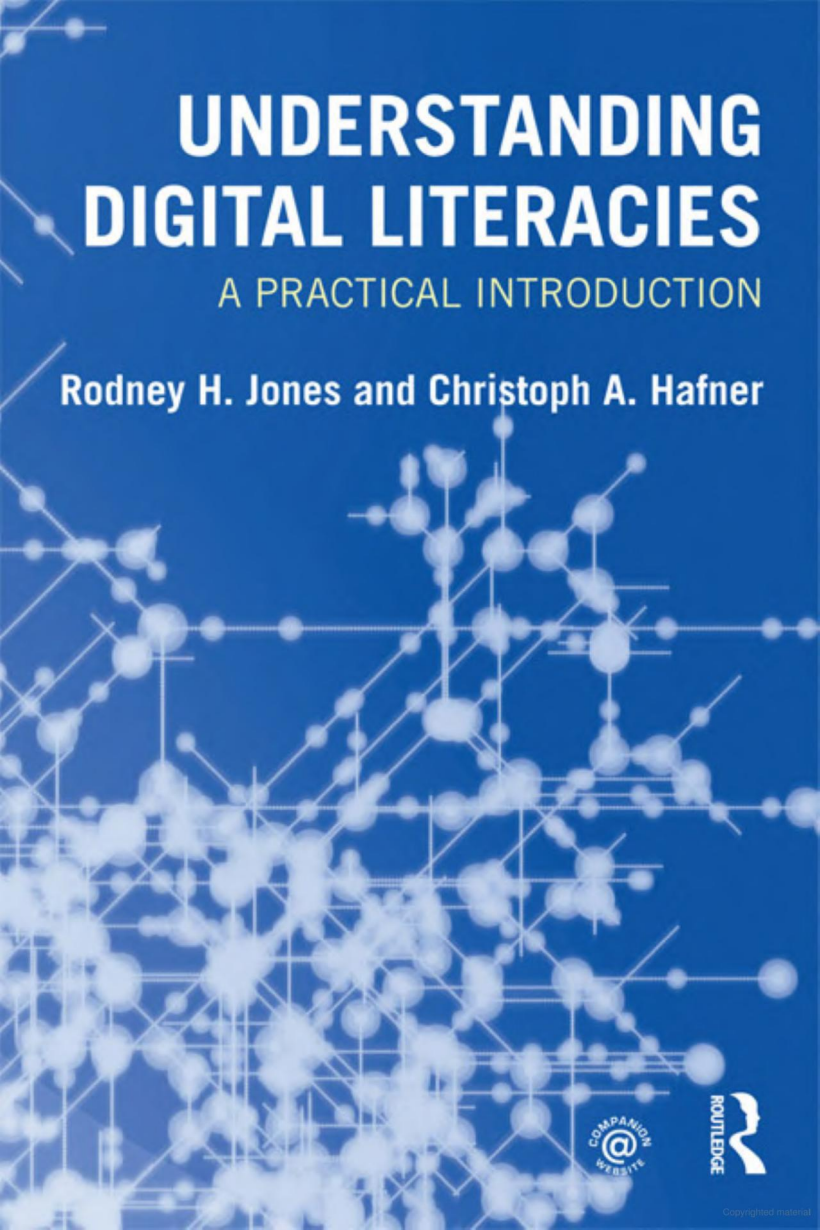
UNDERSTANDING DIGITAL LITERACIES

A PRACTICAL INTRODUCTION

Rodney H. Jones and Christoph A. Hafner



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change the way we experience and think about space and time, fundamentally change the kinds of relationships we can have with people who live far away from us, and fundamentally change the kinds of societies we can build. A light bulb does not just allow us to see at night. It fundamentally changes our experience of circadian rhythms and creates whole new environments for social interaction that did not exist before. A microphone doesn't just make my voice louder. It gives me the ability to communicate to a large number of people at one time, thus changing the kind relationship I can have with those other people and the kinds of messages I can communicate to them.

On one hand, these tools *enable* us to do new things, think in new ways, express new kinds of meanings, establish new kinds of relationships and *be* new kinds of people. On the other hand, they also *prevent* us from doing other things, of thinking in other ways, of having other kinds of relationships and of being other kinds of people. In other words, all tools bring with them different kinds of **affordances** and **constraints**. The way McLuhan puts it, while new technologies *extend* certain parts of us, they *amputate* other parts. For example, while a microphone allows me to talk to a large number of people at one time, it makes it more difficult for me to talk to just one of those people privately. While a train makes it easier for me to quickly go from one place to another, it makes it more difficult for me to stop along the way and chat with the people I pass.

Case study 1: The wristwatch

Before mobile telephones with built-in digital timekeepers became so pervasive, few technologies seemed more like 'extensions' of our bodies than wristwatches. For most people, having a watch on their wrist and referring to it throughout the day was and still is totally natural. In some ways, we even think of watches as part of our minds. Consider the following conversation:

> A: "Excuse me, do you know what time it is?"
> B: "Sure".
> (*looks at his watch*)
> "It's 4:15".

In his book *Natural Born Cyborgs*, Andy Clark points to conversations like this as evidence that we consider tools like watches not as separate objects, but as part of ourselves. When B in this conversation says 'sure' in response to the question about whether or not he knows the time, he does so *before* he looks at his watch. In other words, just having the watch on his wrist makes him feel like he 'knows' the time, and looking at the watch to retrieve the time is not very different from retrieving a fact from his mind.

Before the sixteenth century, timepieces were much too large to carry around because they depended on pendulums and other heavy mechanical workings. Even domestic clocks were rare at that time. Most people depended on the church tower and other public clocks in order to know the time.

This all changed with the invention of the *mainspring,* a coiled piece of metal which, after being wound tightly, unwinds, moving the hands of the timepiece. This small invention made it possible for the first time for 'time' to be 'portable'. In the seventeenth century pocket watches became popular among the rich. Most people, though, continued to rely on public clocks, mostly because there was no need for them to be constantly aware of the time.

It wasn't until the beginning of the twentieth century that watches became popular accessories for normal people to wear on their wrists. In the beginning, wristwatches were fashion accessories worn only by women. There are a number of stories about how wristwatches came to be more commonly used. One involves Brazilian aviator Alberto Santos-Dumont, who in 1904 complained that it was difficult to fly his plane while looking at his pocket watch. So his friend, Louis Cartier, developed a watch that he could wear on his wrist, which eventually became the first commercially produced men's wristwatch. According to another account, during World War One (WWI) soldiers strapped their watches to their wrists in order to enable them to coordinate their actions in battle while leaving their hands free to carry their weapons and engage in combat. These early wristwatches were known as 'trench-watches' after the trenches of WWI.

These two examples demonstrate the new affordances introduced by the simple technology of strapping a watch to one's wrist. It allowed soldiers and aviators to do things they were unable to do before, that is, to keep track of time while fighting or flying their planes. Some might even argue that these new affordances contributed to changes in the nature of battle as well as the development of modern aviation.

This ability to 'carry the time around' also introduced new possibilities in the business and commercial worlds. The development of railroads as well as the 'scientific management' of the assembly line factories of the early twentieth century both depended on people's ability to keep close track of the time.

Of course, these developments also changed people's relationships with one another. Human interaction became more and more a matter of scheduled meetings rather than chance encounters. People were expected to be in a certain place at a certain time. The notions of being 'on time' and 'running late' became much more important.

Along with these changes in relationships came changes in the way people thought about time. Time became something abstract, less a function of nature (the rising and setting of the sun) and more a function of what people's watches said. When people wanted to know when to eat, they didn't consult their stomachs, they consulted their wrists. Time became something that could be divided up and parcelled out. Part of managing the self was being able to manage time. Time became like money. Finally, time became something that one was meant to be constantly aware of. One of the worst things that could happen to someone was to 'lose track of time'.

With the development of electronic watches, portable timepieces became accurate to the tenth or even the hundredth of a second. This new accuracy further changed how people thought about how time could be divided up. Before the 1960s, the second was the smallest measurement of time most normal people could even conceive of.

Ever since the development of pocket watches, timepieces have always had a role in communicating social identity and status. After wristwatches became popular, however, this role became even more pronounced. Many people regard watches as symbols of wealth, status, taste or personality. It makes a big difference to us whether or not someone is wearing a Rolex or a Casio. In fact, with the ubiquity of time on computer screens, mobile phones and other devices, the timekeeping function of wristwatches is becoming less important than their function as markers of social identity and status.

Of course, the obvious question is whether it was the development of the wristwatch that brought on all of these social and psychological changes, or the social and psychological changes that brought on the development of the wristwatch. Our answer is: both. Human beings are continually creating and adapting cultural tools to meet the needs of new material or social circumstances or new psychological needs. These tools, in turn, end up changing the material and social circumstances in which they are used as well as the psychological needs of those who use them.

AFFORDANCES AND CONSTRAINTS

As you can see from Case study 1, the cultural tools that we use in our daily lives often involve complicated combinations of affordances and constraints, and understanding how people learn to manage these affordances and constraints is one of the main themes of this book. Throughout we will be examining the ways different kinds of mediational means make different kinds of actions, meanings, social relationships, ways of thinking and social identities either easier or more difficult.

We can divide the different affordances and constraints media introduce into five different kinds: affordances and constraints on what we can *do,* what we can *mean,* how we can *relate* to others, how or what we can *think*, and, finally, who we can *be*.

Doing

Perhaps the most obvious thing we can say about cultural tools is that they allow us to *do* things in the physical world that we would not be able to do without them. Hammers allow us to drive in nails. Telephones allow us to talk to people who are far away. Just as importantly, they allow us to *not* do certain things. Text messages, for example, allow us to get a message across to someone immediately without having to call them (see Chapter 5).

Some of the things that people do with technology are of earth shattering importance, things like landing on the moon or mapping the human genome. However, most of the

things these tools allow us to do are pretty mundane like sharing photos with friends, using a search engine to find a place to eat, or acquiring the 'magical power' that we need to reach the next level in an online game. It is these small, everyday actions that we will be most concerned with in this book. These are the actions that are at the heart of everyday literacy practices and ultimately it is these everyday practices that form the foundation for greater achievements like moon landings and genome mappings.

Sometimes when individuals are given new abilities to perform small, everyday actions, this can have an unexpectedly large effect on whole societies and cultures. As we saw above, for example, the ability to keep track of time using a wristwatch was an important factor in the development of other kinds of technologies like airplanes, train schedules, and assembly lines, Similarly, your ability to share random thoughts with your friends on Facebook is having an enormous effect on life beyond your social network in realms like politics and economics.

Meaning

Not only do media allow us to do different kinds of things, they also allow us to make different kinds of meanings that we would not be able to make without them. The classic example is the way television has changed how people are able to communicate about what is happening in the world. Reporting on a news event in print allows the writer to tell us what happened, but reporting on it though a television news broadcast allows the reporter to *show* us what happened and to make us feel like we are there.

The lines of print in a book allow us to make meaning in a linear way based on time – first we say one thing, then we add something else to that. Multimodal web pages and hypertext, on the other hand, allow us to make meaning in a more spatial way, inviting people to explore different parts of the screen and different linked web pages in any order they wish (see Chapters 3 and 4).

Media also affect meaning by changing the vocabulary we use to talk about everyday actions. A few years ago, for example, 'friend' was a noun meaning a person that you are close with. Now, however, 'friend' is also a verb meaning to add someone on a social networking site. In fact, about 25,000 new words are added to the *Oxford English Dictionary* every year, most of them the result of new meanings related to new technologies.

Relating

Different media also allow us to create different kinds of relationships with the people with whom we are interacting. One way is by making possible different kinds of arrangements for participation in the interaction. Does the interaction involve just two people or many people? What roles and rights do different kinds of people have in the interaction? What kinds of channels of communication are made possible: one-to-one, one-to-many, or many-to-many?

A book, for example, usually allows a single author to communicate with many readers, but he or she can usually only communicate to them in relative isolation. In other words, most people read books alone. They may talk with other people who have read or are reading the

same book, but usually not *as* they are reading. Also, they normally cannot talk back to the writer as they are reading, though, if the writer is still alive, they might write a letter telling him or her what they thought of the book. The chances of readers actually having a conversation with the author of a book are slim.

A blog, on the other hand, creates very different patterns of participation. First, it allows readers to talk back to writers, to ask for clarification or dispute what the writer has said or contribute their own ideas. Writers can also update what they have said in response to readers' comments. Readers of blogs can also comment on the comments of other readers, that is, readers can talk to one another as they are reading.

The internet, with its chat rooms, forums, social networking sites, social bookmarking sites and other interactive features has introduced all sorts of new ways for people to participate in social life, and people can experience all sorts of new kinds of relationships. They can '**lurk**' in various **online communities** or become active members. They can 'friend' people, 'poke' people, 'spam' people and create many kinds of different 'social gatherings' that did not exist before the development of digital media.

In his famous essay, 'The Relationship Revolution', Michael Schrage (2001) claims that to say the internet 'is about "information" is a bit like saying that "cooking" is about oven temperatures – it's technically accurate but fundamentally untrue'. The real revolution that the internet has brought, he says, is not an 'information revolution' but rather a 'relationship revolution'.

Other than making possible different kinds of social arrangements for participants, media also have an effect on two very important aspects of relationships: power and distance. Technologies can make some people more powerful than others or they can erase power differences between people. For example, if I have a microphone and you don't, then I have greater power to make my voice heard than you do. Similarly, if I have the ability to publish my views and you don't, then I have greater power to get my opinions noticed than you do. One way the internet has changed the power relations among people is to give everyone the power to publish their ideas and disseminate them to millions of people. This is not to say that the internet has made everyone's ideas equal. It's just that more people have the opportunity to get their ideas noticed.

Finally, when our relationships are mediated through technology sometimes they can make us feel closer, and sometimes they can make us feel more distant from each other. When text-based computer chat and email were first developed, lots of people thought that it would be harder for people to develop close relationships through these media since people couldn't see each other's faces. As it turned out, chat rooms and **instant messaging** programs like MSN messenger seemed to facilitate interpersonal communication, self-disclosure and intimacy rather than hinder it. These programs are now used much more for maintaining interpersonal relationships than they are for instrumental purposes (see Chapter 5).

Thinking

Perhaps the most compelling and, for many people, the most worrying thing about technologies is that they have the capacity to change the way we experience and think about reality. If our experience of the world is always mediated through tools, what we experience will also be affected by the affordances and constraints of these tools. Certain things about the

dramatic presentation of a story, but may be less suitable than a newspaper or magazine for lengthy and probing analysis. Social networking sites make it easier for us to stay connected to our friends, but make it more difficult to maintain our privacy (especially from advertisers). Caller identification, which is standard on most mobile phones, makes it easier for us to screen our calls, but it also makes it easier for calls that we make to be screened by others. Often the constraints of new technologies are less visible to us than their affordances. We tend to be so focused on the new things we *can* do with a new tool that we don't pay attention to the things we *cannot* do with it.

It would be a mistake, however, to regard affordances as universally good and constraints as universally bad. Sometimes affordances of new technologies can channel us into certain kinds of behaviour or ways of thinking and can blind us to other (sometimes better) possibilities. Constraints, on the other hand, can sometimes spur us to come up with creative solutions when the tools we have at hand do not allow us to do what we want to do. In this way, the constraints of tools can drive creativity and innovation.

Just because different technologies allow us to do some things and constrain us from doing other things does not mean that technologies *determine* what we can do, what we can mean, the kinds of relationships we can have, what we can think, and who we can be. Despite the affordances and constraints built in to the cultural tools that are available to us, human beings always seem to figure out how to do something new with them. We appropriate old tools into new situations, and we creatively alter and adapt them to fit new circumstances and new goals. The psychologist James Wertsch (1993) says that all human actions take place at a site of *tension* between what the cultural tools available to us allow us to do (affordances and constraints) and the ways we are able to *adapt* them to do new things. In fact, managing this 'tension' is an important aspect of the definition of 'literacy' we will develop below and in the rest of this book.

Furthermore, we rarely use media in isolation. We almost always mix them with other mediational means. As we saw with the example of the wristwatch, using one tool (like a watch) often affects how we can use another tool (an airplane). Sometimes the affordances of one medium help us to overcome the constraints of another. More and more, in fact, different media are merging together. Mobile phones, for example, have become devices which we use not just to have phone conversations but also to check email, send text messages, surf the internet, check stock prices and the weather, take snapshots and videos, and play games. Similarly, social networking sites like Facebook are **mashups** of multiple tools, integrating the functions of photo albums, email platforms, instant messaging programs and blogs.

Therefore, instead of thinking about media in a simple, 'one-to-one' way – a single technology with a clear set of affordances and constraints being used to take certain discrete actions – it's better to think of media as parts of systems of actions and activities, meanings and thoughts, social organizations and identities. The applied linguist Jay Lemke (1998a) uses the idea of an 'eco-system' to describe the relationship technologies have to our activities, our relationships, our societies, and to other technologies. We ourselves and the tools that we use are parts of large 'eco-social' systems in which the affordances of one technology might create constraints in other technologies, the meanings that we are able to make in one situation might make possible new meanings in totally different situations, and the actions that we take now might have profound and unexpected effects on relationships and identities we might form in the future.

MEDIATION AND 'MORAL PANICS'

People have always had strong feelings when it comes to new media. This is not surprising since, as we said above, mediation is intimately connected to the ways we go about doing things in our daily lives, the ways we express meaning, relate to others, and even the ways we think. When new ways of doing, meaning, relating, thinking and being start to develop around new media, it is natural for people to feel insecure and to worry that their old ways of doing, meaning, relating, thinking and being that they are used to are being lost or marginalized.

In the past, whenever new technologies arose, people inevitably expressed concerns. When writing was developed, none other than the Greek philosopher Socrates declared it to be a threat to civilization. Under the influence of this 'new media', he insisted, people would lose their ability to remember things and think for themselves. They would start to confuse 'real truth' with its mere representation in symbols. Later, when the printing press was developed, there were those who worried that social order would break down as governments and religious institutions lost control of information. When the cinema came on the scene, some were afraid that people would stop reading books and spend all their time watching movies, and that what they watched would compromise their moral character. And when television became available, many people worried that it would make people stupid or violent, or both.

Similarly a lot of people today – including parents, teachers, and newspaper reporters – are very concerned about the effects of digital media and the new literacies associated with them on society and on individuals. Some of these concerns are justified, and some are based on emotions and insecurity. Interestingly, most of these concerns focus on the five kinds of affordances and constraints that we discussed above. People are worried that digital media are taking away people's ability to *do* some of the things we could do before, or allowing people to do things that they don't think they should do. People are worried that digital media are ruining people's ability to *make meaning* precisely and accurately with language. Some are worried about the effects of digital media on *social relationships*, claiming either that people are becoming isolated from others or that they are meeting up with the 'wrong kind of people'. Some are worried that digital media are changing the way people *think*, causing them to become easily distracted and unable to construct or follow complex arguments. And finally, others are concerned about the kinds of social identities that we are performing using digital media, worrying about how we can tell whether or not these identities are really 'genuine' or about how much of their own identities and their privacy they actually have control over.

We do not mean to belittle any of these concerns. On the contrary, much of this book will focus explicitly on these issues and hopefully facilitate more informed and deliberative debate about them, especially among educators and students. Too many books about digital technologies promote either the extreme view of **technological dystopianism**, that digital technologies are destroying our ability to communicate and interact with one another in meaningful ways, or the equally extreme view of **technological utopianism**, the belief that digital technologies will invariably make us all smarter and the world a better place. We wish to avoid these two extremes. Mediational means like computers and the internet are neither good nor bad – they simply introduce into our social interaction certain affordances and constraints in particular social contexts which we have the ability to respond and adapt to in any number of creative ways, some with positive social consequences and some with negative ones.

WHAT ARE 'DIGITAL LITERACIES'?

Before ending this chapter, it's very important that we explain more about the title of this book and what we mean by it, and especially by the term 'digital literacies'. As we have seen above, using media is a rather complicated affair that influences not just how we do things, but also the kinds of social relationships we can have with other people, the kinds of social identities we can assume, and even the kinds of thoughts we can think. When we talk about being able to use media in this broader sense, not just as the ability to operate a machine or decipher a particular language or code, but as the ability to creatively engage in particular *social practices*, to assume appropriate *social identities*, and to form or maintain various *social relationships*, we use the term 'literacies'.

'Literacy' traditionally means the ability to read and write. Someone who can't read or write is called 'illiterate'. But reading and writing themselves are complicated processes. Reading and writing in different situations requires very different skills. For example, you write an essay for an English class in a different way than you write a lab report for a physics class or a comment on your friend's Facebook wall. The reason for this is that you are not just trying to make different kinds of meanings, but also to establish different kinds of relationships and enact different kinds of social identities. There are also a lot of other activities that go along with reading and writing like looking things up in the dictionary, finding information in the library or on the internet, and figuring out the right way to package information or to 'unpack' it in different kinds of texts. Finally, reading and writing often involve encoding and decoding more than just language. They might also involve using and interpreting pictures, the spatial layout of pages or the organizational structures of texts.

It should be clear from the above that literacy is not just a matter of things that are going on inside people's heads – cognitive processes of encoding and decoding words and sentences – but rather a matter of all sorts of interpersonal and social processes. Literacy is not just a way of making meaning, but also a way of relating to other people and showing who we are, a way of doing things in the world, and a way of developing new ideas about and solutions to the problems that face us.

This view of literacy as a *social* phenomenon rather than a set of cognitive or technical abilities associated with individuals was pioneered by a group of scholars in the 1980s and

1990s who called their approach 'the new literacy studies' (see, for example, Barton, 1994; Gee, 2008; Scollon and Scollon, 1981; Street, 1984). There are also those, however, who study what they call 'new literacies' (see, for example, Lankshear and Knobel, 2006), meaning that they focus on more recently developed literacy practices which are often (but not always) associated with 'new technologies' like computers and the internet.

In this book, what we mean by 'digital literacies' is informed by both of these traditions of research. For us, 'digital literacies' refers to the practices of communicating, relating, thinking and 'being' associated with digital media. Understanding digital literacies means in part understanding how these media themselves may affect the kinds of literacy practices that are possible. At the same time, we do not wish to fall into the trap of **technological determinism**, to suggest that new practices of reading and writing are determined solely by the affordances and constraints of the new digital tools available. An understanding of these affordances and constraints is important, but developing digital literacies means more than mastering the technical aspects of digital tools. It also means using those tools to *do something* in the social world, and these things we do invariably involve managing our social relationships and our social identities in all sorts of different and sometimes unpredictable situations.

To use the terminology we developed above, 'digital literacies' involve not just being able to 'operate' tools like computers and mobile phones, but *also* the ability to adapt the affordances and constraints of these tools to *particular* circumstances. At times this will involve mixing and matching the tools at hand in creative new ways that help us do what we want to do and be who we want to be. In other words, while we may seem at times in this book to focus quite heavily on the 'digital' part of digital literacies, that is, to dwell on the affordances and constraints of these new technologies, what we are really interested in is not the tools themselves, but the process of *mediation*, or, as others have called it, *mediated action* (Scollon, 2001; Wertsch, 1993), the process through which people appropriate these tools to accomplish particular social practices. It is through this focus on *mediation* that we hope to call attention to the *tension* between the affordances and constraints of digital media and the creativity of individuals and groups as they adapt these media to specific social goals and contingencies. As we said above, understanding this tension is central to understanding 'digital literacies'.

How, then, do 'digital' literacies differ from 'analogue' literacies like those involved in print-based reading and writing? Strictly speaking, the process of mediation and the tension between what tools allow us to do and what we want to do with them is fundamentally the same whether you are using pencil and paper or a word processing program. What *is* different, we will argue, are the kinds of affordances and constraints digital tools offer and the opportunities they make available for creative action. In many ways, digital media are breaking down boundaries that have traditionally defined our literacy practices.

One example is the way digital media are breaking down boundaries of time and space. Because of digital technologies we don't have to go to physical places like classrooms, libraries, offices and marketplaces to engage in literacy practices that were previously confined to particular physical places and particular times. Another example is the way digital media are breaking down barriers that traditionally governed the way we thought about language – for example, the distinction between spoken language and written language. One of the most powerful new affordances of digital media is that they make written language more interactive so that writing of all kinds has become more and more like having a conversation. Still another example, which we touched on briefly above, is the way digital media are breaking down the traditional barriers between media producers and media consumers.

Digital media are even breaking down barriers that used to divide literacy practices themselves. Because they facilitate new ways of distributing our attention, they allow us to participate in many practices simultaneously – we can work and study and shop and hold conversations with any number of people all at the same time (see Chapter 6).

Moreover, because digital tools have a different kind of materiality than physical tools like books, they have a greater capacity to be modified (or 'modded'), to be mixed, merged or 'mashed-up' with other tools, and to be adapted to unique circumstances and unique goals. And so mastering many of the literacy practices we will be discussing in this book depends not so much on being able to mimic things that others have done, but rather on being able to mix tools with one another and with environments and people to create *new* meanings and activities and identities, a process which we refer to in Chapter 7 as **hacking**. As Daniel Miller and Don Slater put it in their book *The Internet: An Ethnographic Approach* (2000:14):

> a central aspect of understanding the dynamics of mediation is not to look at a monolithic medium called 'the internet', but rather at a range of practices, software and hardware technologies, modes of representation and interaction . . . What we were observing was not so much people's use of 'the internet', but rather how they assembled various technical possibilities which added up to their internet.

In order to do this, however, we first need to have a good understanding of the fabric of affordances and constraints digital media make available to us to start out with. In the first part of this book we will focus on these new affordances and constraints, looking at things like search algorithms, hypertext, the read-write web, and the ways new technologies facilitate our ability to manipulate visual elements in texts like photographs and videos in ways never before possible. We will also explore how digital media enable and constrain different cognitive and social processes, ways of distributing attention across different tasks and ways of managing our social relationships. At the end of this section we will critically explore the degree to which these affordances and constraints act to promote particular ways of seeing and representing the world, to normalize particular kinds of behaviour, and to advance the agendas of particular kinds of people.

In the second half of the book we will go on to apply this analysis to specific 'literacies' that have grown up around various digital media and within various communities of media producers and consumers. We will examine practices like online gaming, social networking, peer production and collaboration, and practices involving digital media in the workplace.

Each chapter in the book includes a *case study* in which the concepts or principles discussed are illustrated with an example. In addition, each chapter includes *activities* that help you to apply the ideas we have discussed to examining and analysing your own digital literacy practices. At the end of each chapter a list of *useful resources* is provided for those who wish to explore particular topics further, and additional resources, examples and activities can also be found on the companion website for this book. At the end of the book we have included a glossary of terms, and throughout the book, whenever we introduce an important term for the first time, we will highlight it in **bold type** and include a definition in the glossary.

By the time you read this book, many of the 'new literacies' we discuss here will already be 'old' and many of the 'new technologies' may already be obsolete.

PART I

Digital Tools

CHAPTER 2

Information Everywhere

Understanding how to cope with and use **information** is one of the most important aspects of digital literacies. Many people nowadays believe that digital technologies have brought about a phenomenon known as **information overload** (Waddington, 1998), a condition characterized by increased levels of stress, confusion and difficulty in making decisions resulting from having 'too much information'.

In this chapter we will argue that the problem of 'information overload' is not so much one of 'too much information', but rather one of defining what we mean by information in the first place, and of understanding how to *create* it by forming strategic relationships between different pieces of data. While digital technologies have dramatically increased people's opportunities to create information, they also provide extremely sophisticated tools for **filtering**, and channelling information. Coping successfully with information involves understanding both the information *creating* and the information *limiting* affordances of digital media.

INFORMATION AND RELATIONSHIPS

Much of the concern about information overload comes from a fundamental misunderstanding of what information is. Think about walking on a busy city street. All around you things are happening. There are thousands of sights and sounds, text everywhere, from shop signs to advertisements on the sides of passing busses, people all around you talking, dressed in different clothes and wearing different expressions on their faces. Most people who find themselves in such situations do not feel they are suffering from 'information overload' because they do not consider everything that is happening around them to be information. They selectively pay attention to and process the **data** which they judge to be important for them. In other words, they *create* information from the data that is available.

And so the first distinction we need to make is between 'information' and 'data'. Data are 'facts' (including sights, sounds, colours, words) which exist in the external world. These 'facts' only become information when we create some kind of relationship with them.

Besides data and information, there is also a third category that we need to consider, and that is **'knowledge'**. Knowledge is what is created when information is integrated into our minds in a way that we are able to adapt it to different circumstances and apply it to analysing and solving problems. Knowledge is created when information is *transformed* in some way – when, for example, it is combined with other information or applied to a particular task in a useful way.

Let's return to the busy city street and consider how the concepts of data, information and knowledge apply. In that environment, when we read the data made available to us on signs and connect it to the data on the map we are carrying, we have created information; when we remember that information and interpret it to the extent that we can not only get from one place to another without having to read the signs, but we can navigate through the city in innovative and creative ways, discovering 'short cuts' and 'scenic routes', then we have created knowledge.

The biggest problem people have in 'managing information' is not that there is too much information but that we have too much data available to us, and we are sometimes not sure how to decide which of it is worth turning into information and knowledge. In other words, we have not adequately worked out how to filter all of the data that is available to us and in a way that results in useful information. The good news is that while digital media add to our confusion by making much more data available to us, they also provide a host of tools for filtering data, and for forming the kinds of relationships that transform data into information and information into knowledge.

And so, to sum up, information is not about 'facts' so much as it is about the *relationships* that we create between ourselves (and other people) and those 'facts', and between different 'facts'. In the first chapter we argued, quoting Michael Schrage (2001), that what is often referred to as 'the information age' is more accurately thought of as the 'relationship age', mostly because people seem to use computers as much to connect with and communicate with other people as they do to search for, store and manipulate information. Now we would like to take that idea even further, arguing that even these practices of searching for, storing and manipulating information are more a matter of *relationships* than they are of data itself. In other words, we would like to argue that information is most usefully seen not as a collection of 'facts', but as a *social practice* based on establishing relationships.

Activity 2.1: Reflecting on your information management habits

A. WHAT'S THERE

Think about all of the data that currently exists in all of your personal storage areas, including the hard drive of your computer, any space on servers or 'virtual disks' that you use, and any webmail or other messaging services (including Facebook) where you store messages and other data as well as physical spaces like bookshelves and desk drawers.

1. How much of this data would you consider 'information' and how much would you consider 'unprocessed data'? Give examples.
2. How much of this 'information' do you think you have successfully turned into 'knowledge'? In other words, how much of it have you been able to integrate with other information in ways that help you to formulate new ideas or solve problems?
3. How much of this data was 'pushed' onto your computer (or other storage area) without you asking for it? Give examples.

4. How much of this data did you actively go out and retrieve from some other place? Give examples.

B. WHAT YOU DO WITH IT

Think about how you manage, organize and use the data in your personal storage areas, including the tools and techniques you use to create information out of data and for limiting the amount of irrelevant data you are exposed to.

1. Do you have a system for organizing your data/information? Is this system useful in helping you find data to create information and find information that you can use to create knowledge?
2. What tools or techniques do you use to access data/information in your own personal storage areas? How effective are these tools and techniques?
3. Do you have a method or methods for identifying and removing irrelevant or unnecessary data from your personal storage areas?
4. Do you have a method or methods for preventing other people from pushing irrelevant or unnecessary data into your personal storage areas?

C. HOW YOU FEEL

1. Do you often feel frustrated when trying to locate relevant data? Explain.
2. Do you often become distracted from what you are doing by the other data available to you or being pushed to you?
3. Do you experience frustration at the amount of electronic data you need to process daily?
4. Do you spend a lot of time organizing and processing data which in the end turns out not to be very useful to you?
5. Do you have the constant feeling that there is data in your personal storage areas that you have failed to process correctly or fully? Do you feel like you have processed the wrong things or have failed to process the right things?

ORGANIZING DATA

The first step in creating information is having data available to us in a way that makes it easy to form useful relationships with it. Throughout history, human beings have come up with various systems of organizing and classifying data. An **organization system** is any system which makes it easy for us to locate the data with which we can form meaningful relationships in order to create information and, eventually, knowledge. Organization systems usually arrange data in relation to other data. They can exist in books or online or even in the arrangement of physical objects (the layout of the streets in a city, for example, can be seen as an organization system).

The most widely used organization system is the **hierarchical taxonomy**. The eighteenth century Swedish botanist Carl Linnaeus is usually considered the father of modern

work. On sites like Delicious, Flickr and Amazon, users attach tags to different files or other data that they either upload there or find there, and other people can use these tags to look for things that interest them. Of course, everybody has a different way of tagging based on their own judgments and their own opinions. I might tag a picture of Lady Gaga with words like goddess and sexy, and somebody else might use words like devil and obscene. So, if everybody is adding their own tags to the same piece of information, why doesn't this result in chaos?

The answer is a concept that the philosopher Pierre Lévy (1997) calls **collective intelligence**, a concept that we will discuss in more detail in later chapters, especially Chapter 11. The idea of collective intelligence is that if lots of people make decisions about how something should be classified or organized and you put all of these decisions together, you end up with a system that reflects the collective 'wisdom' of the community.

Many sites that use what has come to be known as **social tagging** present the results in the form of a **tag cloud** so you can visually understand how other people have tagged a particular item or group of items. In tag clouds, the more often a term is used to describe a particular item, the larger the word will appear.

For example, users of the site Library Thing (http://www.librarything.com/) tag books they have read with different key words. So, if you look up the book *Collective Intelligence* by Pierre Lévy, you get the tag cloud shown in Figure 2.1.

One advantage of this practice of displaying tag clouds is that it not only gives you a good way to understand what other people thought the book was about, but it also allows you to search for other books you might be interested in based on key words that are associated with this book.

These systems of classifying data that are invented by the people who actually use the data are called **folksonomies**, as opposed to the rigid, hierarchal *taxonomies* which we discussed above. Taxonomies are 'top-down' – that is, they are invented by experts. Folksonomies are 'bottom-up' classification systems. Some people argue that folksonomies are better than taxonomies because they better reflect the way real people think and classify information in their own minds. Others, however, are more sceptical. The writer Cory Doctorow (2001), for example, points out that collective tagging does not necessarily result in better classification systems for three reasons: 1) people lie (sometimes they just tag things randomly or try to confuse other people); 2) people are lazy (they don't think hard enough when they are doing their tagging); and 3) people are 'stupid' (most people are not very good at thinking up useful tags).

Figure 2.1 Tag cloud
(Retrieved February 12, 2011 from http://www.librarything.com/work/323515, used with permission)

It should be obvious by now that organizing data based on associative networks as opposed to hierarchical taxonomies dramatically changes what we can do with data and the kinds of connections and meaningful relationships that we can form with it. Hyper-linking and social tagging have also had a profound effect on social relationships, to some degree shifting the power to 'create knowledge' away from experts and towards the people who use the data. While this can discourage the ideological control of knowledge by a few powerful people, at the same time, as we will discuss further in the next chapter, it can sometimes make the ideological agendas behind the various associations formed by **hyperlinks** and tags less transparent and easy to detect.

Case Study 2: Search engines

Perhaps the most important and widely used digital tool for turning data into information is the internet search engine. Over the years there have been many different approaches to searching the internet, but nearly all search engines consist of three main components: 1) a *crawler* or *spider*, which is a software program that travels through the World Wide Web and retrieves data to be indexed; 2) the *indexer*, which arranges what has been harvested into a form that can be searched by the user; and 3) the *interface*, which consists mainly of a group of **algorithms** or sets of procedures by which the index is searched and the results of the search are sorted. All three of these components present special kinds of challenges for the designers (and users) of search engines. When they work well, however, search engines provide the enormous affordance of freeing us from hierarchical taxonomies and allowing us to take advantage of the associative networked structure of the internet.

Search engines were not always the preferred way for locating data on the internet. In the early years of the World Wide Web and even into the first years of the twenty-first century, 'directories' or 'web portals' were much more widely used. Portals, like Yahoo and AOL, were originally web pages with lists of links arranged in hierarchical taxonomies according to subject along with, as they developed, more things like news stories, weather reports and horoscopes. In fact, the development of the World Wide Web in the 1990s can in some ways be seen as a competition between the two systems of organization discussed above: the hierarchal taxonomy and the associative network.

The problems with using a **directory** to manage data on the World Wide Web are obvious. First, there is just too much data to fit realistically into a directory, and so the links that are included must always be selected by some central authority. Second, the larger a directory gets, the more time and labour intensive it becomes to search. And finally, as we stated above, directories lock users into rather rigid conceptual categories that may not match with the way they divide up data in their own minds.

Search engines also have problems, mostly having to do with the special technological challenges associated with the three components mentioned above. The first challenge is to develop a *crawler* that can harvest the massive store of data on the

web both thoroughly and efficiently. The second is developing a method for indexing the data so that the right kinds of search terms result in the right kinds of results. For example, if you are searching for York, you are probably more interested in York, England than New York, though most of the web pages on the internet containing the word York are about New York. Similarly, if you type in the name George Washington, you are likely more interested in pages *about* George Washington (the person) rather than pages that just mention him or pages about the George Washington Bridge or George Washington University. Lastly, there is the challenge of developing a set of procedures which will return results in a way which can help the user to judge their relevance to what he or she wants to know or do and facilitate the forming of useful relationships with and among these results. This set of procedures is called an 'algorithm'.

Over the years, different developers have gone about solving these problems in different ways. Perhaps the first great advance in search engine design came with the 1995 launch by Digital Equipment Corp. of Alta Vista, a search engine which, for the first time, made the efficient crawling and indexing of the web possible. The problem with Alta Vista and many other search engines of this period was that they lacked an effective algorithm with which to judge the relevance of results and so were open to abuse by 'spammers'.

'Spam' is a term used for unsolicited and usually unwanted data which is pushed onto your computer. The type of spam most familiar to us is email spam, but another important kind of spam is known as 'search engine spam', which refers to web pages which attempt to fool the indexing systems of search engines and 'impose themselves' into the results of unsuspecting searchers. Back in the 90s the most popular method for doing this was 'keyword stuffing' – filling webpages with popular keywords, often hidden (for example white text against a white background) in order to fool crawlers and indexers. For example, a pornography site might secretly embed the names of popular entertainment figures in order to trick search engines into listing them as the results for popular searches.

One of the most important developments in search technology was the invention of the **PageRank algorithm** in the late 1990s by Larry Page and Sergey Brin, two students at Stanford who went on to found Google. PageRank is based on the central idea we used to introduce this chapter: that information is not about 'facts', but about *relationships*. Thus, the 'information value' of any given piece of data comes from the number and strength of the relationships it has with other pieces of data and with other people. PageRank sorts search results in terms of relevance based on the number of other sites which link to them and the quality of these linkages. In other words, the more sites that link to a given site, the more 'important' that site is deemed to be. Not all relationships are equal, of course. If your brother links to your site, that may help you, but not much because not many sites have linked to his site. If, on the other hand, *The New York Times* links to your site, your site will go up in 'information value' since so many other sites have linked to *The New York Times.*