

PAINTING THE FUTURE

Some Remarks following the *Interval Research*
Brainstorming Session of 7 May 1992

by Rob Tow

Portrait of a future that we *want* to live in—New technologies, new tools, new wealth—Visions of future computing ubiquitous *vs* nomadic *vs* universal computing & virtual reality *vs* augmented reality—*The future's so bright, I gotta wear (data)shades*—Zen and the art of user interface—The evolution of technology—The role of the individual—Lessons from documents fax, desktop publishing, email, & smart-paper—Future phenomenology—What is to Be Done

The world in which we wish to live is that of triumphant science employed for the betterment of mankind. This ideal has its roots in the vision of René Descartes and Francis Bacon, and has changed but little in its essentials since the seventeenth century—when Bacon observed that “no empire, no sect, no star seems to have exerted greater power and influence in human affairs” than the three “mechanical discoveries” of printing, gunpowder, and the compass. He sketched a program designed to “subdue and overcome the necessities and miseries of humanity”, based on technology. This is still the hopeful vision of scientific humanists.

Now the new “mechanical discoveries” of computers, video, and instant communication are changing the world. Certain trends involving these technologies may be easily extrapolated by anyone equipped with log graph paper—there's at least two decades of dependable decline ahead in price and increase in power in conventional silicon fabrication and communications technologies.

Lately, an empire has dissolved under their influence.

New knowledge, new technologies—new tools and instrumentalities for scientists, engineers, *and artists*—create new wealth. They do so more than does labor. For example, bauxite ore is just a heap of rocks—unless one knows the details of the Hall process for smelting aluminum—then it may be transformed, perhaps into pots—or airplane wings. This points a way out of the limits to growth, out of the zero-sum games, out of the Malthusian competition. *This is where Marx got it deeply wrong.*

By the end of the century half the world's population will be under the age of twenty. Aggressively moving forward with technology will be the only way to avoid collapse. Even so, it's going to be pretty rough going as we enter the next millennium.

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An important element of the basic world view expressed in the work done by all of us is an emphasis on the individual person—on empowering individuals, with access to knowledge, personal computing, publishing, and communication technologies

Today there are five main visions of the future of computing. They each make profoundly different statements about the individual and the group

Ubiquitous computing—Mark Weiser's vision—involves living in an architecture that, like classical architecture, defines the relation of the individual to the group by defining space, in the context of a building. In such a building there are many displays, flat panels—several megapixel displays, tens of smaller screens, and hundreds of “post-it” sized displays per person. All are linked into the Net. One wanders through rooms and halls, tracked by the computer architecture by

wearing an active badge that signals one's presence. Your user interface travels along with you, flitting from screen to screen. In Weiser's vision *space* becomes intertwined with *cyberspace*, and *building architecture* merges with *computer architecture*. It's Apollonian computing—philosopher kings engaged in discourse, strolling through serene columns that are the forest tree trunks of an information ecology, the opposite of Plato's cave.

Nomadic computing—currently expressed by the laptop with a fax/data modem—is the vision of a person roaming, equipped with a personal computer, independent of externals, yet able to tap telecommunications to access remote resources—again, a definition of space, of architecture, and of the relationship of the individual and society. Xerox's *PaperWorks*™ fax control software is the latest enabling step in this vision. The near future holds the promise of a wallet sized “personal data assistant” that combines all of the functionality of computer, fax, phone, and net access. It's wonderfully American West—*cowboy computing*.

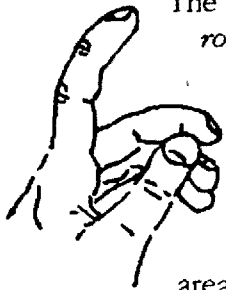
Universal computing—the nanotech dreams of Eric Drexler and Ralph Merkle—aims nothing less than complete transformation of reality from atoms on up. By making self-replicating molecular computing devices—by imposing a new level of information flow upon physics, on to the low level organization of matter and energy—literally everything will become part of the computing universe. The individual ultimately dissolves into the infosphere—*uploads*—producing the most radical redefinition of space, of architecture, and of the relationship of the individual and society. The nanos talk of the *historical singularity*—the time in the future beyond which no meaningful predictions can possibly be made because so much changes. Some put it as close as fifty years from now. The dark side of their vision is *gray goo*—the molecular dissolution of the biosphere by programmed self-replicating molecular machines that transform everything into copies of themselves. The bright side is expressed by the nanos and their close cousins the cryos—the physical resurrection of the body, physical immortality, achievable now by one way time travel into the future via cryonics—frozen corpses awaiting medical nanomachines that rebuild and reconstitute. Curiously, the nanos abhor quantum mechanics, and construct paper models of mechanical molecular Babbage machines, reflecting an overly deterministic reductionism.

Virtual reality—Jaron Lanier's “post-symbolic” synthetic replacement of the sensorium—is the ultimate escapist trip. Some proclaim it to be “better than acid.” It finds its trivialization in cybersex—

teledildonics An early commercial application is in commercial architecture—the designer and customer can walk through buildings, with the sun angle and weather dialed in, experiencing views derived from computer models. Culturally, it's hot—it's on CNN, there's a cult movie (*Lawnmower Man*)—you can go to a San Francisco house party (“rave”), take some choline laced “smart drinks”, put on a VR helmet and a dataglove—and fly away through virtual walls with the point of a finger.

Augmented reality—fighter pilots get this from their heads-up display—overlays the normal sensorium with additional inputs, expanding the experience of external reality. An architect might experience this by wearing *datashades*—light weight head mounted displays with cameras mounted on them—walking into a room he might see a representation of the buildings wiring overlaid within his view of the walls—or a surgeon might see “into” a patient while operating. A popular song of the eighties proclaimed “*the future's so bright, I gotta wear shades*”—by the end of the nineties advances in display technology, taking advantage of VLSI binary optics, will make cheap light weight datashades a reality. Datashades, using eye tracking and eye blinks as the primary interface, will enable people to augment reality while walking, bicycling—even skiing.

“Virtual reality” is like Hindu meditation, trancing into an illusion, “augmented reality” is more like Zen—a more profound immersion in the world. “Post-symbolic” computing smacks of the “paperless office”—just as there's now more *paper* than ever before, in the future there will be more *symbols* than before—richer symbols, communicating to more sophisticated people. Video as a first class data structure is inherent in both, and both will introduce *dynamics* (simulated physics) into user interfaces. Dynamics may ape the physical world—or follow the “laws” of magic (contagion, contiguity, similarity). Augmented reality will be richer and more expressive than “real” reality.



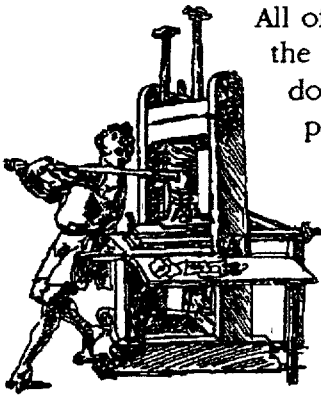
The real future will see all five of these visions intermingled. *All of them are closer to robust realization than most people appreciate.*

New technologies arise from earlier ones, in a fashion reminiscent of biological evolution. There are times of rapid change from a small ancestral stock, followed by smooth radiation and diversity through an ecology—*punctuated equilibrium*. The eighties saw such a evolutionary radiation out from innovations made at Xerox PARC—the personal computer, the desktop metaphor, laser printing, and the local area network.

Shortly, a new radiation will begin, from the five wellsprings identified above.

Individuals make a difference at these times of key innovation. It's important to realize that the same basic technology may be expressed in very different ways—much as is seen in the architecture of buildings—defining/enabling/limiting the individual and the group. When the major innovators of a technology *design* they may influence a school, a generation, a society. Their design is the original mutation, the primeval stock—Lucy walking the veldt. Part of the challenge for technologists is exactly this opportunity. The same skills of design and architecture may be expressed to give the vast cubic land of Hewlett-Packard or the individual offices of Microsoft or PARC. Similar choices abound in the design of computer and communications systems.

The other side of the duality of the individual in this context is found in the opportunity to place humanity—in the form of the individual—back into the center of the universe/infosphere, from which it has been cast out since the Renaissance.



All of this is seen in miniature in the history of documents, pointing the way of the future of other technologies. Gutenberg innovated a robust *mass production* document technology. They became cheap and identical. *Newspapers* became possible—access to basic information increased tremendously, with the standard delay of news transmission dramatically chopped—with great social impact. † Lately, a new innovation in printing has been made—the introduction of digital data embedded within the marks, images, and glyphs on paper, below the limits of sensible perception. This makes the visible appearance of paper documents the tip of an iceberg—most of the substance is below the surface, a frozen snapshot of a Turing-complete process. This “*smart paper*” is the first major change in the basic nature of printed documents since Gutenberg—fax machines and laser printers are elaborations of his vision, not changes.

There are things that are deeply right about fax. Its success stands in stark contrast to the vision of many at the start of the eighties—structured document interchange. Rather than intelligent editors and formats, building on the success of Arpanet’s email, we find at the end of the decade in Silicon Valley thousands of resumes faxing into digital stores, dumped into OCR software, ending in databases accessed by keyword search. Fax has an appealing *physicality*—you can scribble on it, and transmit the scribbles—and makes the simple pixel map a first class data structure.

Video is following fast along the same route, with personal video looming large in the contemporary social, legal, and political scene. Our notions of privacy will never be same once video cameras shrink to buttons, and are worn as clothing by those who are into ubiquitous self-bugging.

All of this has the potential to change the human condition, all the way down to phenomenology. “Reality” is a slippery concept and is definitely constructive. It is built from the confluence of experience, wiring, and input (at least). It is not “external”, as Locke would have it. Altering the input—particularly before the age of ~7, while the wiring of the brain is still evolving—definitely changes reality. Consider cats raised in an environment consisting only of vertical lines: they lack the cortical wiring to “see” horizontal stripes. The latter simply *do not exist* to the cat raised in such a deprived environment. Now consider that we were wired in a deprived sensory environment, compared to what children twenty years from now will experience routinely, in play, in virtual and augmented reality. They may well perceive things we never will.



So, what is to be done? Paul Allen has expressed a desire to give back to society such underpinnings as he stood upon to make his fortune and change the world. This echoes the words of Newton, when he remarked that if he had seen farther that it was because he stood on the shoulders of giants. His challenge is to gather together, use the resources he provides, and to invent the future—in the spirit of a new Enlightenment that enriches and betters us and our children. *The key is to make a difference that makes a difference.*



†In Paris following the Revolution there were over *five hundred* newspapers (and a literacy rate of 93%). Astonishing, but true—for an account of the pivotal role of printing in the French Revolution see Simon Schama’s *Citizens: a Chronicle of the French Revolution*. Lenin’s counterview of the importance of central control of the press may be found in his essay *What Is to Be Done*.

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