

## Everyware

### The dawning age of ubiquitous computing

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#### Introduction

##### 1.

This book is an attempt to describe the form computing will take in the next few years. Specifically, it's about a vision of processing power so distributed throughout the environment that computers per se effectively disappear. It's about the enormous consequences this disappearance has for the kinds of tasks computers are applied to, for the way we use them, and for what we understand them to be.

Although aspects of this vision have been called a variety of names - ubiquitous computing, pervasive computing, physical computing, tangible media, and so on - I think of each as a facet of one coherent paradigm of interaction that I call *everyware*.

In *everyware*, all the information we now look to our phones or Web browsers to provide becomes accessible from just about anywhere, at any time, and is delivered in a manner appropriate to our location and context.

In *everyware*, the garment, the room and the street become sites of processing and mediation. Household objects from shower stalls to coffee pots are reimagined as places where facts about the world can be gathered, considered, and acted upon. And all the familiar rituals of daily life, things as fundamental as the way we wake up in the morning, get to work, or shop for our groceries, are remade as an intricate dance of information about ourselves, the state of the external world, and the options available to us at any given moment.

In all of these scenarios, there are powerful informatics underlying the apparent simplicity of the experience, but they never breach the surface of awareness: things Just Work. Rather than being filtered through the clumsy arcana of applications and files and sites, interactions with *everyware* feel natural, spontaneous, human. Ordinary people finally get to benefit from the full power of information technology, without having

to absorb the esoteric bodies of knowledge on which it depends. And the sensation of use - even while managing an unceasing and torrential flow of data - is one of calm, of relaxed mastery.

This, anyway, is the promise.

## 2.

The appeal of all this is easy to understand. Who wouldn't desire a technology that promised to smooth the edges of modern life, subtly intervening on our behalf to guide us when we're lost, and remind us of the things we've forgotten? Who could object to one that dispensed with the clutter of computers and other digital devices we live with, even while doing all the things they do better?

The vision is, without doubt, a lovely one: deeply humane, even compassionate. But getting from here to there may prove unexpectedly difficult. Everyday life, after all, is something that we already understand and already manage to muddle through, however gracelessly or inelegantly. We will have to balance whatever improvement we hope to achieve by overlaying our lives with digital mediation against the risk of unduly complicating that which is presently straightforward, breaking that which now works, and introducing new levels of frustration and inconvenience into all the most basic operations of our lives.

We will have to account for what happens when such mediation breaks down - as it surely will from time to time, given its origins in the same institutions, and the same development methodologies, that brought us unreliable mobile phone connections, mandatory annual operating system upgrades, and the Blue Screen of Death.

We will have to accept that privacy as we have heretofore understood it may be a thing of the past: that people will be presented with a bargain where access to the most intimate details of their lives is traded away in return for increased convenience, and that many will accept.

And we will have to reckon with the emergent aspects of our encounter with everyware, with all the ways in which its impact turns out to be something unforeseeably more than

the sum of its parts.

What we can already see is this: everyware will surface and make explicit facts about our world that perhaps we would be happier ignoring. In countless ways, it will disturb unwritten agreements about workspace and homespace, the presentation of self and the right to privacy. It contains an inherent, unsettling potential for panoptical surveillance, regulation and "rationalization." Its presence in our lives will transfigure our notions of space and time, self and other, citizen and society in ways that we haven't begun to contemplate.

We're just not very good at doing "smart," and yet it would seem that in everyware we're proposing to remake the very relations that define our lives, remodeling them on a technical paradigm nobody seems to be particularly satisfied with. A close reading of the existing literature on ubiquitous and pervasive systems is all that is necessary to feel the dissonance, trip over the odd dislocations that crop up whenever we follow old maps into a new territory. We become acutely aware of our need for a more sensitive description of the terrain.

### 3.

We will surely need one, at any rate, if we are to make sense of the wave of change even now bearing down on us. And we will feel this need in short order, because whether we're ready for it or not, everyware is coming.

It is coming because there are too many too powerful institutions vested in its coming, knowing what enormous market possibilities are implied by the conquest of the everyday. It is coming because it is an irresistible, "technically sweet" challenge, for designers no less than engineers. It is coming because something like it effectively became inevitable, the moment each of the tools, products and services we're interested started communicating in ones and zeroes.

It is coming - and as yet, the people who will be most affected by it, the overwhelming majority of whom are nontechnical, nonspecialist, ordinary citizens of the developed world, barely know it even exists.

This is not due to any inherent obscurity or lack of interest in the broader field; to date,

there have been some seven annual Ubicomp conferences, three Pervasives, and a wide scatter of smaller but otherwise similar colloquia. These are established events, in academic terms: well-attended, underwritten by companies such as Intel, Sony, Nokia and Samsung. There are at least three peer-reviewed professional journals exclusively dedicated to ubiquitous or pervasive computing. There has been no dearth of discussion of everyware...but little of this discussion, and virtually none that might offer enough information on which to build meaningful choices, has reached the mainstream.

There is a window of time before the issues we've touched upon become urgent daily realities for most of us, but it is quite literally narrowing by the day. As of this writing, "u-" for "ubiquitous" has already joined "e-" and "i-" in the parade of content-free buzz-prefixes used by the marketers of technology to connote trendiness; literally not a day goes by without the appearance of some relevant news item.

We hear about RFID tags being integrated into employee ID cards, a new modular sensor grid on the architectural market, a networking scheme proposing to use the body's own electrical field to carry information - and this in the general press, not the specialist journals. There's already a steady stream of prototype everyware emerging from the research labs and the more advanced corporate design studios, no matter if they're answers to questions nobody's much asked.

With actual, consumer-facing applications (and implications) starting to appear, it's time for discussions about its potential for risk and reward to leave the tight orbit of academic journals and conferences behind. If everyware hasn't yet reached its Betamax vs. VHS stage - that stage in the adoption of any new technology where the standards that will determine the particulars of its eventual shape are ironed out - we can see that it's not so terribly far off. It's time for the people who have the most at stake in the emergence of this technology to be invited to the table. The challenge before us now is to begin thinking about just how we can mold that emergence to suit our older prerogatives of personal agency, civil liberty and simple sanity.

#### **4.**

I'm afraid that readers looking for a technical explanation of RFID tag readers, gestural interfaces, or operating systems capable of juggling the multiple, distributed events of ubiquitous environments, will be sorely disappointed. My intention in this book is simply

to describe what ubiquitous computing is; establish that it is a very real concern for all of us, and in the relatively near term; explore some of the less-obvious implications of its spread as a paradigm; and finally develop some ideas about how we might improve it.

How can we deliver the promise of everyware - the part about calm and relaxed mastery, the part that proposes to replace our balky computers with the effortless simplicity of the everyday - while forestalling some of the pitfalls that are already apparent? How can we, as users and consumers, hope to influence something that is already in the process of unfolding?

The pages to come will frame an answer to these questions. In the balance of this book, we'll explore what the emergence of robust, real-world everyware will mean, in terms useful to the designers and developers of such systems, to the marketers tasked with selling them, and to the policymakers charged with bringing them into conformance with our other agreements about the world. We'll consider some of the deeper context in which notions of everyware arise, in the hope that if we stand back far enough we can see how all its pieces fit together, and what is implied in their joining. And we'll do this without ever losing sight of the individual human being encountering everyware, in the hope that what we choose to build together will prove to be useful and valuable to that person, and supportive of the best that is in us.

If we make wise choices about the terms on which we accept it, we can extend the utility and convenience of ubiquitous computing to billions of lives. We stand a real chance of improving the experience of the everyday, addressing dissatisfactions as old as human history. Alternately, we can watch passively as the world fills up with ubiquitous systems not designed with our interests at heart - at best presenting us with moments of hassle, disruption and frustration beyond number, and at worst laying the groundwork for the kind of repression the despots of the twentieth century could only dream about.

The stakes, this time, are unusually high. A mobile phone is something that can be switched off, or left at home. A computer is something that can be shut down, unplugged, walked away from. But the technology we're discussing here - ambient, ubiquitous, insinuating into all the apertures everyday life affords it - will be environment-

forming in a way neither of those are. There should be little doubt that its advent will profoundly shape both the world and our experience of it in the years ahead.

As to whether we come to regard that advent as boon, burden or blunder, that is very much up to us, and the decisions we make now.