

## **DRM Doesn't Really Make Digital Copyright Management**

### **Abstract**

Digital Rights Management standards are being developed for digital content. Yet the question remains, what problems are the systems trying to solve? Most systems are explicitly modeled on copyright (e.g., Piva, Bartolini, Barni, 2002) and others use the metaphors of piracy and author's moral rights to define or defend the design goals. Thus I begin my examinations of these systems with a utilitarian focus on the functions of copyright. I argue that the brilliance of copyright is that it provides attribution, access, and a definition of a fungible right thereby enabling epistemological surety and literacy, as well as a functioning financial information market. This paper is framed by the Western European experience of copyright. Yet by focusing on function rather than motivation the results may be more widely useful.

After illuminating the functional aspects of copyright I then turn to various digital rights management systems. I examine each system with respect to its effect on the functions of copyright. I examine three systems: Giovanni, CSS, and the Adobe e-book.

I conclude that while each has elements of copyright, none solves the set of problems which copyright solved for the dawn of the print age. I further argue that were information all free, the information market might still fail.

### ***Copyright and its Precursors***

Technological change has long been the driver for copyright, As a class, information property is the creation of the industrial revolution. Previously all information belonged to the Crown or to the Church. The ability for individual ownership of authorship and information rights were hotly contest and explicitly part of the debates and revolutions which raged across Europe in the eighteenth and nineteenth century.

“Information wants to be free” as a phrase may have originated in Stewart Brand’s WELL (Whole earth ‘Lectronic Link) but the concept was instituted (briefly, and as a notable failure) in revolutionary France. (Darnton, 1982) The licensing of the pre-Revolutionary regime of the resulted in excessively controlled debate resulting in a degradation of dialogue provided by the underground<sup>1</sup>. In the case of the French Revolutionary period the adoption of copyright followed a reign of completely free information. In the records of the French revolution the popular political discourse suggests that an excessive control of information or a complete lack of control of information both result in a dysfunctional information market leading to all discourse plummeting to the pornographic: truly the lowest common denominator. (Darnton, 1982)

Once the fundamental contours of copyright had been sculpted the form proved so potent as to sweep the globe, along with the movable type press. Printed paper, like other forms of information storage and transmission, created fundamental problems of economics and reliability

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<sup>1</sup> The similarities between the pornography as politics in the last days of French Royalty and the prosecution of President Clinton as remarkable and striking.

of information. Copyright solved these problems. Now copyright is so deeply embedded into practices now that its success makes difficult the struggle for the appropriate response to the proliferation of information.

Copyright was created a moment of great discontinuity. Before the printing press, content was very expensive to produce and even more expensive to distribute. Effectively there was no distribution excluding the occasional loan for copying. Copying enabled mass creation and necessitated distribution. The two are intimately related. Thus rather than focusing on the alterations in copyright across time and space, I consider copyright as created at the discontinuity. Essentially I seek a return to first principles to guide the design of digital rights management systems.

Like the network today, the printing press changed the economics and politics of information. Any literate middle-class person could author and publish a leaflet and have it distributed across London, Paris, or Berlin. The nobility decried the opinionated chatter of the merchant classes to no avail. Those who controlled the equipment for data reproduction no longer had exclusive rights; as competition reigned the control of content was also lost. (Holdsworth, 1938).

For three hundred years, dialogue thrived, the scientific revolution raged, and copyright established itself as the rational mechanism for content control across the globe. Vastly different cultures adopted copyright. Over the last century, however, new technology, such as the phonograph, radio, motion pictures, and even high-speed presses, has increased the expense of producing and distributing information, leading to fewer publishers demanding greater copyright protection.

Change in technologies resulting in changes in the economics of information have yielded changes in copyright. Phonographs were the first challenge to the functionality of copyright. When there was no medium for recording song or voice the author could be assured of payment when the music was reproduced via sheet music sales. Similarly the author of a play could obtain reimbursement for small productions from the value of the scripts sold. Yet the ability to record song and play changed that equation. When the movies came along there were new concerns about ownership. Yet no technology has been as radical and ubiquitous a change as networked digital information. (Wade, 1997)

As capital requirements for information production and dissemination increased, copyright has followed a technologically driven trajectory reflecting the concentration of capital with production and distribution being dominant costs. Yet now, with the digital communications revolution, the trajectory of technology has been reversed. With the development of network technology embodied in the Internet, the law and technology are increasingly in opposition. In short, we are again at a place not unlike the period of discontinuity where copyright was created.

Thus in this work I am implicitly (by method) and explicitly arguing that a new approach is needed, one which performs the critically important functions of copyright but in the fundamentally new information market.

## The Functions of Copyright

At its creation, copyright was essentially an extension of freedom of communication, in that it replaced the Star Chamber, and fundamentally a mechanism for control in that it required deposit

in the Royal Library. Before the Copyright Act the dual goals of regulation of press had been (often brutal) control of the content and exercise of political power for enrichment of the powerful few. First the printing guilds then under the Stationers Act the booksellers as merchants overtook tradesmen in power, and the Crown controlled and profited. Unique in the case of England a dual judicial system (the Star Chamber as well as the criminal and civil courts) created a set of sometimes-incompatible rulings. Thus with the final collapse of controls on licensing there was no single body of judicial findings on which to build. Printers were printing and selling as they wished. The Copyright Act was, “an Act for the encouragement of Learning, by vesting the copies of printed books in the authors or purchasers of such copies during the times therein mentioned.” (Holdsworth, 1938, Vol. X)

The Copyright Act was radical in the following dimensions:

- The right went to the author, not the printer or bookseller.
- The right had a finite term (14 or 21 years). Previously patents or privileges did not expire.
- Violations of the Act were civil violations, never criminal violations.
- Fair use concepts and educational goals were created.

Arguably the educational uses required in the Copyright Act were not radical. The Copyright Act as signed by Queen Anne (thus becoming part of the Statute of Anne) arguable created the concept of fair use, requiring nine copies of each book so that each of the major universities could each have a high quality copy available in their libraries. Those libraries Oxford, Cambridge, Sion College the Royal library, four unnamed Scottish Universities, and Edinburgh were also notable in that the presses of the Colleges were members of the Stationers Guild previously. (S. Anne, Article 1, Section 8, Clause 8, Section V.)

The depository rights were not radical. Depository laws have an established history, dating from copy requirements of monarchs seeking to build personal/national libraries (Harris, 1995). (The division between a royal library and national one is difficult, as not only was the crown the state but also because some libraries were widely accessed for educational purposes while others were closed.) Yet depository laws very rarely required deposit in more than one institution. Thus the depository requirement for the Royal library is in the traditional of depository requirements while the university requirements reflect something qualitatively and quantitatively different.

As I reference each work in this paper I am able to provide information which will enable to reader to find and locate the learning on which I am claiming to build. A reader can find the material and see if indeed the statements I claim as the foundation on which this work builds are true. Such an ordering is made possible by the printing press. Annotated quotations, peer-review based orderings, and claims of previous proven foundation via reference require some archival trusted information mechanism and some ordered manner to search the archive. In the case of the printed book the page itself and the nature of repeated printings provide the possibility of this certainty. Page numbers, editions, and the ability to reference a work such that a distant colleague can locate and confirm my assertions are a function of the press. Yet the printing press can only provide this large function is there is an archive and a regulated way of identifying authorship, as well as enforcement functions to prevent wide-spread plagiarism. Copyright provides this.

Building upon the innate nature of the press, in that it produces identical copies identifiable at specific times and place, reference and review as used in modern scholarship were created. Practical application of the fundamental practice of peer review requires multiple copies of an identical document.

Thus the problems with which scholars and legislators now study are not new, but ancient. By using the essence of copyright as understood by historians and using the engineering practice of designing from first principles, I move forward to examine the functionality and coherence for networked digital copyright, the netright. Netright must enable the same functions for reference of trustworthy material as copyright in order to provide the same value.

So copyright:

- made it possible to own rights to expressions of information
- prohibited plagiarism from any work by extending the scope of works covered
- made information available to royalty and scholars

The creation of the right to own an expression created a market right. In fact, it created two market rights. One right was the right to copy and resell the material. The other right was the right to have one's name associated with the material. The problems of illegal copying was distinct from the problem of usurpation in the early days of the book. (Johns, 1998). This continues today, as illegal copying is distinguished from plagiarism. (Should a student turn in a false paper it is no defense to say that the student paid for the material and is entitled to use it according to the terms of the contract. )

In summary then, here are copyright's functions

1. Market
  - a. Reputation
    - i. First sale: increases distribution
  - b. Monetary value
2. Epistemological trust
  - a. A method to locate information
  - b. Registration of information, including editions
  - c. Intact author information
  - d. Certainty of access
3. A human right of expression

I do not treat the human rights aspect. The concept of copyright as a human right was created by Kant in an essay on unlawful publishing in 1785 which used natural law to argue for moral ownership for the production of one's mind. (Sterling, 1998) The argument for author's right supposes that the work bears "the mark of the author's personality". I do not address this function except to say that in utilitarian terms it can be seen as part of the reputation right.

I also do not trace the history of the trade-off between ever more broad information protection and ever more specific definitions of fair use. (Vaidhyanathan, 2001). Nor am I concerned with the sources of intellectual property (Fischer, 1999) I am interested at the point of discontinuity, where the economics of the press began to dominate the economics of information.

## Issues in Information Markets

Before the invention of the press, authoring was simple compared to copying. Copying enabled the survival of information from the Summarians, through the Roman and Byzantine empires, through Arab universities and finally to Europe. To copy a work was in no way theft but rather

the only way to save a manuscript. Without laborious copying any authored document would be lost. Each book copied consisted of a set of articles selected by the copier. To copy was to edit, in that modern editing is the selection and ordering of material for inclusion. (e.g., Eisenstien 1979; Febvre & Martin, 2000). Even that most basic ordering – alphabetical order – was in no way standard in Europe before the printing press. “Amo comes before bibo because a is the first letter of the former and b is the first letter of the latter and a comes before b ....by the Grace of God working in me, I have devised this order.” (Citation from Eisenstien, pp. 89). The copy was to be the agent of the author, to serve the author’s greatest interest. Not to copy was to resign the authors’ words to certain destruction over time.

How can copyright create a fair market in which the modern digital value chain is validated? This requires understanding the nature of the change in information economics. In the networked digital age copying is costless. Alteration of documents and redistribution is trivial . (Shapiro & Varian, 1999; Whinston, Stahl & Choi., 1997, National Academy of Science, 2000).

So from being inexpensive copying has become nearly free. Distribution cost have been reduced to almost nothing, a course of affairs which will continue at a rate surpassing even the decrease in cost of computing power (Odlyzko, 2000b) Thus the functions of copyright are still necessary: production can be expensive either monetarily for a Hollywood studio or in sweat of the brow from a single creator. The simplification of misappropriation of goods does not imply that such a state of affairs creates a functional market.

One issue now and in past implementations of information technology is the issue of epistemological surety. How does a reader know to trust the content, the attribution, or the consistency of a document?

One issue is radically different. Herb Simon most famously coined the concept of an attention span economy. As the sheer volume of information increases those services , software, or practices which reduce information flow are becoming increasingly valuable. Corporations seek to decrease the information flow to consumers using affinity marketing and personalization. Something as simple as providing weather for three selected zip codes as offering every user the entire database of world weather conditions is an example of the value of filtering information.

Filtering was integrated with distribution and copying in the world of the printed page. Editors choose which material to publish, and store keepers choose which to provide. The fundamental physical nature of the printed page made filtering a requirement for physical production and distribution. Even today battles rage across the country for access to distribution channels via the newspaper curbside box (REF!!)

A critical element of selecting information is selecting trusted information. Of course not all information need be trusted to be valuable. No one believes the events in Star Wars happened a “long, long time ago in a galaxy far far away”. Yet the information about the relative value of the movie must be trusted; that is filtering is necessary for trusted information.

Trustworthy information is not a new problem. Reliability of information, currently integrity in computer security, has a ancient history. In Babylon clay tablets were the mechanisms for recording information and contracts. Where there was significant concern that one holder of the contract might alter the clay on which the details were impressed, four “copies” of a contract were made. (While our concept of exact copies does not apply, the critical details were the same.) First two of the copies were baked. Then these two copies were encased in the clay of the other copies and baked inside. Thus there exist self-validating contracts. (Harris, 1995)

Trusted third parties may be new in that cryptographers implement them using write-once optical media and digital cryptography but the concept of a trusted third party is as ancient as the library or record-keeping temple. While self-validating contracts were used for transactions that were critical only to the parties to the contract, third party validation was used for critical information. The earliest libraries were temples and then royal archives, where information for greater social importance was stored. The seat of government or the highest temple would hold the canonical document and copies could be provided to those institutions lower in the hierarchy. In this way there was a trusted third party where those concerned with the integrity of information could be validated (Lerner, 1998).

Yet in all these ancient cases each information element was highly valuable and thus the value of small elements of information could support a system of evaluation. Now filtering requires more participants. Increasingly filtering is used to select distinct information for individuals rather than trusted selections per se. Compare the selection of texts for temple inclusion, to the library selection process, to the interactive selection processes of Amazon. In the previous two cases specialists make selections for a wide number of people based on professional training. The relative value of the information they select enabled the pre-press library to survive. Depository laws and community support allowed press-based libraries to survive. What is a digital library? What is the value of filtering and what additional filtering models must be supported for the information economy to function?

Currently libraries continue to receive public support but are overwhelmed at the cost and difficulty of archiving on-line material. Archives (such as the WayBack machine) are being prohibited from providing archival access by copyright – an essential feature of copyright. In addition, individual users develop following with web pages, blogs, personal selections, and electronic subscription or newsletter services.

Thus in addition to the reputation market, monetary market, certainty of access/archiving, referencing systems, and binding of content to creators, the next copyright must function to allow the rewarding of filtering or to explicitly provide support for a filtering market. This is not a set of trivial design requirements. To examine the state thus far, I examine four digital rights managements .

### ***Description of Three Systems and Their Functions***

In this section I describe three copyright systems: Giovanni, Content Scrambling System, and the Adobe Ebook. Noticeably this requires examining DeCSS and the eBook reader. In order to be consistent in this description ownership or copyright data which are distinct from the content is called attribution data. The data which are the content is called, reasonably enough, content. Altered data are called secure data. The use of this terminology is meant to assist in providing clear descriptions. In no way do I intend to imply that all the systems here provide cryptographic security, or that all data which a content owner might want control over is attribution data.

#### **Giovanni**

Blue Spike offers a suite of products, so my focus here will be on Giovanni. Giovanni, Blue Spike's digital watermarking technology, can be used for identification, authentication and auditing of digital audio works. Giovanni is often classed as an audio protection mechanisms,

and indeed there is a company focus on making it inaudible. Yet Giovanni can be used for any content; and it is the explicit goal of Giovanni to be available for all media.

In the Blue Spike model a producer will create content and then mark it as his or her own. This information will be presented for sale at the Blue Spike server. Blue Spike has a public key pair (or possibly multiple public key pairs). The creator or owner of the content selects attribute data to be embedded in the content. The resulting secure content is then stored and made available over Blue Spike's servers.

Giovanni begins by generating a single random number from Giovanni's key and the seed for a hash function. This random number is divided into two segments,  $r_0$  and  $r_1$ .  $r_1$  is used as a symmetric key in order to encrypt the attribute data.  $r_0$  is hashed with the attribution data to create a payload the correct size to data to embed, thereby creating the secure content. Then  $r_1$  is used as a key to encrypt the payload. Then the payload is embedded into the content.

Blue Spike has a model which requires author registration. Blue Spike offers to manage the enforcement of the content as well, by searching for Giovanni signatures across the network.

Blue Spike includes the option of embedding purchaser sensitive information in addition to producer information in a good. It is not entirely clear from the documentation how this is done, although apparently the consumer data are included in the attribution data before hashing. In the case of the producers, the identifying information may be pseudonymous as long as the producer can prove him or herself the rightful owner. In the case of the customer the information is based on payment information meaning that the data embedded are sensitive data.

The practice of embedding consumer information assumes that only the consumer would release the data and does not address the possibility of data theft. In the case of data theft the consumer is subject to the inherent punishment of exposure of sensitive information. Given that identity theft costs the victim on the order of thousands and recovery takes an average of eighteen months; this would be a punishment unlikely to be sustainable in a court of law. While the feature is optional, the choice is up to the producer. In the case of embedding information the producer is allowed to select the level of risk for the customer without customer input. In addition this option precludes the ability read anonymously.

## CSS

The content scrambling system is the standard for CPSA (content protection system architecture). The CPSA is an integrated architecture to prevent transfer of content between formats, and widespread copying.

CSS is embedded into DVDs and DVD players. In the case of CSS the content is the DVD movie itself, and the attribute data consists of a region code.

CSS encrypts the contents of a DVD, so that only approved readers can access the code. A key which unlocks CSS is stored in DVD players. Every DVD player has a small set of player keys. Every DVD has on it a key. First there is the (for lack of a better phrase) key-identifying key (5 bytes). This key is used to create a key exchange (if such a word can be used when one party is a passive read-only device) or key generation. The key-identifying key is a hash of the disk key. The disk key is then listed encrypted in every possible player key.

There is a set of 409 player keys. Every CSS licensee is given a key from this set. (Thus should a CSS licensee implement an unacceptable player, the license can be revoked by removing the corresponding encryption of the disk key.)

The player key confirms that it is using the correct key for the given disk by hashing the decryption of the disk key. The hashed, decrypted key should be equal to the 5 bytes at the beginning of the CSS block.

Once the disk key has been determined, the DVD player uses the disk key to decrypt a title key. The content is either encrypted in the title key or encrypted in some permutation of the title key and the list of encrypted disk keys.

Now having considered the rough operation of CSS, consider its purpose.

CSS does not prevent bulk reproduction and resale of content. When content are mass produced the only issue would be that the region code remains. This means that a large-scale commercial production of illegal copies must purchase originals in the target market. In effect, this prevents consumers from purchasing illegally copied goods in another region and returning home to sell them. Also, by making it more likely that an illegal copy will not work in a CSS-compliant player, CSS may function to reduce demand for illegal copies of DVDs.

DeCSS breaks the encryption provided by CSS so that a DVD can be decrypted and played on any arbitrary player without altering region code. A primary function of DeCSS was to allow users to play DVDs on the Linux operating system using open code<sup>2</sup>. One focus of DeCSS is the integration of region codes. Region codes are a decimal digit which determines in which region a DVS can be sold. The region code prevents regional arbitrage by buyers and allows large-scale geographic price discrimination by merchants. Therefore a primary function of CSS is regional price discrimination<sup>3</sup>.

All players limit the number of times a region code can be altered. The Macintosh OS X DVD player limits the change to three times. Other players limit the number of changes five times. The number of time a player can allow the user to alter the region code is a function of the license associated with the DVD player key. Should any player manufacture a device which allowed arbitrary region code alterations then the license of that producer would be revoked.

## Adobe eBook

The Adobe eBook software provides for digital encryption of content and is associated with a series of sellers who agree to provide copies of an eBook-protected book for resale. eBook merchants provide conversion to digital format, author rights management services via eBook and

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<sup>2</sup> Since a fundamental element of open code is the ability of users to alter the code, no provider of open source players can ensure a limit on the number of times the region code is altered.

<sup>3</sup> I use the phrase price discrimination in the economics sense, implying no moral wrong. In fact, there is a strong economic argument that for high fixed cost, low marginal cost goods price discrimination is necessary for the market to function. (e.g., Shapiro & Varian, 1999). A most common form of price discrimination is the "stay over Saturday night" used by airlines to discriminate between corporate and vacation travellers. Notice that air travel providers are in a high fixed cost, low marginal cost business.



offers to provide distribution. Different providers offer different bundles of services associated with eBook. However eBook can be purchased with server software so there is no archival requirement with eBook services.

As with PDF, Adobe provides a free eBook reader compatible with the eBook digital rights management system.

In contrast with paper books eBooks expire.

In contrast to other on-line books, eBooks prevent cut and paste of significant sections. Of course, the centuries old traditional of plagiarism vs. transcription remains available. Thus in comparison with paper texts there is not effective change between an electronic book and a traditional book with respect to authorship and reputation value.

## ***Analysis***

In this section I bring together her the functions of copyright and the functions of the digital rights management systems. A hypothesis which must be assumed to be true or false for this analysis to be useful is that all illegal copying substitutes for purchasing. While there is evidence to the contrary (Osorio, 2002) the concept of illegally copying as revenue lost will be assumed in the first tabulated form of the results. Then in each discussion I will briefly revisit the issue of illegal copying as lost revenue.

The second, related issue which creates uncertainty in this analysis is the issue of access. If all illegal copying is a direct substitute for legal copying and the value of increased access is negligible then there is simply loss of revenue for the author. If illegal copying functions as free advertisement, and encourages additional purchases then increased access yields increased revenue. If illegal copying yields widespread awareness of a work, then the author losses monetary value but gains reputation value.

Finally there is a third conflict is evident between the functions of copyright: how does availability alter the veracity of a document? When there is an increase in availability and a decrease in security in a document, what dominates? If the content are not available, or the availability is strictly controlled, then the useful functionality of surety is lost as none can learn from or build on the information. A timely example is the alteration of E.T. the extra terrestrial for re-release. In the later released movie potty humor was removed, and police are seen carrying flash lights instead of guns. These digital changes would be misleading to any scholar using E.T. to study the culture of the seventies. This change was made possible by the existence of few master copies. (REF)

Increased access increased surety as widespread reproduction increases the difficulty of subverting reliability. For example, for reliable timestamps (Haber & Scott Stornetta, 1991.) the outputs of hash trees are intermittently published in the N.Y. Times. As the N.Y. Times is widely archived, it would be inconceivably difficult to alter all versions of the published material. Similarly if a document exists in many archives not even the author can go back and alter the content without detection. For example, when there are improved results or clarifications in papers on-line then the publisher or author can improve or correct in real time. In a paper version the improvements correspond to a new edition number. Therefore if a claim becomes

substantiated or an error corrected, referencing functions on paper. If a claim becomes substantiated references to a claim as uncertain would be incorrect. Yet, if the original paper were available on archives, or was widely distributed, it may be possible to locate the reference by date.

Having considered these common issues I now consider the systems I described above according to the functions of copyright. In each cell the function of copyright listed in the second column. Along each row the ability of a system to fulfill that function is listed in the corresponding column. The larger market result which depends on the specific functions are listed in the far right column.

	<b>Functions of Copyright</b>	<b>Adobe eBook With respect to paper texts</b>	<b>Advanced Ebook Processor with respect to eBook</b>
Creator Motivation	Motivation of Creation (money)	Increases value	Decreases value (piracy concerns)
	Creates a tradable good of first sale	Decrease or is Neutral	Increases
	Creates a tradable right	Increases value	Decreases value (piracy and plagiarism)
Surety & Motivation	Maintain Author/Source info (reputation)	Increases value	Decreases
Reader Surety	Archiving	Decreases (forward compatibility of software, file compatibility)	Increases availability & decreases trustworthiness
	Access	Increases changing to Decreases	Increases Value

Advanced Ebook Processor simultaneously enables the right of first sale (or secondary distribution) and decreases the market value. The increase or decrease in market value is a function of the nature of illegal copying as substitution or complement.

Given that Advanced Ebook Processor removes the tight binding between author and content, enabled by the physical nature of copyright, the implication is that eBook decreases reputation value. However this is subject to the issue of distribution vs. encryption as surety mechanisms.

In terms of access eBook increases access in that it provides a portable format and support for creating digital books. However, in the long term eBook decreases access because the format will change over time and the encrypted books expire. ERreader increases access and availability because it prevents expiration and ensures availability when the Adobe-owned format is altered.

Certainly surety is not served if the content in the eBook is altered, so that checking the book is not optimal. In contrast, the wide availability of the book offered by Advanced Ebook Processor means that more copies will be distributed; thus changes are difficult to make.

	<b>Functions of Copyright</b>	<b>CSS</b>	<b>DeCSS</b>
Creator Motivation	Motivation of Creation (money)	Increases value	Decreases value
	Creates a tradable good of first sale	Decreases value	Increase
	Creates a tradable right	Increases value	Decreases or increases value
Surety & Motivation	Maintain Author/Source attribution (reputation)	neutral	Decreases or increases
Reader Surety	Archiving	Decreases value	Increases (forward compatibility of software, file compatibility)
	Access	Decreases value	Increases

CSS increases the monetary value of the DVD because it allows regional price discrimination. CSS limits this value as the secondary market is decreased because first owners cannot resale across boundaries.

As CSS also decrypts the content, allowing misappropriation. It increases each of access and availability. In addition, it creates the ability to make derivative works. Unlike the case of books direct transcription is not an option in video content. Therefore DeCSS increases the value of the tradable right if it increases the use of a good for building other information goods. This reuse will also increase the reputation value.

DeCSS enables archiving by creating an unprotected bit stream and allowing any player to be used. DeCSS increases access by allowing initial cross-border trades and an expanded secondary market.

	<b>Functions of Copyright</b>	<b>Giovanni</b>	<b>Free Information</b>
Creator Motivation	Motivation of Creation (money)	Increases value	Decreases value
	Creates a tradable good of first sale	Neutral	Decreases
	Creates a tradable right	Increases value	Decreases value
Surety & Motivation	Maintain Author/Source attribution (reputation)	Increases	Decreases
Reader Surety	Archiving	Increase value if stored on server	Increases (forward compatibility of software, file compatibility)

	Access	Neutral	Increases
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Arguably the Giovanni system should be far preferable to those seeking to maintain the Giovanni offers critical functionality that is aligned with the value of copyright to society: archiving, maintenance of author information, and no innate restrictions on access. The basic concept, to allow people to view rather than to assume each viewer is about engage in a criminal act, is embedded in copyright.

Giovanni offer critical functions of copyright. If Giovanni maintains copies as an archive as well as ensuring that those who have purchased services can alter the format of the material to keep up to date then Giovanni clearly optimizes the recreation of the functions of copyright.

If the watermarking in Giovanni prevents alteration to other formats and effectively locks the information producer in one technological time, then it is less certain that this Blue Spike offering is optimal. If the watermarking allows for a history of use, just as this document embeds references and quotation from other works, then Giovanni offers a method for building complex hyper-linked trustworthy documents.

Giovanni does not function to provide a tree-like mechanism so that the interrelationship between documents can be traced. However, with market dominance it could provide something not unlike citeseer (<http://citeseer.nj.nec.com/>) with inclusions rather than specific references. (For example, such a reputation or linking system need not require an explicit reference Shakespeare when noting something rotten in the state of Denmark).

A question with respect to Giovanni is if a single company should serve the role of the Royal Library – authorization of effective copyright protection, authorization, and access. There is no obvious and unassailable answer to this question.

Finally the reason for lack of widespread adoption of Giovanni is the perception that the monetary functionality is not fulfilled.

## **Conclusions**

Systems which fall under the rubric of copyright today by virtue of protecting content sometime do enhance the market element of content; however, sometimes at the price of the other functions of copyright. Similarly code which breaks content control mechanisms enhances some functions of copyright and undermines others.

Authors want to be remunerated with some combination of reputation and wealth. The increasing value of the readers' attention span should also be considered in the information economy. If information can be said to want anything, then information wants to be trusted. Neither those who seek to manage authors' rights nor the defenders of access rights are entirely aligned with the purposes of copyright in that no system motivates and award cooperative filtering.

Future work entails examination of more digital rights management systems. One interesting question is the relationship between the surety function and the market function, and the nature of the trade-off illustrated in these few cases.

Of course, the most interesting question is designing a system for netrights, which places copying in the place of history, technology past, and of course honor for functions well met in a different age and moves forward.

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