The Idea of Cyberspace

Lars-Erik Janlert
University of Umeå
April 2005

Reality is slowly catching up with the twenty-year-old vision of Cyberspace at the same time as the real world of things, places and people is about to be invaded by information technology. What are the connections?

Definition and history

Although Michael Benedikt qualified his characterization of *cyberspace* in 1991 as preliminary, for a concise description there is little to improve:

> "Cyberspace is a globally networked, computer-sustained, computer-accessed, and computer-generated, multidimensional, artificial, or "virtual" reality. In this reality, to which every computer is a window, seen or heard objects are neither physical nor, necessarily, representations of physical objects but are, rather, in form, character and action, made up of data, of pure information. This information derives in part from the operations of the natural, physical world, but for the most part it derives from the immense traffic of information that constitute human enterprise in science, art, business, and culture.… In cyberspace, information-intensive institutions and businesses have a form, identity, and working reality … that is counterpart and different to the form, identity, and working reality they have in the physical world. So too with individuals. Egos and multiple egos, roles and functions, have a new existence in cyberspace. Here no individual is appreciated by virtue only, if at all, of their physical appearance, location, or circumstances.… Cyberspace has a geography, a physics, a nature, and a rule of human law." (Benedikt, 1991)

The notion and the word *cyberspace* were brought into the world by William Gibson in his novel *Neuromancer* from 1984 (although strictly speaking the word appeared already in an earlier short story, *Burning chrome*). *Neuromancer* is a dystopia pioneering a new science-fiction genre of "cyberpunk." The dark view of technology apart, Benedikt's definition of cyberspace agrees fairly well with the original Gibsonian notion. The *cyber* in *cyberspace* goes back to the scientific discipline named *cybernetics* that was introduced by Norbert Wiener in a book with the same name in 1948. Incidentally, in that same year the famous novel *1984*—another dystopia—was written and George Orwell created the title by transposing the last

two digits of 1948. Cybernetics was described as a theory of communication for machines and animals and was founded on what was seen as a basic unity in a number of problems concerning communication, control, and statistical mechanics, in machines and living organisms. The word *cybernetics* was a neologism constructed from the Greek word *kybernetes*, steersman. It was at the same time an allusion to the first scientific article of importance dealing with the subject of *feedback*, namely an article by James Clark Maxwell (the creator of the classical theory of electromagnetism) about "governors" (a word with the same Greek root) which was a type of speed regulator for steam engines invented by James Watt in 1782. Such a regulator consisted of two weights suspended from a vertically rotating shaft connected to the main shaft of the engine. The faster the engine would run, the more the centrifugal force would push the weights out from the center and via a lever throttle the steam input. In this manner it was possible to maintain a constant number of revolutions per minute of the engine. Feedback was an important concept of cybernetics. When *artificial intelligence* was launched as a new research area in 1956, that meant the beginning of the decline and eventual fading away of cybernetics but at the same time the perpetuation of many of its ideas and aims. The decisive difference between cybernetics and artificial intelligence was that the analogue representations and causal models of cybernetics were replaced by the digital representations and symbolic models of artificial intelligence: a physics-based approach was replaced by a computational, symbol-based approach. In recent years the role of material circumstances in cognition has been reassessed, and the artificial neural networks explored by cybernetics have become a standard technique, which some would interpret as a step back from pure abstraction towards physical reality.

Neuromancer, the title of Gibson's first novel, is an invented word with interesting interpretation. It can be read as "new romancer" (and the story is romantic); it can also be read as "neuro-mancer," which would be someone practicing "neuromancy," the suffix –mancy meaning divination, as in *chiromancy*, the art of divination by analyzing the appearance of the hand. That is, *neuromancy* would be the art of divination through the "neural," which fits common metaphors for computers and information-technological infrastructure such as "electronic brain" and "nerve system." Note also the close likeness to *necromancy*, the art of divination through communication with the dead. In the enlightened world of today that translates to accessing libraries and books, pictures, audio recordings, videos, and computer memories, which is where the traces, the ideas and "spirits" of our predecessors (and contemporaries) are kept, in what Karl Popper calls World 3.

Popper's worlds

Cyberspace can be viewed as a virtualization, a virtual, "spiritualized," dematerialized version of the world of people, things, and places that we live in. Cyberspace can alternatively be viewed as a concretization of the world we dream and think in, a world of abstractions, thought constructs,

memories and knowledge, fantasies, horror visions, ideals, hypothetical future states, counterfactual states.

The philosopher Karl Popper delineates three different but related worlds:

> World 1 is the physical world.
>
> World 2 consists of our conscious, subjective experiences, thought, memories; our inner life.
>
> World 3 consists of what Popper calls *objective knowledge*, the content of books, libraries, computer memories, etc.

Objective knowledge means that the information—in distinction to the *subjective* knowledge that is part of World 2—is not tied to any particular subject: it is accessible to everyone, and it exists even when no subject takes part in it. (Popper, 1975)

Cyberspace can be seen as the latest development of World 3. It is the continuation of the information world that we constantly have been busy building since the beginning of history (and even before, given that pictures also can be considered to be information technology), the objective (in Popper's sense) information world that so far mainly has been based on books and other writings. It is the human body of knowledge, collected in books, but also—which Popper does not say much about, because of his focus on philosophy of science and scientific knowledge—everything humanly created of symbolic purport that is not "facts" or "information," such as tales, fantasies, utopias, novels and other forms of fiction and cultural expression.

The problems of organization that we meet in cyberspace are not exactly new either; these are problems that e.g. librarians have wrestled with for millennia, which has resulted in alphabetical order, classification systems, card indices, keyword characterization, concordances, bibliographies, thesauri, and more. Some of the organizational problems are old, but there are now new possibilities to solve them. Some of the organizational problems are new, arising because the modern information technology enables forms and attitudes that with earlier technology were impossible or intractable. Very large collections of pictures e.g., were not practically possible before the latest advances in mass storage technology. Methods for organizing and searching pictures are consequently not as developed as for texts. Naturally, in the beginning text-based principles of organization will dominate.

Traditional aids for organization are for practical, physical reasons separated from what they organize. First you search the card index, then you walk over to the book shelves. In cyberspace that separation vanishes.

The particularities of cyberspace

As part of World 3—with a clear annexationist tendency—what distinguishes cyberspace from other sub areas of World 3, such as literature,

theater, music, art, etc.? Below are some points that taken together seem to make cyberspace new and different.

Cyberspace is

a total world

a common world

an objective world

an active and interactive world

a world with history

a world to live in

a lightweight world

Cyberspace is a total world

Cyberspace is one and connected, more connected than the world of books (certainly there will be "private clubs" and secluded areas, but they are still all part of the same world). The same world is in principle accessible to each and everyone. This is similar to the book world and the world of motion pictures, but national and cultural borders are much easier to cross in cyberspace, the obstacles that remain are not differences in time and space but language barriers, differences in knowledge, experiences, and values.

Cyberspace is also a much more tightly knit world. Books can allude to other books, they can implicitly or explicitly refer to or rely on each other, but usually it is not a quick and easy task to follow up on those references. To do it at all (other than in your mind, where as a serious student you no doubt have collected detailed memories of a great many books just because of this difficulty), you have to exit the book you are into and get out in the physical world and bustle about for a shorter or longer period to be able, if all goes well, to sink into the text referred or alluded to. With hyperlinks and different mechanisms for searching and browsing, in cyberspace we can easily and swiftly glide along long chains of references and associations, even those not anticipated by the authors, without leaving the information world.

Cyberspace is a common world

The same world is (in the vision) open to all. One could imagine that cyberspace will play a role corresponding to the role played by the Bible, or the Koran, classical literature, national literature, etc., as a common ground and frame of reference for communication between people. But there is an important difference. The Bible or the classical literature were of such moderate extent that an educated person could acquire adequate knowledge of that frame of reference without having to spend a lifetime, and common people would acquire passable knowledge through secondary literature and other channels. Cyberspace, however, is so huge (it will eventually encompass everything, in the vision) that it cannot fill the

same role. Also, the attitude to knowledge it fosters is anything but fundamentalist; cyberspace rather invites to diversification, specialization and pluralism. The common and lasting frame of reference has to be sought in something else than the content.

We are together in cyberspace: it is a place to be in, to see other people and what they are doing, to see each other, do things together, organized or improvised. In this respect cyberspace is markedly different from the world of books. The book reader is alone inside the book, even should the person sitting opposite happen to be into the very same book. The togetherness of cyberspace has some similarity with the shared meetings with culture and information that take place in concerts, theater performances, exhibitions and conferences. Cyberspace invites to cooperation (and contest), it also gives a view of what is going on in the world of ideas (the objective part as well as the subjective part, belonging to World 2) that was impossible to get with earlier information technology: you can see where something is happening, you can see where nothing is happening, you can make your own choices based on such insights.

Cyberspace is an objective world

Cyberspace is objective in the sense that it is there independent of whether you are in it or just went to the kitchen to make a sandwich. When you get back you can count on it being the same world as when you left, even if there may be some changes. There is no identity problem. You do not switch cyberspace on and off: cyberspace has an uninterrupted, continuous and unambiguous existence, independent of users entering and leaving. It has a reality beyond each user's experience. In this respect cyberspace is like the world of books and Plato's world of Ideas.

But cyberspace differs from those world by being a dynamic world in constant motion. The book world continues to grow, to be sure, but what already exists there is quite dead; it does not change. No matter how many times you read a book, the words remain the same. You may scribble a little in you own copy, but that does not change the other copies, and it surely does not change the *work*.

Cyberspace is active, interactive and engaging

In distinction from the traditional, dead world of text, cyberspace is very much alive, active and interactive. What through text can only be learned at a theoretical, symbolic level, can in cyberspace be experienced.

Cyberspace is active in that the representations do not have to be static but can change over time, as with music, video, animation and other not yet invented media. It is interactive in that it contains interactive media and that the traveler through cyberspace individually can affect and be affected by the information environment—comment, build, modify, engage in a "dialogue" with the information, which is more like conversation than book studies, and that leaves tracks in the landscape. Abstract theory can be animated and concretized through visualized, interactive simulations.

Cyberspace is also active through all the people active in it, and interactive through their interactions.

In this way cyberspace can be engaging, concrete and situation sensitive, in contrast to the traditional information world which celebrates distance, abstraction and universality. Text and textually related forms of representations will of course also be there alongside interplaying with the new forms: without them we would lose the theory and abstraction and universality that we wish to concretize, apply and experience.

Cyberspace is a world with history

Cyberspace is a world with history in the sense that it is a direct and natural continuation of the information world that existed before cyberspace, and that older forms and representations will gradually be transferred to or be made accessible from cyberspace. There will always be different levels of technology, but bridges can be created between them so that one can go back in time and study older forms of representations.

Cyberspace is a world with history also in the sense that cyberspace develops in time. It is immersed in the flow of time in a way the book or Plato's Ideas are not. Whoever takes a walk in cyberspace will not go completely unnoticed. Rather the opposite: at this time, you should assume that anything you say or do in cyberspace is in principle observable for all, for ever. That should lead to something like Kant's categorical imperative: Always act so that what you do will bear scrutiny of the whole mankind, present and future. The perspective is paralyzing until you realize that no person has much time or interest to bother about what very many other persons do.

The introduction of history can also be traced in the development of ordinary software. A program used to be as untouched by use as a pure idea in Plato's heaven; now users can often customize, records of events and actions are often kept, and some applications adapt to a user's individual pattern of behavior. Wear and aging are so far unusual.

Cyberspace is a world to live in

Cyberspace is a world that you can *be* in—in a much fuller sense than you can be in a book, e.g.. It is a world that you can to some extent *live* in. In cyberspace you can work as well as spend your leisure time, you can read and write and communicate, you can create texts and pictures, you can dig for information, go shopping, do business, engage in politics, create new products, play and be entertained, you can indulge in culture, search for jobs and friends—you can do all sorts of things, and the list keeps growing.

It is important to keep in mind that cyberspace is not only facts and information; it is as much a world of culture, amusements and dreams. When dreams take visible and public form, it is not always to our general satisfaction: there is so much rubbish and ugliness and filth, so many who try to make money on other people's weaknesses and gullibility, and people

say so many stupid things. That is how it is, but perhaps this spectacle may urge us to improve ourselves and cyberspace.

Cyberspace is a lightweight world

Cyberspace consists of weightless visions, not of heavy, unwieldy and expensive matter. Surely, the computers and cables need to be there but they are not part of the world. Cyberspace continues to exist while the underlying material is constantly renovated, replaced and modernized.

In the ordinary world the step between planning and executing is large, expensive and hazardous. In the plan everything works perfectly; in reality we often find that we are stuck with a bad but costly construction for a considerable period of time. In cyberspace, the difference between thought and action, idea and implementation, is smaller, or even hard to distinguish. To think out a program is already to create it. If you are not satisfied with the result, just press the UNDO button and rethink. You can let bad ideas die swiftly and mercifully instead of casting them in permanent matter. You can afford to try and err until successful and satisfied.

It is not really true, of course, that thought constructs do not cost time and money. What is true, unfortunately, is that it often happens that bad programs continue to be used because you have already invested so much cognitive effort in them: in constructing them and in learning to use them. Still, cyberspace moves the emphasis from material costs to cognitive costs; demolishing a palace in cyberspace does not consume energy or make your muscles ache.

Architecture for cyberspace

The physical world obeys natural laws, about which we can do little more than try to understand them and adapt ourselves as best we can. Cyberspace is an artificial world not obeying any given laws of physics, other than very indirectly through the underlying technology.

When information technology frees us from the constraints of the physical world we can choose to what extent we still wish to keep them, and we clearly need to explore what alternative organizing principles there might be. Let us keep in mind that humans are co-adapted—biologically and culturally—to those very constraints. That is both an opportunity and a liability. For example, we are good at dealing with spatial relations in 3-dimensional space, but would be completely lost in a 5-dimensional space. Gravity, on the other hand, is an example of a constraint that seems to be less hardwired into human biology and culture. Very many of our artifacts, abilities and habits depend on gravity (e.g. a dinner table, walking, recognizing people and facial expressions), still there is little doubt we can learn to manage without it.

In 1991, Michael Benedikt—an architect by profession, and the parallel with urban planning is obvious, for good or ill—attempted to formulate some regulating principles for cyberspace. Among them the *principle of exclusion*, which is that no two objects should be at the same place at the

same time; the *principle of transit*, which is that travel between two points in cyberspace should involve experiencing all intervening points and incur a cost proportional to the distance; and the *principle of scale*, which is that the maximum velocity of a traveler is inversely proportional to the complexity of the part of cyberspace visible to him, i.e. when you approach a large body of information, your speed should diminish by some sort of inverse law of gravitation. Benedikt soon lost his patience with the slowness of technological development: "by 1993 it was clear that the transmission and processing speeds required to sustain cyberspace were going to be long in coming. They are still not here. To this day, only advanced intranet gamers have a foretaste of Gibsonian cyberspace: a real-time, shared, virtual space seamlessly mixing useful data, personal presence, and real-world, real-time connection." (Benedikt 2003)

Benedikt's proposals is one way of creating a basic structure for cyberspace, focusing on the "physics" and "physical" laws, but physics also has a connection to rules for behavior, judicial laws, social norms and ethical values, which becomes more clear when you get rid of the ordinary physics. Many of our current judicial laws are about and regulate by means of physical objects and physical circumstances. Already there are enormous difficulties in trying to apply them to the immaterial world of information.

The design of cyberspace cannot and should not be determined exclusively on technological grounds. Here is an opportunity to create a completely new world obeying new laws, a sort of utopian project. The technology leaves us great freedom, so great that we may sometimes feel lost in an infinite universe of options and choices. At the same time forces are working to make cyberspace very much the same as the old, ordinary world. Finally, the power of routine and unimaginativeness is great: old solutions and methods are copied to cyberspace simply because there is too little time, money and fantasy to work out more creative alternatives, and because constructors and users are not sufficiently aware of what ideologies and values are hidden in the constructions and the establishment of habits and conventions. Now we would need both daring and intelligence; inventiveness to propose new hitherto unknown principles and constructions, and analytical power to clarify the values and consequences of different alternatives.

Virtual viewpoints

Renaissance painters like Mantegna and da Vinci painted frescos in cathedrals in such a way that the correct point to observe these pictures from is several meters above the church floor. We know that a central perspective drawing is constructed from a single point of observation, which is then the only viewpoint from which all angles and measures in the picture precisely match 3-dimensional reality. We know from experience that a viewer who is off-center is nevertheless able to do some kind of mental "restitution," that is, correctly reconstruct how the depicted scene would appear from the correct point of view (that is how it is possible to have

more than one seat in a motion picture theater). Did the Renaissance masters intend to give the observer a sense of *elevation*?

A virtual world does not only create a view of the environment, it indirectly also creates an image of the viewer, the observer. When you open your eyes you will inadvertently infer where you are positioned in order to see exactly what you see. When you look at a picture you do very much the same. The picture generates a virtual viewpoint. That is why you may get a sinking feeling when the motion-picture camera rides along in a roller coaster, even though you are sitting motionless in the theater. In a virtual world such experiences are stronger. We also have the ability to identify components of the picture and experience with ourselves. Already with a computer screen and a mouse we are quick to identify the mouse cursor with our hand. With a computer glove the identification of the virtual hand with our real hand is stronger.

The virtual point of view extends to a virtual self. What properties must I have in order to have these experiences? In an early experiment with telepresence, a TV camera was mounted on top of a high building and coupled to a head-mounted display so that the camera moved as the user's head moved. The users would feel as if they were standing on top of the roof, looking out at the city. It was unpleasant to look down at the street far below. By amplifying head movements so that when you turned your head a certain angle, the camera would turn twice as much, it became possible to look straight behind your back. How did that feel? It felt, those who tried it reported, *it felt as if you had a rubber neck*. (Dennett, 1981:240)

How tall are your legs in the virtual world, how strong are you, how high can you jump? Are you good or nasty? The possibilities for role-playing are rich. It is difficult to guess the limits to our power of insight, to living the part. In a virtual world users might try how it would be to be a bat, flying by flapping their arms. Perhaps special training would be needed to be able to fly. How should the sound navigation system of the bat be translated? Lowering the pitch to humanly audible frequencies will not help much. Should they rather *see* what the bat *hears*? More serious applications raise similar questions about transforming experiences and actions; it would, for example, be interesting to have telepresence systems where you act with a mini- or micro-sized robot.

In virtual applications as well as in many other uses of computers, there are *two* interfaces to take into consideration: an inner and an outer. This is similar to hand tools that have a user end, e.g. the handle of a hammer, bordering to the user's hand, and a business end, e.g. the head of the hammer, that borders on the work material and the external world—or like clothes, an outside facing the world, and an inside facing the wearer's body. The external point of view can be identified with the outer interface. The wearer's or user's attention to these two interfaces can be differently distributed. In VR of "hallucinatory" quality the inner border has disappeared, as perhaps in the use of a tennis racket by a professional player, but only a small disturbance is needed to make the user shrink back into

the personal, "natural," body, suddenly aware of the inner border. There is typically a tension between the inner and the outer interface: the ideal form for the outer interface may be difficult to combine with a user-friendly, comfortable inner interface. The shoes may be fine to look at but they chafe. What is it like for a human to be a bat? Maybe it hurts. (And probably it gives very limited insight into what it is like for a *bat* to be a bat.)

Net-exhibitionism and self design

In cyberspace you decide your own appearance. You can design your face, your voice, your style, in a completely different fashion than in the real world. You are freer to express who you are deep inside, or who you would like to be. It is much easier to keep many different costumes and masks, intended for different situations and roles. You will probably get help designing yourself by life stylists and shops selling faces *prêt-a-porter*.

People's eagerness to expose themselves on the web is a little surprising. It is hard to imagine that people would set up a bulletin board outside their home, with photographs and texts depicting and describing who lives there, what their hobbies are, what they are working with, their background, relatives, pets, plans for the future, etc. Of course, in cyberspace things, institutions and individuals only have the appearance you care to give them. If you want to be seen you must make yourself visible. Probably people will become more cautious and restrictive as the cyberspace population grows and changes demographic structure: blue-eyed enthusiasts relieved by more suspicious and pragmatic, self-serving everyday people.

People go to great length in designing and maintaining their appearance. Cyberspace offers possibilities to stretch your appearance even further apart from your "true" being. How far it is acceptable to go depends on the common attitude to the "reality" and purpose of appearance; the border is quite flexible already in the real world (consider e.g. dyeing your hair, plastic surgery, politeness, electoral promises). But, again, a contrived appearance is still not without a personal cost. If I don a bat suit in cyberspace, or the role of a trustworthy person—and play the part with credibility and persistency, I will not go unaffected myself. The image of myself I have chosen will press me to become like that. The inner interface of the costume will itch and pinch and chafe until it becomes part of me, or I give up and throw it off.

Or—a chilling thought—is there a risk that the costume will be loaded with character traits and abilities while the wearer becomes ever more empty and shapeless, prepared to wear any costume and smoothly switch from the nice costume to the cruel one? What may save us is that we still want to be persons and not arbitrary collections of roles. The general trend now seems to be in the direction of an increased focus on persons. For example mobile phones has meant that phone numbers are tied to persons rather than to places or functions.

Body and mind

According to modern theories in cognitive science, the body and the environment affect the way we think. The scientific notions as to how cognitive processes are distributed over brain, body, artifacts, environment, etc., have varied. From a period when cognitive processes were almost exclusively located in the head and characterized at a very abstract and matter-independent level, we are now in a period where the body, the environment and the context are assigned important roles. There are rather radical standpoints (Gibson, 1979) claiming that in many or most everyday activities we have to do little more than let us be steered by the rich flow of information that the environment constantly delivers to us. Just let the environment have its way with you.

Given that our body and our environment are of decisive importance to our thinking, it follows that virtual bodies and environments might give us new forms of "virtual" thinking and open new areas of thinking. In the last few years it has become clear that our nerve system continuous to grow much longer after birth than earlier thought, and that these dynamic changes depend on the environment and the activities you do. It is not unlikely, for instance, that the extensive use of computer games has a long-term impact on cognitive processes and abilities. Changes in the human life environment—predominantly cultural, artificial changes—have or course always been part of the development of humanity. We are all artifacts, and that is the way we want it.

Views and sharing

We design ourselves and we design other objects in cyberspace. At the same time we want to control how we perceive cyberspace. We want to be able to screen out things we do not wish to see, to choose between different presentation formats, views and attitudes—perhaps we also want to design views. I want a pink heaven; you want a blue. We can both have our way.

I am sitting with you on a white beach by a blue sea, the surf gently hits the beach, the sun is shining, sea gulls are crying. You have chosen a different view: we are sitting in a sidewalk café in Paris, the street is teeming with people, the sun is shining, cars are honking. We discuss. You need to draw a sketch to explain something, so I give you my pen. But to you my pen is a cigarette. Will the dialogue break down at this point? Perhaps you will just calmly accept that this is an extraordinary cigarette doubling as a pen (and a little later I will casually note that the pen can actually be smoked). The first enthusiasm over the possibilities of metamorphosis may pass and we become more practical and less egocentric in our choices of worldviews.

Relation of cyberspace to ubiquitous computing

Cyberspace can be thought of as "the world in the computer." The creation of cyberspace is a gigantic undertaking, well under way. Ubiquitous computing is the equally challenging project of putting "the computer in

the world." The cyberspace project has had a head start; only quite recently has computer and communication technology started to invade the physical world of artifacts and environments on a wide front, but it seems likely that very soon information technology will pervade most things and activities. What is the relation between these two grand projects? They may appear as two diametrically opposed approaches, but are in fact mutually dependent of each other. Cyberspace and ubiquitous computing are more or less predestined to converge and coalesce. To the extent that cyberspace is about or is in any other way related to the real world—and obviously it very much is—it needs to be updated about what is going on there. The obvious source for that information is the computer and communication technology in our real-world artifacts and environments. There will be information in cyberspace about the mileage of your car because computers in the car have delivered that information. To the extent that actions and changes taking place in cyberspace should have an effect on the real world, embedded computers controlling our real-world artifacts and environments will obviously be used in producing the intended real-world effects. Incidentally, the real world gets involved not only by so-called embedded technology, but by non-invasive technology as well, such as tracking by camera. Especially non-invasive technology opens for ad hoc improvisations; e.g. an ordinary stone could become a pointing device at the whim of the moment. The involvement of cyberspace with the real world, and the involvement of the real, computer-enhanced world with cyberspace, is already considerable and it is growing rapidly. Viewed from the ubiquitous computing perspective, it is clear that various computer-enhanced artifacts have much to gain by being connected to cyberspace, getting access to a wealth of information and coordination possibilities that can enable better, more situation sensitive and flexible function, opening the prospect of having cooperating, learning and developing artifacts. Basically all computers, all artifacts and environments enhanced with computer and communication technology will eventually be connected with cyberspace, and so, in a sense be part of cyberspace.

With such a broad range of devices and applications of varying technological sophistication, computation power and communication capacity (consider e.g. the problem of mobile power-supply), there will also be considerable variation with regard to the tightness of connections, the delays, the losses, the frequency of updates, the degree of inconsistencies, and so on. There are, and there will always remain gaps, connections in need of improvement. A lot of ongoing work is directed at tying the physical world tighter to the information world, in various fields of research and development such as e.g. context-aware computing, augmented reality, tracking and identification hardware. Very much in focus at this time is the effort to connect geography and cyberspace, relating information to the spatial position and orientation of places, objects, people, and activities. There are many problems to solve, both technical and conceptual. The relation between cyberspace and real world is far from unproblematic.

Coordination problems

The year is 2030. Now you can buy the virtual car, an add-on feature that allows you to enjoy your tired old 2010 Volvo like a Porsche without having to sell your house. You sit behind the wheel and it sounds like a Porsche and the countryside whizzes past at the right speed for a Porsche and you have an exciting and life-enhancing driving experience with hair-raising overtaking and breathtaking cornering. Needless to say, the earthly driving is handled by the ordinary fully automated traffic system, which gets you safely to your destination without you having to lift a finger. But when you have arrived virtually, there is a problem of synchronization: at the speed of a Porsche you have arrived, but your old Volvo is only halfway there, and you can't open the door to the real world or you would end up in the middle of the earthly traffic with both legs broken. Instead you have to spend some time in synchronization quarantine sitting in your Porsche in the car park until your material Volvo arrives and parks in the same place; until then the doors remain locked for safety reasons.

Knowledge organization and reorganization

Earlier major innovations in information technology have had an enormous impact: writing technology started the civilization process, printing technology started the industrialization process, to put it very simple. The most immediate effect of introducing radically new information technology on a large scale will clearly be a redistribution and restructuring of the total body of knowledge and information, of the availability and access routes to it, of the patterns of communication, of the knowledge processes, i.e. the ongoing creation, organizing, distribution and use of knowledge and information. In the shift to a new knowledge regime some old knowledge will be lost or marginalized, a great deal of new will be added directly and indirectly. Looking at historical examples we can see that the attitude to knowledge, thinking and communication will be changed too: the methods, the behaviors, the values will change.

The distribution of knowledge can be analyzed along a vertical, a horizontal and a modal dimension:

> the *vertical* organization concerns how knowledge is distributed between mind, body, tools, objects, environment, organization, society, etc.
>
> the *horizontal* organization concerns how knowledge is distributed between different objects, between different persons, between different organizations and institutions; this will involve for instance issues of the availability, the degree of individualization and differentiation (or uniformity) of knowledge, and the relations between originators, re-creators, and users.
>
> the *modal* organization concerns how knowledge is distributed between different forms of knowledge and information: speech, writing, picture, sound, smell, rules and procedures, habits, computer programs, etc.

The first effect of the introduction of writing technology was a vertical redistribution between information, knowledge and skills kept "in the head," kept "in the body," and kept in the environment: in things (like clay tablets and books), in the organization of things (like library classification systems, alphabetical order), in society (like a shared written language). When information is preserved by writing it down you don't have to remember it any more, but instead you must know how to write and read, which in the case of writing most obviously also includes bodily skills. An example of changed values is the depreciation of memorizing ability, whereas the ability to follow written instructions illustrates the introduction of a new value.

The introduction of printing technology had horizontal primary effects. Many persons could now (concurrently) take part of exactly the same information. Simultaneously there is a sharper division between knowledge providers and knowledge users, and an imbalance in the number of information producers compared to the number of information consumers.

Secondary effects range from social (e.g. the effects of written laws) and religious (the printed Bible and Protestantism), to changes in modes of production and patterns of trade and commerce (contracts, bookkeeping). Secondary effects also include our very attitude to knowledge, our habits and abilities to think and improve on our knowledge. New information technology changes the epistemological conditions of our life, which in its turn has effects on attitudes, habits, and methods. One historical example is how the introduction of writing and printing eventually changed the earlier speech culture's predilection for clichés and repetitions, its personal engagement, its concrete and situation related way of thinking. The new culture based on written language has more or less the opposite characteristics: development of grammar, analysis, abstraction, distance to the subject, an ambition to use few but well defined concepts and express oneself as efficiently as possible without redundancy and retakes. (Ong, 1982)

Exactly what will happen this time—with this new computer, communication and interface technology that simply goes under the name of "information technology" as if no information technology ever existed before!—is difficult to say. One important factor is what it is that we *want* to happen: this information technology is also the most versatile, malleable, adaptable and in a formally definable sense *universal*. It can become almost anything we are able to clearly conceive. There are some general, easily discernible possibilities connected with current trends. Computer and data networks obviously have a powerful influence on horizontal organization. Typical office applications have had notable effects on vertical organization. Mobile and wireless technology will most likely have both horizontal and vertical effects. Advances in interface technology, such as graphic displays, tracking technology, haptic feedback, etc., are having a considerable impact on the modal organization. There is a general movement towards more sensual and active modes of knowledge (pictures, sounds, bodily skills, emotions, etc.), and a closer connection between things, processes

and activities in the physical world and the various types of related information.

It would however be a mistake, a mistake often repeated in the history of computer technology, to simply take current trends and major application areas to define the long-term agenda of the technology. Expected effects are often ambiguous. For instance, will the horizontal effects of network use be in the direction of leveling or will it have the effect of developing more diversely specialized skills and knowledge and maybe increase the gap between the knowledge rich and the knowledge poor? Both kinds of effect have been predicted, and it might well be that both predictions are correct. Other effects would seem to be rather definitive and irreversible: the higher value put on originality and creativity as a result of the cheap and easy copying and reuse of information and of the automation of "standard" knowledge is an example. The current information technology is not a very homogenous and narrowly focused technology; rather it keeps diversifying and going in all directions at once. All experience tells us that technology will continue to surprise us.

Objectified knowledge, knowledge without a human subject yet operative, is something that the new information technology offers in abundance. The pocket calculator knows how to do arithmetic by containing and following algorithms for addition, multiplication etc. This is what computers were invented to do, and this is very much what they do. Most of it is not called artificial intelligence, but that is of course exactly what it is. The active knowledge artifact is a completely new kind of entity introduced into the information world by the new information technology, with dramatic effects on the vertical dimension and the whole knowledge organization. We are still only in the beginning of this process as information technology is invading also the physical products, procedures and environments of information society.

No less important to knowledge organization than automation and knowledge automata is the introduction of new *cognitive tools*—artifacts that we think *with* (rather than things that think *for* us). We have seen a shift of emphasis in the use of computers from automata to tools in the last few decades. Still, the development of new cognitive tools based on computer, telecommunication and interface technology is only in its infancy. We have only just begun to explore the possibilities, and what we have seen so far is little more than computerized versions of earlier cognitive tools. When this field of research and development matures it will have tremendous effects on knowledge organization—vertically, horizontally and modally.

Despite its name, the new information technology is as much a technology of sensation, action and interaction. If the old image of thinking was epitomized by Auguste Rodin's famous sculpture, *The Thinker*, a more up-to-date image would show a person in movement, all senses wide open to the environment, engaged with intellect as well as body in action and interaction.

Information society—from material production to getting ideas

In the society in which this ongoing development and merging of cyberspace and ubiquitous computing is taking place, both the form and the content of human activities will also undergo some changes.

In information society the top priority is no longer to produce material goods fast and cheap. What matters most is to produce and use information, knowledge, ideas, experiences. Certainly, just as industrial society did not obviate the food production that was central to the earlier agricultural society but rather industrialized it, information society does not obviate the production of material goods but rather "informationalizes" it: makes the production more efficient by information-technological means, and animates the products themselves with information technology. The new focus, however, is on information, ideas, and experiences; products and services spanning a very broad range, from science, research and learning to culture, adventure, games and entertainment. That will be what most people work with, what they spend most of their money on, what they dream about and talk about most of the time.

Industrial virtues such as standards, norms, specifications, carefulness, knowledge, verification, repeatability, punctuality, rationality, dutifulness, predictability, orderliness, prudence, conformity, uniformity, and control—they all have to be newly assessed in information society. If the ability to interpret and act in accordance with rules, instructions, specifications, were essential requirements of the industrial workforce, they are now rather passed on to the information technology. Computer programs can do that—and better than we ever did. While in the industrial society materials, transports of materials, the production of new copies of a product, and the transports of finished products, stand for a considerable part of the economy, the economy of information society's idea products is entirely in the development (and in the marketing). The only way to make a real contribution, to add value, is by being *creative*. The ability to think and act independently in new and meaningful ways will be generally appreciated in a way it was not before; receptivity, creativity, originality, individualism, unpredictability are likely to become new virtues. As for rule following, knowledge and understanding of rules will remain as important as ever since a significant part of the idea products are systems of rules—plans and programs—and our ability to create such systems, to play with rules, to make things behave as we wish with the help of rules, has obviously increased enormously. But *abiding by* the rules is less imperative. Rules and patterns are there to be broken, but to be broken in new and creative ways. And, obviously, to break the rules there must be rules to break. Very important for the long-term economy of information society is *creative sustainability*—meaning that new creations should enable rather than disable further creativity. Whereas the planning and design of a large industrial type of project typically requires and rewards creativity for the happy few, the ensuing implementation activity and end result typically discourage creativity and contribute to further narrowing the possibilities of independent thinking, action and self-expression for a greater number

of people. It is deplorable that still so many computer programs demonstrate this very error, the ultimately self-destructive sin of information society.

The fusion of cyberspace with the physical world promises that thinking will be physical, active, interactive. Ideas will be tangible, things will be loaded with symbolic content, physical events and activities will also be messages. The sharp separation of thought and action dissolves. The tempo is fast, new information, new ideas will arrive every second, from further afar as our information horizon keeps expanding. We will need to be able to keep many things going in parallel, to apply our cognitive abilities instantly as ever new situations arise. Understanding and critical judgement becomes much more important when everything is in flux and you cannot rely on the old "business as usual." But relax. Instead of panicking and drowning in the deluge of information, let us learn to swim along. Let the information flow but keep an eye open to the possibilities that happen to drift our way.

Literature

Benedikt, Michael (1991) "Cyberspace: Some Proposals," in Benedikt, M (ed.) *Cyberspace: First steps*. Cambridge, Mass.: MIT Press.

Benedikt, Michael (2003) "Towards a general theory of value," an interview by Gong Szeto. *Gain*, March 6, 2003.
http://gain.aiga.org/content.cfm?ContentAlias=michaelbenedikt1 visited 2005-04-20.

Dennett, Daniel C (1981) "Reflections to David Hawley Sanford: Where was I?" in Hofstadter, D R & Dennett, D C (eds.) *The mind's I*. Brighton: Harvester Press.

Gibson, James J (1979) *The ecological approach to visual perception*. Boston: Houghton Mifflin.

Gibson, William (1984) *Neuromancer*. New York: Ace Books.
Online at http://project.cyberpunk.ru/lib/neuromancer/

Nagel, Thomas (1974) "What Is It Like to Be a Bat?", *The Philosophical Review* **83**:435–50.
Online at http://members.aol.com/NeoNoetics/Nagel_Bat.html

Ong, Walter J (1982) *Orality and literacy: the technologizing of the word*. London: Methuen.

Popper, Karl R (1975) *Objective Knowledge*. Oxford: Oxford University Press.

Stephenson, Neal (1993) *Snow crash*. New York: Bantam.

Wiener, Norbert (1948) *Cybernetics*. Cambridge, Mass.: The Technology Press.