Introduction

> We do not *use* technologies so much as *live* them.
>
> (Winner, 1977, p. 202)

Today much of our writing is done with digital devices such as computers, mobile phones, and tablets, using various software interfaces. In industrialized societies, digital media have become so integrated into people's lives that it may well be that we have arrived at the point where we spend more time communicating via devices than we do communicating face to face. Digital technologies have influenced language and how we use it in a number of ways. Perhaps most obvious is the proliferation of new vocabulary. The Urban Dictionary, for example, currently holds over seven million entries defining acronyms, abbreviations, neologisms, and other forms of internet language, and it is currently adding entries at a rate of almost a million per year.[1] What passes as a routine thing to say today, like "I googled it, posted it on Facebook, and then tweeted it to my followers" would have been incomprehensible before Twitter's founding in 2006. We use computer metaphors to talk about our own behavior (I'm multitasking) and anthropomorphize our computers (I'm putting my computer to sleep). We give old words new meanings: *wallpaper* now refers to images that adorn a computer *desktop*, *mailbox* refers to an email directory, *backbone* refers to a main data pathway, and an *editor* is a software program used to write code. In Facebook, we 'friend' and 'like' by clicking a button. And we have created neologisms galore. We try to follow rules of 'netiquette,' we add expressiveness to our writing with 'emoticons,' and teenagers talk about being 'intexticated' (i.e., being distracted by texting on their mobile phones while they are driving or walking). And the diverse array of creative written forms that we see in texting, chatrooms, forums, and instant messaging sometimes ends up entering the mainstream. LOL, OMG, and ♡, for example, now figure as entries in the *Oxford English Dictionary*.[2] This is the most obvious level of change: new ways of talking to refer to new social phenomena and practices.

[1] urbandictionary.com.
[2] Laughing out loud, Oh my god, and love, respectively. OMG, however, cannot be claimed by the internet generation: it was first used in a letter to Winston Churchill in 1917.

But the ways in which we adapt our uses of language in online environments are accompanied by broader changes in how we read, how we write, how we interrelate, how we construe and share knowledge, and ultimately how we understand ourselves in relation to the world. These changes are not borne by computers alone, but are tied to a broad array of social conditions influencing how the powerful cultural systems of technology, language, and literacy interact.

The purpose of this book is to explore these changes. How are reading and writing, as cultural practices, influenced partly by the social environment (past and present) and partly by the material–technological constraints and possibilities of the mediums that people use to engage in those practices? And how do these social–material practices relate to the particular ways that individuals use language and other semiotic resources to shape meanings and identities in creative ways that may go against the grain of established conventions, or create new conventions?

In exploring these questions we will not limit ourselves to the digital era, but will take a broad historical perspective that helps connect what we do with computers today to older literacy technologies and practices, allowing us to see that much of what we consider 'new' in the computer age (such as hypertext, abbreviated language forms in SMS texts, manipulable text, multimedia) has antecedents in past practices, and that what we share with our forebears is the ongoing problem of shaping acts of communication in relation to sociocultural, material, and individual resources and constraints.

The central metaphor we will use to talk about this adaptive shaping is *design of meaning*.[3] Design has to do with the conception, planning, and shaping of some artifact for some intended purpose. As a verb, design focuses our attention on creative human processes. As a noun, design signifies the *products* of those processes. These products of design are drawn upon as resources for subsequent acts of design, generating an ongoing cycle of transformation. As will be elaborated in Parts I and II of this book, design involves the interaction of material resources, social resources, and individual resources – and reciprocally produces new resources for future acts of design.

Language, technology, and literacy are all processes and products of design. Let's take a moment to consider how the three terms of the title – language, technology, and literacy – will be viewed in this book.

Language and its manifestations

Language is a social and cognitive system that helps us create and express meanings. It is an 'open' system that accommodates variation and change at

[3] Design of meaning, to be described more fully in Chapter 1, was developed in the New London Group's (1996) manifesto, as well as in the work of Gunther Kress.

societal levels as well as idiosyncratic invention at the level of the individual. Consequently, language is not *just* a system, but also an adaptive human practice. And it is a practice that often involves material dimensions. While language operates in hidden and silent ways in our heads, it is observable when we speak, sign, or write. The particular ways we choose to actualize or materialize language in speech, signing, or writing will depend on many factors, such as our repertoire of words and structures, our purpose, our assessment of the setting, our interlocutor or audience and the social roles and expectations that are associated with them, our knowledge of discourse and genre conventions, and the particular ways our interlocutors are using language with us and around us in a particular context. In the case of writing, how (and how much) we write will also depend on what material resources we have available to us. We make choices about wording and about what to say and what not to say based on our past experience, but each new communicative situation we face will always be a little different from situations we have encountered in the past, so creative adaptation is a perennial necessity.

Language is often talked about as a *code* that allows people to communicate by signs that have commonly agreed-upon meanings. Computers also rely on codes for all aspects of their functioning. The common reference to *code* in both human and computer contexts can be misleading, for it reinforces a popular idea that human communication is a process of transferring information from one person to another. Since much of this book concerns computer technology and communication, it is important from the outset to clarify that communication between humans happens very differently from that within and between machines.

The fact that experience and linguistic repertoire will inevitably vary across individuals means that communication cannot be a matter of transmitting 'the same' meaning from one person to another. Human communication is more a matter of elaborating, monitoring, and negotiating meanings in ongoing dialogue with others, producing a kind of communal working draft that can always be revisited as needed, but left alone as long as it produces mutually acceptable results to the participants. As we produce discourse in collaboration with real or imagined others, we often assimilate further resources into our linguistic and discursive repertoire, but none of us possesses anywhere near all the possible resources. Moreover, language never signifies on its own. It always signifies in relation to the specific contexts in which it is generated and interpreted. Like money, which has only potential value until it is realized in the context of a commercial transaction, language's meaning potential is only actualized in contexts of use, whether in thought, speech, gesture, or writing.

Although we internalize language and frequently use it as a silent, personal resource for thinking, language is primordially a social phenomenon, and we first experience language in the world around us in audible or visible forms. Language therefore requires some kind of medium and an accompanying

technology of use. In the case of speech, the medium is sound waves moving through air, and the technology is the collection of processes involved in articulating, hearing, and interpreting sounds. In sign language, bodies, space, and light constitute the medium, which requires an embodied technology of producing, perceiving, and parsing gestures. In writing, the medium is a surface or space, and the technology involves the use of material tools to inscribe and interpret graphic signs.

In an era in which technology allows us to instantly transform speech into text, text into speech, and even brainwaves into speech or text (Low & Hawking, 2012), forms of communication are more protean than ever. Trying to locate the original source, the essential 'it' of language is an elusive pursuit, as meaning resources are widely distributed, both inside and outside people's heads.

The multiform materiality of language raises the fundamental problem of what relative status to attribute to each form. Language is often thought of as primarily spoken and only secondarily written. And hearing people may only think of signed language if reminded. This is perhaps due to the relative youth of writing and sign language, which go back five millennia and five centuries respectively, whereas speech presumably dates back hundreds of thousands of years. Moreover, while every society uses speech, not all use writing. And within societies that do use writing, not everyone learns to write, because writing requires conscious learning in ways that speech does not, and literacy is sometimes reserved for only certain social classes. Finally, although we may talk to ourselves and to our pets, we most often speak when other people are present. Writing, on the other hand, typically occurs when people are absent from one another, perhaps making writing seem less integral to human life.[4]

Indeed, from Plato and Aristotle through Rousseau, Saussure, Vygotsky, Jakobson, Bloomfield, and Steven Pinker today, the dominant assumption has been that writing is simply a *representation of speech* in a physically preservable medium. As Aristotle put it, "Spoken words are the symbols of mental experience and written words are the symbols of spoken words" (Aristotle, 2001, p. 1). In this view, written words are signs of signs, twice removed from the things they represent. "Writing is not language," Leonard Bloomfield went so far as to say, "but merely a way of recording language by means of visible marks" (Bloomfield, 1933, p. 21) akin to the use of a phonograph (*ibid*., p. 282). This predominant perspective is also reflected in the definition of writing proposed in the highly authoritative volume *The World's Writing Systems*:

> [Writing is] *a system of more or less permanent marks used to represent an utterance in such a way that it can be recovered more or less exactly without the intervention of the utterer.* (Daniels, 1996, p. 3)

[4] Exceptions include things like signing legal documents and autographs, which generally require the presence of others.

One problem with this writing-as-notation-of-speech view is that it implies that linguistic innovation and change occur only in speech (and are only subsequently recorded in writing), that writing never influences speech, and that the meaning-making resources of writing are subsumed by those of speech. Even a moment's reflection shows that such notions do not hold true. Centuries of literary expression and experimentation would not be possible if writing were limited to the representation of speech. To cite just a few examples, consider Apollinaire's *Calligrammes*, or Sterne's *Tristram Shandy*, or Joyce's *Finnegan's Wake*, or the creative forms used in online communication today – all of which innovate through resources specific to writing. Now, it may be true that few such written innovations lead to systematic change in spoken language, but that is not to say that writing does not influence speech. Putting aside the question of whether innovation has to influence the entire linguistic system in order to be considered significant, consider how pronunciations of words such as *falcon*, *figure*, *golf*, *humble*, *medicine*, *often*, *palm*, *victuals*, and *zoo* have been influenced by their orthography, or how acronyms (like AIDS, UNESCO) enter speech only after they have appeared in writing, or how formal spoken presentations often include syntactic structures normally used in writing. Most recently, internet written expressions like LOL, BTW, BRB, and <3 have found their way into spoken use as 'loll,' 'bee tee dubs,' 'berb,' and 'I less than 3 you' (i.e., I love you).

Regarding the notion that the meaning-making resources of writing are subsumed by those of speech, Derrida, for one, argues the opposite, that "there is no linguistic sign before writing" (1976, p. 14). In his view, writing precedes speech in the sense that words are inscribed *in the mind* before they are uttered. Echoing Kant's notion that the representation creates the subject, not the other way around, David Olson (1994) argues that because every written script can be verbalized, it serves as a model for speech. That is, by affording us a way of preserving 'what was said,' writing creates the categories through which we become conscious of speech, making it possible for us to generate dictionaries, grammars, logics, and rhetorics. But writing does more than both model and represent speech, for not every piece of writing can be read out loud with full preservation of its meaning. Since the earliest writing in Mesopotamia, there have always been texts that have no spoken equivalent, and today we can think of many examples, such as checks, receipts, signatures, spreadsheets, lists, business cards, contracts, recipes, reports, novels, concrete poetry, graffiti, and computer programs, as well as texts that rely on graphics, illustrations, visual play, typographic or formatting conventions, or other media to complete their meaning. In such cases, writing exceeds speech. However, it is also undeniable that intonation, rhythm, pace, articulation, and physical context all contribute to the meaning of a spoken utterance – and these are features poorly represented in writing. From this perspective, speech exceeds writing. The point is that language manifests in different forms in thought, speech, gesture, and writing. Although any one of these forms *can* represent another, it does not mean that

it is *limited* to representing another form. Rather, acoustic, visual, and mental manifestations of language complement one another as we make meaning. And the meanings we make will be influenced by the resources we choose to use (or that are chosen for us by their availability or by social convention).[5]

Writing will be the principal form of language dealt with in this book, although we will always try to keep in mind its interrelationships to other manifestations of language. Because writing is not *limited* to linguistic uses, however, we must define writing broadly as acts of designing meaning by means of graphic forms and space. Such a definition may disturb some readers by not specifically including language, but the fact is that although most writing is linguistic, not all of it is, and no writing is ever exclusively linguistic.

Finally we must make a distinction between scripts and languages. Any given script may serve a variety of different languages (think about how many languages are written in the Roman alphabet, for example). Conversely, multiple scripts can be used to visually mediate a single language (e.g., Japanese, which is written with *hiragana*, *katakana*, *kanji*, and *romaji*). Writing is adapted to language by historical accident, overt political decision, or individual initiative, but in all events, its signs bear an arbitrary relation to language.[6] That is because writing is a technological mediation of language.

Technology

Language and technology have ancient connections. One connection is etymologically based. The word technology comes from the Greek words *technê* (art, craft, knowing-how) and *logos* (word, discourse) and originally referred to a systematic treatment of grammar. It was not until the mid-nineteenth century that technology came to refer to a science of mechanical and industrial arts, which was about the transformation of raw materials into finished products.

The second connection has to do with the ways we put language to use. Technology and language have been intimately interconnected at least since the origins of writing, and arguably since the origins of language itself.[7] The

[5] Technologically mediated forms of language use (e.g., writing, telegraph, radio, TV, printing, Internet) have always been unevenly distributed in society. Consequently, people's access to certain forms of discourse and literacy practices also varies correspondingly.

[6] Consider, for example, the case of Azerbaijani, a language that has changed writing systems multiple times, all within the span of a century. Lester (1997) describes how Latin, Arabic, and Cyrillic scripts coexist in the Azerbaijani public realm.

[7] Although cognitivists such as Steven Pinker (1994) think of language as a human instinct, anthropological linguists such as Edward Sapir (1921) view it as a cultural artifact. Anthropologist Ruth Finnegan (1989) argues that even speech is a technology of communication since "it was neither 'natural' nor inevitable that human primates would automatically develop this particular form of communication technology" (p. 112). If we are to consider speech a form of technology, we need to acknowledge that it is an internal, embodied technology quite different from the external, disembodied technologies involved in writing.

technology of writing made language visible, which in turn made it possible for people to preserve language and to use it across distance and time. Writing also made language an object of analysis, leading to the development of metalinguistic notions of words, parts of speech, and rules, which could be codified in dictionaries and grammars. Sound technologies such as the telephone and magnetic recording allowed us to extend the human voice beyond its natural transmission distance. Film and video technologies added visual images, facial expression, body movement, sounds, and music to recorded speech.

Today, digital technologies integrate all these forms which were traditionally stored in their own distinct medium and format (paper, magnetic tape, polyester film) but now share a common underlying data structure encoded in zeros and ones, allowing unprecedented mixing and manipulation of media. Furthermore, unlike television and radio, which involve the one-way broadcasting of authorized programming from central distribution points to relatively passive audiences, internet-based technologies are notable for making all points of a network potential broadcast sources, thereby promoting the agency of individual internet users.

These changes in the material infrastructure of media, allowing rapid electronic transfer and easy editing, have been accompanied by social changes as well. Information and communication technologies have made it possible for us to make contact with people, images, ideas, and information from around the world faster and more cheaply than ever before. They provide the platform for new kinds of social encounters, new kinds of communities, and new kinds of learning environments that do not require bodily presence in a classroom. Corresponding to these new ways of relating to one another are new forms and uses of language that may lead us to rethink what we mean by writing.

Design, transformation, and mediation are three key processes of technology that will be elaborated in Chapters 1 and 2. We have seen that design is the creative process (and product) of transforming existing resources into new ones, in relation to particular needs, purposes, and contexts.

The kinds of transformations that we will be concerned with here are not so much those of converting raw materials into finished products, but rather the reworkings, reframings, and recontextualizations of symbolic resources having to do with language, communication, and identity. This may mean moving between modes of expression, such as from speech to writing or audio-visual presentation, or between languages, as in translation, but it also has to do with the transformations of signs, whether it is movement between iconic and phonetic representation in writing, or the movement from the zeros and ones of a computer storage system to what we experience as writing, sound, music, graphics, video, and so forth.

Mediation has to do with the ways that design is affected by 'things in the middle.' It might be the influence that a material medium (such as clay, stone, palm leaf, or smartphone) has on the ways that written signs are shaped and

produced. It might be the way that language structures our attention and thinking. Or it might be the ways that physical environments, cultural contexts, social role relations, and activity frames affect how people communicate. Although we may think especially of writing and computer-based communication as mediated, face-to-face communication is also mediated on several levels. There is the 'hardware' level of our bodies (brains, nerves, eyes, ears, mouths, hands, and so on) and the 'software' level of conventional, culturally based codes, both linguistic and non-linguistic. And, as mentioned earlier, air, light, and sound waves are essential mediational elements. So mediation involves both natural and cultural forms of support.

We don't usually think of face-to-face communication as having anything to do with technology because there is no overt 'device' involved. Even writing (say with the devices of pen and paper), does not seem very technological. That is because the more a technology is used, the more naturalized it becomes. "The most profound technologies are those that disappear," writes computer scientist Mark Weiser. "They weave themselves into the fabric of everyday life until they are indistinguishable from it" (Weiser, 1991, p. 66). Writing with computers is viewed as impossibly technological to some, and utterly non-technological to others. As one undergraduate put it, "It's only technology if it happened after you were born" (Lewin, 2012).

Technology is a moving target. Computer systems, applications, input devices are not only continually upgraded, but also the uses to which they are put are continually evolving. If we think of technologies as static objects, apparatuses, or tools, we lose sight of their social meaning. The Internet, for example, can be described in terms of objective facts about its complex structure, the number of nodes, the number of users, its software protocols, its transmission speeds, and so on. But such descriptions do not begin to capture the meaning of the vast and varied domains of human activity that people engage in on the Internet, from business and finance to research, communication, education, and entertainment. Each person who uses the Internet engages in particular configurations of practices, using particular resources, in collaboration with particular people, for particular purposes. Once a person develops a familiarity with particular resources, he or she is 'at home' on the Internet. But my Internet is not your Internet, and no one, anywhere, has done or will ever do everything that can be done on the Internet.[8] Most often we are engaged in local ecologies of activity that involve interaction both with technology and

[8] This is of course not unique to the Internet, but applies to any medium of communication. Writing to me is not what it is to Philip Roth. Television to me is not what it is to my mother. My radio is not my daughters' radio. And because we represent media to ourselves in individual, personal ways, even the 'same' artifacts will be different to different people. My Bible will not be the same as your Bible, my collection of music will not be the same as yours, even if we own the same music performed by the same performers.

with other people. We work, learn, and play in multiple online spaces as we move across particular applications, resources, and communication channels, and we use these resources in locally relevant – not universally uniform – ways. Facebook as it was used in Egypt to organize masses of people in the 2011 revolution is a different Facebook from 'my' Facebook, which I visit only very sporadically to see news from friends. The Internet is therefore an ever-shifting constellation of voices and spaces that are highly subjective.

At the same time, it is undeniable that each online space develops its own culture, embedded both in its design and in its users' practices. Facebook, for example, provides a structure for people to fill in with their own content. It embodies values like personal agency (e.g., crafting an online self-representation), openness (e.g., sharing personal information and preferences), and connectedness (e.g., multiplying personal connections). But it *shapes* these broad values in its own particular 'Facebook' way. For example, to craft an online self-representation, one uses Facebook's pre-determined categories of information, and the use of pseudonyms is strongly discouraged. Openness can quickly become invasion of privacy when a default setting disseminates one's information more widely than one expects. And personal connections ('friends') are not defined by any real familiarity with others, but merely by mutual willingness to be linked within Facebook.

The general approach adopted in this book is that technology does not determine cultural practices, nor does culture determine technology, but rather that technology and culture (and thereby language and literacy practices) are linked by interactive, symbiotic, reciprocal relations. In other words, it is difficult to 'factor out' the technological from the social, and the social from the technological. From this standpoint, issues will be framed less in terms of looking at how technology changes language use and more in terms of exploring how people deal creatively with the resources that new technologies present to them as they engage in traditional activities in new ways – or invent whole new social practices that take advantage of the possibilities afforded by new technologies. That is to say, the book is interested in people's eco-social adaptation to technological change, and how this adaptation is reflected in and shaped by their language use.

Most work devoted to the applications of technology to language education has tended to take a relatively narrow view of technology that centers primarily on how the computer and other digital devices might improve language, literacy, and intercultural communication skills. It divorces itself from millennia-old issues of how technology relates to language, literacy, and learning in terms of symbolic and mediational issues that are extremely relevant to educational programs today. One goal of this book, then, is to broaden the scope of our thinking about relationships between technology and language, and to derive implications for language and literacy education.

Literacy

Literacy lies at the interface between language and technology. In Jean-Christophe Rufin's dystopic science fiction novel *Globalia*, Puig Pujols, a persecuted journalist who has been stripped of his job, is confronted with the problem of how to write a message without his confiscated communications tool (called a *multifunction*). Having always used a 'voice converter,' he had never needed other writing tools. Fortunately, when he was a boy, his Catalan grandmother had insisted that he learn to write, not just to play with writing like other children. Pujols decides to write a paper letter if only he can find the necessary materials. He goes to a store and is offered toilet paper, wallpaper, or glasspaper. He finally finds writing paper in the 'bricolage' aisle. For a pen he has to go to the 'toys' section.

However far-fetched this may sound, Chinese professionals who use computers extensively are finding it increasingly difficult to remember how to handwrite the characters they learned as children (Demick, 2010; J. Lee, 2001), and a 2010 survey showed that three out of four respondents had few occasions to use handwriting in their daily lives (People's Daily Online, 2010). With a keyboard, most users type out the pinyin (phonetic, alphabetic) transliteration of what they want to write and the computer displays a corresponding table of characters from which they can choose. Or sometimes the computer automatically 'guesses' the appropriate character based on the semantic and syntactic context. In the US, cursive handwriting is undergoing a similar fate; recent newspaper articles report that young people are finding it increasingly difficult to read handwriting, much less write it (Zezima, 2011), and some state curricula are abandoning all instruction in cursive, focusing instead on keyboarding skills (Webley, 2011). Although the phenomenon of 'forgetting' handwriting is at present merely anecdotal, it resonates with ongoing debates about the role of technology in learning (for instance, fears of overdependence on spelling and grammar checkers, calculators, Wikipedia, and so on).

Our conceptions and practices of literacy in a particular time and place are always tied to material technologies of writing. Whether it is clay, wax tablet, papyrus, parchment, paper, or liquid crystal display, the materials with which we read and write have each introduced new possibilities as well as challenges for literacy and have each been associated with particular cultures of reading and writing. By this I mean beliefs and attitudes about writing, the specifics of what, when, why, where, and how people read and write, and patterns in who reads and writes and who doesn't. Cultures of reading and writing vary across time and place, of course. What literacy meant to the Ancients is not what it means to us today. And what it means today is not necessarily the same for a Muslim as for a Christian, or for a journalist, or for a graffiti artist, or for a teacher.