ByteNoise

The Digital Revolution

A brief look at the advantages of digitising information, and the repercussions of these advantages.

There are several problems with analogue media which are resolved by their digital counterparts. While it's hard to put an exact figure on them, as they are so intertwined, there are roughly three main areas in which analogue media are less than perfect: firstly, they cannot be efficiently organised (stored, retrieved, indexed, searched, filtered or manipulated); secondly, each type of information is bound to a different physical medium (such as text and images to ink and paper or microfilm, and sound to a groove or strip of magnetic tape); thirdly, and most importantly, they cannot be perfectly copied.

In the Beginning

As digital microprocessors (along with storage devices such as hard drives) are the technology that enables the organisation and manipulation of digitised media, it makes sense that the first thing to be fed into them was machine code instructions — the very thing that brings them to life, giving them a task to perform. It was a group of intelligent, anarchistic people that had a passion for writing these instructions, or programs. They called themselves hackers, long before the word attained illegal connotations. They believed in sharing more than they believed in money or power, and they generally distrusted authority and

bureaucracy. It is no surprise, then, that these people's programs were exchanged freely for the good of the community. Everyone was free to copy, modify and improve everyone else's programs.[1]

After the microprocessors' native machine codes, the first medium to be translated into a digital format was English text. Using ASCII, the American Standard Code for Information Interchange, seven ones and zeros could be grouped together to represent any single letter, digit, punctuation mark or spacing present in the English language. This enabled computers with even modest amounts of memory to be able to accept, store and display English text.[2]

Dissemination

The Internet has facilitated the publishing and distribution of digital information in a way few people would have dared to hope was possible. No longer do files have to be spread slowly, as each individual copies the most interesting knowledge in their collection onto friends' floppy disks when they visit, who in turn make copies for their friends (a method sometimes referred to as Sneakernet). No longer do people upload their files to a handful of bulletin board systems, then wait for them to slowly propagate throughout the community.

On USENET newsgroups or the World Wide Web, for instance, you can write a story, review, or essay and make it immediately available to the public (although in the case of the Web, you need to ask someone else to link to your page before anyone will be able to find it). Unless explicitly told not to, automated software will also read it, archive it for posterity and help people find it.

This is why the Internet may even be more important than the printing press: it allows anyone with access to it to be an author, rather than merely a passive reader. Everyone's voice can be heard.

For the first time in history, we may actually have the problem of recording too much information. It seems logical to predict that filtering useful information from the noise of everybody voicing an opinion on everything may become one of the most valuable services of this era.

Organisation

To give merely a very quick glimpse of how digital media are easier to navigate than their analogue counterparts, let's just look at a computer's ability to search text. If you've ever had to skim read a book several times in order to find a specific quote that you know is in there somewhere, you know how frustrating it can be.

Computers take the work out of searching to the extent where you can just type something like "`egrep -n 'What\? A great man\?' beyond_good_and_evil.txt`" to make the computer instantly report that the quote in question is on the two thousand, six hundred and thirtieth line of the digitised book. While the language used to perform the search can take a while to master, it is still quicker (and more intellectually stimulating) to learn how to ask a computer where a string of text is than to find it yourself.

Search engines that comb the Web can be even more useful, telling you which pages contain the text you're looking for even though you'd never heard of those pages or even their authors

before, and letting you view them with just a single click. Similarly, search engines that archive USENET newsgroup posts can search over twenty years' worth of messages and show you just the ones that contain the phrase you were looking for.

Unification

Computers have come a long way since the days when ASCII was a new standard. More and more, people are switching to Unicode, a multilingual standard that enables every known written language, from Arabic to Yi, to be digitised. This is certainly more in line with the ideal of knowledge being shared by everyone, rather than a privileged few.

With their ever-increasing processing power, however, computers have now become able to store media much more complex than plain text.

The use of bitmap graphics allows computers to represent any given colour using numbers, enabling them to use a mosaic style grid to represent any two dimensional picture. Using scanners, printers, graphics cards and now even digital cameras, this allows them to see, store, manipulate, display and print out any picture, from fine art to pornography or even your holiday photos.

Thanks to pulse code modulation, a method of translating the position of a speaker cone into numbers, computers can also now record, store, manipulate and play back any sound. This has not only resulted in the creation of the high fidelity medium of CDs and (together with the Internet) vastly increased the sharing of music amongst people, but has also transformed the

cumbersome act of splicing audiotapes together into the much easier act of digitally sampling sounds, which has shaped the art of music composition itself.

While each of these is good in its own right, the ability to seamlessly combine different media such as text, images, sounds and video footage, all on the same storage device, provides even more opportunities.

Transcendence

It used to be the case that different types of information — text, sounds, pictures, and video clips — were stored on different types of physical storage devices — paper, vinyl records, tapes and so on. You could copy a sound from one audio cassette tape to another, for instance, but you couldn't easily transcribe it onto paper.

This is not the case with digital media. If a storage device is capable of storing binary data, then it does not matter what all those ones and zeros represent. All types of information are treated equally, and all can be recorded onto any medium. A floppy disk, for example, is equally well suited to storing a book, a few seconds' worth of sound, or several pictures. Space permitting, any type of information can be stored on any type of storage device.

Immortality

If information has transcended any single physical medium, then it follows that it will never be bound to an obsolete format and fade away.

The main exception to this is machine code, which is written in a language specific to a particular model of microprocessor. However, it should be possible to emulate the processor on one of its successors.

The other trap to watch out for is getting locked into a proprietary format that won't be around forever, then eventually discovering that no software can read that format anymore. Sticking with popular, older formats that are as simple as possible should help avoid this. Plain text files are a safer bet than word processor documents, and uncompressed pictures and sounds are easier to decode than their smaller counterparts, making it more likely that people will continue to create software to view and listen to them.

Once a novel, album or painting has been digitised, it can be copied to the latest medium as soon as it exists. If and when the old medium becomes obsolete, the actual data it contains are transferred to the new medium, and the contents live on.[3]

As long as someone is willing to invest enough time into transferring data from an old digital medium to a new one, and the old medium hasn't degraded too much to be readable, it will always be possible to transfer it. As each medium becomes more reliable than the last, transferring the data should only get easier. As each medium has a greater capacity than the last, there should always be room for all information that has historical value.

Digital technology and society

One of the main problems with digital technology is a political one: it is now trivially easy to copy any information and give it to

any person. It is even possible to swap files with anonymous strangers. The hacker mindset encourages this, believing in the freedom to access, copy and modify any information that would benefit the public or advance the state of the art.[4]

On the other extreme, many people — especially those concerned with the profits of large corporations — have invested a lot in the principle that information, be it entertainment such as music and films, or useful knowledge such as dictionaries and maps, should not be free. They believe that the owner of the original work (nearly always a corporation, not the original artist) should be paid royalties for each copy sold, and that the people buying copies of the information should only be allowed to use it in certain ways.[5]

These two philosophies are clearly at odds with each other: corporations want to encrypt the information they sell you, allowing the software they sell you to decrypt it, but not allowing you to save the decrypted version, as you would be able to do whatever you wanted with it; authors of free software, on the other hand, want you to be able to use the information in any way you wish, as long as it doesn't get in the way of other people's rights to also use it any way they wish.

This is why free software inherently doesn't decrypt DRM-shackled information: if it did, you would be able to see exactly how it decrypts it, save the decrypted version, and do whatever you want with it. Corporations want to prevent you from being able to do this at all costs.

Although it is futile to predict whether we will end up in a utopia where anybody can improve upon anyone else's work, a dystopia where computers will obey the corporations that wrote

their software instead of the users that own and use them, or somewhere in between, it looks certain that one way or another, copyright laws are going to change a lot in the near future.

Brave New World

With all this in mind, calling this period in history the "information age" may be more than mere hyperbole; we are starting to navigate something as simple and abstract as information itself with as much enthusiasm as we previously started to explore space. Unlike space travel, however, this is already an arena in which everyone with access to the Internet, not just the privileged elite, can participate. As long as the system of distribution remains decentralised, and everyone is allowed the freedom of speech, this age may prove to be a liberating time.

References

1. For a good example of this, see the evolution of the Spacewar game in Steven Levy's book Hackers. Steve "Slug" Russell wrote the first version of it, with some help from Bob Saunders. Even after they finished making it, Peter Samson improved the map of stars in the background to actually make it accurate, and Dan Edwards added a big star in the middle of the screen that gave the game gravity. These additions and improvements continued until the game was considered perfect.

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2. Project Gutenberg is a good example of people preserving valuable texts by digitising them. Its volunteers and employees have translated many classic books, from A Christmas Carol to Ulysses, into the digital realm. Even when the first editions have

long since faded, hundreds of copies of the digitised versions will live on, all of them literally identical to the first publicly released digital versions.

URL: http://www.gutenberg.org/

3. For example, Henry Spencer began archiving posts to USENET newsgroups in 1981 using a three hundred baud modem and some forty megabyte magnetic tapes. Ten years later, he had amassed a hundred and twenty megabytes' worth of data, and Bruce Jones paid him a visit to transfer the data for his Ph.D. dissertation on the history of USENET. After a lot of time, money and effort, they managed to transfer the data to a more modern medium, and the whole archive is now a part of Google Groups.

URL:
http://www.salon.com/tech/feature/2002/01/07/saving_usenet/

4. The GNU project both exemplifies and articulates this extremely well. When finished, it will be a whole operating system that people are free to run for any purpose, study, copy to their friends and improve upon.

URL: http://www.gnu.org/philosophy/

5. Already, you can download songs from corporations that you are not allowed to back up as much as you'd like for your own use, cannot sell second hand, and can only play on devices made by the corporation you bought the songs from because they refuse to license the technology to decrypt the songs to anyone else. While this prevents people who bought the music from sharing it with their friends or selling it second hand, and prevents them listening to the songs they have bought on a rival

corporation's music player or free software music player, it does nothing to stop organised crime syndicates churning out pirated copies of music on a large scale, as they use special duplicating equipment that individuals cannot afford and — unless they happen to create their own original CDs — have no use for.

URL: http://www.eff.org/IP/DRM/guide/

On to The Digital Revolution, Part Two: E-books