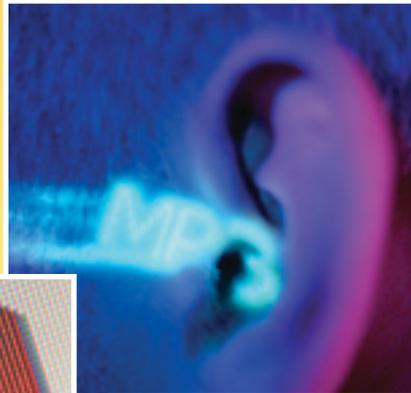
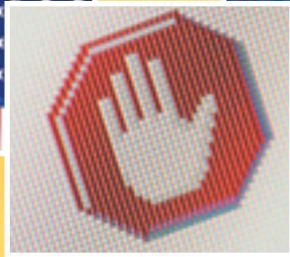




By William E. Halal

The Intelligent Internet

The Promise of Smart Computers and E-Commerce



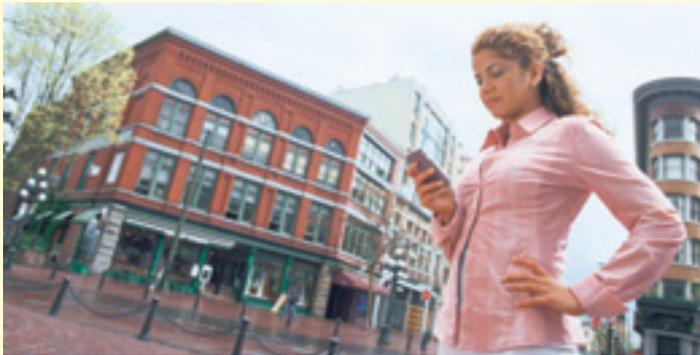
Information and communication technologies are rapidly converging to create machines that understand us, do what we tell them to, and even anticipate our needs.

We tend to think of intelligent systems as a distant possibility, but two relentless supertrends are moving this scenario toward near-term reality. Scientific advances are making it possible for people to talk to smart computers, while more enterprises are exploiting the commercial potential of the Internet.

This synthesis of computer intelligence and the Internet is rapidly creating a powerful new global communication system that is convenient, productive, and transformative—the Intelligent Internet. Here are three simple examples of what should become common soon.

- The UCLA Cultural Virtual Reality Laboratory has developed a Web site that recreates ancient Rome. Visitors are able to virtually walk around 3-D images of reconstructed temples, monuments, and plazas as though they were living in Rome

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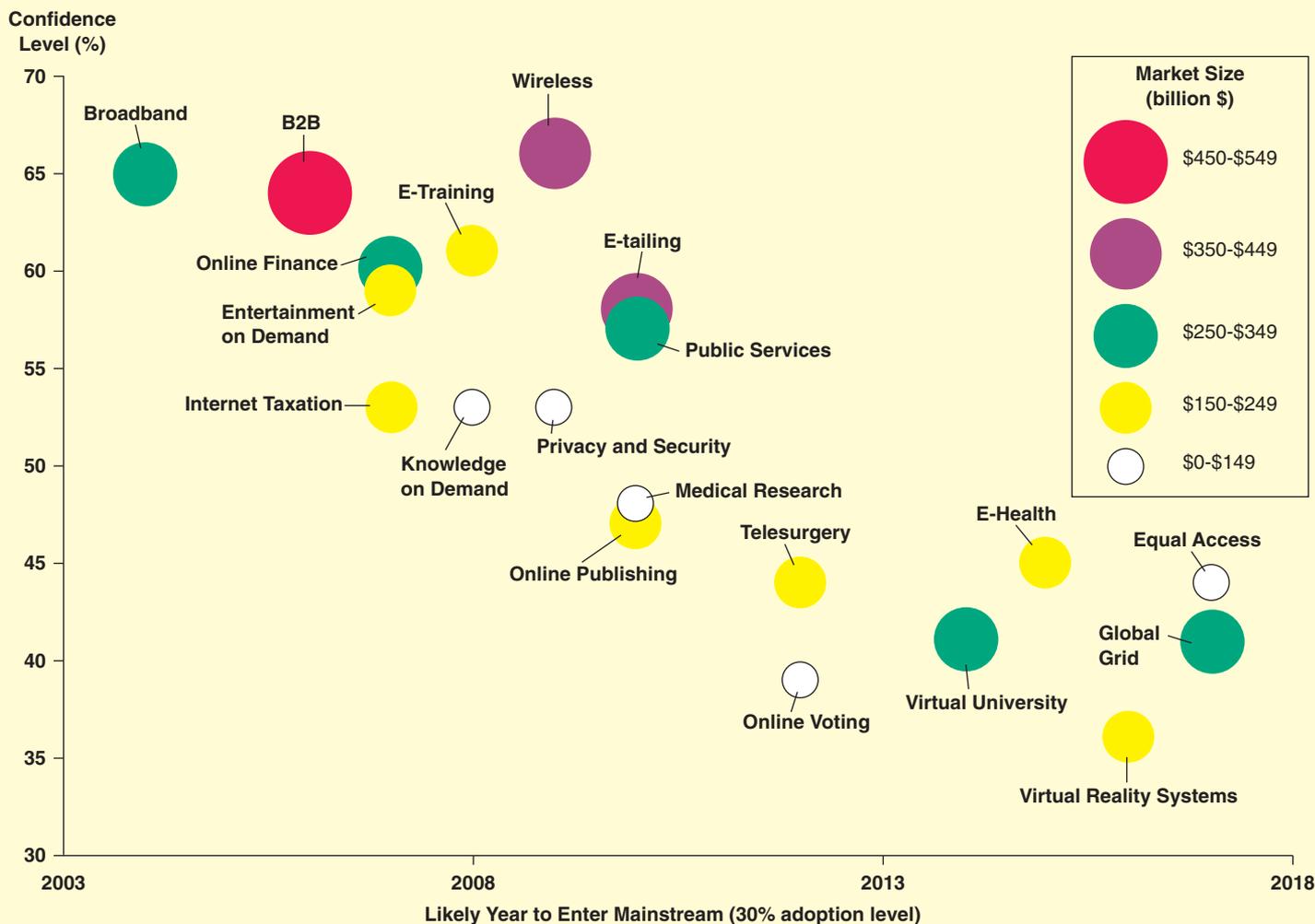


Wireless Webphones: Mobile smart phones such as Microsoft's will find their way into more and more hands.



Privacy and Security: People will feel safer about Web surfing.

E-Commerce Technology



Notes: "Likely Year" is the most likely year that each e-commerce service is expected to reach its stated adoption level in industrialized nations. Adoption levels are defined as a percent of the total that is possible. For instance, *broadband* is defined as the percent of households, while *e-tailing* is the percent of retail sales. "Confidence Level" is the confidence experts place in their forecast of "Likely Year." "Market Size" is a relative measure of the economic market resulting from each e-commerce service, on a scale from a low of less than \$150 billion to a high of about \$550 billion. See www.TechCast.org; "Emerging Technologies," THE FUTURIST (November-December 1997); and "The Top Ten Emerging Technologies," THE FUTURIST (July-August 2000).

ORIGINAL GRAPH CONSTRUCTION BY PAUL WILLIAMS, GWU GRADUATE ASSISTANT. DESIGNED FOR THE FUTURIST BY LISA MATHIAS.



Entertainment on Demand: MP3.com's digital music site is forerunner of entertainment services to come.



Online Publishing: RealRead offers online book, magazine, and catalog services.

Timeline

Broadband High-speed channels (DSL, cable, Ethernet, and satellite) are used in 30% of homes: 2004.

B2B 30% of commercial transactions are conducted online: 2006.

E-Health Online systems are used 30% of the time to prescribe drugs, order lab tests, monitor patients, etc.: 2015.

Entertainment on Demand 30% of music, movies, games, and other entertainment is sold online: 2007.

Equal Access Most (90%) of underprivileged people have Internet access: 2017.

E-tailing 30% of goods and services are sold online: 2010.

E-Training Distance learning (Internet, video, e-mail) is the main method used in 30% of training programs: 2008.

Global Grid Half of the world population has access to PCs, Internet, etc.: 2017.

Internet Taxation Internet sales are taxed by major nations: 2007.

Knowledge on Demand Focused educational programs are used online to serve 30% of specific needs: 2008.

Medical Research 30% of clinical research is conducted using computerized systems: 2010.

Online Finance 30% of banking, investments, and other financial services are performed online: 2007.

Online Publishing 30% of newspapers, magazines, journals, and books are sold online: 2010.

Online Voting ATM-type machines or PCs on the Internet are used in 30% of elections: 2012.

Privacy and Security A majority of the public feels safe about the privacy and security of their information: 2009.

Public Services 30% of government services (auto registration, licenses, fees, etc.) are conducted online: 2010.

Telesurgery Surgical procedures are performed at remote locations: 2012.

Virtual Reality Systems are used by 30% of the public to experience exotic environments (Mars), entertainment (games, virtual sex), education, testing designs, etc.: 2016.

Virtual University Distance learning (Internet, video, e-mail) is the main method used in 30% of courses: 2014.

Wireless Web phones, handheld devices, etc., are used by 30% of the population for Internet, video, etc.: 2009.

About the GW Forecast and TechCast

The George Washington University Forecast of Emerging Technologies (GW Forecast) is a research project initiated by William Halal, management professor, that has been in operation for a decade. In order to provide a source of funding to support this work, TechCast was formed two years ago as a limited liability corporation (LLC), with the goal of commercializing the results. TechCast is jointly owned by Halal and the other officers of the project, by George Washington University, and by partner George Mason University. TechCast intends to offer individuals and organizations access to the information on its new Web site, www.TechCast.org, on a subscription basis.

2,000 years ago. The head of UCLA's lab calls it "a kind of time machine."

- Amtrak has installed speech recognition software to replace the button-pressing menus that drive many people mad. Now you can talk to a virtual salesperson named Julie to get train schedules, make reservations, pay for tickets, and discuss problems. Customers are happier, and Amtrak is saving money.

- The Waldorf-Astoria Hotel in New York City leases out a five-by-seven-foot videoconferencing system that allows guests to hold virtual meetings with other people at remote locations. Business people find it so useful that the system is always busy.

It may seem foolhardy to claim that the Internet will soon thrive again when economies around the globe struggle out of recession. After all, it was the unrealistic hype of endless growth we heard during the dot-com boom that caused today's economic pain. But forecasts conducted under the TechCast Project at George Washington University indicate that 20 commercial aspects of Internet use should reach 30% "take-

“We are poised at the cusp of another major technology transition, much as the 1980s brought the PC and the 1990s brought the Internet.”

off” adoption levels during the second half of this decade to rejuvenate the economy. Meanwhile, the project’s technology scanning finds that advances in speech recognition, artificial intelligence, powerful computers, virtual environments, and flat wall monitors are producing a “conversational” human-machine interface.

These powerful trends will drive the next generation of information technology into the mainstream by about 2010. Rather than forcing us to hunch over a keyboard, this Intelligent Internet should allow people everywhere to converse naturally and comfortably with life-sized, virtual people while shopping, working, learning, and conducting most social relationships.

Economic Maturing Of the Internet

The TechCast system, formerly called The GW Forecast, is a database-driven Web site in which panels of experts provide online estimates to carefully researched questions. The estimates are pooled automatically to produce the best possible forecast of when each technology is likely to take off, the associated confidence level, and size of the potential market—in real time.

Results are presented in the E-Commerce Technology Timeline [see chart on page 28] for 20 applications of e-commerce. The expert panel convened for this study comprises 38 authorities from a variety of backgrounds, including CEOs of high-tech firms, technology officers, scientists and engineers, consultants, academics, and futurists. Not all experts respond to every question, so

the typical number of respondents averages 22. Delphi forecasts of this type are generally considered sound if they use a dozen or more experts, which makes these results fairly reliable.

These results portray a striking scenario in which the dominant forms of e-commerce—broadband, business-to-business (B2B), online finance, entertain-

ment-on-demand, wireless, e-training, knowledge-on-demand, electronic public services, online publishing, e-tailing—grow from their present 5%–20% adoption levels to 30% between 2004 and 2010. TechCast considers the 30% penetration level significant because this roughly marks the “take-off point” when technologies move from their early-adopter phase into the mainstream, where they permeate economic and social life. Andrew Grove, former CEO of Intel, told *Business Week* (May 5, 2003), “Everything we ever said about the Internet is happening now.”

Many think the Internet is mainstream now, but that’s only true for nonpaying use, such as surfing for free information. As of 2003, commercial operations involving monetary exchange were limited to about 23% for broadband, 10% for e-tailing, 12% for B2B, 10% for distance learning, and 5% for music. And these are the most popular Internet applications. Others hardly register in adoption levels at all.

TechCast’s other results suggest that more-complex applications—online voting, e-health, the virtual university, virtual reality, and the global grid—are likely to follow later. These forms of e-commerce lag because they involve more exotic and costly technology, difficult institutional changes, and new forms of consumer behavior. Making the virtual university a reality, for instance, requires professors to switch from traditional lectures to communication technologies that are poorly developed, college administrators to justify the economic feasibility of more expensive systems, and students to feel comfortable and trusting in a virtual setting. E-health de-

mands a similar transformation among physicians, hospitals, and patients.

The remaining developments in our forecast—taxation, privacy and security, computerized research, telesurgery, and equal access—should appear at varying times throughout the next two decades. These applications differ because they do not serve major new social needs but involve modifications of existing systems.

Interwoven through these advances in e-commerce are other trends leading to a new generation of intelligent systems expected to emerge during the same time period. The TechCast project calls it TeleLiving—a conversational human-machine interface that allows a more comfortable and convenient way to shop, work, educate, entertain, and conduct most other social relationships [see THE FUTURIST, January-February 2003]. The following are a few of the advances in speech recognition, artificial intelligence, powerful chips, virtual environments, and flat-screen wall monitors that are likely to produce this intelligent interface.

■ Reliable speech recognition should be common by 2010.

- IBM has a Super Human Speech Recognition Program to greatly improve accuracy, and in the next decade Microsoft’s program is expected to reduce the error rate of speech recognition, matching human capabilities.

- MIT is planning to demonstrate their Project Oxygen, which features a voice-machine interface. Project director Rodney Brooks says, “I wanted to bring the machine into our world, a machine that will look you in the eye, let you ask questions in casual English, and answer them the same way.”

- Amtrak, Wells Fargo, Land’s End, and many other organizations are replacing keypad-menu call centers with speech-recognition systems because they improve customer service and recover investment in a year or two. Analysts think most companies will make the conversion soon.

- Internet search engines such as Google and Yahoo operate voice-

recognition systems that help users find what they seek.

- General Motors OnStar driver assistance system relies primarily on voice commands, with live staff for backup; the number of subscribers has grown from 200,000 to 2 million and is expected to increase by 1 million per year. The Lexus DVD Navigation System responds to over 100 commands and guides the driver with voice and visual directions.

- Even more pervasive yet simpler, Sprint offers voice dialing on most cell phones and networks.

■ Smart computers will be learning and adapting within a decade.

- The Defense Advanced Research Projects Agency is developing a hypersmart computer that can maintain itself, assess its performance, make adaptive changes, and respond to different situations.

- The Department of Energy is creating an intelligent computer that can infer intent, remember prior experiences, analyze problems, and make decisions.

- IBM's "autonomic computing" program will allow servers and networks to solve problems and reconfigure themselves to accomplish a goal, just as organisms rely on an autonomic nervous system to regulate heartbeat and body temperature.

- Norton provides PC software that can eliminate virus infections, optimize computer performance, fix registry mistakes, and perform other tasks without user intervention.

- AI is being used to intelligently guide human action figures in computer games, such as *Sims*, *Metal Gear Solid*, *Unreal Tournament*, and *Halo*.

- Pattern matching and text parsing are used to improve searches by Google and AltaVista.

- BCC Corporation estimates total AI sales to grow from \$12 billion in 2002 to \$21 billion in 2007.

■ A new generation of computer power is here.

Intel and AMD are introducing 64-bit processors to replace the 32-bit chips that brought us the Windows operating system a decade ago. The 64-bit chips mark a new generation of computer power that features

cinematic displays rivaling the most sophisticated science-fiction movies, accurate speech recognition, and artificial intelligence.

■ Virtual robots/environments will populate the Web by 2010.

- Virtual robots, or avatars, are becoming common, such as Ananova, a female robot who presents weather reports. In Japan, Yuki Terai is a virtual rock star who has become a national idol.

- "There" is a multimedia Web site featuring 3-D computer-generated environments populated with avatars that interact with users and other avatars.

- According to the CEO of Native Minds, a virtual robot maker, "The Internet will be filled with robots by 2010."

■ Flat wall monitors should become common in a few years.

- Sales of liquid crystal display (LCD) monitors now surpass cathode ray tube (CRT) sales, introducing an era of flat monitors that use one-third the power of CRTs. "Ultimately, the flat panel is less expensive," according to a Dell manager.

- Leading TV makers are all bringing out 60-inch wall-mounted digital TV monitors.

- Albeit expensive now, as the switch from CRTs to LCDs gathers momentum, costs and prices should fall dramatically, making \$1,000 wall monitors the size of a movie screen fairly common. A fully functional three-by-five-foot wall monitor should sell for less than \$500.

These are formidable undertakings, to be sure, and some may not succeed as planned. But such remarkable developments promise to transform the human-computer interface. Powerful new scientific capabilities are being applied now for simple uses, and if current trends hold, a modest version of the talking computer made famous in *2001: A Space Odyssey* should be available about 2010. Rather than use a keyboard or mouse, the PC will disappear into a corner while we talk to life-sized virtual persons on large wall monitors.

A few years ago, Microsoft chairman Bill Gates claimed, "The future

lies with computers that talk, see, listen, and learn." This view is now supported by computer industry leaders. Robert McClure of IDC stated recently, "What the graphical user interface was in the 1990s, the natural user interface will be in this decade." Sony President Kunitake Ando expects the PC of 2005 to be a more personalized, intelligent system, acting as a "teacher, agent, and guide." Ian Pearson at British Telecom sees a resumption of Internet growth in 2005 and 2006, driven by "better interface technology . . . and artificial intelligence." And computer scientist Ray Kurzweil forecasts, "It will be routine to meet in full-immersion virtual reality for business meetings and casual conversations in five to seven years."

The Next Information Technology (IT) Generation

The enormous gap between today's depressed IT industry and the vibrant trends noted above signifies that we are poised at the cusp of another major technology transition, much as the 1980s brought the PC and the 1990s brought the Internet.

The economic recession left in the wake of the dot-com bust may linger awhile, but all technological revolutions go through a similar boom-and-bust cycle. The introduction of railroads, telephones, and radios invited wild speculation similar to the dot-com bubble. But a few years after the inevitable crash, renewed economic growth and more prudent business practices caused these fledgling industries to boom again.

A similar resumption of growth is likely for dot-coms. Economically sound e-practices are common now and should continue to expand. As the economic recession runs its course, venture capital is also appearing to support new startups. And broadband is reaching the critical 30% take-off level, which will soon create huge markets for exciting new applications that need lots of bandwidth. The TechCast Project participants therefore see no serious obstacles to the first wave of relatively straightforward e-commerce services noted in the forecast, which

is likely to reach the 30% adoption level during this take-off period running roughly from 2005 to 2010.

This time, however, the intelligent interface holds the key to putting today's underutilized IT to work. Many more examples like those noted above are being developed by Web entrepreneurs, and competition could mount as customers demand these attractive new benefits. The first "wired generation" of college students is entering work, expecting the unlimited bandwidth and sophisticated Internet features they grew accustomed to on campus. The nagging problem of selling entertainment online—the digital rights management conundrum—is also likely to be resolved soon, which could unleash a huge market for music, videos, movies, and other intellectual property.

These emerging markets are perfect for the lifelike, conversational multimedia of TeleLiving, encouraging a new generation of IT that should be extremely appealing and relieves today's exploding complexity. Ninety percent of Americans say today's computers are too complex and time-consuming. The huge advantages of this next-generation IT could fuel demand for the Intelligent

Internet to blossom sometime around 2010, as the trends above suggest. *Business Week's* special issue, "The E-Biz Surprise" (May 5, 2003), noted, "The Web is the same age color TV was when it turned profitable."

Almost any social transaction—teleworking with colleagues, buying and selling online, education, consulting with your physician, entertainment, or just a casual talk with a distant friend—could soon be conducted in a conversational mode, speaking with life-sized images as comfortably as we now use the telephone and television. It should feel as though virtual people are right there in the same room with you.

This scenario is not without uncertainties. Cynicism persists over unrealized promises of AI, and the Intelligent Internet will present its own problems. If you think today's dumb computers are frustrating, wait until you find yourself shouting at a virtual robot that repeatedly fails to grasp what you badly want it to do. And this forecast for a glorious IT future may seem extravagant amidst the dismal mood of IT today.

The main obstacle is a lack of vision among industry leaders, customers, and the public as scars of the

dot-com bust block creative thought. Yes, the dot-com boom was unrealistic to a large extent, but it was driven by a powerful image that inspired huge gains in many areas. Bold innovations always require equally bold imagination, and so unleashing pent-up demand for online social transactions will require an imaginative understanding of how IT can improve life in the difficult years ahead. The evidence suggests the future lies in developing an Intelligent Internet, and that the world could benefit enormously by focusing on this concept with clarity and determination. □



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