

IPR Background: Theme 1 Functioning of IPR systems

Jonathan Cave
University of Warwick
7 October 2003

1. Types of IPR

1.1. Different types of intellectual property

It is traditional (see e.g. WIPO) to distinguish intellectual from industrial property. Intellectual property is protected as to expression or fixation via copyright, while industrial property content is protected through patents, trademarks, design protection, etc.

For present purposes, the classification is closely connected to the type of right asserted (next section). As the central focus is on research, it seems useful to recall as well the epistemic foundations of IPR. One part of this meme is the ‘intellectual’ definition of what is created by research. It is simple (and simplistic) to consider research as the creation of knowledge and then to further differentiate between (e.g.) basic, applied and application-orientated knowledge or research. This classification certainly identifies proximity to ‘uses’ of knowledge for which society might, in principle, be prepared to pay – in other words, where there is a payment to be made for the right to use the knowledge directly. Of course, the argument is strongest for knowledge embodied in goods or services that are themselves objects of commerce; this knowledge therefore obtains a factor payment. This view treats basic and applied research as factors in the production of application-orientated research, earning ‘upstream’ factor payments. Central to this way of thinking is the demand side: payment is made in proportion to *utility* in some pragmatic (private or public goods and services) sense. However, this view falls short in (at least) two respects.

First, some valuable aspects of the pursuit of knowledge cannot be captured by their embodiment in practical ‘products.’ These include:

- General advances in understanding and civility (similar to, say, moral education);
- The ‘option value’ of potentially applicable knowledge in an as-yet-unseen future;
- The value of ‘failed attempts’ to identify new knowledge – including both *ex ante* evaluation of risky prospects and the ‘lessons of failure’ in forestalling wasted efforts and providing scientific endeavour with incentives, discipline and long-term focus;
- The interaction of research and education; and
- Facilitating other societal coordination from access to a common knowledge base.

Second, much of the valuable output of research cannot adequately be represented as knowledge in the global sense. Aspects that must be considered include: the *distribution* of knowledge; the *quality* of knowledge; the *codification status* of knowledge (including the ease an adequacy of imitation or adaptation); and the *epistemic status* of knowledge (simply, whether we are producing knowledge, truth or ‘merely’ belief).

1.2. Different types of right

Property can be owned and possibly transferred, transformed or consumed. Most legal representations of intellectual and other ‘intangible’ property rights concentrate on economic rights – claims on payments of one form or another. Additionally, some copyright systems deal with the ‘moral right’ to be identified as the author of a work and to control its usage. Both rights are, at least in principle individual – though economic rights can belong to ‘legal persons’ (groups having legal identity). In the research context, some intellectual property is inherently and inescapably collective, so individual rights may not be feasible, equitable or efficient. This points to externalities and especially public goods characteristics¹ of knowledge creation and exploitation. One important right connecting individuals and groups is the right to participate in knowledge creation, exchange of ideas, etc. This right is often granted in recognition of qualifications or contributions and the literatures on group identity and the evolution of conventions are relevant.

IPR systems also differ in formalisation, transferability and covered uses, including specific exemptions such as ‘fair use’ or ‘compulsory licence.’

One aspect of formality concerns the use of language – jargon creates access barriers to absorbing (and applying or extending) knowledge, entry barriers (e.g. to peer-reviewed publication) and limits to application of ideas. At the same time, it facilitates efficient exchange and precision in communication and thinking². Whether institutional or evolutionary forces produce useful terms (and memes) is a subject for research similar in character to the study of the tradeoffs inherent in formal property rights regimes.

1.3. Breadth, depth and duration

Rights are limited in other ways, such as³ the depth of IPR protection from basic to application-orientated research. Consider basic research leading to a specific commercially profitable application. If IPR are only granted to the applied bit, basic research will be under-supplied. If IPR are only granted to the basic bit, applications will be underdeveloped. Finding the right balance is tricky, especially since:

- Different steps may⁴ involve parties with different motivations and cultural connections;
- Legal systems tend towards one-size-fits-all, which ignores important differences; and

¹ Specifically, they may be non-rivalrous and/or non-excludable. This Samuelsonian view could be generalised to include positive spillovers (non-rivalry means 0 spillovers) and a broader view of the consent and previous knowledge required to enable access. But the public goods idea is not universally accepted – see Section 4.

² This can be modelled by treating knowledge creation as a congestible public good, considering diseconomies of scope in knowledge creation, or analysing trade-offs between *a priori* quality screens and diversity of approaches.

³ cf. Scotchmer (1991).

⁴ There may be advantages in having different people, representing different perspectives and institutional cultures, involved at different stages in the life cycle of a practical idea. If rights are too vertically extended, the entire life cycle may be effectively controlled by a single (type of) entity. Appropriate rights reflect substitutability or complementarity among ideas, and the types of contract that are a) appropriate and b) likely to evolve as a result.

- Effort is expended *ex ante* but the payment is made *ex post*, so the uncertainty and its resolution need to be included.

Similar reasoning applies to the breadth of IPR protection – broad rights can discourage complementary innovation, while narrow rights can discourage effort on what may turn out to be seminal contributions. One interesting development is the use of the ‘genetic algorithm’ to identify the closest non-infringing innovation to a patented idea. This highlights the role of IPR regimes in encouraging useful innovation – the consideration is between ‘sterile diversity’ and paradigm-shifting invention. Finally, the duration of IPR affects both economic incentives and the character of the scientific enterprise. As to the latter, it has been observed that citations (and perhaps scholarship itself) increasingly favour the ends of the age distribution – the most recent work and the received ‘canon.’ Whether this leads to better scientific progress, better communication among fields, and a scientific community that combines inclusion with discipline is a matter of ongoing debate.

1.4. Jurisdictional basis

Formal IPR have different bases – international for copyright, national for patent, market-based for trade marks, etc. The legal and/or spatial basis of moral and participatory rights, and their extension to tacit or systemic knowledge, traditional knowledge, etc. remain open.

2. Why we have IPR

Macro arguments for IPR reflect *efficiency* and *equity* concerns. Efficiency covers:

- Allocation efficiency – the maximisation of gains from trade, elimination of deadweight loss, etc. here the argument is complex: due to externalities, *some* form of market is seen to be desirable, but IPR as currently constituted are exclusive monopoly rights and create countervailing deadweight loss.
- Production efficiency – the minimisation of average cost. The issues here concern linkage between IP production and markets for ‘real’ goods and services, the imputation of appropriate opportunity costs, the relation of marginal, average and fixed costs and the issue of sunk cost (e.g. of basic research, training, etc).
- Dynamic efficiency – the incentive to produce continuous improvement through further innovation, investment, etc.

Equity covers the distribution of returns across participants. One specific concern is that ‘winner-takes-all systems’ (like conventional exclusive monopoly patent rights based on considerations of originality and non-obviousness) produce an allocation of effort that is both inequitable (e.g. to co-workers, slightly slower teams, people doing related work etc.) and inefficient – inefficient *ex ante* because it leads to an over-allocation of effort to those approaches thought most likely to give a quick result leading to a patent that would blockade further progress for a while and inefficient *ex post* because of the implied ownership or incumbent advantage in making the next innovation – which in turn changes the nature of progress towards the incremental.

It almost goes without saying that economic IPR are ultimately intended to advance efficiency through enabling markets or bargaining, and that these ‘solutions’ must take account of the inherent informational asymmetry in such negotiations: once the ‘buying’ party knows what is on offer, s/he effectively already possesses it. This is only partially captured by the public goods approach, and recent work on games of incomplete information (e.g. signalling and principal-agent games) is increasingly applicable to research collaborations.

2.1. Incentives for innovation

The standard basis for IPR protection is that the economic or other returns are necessary to motivate creative effort. Other aspects include the use of IPR as a filtration device to discourage unsound knowledge, guide collaboration, and make promotion, etc. decisions.

2.2. Incentives for exploitation

The fact that the payments for economic IPR are tied to exploitation is thought to provide incentives for applications, deployment, adaptation, etc.

2.3. *Juste retour*

In addition to the economic arguments, IPR are sometimes justified on grounds of natural justice, though this is perhaps more applicable to the domain of copyright where uncertainties are more likely to be controllable by the creator of the protected work. In the scientific domain, this may place an undue a potentially distorting emphasis on devoting effort to problems likely to offer successful resolution and may thus discourage efficient risk-taking. In other words, the justification appeals to the appropriate return to effort while the right attaches to the (stochastic) result of effort.

2.4. Subsidising the value chain

The idea here is that the creation, refinement, exploitation and elaboration of ideas involve a wide range of participants. Their contributions have different motivations, different degrees of exploitability, and different relations (substitutes, complements; investment, inputs, etc.)

3. Effects of IPR

3.1. On innovation speed

Most individual IPR schemes are first-past-the-post (winner-takes-all). This encourages speed and secrecy. From the societal point of view, speed is fine if the nature of the innovation is well known in advance, but not if there are many possible avenues. First, WTA will concentrate efforts on the ‘most likely’ solution (esp. for small research outfits without a good portfolio of other work or RIs with highly project-specific individualised funding). Second, this draws effort away from ‘accidental’ discovery, esp. when the proximate use is used to obtain a right to the innovation (and thus partially covers other uses). In terms of the efficiency of scientific endeavour, WTA is wasteful *ex post* (since all but one RI will have

wasted its effort) and may encourage the ‘wrong kind’ (of collaboration (collusion)). This is particularly true where economic exploitation encourages a slower pace of innovation, as in cases of ‘predatory patenting’ used to deter or delay entry into markets.

3.2. On scientific collaboration

IPR are known to affect scientific collaboration, and it is necessary to reconcile IPR ownership with access to knowledge and participation in research – this is not limited to the scientific community. But IPR interacts with other parts of the institutional context of collaboration to support or inhibit cooperation and the informal underpinnings of trust and research quality. The main points are that current economic IPR convert the possibly collective good of collaboration into a private good, and emphasise obtaining the right over solving the problem.

Institutional impediments to collaboration include: contractual relationships among partners (e.g. in different sectors of the research community or jurisdictions); ownership of previously created material whose salience and thus value can’t be fixed in advance; ownership of joint products of the collaboration (and rights to exploit them); and liability arising from the partnership. Each is reflected in conventional law (usually developed for other contexts⁵) and recent practice (e.g. in PSRI exploitation offices).

Possible disputes involve (at least) 3 types of party – active scientists, the administration of their host institutions and funding bodies. They may also involve outsiders. External risks are spread by indemnity clauses and internal risks by informal conventions or norms⁶ for promotion, revenue allocation, subsequent individual or collective writing or other exploitation. As research spreads to larger teams from diverse institutional cultures, disciplines and/or mixes of public and private funding, these norms become less clear, less trusted and less efficient.

This is exacerbated by increased competition and financial motivation among universities, non-profit institutes and other publicly supported research organisations. Existing systems⁷ for using institutional resources and collaboration across institutional boundaries need to be brought within the control of the parties to permit customised formal arrangements and/or new conventions reflecting specific needs.

But there are drawbacks to the contractarian approach. Contracts are often incomplete or founded on misunderstanding. Of course, breach of contract can be efficient, esp. in research

⁵ E.g. arbitration and civil procedure, competition law, contract, conflict of laws, data protection, IPR law, tort law.

⁶ E.g. ordering of authors’ names, attribution of credit for research findings.

⁷ Also worth noting is the interaction of economic IPR effects with other mechanisms for research evaluation and resource allocation, such as the UK Research Assessment Exercise (RAE).

contexts when contingencies cannot always be identified, let alone agreed in advance. It may be necessary to use specialist courts or scientific reference panels to deal with such issues.

Another problem is philosophical – explicit contracting or even the advance identification of IPR – potentially conflict with the necessary spirit of trust and collaboration. Lawyers concentrate on worst-case outcomes and financial consequences while effective collaboration is born of optimism and intellectual curiosity. Each approach is likely to be wrong more often than not, since science is uncertain by definition. To an economist this suggests that solutions should be forward-looking – providing incentives to foster future cooperation rather than safeguards to reallocate past gains and losses. This is particularly important because the common perspectives of institutional administrators and funders are very different from those of scientific partners – the arrangements devised by the former may well turn cooperation into competition to everyone’s disadvantage. In addition, differences among funders, host institutions, regulators, etc. about the division of spoils, risk management or apportioning responsibility may produce destructive fallout. These issues are hard to resolve through one-size-fits-all IPR arrangements or standard form contracts. Collaborative agreements take a wide variety of forms and evolve over time – sometimes within a single project. Future collaboration will be even more fluid and ‘networked’ rather than institutionalised. Existing formal arrangements are unsuited to this new environment, the ‘hard’ problems addressed through the dispersed operations of loose networks of scientists probably cannot be addressed in any other way, legacy arrangements are already distorting the evolution of new collaborative forms and *laissez-faire* approaches – for instance dropping existing IPR arrangements – might discourage knowledge-sharing or generally encourage *ad hoc* and exclusive IP protection arrangements that work against both individual and collective interests.

There is also an agency problem between the scientific workers and contracting and exploiting offices in their host institutions. Few active scientists relish involvement in IPR or other contractual or accounting activities and it is neither equitable nor efficient to impose these burdens on them⁸. But if control is given to ‘specialists’ their narrow interests can distort arrangements, conflicts between contractual and research norms may lead to reliance problems and gaps in understanding may lead to inappropriate action on both sides.

These considerations are already visible in criticisms of recent developments in e.g. database and copyright IPR. The Royal Society (2003), criticises the narrow and ill-defined limitations on “fair dealing” exceptions for research embodied in U.K. law implementing the EC Database (1996) and Copyright (2001) Directives. The alteration of traditional practice

⁸ Due to both moral hazard and adverse selection.

limits the exemption to research with “non-commercial purposes” – implying *inter alia* that any research can have only commercial purposes – and education and further limits the exception to extraction (and not re-utilisation) of protected material. This completely inhibits the scientific community’s use of increasingly important databases of scientific information – not least because empirical science depends explicitly on verification – namely, on re-use of specific aspects of the original information and also because innovation across disciplines and the development of applications rely on re-use of original data in ways that might not have been foreseen by original researchers – and in ways over which those researchers would not wish to assert rights if there was a feasible way to ‘unprotect’ them. However, even if there were, it does not follow that administrators and legal experts would share this ‘open science’ perspective. Nor is it the case that re-use and adaptation necessarily damage the original creator’s interests – under academic norms relating to citation, exactly the opposite can happen. It also seems strangely inconsistent with widespread government policy to induce universities to exploit IPR over the fruits of publicly funded research and could well accelerate the tendency to reduce funding for lines of effort that do not directly contribute to these rights, including core infrastructural funding.

There is no reason to believe that protections offered by copyright and database status are appropriate for the fruits of creative research. In the copyright situation, the question is whether the (protected) expression is an adequate representation of the idea; in the database situation, the issue is whether protection for the database *per se* inhibits use of database contents. Such protections may deter further development. Alternatively, these protections might be inadequate for ideas that do not meet the originality, non-obviousness and practicality requirements of patent law.

Unfortunately, partners whose contributions are complementary have incentives to capture as large a share of the returns as possible leading to rent-seeking, opportunism, secrecy, excessive modularity and other activities that can weaken the entire partnership or at best give rise to protracted and costly bargaining, monitoring and enforcement. The increasing mobility of scientists is bound to complicate bargaining between institutions over IPR. Perhaps the biggest complication is that Universities must make contractual commitments (e.g. about privacy) that they cannot enforce, and thus face considerable liability. This excess risk may further undermine traditional academic norms. Such excessive precaution reduces the efficiency of the collaborative enterprise as a whole.

The challenge is to reshape IPR to permit clear arrangements that support collaboration, apportion risk appropriately, preserve the trust and sharing essential to collaborative research, and involve the scientists and administrators in appropriate ways.

3.3. On information exchange

PSRIs have responded to government policies urging capitalisation of research outputs and cooperation with business. The consequent emphasis on exploiting IPR⁹ through licensing or university-owned ‘start-up’ enterprises has undermined traditional norms of full and rapid disclosure and collaborative efforts to ensure quality through peer review and replication of empirical findings. Even amongst (esp. life) scientists, there is growing dispute as to whether co-operation for the advancement of knowledge is more important than research aimed at commercial outlets – including those offering personal rewards¹⁰ and those benefiting society at large.

These trends are not uniform across disciplines, regions or institutional types. They are stronger in life sciences, in ‘market economy’ countries (e.g. US, Canada, UK) and in PSRIs facing budget pressure or competition from other research institutions.

3.4. On distribution of returns

Because IPR regimes tend to reward ‘winners’ and because the advantages of collaboration are local public goods, there is a tendency towards inequity: between skill levels and disciplines (favouring certain combinations of scientific and entrepreneurial skill and proximity to market applications); within skill levels and disciplines (favouring rapid and flexible adaptation of emerging knowledge, or simply luck); and between regions and institutional types (favouring those with supportive collaborative cultures and ready access to money). Moreover, to the extent that returns are retained or reinvested in research, or that individuals gravitate towards centres of excellence, there is a tendency for this creative destruction to become institutionalised, and to grow over time as yesterday’s winners start today’s race ahead of the pack. This tendency is reinforced by other policies (e.g. allocation of public support) that favour project-based funding, target IPR-rich areas of activity or try to focus funding and research activity in a few centres.

3.5. On market structure, conduct performance

Conventional IPR are based on exclusive monopoly rights and naturally impose deadweight losses. Moreover, the tendency towards ‘tipping equilibrium’ in terms of market competition among ideas and access to venture capital reinforces the tendency to monopoly. But start-ups have high failure rates as well, and the possibilities of excessive competition or the costs of competition should be explored.

⁹ This includes licensing trademarks and logos, university owned patents, copyrights and database rights, assigning patents to university-sponsored start-ups. Lately, the UK government has also strongly encouraged so-called “Third Stream” activities (commercial provision of knowledge products and services) and formation of long-term “knowledge asset” strategies. See Molas-Galant et al. (2002).

¹⁰ See, e.g., Owen-Smith and Powell (2001), Eisenberg (2001) and Walsh, Arora and Cohen, (2003).

4. Added material relating to IPR¹¹

IPR have come to the fore at all times of technological change (Jefferson and McAulay defined the state of patent law at the beginning of the second Industrial Revolution for instance) so it is hardly a surprise that it should be central to the Information Society; what is perhaps more surprising is the close relationship between the current debate and the debates of the 19th century.

"Why have property? Property feels right to many of us because of a sense that each of us should own the fruit of our labour. But this is at least not the whole story, because some property - such as land - wasn't created by its owners. Say there's a large stretch of land that's commonly owned, such as the West of the U.S. once was. The government decided to open the land for private ownership. It didn't have to do it; it could have kept it as a giant park, and no-one's property rights would have been harmed. But it gave or sold the land to people who didn't create it, thus limiting the freedom of action of all others. The reason for this was incentive: If people have the right to exclude others from their land, they'll have more incentive to invest effort in improving the land - build homes, plant crops, and so on...So far, the argument tracks copyright and patent law quite well. The theory of intellectual property is likewise that giving people the right to exclude others from new works or inventions will give people an incentive to invest effort in creating and inventing.¹²"

The Global Network Knowledge Society runs on ideas and information. Instead of deeds and fences, it has copyrights and patents. We have tended to think of ideas as public goods and thus that ownership rights need to provide special kinds of protection. We also think that exclusive IPR are both necessary and appropriate for innovation and development of ideas. However, there are grounds for arguing that neither of these propositions is true.

An idea in my head has value in use (I can exploit it to make things) or exchange (I can communicate it to those who might use it). Before I do these things, *it is a private good* - rivalrous (since only I can use it) and excludable (since I can keep silent). Communication is an act of production using private inputs: the idea and the teacher's and students' time. It produces a new private good (the idea in your head). Ideas embodied in our minds are even more private than houses or land, which at least survive if their owners died.

In contrast, disembodied abstract ideas¹³ have no economic value. The economically valuable instantiation is a copy of an idea¹⁴ (which leads back to mimetic evolution). This brings us to rights. If my copy of an idea and yours are separate entities, my use of mine does not affect your use of yours. This does not make them public goods any more than my use of a CD affects your use of your copy of the same CD. Oddly, IPR does not merely replicate 'real' property rights, but goes well beyond. If I sell you a car I would not seek to tell you

¹¹ Some of the ideas in this section are developed at greater length in Boldrin and Levine (2003), Tesch and Descamps (2003) and Cave (2003).

¹² Volokh (2003).

¹³ Ayres and Warr (2002) analyse the role of such abstractions in neoclassical growth theory.

¹⁴ See Blackmore (2000) for an exposition of the evolution of ideas through copying.

where you could drive it or for what purpose - but IPR seeks to do that¹⁵. Your right to control *your* copy of your idea does not need a great deal of protection. IPR is concerned with your right to control *my* copy of your idea.

IPR may be seen as a (default) contract rather than a right. But such a contract would normally be regarded as illegal, inefficient or unethical. First, *legality* - in any other context, contracts prohibiting reuse¹⁶ would probably be seen as anticompetitive and illegal. A refinement of the counter-argument portrays IPR as a voluntary 'default contract' that saves transactions costs. But such IPR "contracts" are difficult and costly to implement or enforce. This *inefficiency* is perhaps the most important reason for limiting any arrangement that tries to restrict subsequent rights of buyers of ideas. Comparing codified with tacit knowledge¹⁷, this is exactly why people are allowed to rent out their labour but not to sell it. Labour and ideas (as economically valuable things) are attached to persons, so enforcing sales contracts requires unethical, intrusive and very expensive methods. Even software or books become your private property once you have bought them and the seller's other rights should be exhausted at point of sale. If this is inappropriate in some cases¹⁸, you could lease ideas, borrow them from the library, etc. The intrusiveness required can be extensive: in a recent music copyright case¹⁹ the court ruled, "His subconscious knew it already had worked in a song his conscious did not remember... That is, under the law, infringement of copyright, and is no less so even though subconsciously accomplished."

This is one reason why the IPR debate is closely linked to the privacy debate. 'Software audits' and enforcement actions against 'pirates' are intrusive, costly and often paid for by third parties (taxpayers, ISPs, computer manufacturers). The fundamental issue regarding voluntary contracts is whether all affected parties have a say. If you buy software and, breaking your agreement, sell it to a third party, they are still bound by the original agreement. If you do this using my network, I am liable for violating a contract to which I never agreed. There seems little justification for the IPR laws as written and enforced.

But what about the incentive argument for exclusive rights? We don't usually look beyond terms of sale for incentives - innovation and development in making desks or growing apples are (or were) usually rewarded without exclusive state-granted monopolies. In the view sketched above, ideas are like machines that can be used to produce useful things. If they could be scaled up or down, we could simply abolish IPR and harness the power of free

¹⁵ This is largely limited to the IPR system *per se*. As Botterman, *et. al.* (2001) point out, such restrictions are not allowed in e.g. Freedom of Information requests.

¹⁶ David and Spence (2003) discuss the impact of EC Database Directive re-use prohibitions.

¹⁷ See e.g. Cave, Hughes and Mesarovich (2002).

¹⁸ For instance, in recognising the moral right to be identified as author of a work or to make limited use of the idea, where the purchase transfer of right is 'too big.'

¹⁹ Bright Tunes Music Corp. v. Harrison's Music, Ltd. [420 F.Supp. 177 (1976)], cited in Boldrin and Levine (2003).

enterprise to determine the correct amount and allocation of ideas. We would get socially valuable ideas, which would be used as widely as was appropriate. There would be no more need for IPR than for laws allowing the makers of breakfast cereals to control how we choose to eat them. But ideas are not neatly divisible - two half-ideas do not make a whole one.

Can the sale of ideas sustain innovation without monopoly power²⁰? Here is a standard argument²¹: "A good argument for copyright in music. You've just earned a \$250,000 advance for your rock band, and you don't see any real profit from it...without copyright income the artists would be deeply, deeply in debt, or more realistically would never have the chance to record in the first place." But in fact the innovation took place *despite* the poor reward, so the *a priori* case for monopoly is weak. Moreover, the essential indivisibility is the cost of the first copy - which new technologies have drastically reduced, as they have cut costs of subsequent (even 'pirate') copies. In fact, many people can modify existing work or create their own.

IPR keeps this flow of innovation in check. One cannot begin by modifying existing work because it is locked up for the foreseeable future - the shoulders of giants²² are fenced off. If they want to make brand new material, they have a steep entry barrier, compounded by the allocation of access to distribution channels on the basis of distributors' expected future IPR income²³. This biases innovation in favour of profitable 'product' and, in turn, against really original output. But really new output is the only kind that can avoid the existing 'protections.'

Ultimately, these considerations suggest that "intellectual property" debate is not about creators' rights to the fruits of their labour, nor the incentive to create, innovate or improve. It is about the "right" to preserve existing business models. In 1939, Robert Heinlein's judge in Life Line observes:

"There has grown up in the minds of certain groups in this country the notion that because a man or corporation has made a profit out of the public for a number of years, the government and the courts are charged with the duty of guaranteeing such profit in the future, even in the face of changing circumstances and contrary to public interest. This strange doctrine is not supported by statute or common law. Neither individuals nor corporations have any right to come into court and ask that the clock of history be stopped, or turned back."

²⁰ See Tesch and Descamps (2003) for a policy proposal based on this insight.

²¹ Cowen (2003).

²² Scotchmer (1991) argues in favour of modification, re-use and cumulative innovation.

²³ Recently, exceptions have begun to emerge in the world of peer-to-peer music sharing (Times (2003)) and open-source software.

5. References

- Ayres, R. and Warr, B. (2002) "Useful Work and Information as Drivers of Growth," INSEAD, mimeo.
- Blackmore, S. (2000) The Meme Machine, Oxford University Press.
- Boldrin, M. and Levine, D. (2003) "Property Rights and Intellectual Monopoly," UCLA on <http://www.dklevine.com/general/intellectual/coffee.htm>.
- Botterman, M. Bikson, T., Bosman, S., Cave, J. Frinking, E. and de Pous, V. (2001) Public Information Provision in the Digital Age: Implementation and Effects of the U.S. Freedom of Information Act, RAND MR-1250-RE/BZK, RAND, Santa Monica.
- Caballero, R. and Jaffe, A. (1996) "How High Are the Giants' Shoulders: An Empirical Assessment of Knowledge Spillovers and Creative Destruction in a Model of Economic Growth," Economic Growth: Theory and Evidence. Volume 2 (1996): 100-159.
- Cave (2003c) "The propriety of intellectual property" TERRA2000 Occasional Paper, mimeo.
- Cave, J. Hughes, B. and Mesarovic, M. (2002) "Human Capital in the Networked Knowledge Society," TERRA 2000 project Issue outline, mimeo.
- Cowen, Tyler (2003), posting on the Volokh Conspiracy weblog: http://volokh.com/2003_09_07_volokh_archive.html - 106350892686231687
- David, P. (2000) "A Tragedy of the Public Knowledge 'Commons'? Global Science, Intellectual Property and the Digital Technology Boomerang," All Souls College, Oxford, mimeo.
- David, P. and Spence, M. (2003) "Towards Institutional Infrastructures for e-Science: The Scope of the Challenge" Final Report of the Oxford Internet Institute project on "The Institutional Infrastructure of e-Science: The Scope of the Issues."
- Dixon, P. and Greenhalgh, C. (2002) "The Economics of Intellectual Property: A Review to Identify Themes for Future Research" Oxford Intellectual Property Research Centre working paper.
- Eisenberg, R. (2001) "Bargaining over the transfer of proprietary research tools: Is this market failing or emerging," Ch. 9 in Expanding the Boundaries of Intellectual Property, Eds., R. Dreyfuss, D. L. Zimmerman and H. First. New York: Oxford University Press.
- Gallagher, T. (2001) "Copyright, Compulsory Licensing and Incentives", Oxford Intellectual Property Research Centre Working Paper.
- Molas-Galant, J. et al., (2002) "Measuring Third Stream Activities: A Report to the Russell Group of Universities," SPRU, University of Sussex, 2002, mimeo.
- Owen-Smith, J. and Powell, W. (2001) "Careers and Contradictions: Faculty Responses to the Transformation of Knowledge and its Uses in the Life Sciences," in Research in the Sociology of Work (Special Issue on The Transformation of Work, edited by Steven Vallas), 10, 109-140.
- Pitkethly, R. (1997) The Valuation of Patents: A review of patent valuation methods with consideration of option based methods and the potential for further research" Judge Institute Working Paper WP 21/97.
- Royal Society (2003) "Keeping science open: the effects of intellectual property policy on the conduct of science," April.
- Scotchmer, S. (1991) "Standing on the Shoulders of Giants: Cumulative Research and the Patent Law" *Journal of Economic Perspectives* v5, n1 (Winter): 29-41.
- Tesch T. and Descamps, P. (2003), "IPR: a modest proposal", TERRA2000 Occasional paper, mimeo.
- Times: "Cover story: Screaming out a revolution" October 19 2003: <http://www.timesonline.co.uk/article/0,,2103-859014,00.html>
- Vaver, D. (1999) "Recent Copyright Developments in Europe" presented at International Conference on The Commodification of Information, May 30-31 1999, Faculty of Law, Haifa University.
- Volokh, E. weblog posting quoted by by A. Ducker: <http://www.livejournal.com/users/andrewducker/424260.html>.
- Walsh, J., Arora, A. and Cohen, W. (2003). "Research Tool Patenting and Licensing and Biomedical Innovation, December. in The Operation and Effects of the Patent System, [Report of the STEP Board of the National Research Council, National Academy of Sciences], forthcoming from National Academy Press.