

And You Thought the Printing Press was Important

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1 Changes

Converted some formula from plain text to L^AT_EX. Was able to do this because I finally installed L^AT_EX2HTML correctly. Also corrected the unit analysis in that formula so that it ends in $\frac{dollar}{book}$ instead of just *dollar*. Technically more correct.

2 Introduction

You've seen the SSSCA, the DMCA, & other proposed laws that would limit everyone's rights in an attempt to prevent piracy of software, digital audio recordings, digital movies, electronic books, & other electronic documents. These proposed laws are all attempts to restrict how electronic documents work so that the old copyright laws can apply to them, but to achieve that goal, these laws would have to do terrible things to everyone's rights. As an informed reader of 2600, you've wisely quaked in your boots at the potential these proposals have for destroying our freedom of speech.

What is so different about electronic documents that, to make them behave like traditional documents, these laws would have to do such terrible things to people rights?

I'm gonna tell ya, starting with a history lesson.

3 The Ancient Rules

Before the invention of the printing press, publishing was done by copying books by hand. An original book was written by an author. To make a copy, the book was given to a scribe who copied it with quill & ink on paper (or hammer & wedge on a clay tablet—there have been a lot of variations).

By today's standards, the cost was exorbitant. I haven't found detailed documentation of the time required to copy a book, but I've read anecdotal evidence that a scribe could copy a book in about a year. Using today's money & labor laws¹, if the scribe could copy the book in a year, working 40 hours each week at roughly the current minimum wage in the United States (about 8.50 dollars), the copy cost was

$$\frac{8.50\text{dollar}}{\text{hour}} \times \frac{40\text{hour}}{\text{week}} \times \frac{50\text{week}}{\text{year}} \times \frac{\text{year}}{\text{book}} = \frac{17,000\text{dollar}}{\text{book}}$$

Compare a book that cost 17,000 dollars to produce with the paperback science fiction novel you bought last week for less than five or six bucks.

4 Gutenberg & the Old Rules

Johannes Gutenberg changed the economics of that when he invented the printing press.

I haven't found the precise financial numbers I'd like for running a print shop with a Gutenberg printing press, but I have read that such a printing shop could employ five people to operate the printing press & do the other labor. If each of those employees worked the same hours as the scribe & for the same pay, that would cost the print shop (5 employee) * (17,000 dollar/employee) = 85,000 dollars in employee compensation annually. I've also read that such a print shop could produce five editions in a year. I don't know how many copies were in an edition, but Gutenberg himself produced 300 copies of his famous bible, so let's assume there were about 300 copies in an edition. So a print shop could produce (5 edition/year) * (300 copy/edition) = 1,500 copy/year.

That's 1,500 times more copies than the single scribe could produce, at a cost of 85,000 dollars to pay employees, which is less than 57 dollars per copy, reducing the price of printing by a factor of roughly 17,000/57 = 300. So Gutenberg reduced the cost of a book about 300 times, & Gutenberg's printing press is considered possibly the most significant invention that created the information age.

Think about what the printing press did not change. Whether books were copied by scribes or printing presses, the act of copying was separate from the act of reading the copy. Reading a copy didn't create or destroy copies. So the rules of copying & accessing books remained the same: Once created, a copy could be read without destroying or creating copies.

Notice that these rules apply to all our other pre-computer documents, too. Viewing a movie from celluloid or a video tape doesn't create or destroy copies. Same with audio cassette tapes. The world in which these rules apply to information is the world for which current copyright & intellectual property laws are designed.

¹Neither of which existed in the middle ages, but you must keep something constant to make a comparison.

5 Computers Change the Rules

The information age was created because the printing press changed the economics of copying information, but the rules of information access remained the same. Imagine what would happen if the rules changed.

Let's look at the economics first.

I counted 2,254 characters on a randomly selected page of a mystery novel I selected at random from my bookshelf. Assuming that book represents an average novel, an average 300-page book is about 660 kilobytes.

If I have a 56 kilobit/second modem, which gives an effective throughput of about 3.2 kilobyte/second with a TCP socket over a PPP link, I can download that 660 kilobyte book in 206 seconds. My Internet Service Provider (ISP) charges 20 dollars per month for 120 hours of online time per month, so downloading that book costs me less than 1 cent, 1 copper-alloy disk with Abe's profile on it. With DSL or a cable modem, which is many times faster but not much more expensive per month, it'll cost even less.

Think about what this means. From scribe to printing press, the cost of copying a book decreased by a factor of 300, & that change created the Information Age. From printing press to computer, the cost of copying reduced by a factor of at least 6,700. What will that change create?

But like I said, the change in economics isn't the most important change computers cause. They even change the rules of copying.

Remember the rules of reading that applied from scribe to printing press to movies & music. Copying & reading it are different acts. Once a copy is created, it can be read any number of times. Reading or otherwise accessing a copy does not create or destroy copies.

Computers don't work that way. With a document on a computer or on a network of computers (like the Internet), reading a document requires copying it.

When you type a Universal Resource Locator (URL) into your Web browser to visit a web site, your computer sends a request to the other computer. That other computer sends you the document you've requested. We think of it as sending the document, but it doesn't send the document at all. It copies the document. That copy goes into your Web browser, which displays the document so you can read it.

The process even decomposes into many acts of copying. To send you a copy of the document, the other computer copies the document from a file on disk into its own memory. To send the in-memory copy, it tells its network software (the TCP/IP stack) to send it. The network software has to copy the document onto the network wire. On the wire, it might be read by another computer, a router or bridge, which copies the document into its own memory, then to another network wire. The document is copied from computer to computer until your computer finally receives a copy. When that router copies the document onto the network wire, your computer will receive it, making the final copy into its own memory for your Web browser so that you might view it on screen (after it's copied to your computer's video memory) or save it to a file (by copying)

or e-mail it to a friend (by still more copying over the network).

But wait, there's more! Those intermediate copies aren't necessarily whole documents because computers copy blocks or buffers at a time. So the blocks of a single intermediate copy might not exist at the same time. The intermediate copies are still complete over time, though.

So reading an electronic book, listening to digital music, or viewing a digital movie requires copying. In fact, the act of reading creates & destroys many copies transparently. That is how computers have changed the rules, & it's more important than the economic change they made.

The copyright laws clash with electronically stored information because of this change in the rules, not because of the change in economics. Copyright laws regulate the act of copying in an age when reading & copying were separate acts.

Also, the new rules threaten the business model of any company that sells copies. Those companies don't dislike the change in economics. Imagine if you printed books, & computers had reduced the cost of printing by a factor of 6,700 (without changing the rules). Either you can now sell whole libraries of paperbacks for the current price of a paperback, or you can sell your paperbacks for, oh, about a penny. Hell, if your consumers didn't realize that the price of printing had dropped to the infinitesimal, you & the other printing companies could continue to sell paperbacks at their current prices, but now they are nearly pure profit. Same goes for movie & music publishers. So do companies hate the change in economics? I don't think so.

The change in rules, the blurring between copying & reading, is what threatens publishers of movies, music, & books. Traditionally, publishers have made money by selling you a copy. If you buy a printed book, we can all agree on what copy you just bought. We can point to it, handle it, read it, burn it. Everyone agrees on what you just bought. What about an electronic document that you purchased online & which was sent—I mean, COPIED—to you in real-time, complete with all the indistinct intermediate copies, the copy in your browser, & the copy you saved to a file. Which copy did the publisher sell?

Maybe they sold the one you saved to disk. To read it, you'll need to load it into your browser (copy it). Presumably that's legal, but what if you copy it for a friend? Is it legal for him to view (copy) it? Probably not, but you could lend him an old-fashioned book legally. To simulate that with the digital book you purchased, you might let him copy it, then delete your copy. When he's done reading the book, you copy it from him & then he deletes his copy. But what if his copy is now in a bunch of nightly backups his network administrator did over the time your friend was borrowing the book? Or what if his copy of the file is on a Storage Area Network (SAN) or some type of networked storage system that hasn't been invented yet?

What if you & your friend want to load (copy) the book into your browsers at the same time from a shared file on a networked file system?

We can make the laws more complex so they'll allow us to use electronic documents in ways that simulate the ways we've used traditional media, but it's possible the laws will become so complex that no one can understand them. That leads to the possibility of abuse. But wait! Isn't that what we're facing

even now?

Why restrict how we use digital information at all? The medium is capable of so much more than our traditional forms of information. We can probably do things with digital information that no one, anywhere, has yet imagined, so why should humanity limit itself? Are we afraid of what benefits we might realize? I think the answer is, "Yes, some of us are afraid". That's too bad for everyone.

End.