

I n t r o d u c t i o n

Who could want computers everywhere? The saturation of the world with sensors and microchips should be a major story, and an active concern for all designers. Yet for several reasons, it is not.¹ Ever since the boom and bust of the Internet, many people feel that they have heard enough about computers. Since the events of 9/11, people fear that new roles for information technology are mostly about surveillance. Even without its political ramifications, the accumulation of “smart” devices in our lives increasingly seems misguided. Who wants more gadgets to own and manage—even ones that do not watch us? Who programs all this apparatus, and who among us can accept just how things have been programmed? Do smart machines generally force humans into stupid activities? These and other forms of information pollution have generally taken the shine off information technology. Meanwhile, the technofuturist imagination seems to have abandoned computing for biology. This is the century of the gene.

To turn our backs on computing would be foolish, however. To neglect further prospects in ambient, saturating, information technology will not make them go away. We would be wiser to accept them as a design challenge, to emphasize their more wholesome prospects (which are less likely to develop by default), and to connect them with what we value about the built world.

This is fundamentally a matter of embodiment. Digital networks are no longer separate from architecture. Unlike cyberspace, which was conceived as a *tabula rasa*, pervasive computing has to be inscribed into the social and environmental complexity of the existing physical environment. Situated technology may help us manage the protocols, flows, ecologies, and systems that form the basis of valued places; or it may add a layer of distrust, information glut, and experiential uniformity to them.

Unless this new field is to belong solely to technocrats, or tyrants, it demands richer cultural foundations. Here in the early 2000s, this

design challenge appears to be in play. Interface design has become interaction design, and interaction design has come into alliance with architecture.

Human life is interactive life, in which architecture has long set the stage. The city remains the best arrangement for realizing that human nature. But today information technology allows people to interact remotely, asynchronously, and indirectly. Digital systems that are carried, worn, and embedded into physical situations can fundamentally alter how people interact. Psychologists, ethnographers, architects, and cultural geographers barely understand the consequences of all this mediation in terms of their respective disciplines, much less the implications for any new synthesis in design.² Where design has occurred at all, it has been without these cultural considerations. Software engineers have pursued the accumulation rather than integration of technical features. Interface designers have emphasized first-time usability at the expense of more satisfying long-term practices.

Notions of what a computer is have not kept pace with realities of how digital systems are applied. As ambient, social, and local provisions for everyday life, those realities have become part of architecture. Whereas previous paradigms of cyberspace threatened to dematerialize architecture, pervasive computing invites a defense of architecture. In sum, my essential claim is that interaction design must now serve our basic human need for getting into place.

In this book I have attempted to weave several threads of consensual wisdom into a common basis for architecturally situated interaction design. This foundation incorporates the ideas of philosophers on embodiment, psychologists on persistent structures, architects on scale and type, engineers on embedded systems, cultural geographers on infrastructures, and environmental economists on the value of places. Although the word *ground* may represent this broad basis as well, the book's title more specifically represents how information technology must be moved from the center of our focal attention into the periphery; and conversely, how certain contexts become responsive through the addition of technology.

In the book's three sections, I examine embodiment in context, technological issues in context-aware computing, and cultural frame-

works for the value of context-oriented technology design. I have assembled arguments from architecture, psychology, software engineering, and geography to build a theory of place for interaction design.

Part I examines predispositions. What do we expect technology to be used for, what do we expect using it to be like, and how does any of that use enhance what we expect of everyday life? Many of these predispositions arise from our physical location, our embodiment, and our architectural settings. Persistent structures remain essential to how people understand and use the world. This is relevant as a basis for the current information technology paradigm shifts beyond cyberspace, and as a foundation for new forms of interaction design.

Part II turns from ends to means. Chapters 4–6 lay out the fundamental components of pervasive computing technology in terms of the physical gear (hardware), the symbolic models (software), and the patterns of usage (applications).

Part III explores the value of context-centered design. Chapter 7 presents interactivity as a cultural and not only technical challenge. Chapter 8 attempts to establish a worthwhile concept of place, despite that word's usually sentimental connotations. Chapter 9, in an apparent departure but essential turn, justifies place-centered design in terms of natural capitalism and psychological economics. All of these chapters emphasize the relevance of architecture and point to the increasing significance of interaction design.

This book should be of interest to people working in a variety of fields. They include the following.

Practicing digital designers. People who invent and integrate interactive systems now make a case for design. They need to understand recent developments and next steps in solving current problems. They also need to fill in background knowledge. They are strongest on day-to-day issues, and expect to learn more about how recent developments increase the practical role of design. They understand design advocacy quite well, but must be persuaded that the situation is changing with regard to the economic reductionism that they always face.

Researchers and developers in contextual technology. People who deliver reproducible results with empirical rigor need to understand

the legitimacy of design. They know they can no longer ignore it. How is design measurable and accountable? How do interaction designers establish a different outlook on what is legitimate knowledge? With regard to such topics, these people are looking for next steps on practical problem of systems integration. They bring much more knowledge of specific technologies, but may wish to see a bigger picture. They may not recognize meta-issues of design as proposition, however. They need to be convinced this problem is theirs too. They need examples as problem solutions. They want to know how to view their own issues as design problems.

Architects and urbanists. Architects, and those in related disciplines of the physical environment, need to become aware of the challenges and opportunities raised by ubiquitous computing. They need to understand where technology is going, and what it has got to do with architecture. They may have little knowledge of the new field of interaction design. They may wish to know its principles, at least, with a special interest in new operations and challenges it brings to the built environment. They have been conditioned to an outlook of continuing marginalization, however. Many architects have conceptual difficulty with the digital world, and they may not anticipate ubiquitous computing.

General readers. Many general readers maintain an interest in the history, criticism, and philosophy of technological change. They tire of futurism, however, and wish to think about technology in terms of social and environmental concerns. They see broad connections, and think that a good read should involve those. Their knowledge of history varies. They have no particular knowledge of design process. Their general interest lies in how times are changing, especially with respect to technology and environment. They will want to see potential for solutions, but not within immediate developments so much as a broader historical sweep.