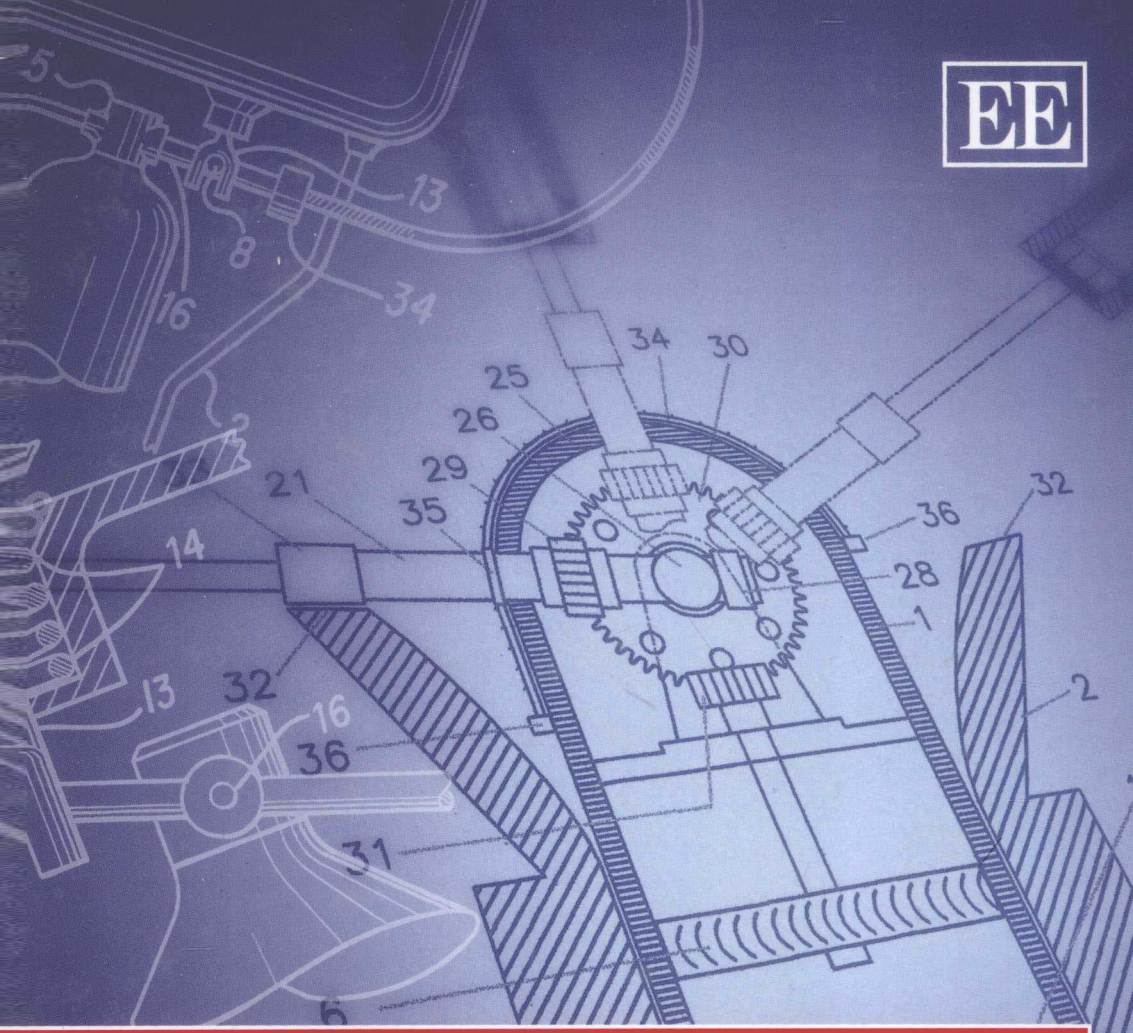

Beyond Intellectual Property

Matching Information Protection to Innovation

William Kingston

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Preface

Innovation is turning information into tangible realities. By no means all innovation is economic, but when it is, individual property rights have shown themselves to be the most effective way to make it possible. This is because they set the widest range of human creative energy free to act in ways that can be measured by money. They provide the best environment for the activities of people who have both the imagination to be able to grasp the implications of a new concept and the practical ability to deploy the resources of society to turn it into a tangible embodiment.

Individual property rights were themselves a wonderful social invention, part of 'the glory that was Greece', and then the economic basis of 'the grandeur that was Rome'. The incomparable wealth and prosperity of the modern world since the sixteenth century has depended upon further social inventions in terms of rights and privileges. Not only do these enable creative energy to express itself in economic ways, they can also force self-interest to serve the public good – they are able to *civilize* it. Self-interest is disciplined in this way through markets, which exist only as a result of property rights, and the kinds of markets there will be, depend upon the kinds of property rights there are. Adam Smith could envisage the operation of 'the invisible hand' because he could assume rights of property that led private and public interests to converge. Even as late as 1913, Edward Cannan was able to write that 'the working of self-interest is generally beneficent, not because of any natural coincidence between the self-interest of each and the good of all, but because human institutions are arranged in directions in which it will be so'.[1]

But these assumptions no longer hold good. Because property rights and the markets they bring into being are human constructions, they are subject to imperfection, decay and manipulation. It does not take genius on the part of those who are being disciplined by market forces resulting from property laws drafted with the public good in mind, to grasp the advantage they would gain if they could modify these laws to suit themselves. Pleas for free markets are invariably made by those who want markets to be shaped in ways from which they will benefit. The last thing business people want is a genuinely free market, since this would have no barriers to new entrants who would erode the incumbents' profits.

1 Cannan, E. (1913) 'Review of N. G. Pierson *Principles of Economics*' *Economic Review* 23, 331–33.

In democratic societies, as the cost of getting elected has escalated, politicians have become correspondingly more vulnerable to those who provide party or individual finance, resulting in laws that are increasingly shaped by interests. Nothing better illustrates how property rights can become corrupted than the 2008–9 worldwide financial collapse, which is a direct result of allowing bankers to escape from the laws that used to discipline them. Capitalism can only operate to the extent that capitalists are denied the power to decide their own working conditions.

PROTECTING INFORMATION

In terms of the subject-matter of the present book, a significant aspect of this evolution of property rights has been increasing concern with invention and innovation. It would be altogether irrational to invest in developing information with economic potential if it were not legally protected. But the scope of the laws which do this go well beyond those which are grouped in what has come to be called intellectual property. Rights in information have also suffered in the same way as all other property rights, in that they have progressively fallen under the control of those who can benefit from them. Of course, there has never been a time when interests have not played a part in law-making, but in the past, there have been strong countervailing forces to them, articulated both by widely held societal values and by quite different types of public bureaucracies to those which exist today.

This book sets out to explain how this has happened, to identify what is wrong and to propose remedies in the form of changed rules for information protection. The first four chapters discuss how current arrangements for protecting information relevant to economic innovation have evolved. The next three explore this history specifically in terms of the interaction between visions of the public good and interests. The third chapter in this group explains why the current domination of policies by vested interests makes the need for reform urgent; and the next group of four chapters of the book offer specific proposals for this reform. A brief Epilogue then sums up the arguments.

Some, but by no means all, of the proposals would require changes in legislation. Whether these changes can be made depends upon whether ways can be found to break the present link between vested interests and law-making through their funding of democratic politics. Clearly, all legislation which results in property rights must be the product of a combination of interests and visions of the public good. We do not live in Plato's ideal world where laws are made by selfless 'guardians', which is no doubt why John Stuart Mill pointed out that: 'the laws of property have never yet conformed to the

principles on which the institution of private property rests'.[2] But they do not have to conform as badly as we have allowed lobbying by interests make them do. Searching for a better match between property laws and their principles therefore needs to be pursued optimistically, even though the problem of who is to articulate the public interest now seems to be almost insuperable.

Many of the ideas which follow appeared earlier, as they were developed, in journals such as *Creativity and Innovation Management, Economie Appliquée, European Intellectual Property Review, European Journal of Law and Economics, Industry and Innovation, Intellectual Property Quarterly, International Journal of Entrepreneurship and Innovation, Journal of Evolutionary Economics, Journal of the History of Medicine and Allied Sciences, Oxford Development Studies, Prometheus, Regulation, Research Policy, Science and Public Policy,* and *Studies.*

I owe a debt, not only to their editors for giving a platform to ideas which must sometimes have seemed controversial, but in particular to their reviewers, from whom I invariably learned. The original research behind some of the proposals for reform of the international information protection system was funded by the European Commission, the European Patent Office, the National Science Foundation of the United States and Columbia and George Mason universities, as well as my own university, and this support is gratefully acknowledged.

William Kingston

2 Mill, J.S. (1848) *Principles of Political Economy*, Book II, Chapter I. London: John Murray.

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1. Information, property rights and innovation

Until we have some clear idea of what information is we cannot even begin to discuss why and how it is to be protected. And it is surprising that although protected information is crucial for innovation, those who are concerned with this relationship, whether as practitioners, researchers, teachers or judges, have not paid more attention to making the definition of what is to be protected more precise. Equally, discussion of the information economy has not generally been characterized by strenuous efforts to define its terms and demarcate their limits. This general lack is all the more remarkable because the emergence of the new discipline of information theory in recent decades has provided much of the necessary vocabulary. Also, since so much of the growth of information in products and services has been due to specific laws, it might have been expected that more effort would have been put into discovering what contribution better theory could make to our understanding of how such laws actually work, so that we might be able to make them more effective.

Moreover, laws to encourage the production of information which has an economic purpose are intended to lead to investment decisions. The incremental change in a component has only been made so that the complex device which incorporates it can perform better; the patented invention is there to be innovated, the copyrighted manuscript exists to be published, and the protected plant variety has been developed so that it can be multiplied. The comparably new and valuable discipline of decision theory does not appear to have been called in as much as it might have been, to throw light on the relationship between information, the law which protects it, and the investment decisions which are made as a result of it.

INFORMATION AS 'SURPRISE'

In fact, much of the theory which is useful to us in all these connections has come, not from academic research in any of the areas just mentioned, but from the prosaic need to get more value out of telephone lines. The management of the Bell system in the United States understood that the millions of miles of copper wire which connected their exchanges and subscribers were vastly

underused. The sound of a voice transmuted into electrical impulses at one end, and retransmuted into sound at the other end, only uses up a fraction of the capacity of the connecting wires to carry electrical impulses, so there was much to be gained by learning how to put more messages onto the same wire at the same time without mixing up the impulses which carried them. This was the task undertaken by two of their scientists, Shannon and Weaver, which led to their highly important 1949 book, *The Mathematical Theory of Communication.*[1]

It was in this book that the idea of information as 'surprise' emerges for the first time. For these writers, the information content of any message is defined in terms of the probability that it is 'news' to the recipient, that is, that it is surprising to him. A message which tells someone what he already knows cannot surprise him, and so contains no information at all.

MACHLUP'S DEFINITIONS

Shannon and Weaver provided a definition of information as such, but did not deal with any of the other words or concepts we normally use in connection with it. So much is this the case that the economist Fritz Machlup, much of whose later work built upon his discovery of the existence of the information economy, felt it necessary to discuss 'semantic quirks in studies of information'.[2] In this, he makes the important distinction between information and knowledge. Information always has the sense either of the telling of something or of that which is being told – it is a process. Knowledge, in contrast, is information that has been received and structured – it is a state. Distinguishing further, Machlup points out that:

1. Information is piecemeal, fragmented, particular, whereas knowledge is structured, coherent and often universal.
2. Information is timely, transitory, perhaps ephemeral, whereas knowledge can be of enduring significance.
3. Information is a flow of messages, whereas knowledge is a stock, largely but not necessarily completely resulting from such a flow, in the sense that the 'input' of information may affect the stock of knowledge by adding to it, restructuring it or changing it in some way. It is also conceivable that information may leave knowledge unchanged – the offered 'surprise' may be rejected.

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1 Shannon, Claude E. and Warren Weaver (1949) *The Mathematical Theory of Communication.* Urbana, IL, University of Illinois Press.

2 Machlup, F. and U. Mansfield (eds) (1983) *The Study of Information.* New York, Wiley.

These ideas fit well with Shannon and Weaver's definition of information, and were expanded still further by Kenneth Boulding, who held that:

> We cannot regard knowledge as simply the accumulation of information in a stockpile, even though all messages that are received by the brain may leave some sort of deposit there. Knowledge must itself be regarded as a structure, a very complex and frequently quite loose pattern ... with its parts connected in various ways by ties of varying degrees of strength. Messages are continually shot into this structure, some of them pass right through its interstices ... without effecting any perceptible change in it. Sometimes messages 'stick' to the structure and become part of it ... Occasionally, a message which is inconsistent with the basic pattern of the mental structure, but which is of such a nature that it cannot be disbelieved, hits the structure, which is then forced to undergo a complete reorganization.[3]

MACKAY'S INSIGHTS

Donald M. MacKay then lifted the discussion to the level where it became primarily concerned with meaning and relevance. MacKay points out that Shannon and Weaver, the founders of the statistical theory of information, insisted that the 'amount of information' in a message that they define bears no direct relation to any semantic function the message may have. As he put it:

> Communication engineers have developed a theory dealing explicitly with only one particular feature or aspect of messages 'carrying' information – their unexpectedness or surprise value ... Semanticists, on the other hand, are concerned with different features of information, such as its logical complexity and its meaning ... both [engineers and semanticists] have in mind the same concept of information ... that which promotes or validates representational activity (activity from which it is possible to infer something about some other state of affairs). Both are entitled to regard the function of information as to be selective: to prescribe *choice* or *decision*.[4]

Such choice, according to MacKay, is between 'states of conditional readiness ... for goal-directed, adaptive activity' and the analogy he uses to illustrate this is that of a signal box controlling a railway marshalling yard. The position of the levers (or switches) at any moment will then decide where any wagons which may enter the yard will be able to go. We can now add the assumption that these levers are controlled by keys carried by the trains themselves, by analogy with the 'staff' device of single-track railway working of former days which carried the key to local levers so that their position could be changed.

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3 In Machlup and Mansfield, op. cit.

4 McKay, Donald M. (1969) *Information, Mechanism and Meaning.* Cambridge, MA, MIT Press, 24, 42.

This allows us to see how a particular key selects the track along which wagons (if they come) will travel.

By analogy, any particular message is similarly able to select (in a vastly more sophisticated way, of course), out of all the recipient's possible states of conditional readiness for goal-directed activity, upon which of them it will act. According to MacKay's thinking, then, meaning results from the receipt of information in a message which makes a selection from the available range of mental states of readiness of an individual; an ambiguous message is one that could make more than one selection from these states; and a meaningless message is one that makes no selection at all.

THE MEANING OF MEANING

Consequently, meaning is not a unique property of a message itself, but instead is a relationship between message and recipient. The ranges of states of conditional readiness of any two recipients are likely to be different, so the selection function of any given message on each will also be different – its meaning will not be the same for both. Information in a particular message which reaches two recipients can have little or no meaning for one of them, but a great deal of meaning for the other, depending upon the differences between their pre-existing knowledge. A corollary of this is that there is no one-to-one correlation between information and meaning; in any individual case, a message can have a lot of information (in the sense of telling much that the recipient does not already know) but little meaning for that recipient, and vice versa.

Furthermore, the 'effective' meaning (the selection function actually performed on the recipient's mental states of readiness) may not be the selection function which the originator actually wanted to be performed – his 'intended' meaning. In such a case, communication has failed, since what distinguishes communication is the fact that the representation produced is (or purports to be) a replica of a representation already present in the mind of the sender. Communication, then, is the activity of replicating representations.[5]

A valuable summary of what these authors have taught us about information has been provided by Richard Langlois in the following terms:

> Information is not homogeneous; meaning is a matter of form, not of amount; and the value or significance of a message depends as much on the pre-existing form of the receiver as on the message itself ... [I]nformation is stored in a system not as oil is stored in a tank, but by virtue of the change that information makes in the very organization of the system itself. In a fundamental sense, knowledge and organization are identical.[6]

5 ibid.

6 Langlois, Richard, in Machlup and Mansfield op. cit. 593.

But what is being organized? As far as we know at present, this is patterns of electrochemical impulses and pathways for them in the brains of sentient life. Each of our brains is thought to consist of the order of 30 billion nerve cells (neurons) each connected to many others through two kinds of cell extensions (axons and dendrites). Senses are linked to brains in ways that can change those patterns, and messages from external sources can affect senses. The content of such messages, which is information, can consequently shape the pattern of neural connections, which is knowledge. There are in fact two different patterns of such connections, corresponding to two distinct parts of the human brain. One of these is called the hippocampus, which is responsible for knowledge which only remains available for use over relatively short periods; the second part (the neocortex) processes information which remains in existence for what can be up to a lifetime.

A partial analogy is that most of the information in a computer is in long-term storage, from which required portions are transferred temporarily to the central processor to be worked on. Where this analogy breaks down is that in the computer the long-term storage does not change of itself, whereas in the human brain the neocortex is active, although changes in it happen more slowly and require more effort than they do in the hippocampus.

MOLECULAR INNOVATION

All forms of life use their knowledge for action – indeed, as MacKay pointed out, knowledge is a store of information in a state of readiness for goal-directed activity. It is characteristic of higher life forms to use their knowledge for discovering, doing and making things. Finding new things is what we call invention or discovery, and getting new things done, that is, turning them into concrete reality, is innovation. The activity of innovation appears to be characteristic of all kinds of life, even down as far as biological cells. We now know that these are repositories of knowledge, in the form of DNA. In information technology terms, its DNA is a cell's 'operating system'.

The origin of our awareness of this is Ernst Schrödinger's 1943 lectures, published as *What is Life?*, which set off the entire molecular biology revolution. Not only does he explain in this how chromosomes 'contain in some kind of code-script the entire pattern of the individual's future development and of its functioning in the mature state', but he also shows how their structures 'are at the same time instrumental in bringing about the development they foreshadow,' that is, their innovation.[7] Thus, the activity of turning information into something external and new, which is innovation, is built into life even at the most primitive levels about which we know anything significant.

7 Schrödinger, Ernst (1944) *What is Life?* Cambridge, Cambridge University Press.

CREATIVITY

Human activities which produce information and knowledge as these have just been defined, express creativity. So do activities which innovate knowledge. Creativity can be brought to bear on rearranging individuals' knowledge from inside, perhaps even more than on responding to messages arriving from external sources and impinging on these individuals' senses. This can be illustrated by something we know about the method of composing of one of the most creative musicians, indeed possibly one of the most creative people, who ever lived, W.A. Mozart. According to his widow:

> When some grand conception was working in his brain, he was purely abstracted, walked about the apartment and knew not what was passing around, but when once arranged in his mind he needed no Piano Forte but would take music paper and whilst he wrote would say to her, 'Now, my dear wife, have the goodness to tell me what has been talked of,' and her conversation never interrupted him, he just wrote on. 'Which is more,' she added, 'than I can do with the commonest letter.'[8]

Clearly, rearranging the pattern of electro-chemical impulses in his brain while he was composing took every bit of Mozart's concentration and energy, but when all he was doing was making marks on music paper to record whatever new mental arrangement he had made, he had energy in plenty for other things, including catching up with his wife's news from the time when he had been abstracted. Just as creative individuals are good at using their energy to rearrange their own brain-patterns in new ways, it also seems that the same energy makes at least part of that knowledge exist in a heightened state of readiness for goal-directed action. The result is that information in messages which impinge on their senses from external sources tends to have more meaning for them than for others. In some cases, this extra meaning causes the individual to restructure and expand his knowledge, and in others it has the effect of stimulating him to innovate some aspect or aspects of the knowledge he possesses.

This has considerable relevance for economic innovation. One of the earliest historians of this observed that:

> In making the tally of the forces responsible for economic growth in the Western world ... we cannot leave out of account the contributions of a limited number of industrial entrepreneurs. Most of these men have absorbed themselves in tasks calling for much action of no great or varied intellectual interest; they have been willing and have possessed the nervous energy to take risks; and they have

8 Glover, Jane (2005) *Mozart's Women.* London, Macmillan.

> possessed the sanguine outlook which enables a man to reach a policy decision even when a good deal of information theoretically necessary is not available.[9]

This ability to reach decisions despite lack of information is an aspect of creativity, and is probably also linked to the lateralization of brain functions. The neurons and their connections which can be affected by information, and whose arrangement constitutes our knowledge, do not seem to be evenly spread over our brain tissue. Instead, the left side of our brains deals with logical relationships, that is, broadly speaking those where all the necessary information for processing is available; the right side handles information which has many gaps which it has to fill in some mysterious way, which is akin to artistic creation even if its subject-matter is mundane business. This is why innovators are a rare breed: they have imagination from their right brain and practicality from their left one, and the result is ability to turn ideas into concrete realities.

COPYING

Knowledge incorporated in an innovation is a tangible representation of the knowledge in the mind of the inventor or innovator, and is consequently capable of being accessed by others through study of the result. This is especially the case for business competitors, whose minds are likely to be already in an above-average state of readiness for action because of their objectives and existing knowledge. A striking illustration of this can be found in the history of Xerox's PARC research establishment in Palo Alto, California, from which came so many of the features of modern information processing. Its inventions included the prototype personal computer, the Alto, with its uniquely valuable graphical user interface, the mouse and the laser printer. However, none of these eventually reached the market through Xerox's initiative, but instead mainly through Steve Jobs's small computer business.[10]

The background to this is that Xerox's cash flow from its copiers was so great that it was always looking for acquisitions, and its financial people thought of buying out Jobs. His first response was that if Xerox were to be allowed to examine his accounts with a view to this, then he and his colleagues should be allowed to have a look at PARC. Because those responsible for acquisitions in Xerox had little idea of the wealth of invention their firm possessed in that research complex, this permission was given. Naturally, the managers in PARC itself, who knew the potential value of these inventions much better,

9 Jewkes, John (1965) *Public and Private Enterprise*. London, Routledge & Kegan Paul.

10 Smith, Douglas K. and Robert C. Alexander (1999) *Fumbling the Future: How Xerox Invented Then Ignored the First Personal Computer.* New York, Excel.

were concerned to minimize the information which Jobs and his colleagues would obtain from their visit.

But even they did not understand how much meaning even that limited information would have for the visitors, nor how ready the minds of these exceptionally creative people were for purposive action based on it. The Jobs team went away with what they had learned directly or were able to infer, quickly innovated several of the most important of Xerox's inventions in their Apple Lisa and Macintosh computers, and put them on the market. As the head of PARC commented afterwards: 'To allow Jobs to see the power of the Alto system ... was a dumb thing to do ... Once he saw it, the damage was done; he just had to know that it was do-able.'[11] When competitors learn about an invention, the very fact that they can now see that something new 'can be done' is highly meaningful information and as such is a powerful stimulus to them to set about copying it. This is from their engineering and production side; when their marketing people report that the new product is actually making sales, this information of course has an even more dramatic impact on the readiness of top management for purposive action in the form of a decision to invest in copying.

This illustration leads on directly to the relationship between copying of information and economic innovation. Some invention, like the exercise of creativity in art or literature, is the result of spontaneous action by an individual, and owes little to support from external sources. But when external support is needed for its production, information has the great disadvantage that it can spread so easily. As W.D. Nordhaus put it: 'Information is difficult to produce, easy to reproduce and consequently hard to profit by'.[12] In order to make investment to generate information rational, therefore, something has to be done to give control of the results to those who have invested, so that they can anticipate a high return for the high risk they are proposing to take.

THE NATURE OF A 'COMMONS'

Why this is necessary is explained in the most influential article on economics ever written by a biologist, Garret Hardin's 'The tragedy of the commons'.[13] Hardin discusses a pasture of limited size, to which a number of herdsmen, each owning his own flock, have free access – for this reason, it is called a 'commons.' It is in the interest of any individual herdsman to add an extra animal to his herd, because the benefit of all its milk, meat and by-products will

11 ibid., 242.

12 Nordhaus, W.D. (1969) *Invention, Growth and Welfare.* Cambridge, MA, MIT Press, 52.

13 Hardin, Garrett (1968) 'The tragedy of the commons' *Science* 162, 1249.

be his alone, whereas its cost, which is the extra consumption of the pasture, will be spread over all the other herdsmen. But what is true for one owner is equally true for all, with the inevitable result that every herdsman, each pursuing his own interest, will want to add an extra animal to his herd. When they all do this, the inescapable result is that the pasture will be overgrazed and destroyed. 'Freedom in a commons,' Hardin therefore concludes, 'brings ruin to all.' As we observe the sea fisheries of the world being destroyed before our eyes precisely to the extent that they have been a commons, it is impossible to doubt the fundamental validity of Hardin's argument.

Avoidance of such ruin depends upon the institution of rules accepted by all the herdsmen, the most effective of which have proved to be individual property rights. Instead of being left as a commons, condemned to inevitable destruction by the self-interest of the herdsmen, the resource can be divided up between them. Once this has been done, each herdsman, still acting in his own interest, will then be careful not to ask his particular share of the pasture to feed more animals than it can carry. At least as important, and especially relevant for the present discussion, is that individual ownership makes invention and innovation possible: it will now pay each herdsman, again in his own interest (which in the environment of a 'commons' would have led him to contribute to destroying the resource) to learn how to get more productivity from both his herd and his crops, and to put what he learns into action to achieve this, that is, to innovate as well as to invent.

CIVILIZING SELF-INTEREST

Individual property rights therefore perform the uniquely important and valuable task of changing self-interest from being destructive to being constructive; in other words, they civilize it.

This civilizing process, however, is subject to a major caveat. All our ideas of law owe an enormous amount to Greek culture, and particularly to Plato. His ideal was that laws should be laid down by special people known as 'guardians' who were bred, trained and constrained in their lifestyle so that they would do this with only the public good in mind. In the real world the laws of property, like other laws, are far from being completely or even substantially shaped by such disinterested and wise people. Instead, they come into being as a result of a mixture of individuals' visions of the public good and their own interests, so that the law-making process is always in danger of being captured by those whom its function it is to discipline. If laws are preventing an individual from doing what he wants to do, it will not take him long to grasp the potential advantage of taking action to try to bend them into a more congenial shape.

The result of this interaction, as John Stuart Mill observed, is that:

> The laws of property have never yet conformed to the principles on which the justification of private property rests. They have made property of things which never ought to be property, and absolute property where only a qualified property ought to exist. They have not held the balance fairly between human beings, but have heaped impediments on some, to give advantage to others; they have purposely fostered inequalities and prevented all from starting fair in the race.[14]

Consequently, the actual laws of property that we possess can never be more than partially successful in preventing us from destroying resources to which we have access in common (such as the atmospheric canopy which shields us from harmful radiation from space, or clean air). Nor are the forces which shape laws of property evenly balanced: visions of the public good are invariably clouded by multiplicity, confusion and ignorance, and only very few individuals are motivated to expend energy in trying to get them turned into reality. In contrast, the focus of those with a personal interest in getting a law changed, or a new law, is all the sharper because of the strength of their self-interest, concerned with how the change will benefit them. The rigorous analysis of Mancur Olson has called attention to the great advantage which relatively small, well-organized groups have in getting legislation that suits them, over more disparate groups which may in fact be much larger.[15]

INFORMATION AS A 'NATURAL COMMONS'

The relevance of this to information is that information has all the characteristics of a commons, because there is no limit to the number of people to whom it can spread, who can have access to it, and whose knowledge it can change. This of course is just the opposite of a physical commons, which will be destroyed more quickly according to the numbers of users who have access to it. Since no matter how many people receive information, it is not diminished in the slightest, it might appear that Hardin's forecast of ruin might not apply to an 'informational commons'.

In fact, the situation for information is actually worse, because whereas freedom of access will destroy a physical commons, the same freedom will actually prevent useful information from coming into existence in the first place. Why should anyone undertake the difficult and risky task of generating it if others, who have contributed nothing to this process, can then use it freely? It is not just that an individual who does bring such information into

14 Mill, J.S. (1848) *Principles of Political Economy*, Book II, Chapter I. London: John Murray.

15 Olson, Mancur (1982) *The Rise and Decline of Nations.* New Haven, CT, Yale University Press.