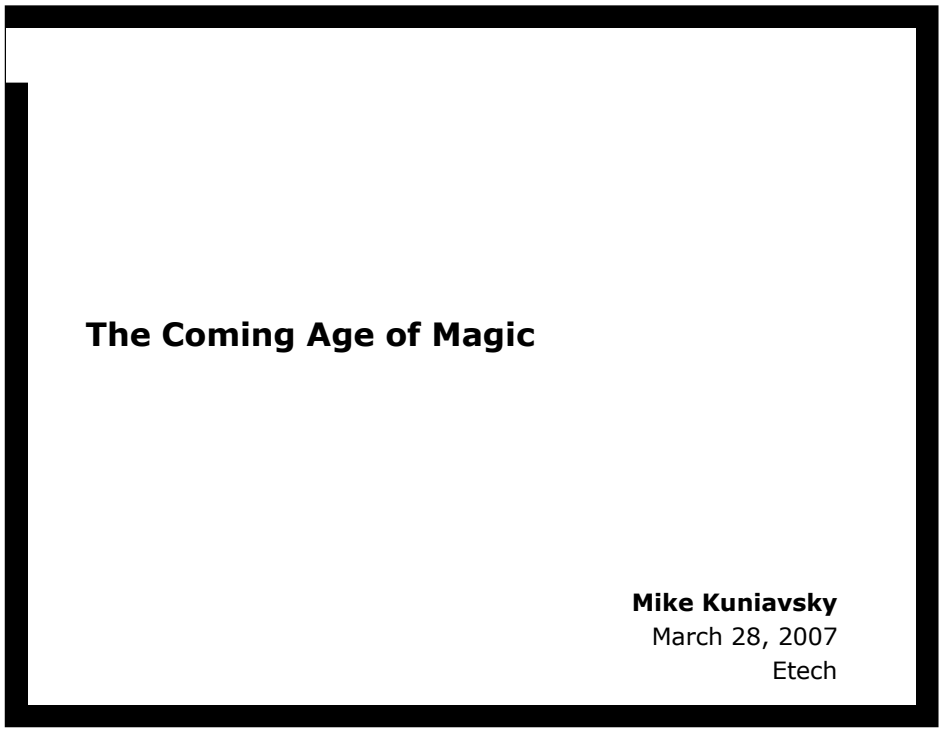


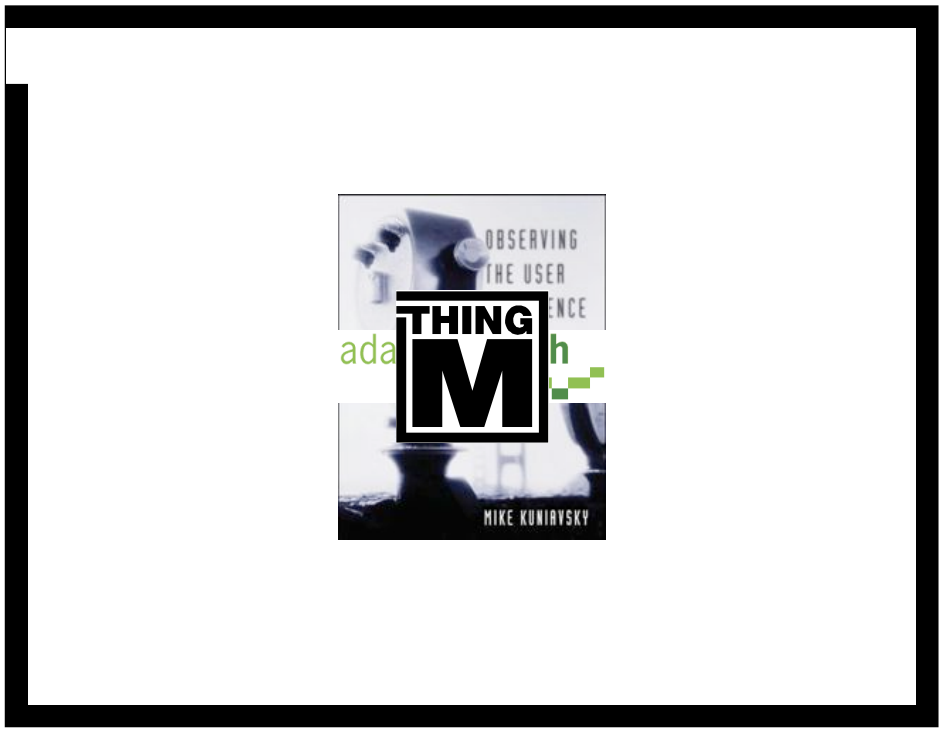
Good morning!

My name is Mike Kuniavsky and this morning I'm going to tell you about the coming age of magic, specifically as it applies to the design of ubiquitous computing user experiences.

I'd like to start by telling you a bit about who I am.

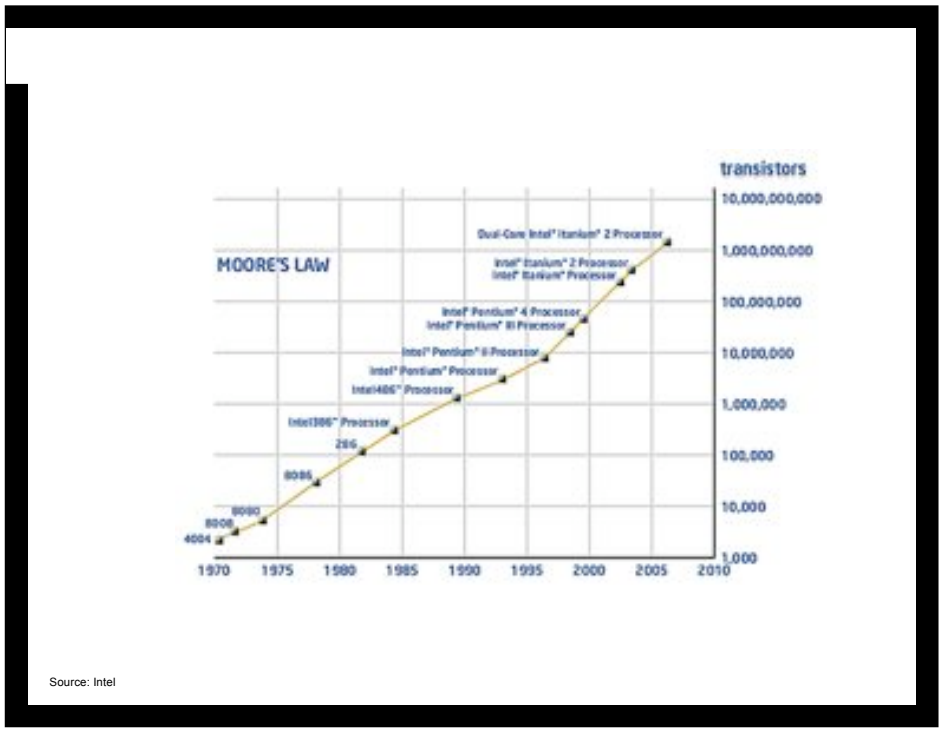
I am a consultant specializing in user experience design and user research. What that means is that I spend a lot of my time thinking about the relationship between technology and people. My core philosophy is that making technology is easy compared to figuring out what technology to make, and that's driven by understanding people.

Over the years, I've worked with many different organizations to help them develop technology with people in mind.



I wrote a book on that topic, focusing on user research techniques. I also co-founded a design company called Adaptive Path.

Last year I started a design and research company called ThingM. We call ThingM a device studio and we specialize in the relationship between information systems and objects. In other words, we're a ubiquitous computing design studio.

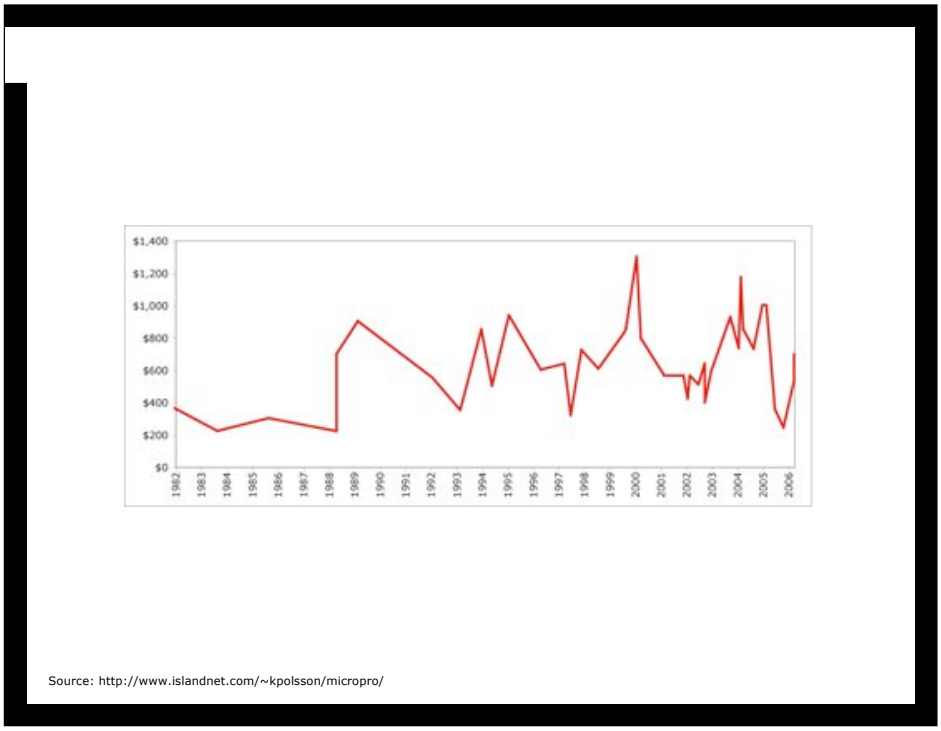


Let me tell you about ubiquitous computing and why I think it's really important. And where that starts is in something that's close to every technologist's heart. Look, it's Moore's Law!

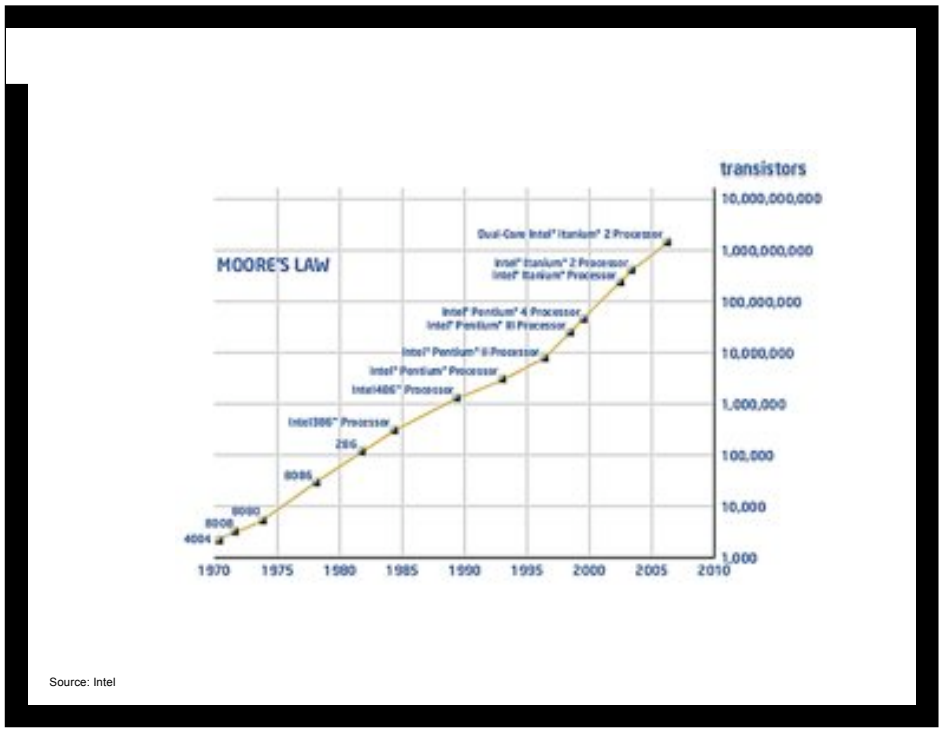
I know you've seen it a thousand times, but let's look at it again. People typically read this chart as a trend focusing on the number of transistors.

What's implicit in this trend, however, is that this is happening within the context of a marketplace.

This is not just the theoretically largest number of transistors that's possible to put on a on a CPU die. It's the number of transistors that can be sold at a specific price point.



However, the prices of CPUs on release have stayed the roughly same. This is a graph I made of the introductory price of many of the major chips at the time of their introduction. Even with the fluctuations in the price because of market positioning and the competition between Intel, Motorola and AMD, the price has remained pretty steady, generally between $500 and $1000 at the time of introduction.



Taken in light of processor prices, the other way that you can read this chart is that the price of older processor technology decreases proportionately to the increase in transistor density. And although people tend to concentrate on the right side of the curve, I'd like to draw your attention a little to the left, to what I call the Hidden Middle of Moore's Law.

This range of processor power can do an immense amount and the price of it has dropped to near-disposable commodity levels. I think it starts right around the 486.

1989: $900

Quantities of 1000

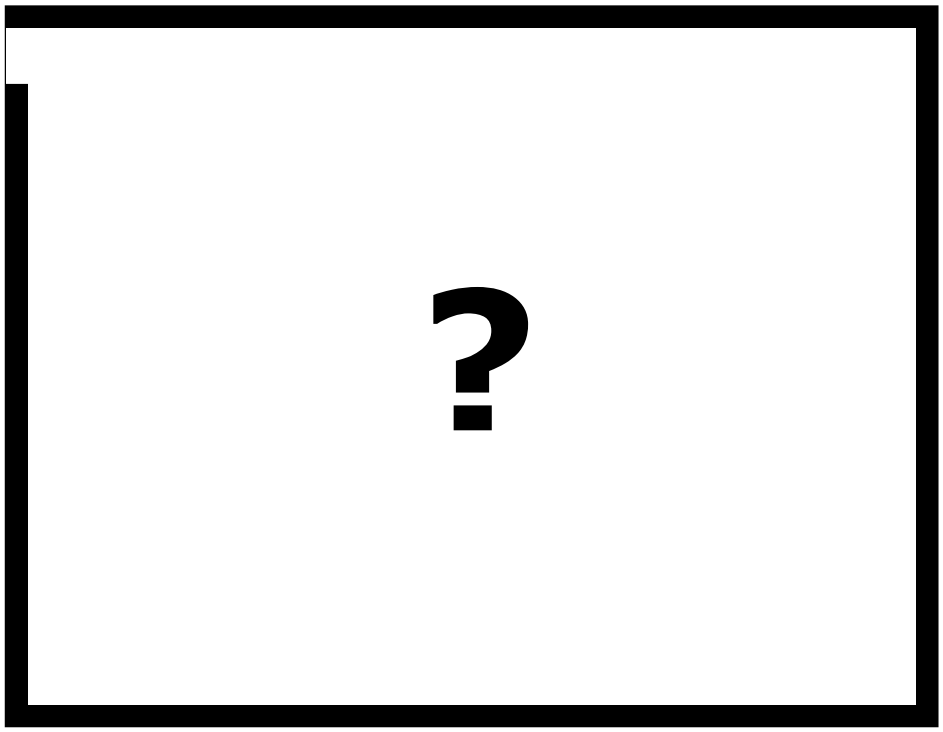
33MHz, 20MIPS

2007: $0.53

Quantities of 1

20MHz, 20MIPS

Sure enough, you can see that the actual chip prices reflect that price drop.Yeah, an Atmel CPU isn't the same as an i486, but it certainly shows that the trend is roughly correct.



What does this mean? This means is that embedded information processing becomes a cost-effective competitive advantage, much as new kinds of materials are.

And, like any fundamentally new material, when added to the design of an object, information processing and wireless networking fundamentally changes the capabilities of the object, It's akin to deciding to make something out of rubber rather than plastic. Or steel versus bamboo.

Say you want to sell more toy monkeys in an already crowded toy monkey market. Interactive behaviors, such as speech, memory, maybe a little servo control under a silicone skin may just be the differentiator that sells more of your monkeys. Doing that purely mechanically or with basic electronics is prohibitively expensive, but now that CPU power is cheap enough, you can in essence throw information processing at an otherwise difficult physical problem and it becomes a competitive calculation. You can put it on a spreadsheet like you would choose between latex and silicone or different kinds of fur.

[Thanks to Rafi Haladjian for the example.]

This means that the vision of ubiquitous computing the late Mark Weiser had 15 years ago at Xerox PARC is now a practical reality. And furthermore the competitive advantages of systems with embedded information processing make ubiquitous computing an emergent byproduct of the decrease in chip prices.

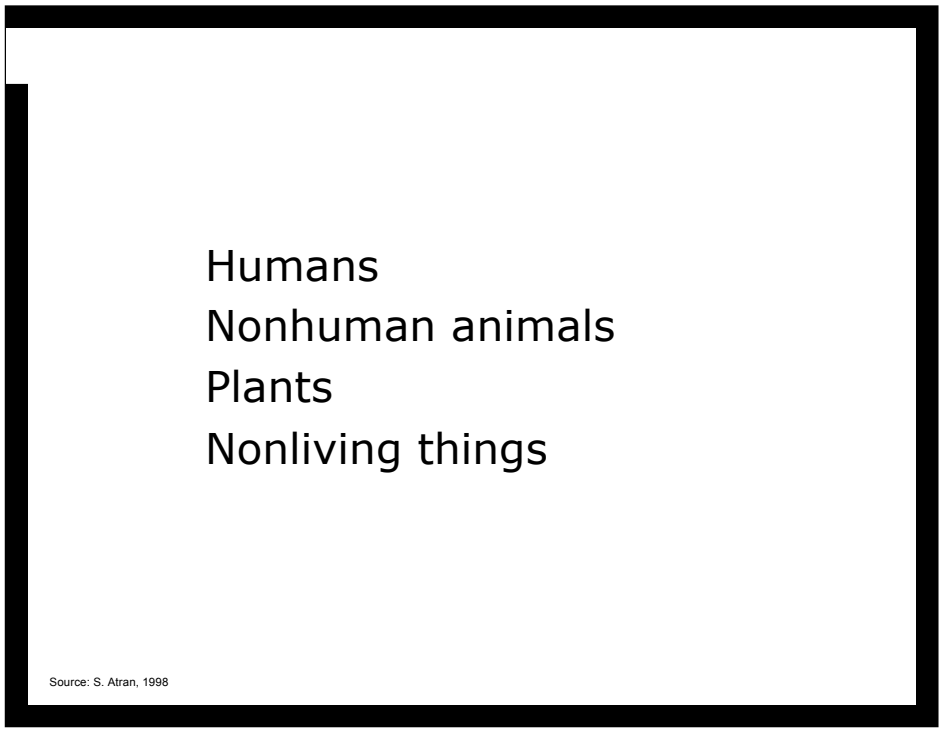
Here we get to my personal motivations. I left Adaptive Path and the Web three years ago, and I founded ThingM with Tod Kurt last year because I believe that ubiquitous computing holds amazing promise for making the world a better, happier and more interesting place. It is today where the Web was in 1992.

Like the Web, at its core it's about a new way of using knowledge. Ubicomp allows us to embed knowledge into our tools, rather than requiring us to always serve as knowledge intermediaries. This was possible before cheap processing, but it was much harder. Encapsulating our knowledge of what's useful, what's interesting, and what's entertaining is much more difficult to do with steel, wood and glass than CPUs, memory and wireless networks.

But designing for it is a very different problem than designing a software application. All devices with computers in them are not terminals. The old paradigm barely works for portable computers that have screens…

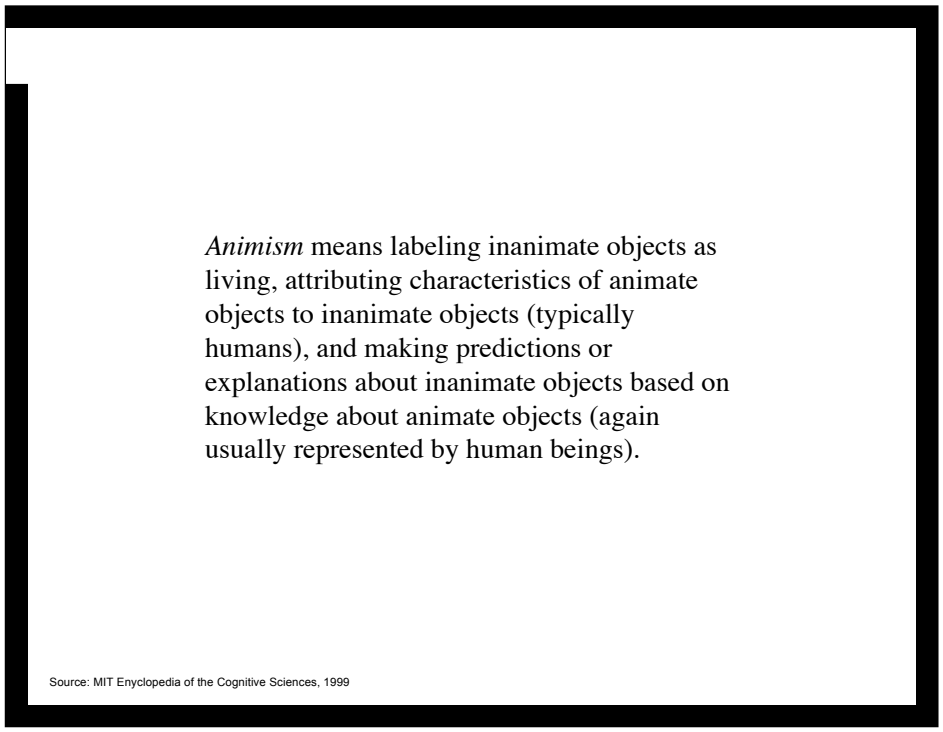
…but that's never going to work for a shoe, and that's the kind of device that's we're going to have to be designing.

I decided to step back and think about how people could think about such devices. These aren't just static objects. As a class, ubiquitous computing objects can have memory, can communicate, and can act without the interactions of obvious physical forces. What does that do to people's experiences with them?



Well, according to anthropologist Scott Atran who studied the development of scientific ideas in various cultures (S. Atran, 1998, **Folk Biology and the Anthropology of Science: Cognitive Universals and Cultural Particulars**), most world cultures classify all entities into one of four general classifications.

Which of these classifications would devices with internal decisionmaking and behaviors fit into? My hypothesis is that people make analogies between the devices and animals and consider them closer to animals than to nonliving things like rocks. In other words, their reactions to ubiquitous computing devices are likely to be at some level animist.



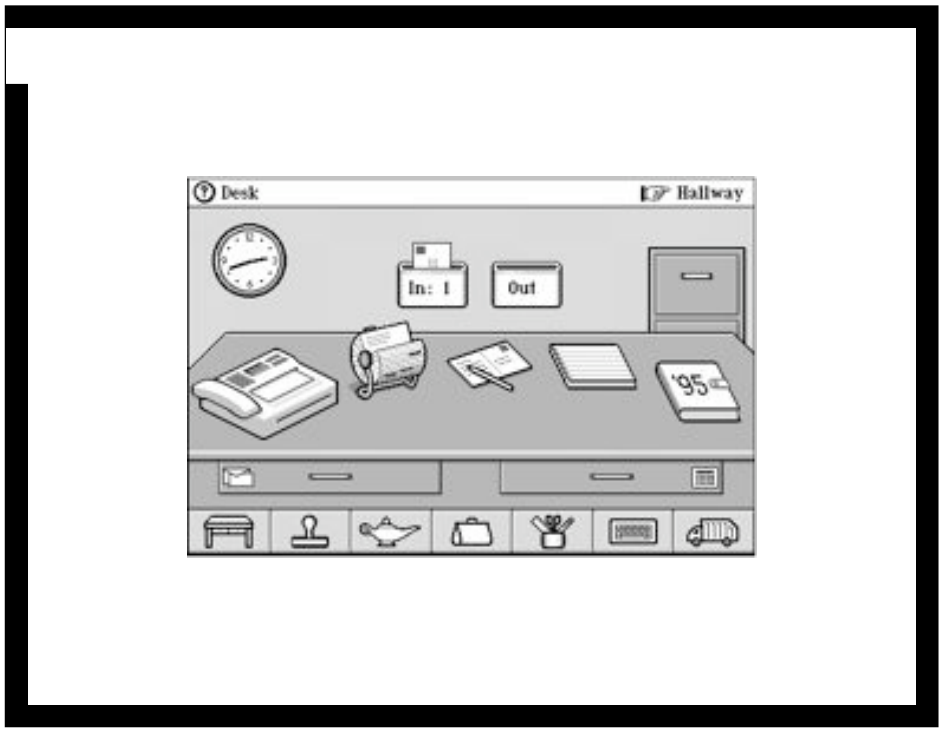
Here's one definition of animism. What's interesting to me about how it relates to ubicomp is not that it literally represents people's relationship to embedded information processing, but that it may represent at a gut level how people relate to all objects that exhibt behaviors which go beyond basic action-reaction physics. People KNOW that a Roomba isn't an animal, but sometimes they still treat them that way.

For me as a designer, knowing how people react when presented with a novel expereince, or what their expectations are for it, makes it easier to design the technology.

But there's a problem. We can't design animism. It's an effect, not a design guideline. This led me to my next question. How had portable computing devices been designed before?

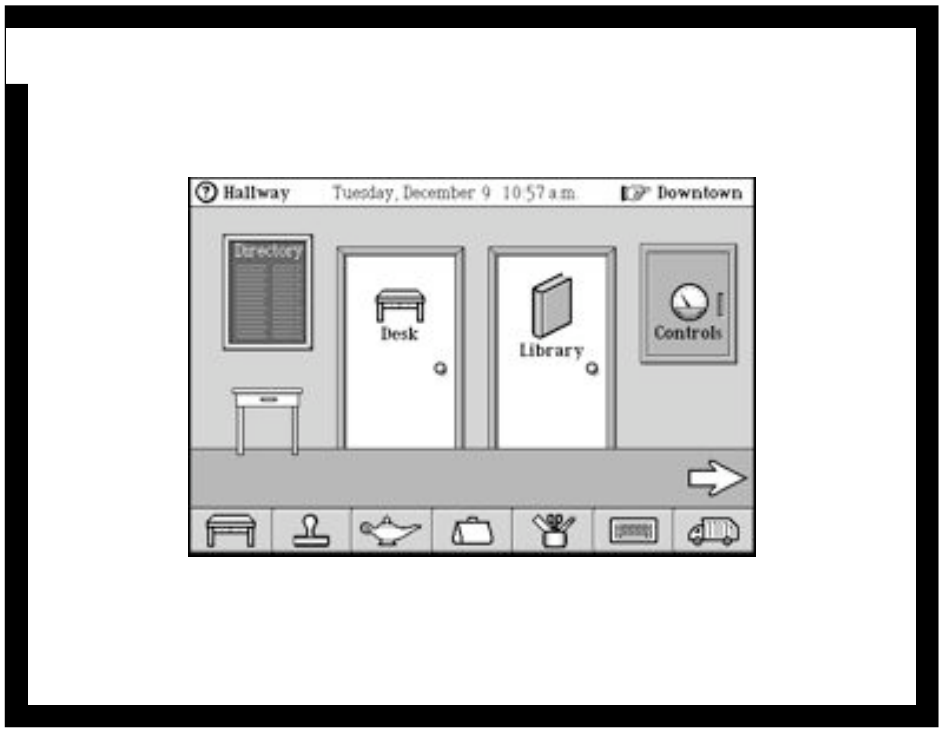
And I found this. This is the Sony Magic Link, released in 1995. It's running an operating system called Magic Cap developed by a company appropriate called General Magic. It was started by a bunch of Apple expats.

Their core development principle was to couple a portable computer with network communications. Sound familiar? It’s very ubicomp-ey, and I think it’s going to be an interesting footnote in the history of ubiquitous computing. General Magic, understanding that these devices were different than desktop computers, tried to extend the desktop metaphor to create an user interface that could encompass the power of portable, networked devices. The way they decided to do it was to leverage off of their experience creating the Maintosh UI at Apple and to extend the desktop metaphor to a networked device environment. Let's see what happened.



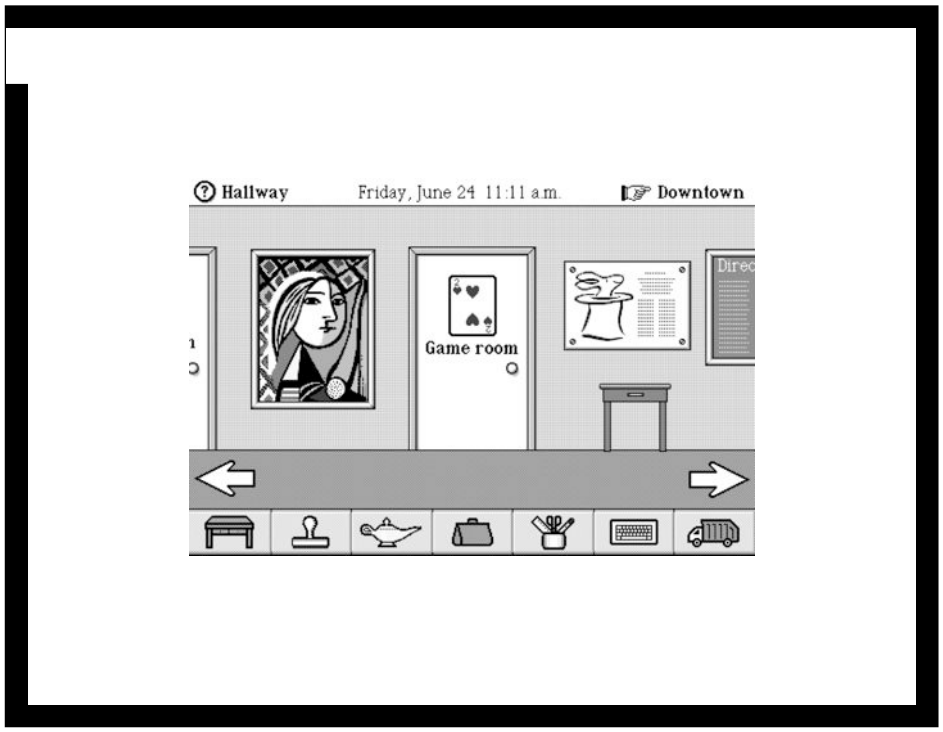
This happened. Here's the Magic Cap desktop. Unlike previous desktops it looks like a desk. Why is that, you may ask? Isn't that going backwards?

Well they had a reason for it. I don't know them, and I haven't talked to them about this theory, but I believe that they wanted to make it clear that because you were now no longer physically confined to a desk by the device, you should not be confined to it in the interface. Just like the device could physically leave your desk…



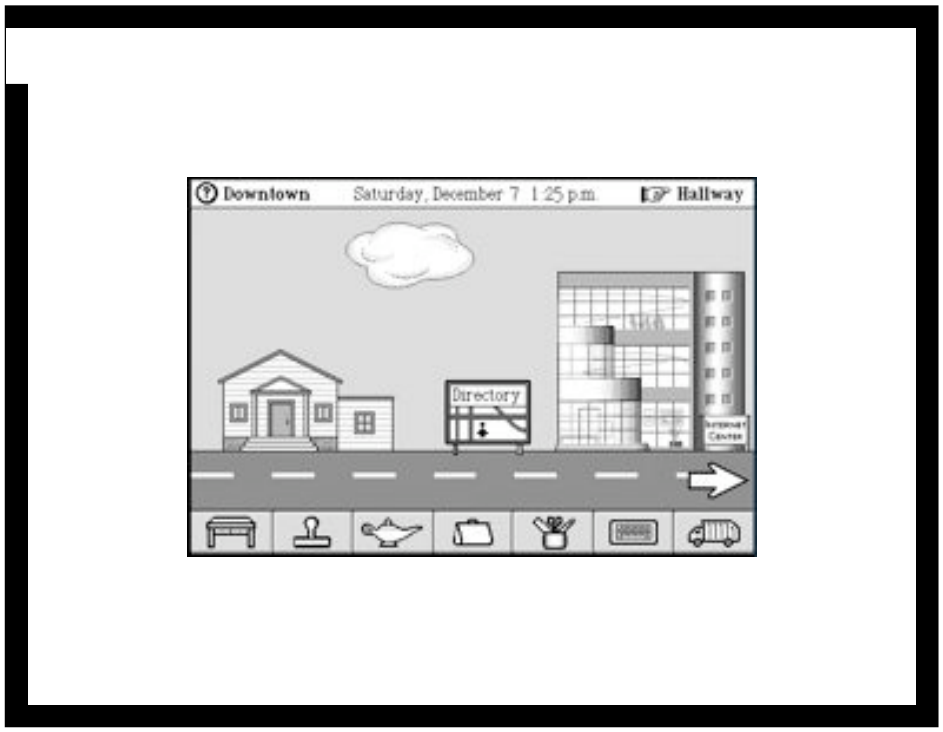
…you could leave the desktop in the OS. See, there's your desk, and here it says it we're in the Hallway.

This is where you can start to see the problem of sticking too close to a metaphor when it's no longer really applicable. We're using an operating system, but now we're in a maze of passages, all alike. What happens when we go East, er, I mean right. [point out right arrow]

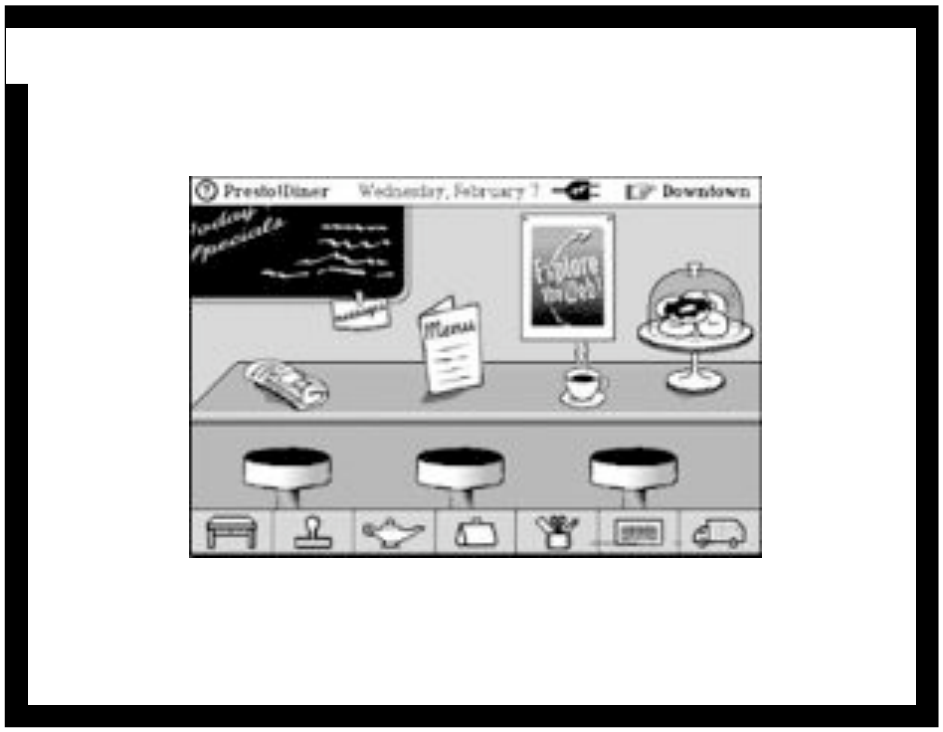


Uh, we go further down the hallway! There aren't even any labels on anything anymore. What is this screen FOR? Well, it's for continuing the metaphor, of course. If you have a hallway, there should at least be two end to it.

Let’s see what happens when we go downtown…



Here's our house, here's the directory…and here's the Internet! If you walk further down, you may find a diner…



And here's a Web browser.

I still don’t know what happens when you click on the doughnuts.

Now I don't want to criticize the General Magic folks too much. They were doing this more than 10 years ago and it's always easy to mock something in retrospect. But what's interesting is that if you extend the desktop metaphor into a quasi-virtual space as a way of extending it to portable devices, it's grossly inappropriate. How am I, Sony customer and business person, supposed to do any WORK with this thing?

Why I'm bringing this up is because the desktop metaphor does not and will not work with ubiquitous comuting devices. It didn’t work in 1995 and it won’t work now.

Yet that's exactly how some people are thinking about it. Sticking a basic, lagely unmodified pc into an everyday object has never, and will never, take off. [click for NO sign] It's just not how people use the tools in that environment. It creates an information management problem on top of all of the other problems that someone is trying to solve.

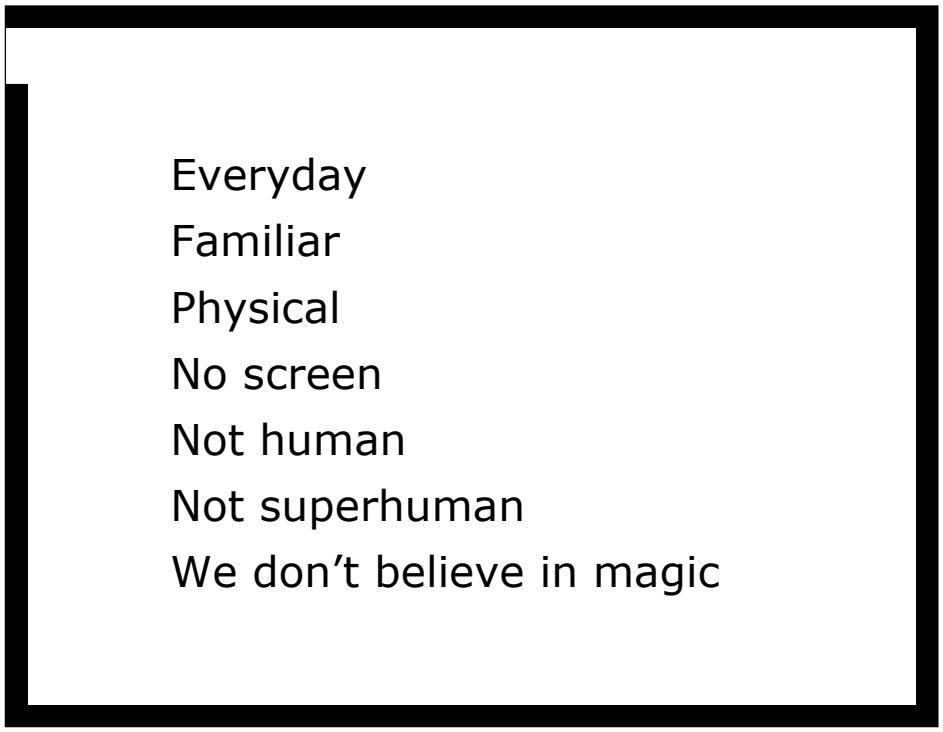
And home automation? That's no better. Your house isn't a factory to be optimized. You don't produce leisure and you can't automate happiness. The analogy is all wrong.

I thought, there must be a better way of designing such devices for people. There much be an existing metaphor for objects that sense, analyze, communicate and act.

Why yes there is. It’s magic. Now let me define what magic I mean. I don't mean augury, telepathy, rain making, clairvoyance, necromancy, demonic possession or transmutation. I'm not talking Dungeons and Dragons, Magic the Gathering, the Bride with White Hair, or World of Warcraft. In fact, I don't mean the vast majority of magical concepts that exist in every culture.

I mean enchanted objects. What I'm proposing is a metaphorical relationship between magic and portable, network-aware, information processing objects that is analogous to the relationship between office supplies and computer screens in the desktop metaphor. I am explicitly not advocating pretending that technology is a kind of magic or lying about how technology works, but using our existing cultural understanding of magic objects as an abstraction to describe the behavior of ubiquitous computing devices.

If we revisit our ideas of echanted objects we see that what differentiates them from their nonenchanted counterparts is their ability to have independent behaviors, to communicate, to remember, and to interact with other enchanted objects and people. And they don’t need screens or keyboards to do it.



I’ve enumerated the properties of enchanted objects that I believe make them particularly good for designing ubicomp devices:

1. They are everyday objects.

2. We’re familiar with how to use them, at least on a basic level

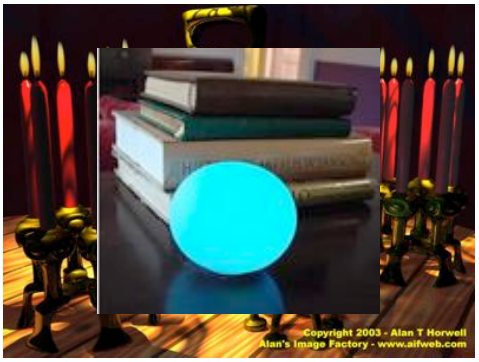
3. They are physical. You grab them, you swing them, you twist them, you push them.

4. They do not have a screen. There isn’t the assumption that somewhere there’s text output.

5. Behaviorally, magic objects are not humans, and we do not expect them to act human. This is contrast to, say, the implications of something like “ambient intelligence,” another metaphor for ubiquitous computing devices. How smart is that intelligence? Is It like me? It’s not clear.

6. They are not superhuman. They may be hard to control, but ultimately it is we who are in control, not they, by definition.

7. There is a healthy disbelief in magic, so it's likely to be treated as an analogy, rather than as the literal truth.

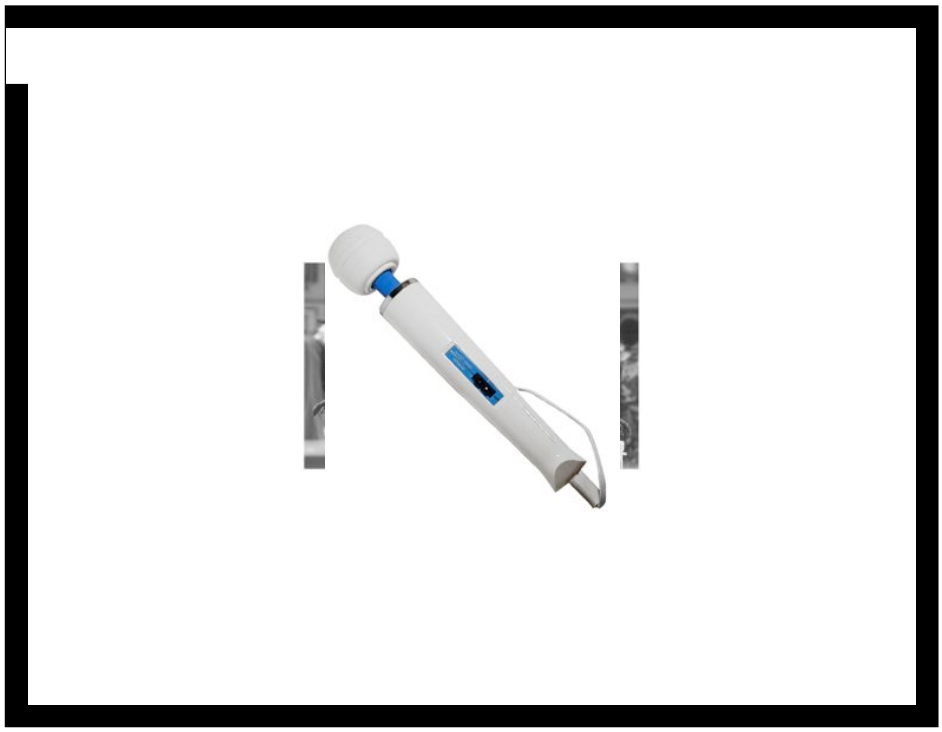


Many of today's ubicomp objects already tap into the magic metaphor, though maybe not explicitly.

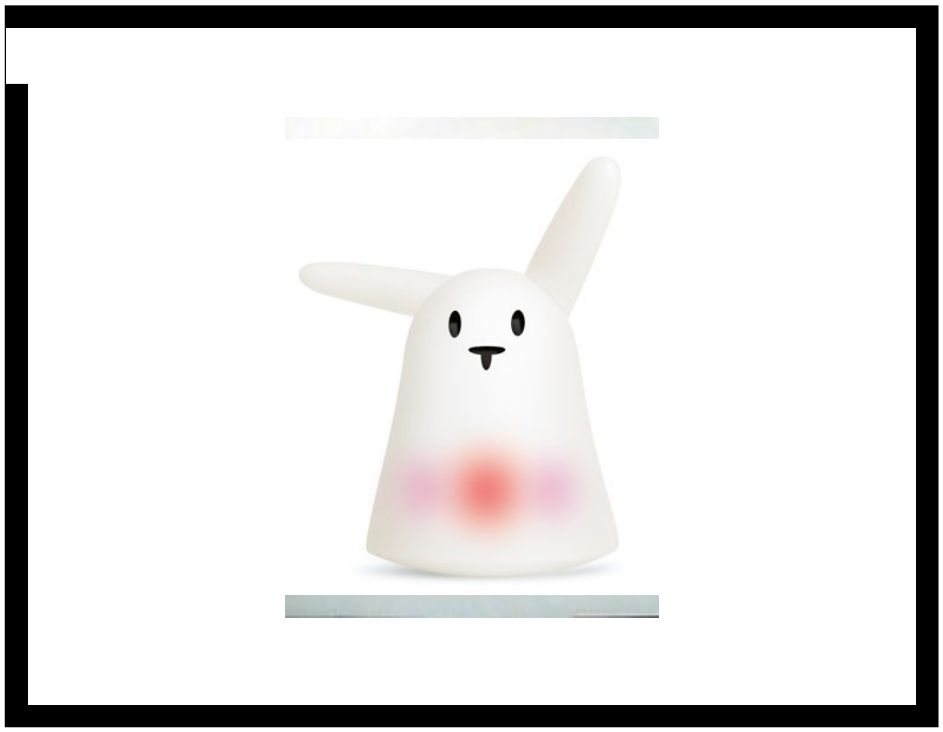
[Click through]

This is the Ambient Orb from Ambient Devices. It's probably no accident that it looks like a crystal ball.

This is the Nokia Medallion, which is a kind of digital amulet.



And there are many wands. There's of course the Nintendo Wii, but Sony also has this patent for a wand-like video game control. Here's a wand that's familiar to anyone who's been through an airport reently. And here's one that's even appropriately named, it's the Hitachi Magic Wand.

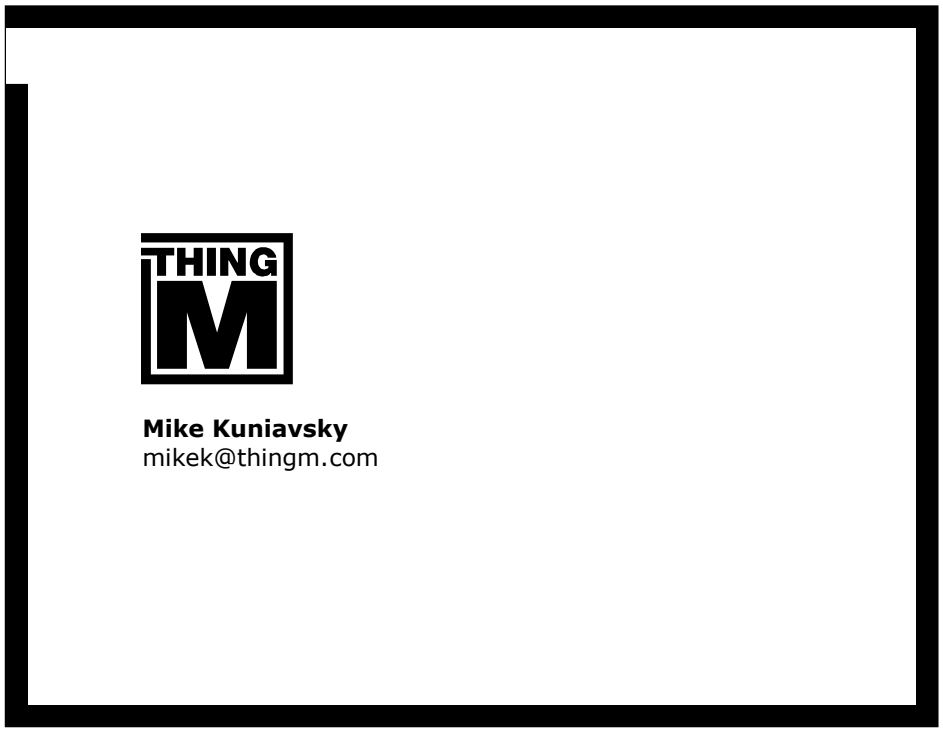


Here’s Lewis Caroll’s enchanted rabbit. And here’s Violet’s.

In conclusion, the age of magic is coming. Ubiquitous computing's emergence is an inevitable byproduct of market forces acting coupled with inexpensive CPUs. Metaphor is emergent, it permeates human consciousness and it's how we reason. Magic as a metaphor for the design of ubicomp objects is emergent, in fact it has emerged, because it's easier to go with a familiar pattern than a new one, and enchanted objects are one of the most familiar of all, transcending culture, material and context.

However, metaphor is very powerful. We need to be conscious of its power when we use it, or we can end up in irrelevant replication of unncessary and misleading details. We, as technology creators, need to design products that use magic as a useful abstraction.

It should not excuse bad design or illogic. Magic--or at least good magic--does not conceal, decieve or cripple, it explains.



Thank you.