The World of Bits

Andrew D Murray, London School of Economics and Political Science
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In reading this book you will be asked to think about the world around you slightly differently. While the question at the heart of most legal textbooks is: ‘how does the rule of law affect individuals within the environment over which this law is effective’, the question at the heart of this book is: ‘how does the environment over which the law seeks to be effective affect the rule of law’. The reason for this distinctive approach is the distinctive subject which this book examines. This is the first book to look in detail at the relationship between established legal settlements and the rise of the information society.¹ While you may consider digital information, the internet, and applications such as YouTube or social networking tools like Bebo, MySpace, or Facebook, to be simply part of the fabric of everyday life,² the British legal system, which can trace its roots through at least seven hundred years of Common Law tradition,³ finds these developments to be extremely disruptive. These disruptive effects, once the preserve of the interested academic commentator,⁴ have become of critical importance to politicians, economists, lawyers, and in turn to us all, as developed economies move from the traditional economic question of ‘what can we produce?’ to ‘what can we control?’.

This change in economic language reflects a wider change in modern developed economies. The traditional measure of an economic superpower was their output. Economies were measured by their ability to support communities. Agrarian economies measured how efficiently the land could be managed and farmed to support the surrounding community; freeing members of that community from the soil to allow them to carry out more specialised roles such as fletcher, blacksmith, or cooper. Such economies were though conspicuously inefficient, as demonstrated by Adam Smith in his famous text *The Wealth of Nations*.⁵ In this, Smith demonstrated how specialisation could improve individual

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¹ While many books such as Ian Lloyd’s *Information Technology Law* (5ed, 2008), Chris Reed and John Angel’s *Computer Law* (6ed, 2007) and David Bainbridge’s *Introduction to Information Technology Law* (6ed, 2007) examine the effect of ‘computerization’ on the Law, they take a technology-centred approach and focus on the narrow application of the law to computer systems, computer programmes and technology related legal issues such as data protection. This book will take a wider approach looking at the interaction of the law and the information society.

² This may be determined by your age. If you are 18, you were born when the World Wide Web was released and have never known a world without it. You were probably active on social networking sites before you were a teenager and find a mobile telephone more useful as an SMS device than as a telephone. Older readers though may remember the excitement of their first internet connection and signing their first mobile phone contract.


output, a process which led eventually to the development of the factory, the production line and, with the introduction of steam power to the equation, the industrial revolution.\footnote{ibid. Book 1 Ch.1.}

The industrial economic model became the dominant economic model of the nineteenth and early twentieth centuries. The industrial economy was driven by economies of scale and by mechanisation. No longer was economic success measured at a local level, it was now measured by output at a national level.\footnote{Gross Domestic Product became the touchstone of economic success.} It led industrialized nations such as the United Kingdom to seek to extend empires across the globe to secure the raw materials which could be turned into textiles, iron, or later aluminium or steel. Industrial economies made money by making things: ships, weapons, clothing, railway tracks, and later aircraft. Industrialists grew wealthy but the workers did not: a few grew exceedingly wealthy while exploiting the human capital of the many.\footnote{This of course had been explored by Karl Marx in his famous text \textit{Das Kapital} (1867).} Following the economic downturn of the 1920s, the effects of worker revolt such as the General Strike and the terrible impact of two world wars on the industrial capital of European states a new economic model began to appear in post war Europe. It is this new model of post-industrial economics that gives us our first insight into the importance and value of this subject, and therefore this book.

Post-industrial economics emerged in the UK immediately after World War II. With the cost of production of traditional industrial products such as shipbuilding and steel production being cheaper offshore, the UK’s industrial capital began to move to places such as India, Malaysia, and Hong Kong. The UK economy started the painful transition from industrial values of ‘what can we produce?’ to the newly developing service sector and the question ‘what can we provide?’ With a massive growth in professional services such as banking, insurance, legal services, education, and media, the UK became the archetypal post-industrial, or service, economy. We no longer made money from making things we made money from providing services. In the 1980s the last vestiges of our old industrial economy were swept aside. We closed car plants, coal mines, shipyards, and steelworks. The UK was going to be the world’s leading service economy, but then something happened and it is that something which is at the core of this book. The post-industrial, or service, economy was itself overtaken only forty years or so after it was first developed. The new economic model is known as the ‘information economy’ while its correspondent theory in social sciences is the ‘information society’. While the UK had invested in banking, insurance, and financial support services, the US, or at least parts of it, had developed an economy built upon the systems that allowed information to be collected, stored, and processed. In so doing they created a new generation of super-rich industrialists who far surpassed the wealth of the nineteenth century industrialists. These were people like Steve Jobs, Larry Ellison, and most famously
Bill Gates who recognized the value wasn’t in the information itself; it was in what you could enable people to do with it. They started to ask the question which is at the heart of this book: ‘what can we control?’ This question is the thesis which underpins both the information society and the knowledge economy. It represents a shift from ownership or control of things to ownership of or control over information. It represents the maturity of information technology and most importantly signals a change in economic value from owning things, or in physical terms atoms, to owning information which in the digital environment means bits. This transition from the world which saw economic value in atoms to a world which values information in bits will form the focus of the remainder of this chapter.

An Introduction to Bits

The move from economic value being sited within physical goods, to economic value being sited within information, is referred to by Nicholas Negroponte, Director of the Media Laboratory at MIT, as the move from atoms to bits. Negroponte, and others, believe that in time this move from atomic value to value in bits may prove to be as important to social scientists and economists as the discovery of quantum physics was to physical scientists. Before we embark on the deeper impact of the move from atoms to bits we need to answer the basic question what is a ‘bit’? We all know what atoms are, or at least I assume we do. If you do need to have a basic seminar on atoms and their role in the physical world I suggest you read chapter nine of Bill Bryson’s excellent book A Short History of Nearly Everything. On the assumption we know the role and position of atoms in the physical world, what then is a bit, and what is its role in the information society?

### Highlight Box: What is a Bit?

At its simplest ‘bit’ is a truncation of the term ‘binary digit’. To expand, a binary digit is simply either a 0 or a 1.

The answer to what is a bit therefore doesn’t get us any closer to the questions at the heart of this book ‘why are bits economically valuable?’, ‘how do bits effect social interaction?’, and most importantly for a legal textbook, ‘why does the law have to take account of the effect of bits?’ To answer these questions we must look, not narrowly at what a bit is, but more widely at what a bit does.

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9 To gain an insight into the thought process of Bill Gates during the early stages of what he calls the ‘information age’ read: Bill Gates, The Road Ahead (1995), Ch.2.
10 The post-industrial economic model may be seen as a step along this road being about ownership of or control over knowledge.
13 For more on this read A. Murray, The Regulation of Cyberspace: Control in the Online Environment (2007), Ch.9.
At the most basic level therefore a bit is simply a 0 or a 1, but like atoms, which on their own are not very impressive either, it is how bits can be used to construct larger, more complex systems that give them their economic value and social importance. In the world of computer systems a bit represents a single instruction to the computer. This instruction is either to do (1) or not to do (0) a particular function. The instruction is read by the brain of the computer, the Microprocessor or Central Processing Unit (CPU). The CPU may be thought of as a superfast calculator which works in base 2. Bits of information are fed to the CPU from the computer memory, the CPU does a calculation and based upon the result the personal computer (or PC) carries out a predetermined function. The process that is followed is called von Neumann architecture after mathematician and computer pioneer Jon von Neumann.

Von Neumann architecture is a four step system that turns bits into computer operations or data. The first step is fetch, which involves the CPU retrieving an instruction (represented by bits) from program memory. These are instructions preloaded into the memory of the computer by a piece of software such as Microsoft Windows or Word. The second step is decode. In this step the single instruction is broken up by the CPU in separate instructions which require the CPU to do different operations. Thus a single instruction will usually contain an operational instruction telling the CPU what to do and a series of informational instructions giving the CPU the data it needs to fulfil the operational instruction. Step three is the execute step. In this step the CPU will carry out the operational instruction contained in the fetched data. This may be a purely internal process such as an autosave function managed completely by the software instructions fetched from the program memory or it may involve a user input where the actions of the user of the computer cause a particular event to happen (more will be said on this below). The execute step is a series of calculations using binary notation which gives a series of results managed by the CPU and carried out by a series of units on the microprocessor. The final step is writeback. Here the CPU ‘writes back’ the result of its operational process to memory. This may be either the CPU memory (if it is about to carry out a further operation based on this result) or to the main memory if the operational process is complete for now. After writeback the whole process begins again with the cycle being repeated billions of times per second. At its most basic level therefore a computer CPU is simply a rather unimpressive calculator. It can add and subtract or multiply and divide but only in base 2. It can do this billions of times per second and therefore is very powerful but as we are only dealing in 1s and 0s how does the manipulation of bits affect the established legal order? The answer is in the flexibility of the bit.

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15 This is the computer part that is advertised as ‘Intel Core’ or ‘AMD Phenom’ or similar in promotional material.
17 For more on this see Gates, above n.9, Ch.2 which gives an exceedingly lucid description of this complex subject.
The Process of Digitisation

Much as atoms can be used in the physical world to construct everything from the human liver to an Airbus A380, bits are the basic building blocks of the information society. In his book, *The Road Ahead* Microsoft co-founder Bill Gates explains the difference between the analogue world of atoms and the digital world of bits though a simple example.\(^\text{18}\) He asks his readers to imagine a 250 watt light bulb attached to a dimmer switch. Using the dimmer the user may select graduated illumination from complete darkness (0) to full illumination (250). By turning the switch halfway you will get something around 125 watts of light and at one quarter distance about 63 watts. But as Gates points out exact replication of the level of illumination achieved in such an analogue set up is difficult. If I find one night that about one quarter turn is the perfect level of illumination to have a romantic dinner I could make a mark on the dimmer switch and use this as a level for future reference, but if I want to tell my friend in Seattle this I need to try to communicate to him exactly where on the switch I made my mark (usually descriptively by telephone). If he then passes this information on to his friend in Gothenburg he repeats the process, but as anyone who has played Chinese Whispers knows the message will over time change and deteriorate: this is known as analogue drop off and affects all analogue transmissions as anyone who has made a copy of a copy of a friends mix tape knows.\(^\text{19}\) If we replace the one 250 watt bulb with eight bulbs of differing output, each double the output of the previous, we create an analogy for a digital system. We now have eight switches, one for each bulb as below numbered one through eight.

![Figure 1.1: A ‘Digital Lighting System’](image)

We can still control the level of lighting in the room from darkness (by switching all lights off) to full illumination (by switching them all on). But now instead of representing this as an analogue value between 0 and 250 we represent it using binary notation from 00000000 to 11111111 where 0 is ‘off’ and 1 is ‘on’. Now if I find that the perfect level of lighting for a romantic meal is 93 watts I can set my switches as ‘off’ ‘off’ ‘on’ ‘off’ ‘on’ ‘on’ ‘off’ ‘on’ or in binary notation 01011101. Now if I want my

\(^{18}\) What follows is a simple recreation of Gates’ example contained at 26-28 of Gates, *ibid*.

\(^{19}\) If you are too young to know what a mix tape is ask your parents.
friend in Seattle to be able to replicate the **exact** level of lighting I had I simply send him this code. He may then send this code to his friend in Gothenburg who can exactly replicate what I did without ever speaking to me. Thus digital transmissions are less likely to suffer drop off as the message sent is short and precise, unlike analogue transmissions.

If we can represent levels of lighting in digital notation, what else can it be used to represent? The answer is almost anything. Gates gives the traditional example of ASCII or the American Standard Code for Information Interchange. ASCII is the common system used by all computers to encode all the letters and punctuation of the English Language. ASCII gives each character a value between 0 and 255, 255 being the maximum number which can be created by an eight character byte of bits. Capitals A-Z are given values 65-90 while lower case a-z are given values 97-122, while a space is valued at 32. Thus in ASCII the message ‘Long live the Queen’ is given as:

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01001100 01101111 01101110 01100111 00100000 011011 00 01101001 01110110
01100101 00100000 01110100 01101000 01100101 00100000 01010001 01110101
01100101 01100101 01101110
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Of course it is not just text that may be represented in this way. As Negroponte points out we have been able over the years to represent more and more information in binary digits. Music has been distributed digitally since the early 1980s. It is digitally encoded by taking constant samples of the audio waveform (sound pressure measured as voltage): a numerical value which may then be encoded as bits. In digital photography each colour and shade is allocated a numerical value which allows for perfect replication and display of the encoded data on an output such as a computer monitor or digital photo frame. Digital video may be seen as a meshing of these two techniques. Here a constant stream of data replicating moving imagery is encoded on a DVD or HDD. The applications of bits are seemingly endless, with some physicists even believing that bits may eventually lead to the creation of a Star Trek style matter transporter. As Negroponte points out: ‘the emergence of continuity in [individual bits] is analogous to a similar phenomenon in the familiar world of matter. Matter is made of atoms. If you could look at a smoothly polished metal surface at a subatomic scale, you would see mostly holes. It appears smooth and solid because the discrete pieces are so small. Likewise digital output.’

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20 For more on ASCII visit [http://www.asciitable.com/](http://www.asciitable.com/) where you can find the digital notation of all characters used on the keyboard.

21 In case you wondered what the difference between a bit and a byte was, this is it. A bit is a single binary digit a byte is a collection of eight bits used to create a single instruction to a CPU. Despite my earlier description of how a CPU works information is always sent in bytes not bits to the CPU. I left this out of the description at the earlier stage to avoid confusion.


23 Negroponte, above n.11, 15.
In the information society we see a shift from encoding information in atoms (such as writing it on the page) to encoding it in bits (such as word processing it). But this move is not limited to the written word: it may be sounds, images, or electrical outputs. Almost anything which may be recorded may be digitized. As digital information is cheaper to store, cheaper to distribute, and cheaper to encode there has been a widely publicized migration from analogue technologies to digital technologies and with it a shift in economic values of information.

Moving from Atoms to Bits

The economic driver of the move from atoms to bits is clear from the final paragraph of the preceding section. During the 1980s the computer moved out of the research laboratory and the workplace into the home environment. The home computer of the 1980s, devices such as the Sinclair Spectrum and the Commodore C64, were the trailblazers for the home PC or personal computer. As the PC became a fixture of homes across North America, Europe, Australasia and the Pacific Rim, computerization of media became the cutting edge technology. The first entertainment media to be digitized were children’s games (although now they were often played by adults). The games console was the breakthrough technology of the 1970s. Although the first home games console, the Magnavox Odyssey released in 1972 was a failure, in 1977 games company Atari released the now legendary Atari 2600 games system which sold over thirty million units in its lifetime making it the iPod of the home video games industry, an industry which remains at the cutting edge of home electronics through products such as the Nintendo Wii, the Xbox 360, and the PS3.

Most people though became aware of the digital revolution in the 1980s. Music was the first traditional mainstream media industry to go digital. With the advent of the Compact Disc digital distribution became the norm. Why did the music industry move over? It was because of perceived benefits in music production, where digitization allowed for greater control over post-production cleanup and mixing and because the traditional analogue distribution systems for music (Compact Audio Tape and Vinyl Disc) were perceived to be of low quality. CD was more durable, offered better sound quality, and most importantly gave greater flexibility in post-production. I wonder since if the music industry has ever regretted being in the vanguard of digitization. The story of the digitization of the music industry is the most turbulent of all. While the first process of digitization in the 1980s was evolutionary rather than revolutionary the second process which took place in the 1990s was set to cause a revolution in the music industry.

24 Now many homes have several PC devices such as laptops and desktops which often share a wireless network creating a local area network or LAN which allows music, video, or other files to be streamed wirelessly between them.

25 At this point I feel I should take a line or two of text to defend my decision to begin the story of digitization of the entertainment market with a short discussion of the early success of Atari. Too often academic commentators dismiss the home video game market as unimportant, yet gamers spent $9.5bn on home video games in 2007 in the United States, which compares favourably with the $16bn spent on DVD purchases and $2.9bn spent on music downloads.
The introduction of the CD (as with its sister product the DVD some fifteen years later) was not to cause a digital revolution. The industry was in control of this evolution from the outset and the only discernable change to the consumer was a change in carrier media and in media player. Music was still carried on a disc, although now small and shiny rather than large and black, and was still played on some form of turntable device, although now read with a laser beam. Most importantly both the CD and DVD retained the traditional distribution models of their predecessors the tape/vinyl disc and the videocassette. You still visited your local HMV, Virgin, or Woolworths to purchase them. They were still carried by road haulage and they still were ‘pressed’ and packaged in a far off production line. This is why both CDs and DVDs are evolutionary: they are simply a better way to replicate what was already being done. But, as Negroponte points out one of the key values of digitization is that it allows us to discard much of the baggage of the atomic world.26

Music Goes Digital

This occurred with respect to the music industry in 1994 when the release of the MP3 sound compression technique allowed us to reduce the size of music files down to between 6-8 Megabytes on average.27 MP3, like all compression techniques, allows us to remove information not required for reproduction of the recorded data. With MP3 much of what is removed is information which refers to sounds recorded but outside normal levels of human hearing. There is a drop off in quality compared with high bitrate recordings such as full CD quality, but for the purposes of most consumers the MP3 quality is ‘good enough’. The smaller file size allowed by MP3 allowed for distribution of music in a completely revolutionary way. Instead of pressing discs and distributing them via traditional routes such as high street stores with all the accompanying overheads these carry some enterprising individuals demonstrated that music could be carried directly from computer to computer cutting out all the middle men.

One such service was offered by MP3.com an internet start up who offered consumers the opportunity to ‘space shift’ their music collection.28 The concept was simple. You demonstrated you owned a particular album or single by placing your copy of the CD in your computer’s CD drive. Once the MP3.com software confirmed the authenticity of the CD it allowed the music content of the CD to be added to your online library. Then wherever you were in the world, as long as you had internet access, you could access your entire music library via the MP3.com website. There were obvious problems with this system. Firstly MP3.com never established ownership of the CD placed in the computer: there was

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26 See Negroponte, above n.11, 35-36.
27 Allowing for up to 100 tracks to be put on a single CD.
28 The concept of space-shifting is discussed in greater depth in Chapter 10.
nothing to stop you borrowing your neighbour’s CD collection and adding it to your library. Secondly MP3.com never had the permission of the rights holder to allow you remote access in this fashion.

As a result a copyright infringement case followed the outcome of which we’ll see in chapter ten. Also in chapter ten we’ll discuss the case which changed the music industry forever: *A&M Records Inc v. Napster Inc*\(^29\) Napster is a vitally important legal decision and the legal impact of Napster will be discussed in depth in chapter ten, but that is not the aspect of the Napster litigation I am interested in here. Napster was also of significant socio-economic impact. People not only learned the ‘bad’ lesson that they could get music for free, such free riding if left unchecked would have undermined the economic effectiveness of the entertainment industry as a whole not just the music industry, they also learned the ‘good’ lesson that music could be streamed directly to their computer, no leaving the house, no middlemen, no wasted costs on packaging, transport etc. This lesson was the revolutionary application of MP3 technology that has changed the music distribution model, probably permanently. Following the success of Napster,\(^30\) industry players such as Apple have perfected the online music delivery model though systems such as iTunes/iPod to the point now where devices such as the iPhone and the iPod Touch no longer need a computer to download music, both being capable of downloading music directly through their WiFi connectivity.

**Digital Goods and Society**

The success of the iPod and its family of products including the iPhone heralds the digital future. Music is once again at the vanguard, but not far behind is a similar model for digital video. BitTorrent may be seen as the TV and film industry’s Napster moment and the success of video streaming sites such as YouTube and the many thousands of imitators it has spawned point to a future model. A colleague has informed me that his fifteen year old daughter watches mainstream television programmes such as *Lost* in fifteen minute segments on video sharing sites rather than through the traditional broadcast model.\(^31\) I’m sure this model will grow. Equally book publishers shouldn’t imagine they are exempt. The success of Google Books and the launch of the Amazon Kindle and the Sony Reader suggest that the digitization of books is near to hand. Thus anything we consume which is in nature information carried on a carrier media, rather than based in physical form, is ripe to go through a similar revolution to the one experienced by the music industry in the 1990s.

The experience of the music industry answers to some extent the questions ‘why are bits economically valuable?’ and ‘how do bits effect social interaction?’ Although there is much more to explore in

\(^{29}\) 114 F Supp 2d 896 (ND Cal 2000).

\(^{30}\) Before legal action forced it to shut down it had in excess of 16 million customers.

\(^{31}\) This anecdotal evidence is confirmed by columnist Jeremy Clarkson in his *Sunday Times* Column of 7 October 2007 ‘The Kids are all right with lousy TV’ where he notes ‘Now my daughter only really watches YouTube.’
relation to both these questions we can open by saying bits are economically valuable because they represent new and revolutionary models to market and deliver those products or services, which are by nature informational products and which are traditionally embedded in or attached to a separate carrier media. The music industry has already felt the full impact of this but other industries which may soon, or may already be feeling the impact of digital delivery include film and television production and broadcasting, telephone service providers, mail service providers, educational providers, publishing, advertising, print media, and even the legal profession. Further, bits effect social interaction as they provide new avenues for communication, exchange of ideas, and for challenge to traditional orthodoxy. The reason the music industry was forced to change was because of Napster. Although there is no doubt the vast majority of Napster users were driven by economic desire to free ride (for which read get free music), once Napster was gone people realized they also valued the convenience of Napster and for some the feeling of belonging to the ‘Napster community’. Although legal download sites such as iTunes replaced the convenience, these corporate sites do not have the same community spirit. I believe this led indirectly to the development of social networking sites, and in particular MySpace which is heavily influenced by popular culture and music culture. MySpace has in return influenced popular music through the promotion of bands and singers such as the Arctic Monkeys and Lily Allan. Whereas in the 1970s and 1980s groups of teenagers would meet in their local record shop to discuss music, now they do it on MySpace, mostly because iTunes and others do not support social networking (a rare missed trick from Steve Jobs). What remains though is the most important question for a legal textbook, ‘why does the law have to take account of the effect of bits?’

Rivalrous and Nonrivalrous Goods

Rivalrous and nonrivalrous are terms of economic art. Rivalrous goods are goods whose consumption by one consumer prevents simultaneous consumption by other consumers. This generally is true of any ‘atomic’ good, for, notwithstanding some recent developments in quantum mechanics, it is generally accepted that no two atoms may occupy the same space simultaneously. Thus should I borrow my wife’s umbrella because it is raining, she cannot use it during the period it is in my possession: my possession is rivalrous to her possession. Atomic goods may be either durable or nondurable, but in general both are rivalrous goods. The umbrella example is an example of a durable rivalrous good. My use of the umbrella presents a barrier to others who desire to use that umbrella at the same time. However, my use of the umbrella does not ‘use up’ the umbrella, meaning that it, as with other durable rivalrous goods, can still be shared through time. By contrast nondurable rivalrous goods are destroyed by their use (consumption) and cannot be shared. A concert ticket is a nondurable rivalrous good: if I ‘borrow’ my wife’s ticket to see a concert by her favourite band, the fact that I can return the ticket to...

32 For a discussion of some of the challenges the legal profession may face see R. Susskind, The End of Lawyers (2008).
33 This is an application of the ‘Pauli exclusion principle’. To read more on the Pauli exclusion principle visit: http://hyperphysics.phy-astr.gsu.edu/Hbase/pauli.html
her afterwards does not disguise the fact that I have ‘consumed’ the economic value of that ticket leaving her with a worthless piece of paper. Thus nondurable rivalrous goods cannot be shared through time. By contrast, nonrivalrous goods may be consumed by several consumers simultaneously. Nonrivalrous goods are usually intangible. The most famous example is probably that of an idea as presented by the eighteenth/nineteenth century scientist, philosopher and politician Thomas Jefferson.

**Highlight Box: Thomas Jefferson’s Letter to Isaac McPherson.**

If nature has made any one thing less susceptible than all other so exclusive property, it is the action of the thinking power called an idea, which an individual may exclusively possess as long as he keeps it to himself; but the moment it is divulged, it forces itself into the possession of every one, and the receiver cannot dispossess himself of it. Its peculiar character, too, is that no one possesses the less, because every other possesses the whole of it. He who receives an idea from me, receives instruction himself without lessening mine; as he who lights his taper at mine, receives light without darkening mine.

Here Jefferson captures the key elements of nonrivalrous goods. By taking from the original owner you do not deny them of their possession and enjoyment of the good, nor do you deny anyone else the opportunity to consume, simultaneously, the same good. In the modern world technology has enabled us to increase the number of nonrivalrous goods available to us. Television broadcasts are an example of a nonrivalrous good: if I turn on my TV set to watch a broadcast of Boston Legal this does not prevent my next door neighbour, or anyone else, from watching the same show. Goods that are nonrivalrous are therefore goods that can be enjoyed simultaneously by an unlimited number of consumers.

If we list nonrivalrous goods we find an interesting commonality between them. Nonrivalrous goods include ideas, radiocommunications broadcasts (TV and Radio), visual light (think of a beautiful view or a sunset), digital media (you can ‘give away’ MP3 music while retaining the original), and sound (a speaker at Speaker’s Corner may be heard by one person or one thousand without affecting the enjoyment of others). The commonality is that they are all ‘informational goods’. All are about transmitting information from one source to another. To return to the earlier language of Negroponte they are all susceptible to be encoded as binary digital information (bits) to be stored or shared: thus ideas may be written on a document file (as I am currently doing), radiocommunications broadcasts are being replaced by digital broadcasts, digital photography and video is capturing that beautiful view, and as we have seen, MP3’s encode sound. Thus the move from the world of atoms to the world of bits, or the move from the industrial to informational society, can be similarly defined as a move from rivalrousness to nonrivalrousness.
The Legal Challenge of the Information Society

What does this all mean to lawyers and to lawmakers? Well we have now identified three effects of the move from the industrial to the informational society:

1. It represents a shift from ownership or control of things to ownership of or control over information;
2. It represents a new and revolutionary model to market and deliver products or services; and
3. It represents a move from rivalrousness to nonrivalrousness.

All three of these pose serious challenges to traditional legal values and traditional legal rules. All traditional legal systems, including the common law system found in the United Kingdom and the civilian tradition found on continental Europe, have a basic distinction between tangible and intangible goods. Tangible goods represent goods of economic value and are protected. Thus s.1 of the Theft Act 1968, expect tangibility: ‘A person is guilty of theft if they dishonestly appropriate property belonging to another with the intention to permanently deprive the other of it.’ The key phrase is ‘intention to permanently deprive’ as this makes clear that to commit the offence of theft you must take something which is physical and rivalrous. Thus ‘copying’ an MP3 without the permission of the owner is not theft. Neither is intercepting a transmission without permission.\textsuperscript{34} Both of these things are regulated elsewhere,\textsuperscript{35} but neither is theft in the true sense of the word. This may not seem important: you may believe this is simply a matter of language, or you may believe it is simply a choice by lawmakers to distinguish between theft proper (the taking of a ‘thing’) and misappropriation of information. But this simple example reveals a greater tension between traditional legal values and the new economic values of the information society.

Traditional property theory examines how scarce resources ought to be put to use but in the world of bits scarcity loses its immediate impact. Although there are still limits which apply over storage space and bandwidth, the average user sees bits as almost limitless as they are infinitely scalable: want the new REM album but can’t afford it?: someone will make it available for free, not by giving you access to their copy but by creating a brand new copy for you. Bits never run out and because bits never run out we can keep creating, the only limit is on how many bits we can store.

The traditional law of atomic property, and with it atomic values of wealth through owning and retaining things, is fundamentally altered by the scalability of bits meaning those things which appear to

\textsuperscript{34} Think here of erecting a satellite dish and installing an illegal decoder thus taking the economic benefit of the broadcast from the broadcaster without making payment.

\textsuperscript{35} The copying without permission by the CDPA 1988, the broadcast example would be regulated by the Communications Act 1990 and/or the Regulation of Investigatory Powers Act 2000.
be of economic value (information) seems perversely to be of no value because anyone can replicate it at any time at almost no outlay.\textsuperscript{36}

\begin{center}
\textbf{Highlight Box: The Informational Paradox.}

Information is valuable. It is also (almost) infinitely scalable, nonrivalrous, and intangible.
\end{center}

Our traditional legal values are predicated on an environment where valuable goods are either physical, tangible, and rivalrous or where intangible goods (as protected by intellectual property laws) are fixed to some form of tangible carrier: books, vinyl or compact discs, compact music cassettes, videocassettes, patent specifications, or attached as ‘badges’ to products. But as John Perry Barlow demonstrated in his famous polemic: \textit{Economy of Ideas: Selling Wine Without Bottles on the Global Net}: ‘with the advent of digitization, it is now possible to replace all previous information storage forms with complex and highly liquid patterns of ones and zeros’.\textsuperscript{37} In Barlow’s parlance the valuable content (the nonrivalrous good) is being separated from the traditional carrier (which was rivalrous). Not only is the move from atoms to bits affecting traditional property values, it also undermines our traditional models for enforcing intangible, intellectual property rights.

The question of how we protect the value of information in an age where it is instantly replicable, transmissible, and is almost infinitely scalable is the challenge lawyers face today. It is also the core value of this book and it represents the thread that draws together the chapters which follow on disparate subjects such as cyber-speech and defamation, databases, copyright in the information age, and computer crime. The common theme which will emerge is that attempts to broker a piecemeal settlement: here a Database Directive, there a Convention on Cybercrime are wrong-headed and will eventually lead to a fragmented approach which will fracture not just along jurisdictional lines but also along lines of technology and types of information. This would be the informational age equivalent of fragmented responses to different types of physical things in traditional legal settlements: thus instead of a law of property and chattels we have a law of the steam engine, a law of the gramophone, and a law of the pocket-watch. This is exactly what we are doing now in the world of bits by producing specific regulations to deal with copyright infringement, indecency, computer crime such as hacking, and informational products such as databases. This book will, in the traditional style examine the extant

\textsuperscript{36} This was recognised early on by Bill Gates who records in \textit{The Road Ahead} ‘It seemed to me that too many people were accepting, at face value, uncritically the idea that information was becoming the most valuable commodity. Information was at the library. Anybody could check it out for nothing. Didn’t that accessibility undermine its value?’, above n.9, 22.

\textsuperscript{37} ‘The Economy of Ideas: Selling Wine Without Bottles on the Global Net’, \textit{Wired} 2.03, March 1994. This paper is discussed further in chapter 3.
and proposed legal-regulatory framework of each of these (and many others), but it will also encourage you, the reader, the question whether it is time to take a more comprehensive approach to the legal regulation of digital information rather than attempting to fit the square peg of the world of bits into the round hole of a legal system designed for a world of atoms.

Further Reading

Books

D. Tapscott & A. Williams, Wikinomics (2008)

Chapters and Articles