Marc Weiser The World Is Not A Desktop What is the metaphor for the computer of the future? The intelligent agent? The television (multimedia)? The 3-D graphics world (virtual reality)? The StarTrek ubiquitous voice computer? The GUI desktop, honed and refined? The machine that magically grants our wishes? The right answer is "none of the above," because all of these concepts share a basic flaw–they make the computer visible.

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A good tool is an invisible tool. By invisible, I mean that the tool does not intrude on your consciousness; you focus on the task, not the tool. Eyeglasses are a good tool—you look at the world, not the eyeglasses. The blind man tapping the cane feels the street, not the cane. Of course, tools are not invisible in themselves, but as part of a context of use. With enough practice we can make many apparently difficult things disappear—my fingers know editing commands that my conscious mind has long forgotten. Good tools enhance invisibility.

I think the value of invisibility is generally understood. Unfortunately, our common metaphors for computer interaction lead us away from the invisible tool, and towards making the tool the center of attention.

Take multimedia. The idea, as near as I can tell, is that people already spend hours a week at home watching television, so clearly television

is attractive, and we want our computer interfaces to be attractive, so let's put TV into them. But a few things may be wrong with this line of reasoning—is everything we spend a lot of time doing attractive (like sleeping? breathing? worrying?). Will the attractiveness of multimillion dollar production TV translate to casual computer TV? And most importantly for this essay, should computer interfaces be attractive at all? Attractiveness is the opposite of invisible.

Take intelligent agents. The idea, as near as I can tell, is that the ideal computer should be like a human being, only more obedient. Anything so insidiously appealing should immediately give pause. Why should a computer be anything like a human being? Are airplanes like birds, typewriters like pens, alphabets like mouths, cars like horses? Are human interactions so free of trouble, misunderstanding, and ambiguity that they represent a desirable computer interface goal? Further, it takes a lot of time and attention to build and maintain a smoothly running team of people, even a pair of people. A computer that I must talk to, give commands to, or have a relationship with (much less be intimate with), is a computer that is too much the center of attention.

Take magic. The idea, as near as I can tell, is to grant wishes—I wish I were the person I am now, but richer, I wish my boyfriend were smarter and more attractive, I wish my computer would only show me what I am interested in. But magic is about psychology and salesmanship, and I believe a dangerous model for good design and productive technology. The proof is in the details—magic ignores them. Furthermore magic continues to glorify itself, as Robin Williams' attention-grabbing genie in Aladdin amply illustrates.

Take virtual reality. The idea, as near as I can tell, is that by moving to full-body sensing and interaction we'll solve the user interface problem by maximally utilizing all of our body's input and output channels. Setting aside for a later time the appropriateness of the "input" metaphor to humans being-in-the-world, VR seems to have the goal of the invisible computer behind the scenes. But is it really true that the problem with our current user interfaces is that we don't have enough of them. Is it a quantity problem—a little user interface is good, more is better? VR, by taking the gluttonous approach to user interfaces design, continues to put the interface at the center of attention, leaving the real world behind.

Take voice input. The idea, as near as I can tell, is that if I could just talk to my computer it would finally understand me. The problem is, if I could talk to my computer today, I'd have to talk in C or Fortran or C++, because that is what they understand. When I can send email to my computer and have it DWIM the answer, then I'll start to believe in voice computer for limited applications. Limited, because most of my life I am with other people, and I want to talk (or listen) to them, not to my computer. If I want to take notes, or glance at information, I want to do so unobtrusively. Voice command is so well-known in science fiction exactly because it is prominent and attention grabbing—fiction is supposed to hold our attention. A good tool is not.

I do think that research on agents, speech recognition, and so on is important; the problem is that they are all in the domain of the conscious interaction. The result is that the research dialogue is restricted to a narrower-than-necessary set of problems, rather than the broader problem of good, invisible, tools. I believe we could use a lot more attention on techniques of invisibility, including abandoning computers as we know them

To understand invisibility the humanities and social sciences are especially valuable, because they specialize in exposing the otherwise invisible. For instance, ethnography can teach us something of the importance of the details of context and setting and cultural background; feminist deconstructionism can teach us a little of the necessity of different, deeply lived, points of view to real understanding.

The clock and the clockwork machine are the metaphors of the past several hundred years of technology. Invisible technology needs a metaphor that reminds us of the value of invisibility, but does not make it visible. I propose childhood—playful, a building of foundations, constant learning, a bit mysterious and quickly forgotten by adults. Our computers should be like our childhood—an invisible foundation that is quickly forgotten but always with us, and effortlessly used throughout our lives. ■

Mark Weiser is principal scientist and manager of the computer science laboratory at Xerox PARC.
***email:* weiser.PARC @XEROX.COM**

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