Ben Shneiderman

the human connection

Between Hope and Fear

HOPE IS A VITAL HUMAN EMOTION, STIMULATED BY THE DESIRE TO MAKE life better and infused with the belief that change is possible. Hope has a strong rational component that shapes plans and reasons about possible outcomes, but hope depends on passion for forward movement.

Deeply held hopes can invigorate others to join in purposeful action. Martin Luther King's "I Have A Dream" speech is inspirational because of its image of racial harmony. Similarly, John F. Kennedy's vision of setting foot on the moon helped bring it about. His passion provided the propelling force for the rational scientific work that followed.

Often hope must overcome resistance—the fear that action will fail or leave us worse off. Fear can be a terrifying barrier to change, but also an energizer for action. Confronting fears and summoning the courage to press forward requires self-confidence and a determination to succeed. Because of these challenges, people and civilizations are often remembered for their deep hopes, or in the words of Ezra Pound: "One measure of a civilization, either of an age or of a single individual, is what that age or person really wishes to do."

The Deep Hopes of Computing Professionals

On this Golden Anniversary of ACM, computing professionals can reflect proudly on 50 years of accomplishments. It is also appropriate for us to consider our deep hopes for the next 50 years. Computing has grown into a worldwide infrastructure that touches every country and soon may touch every individual on the planet. But what are our deep hopes for the next 50 years? If our hopes inspire action, our profession will be appreciated for contributing to a better society [2, 10, 12].

Through the half-century of our profession, visionaries have inspired constructive development. In the 1940s, Vannevar Bush's envisioned memex, a desk with microfilm libraries to extend memory by accessing vast resources of patents, scientific papers, or legal citations [3]. J.C.R. Licklider carried the digital library idea into the world of electronic computers and recognized the potential for teleconferencing to bring people closer together [7]. Douglas Engelbart envisioned computers as symbol manipulators that could augment human intellect [5]. He created an ambitious workstation with a mouse, chorded keyboard, an outliner, and links across documents that he demonstrated at the Fall Joint Computer Conference of 1968. Later visionaries brought us personal computers, networks, electronic mail, graphical user interfaces, and more. These helped launch the modern computer industry, but finding the next breakthrough is still a challenge.

An obvious vision of hope is by technology extrapolation which posits that advances in technology are in themselves beneficial to society. This approach leads to

In 1947, when ACM was founded and I was born, my father published a book on post-war Europe entitled Between Fear and Hope. *I chose my essay to reflect an emphasis on hope and to honor my father who died on October 8, 1996 at age 90.*

dreams of gigahertz processors producing rapid user-controlled 3D animations on gigapixel displays. Technology extrapolation also suggests terabyte hard disks and webspaces with petabytes of information at our fingertips. Progress is relatively easy to recognize if we follow technology extrapolation, but a more challenging path is to consider what technologies we want to change ourselves and our civilization.

A more elaborate form of technology extrapolation is to dream for intelligent agents, speech interaction, or information at our fingertips [6, 8]. These are technology-oriented goals, but they are not directly linked to clear societal benefits such as world peace, improved health care, or civil rights. Linking grand goals to realistic scenarios for accomplishing them, takes impassioned imagination combined with scientific rigor.

Let's start with imagination. The fisherman who rubbed Aladdin's lamp evoked a genie who offered three wishes. If rubbing your keyboard could produce a modern digital genie, what deep hopes would you chose to shape the future? After much reflection, here are my three wishes:

Wish 1. Universal Access to Computing Technology

My first hope is for universal access, in which progress is defined by the percentage of the population with convenient low-cost access to specific World-Wide Web services, such as electronic mail, distance education, or community networks [1]. Providing electricity, hardware, and communications is just the beginning. Applications and services will have to be re-engineered to meet the differing needs of the many still forgotten users. We must think about how email can be reshaped to accommodate poor writers and readers, while helping to improve their skills. How can job training and hunting be organized to serve those with currently poor employment skills and transient lifestyles? How can services such as voting, motor vehicle registration, or crime reporting be improved if universal network access is assumed?

Perhaps we can begin by redesigning interfaces to simplify common tasks. We can provide novel training and help methods so that using a computer is a satisfying opportunity, not a frustrating challenge. Evolutionary learning with level-structured interfaces would allow first time users to succeed with common tasks and provide a growth path to reveal more complex features. With millions of new users, improved strategies for filtering email, searching directories, finding information, and getting online assistance will be needed. Low-cost manufacturing is a central requirement to achieve universal access, for poorer Americans or the many still poorer citizens in less technologically developed nations.

Facile tailoring of interfaces for diverse populations could be accomplished with control panels that allow users to specify their national language, units of measurement, skill level, and more. Portability to non-standard hardware, accommodation of varying screen sizes or modem speeds, and design for handicapped or elderly users should be common practices.

Support for increased plasticity of information and services is technologically possible but attention has been limited. Convenient semantic tagging of items would enable software designers to reformat presentations, selectively remove unnecessary information, or integrate related materials dynamically to adjust to users' needs. Comprehensible software tools to support platform-independent authoring will enable many more people to contribute to the growing worldwide information infrastructure, as well as to their local resources.

Universal access is a policy issue because common practices and a guiding vision are helpful. Regulatory policies for telephones, television, and highways have been successful in creating near-universal access to these technologies, but computing economics, designs, and services apparently need revision to reach a broader audience. Fears of inappropriate intervention in free markets are legitimate, but commercial producers are likely to be huge beneficiaries of universal access policies. How might decision makers encourage industry to support universal access so as to create an expanding market that also benefits producers of commercial products and services?

In communities where adequate housing, sanitation, and food are still problems, telephones or computing are not primary needs, but the technology can

still be helpful as part of an overall development plan. Community networking technologies are being tried in well-off locales such as Taos, N.M., Seattle, Wash., and Blacksburg, Virg., but adapting these designs to mountainous Nepal, urban Rio de Janeiro, or rural Botswana will take creative engineering, in addition to financial resources.

Wish 2. Universal Medical Records

My hope is for improved medical recordkeeping. Resistance to changing the current paper-based approaches limits the availability of medical information for clinical decision-making, quality control, and research. It is a paradox that airline reservations are available around the world, crossing hostile political boundaries and spanning networks of competing companies, but your medical records are inaccessible even when they might help save your life.

A physician at any emergency room in the world should be able to review your history and see your most recent electrocardiogram or chest x-ray within 15 seconds of your arrival, either by network or personal datacard. The display should appear in the local language, using familiar units of measurement, with easy access to details and convenient links for electronic consultation with physicians who know you personally.

Progress on standardizing clinical records, speeding data entry for patient histories, and designing effective overviews for viewing patient records [9] could be dramatically accelerated. With a one-screen overview of patient histories, physicians could quickly spot previous surgeries or chronic diseases that might affect current decisions. Privacy protection and cost containment are serious concerns, but the potential for improved healthcare and reduced costs are compelling.

Further benefits of online medical records include assistance in formulating treatment plans and clinical research. Shouldn't your physician be able to review last year's outcomes for potential treatment plans in a sample of 10,000 patients with your symptoms? Shouldn't scientists be able to retrospectively study case histories to support research on treatment plans and their clinical outcomes?

With careful attention to personal privacy and costs, online medical records can become the basis for improved accountability of individual physicians and health management organizations, as well as improved medical understanding. Physicians may resist such visibility of their decisions, but objective comparisons with peer performance seem preferable to the current complexity and cost of malpractice litigation.

Wish 3. Universal Educational Support

Education is the hope of civilization. Computing is already dramatically altering education, but it is not enough to teach children about surfing the net, we must also teach them about making waves [11]. Finding information is useful only if students have a meaningful goal and a chance to influence their world.

My approach combines education with social benefit and authentic experiences to teach students how to participate in work groups, political systems, and communities. Powerful information technologies enable students to collaborate effectively in constructing meaningful results that benefit someone outside the classroom. These action-oriented and authentic service projects done in teams produce a high level of motivation among students and give them the satisfaction of helping others while learning.

A favorite student project involved a team interested in computing for the elderly. They read the literature, made a plan, brought computers to a nearby nursing home, and trained the elderly residents for several weeks. Then their final report was written to the director of the home, with a well-reasoned plan for what might be done and pointers to helpful organizations. Another project set up a database system for a charitable organization that continues to manage volunteer and donor lists with more than 20,000 names.

Student projects could be educationally oriented, such as writing an online textbook. Creating services for others is compelling to students and is in harmony with

Web Revelations

In trying to fathom the link between the emotional quality of hope and the rational world of technology, I ventured onto the Web. A quick search revealed an encouraging pattern: More than a million entries for hope, and only a third of a million for fear.

Some probing yielded a web site from a recent international conference in Japan on "The Future of Hope." (http://iij.asahi.com/paper/hope/english/index.html) Along with many speakers, Elie Wiesel called for recognition of past and current suffering. The closing Hiroshima Declaration stressed continued reduction in nuclear weapons and support for human and civil rights. It mentioned the potential for revolutionary technologies which "offer ever more opportunities to bring people and leaders together in dialogue and thus resolve their conflicts." These are appropriate goals for writers and philosophers, but I wondered what we, as computer science researchers and practitioners, might have as hopes for the future?

the efforts in many states, such as Maryland, which requires 60 hours of community service for high school graduation.

This relate/create/donate approach enlivens the educational process, pushes students to learn the relevant fundamentals and encourages them towards practical goals [4]. I'm encouraged by reports from others who have replicated and adapted this strategy from elementary schools (10-year-olds creating a multimedia course on the animals of Africa for 8-year-olds) to graduate business schools (MBA students set up Web pages for 24 campus and community groups).

Current technologies provide some support for relate/create/donate styles of education, but four phases of creative work could be improved with advanced technology:

- Reliable retrieval of existing knowledge relevant to team projects
- Creative activities with brainstorming tools, simulation modeling, design exploration, and authoring tools
- Consultation with peers and experts using convenient group support tools
- Dissemination of results through community information tools

> "A computer is like a big box of games. It can do everything. It needs electricity to work. My dad uses it to write and the computer pays him money."
>
> — Alex Gordon, age 5
> Dublin, Ireland

Imagine online science festivals in which student projects could build on one another over the years. New student teams could view previous projects, conduct research and develop creative contributions, while consulting with other teams who are working on related problems or with professional scientists. The results could be reviewed by award panels, disseminated to interested people, and posted for future students.

Resistance to team projects is natural from faculty who have never had the experience themselves, but many are learning to guide computer-mediated team projects. The shift from "sage on the stage to guide on the side" is a challenge, and finding appropriate team projects plus management strategies takes experience. Those who succeed are enthusiastic about the power of collaboration and the thrill of intense experiences.

Conclusion

Taking responsibility for the future is a substantial challenge. It is my sincere belief that we, as computing professionals, should accept the challenge to look beyond the technology and create a vision that inspires action. If we do this, we may be well-remembered by history.

There are so many important problems to work, there is room for everyone to contribute: Jobs can be more rewarding, communities can be safer, and lives can be happier. Each one of us can make a difference.

Universal access to computing technology, universal medical records, and universal educational support are my ambitious hopes. There are surely other hopes and visions that can steer computing towards higher societal benefits, while providing unlimited challenges for researchers, entrepreneurs, and practitioners. For those who feel inspired and wish to contribute, the time to begin is now and the leader to look to is you.

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References

1. Anderson, R.H., Bikson, T.K., Law, S.A., and Mitchell, B. Universal Access to Email: Feasibility and Societal Implications. RAND, Santa Monica, Calif (1995). Also at http://www.rand.org
2. Brooks, F., Jr. The computer scientist as toolsmith II. *Commun. ACM 39*, 2 (1996), 61–68.
3. Bush, V. As we may think. *Atlantic Monthly* (July 1945). Also at http://www2.theAtlantic.com/atlantic/atlweb/flashbks/computer/tech.htm
4. Denning, P. J. Educating a new engineer. *Commun ACM 35,* 12 (1992), 83–97.
5. Engelbart, D.C. and English, W.K. A research center for augmenting human intellect. In *AFIPS Proceedings Fall Joint Computer Conference 33* (1968), 395–410.
6. Gates, B. *The Road Ahead.* Viking Penguin, New York (1995).
7. Licklider, J.C.R. *Libraries of the Future.* MIT Press, Cambridge, Mass. (1965).
8. Negroponte, N. *Being Digital.* Hodder and Stoughton, London (1995).
9. Plaisant, C., Rose, A., Milash, B., Widoff, S., and Shneiderman, B. LifeLines: Visualizing personal histories. In *Proceedings of ACM CHI'96 Conference: Human Factors in Computing Systems*. ACM, New York. (1996), 221–227, 518.
10. Shneiderman, B. Durango Declaration. *Commun. ACM 38,* 10 (1995), 13.
11. Shneiderman, B, Engagement and construction: Educational strategies for the post-TV era. *J. Computers in Higher Education 2*, 4 (Spring 1993), 106–116.
12. Shneiderman, B. Human values and the future of technology: A declaration of responsibility. Keynote address. *ACM SIGCAS Conference on Computers and the Quality of Life CQL '90.* SIGCAS Computers & Society 20, 3 (Oct. 1990), 1-6. Reprinted in ACM SIGCHI Bulletin (Jan. 1991)

Ben Shneiderman (ben@cs.umd.edu) is a professor in the Department of Computer Science, Head of the Human-Computer Interaction Laboratory, and member of the Institute for Systems Research, all at the University of Maryland at College Park.