What is Human-Centric Computing?

Futurists tend to agree that personal computing will be dramatically changed in the future. But how? One overriding objective will be to make the technology transparent to the user, thus eliminating the frustration that many users face today. Futurists divide into two camps, however, when asked to envision how this goal will be achieved.

On one side are those futurists supporting pervasive computing, who argue that IT needs to "get the end user experience right," (as explained by IBM) with the focus on designing devices that are easier for users to interact with to find relevant information. Carnegie Mellon and IBM are both working on projects that are designed to create devices and applications that allow the end-user to constantly be able to connect to information important to them. Their vision is that users will increasingly be using wireless devices (such as cell phones and PDA's) to obtain information, so computing needs to make disparate systems interact with one another. Thus, the goal becomes two-fold: 1) To make the interfaces easier to use, and 2) To create necessary infrastructure (beyond XML) to make knowledge repositories accessible. IBM is currently working with 40 behavioral and computer scientists to define user scenarios and build applications that handle real-world problems. Meanwhile, researchers at Carnegie Mellon, who feel the attention span of a typical user is decreasing, are examining how to re-design devices to become hands-free, speech and eye driven, and capable of recognizing gestures. They are also examining issues of energy consumption (examining how to increase battery life), redundant systems to eliminate user annoyances, agents and bots, and wearable computers.

On the other side are futurists who favor human-centric computing. Here the objective is not to focus on the devices themselves, but rather to create an entire solution so that the human, rather than the device, is always connected. As with pervasive-computing, human-centric computing requires devices, however, the devices exist simply to obtain input from the human and are embedded in objects that humans interact with on a daily basis (including doors, socks, batteries, etc.). The human can speak to the device freely, with the solution allowing the human to tell the device how to work, as opposed to the device constraining the human. Human-centric advocates argue that pervasive computing is placing too much emphasis on devices and infrastructure and that the devices are making humans adapt to them. Instead, the devices should serve as a slave to the human. Thus, the objective is not to create a new device using the traditional approaches. Rather, we should be working on devices that work in the background of our lives and surround us. The biggest advocate for human-centric computing is MIT, which is currently working on Project Oxygen (described below), a collaborative effort with Acer, HP, Nokia, and Philips. In human-centric systems such as Oxygen the device will exist in space around us and have the ability to interpret what we say, follow commands, give us information that is relevant to us, or carry out specific actions.

	Pervasive Computing	Human-Centric Computing
Objective	To create a device that is constantly connected, portable, and available	To create a solution so that the human is always connected, portable, and available
Focus	Devices	Humans
Method of interaction	Work with the device for the information	Speak to the solution for the information
Current Projects	IBM's Project Blue Carnegie Mellon's Project Aura	MIT's Project Oxygen

How will Human-Centric Computing work?

As you walk around, you will carry a device. The device might initially be about the size of two paperback books. It will contain a camera, a video screen, the equivalent of a cell phone/beeper, a GPS, a pointing device, and a headphone jack. The latter to be used so that the device can read to you your e-mail and important information. If you are not walking around and are in an office, car, or house, out-of-sight devices will be embedded into the walls, ceilings, car trunks, or any place where a device can be installed. The entire network will be custom-configured to what you want and will be controlled by your voice. As such, your network security will be guaranteed, due to the speech recognition system.

When will human-centric prototypes be available?

The first pervasive devices are already beginning to infiltrate the market. With devices such as the wearable computer and Microsoft's Project Hailstorm, corporations are beginning to work toward the idea of pervasive computing. Both of these concepts are in their infancy, but have recently attracted considerable attention from the popular press.

The wearable computer is already beginning to be seen on the Paris runways. The idea is that a computer can be sewn into various parts of your clothing: a miniature keyboard stuffed in one pocket, a miniaturized CPU in another, and a monitor projected in glasses. Using the computer, you can surf the Internet, read e-mail, and work on documents while walking down the street, while shopping, or while driving a car. Since this is pervasive computing technology, the focus is on the device and its ability to operate anywhere in the world.

Microsoft Project Hailstorm, also known as .net, seeks to take the Windows operating environment onto the Internet. A user would log on to the Internet, surf to Microsoft's website, and log in. At log in, the user would see "Windows," along with any other software that the user is renting from Microsoft. Licenses would be granted annually and the user could see the same interface from anywhere where they can obtain an Internet connection. Once again, since this is pervasive computing technology, the focus is on the interface, attempting to make the interface accessible anywhere in the world.

While pervasive computing technology is available now and will be increasingly flooding the consumer and business market, real human-centric computing breakthroughs are unlikely in the near term. Since human-centric computing requires a shift in the way that computers are conceptualized and built, it will take more time for the true idea of human-centric computing to take form.

One of the most promising human-centric projects is Project Oxygen. Project Oxygen, using the elements described above, hopes to embed computing technology into the environment. Systems will respond to user requests, working for users in the background to supply information. Not only will the systems handle problems such as booking airfare and hotels, the system can also monitor our homes or cars and report back to us on its status, regardless of our location. Further, as systems become more advanced and able to monitor our movements, human-centric computing may lead to systems that can answer questions such as: "Did I take my medicine today?" or "Where did I put my glasses?" Since this is human-centric computing, the focus is on the human and what the human needs and not upon how to make the device easier to use. The best near term vision for Project Oxygen is for a prototype to be available in 2002, with the full version emerging in the marketplace perhaps a decade later.

What will be the projected benefits of human-centric computing to the Individual?

Human-centric computing will provide benefits to individuals, organizations, and society. On the individual level, users will not be as frustrated, for the computer will now work for them. Advocates of human-centric computing argue that the computer has taught us how to work and required us to sit in a certain location, in a certain position, staring at a monitor, and using a keyboard. Today we are essentially enslaved by the computer. Tomorrow the computer will be our slave. With bots working in the background to collect information from heterogeneous databases, and then synthesize and present that same information to you, you will be less frustrated and better informed. You will, claim these futurists, finally have the opportunity to leverage computing power in a way that you want.

What will be the projected benefits of human-centric computing to my Organization?

On an organizational level, if individuals are constantly in contact with a computer, employees can, if they wish, stay in constant in touch with their workplace, customers, suppliers, and channel partners. The boundary between work and home will dissolve further, for an employee will not be able to "disappear." Further, neither will customers, thus allowing corporations to reach and interact in the daily lives of their customers. These benefits are beyond the simple and obvious financial advantages that will come from training and educating users on the devices.

What will be the projected benefits of human-centric computing to humanity and society?

Advocates of human-centric computing argue that humanity will benefit since global collaboration will be easier. Since individuals from disparate cultures and countries will be able to interact with one another in their daily lives, the social boundaries will be removed. The result, according to futurists, will be a society that is less judgmental and prejudiced. They argue that the increased exposure will further offer opportunities to third world countries, where the current skill sets are not being utilized to their full potential and all of humanity will benefit.

What are the projected risks of human-centric computing?

Human-centric computing will allow users to move about the world and always be connected to others. One obvious risk is that one of the benefits, that employees are always connected to their work, will become a detriment. No longer will individuals be able to escape from work, for work will always be accessible to them. Privacy advocates worry that collecting the information about our lives will allow the government to track our movements and gather data about us in ways that were never possible before. The reaches of a computer will extend into our most intimate of moments; preventing humans from having the privacy that each of us has a right to possess. Further, while human centric advocates argue that the network of computers will allow third world countries to use their skills in new areas of the world, critics claim that the access will encourage organizations and individuals to take advantage of the connectivity and use and manipulate these citizens for political or economic advantage. Data input also threatens to be a barrier to the effective implementation of human centric computing. Voice controls, for

instance, will be problematic in crowded environments and impossible for those who have severe speaking handicaps.

What comes after human-centric computing?

Once human-centric computing materializes and individuals begin to realize the benefits, futurists project two further reaching futures. Technologically, as the computer learns from practice and observation, then machine learning will evolve to new levels and the promises of artificial intelligence will finally begin to be realized. The second future is the inevitable merger of biology and computer science into biological computing, a merger that will allow the computer to serve humans at a deeper level.

How can organizations today start to become involved in human-centric computing?

Human-centered computing is foremost, a change in the way computers and computer usage is perceived. So, the first step is to begin imagining how systems will serve people, rather than the other way around. After changing the paradigm from focusing on the device to the human, a number of steps have been suggested:

(1) Look at today's speech systems. How are the 200 some start-ups developing speech related products, pushing the speech synthesis and recognition frontiers? How might you use these products in your business?
(2) Look at automation. Can you further automate the things people currently do that do not adequately use their intelligence, thus relieving them of work and making their jobs more interesting and the execution of their former tasks more reliable?
(3) Look at how people work. Can you help your associates or customers work across space and time more effectively?
(4) Look at customization. Can you customize your systems to the requirements of individuals?
(5) Look at what you are doing in your daily actions. It's not enough to say you support the ideas. You must show it in every action.
(6) Begin slowly. Pervasive computing, which is not nearly as complicated as human-centric computing has already proven to be difficult, with IBM struggling with issues of bandwidth and compatibility of databases. Human-centric computing adds a new layer of complexity and requires new networks to be built which will require vast amounts of data.

For More Information

Online resources

To read an overview of the Project Oxygen project, about.com has an article and a bulletin board devoted to the subject: http://ai.about.com/library/weekly/aa092800a.htm

To clear up any confusion about differences between pervasive and human-centric computing, IT world spoke with Michael Dertouzos: http://www.itworld.com/Tech/3494/CWD010507STO60203/

To find out how to become involved with Carnegie Mellon's Project Aura project, they have set up a site dedicated to the project and publications about their research: http://www.cs.cmu.edu/~aura/

To read more about IBM's Project Blue project, which is seeking to expand the wireless Internet, look at their information page: http://www.research.ibm.com/compsci/planetblue.html

For information on MIT's human-centric Project Oxygen: http://oxygen.lcs.mit.edu

Articles

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Robinson, Gene. "Computing Nirvana 'is here as Pervasive Computing Bursts Onto the Scene." *Electronic Component News*, April 2001, page 11.

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Important Books To Read

Invisible Computer: Why Good Products Fail, the Personal Computer is So Complex and Information Appliances are the Answer by Donald Norman.

*The Unfinished Revolut*ion by Michael Dertouzos.

What Will Be: How the New World of Information Will Change Our Lives by Michael Dertouzos and Bill Gates.