Keeping It Simple

John Seely Brown and Paul Duguid

The future of design in information technologies lies not in developing means of increasingly full re-presentation, but rather in allowing increasing amounts to be underrepresented; not by increasing what is said, but rather by helping people to leave more unsaid.

As head of research for Xerox, John Seely Brown directs the Xerox Palo Alto Research Center (PARC), where he initiated one of the first industrial computing-research groups focusing on understanding work practices, as an integral part of software and hardware development. Brown and Paul Duguid, a sociologist of technology, have written extensively on the social context of technological innovation.

In this chapter, Brown and Duguid draw on the history of print to reveal the universal nature of important aspects of technological change that we are witnessing anew in the so-called information revolution. They illustrate the subtlety and richness of background that people bring to each encounter with the designed objects that make up the physical fabric of their lives. They argue that information-system design has often overlooked the interplay between the designed object and its periphery—a relationship on which designers in longer-established domains intuitively rely. By using the complexity of a shared periphery as a design resource, designers can bring simplicity to the objects that they design.

The themes in this chapter were the basis for an entire issue of the journal Human–Computer Interaction (Moran, 1994), featuring a paper by Brown and Duguid entitled "Borderline issues: Social and material aspects of design." A group of 24 respondents—including a number of authors from this book—wrote commentaries from a variety or perspectives, including software design, human–computer interaction research, education, architecture, and many more. The intention of both the earlier paper and of this chapter is to draw attention to the wide periphery that surrounds software design—to the span of issues that can affect the suitability, usability, and desirability of the software that designers create.

— Terry Winograd

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Everything seemed insubstantial. The only solid evidence he had was a lump the size of a dodo's egg with a pain that bourbon couldn't kill. He had enough information to sail a ship on, but no clues to navigate by. Only a raft of words taking him nowhere, very, very slowly. They offered to tell him everything, but so did the dictionary. The victim was more eloquent. And those crumpled sheets on the bed spoke volumes that those flat white sheets of paper could never match. On those there was only words, words, words.

We are confident that you did not think that this chapter was embarking on a detective story. But why? No doubt our pastiche is not particularly good, but there is enough bad detective fiction around to cover our blushes. So why would no one expect that reading on would reveal "who did it"?

To find that out, we need to shift the question from "who did it?" to "what did it?" What made it clear, before all the pastiche we could muster, that this chapter was never going to be a detective story? The simple answer is the physical book itself. Its heft, its shape, its cover, its paper, and innumerable other things about it tell you, well before you read a word, that the book you are holding is not going to contain a detective novel. Even if a photocopy or a fax has stripped away much of the book's integrity, the remaining page layout, running heads, typography, shape of the chapter heading, indentations, and a tumult of other features implicitly insist that the pages you are holding do not contain a whodunit.

This kind of inference is not just relevant for books. Well-designed media provide peripheral clues that subtly direct users along particular interpretive paths by invoking social and cultural understandings. Context and content work together efficiently as an ensemble, sharing the burden of communication. If the relationship between the two is honored, their interaction can make potentially complex practices of communication, interpretation, and response much easier for designers and users alike. This relationship is the essence of keeping things simple.

Taking account of context involves more, however, than crafting a well-integrated interface. It also requires taking account of the continually evolving social conventions carried by context. As we suggest in this chapter, it is not enough to design an on-line newspaper that looks like a conventional newspaper or magazine. Designers have to take account of the complex social understanding engaged by the newspaper and underwritten by its physical form. This understanding goes beyond the objects themselves, to the social practices that are—in Gibson's (1979) term—afforded by those objects, and that might no longer be afforded if the objects changed. The resources for design are not all in the designer's hands. Many are developed in use. The challenge, then, is not just to design an interface that looks like a book, a newspaper, a magazine, a library catalog, or whatever. It is to engage and develop, in a new medium, the ever-changing social understanding that emerged first around these artifacts and still draws on their material properties.

There are two reasons why it is important to bring the attention of software designers to the interactions between content and context—or between other related divisions, such as center and periphery, content and form, message and medium, or information and noise.

First, the greatest challenge that designers and users face is achieving clarity and simplicity. Yet many discussions of design overlook ways in which peripheral resources can help us to clarify and simplify.
Second, the truly revolutionary impact of the information revolution will be not in the new ways that technology can separate message from medium by making everything digital, but rather in the continually new ways that it finds to recombine message and medium creatively. Software design, in particular, ambiguously straddles divisions of form and content. If we are to go beyond designs that remain heavily dependent on older technologies and forms, designers need to develop a fine sense of the redistribution of resources made possible by software technologies.

This chapter directs attention away from central information and functionality, to the peripheral clues that crucially shape understanding and use. In the future, the role of the designer may lie as much in enabling and seeding new practices and new interpretive strategies as in building new technologies.

**Detecting Resources**

In opening the chapter with an example drawn from books, typography, and page layout, we may at first appear lost in the Gutenberg revolution rather than concerned with its information successor. The dramatic proliferation of the world wide web (Profile 5), however, indicates that both the document metaphor and documents themselves may be as significant to the information galaxy of cyberspace as they were to its Gutenberg equivalent. Furthermore, documents are a powerful example of the way that people use peripheral resources to underwrite the efficient use of all sorts of technologies. We offer document-based examples, then, for two reasons. First, it is still important to understand documents and document use. Second, documents are a specific instance of a more general phenomenon: People read and interconnect artifacts much as they read and interconnect documents, taking into account not just the established text or functionality, but also the clues provided by context.

Consider, for instance, something as simple as a telephone-answering machine. The conventions for its use are not self-evident. A moment's thought reveals that the common message "I'm not here now" is, in the abstract, nonsense. Whomever "I" refers to should be "here," wherever here is, "now," whenever the phrase is uttered. Yet, in practice, despite its formal incoherence, the phrase turns out to be much more efficient than are attempts at formal coherence, such as "If you are hearing this message, then I will not be at home at the time at which you will be calling."

What gives the more pithy phrase its effectiveness? Clearly, the words alone do not clinch the matter. To be understood, they rely on peripheral clues for interpretation. Background clicks and whirs, hisses from the tape, and the recorded quality of the voice itself all help callers to realize that they are hearing a recorded message, and thus prepare them for a message's particular—if in the abstract peculiar—logic. These *peripheral resources* are not usually regarded as part of the information with which information technology is concerned. Yet, appearing unproblematically in the hiss of a recorded message, peripheral contributions can nevertheless be unquestionably informative, allowing the person leaving a message and the person hearing it to communicate with a simple efficiency.

Important though they may be for design, these peripheral resources are not necessarily designed themselves. More usually, they evolve, as people—often unreflectively—enlist the support of contingent properties of a technology to keep things simple. Answering-machine messages once included the clumsy announcement, "This is a recording." As the quality of telephone lines rose relative to the
quality of tape recordings, people found that they could drop the introductory phrase. The distinctive tone of the message made the fact that it was a message self-evident. Further changes can render these evolving resources extinct. Now that the quality of the recorded message is again level with that of the live voice, useful peripheral resources have been lost. Callers find themselves addressing a recorded voice as though it were live, and consequently clumsy introductory phrases such as "Hi, this is a recorded message . . ." are returning.

**Inescapable Evidence**

The idea that there is a clear boundary between information and noise, of course, is not a product of new information technologies. Standard accounts of the Gutenberg revolution portray the book as having been a radically new way to liberate information from the contextual constraints that accompanied spoken language. The information revolution is portrayed as a continuation of this process, providing more effective ways to free information from restraining material encumbrances.

In attempting to rid communication of peripheral resources, such accounts evoke the old game in which children challenge one another to describe an awkward object, such as a spiral staircase, without using their hands. As a game, this challenge is amusing; in practice, if you have to show someone what a spiral staircase is, it is almost always much more efficient to use your hands—particularly if you can point to an example. The material world is rich with explanatory resources, in part because most of our explanations involve the material world. Abandoning it, therefore, is not only a difficult task, but also a step that is unlikely to make things simpler.

As an example, consider the library. At least since Vannevar Bush (1945) described his idea of Memex (a proto-hypertext system), people have sought to distill information out of libraries. Attempts to extract information from its embodiment have been problematic, because Bush and many of his followers see libraries and books themselves as little more than antiquated storage devices. The transferral of the content of books and other publications to hypertext databases has left behind elaborate and important interpretive resources.

For instance, the piece of information that George Washington said, "I cannot tell a lie" would probably be stored in many different contexts in any conventional American library. Among others, it would be stored in later editions of Mason Locke Weems's biography of George Washington; in Mark Twain's works; in books with titles as varied as *History and Ideology, Our Presidents*, and *Every Child's Own Encyclopedia,* (and perhaps in a book about software design). These different locations are not irrelevant. Where it is stored, how it is stored, and even that it is stored provide important resources for assessing what is stored.

On its own, the sentence about Washington cannot tell us how it should be interpreted and valued. The range of possible interpretation goes well beyond a simple assessment that some of the books contain correct information and others contain falsities. Historical fables, after all, whether true or false, may be highly illuminating. But the reader still has to work out whether the statement appears in a fable, and, if it does, in what kind of fable: sincere, ironic, humorous, popular, local, widespread, and so forth.
In practice, readers rarely have to consider all available options. Before they come to the sentence, the particular bound book and unfolding linear narrative will have significantly narrowed the interpretive options. One book will provide reliable indicators of what Washington is likely to have said, another what Twain wrote, yet another of what Weems said Washington said, and so on.

People need to know more than what a piece of information means. They also need to know how the information matters. Evaluation requires more than the information itself, which cannot validate its authority any more than it would validate a bad check to write "good" on its face.

All books and all the bits of information that they contain are not equal. Different kinds of books efficiently provide different kinds of warrant for the information they offer. With book technology, society has developed conventions that allow both writers and readers to use the material objects themselves to limit interpretation, to warrant information, and to keep communication relatively simple. Designers of digital libraries, or even just designers of other document forms, such as pages for the world wide web, will need to find and create alternative resources for the interpretive reliability and simplicity provided by older communicative artifacts.

**Picking Up Clues**

Schooling may stress abstract information, but students learn a great deal more than schooling explicitly stresses. As they read comics, novels, biographies, mysteries, true crime stories, and textbooks, they learn to distinguish different types of books and the types of information contained within those books. With the help of external clues to interpretation, readers confidently learn to distinguish fiction from nonfiction; to distinguish books of detective fiction from books about detective fiction; and to recognize irony, parody, and pastiche as distinct from the forms on which they are based.

Moreover, people approach more than books in this way. They seek interpretive clues in the periphery of all sorts of communicative interactions. They distinguish different kinds of movies, videos, and TV programs, and can usually flick unerringly from news breaks to soap operas, from docudramas to movies, from advertisements to MTV videos, navigating as much by the context as the content. They learn to distinguish almost on sight consumer products from commercial appliances, personal media from professional media, educational software from entertainment software, and so on.

In learning to recognize and distinguish information, people behave like good detectives, continually working with the clues that they find at the scene, extrapolating from partial evidence to the whole story. To engage these practices, good designers, by contrast, need to be more like bad criminals than good ones, always leaving behind a traceable array of clues.

Of course, designers and users are not always in cahoots. Although some designers and users have corresponding interests, there are other designers who, for a variety of reasons, set out to penetrate users' defenses by scattering misleading clues. We see this approach in junk mail that imitates personal mail, in advertisements that imitate rock videos, and in bogus software that imitates genuine programs. In each case, if the center looks authentic (if it does not, the subterfuge fails immediately), wary users continually look for more and more refined clues in the periphery to distinguish the genuine. The designers, meanwhile, are equally trying to craft a more
perfect subterfuge.

**Material Witnesses**

Attempts to separate the material form from an informational content are highly problematic, both in theory and in practice. To take a practical example, consider the daily newspaper. At first glance, it certainly seems reasonable to think of separating the material form from the information, the paper from the news. Yet, to date, the conventional newspaper survives, despite the arrival over the years of radio, newsreels, television, and news databases, each of which was thought likely to make newspapers irrelevant. Highly visible failures to sell online news—such as Knight-Ridder's Viewtron, which lost $50 million (DeGeorge and Byrd, 1994)—show that this task is far from easy. The material contribution of the medium helps to explain why the newspaper survives.

The newspaper does not just report news; it makes news. The underlying paper has a significant role in that making. First, only certain items can fit within the bounds that paper provides. In general, what gets in is news; what does not is not news. Second, the circulation of unchanging newsprint through a society (ensuring that the same news is available to everyone at roughly the same time) turns those items into *social facts*—common to a broad readership. Politicians are disturbed to find their scandalous behavior splashed under the headline not because the story is news to them, but because it has become front-page news to 100,000 other people. The newspaper has been described as a "1-day best seller"—and, as with other best-sellers, the point is that everyone is reading it. It is the collective selection, presentation, and circulation of information that turns that information into news.

Consequently, the idea that readers should gather items individually out of a vast database misses the point. Although the resulting copy might look like a conventional newspaper (as in Figure 7.1), the items included would lack the social status and warrants that comes from the combination of editorial selection, location on the page, and wide distribution. The personally tailored, genuinely unique newspaper, selected privately from a database, offers neither physical nor social continuity. Each individual output would be no more than that—individual, with little or no indication of its social significance.

>>>>>>>>INSERT FIGURE 7.1 ABOUT HERE<<<<<<

**Figure 7.1 Personalized Online Newspaper** Online services provide users with personalized information, duplicating the look of a paper newspaper on the computer screen. These custom pages have a superficial appeal, but they miss the underlying social significance of a newspaper, which draws its power from the shared communicative space created by the social traditions of how a newspaper is edited, organized, and distributed. (*Source: Courtesy of WAIS, Inc.*)

In recognition of the newspaper as a maker of news, both broadcast and on-line news services tend to defer to—and often to report—what major papers carry. Furthermore, in acknowledgment of the significance of the newspaper's physical structure, these secondary sources often note whether the story that they report was on the front page or in the business section, and, occasionally, whether it was above or below the fold. In relaying news in this way, broadcast forms indicate that, even though they too make news, they lack the resources to structure news in similarly informative ways. On-line sources, in general, make it clear that they do not even
make news. What they carry as news comes from other sources—primarily print media. As yet, however, they have not developed ways to provide and warrant information on their own. Their dependence on the conventional press strikes us as an instance of a significant, more general point. If designers fail to understand how to encode and warrant information within new technologies, they and their new designs will remain unnecessarily dependent on old technologies.

Border Guards

If information is to be socially encoded and decoded, as it is in the newspaper, the peripheral clues must inevitably circulate with the information. The extent to which peripheral objects are shared varies considerably with the type of social interaction and the type of technology. In face-to-face communication, a speaker can use words such as I, you, here, or that, knowing that listeners have access to the same periphery.

Similarly, with fixed objects, people can predict with reasonable confidence what clues will be available for future participants. For example, a building remains in a fairly continuous relation to its periphery. As you approach a building, you meet an array of architectural strategies designed to refine these expectations: The landscaping, the relation to neighboring buildings, the massing, and the color all tell you about the building. The ways in which pathways lead you to the building—to the front, around the side, through the middle—further develop your sense of the interior spatial relations and even of the interior social relations. An architect can rely on the presence of these fairly stable objects in the periphery to give a visitor much of the code required to read the building itself.

When interaction is no longer face to face, or when objects no longer have a fixed periphery, use of the periphery is inevitably more complex. When objects travel across space and time, only certain aspects of the original context travel with them. Instead of working in juxtaposition to a relatively unchanging, broad periphery, users have to rely on a far narrower band of unchanging features. We call this area the border. Although partial, the border can be helpful. For instance, at the opening of this chapter, we were able to use words such as "we," knowing that the names of the joint authors would be evident, and "this," to refer to the book in your hands. Of course, the border has its limits. We cannot use "now," or "over there," because we have no idea when or where the chapter might be read.

Book covers provide a well-used example of a border resource becoming established. Before the nineteenth century, booksellers bound most books for individual customers, so readers of a book did not all see the same cover. Consequently, a shelf of eighteenth-century books, although it may look beautiful, is usually not informative; it is just a row of large books in calf skin bindings, which tell you more about their owner than about the books' content. By the twentieth century, publishers had taken over the process of bookbinding, and all copies of a particular edition had the same cover. Book covers developed into a highly informative social resource. Look along a shelf of contemporary books, even without reading the titles or cover copy, and it is relatively easy to recognize the types of books—to distinguish the adult encyclopedia from the children's, the political-science treatise from the pot boiler, or whatever.

Admissible Evidence
People learn to interpret the information within buildings or books according to the type of building or book in which they find it. Drawing on literary terms, we call these types genres. Just as, in literature, deciding whether a piece is a short story or an essay makes a great difference to interpretation, so, more generally, recognizing the genre of a communication or of an object is important. To return to an early example, the genre established by the hiss of the answering machine allows you to leave a simple salutation that a caller can decode despite its problematic logic.

Genres also allow similar information to have different interpretations. The request "Don't miss this event!" on a softball invitation has a meaning distinctly different from the meaning it would have in a memorandum from the boss. Indeed, people are implicitly considering these differences whenever they choose a particular type of communication: the telephone for an informal chat; electronic mail for a reminder; a memorandum for a message with authority; a business letter for a formal bid, and so forth. By choosing a certain border for their message, they are attempting to constrain the interpretation of the message.

Genre is an important concept in software design for three reasons.

First, in any form of communication, genres engage socially shared knowledge. Establishing the genre for a particular communication—whether it be academic essays, collegial electronic-mail notes, film noir, music videos, or computer games—draws on knowledge shared within the groups that use these particular forms. The more that a level of shared expectation can be assumed, the less needs to be said explicitly about how the information should be read. Conversely, the less that is shared, the more that needs to be said, and the harder communication becomes. The borders of genres provide sturdy yet light scaffolding for the simple coproduction of complex structures. In this way, they are central to the task of keeping things simple.

Second, because information is always formed with regard to one genre or another, understanding genres is crucially important to dealing with the demands of the information age. So, for example, one way to make knowbots more efficient at navigating through databases is to make them responsive to genre cues. They can then distinguish (as readers do) the different values of the same sentence occurring in the National Review, the Nation, the National Inquirer, or the National Lampoon, using broad generic clues rather than specific and particular knowledge of periodicals and magazines.

Third, as we argue in the final two sections, to fulfill their potential, new technologies require new genres. These genres emerge naturally, and can also be the subject of conscious design.

**Breaking the Law**

So far, the picture of genres that we have painted is inherently conservative. We have primarily noted ways in which it is either important or helpful to stay within the bounds set by genres and their borders. But that is not the whole story. Design evolves and innovates to a significant extent by crossing boundaries, rather than respecting them; by flouting conventions, rather than by heeding them. In breaking through the old, we open new frontiers.
Breaking the bounds is particularly familiar to good artists, who continually push at the constraints of their chosen forms. Their transgressions often involve a two-step process: As unseen boundaries are crossed, they are simultaneously brought to light. In raising the condemnation that "this thing is not art," for instance, artists force people to think about what art is, what its conventions are, and what results from conforming or not conforming to them.

Crossing boundaries is not always beneficial. Staying within the old forms may fail to engage and develop new types of interpretation. But paying no heed to established conventions may fail to engage any coherent interpretation at all. It takes a fine sense of genre to negotiate a path between these two extremes, and the right path is often the subject of much debate over the development of new expressive forms.

In jazz, for instance, Miles Davis claimed that Wynton Marsalis was too respectful of old forms to go anywhere new. Other musicians, however, criticized Davis for moving too far beyond conventional forms to be understood. Almost every time that he moved across musical boundaries, Davis was charged with incoherence. (One reason that Davis disliked the reverence paid to older jazz forms was that he had played them when they were new and judged unintelligible: "Don't tell me the way it was. Hell, I was there... no one wanted to hear us when we were playing jazz," he once complained.) Before long, however, it usually became apparent that he had built a new audience for his work, and a new frontier for musicians—often led by Davis himself—to cross.

In a time of changing technologies, it is not surprising to see a profusion of new genres. Through techniques of mixing, dubbing, cutting, and sampling made much easier by the wider availability of recording equipment, hip hop has revolutionized older forms of contemporary music. Hypertext technologies, poaching strategies, and Internet zines have innovatively disrupted conventional ways of writing and reading. And cheap editing technology, on the one hand, and the disruption of linear control provided by video players and CD recordings, on the other, have led to creative changes in both video and film. When technology forces the pace, designers—like artists—need to keep an eye not just on emerging technologies, but on the emerging interpretive genres as well. The most responsive will, like Davis, be capable of developing new forms, and of bringing new audiences into being.

**New Forms of Escape**

In new media as in old, the general context crafted by designers provides individual producers and consumers with key resources for coproducing the content. Media are clearly no longer neutral carriers. As new genres evolve, old boundaries are erased; what was once the border is absorbed into content, and new borders emerge elsewhere.

Theories of design, however, sometimes shy away from blurred distinctions. Computer design clung too long to an oversimplified division between software and hardware. Apple Computer's managers, for example, may have been fatally indecisive in failing to make up their minds whether the company was dealing in hardware or software, and in failing to discover how to avoid the dilemma. Now, new shifts in software are making previously clear distinctions even trickier to maintain. Classic applications—such as spreadsheets and word-processing programs—make software appear as form or content provider. But the software is more intricately a part of the content in media such as computer games, MOOs (a game-based, shared, virtual environment in which on-line participants
working on individual computers can communicate and program collectively in real time), HTML pages on the world wide web (see Profile 5), and complex documents in SGML (a sophisticated markup language widely used to translate books and other documents into digital form).

As the distinction between program and content is becoming blurred, the distinction between software design and other forms of design is becoming harder to maintain. With games, is it possible to ask where software ends and content begins? In MOOs, are participants building a room engaged in design of content or doing collaborative programming? Is designing a home page for the world wide web a matter of document design, multimedia design, or software design? Can the task of design in cases such as these be simply divided between software designers and content designers? If it cannot, does software design teach the skills required for this sort of work?

As the technology shifts, software designers will need to acquire many of the skills and intuitions of other designers. (And, conversely, other designers will need the software designer's skills.) Both will have to develop a sense of the continual evolution of genres and of the way in which people's changing understandings of what is peripheral, what is part of the border, and what is at the heart of a design help to drive that evolution. Given an understanding of these interrelations, designers can influence the direction of evolution by seeding new genres, creating new audiences, and establishing new repertoires, much as artists do.

Design of genres, in our view, is the way to approach design today. New technologies are proliferating, as is the ocean of information with which they have to deal. New forms, genres, and conventions to accommodate technologies and information to human use seem, by comparison, to be lagging behind. The challenge for the future is not to develop new technologies, on the one hand, and new sources of information, on the other. Instead we need to seed and develop new interpretive conventions to make both the emerging technology and the information more manageable simultaneously.

The future of design in information technologies lies not in developing means of increasingly full representation, but in allowing increasing amounts to be underrepresented; not by increasing what is said, but by helping people to leave more unsaid; not in refining abstractions, but by making use of their inevitable impurity; not by making more explicit, but by leaving as much as possible implicit, and in the process keeping things simple.

Suggested Readings


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