NEW MOVES IN 'LEGAL JUJITSU' TO COMBAT THE ANTI-COMMONS

Mitigating IPR constraints on innovation through a 'bottom up' approach to institutional reform

BY

Paul A. David

Stanford University, UNU-MERIT (Maastricht), Ecole Polytechnique & Telecom-ParisTech

pad@stanford.edu

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The policy point of the presentation, in a nutshell—

The creation of "(scientific) research commons" by cooperative pooling and open access cross-licensing of research tool-sets is a practical proposal.

It provides an institutional remedy for the harms that can result from the expanded the use IPR protections and the market as a means of promoting the production of international public goods that take the form of scientific and technical information that provides a platform for innovation.

The policy point of the presentation, in a nutshell—

Policy ***Proposal*****: National funding agencies should agree individually and jointly to exercise their authority to impose compulsory common-use licensing of IPR in complementary research "tool sets";**

they should set management rules for the irrevocable assignment of IPR to regulated "public research commons in information" (PRC-i) when such rights arise directly from projects that draw significant public funding.

This is the policy argument in seven steps - 1

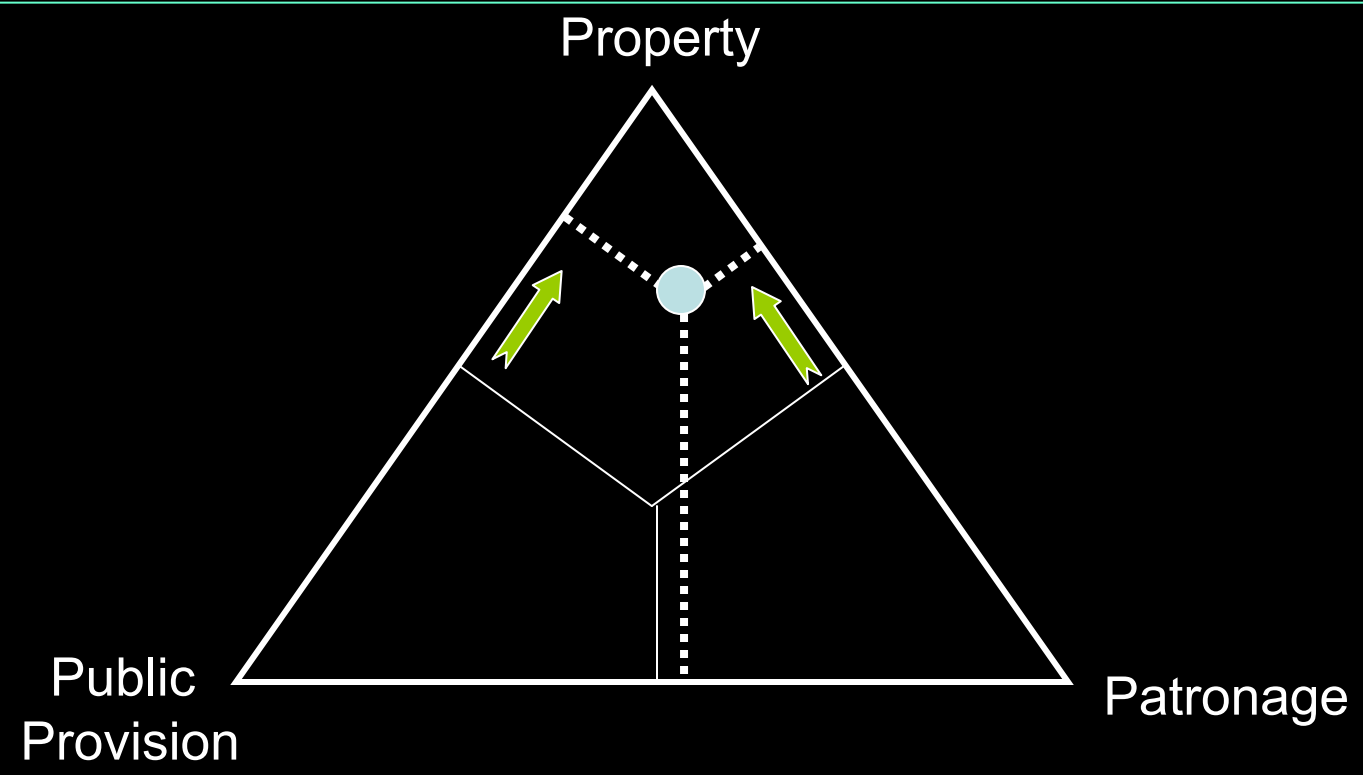
- Prop. 1: Scientific and technical research in the modern world entails the production of data and information (which are international public goods) by means of the same class of international public goods.

- Prop. 2: There are three pure types of institutional solutions for the allocation problems in the production and distribution of information that result from the latter's public goods properties: *Property*, *Patronage* and *(Public) Provision*.

- Prop. 3: Each of the "*3 P's*" offers an imperfect solution, and most of the successful modern economies employ all of them in some degree, but in the past 25 years the mixture has shifted towards *Property*.

The "Anti-Commons" as a manifestation of the trends of the past 25 years of pressures on "Open Science" --

The balance among the complementary solutions to the appropriability of information as a public good has shifted toward reliance on IPR protection.



Fiscal pressures to "privatization" government information production, reinforced by stronger and more comprehensive IPR protections, and the disruptive effects of ICT innovation, and contributing to a drift toward the "property" pole.

This is the policy argument in seven steps - 2

- Prop. 4: The "Property solution"(IPR) creates legal monopoly rights to exploit the new information, and may improve the market allocation of resources in information production through the incentive effects;

  but commercial exploitation of the rights itself inhibits information use – and the "deadweight burden" that is incurred in scientific and technological research itself is likely to be particularly heavy for society.

- Prop.5: Information disclosed and left in the public domain enables the efficient *growth* of knowledge through the conduct of "open science" research, so long as (a) patronage is available and (b) "enclosures" of the public domain does not impede access to the research tools.

Macro-institutional complementarities and the place of open science in the "ST&I system"

If the "3 P's" are alternative (i.e., substitute) solutions for the appropriability problem, why do they co-exist productively in modern economies?

- Proprietary, commercially-oriented R&D is suited for maximizing the volume of economic 'rents' extracted from an existing stock of knowledge, but does not sustain its profitability in the long run
- Open science is suited for exploratory research that maximizes the growth of the stock of reliable knowledge, but is not able to support itself
- Agency and security problems make it most expedient for government mission agencies to carry out some of the research on which their action must be based (e.g, public health actions space research, weapons production)

The policy argument in seven steps - 3

- Prop.6: There are conditions under which IPR in research tools is particularly damaging to scientific progress, these have come to be referred to loosely as “the anti-commons” – which needs to be precisely defined; in those conditions, “common-use” pooling of information resources is likely to be both socially more efficient, and a dominant strategy for researchers.
- Prop.7: IPR owners can contractually construct “information commons” that emulate public domain conditions that will be sustainable against opportunistic “enclosure”; and in the case of a non-exhaustible resources (information), there is good reason not to exclude any contributor of IPR to the research commons -- so long as the additions also are complements of the rights from which the existing PRC-i has been formed.

To get to that argument…

We need to start by discussing two classes of questions:

First, what is the ‘anti-commons problem’ -- for which the “contractually constructed research commons” is the proposed solution? If it exists, isn’t just about too many patents on biomedical research tools?

Second, do we really need public policy intervention here? If intellectual property protections cause inefficiencies, won’t private contracting work to mitigate the harms – because it will be profitable for IP owners to do so?

Unintended consequences of stronger IPR protection for social rate of return from public R&D - *1*

- PROs' engagement in obtaining and exploiting IPR weakens norms of trust and cooperation among researchers (Owen-Smith & Powell, 2001).
- Conflicts over IPR distribution complicates negotiations for joint research projects by firms and universities (Hertzfeld et al, 2006).
- Similar IPR conflicts have even blocked such projects between PROs in developed and developing country PRO's institutions (e.g., U.C. Davis and the collapse of the Andean strawberry project).
- Database utilization encumbered by imposition of "pass-through" IPR licensing conditions – further reinforced by legal protection of encryption – has reduced the research value of repositories that were well annotated by publicly funded research communities (e.g., the Swiss-Prot case).

Unintended consequences of stronger IPR protection for social rate of return from public R&D - *2*

- **Deep-linking and database federation is impeded by database rights, and copyrights, thereby obstructing exploratory searching of extensive "discovery spaces" (e.g., Cameron, 2003, on genomic and related research domains).**
- **Incompatible, or "non-interoperable" digital rights management (DRM) and "trusted" systems also obstruct broad search of scientific literature, e.g., using semantic web metadata (e.g., on Elsevier's copyright terns, Boyle and Wilbanks, 2006)**
- **"Anti-commons" effects: patent thickets and royalty-stacking – a much discussed problem on which the evidence is mixed (Heller & Eisenberg (1998) vs. Walsh, Arora and Cohen (2003).**

PEELING THE ONION OF THE "ANTI-COMMONS"

(without apologies to Günter Grass)

The nature and source of the Anti-Commons Problem—an economist's version:

- The three layers of the anti-commons problem all are rooted in the distribution of exploitation rights (hence, exclusion rights) over the constituent items of researchers' tool-sets.
- Complementarities among elements in the tool-set exacerbate all the problems and costs of the three distinct forms of the "anti-commons":

The topology of the Anti-commons—moving from the surface to the economic core:

Layer 1: **Search costs**

Layer 2: **Transactions costs**

Layer 3: **"Multiple-marginalization" and royalty-stacking**

THE "RESEARCH ANTI-COMMONS"-- *PEELING THE ONION*

Layer 1: Search costs, **…**to discover whether tools described in the research literature are privately appropriated, and to whom the property rights were assigned, whether as patents, or as copyright computer code, or as database rights.

Layer 2:Transactions costs, …. strictly these arise when one has identified the owner(s) of the IPR and seeks a license, or an agreement to transfer materials.

Evidence of "anti-commons" effects due to patenting?

Eisenberg' s (2001) analysis of the testimony gathered by the NIH Working Group on Research Tools during 1997-98 from 29 biomedical firms and 32 academic institutions, emphasized "transactions costs" aspects --

"The exchange of research tools with the biomedical research community often involves vexing and protracted negotiations over terms and value. Although owners and users of research tools usually mange to work out their differences when the transactions matter greatly to both sides, difficult negotiations often cause delays in research and sometimes lead to the abandonment of research plans …."

Evidence of "anti-commons" effects due to patenting?

Eisenberg' s (2001) analysis emphasized "transactions costs" aspects -- continued

"**....**The foregoing discussion suggests some features of a market for intellectual property that may impede agreement upon terms of exchange, including high transactions costs relative to likely gains for exchange, participation of heterogeneous institutions with different missions, complex and conflicting agendas of different agents within these institutions, and difficulties in evaluating present and future intellectual property rights when profits are speculative and remote."

Source: Rebecca S. Eisenberg, "Bargaining over the transfer of proprietary research tools: Is this market failing for emerging?," Ch. 9 in Expanding the Boundaries of Intellectual Property, Eds. R. Dreyfuss, D. L. Zimmerman and H. First, New York: Oxford University Press, 2001.

THE “ANTI-COMMONS”-- *PEELING THE ONION - 2*

Layer 3: Multiple-marginalization and royalty-stacking -- the core problem

Even when there are no strategic “hold-outs”, the distribution of exclusion rights to multiple items means that they may be priced in a way that disregards the negative pecuniary externalities of raising the price on any single item.

When tools are ‘gross complements’, rather than substitutes, the resulting inefficiency is the dual of the that produced by ignoring congestions externalities. Here pricing of components ignores the pecuniary externalities on the demand for the project as a whole, resulting sub-optimal use of the entire bundle.

The severity of the inefficiency increases with the number of tools that are strict complements for the given research project.

"RESEARCH ANTI-COMMONS"–THE GENERALIZED CORE 1

Multiple-marginalization effects

-- not only potentially impede the use of patented or copyrighted research tools, and thereby delay, distort or discourage the conduct of some research projects;

-- they also can degrade the exploration of large data-fields – or "discovery spaces" – that have become particularly important in exploratory research, in geophysics, medical genetics.

Think about "database rights" in this connection.

"RESEARCH ANTI-COMMONS"–THE GENERALIZED CORE

Consider a simple model of a research production project: the output is results R, produced under cost-minimizing conditions on a budget of G

$$G = \sum [\, p\{i\} \,][\, b\{i\} \,] + X,$$

according to production function

$$R = F(S, X),$$

where

X is a vector of inputs of experimental time and equipment

and

S is the output of a *search* activity, according to search function:

$$S = S(b\{1\}, b\{2\}, \ldots . b\{B\}),$$

in which

b {i} is the information extracted from database i.

"ANTI-COMMONS"–THE GENERALIZED CORE - 2

Modelling steps:

1) For simplicity, symmetry of intensity of database use is assumed, and all projects are also assumed to have identical search strategies.

2) From a CES production function for "search" one obtains derived demands for access to database contents, as a function of unit extraction charges, project real budget level and the elasticity of substitution among databases.

3) Assume database owners set profit-maximizing royal rates for data extraction independently (as discriminating monopolists), and solve for the resulting relative prices, and the project's consequent cost-minimizing search and production decisions.

"ANTI-COMMONS"–THE GENERALIZED CORE - 3

Basic solution results:

1. Even if the b {i} are not strict complements, and there is symmetric non-zero elasticity of substitution between them--

(a) when database rights are separately owned and priced individually to maximize the owners' separate revenues without taking account of pecuniary spillovers, the larger the number of databases, B, the more severely degraded will be S;

(b) hence R (research output) for given funding levels will be reduced – so long as S and *X* are not infinitely substitutable.

2. The outcome is welfare-inferior to that obtained with joint monopoly ownership of databases.

LIKELY SITES FOR RESEARCH ANTICOMMONS PROBLEMS

- **Biomedical research tools**
- **Scientific software**
- **Software patents**
- **Scientific databases – esp., in genetics, genomics and proteinomics**
- **Nanotechnology tools**

LIKELY SITES FOR RESEARCH ANTICOMMONS

Biomedical research tools and diagnostics -- 1

- The tool that offered commercial opportunities for academic patentees was molecular “targets” for development of drug therapies.
- Walsh, Arora and Cohen (2004) note this has long been an area of concerns, but ask: are the “targets” really patent complements?; are there many such targets in research on particular disease therapies, forming real thickets?
- There are other key tools that were non-exclusively licensed, and were very accessible in the research community: monoclonal antibodies, polymerase chain reaction, restriction enzyme methods where the impacts would be greater as these became basic foundations for a large research field.

LIKELY SITES FOR RESEARCH ANTICOMMONS

Biomedical research tools and diagnostics-- 2

- Genetic testing is another field, where royalty-staking is a problem --

  See the Walsh, Cohen and Cho (2005) and the Cho et al. (2006) studies of diagnostic kit patents, esp. the Myriad patents:

The effects of the suite of tests each patented is that the price is sufficiently high that the number of labs doing them has decreased, and there is negative feedback on the improvement of diagnostic accuracy.

This is not a research anti-commons problem, because it arises in a final service (downstream), but upstream developments may be blocked by the patent-owners unwillingness to license.

LIKELY SITES FOR RESEARCH 'ANTI-COMMONS'

- **Scientific software:**

  A wide range of tools come out of labs, a case of 'user innovation' – but many are not preserved and packaged for wider use; they remain un-portable until commercial entrepreneurs the complementary resources obtain the rights (often freely) for exploiting them…

- **Software patents**

  These raise a double problem:

  (1) The modularity of software gives rise to strong complementarities, and the potential for reuse in new combinations to produce novel functionalities. Software is a good site for the formation of patent thickets: see the evidence from the MPEG and other cases in Clarkson (2005).

  (2) Because the convergence of information technology with emerging research fields, including biotechnology (bioinformatics) and nanotechnology means that the ramifications of software thickets extend into promising frontier areas research, where new tool-building is likely to go on.

The EU Directive on the Legal Protection of Databases

The Directive issued on March 11, 1996 mandated the statutory implementation by EU Member States of a *sui generis* property right in databases (def.="collections"):

- extended **legal protection to content previously in the public domain** and otherwise not copyrightable;
- **removed the distinction in the treatment of pre-existing expressive material and original expressions**;
- permitted virtually **indefinite renewal of legal protection for databases** without requiring the substantial addition of new and original content;
- **abandoned significant exclusions** (such as exist in copyright law) for "fair use" – such as scholarly and literary criticism, use in scientific research, and education;

Does the existence of the anti-commons problem automatically call for interventions to "reform" the IPR system?

There have been many such "reform" proposals, including:

- Expanding and clarifying the experimental use exemptions to create a "research exemption";
- Creating conditional "research exemption" for publicly funded science and engineering projects;
- Restricting application of legal enforcement of rights to cases of alleged infringement for commercial exploitation, in effect replacing IPR with a liability system under which public research users would be less constrained;
- Letting the free enterprise fix the problem, by creating a profitable business in services that search for the IP rights-holders, collect royalties, and curtail unwillingness to license: this envisages a generalized "collections society" solution.

Why won't private "intermediating" organizations emerge and profit by providing a market solution for scientists' anti-commons problems?

The Collections Society Proposal

This "solution" aims to reduce costs of search and transacting, and lower the costs of rights enforcement, by using economies of scale and scope in search, and re-utilizing the information in repeated licensing transactions.

By making the use of IPR less costly, collecting societies may encourage research production – by inducing more inventions of patentable research tools.

In addition, the collections society has an incentive to write contractual provisions (grant back), in order to induce non-cooperating owners to share use of their exploitation right, in exchange for royalties.

…..It does sound good, but Spence (2006) points to reasons to think it maybe too good to be true.

Reasons why private "intermediating" institutions will not be workable solutions for scientists' anti-commons problems?--1

Feasibility and cost problems with the generic collections society solution: arise because there are flaws in arguing for an institutional innovation by analogy -- copyright collecting organizations deal with a form of IP that is very different from the contents of patents, and database rights:

- Copyright authors typically want their products distributed widely, but this is not so generally the case with patents
- Copyrights in songs, in texts and even images are more likely to be substitutes than is the case with patents, and scientific data
- Copyright collection societies target specific use-markets, but uses of research tools are much wider and more difficult to predict, so pricing decisions are more difficult

Flaws in the Collections Society Solution --2

- There are cost-savings in searches, and identifying right's holders who will grant non-exclusive licenses, but by making the use of IPR easier for the PRO's it could also encourage strategic uses of licensing terms that would disadvantage rival research projects, or encumber researchers in rival institutions. The view that PROs would not behave that way ignores the competitive pressures under which they are operating, especially today.

- One should ask whether there will be an improvement on the existing situation in the public sector -- where (according to Walsh, Arora and Cohen,2003) academic biomedical researchers say they just ignore patents? Compared to the state of non-compliance and non-enforcement, collections societies could make things worse.

Flaws in the Collections Society Solution --3

- The music copyright collecting societies' history reveals a potential for abuse of market position (Einhorn 2006). Bundling of wanted and unwanted licenses is an attractive strategy for the society, so competition authority supervision would be needed.

- While the collecting societies in the field of music performance rights are restrained from excessive pricing by the adverse effects on revenue, that is in large part because other copyright material are available as substitutes. This condition is less usual in the case of patents, and there could be unjustifiably big markups -- especially when some patents in the bundle that were complements --.

The radical critique of the general case for patents-- Do we really need IPR for innovation?

- **When inventions are sequential and cumulative (later inventions build on earlier ones), free imitation can yield spill-overs that early inventors can exploit, and under some conditions the net effect of collecting patent royalities actually reduces profits from innovation.**

- **Leaving one's inventive step in the public domain for others to build upon can provide an enhanced knowledge base for more profitable future innovations.**

See Bessen and Maskin's (2006) formalization of this critique of the patent system, showing conditions in which it is privately as well as socially sub-optimal.

What is to be done?

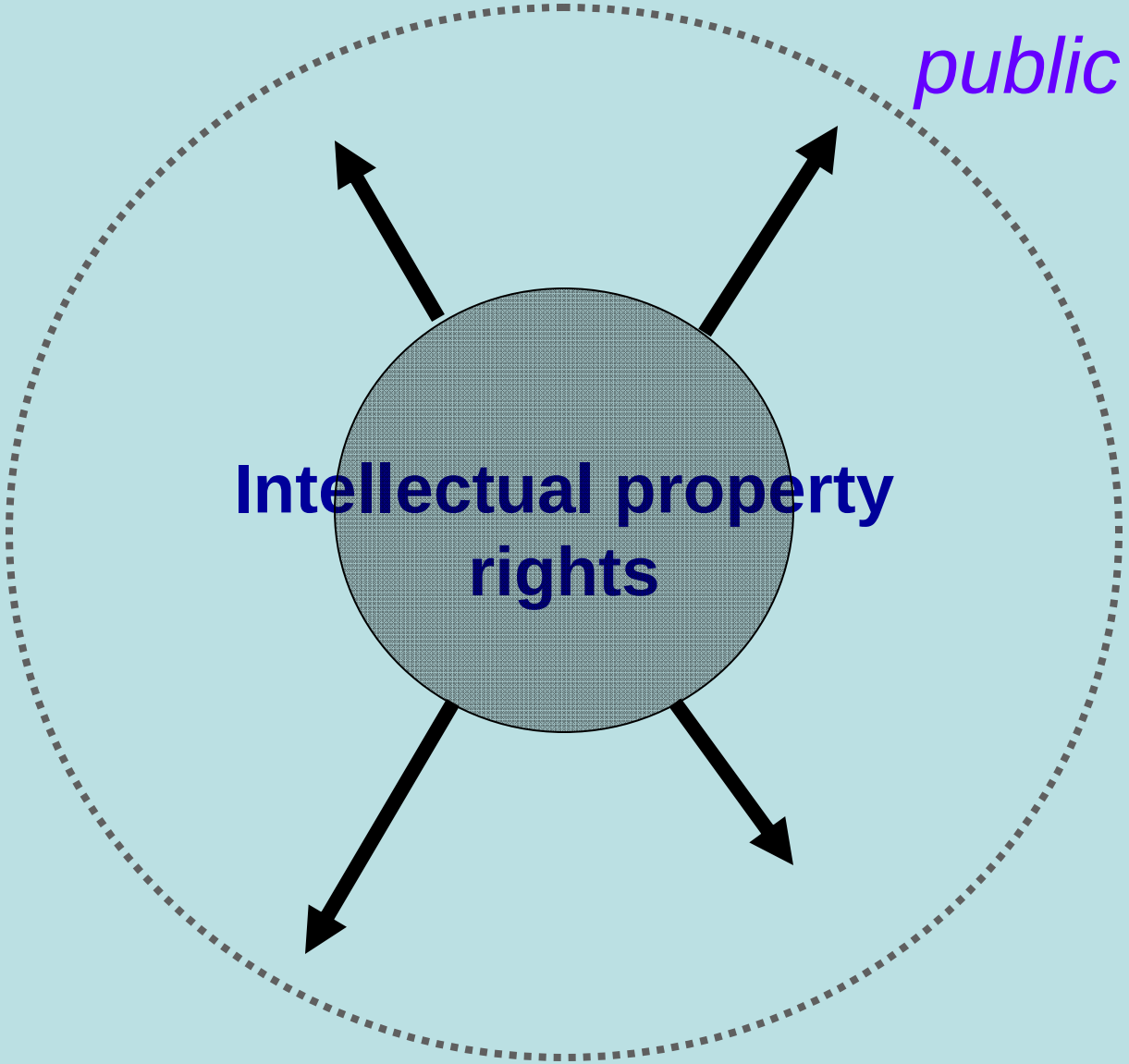
Recent analytical reconsiderations provide a stronger rationale for

resisting further encroachment of IPR upon the public domain (see e.g., Boyle, and the 'HapMap strategy) ,

facilitating cooperative sharing of scientific and technical data and information by commons-based peer-production communities

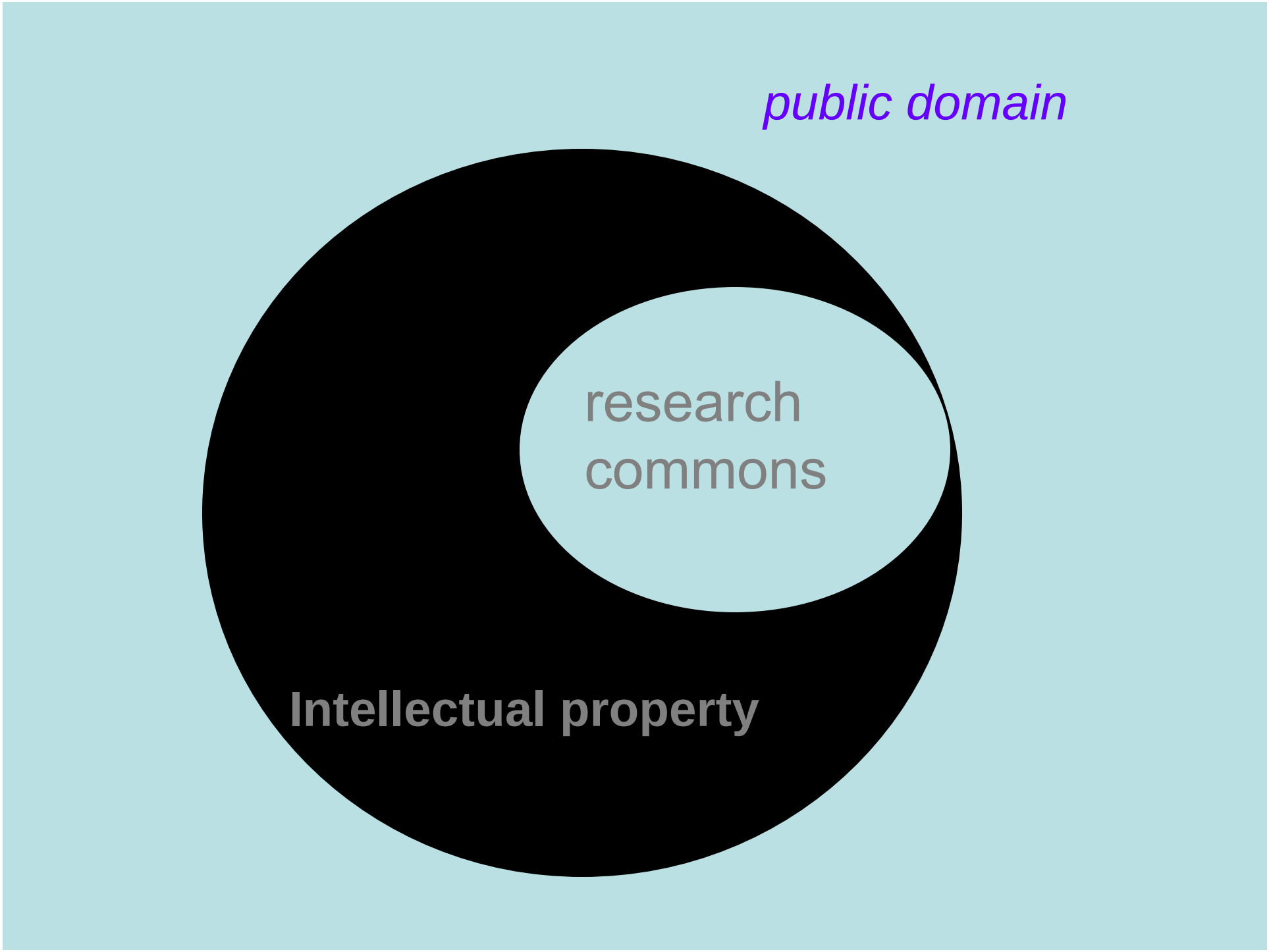
(see Benkler, and the FLOSS paradigm)

In other words, an organized "push back" against the expansion of the IPR domain.


public domain
Intellectual property rights

But…Why not also pursue a less radical approach to mitigating the harms of the present state of affairs, resulting from existing IPR and the likely continuation of IPR grants of exclusion rights on research tools ?

The proposal: 'contractually construct' protected information spaces that preserve or emulation public domain conditions for common use of scientific information and data. ***[see Reichman and Uhlir (2003), David and Spence(2003)]***


public domain
research
commons
Intellectual property

The Commons is the more immediate practical remedy for the anti-commons – it makes use of the IPR regime, rather than proposing radical reform (or abolish it)

To make space for the "Commons solution" in policy discourse it will help to clear away the misconceptions of economists and lawyers concerning the economic history of "the Commons", and stop textbook repetitions of the travesty of the 'Tragedy', like this one:

"The *anticommons* is a play on words and refers to the 'tragedy of the commons' which is taught in freshman economics. In the tragedy of the commons peasants in early modern Britain overgrazed shared pastures ('the commons') because the absence of private property eliminated incentives to conserve." -- Scotchmer (2004:88)

…by acquainting them with the historical reality:

Contrary to the historical fantasy of a medieval "common pool problem" promulgated in the influential essay by Garrett Hardin (1968), that particular "tragedy" never was:

- From the 13th century onwards, the records of Europe's agrarian communes detail quantity-regulations adopted "by common consent" of the villeins (tenants) to control the exercise of rights of common grazing on the fallow fields, the meadows, and the stubble-fields (the post-harvest grain-fields) of the village's arable land. Internal management of these exhaustable resources accompanied the exclusion of strangers.

- Ostrom (1990), and in subsequent works on "common property resources," has shown the relevance of this experience to real resource problems in developing economies.

The historical experience of successfully managed Common Property Resources

- By the ‘early modern era’ in Britain, and equally in the more densely settle arable farming regions of northern Europe, the management of common grazing rights prescribed *stinting*: tenants in the village were allocated “stints” that specified the numbers of specific animals that commoners could put on the fallow or common pasture lands, apportioning these rights in relation to the size of their holdings in the arable field, and sometimes in the meadow-land.

The historical experience of successfully managed Common Property Resources--2

The terrier of Salford Manor, in Oxfordshire records the following two items among the by-laws adopted by common consent of the "inhabitants" on 17th September, 1592:

"1. *Imprimis* it is agreed that every inhabitant may kepe for every three acres of follow [fallow]that he hath within this parryssh eight sheepe and not above upon payne for every sheepe he shall kepe above that rate to foryte every tyme xij d [12 pence, i.e. one shilling]";

"7. Item that every may kepe for every five acres of land in one field [referring to the three open-fields of the arable land in the village] foure kyne [kine referring to 'cows'] and not above upon payne of iij s. iij d. [3 shillings and 3 pence] ."

Source: Salford Manor,No.368, in the Codrington Library (All Souls College, Oxford), transcribed and printed as doc. 216 in Ault (1965: Appendix, p. 93).

The Commons in tangible exhaustible resources still lives!

Collective possession of exhaustible resources did, and does not translate into a chaotic struggle for possession among neighbors, nor does it result in the egalitarian distribution of use-rights.

Even in western Europe today, such arrangements based upon *de jure* common use rights (*res communas*) that date from the Middle Ages have survived in the Swiss Alps and Northern Italy—e.g., the Magnifica Comunità di Fiemme, in the valley of Aviso (Trento) -- where they still govern the use of tens of thousands of hectares of alpine forests, pasture and meadow land.

PROTECTING DATABASES AS CRITICAL FACILITIES -- IN GENETICS AND GENOMICS: THE INTERNATIONAL “HAP-MAP” PROJECT

HapMap is an example of an open collaborative research effort that created a public domain database resource which was protected against privatization by legally enforceable contracts.

Scientific Purpose

- The haplotype map, or "HapMap," exemplifies a database tool that has been created to allow researchers to find genes and genetic variations that affect health and disease. The DNA sequence of any two people is 99.9 percent identical, but the variations may greatly affect an individual's disease risk. Sites in the DNA sequence where individuals differ at a single DNA base are called SNPs (single nucleotide polymorphisms).

- Sets of nearby SNPs on the same chromosome are inherited in blocks, and the pattern of SNPs on a block is called a haplotype. Blocks may contain a large number of SNPs, yet a few SNPs are enough to uniquely identify the haplotypes in a block. The HapMap is a map of these haplotype blocks and the specific SNPs that identify the haplotypes are called “tag SNPs”.

- By reducing number of SNPs) required to examine the entire genome for association with a phenotype -- from the 10 million SNPs that exist to roughly 500,000 tag SNPs – the HapMap provides a means of greatly reduce the costs and effectiveness of research in the field of genetic medicine. By dispensing with the need to typing more SNPs than the necessary tag SNPS, it aims to increase the efficiency and comprehensiveness of genome scan approaches to finding regions with genes that affect diseases.

DATABASES AS CRITICAL FACILITIES -- IN GENETICS AND GENOMICS

THE INTERNATIONAL "HAPMAP" PROJECT'S *"OPEN DATA ACCESSPOLICY*

- The National Human Genome Research Institute (NHGRI) and other national funding agencies launched the International Halotype Mapping Project in 2002 (see http://www.genome.gov/10001688). The HapMap project followed the precedents established by the Human Genome Project (HGP), by rejecting protection of the data under copyright or database rights, and establishing a policy requiring participants to release individual geneotype data to all the project members as soon as it was identified.

- It was recognized that any of the teams with access to the database might be able to take that data and, by combining it with their own genotype data, generate sufficient information to file a patent on haplotypes whose phenotypic association with disease made them of medical interest.
- To prevent this, a temporary "click-wrap license" was created – the *IHMP Public Access License* – which does not assert copyright on the underlying data, but requires all who accessed the project database to agree not to file patents where they had relied in part on HapMap data.

- In a sense this is a special case of *legal jujitsu*, where a copy-left strategy has been mutually imposed on database users by an enforceable contract in the absence of IPR ownership; technological protection of the database at a level sufficient to compel users to take the "click-wrap" license makes it possible to dispense with the legal protection of asserting copyright in order to use "copyleft" licenses.

-- Creating a "research commons" by licensing of existing intellectual property:

- Science Commons: common use licensing of data contributed to repositories, cross-licensing of patented research tools, pre-commitment to materials transfer licensing on RAND terms
- *GISCI* – the Global Information Commons for Science Initiative: a support facility for 'bottom-up' commons-building initiatives, and programs for coordination among "top down" public agency support actions.

SELECTIVE IMPLEMENTATION : EFFICIENT IPR POOLS

- The case for efficient patent pools rests on overcoming the obstacles to research and innovation posed by the growth of " thickets" and designed complementarities in claims that create blocking patents.

- Defense against anti-trust objections to pooling would be easier where there an empirical procedure for establishing the likelihood that an inefficient patent cluster, i.e., a "thicket" had formed.
- Clarkson (2005) proposes and demonstrates an application of network analysis to discover thickets.
- But, dual pricing policies by foundations running PRC-i's, are potentially subject to abuse, and competition among the foundations will be limited if complementaries are to be internalized. So anti-trust supervision will be necessary.

Contractually constructed “research commons” -- Is this also a feasible migration path toward an an efficient reform of the of the Bayh-Dole regime?

- assignment of university patents to larger, professionally managed non-profit independent foundations would provide efficient pools
- economies of scale and scope of the “foundations” would contribute to more licensing deals, and increase net income from licensing – which could be returned for use in seed-granting new exploratory university research
- closure of many TTO’s that currently do not cover their operating costs from licensing revenues would recover university resources that could be devoted to other programs that visibly support to regional development
- separation of “technology management” functions from the university would reduce institutional conflicts of interest, free high-level administrative personnel from involvments in IPR-related negotiations arising from industry-university, and inter-university collaborative research project proposals

A final note, for the copyright lawyers…