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The Seeds of Inspiration

Roy Want

An interesting question for any of us is why we chose our current profession. As a reader of this magazine, there's a good chance you're working in the field of pervasive or mobile computing, and the inspiration for your choice is perhaps something we have in common: a fascination with gadgets, a tendency to shop for electronic odds and ends, and an interest in turning fictional devices into reality.

A FASCINATION WITH GADGETS

I've always been fascinated by gadgets of all shapes and sizes. I was born in 1961, and although consumer electronics in my family home was limited to a transistor radio, a television (valve technology), and a telephone (the POTS variety), my interest was usually piqued beyond their intended use—especially when I could see inside them. In particular, I remember changing the battery in the transistor radio and being intrigued by the colorful resistors, capacitors, and the maze-like traces of copper on the printed circuit board, highlighted by swirly patterns of red photo-resist.

Changing the battery in a radio and seeing the inner workings might have been the inspirational moment that triggered my career in engineering. What were all those little components? How did they work? What else could they be made to do?

It wasn't long before I found myself taking apart old radios that family members had thrown out and becoming familiar with them at a basic level. The fun aspect of this approach was that I learned about a component's physical behavior by experimentation, sometimes breaking it but more often learning something unique. This is quite a different learning experience from sitting in an electrical engineering lecture and being presented with theory. The latter is clearly important, but experimentation, with time to understand what you've seen, provides a personal connection with the technology. And if it's fun, it encourages more of the same, motivating you to push the limits of what's known and understood.

I believe this connection is fundamental to creative design, and once inspired in this way, I could no longer look at an object in a neutral way. Perhaps a true designer can't see something without inviting the question, what could I use it for, or how could I adapt it for another purpose?

Consequently, one of the more directed inspirations from my youth was the construction kit. In particular, Meccano (now known as the Erector Set) was one of my favorite mechanical toys, along with the still very popular Legos. I always thought Meccano had the edge, though, because you could build gadgets that were physically strong and driven by motors and gears. At age 10, to support my interest in electronics, I was given Radionics, a not-so-well-known kit made by Philips. It let me build many different kinds of two-transistor circuits by screwing components onto a multipurpose printed circuit board—each component base connecting to pads on the circuit board by compression.

The wonderful thing about these kits was that although each one came with a set of suggested projects, it didn't take long to build up my confidence and start designing and building my own. This interest later inspired me to visit hardware stores, both mechanical and electrical, just to browse the shelves looking for items that could be of use in future projects.

AN EYE FOR ELECTRONIC CAST-OFFS

When I lived in London, the prime electronic surplus stores for a technology tinkerer were based in Tottenham Court Road, and Proofs was a favorite of mine in the mid-1970s. The southern end of the Edgware Road was also well known for hobbyist electronic stores—in particular, one called Henry's. When I moved to Silicon Valley in the early 1990s, I found a similar set of retail stores, such as the Weird-stuff Warehouse and Haltek and Halted. Here you could find all manner of electronic cast-offs of some value to hobbyists—either to be mended, enabling an inexpensive purchase for a high-value item, or (more typically) to be cannibalized and resurrected into an exciting new project.

In the London area, I'm told that many of these classic stores no longer exist, mainly due to the high cost of rent, the low-profit nature of the busi-

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ness, and the now wide availability of inexpensive and diverse consumer electronics. The latter has undermined the motivation of many people to repurpose junk, when the cost of a new device with a flashy plastic case and a manufacturer's guarantee is often more attractive.

However, in Silicon Valley, many of these hobbyist stores are still open. Although much more up-market than my previous examples, one of the most successful and famous is Fry's Electronics. Fry's is familiar to every computing hobbyist in the area. It retails components, computers, peripherals, and software, along with candy, packaged food, and toothpaste—everything a true engineer/hacker might need!

INSPIRED BY MEDIA

Another inspiration for my professional interest in pervasive computing was the vision of possible futures provided by science fiction. Classic novels have their place, but probably even more compelling are science-fiction movies and TV shows. These let you see something that can't yet be made but still learn something about how it might be used.

Looking back at 1960s science-fiction TV shows, there have been a remarkable number of gadgets envisioned that were beyond that era's manufacturing ability: home and palm-sized computers, flat-panel monitors, flip-phone pocket communicators, music collections on a card, electronic books, and satellite navigation. These are all things we now take for granted. But what came first—the necessity for the invention or the vision in the form of a story or a movie?

William Shatner and Chip Walter's book *I'm Working on That* (Star Trek, 2002) considers this question and tries to identify other inspiring science-fiction technologies that might be right around the corner. The book also ponders whether concepts such as warp drive and teleporting might be possible, given our understanding of physics today. In 1999, I was fortunate enough to see some of the early material for this publication, when the authors visited my former employers at Xerox PARC to do research for the book.

In my mind, there's no doubt that a strong connection exists between the science-fiction stories we write and the quest for pervasive computing technologies that we want to design and build. As some evidence of this connection, consider the mobile products engineers at Motorola. They modeled their StarTac phone, which was released in 1996 and was the first clamshell product of its kind, on Star Trek's personal communicator. Furthermore, in visionary institutions such as NASA Ames at Moffet Field in Silicon Valley, many of the engineers are big science-fiction fans, which helps inspire the kind of work they do.

In general, I find that fictional worlds that are more plausible extrapolations of our own society provide the most useful inspiration. For example, the 1982 movie *Blade Runner* depicted a television that could scan a photo onto its screen, digitally zoom-in, and then enhance the image containing a face reflected in a mirror to determine the camera's owner. This can clearly be done today, some 26 years after the movie, except the starting point is actually a high-resolution digital camera (enabling enough detail to be present in the picture), followed by zooming and image enhancement, which are usually carried out with software running on a home PC. Perhaps this capability will soon merge with the next generation of digital TV products.

Another movie, *Minority Report* (2002), depicts our everyday world as a ubiquitous smart environment based on pervasive technologies. This environment can recognize nearby people by scanning their retinas from a distance, then customize its public displays, advertising billboards, and store fronts so they're relevant to passersby. Although I don't believe remote retina identification is likely on a large scale, scanners reading uniquely addressed tags in your clothing, credit cards, and personal electronics may be sufficient to enable the same set of scenarios. At first glance, this example isn't as appealing as the first, but under some circumstances (perhaps if users had a choice of opting in for certain types of service), it could be seen as a positive advance. For example, just as FasTrak lets cars bypass toll booths to ease traffic, such an RFID service would let me walk into a movie theater or sports event without waiting in line, and any charges would go through to my credit card automatically.

Movies such as *Blade Runner* and *Minority Report* were ahead of their time, but they inspired researchers to consider the technologies they present. Media isn't an endpoint for human inspiration but the catalyst for innovation that can go far beyond the original ideas. Visualization is a key accelerator in this process; without it, ideas would evolve much more slowly.

THE HACKING CONNECTION

The motivation behind hacking commercial products, which is the central topic of this special issue, has connections with all the sources of inspiration I've described. First, it lets us take a device that performs one function and make a mental leap to another.

Second, it can bring together many unrelated components and commercial products to be repurposed for a new design need.

Finally, it lets us rapidly prototype ideas and then assess their value before taking a more resource-intensive next step.

In pervasive computing, perhaps more than other branches of computer science and electrical engineering, we can make progress on our work in a wide variety of ways. Of the options available during the design process, hacking is a powerful tool that can inspire our thought processes and reduce the time it takes to create a viable prototype. I'm willing to bet that most of our readers have some hacking genes in their DNA, and many of the techniques used in this issue's articles will sound surprisingly familiar.