

Timelines

Living Without Parental Controls: The Future of HCI

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The Art of Prophecy

Does studying the past help us predict the future? Lao Tzu, 2500 years ago, was pessimistic: “Those who have knowledge don’t predict. Those who predict don’t have knowledge.” With the Enlightenment and science came optimism: “It is far better to foresee even without certainty than not to foresee at all,” wrote Henri Poincaré. But 20th century technology predictions often proved embarrassing. Edgar Fiedler observed, “He who lives by the crystal ball soon learns to eat ground glass” [1].

Early HCI predictions fared well. Influential figures envisioned a time when use wouldn’t be restricted to computer professionals; computers would support people engaged in other pursuits. This came to pass, although it took longer than some expected [2]. But most subsequent HCI visions, preserved in the SIGCHI video series, did not fare well. Visions of the future were tied to specific dates that came and went. Most assumed that speech recognition and natural-language understanding would soon dominate interaction. Billions of dollars were spent on speech and language R&D, constraining imaginative exploration of nonverbal interaction forms. Statistical analyses of vast online corpora will assist machine translation, improve searches, and find ingenious uses in education [3], but at the risk of a future serving of ground glass, I forecast that natural language will not become the key interaction modality for healthy individuals. We are headed elsewhere.

The Demon and Engelbart's Children

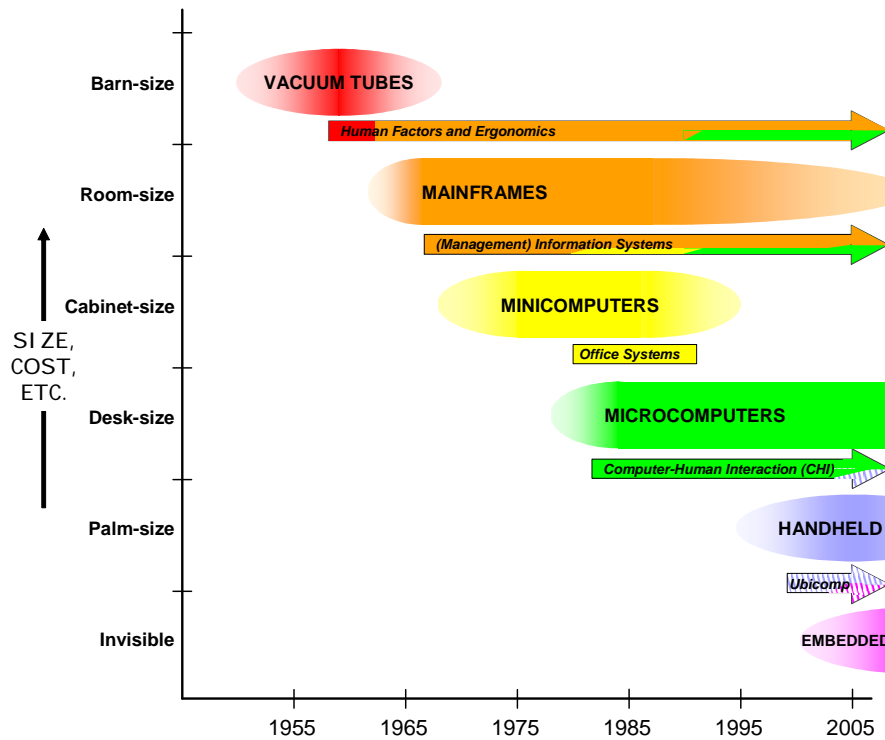


Figure 1. Human-computer interaction research fields that developed around each platform, color coded to indicate major shifts of focus.

In past columns I introduced the demon who has been enforcing Moore's Law, and the succession of hardware platforms and research fields that appear in Figure 1 on a roughly log-linear plot. Note the longer horizontal gap between green and blue bands. Through 1985 a new platform gained prominence roughly every ten years. In the 1990s the Apple Newton and Palm Pilot appeared on schedule, but unlike mainframes, minis, and PCs, handhelds did not quickly become a major industry. Smart phones are now arriving, but why the ten-year delay? HCI!

Mainframes, minis, and PCs shared an interaction paradigm: QWERTY keyboards and slowly improving visual displays. Interaction design and computer-use skills transferred smoothly from one platform to the next. But handhelds couldn't accommodate comfortable QWERTY and large displays. Also, by 1995 desktop computers were networked—handhelds were not. People did not flock to the new form factor.

Today, smart phones provide a network link, and we've learned to route information effectively to the small displays that accompany nicely tooled keypads. Young people who grew up with game controllers and text messaging are not wedded to QWERTY. In the 1960s Douglas Engelbart argued that efficient use of computers required one-handed text entry; 40 years later, a generation with such skills is arriving. Significant input and output innovation on small devices will continue.

The demon did not pause to let us catch up, so the next platform is here—inexpensive, embedded computation. Our devices will house a growing variety of sensors. Networks are being devised to route the resulting floods of data. As mobility, ubiquity, and astonishing geotagging and map mash-ups proliferate, the past two decades may come to be seen as a period of *slow* growth. We absorbed one new platform, the PC, and the Web as a tool supporting individual transactions, whereas in the next decade we will assimilate two platforms and a highly interactive Web.

Design and Marketing: Catching Up

Design and aesthetics are also in the spotlight. Design should have become central to HCI when the GUI succeeded in 1985, but HCI professionals trained as scientists and engineers were uneasy with a discipline that prizes portfolio and reputation over peer-reviewed publication. Designers often trust intuition and inspiration over data. In 1985, working for Wang Laboratories, I asked box designers in the Industrial Design group, “Is anyone interested in designing software interfaces?” A graduate of the Rhode Island School of Design spoke up. A year passed before he was accepted by the software team.

In the mid-1990s, CHI let the nose of the camel called Design into the tent by sponsoring workshops and the Designing Interactive Systems conference series. Now the whole camel is inside the tent, pushing some scientists and engineers out into the Human Performance Modeling and Cognitive Engineering technical groups of the Human Factors and Ergonomics Society. NSF embraced “Science of Design” in a somewhat odd effort to domesticate this critter.

Marketing—a discipline that engineers trust even less than Design! But branding and other forms of marketing are integral to human-computer interaction. HCI will reluctantly focus on the often startling issues raised by marketing. For example, a Web-page visitor wishes to find and handle information quickly, but commercial sites benefit by trapping eyeballs. The principles are known—supermarkets place commonly purchased items far apart, department-store escalators force you to walk briefly on each floor—but they introduce methodological issues and value conflicts for HCI professionals who see themselves as user advocates.

However, in the long run, the demon has little interest in design or marketing. Neither is directly subject to Moore's Law, broadly defined. Once our handling of these disciplines matures, it will proceed in an orderly fashion [4].

Information is different. The demon is interested in information, very interested.

Getting Ahead: Information and the End of Parental Controls

“A machine with vast logic power, capable of storing enormous quantities of information... The dam is bursting... Mankind today faces an information deluge of unimaginable complexity... We must protect computer users from the vast and overwhelming mass of data...” —James Martin, 1973

In describing the free fall in the cost of memory, “stunning” is not a metaphor: We have trouble thinking about the consequences. Sensors proliferate to collect information, repositories spring up to hold it, bandwidth increases to access it, displays of all sizes improve to view it. And these are early days. Today, 1973 seems of the age of digital-information *scarcity*. Tomorrow, 2007 will seem of the era of information scarcity. In 1973, only a few information-processing professionals confronted digital data. Today we are all engulfed by oceans of information.

Oceans of information. Objects of beauty and wonder bob alongside flotsam and jetsam. Beneath the surface are pearls and perils. We don't swim alone: We create social spaces, we find and leave notes. But information comes so fast that we must address much of it directly and quickly, developing skills for searching, skimming, assessing, and synthesizing. Consult friends or trusted sources, but make your own judgments. Parental controls are coming off, and coming off fast. Students won't rely on professors; they will turn to the Web and inform one another. Researchers will rely less on journals and invisible colleges, more on visible online colleges. Today, a Baghdad blogger supplements newspaper coverage; tomorrow, bloggers rule. Encyclopedias wither, Wikipedia thrives.

Why the change? Economics. Sharing information used to be expensive. It was costly to print, distribute, shelve, and access it in libraries, bookstores, and newspaper stands. Not as expensive as when manuscripts were copied by hand, but enough to force society to be selective. Editorial and review processes governed the production of books, journals, magazines, and newspapers. Painstaking effort went into dictionaries and encyclopedias. The cost of assembling students led educational institutions to collect instructors who would prepare hour-long lectures. Experts *in loco parentis* selected, assessed, synthesized, and structured information, relieving readers and students of much of the need to exercise those skills. We could generally trust these authoritative sources. Not so on the Web. Each of us must hone our ability to search, skim, assess, and synthesize. Reputation systems, annotations, and other tools can help, to a point, but they too must be

assessed. Those who insist on relying on authority figures will not prosper. Kids may figure this out before their parents.

Under the heading “Media know more than we did: 7/7 Terror in London,” British Home Secretary David Blunkett described government ministers rushing to an intelligence briefing following the coordinated bus and Underground bombings [5]: “The news media were ahead of the material being presented to us. They had eyewitnesses sending through video footage, photographs, and on-the-spot accounts. It was, in essence, the first time I think that reporting was as much about the men and women on the ground as it was about professional reporters themselves. This posed a difficulty with sorting out the validity and credibility of what was being said and by whom. We were entering a new era.” Indeed.

Wikipedia and Information Reliability

Stacy Schiff’s essay “Know it all: Can Wikipedia conquer expertise?” reviews a raging debate over information reliability [6]. Is the undeniable unreliability of Wikipedia entries a fatal flaw? Some prefer authoritative encyclopedia monographs. Although Wikipedia supporters stress efforts to raise article quality, the nature of the form, like the nature of the Web, works against reliability. But it doesn’t matter.

Schiff reports Wikipedia founder Larry Sanger’s distinction “between knowledge that is useful and knowledge that is reliable.” Wikipedia is useful because the cost of information access has shifted. A less than fully reliable Wikipedia can provide information—links or terms to use in searches—that guide us to more authoritative online

sources. And if I trust something I shouldn't, I will learn from my mistake, thereby honing my ability to search, assess quality, and synthesize across multiple sources—key skills for navigating the Web. Life without parental controls: Don't believe everything, but don't wring your hands because anointed experts haven't blessed a text. In oceans of information, once we know enough to keep our heads above water, we can swim faster and farther when not wearing a life jacket.

In 1994, having seen the films *Wyatt Earp* and *Tombstone*, I looked up Earp, Doc Holliday, and Kate Elder in my *Britannica*. Had the information not been there, I would not have bothered going to a library, so I was happy that I could trust its accuracy. Today, with more-authoritative online sources often a few seconds away, a Wikipedia entry need not be authoritative to be useful. Wikipedia and the Web afford timeliness, multiple perspectives, and unlimited space. Wikipedia resolves some things, is a first step to online sources for others, and sometimes sends me to a library. For Wyatt Earp, today my 200-word *Britannica* entry is not needed. The Wikipedia entry contains more than 10,000 words contributed by dozens of people over three years, with seven photographs, an annotated bibliography, and links to relevant Web sites.

Authors and editors of encyclopedia and journal articles, professional journalists, teachers, professors, politicians, and other parental figures make mistakes too. If navigating the Web promotes questioning authority, is that a bad thing?

Oral, Literate, and Digital Societies

Oral	Literate	Digital
• Aggregative	• Analytic	• Synthetic
• Redundant	• Sparse	• Multiform
• Homeostatic	• Cumulative	• Dynamic
• Traditionalist	• Experimental	• Innovative
• Situational	• Abstract	• Universal
• Empathic	• Objective	• Tolerant

Figure 2. Characteristics of cultures, extending the work of Walter Ong

Digital Cultures

Walter Ong identified characteristics that distinguish oral cultures from literate cultures [7]. Most useful in oral cultures are small chunks of information that can be easily spoken, learned, and aggregated. Memorization is aided by redundancy, empathy, and engaging rhetorical skills. Oral cultures are homeostatic, meaning that information that is no longer useful is no longer passed on, unlike cumulative literary cultures, which prize analysis and support longer explications.

Figure 2 supplements Ong's distinctions with characteristics that may be favored in digital cultures. Consider the first row. Aggregation, analysis, and synthesis always were and always will be present, but our educational standard is now analysis, focused on "the

syllabus,” a succession of readings. In the future, skimming and extracting value from multiple sources will be prized.

Authority figures in our lives have steadily lost influence: In oral cultures, all knowledge came directly from parents and elders. The old person’s habit of repeating stories that can be tiresome today had great value, transmitting knowledge to children while young adults gathered food. The undermining of such authority is now almost complete. Anyone can be challenged; everyone will have to prove themselves anew each day.

Higher education is designed around analysis, authority figures, and the economics of information scarcity. In realms of high digital access, pedagogy will change radically and probably with unanticipated speed.

Meeting our destiny in a transparent society. The computer scientist and philosopher Masanao Toda, best known for the elegant 1962 essay *Man and the Fungus-Eater*, later wrote about the consequences of our gradual separation from the “wilderness state,” where almost everything of importance occurred “here and now” [8]. Our cognitive, communicative, emotional, and social characteristics evolved to function in the here and now. Larger social organizations enabled by agriculture fostered technologies to support communication across time and space, embedding us in contexts that are uncongenial to our nature.

Digital technologies complete this separation from the wilderness state. Increasingly, any action or event can be recorded by a camera or other sensor and put on a network. Having reached a network, data could show up anywhere in the world at any time in the future. It might not, but it might, and we have limited control over whether or not it does. Dealing with this, individually and collectively, could be the most profound issue we face.

No longer can we easily get a fresh start by moving to a new place. Our digital past accompanies us. Today it is still mostly celebrities whose youthful indiscretions are immortalized on the Web; soon it could be anyone. College graduates could routinely find high school blog posts in the hands of job interviewers, politicians will find videos of their first inexpert campaign speeches on the Web, and so on.

Toda noted the social effects, positive and negative, of ephemeral, informal interaction. Now nothing can be counted on to be ephemeral. When behavior sticks around—officers caught on video conducting an arrest, a Congressman’s IM conversation with a page—we are often forced to deal with it.

The long tail. Chris Anderson has noted that visibility and access via the Web allow niche products to find dispersed audiences [6]. In the short term, heterogeneity may thrive and will certainly be more evident. In the long run, the effect could prove to be the opposite, a more homogeneous world. It depends on the choices we make when we have many choices. We are a very conformist species, which is probably good; if people

exhibited frequent random behavior, driving at fast speeds on busy highways would be way too exciting.

For example, in the five centuries since transportation and printing gave people around the world more choice in languages to learn, over half of the world's languages disappeared despite a ten-fold increase in the world population. People chose languages that offered more literature, information, speakers, or access to power. In the US, communication technologies have extinguished regional political parties and eliminated deadlocked presidential-nominating conventions. People around the world grow up with similar gadgets, movies, fast food, supermarkets, and shopping malls; how could this not lead to broad cultural convergence?

At a more personal level, sensors blanketing the planet will present us with a picture that is in a sense objective, but often in conflict with our beliefs about the world—beliefs about the behavior of our friends, neighbors, organizations, compatriots, and even our past selves—and in conflict with how we would like the world to be. We will discover inconsistencies that we had no idea were so prevalent, divergences between organizational policies and organizational behaviors, practices engaged in by others that seem distasteful to us.

How we as a society react to seeing mismatches between our beliefs and policies on the one hand and actual behavior on the other is key. Will we try to force the world to be the way we would like it to be? Will we come to accept people the way they are? Some of

each: Some practices previously accepted within one or another culture will be judged beyond the pale of acceptability. Within a narrower range of behavior we will become more tolerant, because human nature can be changed only so much, and it includes a capacity for tolerance.

A tip of the hat...

...to Erica Robles, Fernanda Viégas, Martin Wattenberg, Beki Grinter, and Andrea Forte for pointers and Wikipedia discussions, and Steve Barley, Don Norman, and Bob Glushko for provocative discussions of the reliability of Web information. After drafting this I heard Steven Johnson and Douglas Thomas describe the shift from authority to individual decision making in a panel on digital games and learning, which left me optimistic that my need to consume ground glass will be minimal.

References and Notes

1. For examples of embarrassing predictions, see http://en.wikiquote.org/wiki/Incorrect_predictions. Quotations that are not otherwise attributed are from wikiquote. The James Martin excerpt is from *Design of Man-Computer Dialogues*, Prentice-Hall, 1973, pp. 4-5.
2. For examples of prescient visions, see A Moving Target: The Evolution of Human-Computer Interaction, in A. Sears and J. Jacko (Eds.), *Human-Computer Interaction Handbook: Fundamentals, Evolving Technologies and Emerging Applications*. Erlbaum, 2007.

3. Thomas K. Landauer, LSA as a Theory of Meaning. In T.K. Landauer, D. McNamara, S. Dennis, & W. Kintsch, (Eds.), *The Handbook of Latent Semantic Analysis*. Erlbaum (2006).
4. The growth of information, discussed in the next section, suggests that information visualization is an area of design that will continue to evolve rapidly.
5. <http://politics.guardian.co.uk/blunkett/story/0,,1891667,00.html>
6. Anti-Wikipedia positions are found in Stacey Schiff's July 31, 2006 *New Yorker* article (http://www.newyorker.com/fact/content/articles/060731fa_fact), in Jaron Lanier, *Digital Maoism: The hazards of the new online collectivism*, Edge 183, May 30, 2006 (<http://www.edge.org/documents/archive/edge183.html>), and in Andrew Keen's position in a sharp debate with Chris Anderson (http://htgg2.stanford.edu/archives/2006/10/keen_v_anderson.html).
7. Walter Ong, *Orality and literacy: The technologizing of the word*. Routledge, 1988.
8. Man and the Fungus-Eater is in Masanao Toda's collection, *Man, robot and society*, Martinus Nijhoff, 1982. His general argument is best found in English in The history of human society as moulded by emotion: past, present and future, *Social Science Information*, 40, 1, 153-176, 2001.

About the Author

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Getting Answers from Inconsistent, Unreliable Information

Even unreliable information can inform us of common practices, provide a useful first step in exploration, and serve as a basis for inferring a correct answer.

Help with language. Which is the right preposition to use? In English this question stumps me on occasion; in French or Spanish, I'm often scratching my head. So it is no surprise to find non-native English speakers struggling with language choices. Style guides can help, but which one, and could it be out of date?

Many language questions can be resolved with a search engine. Is “compared with ours” or “compared to ours” better? The first appears 34,000 times on the Web, the second 85,000 times. Either way you will have company, but if in doubt why not use the latter? One style guide prefers “compared with last year’s,” but on the Web it gets 126,000 hits, whereas “compared to last year’s” gets 400,000. Crowds may or may not exhibit wisdom in general, but in matters of grammar, prevailing use comes to be accepted.

Is it “for awhile” or “for a while”? The first appears 8.7 million times, the second 47 million. “Try to find” outnumbers “try and find” by 10.8 million to 2.9 million. I objected to “try and” when I corrected student papers. Perhaps I was a bit like the grade-school

English teachers I once objected to, complaining about something in widespread (albeit minority) use.

“Aversion to” outnumbers “aversion for” by 3.4 million to 200,000; “as if” vanquishes “as though” by 128 million to 23 million. You won’t be alone with either choices, but the less familiar constructions could distract readers.

I have always used “miniscule,” my spell checker also accepts “minuscule.” Hmm, the latter is used more, 3.0 million to 5.3 million. There are endless opportunities for consulting the crowd for advice.

Faulty definition as first step. A year ago I checked the Wikipedia entry for “grounded theory,” the methodological approach in which one eschews an initial hypothesis to collect and organize observations and develop a theory from the ground up. Wikipedia described its origins in the collaboration of Barney Glaser and Anselm Strauss, mentioned that the two split over methodology, and linked to an entry on Glaser and a stub on Strauss. Nowhere was the nature of their dispute identified. Not great, but good enough; searching on <Strauss Glaser disagreement> retrieved a lengthy paper on the dispute. (Angle brackets < > represent search terms entered without quotation marks.) Recently, a confusing paragraph on the dispute was added to the Wikipedia entry.

Inferring the probable. I recently searched for a statement about privacy by the former CEO of Sun Microsystems. I found eight different wordings, each claiming to be a direct

quotation! Perhaps he made the point several times, but I also found them under the names Scott McNealy, Scott McNeally, and Scott MacNealy. Don't trust the first thing you find! But there were 300,000, 375, and 39 hits, respectively, for the names: McNealy it is! For wording, "You have zero privacy anyway, get over it," collected more than 900 hits, with 530 for "You have no privacy. Get over it." The others ranged from two to 192. Memory tends to simplify, so the first seems likely. Definitive? No, history rarely is. But probably good enough.

Looking for the final soliloquy in *Bladerunner*, I found the replicant quoted as saying, "I watched C-beams glitter in the dark near the Tannhauser Gate" and "I've watched C-beams glitter in the dark near the Tannhauser Gate." The first drew 54,000 hits; the second, 13,000. The speech began, "I've seen things you people wouldn't believe," setting people up to persevere the contraction. The first is a good bet.

Finally, in looking for quotations about forecasting the future, I came across variants of the statement "Prediction is very difficult, especially if it's about the future," attributed to the Nobel laureate physicist Niels Bohr and to the baseball player Yogi Berra.

<prediction difficult future Bohr> got 200,000 hits, <prediction difficult future Berra> got 60,000. No doubt both said it. Bohr was probably first, but Bohr may not have been joking. Physicists are wary about the future. Einstein said, "I never think of the future, it comes soon enough."