumvention measures),
- expanded enforcement powers (e.g., the DMCA's provisions requiring ISP's to remove material in response to notification of a claimed infringement),
- increased the scope of patentable material to include such things as business methods and gene sequences.

Publishers have also changed their posture with respect to control of electronic information on campuses. Where their original concern focused on security, copying, and possible redistribution of content, more recently publishers have attempted to control who has access to information. Should only those with a formal connection to the college or university be permitted access, denying access to outsiders who came to the campus? What about alumni, emeriti, non-academic staff, etc.? While understandable from a strictly economic perspective, the consequences of such restrictions change the notion of a library in fundamental ways.

Publishers have also become more aggressive in enforcing rights. As one example, "…lawyers for the Association of American Publishers have sent letters to the university that object to the use of electronic reserves on the San Diego campus. The publishers say that the use of electronic reserves is too extensive, violating the fair-use doctrine of copyright law and depriving them of sales." [*Chronicle of Higher Ed.*, 22 April 2005]. The University claims they are within the bounds of fair use. The issue is to be sorted out, but does it foreshadow a time when journal publishers sue authors for posting their own published papers on their own web sites?

In some cases publishers have also begun requiring authors of technical papers to provide the data on which the results are based. While this is in one sense a useful development (providing openness in the scientific process), it is doubtful this is the primary motivation for the publishers, who stand to profit from a more valuable product that comes to them at little or no additional expense.

The past two decades have also seen a substantial consolidation in publishers, producing a narrowing in the ownership of scientific journals. This offers publishers the power to license a substantial package of journals on a take-it-or-leave it basis, with universities faced with extremely difficult choices. Given, in addition, the tendency for a

relatively small group of journals to come to be viewed as the elite, and hence necessary, places to publish [Guédon, 2001], yet more power accrues to publishers who have those journals in their stable.

There has also been the much commented-on transition from traditional subscriptions of print journals to the licensing model for electronic journals. This of course raises a variety of difficult issues for libraries, including apparent complete lack of access to any issues of a journal once the license expires, the inability to make archival backups even of legally licensed volumes, etc. For the publishers this is a new business model; for the universities it is a tectonic shift in how they get access to information that could have substantial consequences.

More generally there is the fundamental shift in the legal framework under which information is distributed, moving from intellectual property law to contract law. The change matters because, where IP law has been carefully crafted over many years with an eye toward public policy, contracts can of course contemplate any legal terms the licensee is willing to accept.

VI.2. The cost of information is skyrocketing

Data at the website of the Association of Research Libraries (www.arl.org) provide stark documentation of the skyrocketing cost of journals. Figures 1-3 illustrate the experience at MIT. Figure 1 shows the total cost of serials purchased by the MIT libraries over roughly the past twenty years. Over that period serials costs have increased by a factor of 3.9, while the CPI has increased by a factor of 1.7[11]

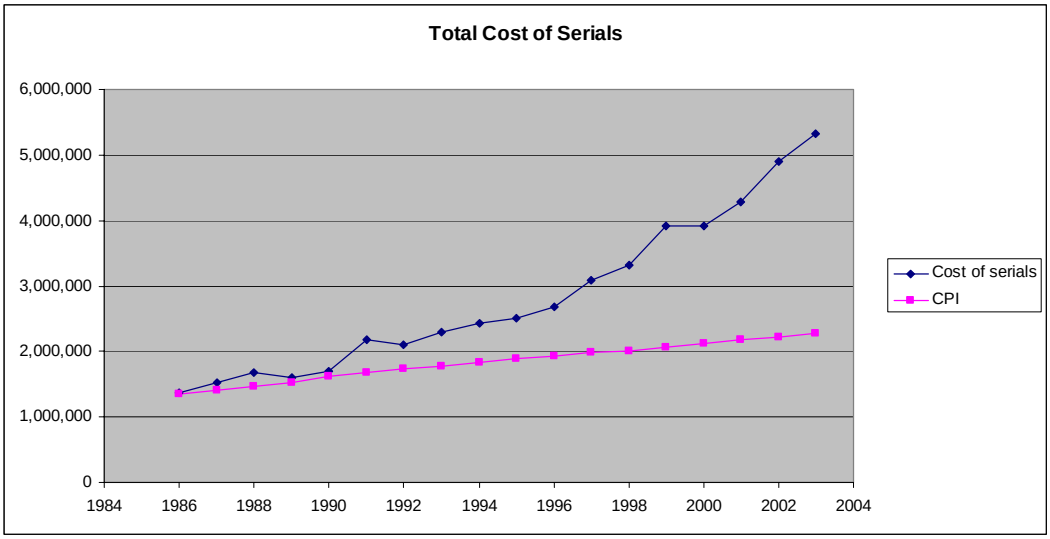

Figure 1

Figure 2 shows how the average cost of each serial has jumped over the past two decades, again compared to the CPI, demonstrating that the increase is not due to an expanded number of serials being purchased.

[11] CPI data from www.bls.gov.

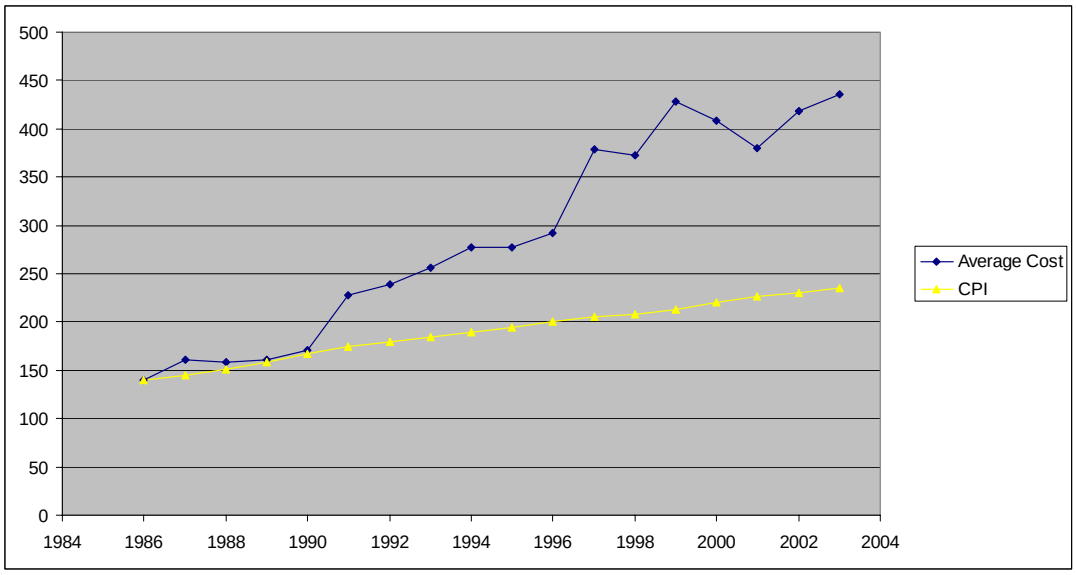

Figure 2: Average cost of purchased serials, compared to CPI

Figure 3 illustrates that it is the cost of serials in particular that has jumped, rather than the cost of publishing in general: the average cost of a monograph has essentially tracked inflation over the same period.

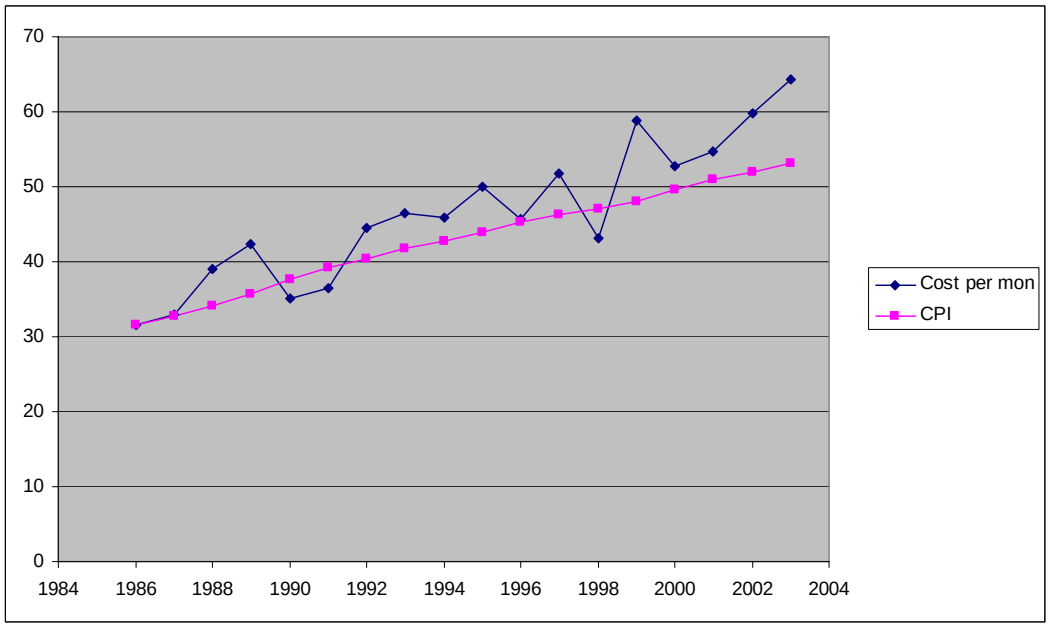

Figure 3: Average cost of monograph

The charts illustrate starkly how sharply the cost of the journals has driven up the cost of scientific information.

The business practices of leading publishers add to the difficulties. Electronic journal subscriptions are often bundled, with the entire package offered, as noted, on a take-it-or-leave-it basis. There is also no clear market or pricing for licenses of electronic

journals. Large publishers typically negotiate with each university individually, and, remarkably, insist on non-disclosure of the licensing terms so that no institution can find out what another paid. All of these lead to pressure on prices, increasing the cost of information.

VI.3. Consequences

A variety of consequences may arise from the current situation, some of them worrying. There is clearly an issue to be worked out regarding fair use. As universities gain the benefits of electronic dissemination of source material (journal papers, book chapters, etc.) they must be sensitive to the impact this may have on publisher's revenue, and hence to the boundaries of fair use. But the impact is not yet clear. University presses that have put online the entire text of books they publish (e.g., MIT Press) have reported increases in sales. The evidence is still anecdotal, and could change as a new generation of students gets used to reading online and as display technology improves. But the impact is not a foregone conclusion and needs careful study.

As suggested above, fair use issues also arise with respect to access and use of information created by faculty. Can I post on my website articles I have published? Can I contribute them to archives being created on campus (e.g., MIT's DSpace,) and on the web?

Of greater concern is the possibility that some journal publishers are in a position to influence the academic status of a university. Given the value of the journals they control, the intense pressure on research universities to make those journals available to the students and faculty, the lack of competition, and the practice of keeping secret the nature of the contract they sign with each institution, publishers can plausibly raise the status of one institution by offering it prestigious resources it might not previously have been able to afford, while doing harm to another by insisting on contract terms (e.g., price, control of access) that are untenable. Legal though such moves may be, is this how we want universities to function?

Perhaps most important, the notion of controlled access to information strikes at something essential to the notion of a university. Historically (i.e., for somewhere between 500 and 1000 years), universities have been places where access to information was, at worst, unlimited flat-rate: Once students pay their tuition, they have access to anything in the library and can read/view it as often as they want. Faculty have access by virtue of being members of the community (and contributors to the stock of information); in modern times many university libraries have also made resources available to the local community and anyone willing to get to the library, on the same basis (i.e., effectively unlimited in amount).

The prospect of controlling access to information leads inevitably to the prospect of metered access – pay as you read. The notion of information as a service is gaining currency (literally) elsewhere, why not in universities? The problem here of course is how fundamentally this conflicts with the character of a university. If things continue to move in this direction, will students in the future have to ask themselves "I know I should go back and study chapter 8 again, but can I afford it?" The notion of having to consider the economic consequences of reading (viewing, listening) is disturbing.

Nor is the issue easily handled at the institutional level. Even should they want to, universities would be unable to insulate faculty and students from the metered model. To

a substantial degree universities operate on a fixed income, running off of endowment (at MIT, about 25% of operating income), tuition (~50%), and gifts (~25%). They can't simply manufacture more "product," or try to gain additional market share in order to deal with the variable nature of usage fees.

Life at a research university that had metered access to information would be a very different, and, in the end, I suspect, self-defeating prospect, as it would inhibit the source for much of the information publishers are marketing.

VI.4. Responses

A variety of measures are being explored to deal with these issues. There are numerous efforts at making technical literature widely available, ranging from early preprint servers (e.g., arxiv.org, originally at Los Alamos National Lab, now hosted at Cornell), to university archives like DSpace noted above, to large-scale efforts to create a mechanism and culture of open access, such as the free online scholarship efforts of Peter Suber (http://www.earlham.edu/~peters/fos/), SPARC (the Scholarly Publishing and Academic Resources Coalition, http://www.arl.org/sparc/), the Budapest Initiative (http://www.soros.org/openaccess/forum.shtml), the Bethesda Statement, and many others. These share the basic inspiration that the available technology, augmented with agreement on standards, and community effort and collaboration, can result in the assembling of major bodies of literature that can be made universally and effectively available worldwide.

The creation of PubMed Central by the National Institutes of Health marks a step by the government into the area. NIH is now requesting that NIH-funded authors deposit the final version of their published manuscript in the repository, where it will become freely available for reading. In order to avoid conflict with publishers, the public availability of an article may be delayed by up to 12 months, but the repository is designed to become a free archive for the full text versions of all papers supported by the NIH.

Some faculty have also been motivated to create freely available online journals, partially in response to the cost of paper publications. *The Journal of Machine Learning Research*, for example, published free on the web (and also available for purchase in hardcopy), was started as a breakaway from the long-established hardcopy journal *Machine Learning*. This is in part a recognition of the ways in which the technology has empowered researchers: journal content is worth it (or not) largely as a consequence of the efforts of the editors and reviewers, who serve without pay (another aspect of the gift economy). With no hardcopy, there's nothing to print or mail, no subscriptions to manage, no money to collect, etc. The entire thing really can be run on a shoestring by the people who create the value in the first place, and as the *JMLR* makes clear, can be run successfully.

VII. Copyright agreement terms can be quite remarkable

The discussion above considered the issue of what rights authors have over their own work once it is published. A related issue concerns the terms authors are presented with as a condition of publication. These at times can include terms both amusing and dangerous. Two examples are supplied by the permission and release forms used by two major professional IT societies, the ACM and the American Association for Artificial

Intelligence (AAAI). The ACM form contains this gem: "All permissions and releases granted by me herein shall be effective in perpetuity and *throughout the universe* unless otherwise stipulated, …." [emphasis added] Hence even were I somehow able to get to another galaxy, I would still not be free from the terms of this agreement.

On a more serious note, the AAAI form indicates: "If anyone brings any claim or action alleging facts that, if true, constitute a breach of the foregoing warranties [concerning originality, absence of copyright infringement, absence of scandalous, libelous, or obscene matter] , the undersigned *will hold harmless and indemnify AAAI, their grantees, their licensees, and this distributors against any liability, whether under judgment, decree, or compromise, and any legal fees and expenses arising out of that claim or actions…"* This remarkable text indicates that in exchange for the privilege of publishing with this organization, I will risk all of my personal assets to ensure that the organization is protected from financial harm. Note in particular the agreement to pay legal costs, meaning I would have to pay to defend the organization no matter how outlandish the claims, as long as, *if true*, the claims would constitute a breach. The only plausible response is not to sign the form, which is what I have routinely done.

VIII. The Rise of the (Software) Service Economy

A common theme underlying many of the issues above is the transition to the view of information as a service rather than a product. A somewhat different, but still important transition on the horizon is the impending transition to software as a service as well, a transition that could be problematic for creative people in IT and elsewhere. As the market for software matures, it will make increasing economic sense for software vendors to transition from traditional sales of software, to providing it as a service:[12] You can sell a program only once, but you can charge for its use forever if you offer it as a service. The move is also motivated by the desire for users (especially companies) to offload the effort of software maintenance, upgrades, etc., leaving it to the application service provider to do all that, in a process that is automatic from the user's point of view.

And therein lies the problem. Software has (finally) evolved to the point where it is delivering the productivity enhancements that seemed elusive for so long.[13] Importantly, a significant fraction of that productivity enhancement arises not just because of the power of the software, but *because users know how to use that power*. That is, *familiarity is key*. *Stability is key*. Without these, productivity disappears.

A simple example will make the point. Consider the lingering difficulty encountered when upgrading from one version of a program to the next. Inevitably hours are lost trying to coerce the software into doing what you know it can do, but capabilities in the new version have been reorganized, renamed, reconceptualized, or perhaps just removed. After extensive experience you have come to know the foibles and frustrations of the previous version and can work around them,[14] but the new version often invalidates some

[12] Software is of course actually licensed, not sold, but the traditional retail license is a one-time fee for effectively perpetual use, looking to the consumer as a sale.

[13] In the 1990's a good deal of investigation went into understanding the "productivity paradox," the claim that "investments in IT, though massive, have not produced significant improvements in industrial productivity. Or, as one economist quipped, 'we see the computers everywhere but in the economic statistics.'" Ives, Probing the Productivity Paradox, *Management Information System Quarterly*, Volume 18, Number 2, June, 1994.

[14] Davis' First Rule of Computing.: Never use software you can't outsmart.

significant part of that experience, and you find yourself back to learning, wrestling with the new version.

The only, and important, saving grace in the current model is that the decision to upgrade is the user's, made when they are willing to do it even knowing the cost, and, crucially, the decision can be undone anytime they choose.

The issue here is of course not any particular program or software vendor. The issue is the service model. The fundamental flaw in software as a service is that it requires users to surrender control over what has become an important resource and tool. It requires that they allow someone else to change it out from under them, on someone else's time schedule, convenience, and most likely, with no recourse and no path back. This model, I believe, will destroy the value of the tool because it will destroy familiarity and hence effectiveness. There is also a reasonable chance it will diminish the market as well, as users find that this loss of control severely impacts their efficiency. We may also ask how many man-hours will be burned up in what will become a classic instance of cost-shifting – the companies who offload software maintenance profit from the move, the application service providers profit mightily from the move, but the cost (loss of control and efficiency) will be paid by the end user.

IX. Summary

The models of reward differ significantly in the commercial environment and the academic research environment, and, importantly, rely on opposing mechanisms: where reputation depends on sharing and dissemination, commerce depends on the ability to exclude. The two camps are thus at times at odds for reasons deeply embedded in their world views. The difference matters because of the significance of academic research as a source of innovation: where considerable attention has been devoted to developing IP policies that encourage commercial innovation, less attention has been given to exploring what IP policies encourage the gift economy of research.

A small informal survey suggests that academic IT researchers report being largely unaffected by IT patents, but routinely feel frustrated by copyrights and restrictions imposed by licensing terms. The fundamental issues are access to source code for programs they wish to build on, unfettered use of programs in a research context, and a convenient and accepted mechanism for ensuring that code they create can be used by others without restrictions of any sort.

The restrictions encountered are in many cases there for plausible reasons, but they can also become roadblocks in unintended ways. Some friction in the system is probably unavoidable, but we should be aware of it, and work toward getting rid of it where the resulting benefit would be widespread.

University libraries face an important challenge in maintaining their character in the face of pressure for increasing control over technical information and skyrocketing costs. In the near term the issue is ensuring access to all members of the university community, and in the longer term, the looming specter of metered access, which would do considerable damage to the character of the library and the university.

Acknowledgements

The faculty who gave time and serious thought to the questionnaire provided a wealth of interesting experience. Hal Abelson commented on an early draft of the paper. Comments from Ann Wolpert, MIT's Directory of Libraries, provided the impetus for and much of the substance of section VI of the paper.

References

[Benkler2002]
Benkler Y, Intellectual property and the organization of information production, *Intl Review of Law and Economics*, 22 (2002) 81–107.

[Benkler2002a]
Benkler Y, Sharing nicely: On sharable goods and the emergence of sharing as a modality of economic production, *Yale Law J*, 114(2004).

[Benkler 2002b]
Benkler, Y, Coase's Penguin, or, Linux and *The Nature of the Firm*, *Yale Law Journal*, vol. 112.

Gnu General Public License: http://www.fsf.org/licensing/licenses/gpl.txt

[McSherry 2001]
McSherry C, *Who Owns Academic Work? Battling for Control of Intellectual Property*, Harvard University Press, 2001.

[Moore 2003]
Moore, J S, Model language for patent and licensing agreements for industrially sponsored research in information technology. Available at http://www.cra.org/reports/ip/.

[Raymond 2002]
Raymond, Eric, The Cathedral and the Bazaar, at http://www.catb.org/~esr/writings/cathedral-bazaar/

[Guédon 2001]
Guédon, Jean-Claude, In Oldenburg's Long Shadow: Librarians, Research Scientists, Publishers, and the Control of Scientific Publishing. *Proceedings of the 138th Annual Meeting*, Association of Research Libraries, Toronto, Ontario, May 2001, Available at www.arl.org/arl/proceedings/138/guedon.html