The imaginary of Internet

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I The Ideal Scientific Community

Summary

The Internet is the result of an imagined, technological construction in a particular social environment: academic computer science departments. This article considers the intentions and socio-technological choices of the initial designers of the Internet era. It focuses on the definition of the concept of network computing, the setting up of the network and its uses, the creation of a single world network and finally, hypertext projects and tools for accessing information. The earliest Internet model built in this framework has remained an unavoidable reference for all Internautes to this day.

How can the success of the Internet be explained? Most analysts see the world as undergoing a major technological revolution comparable to the development of the steam engine or electricity, with the Internet at the summit of the third wave so dear to Alvin Toffler: high-tech, anti-industrial and based primarily on services and technology. This technological determinism often goes hand in hand with technological optimism which sees the Internet as the spearhead of a profound social transformation affecting the corporate world, the state and social relations alike. Others, however, consider that the prophets of the Internet have a short memory. A few years ago their peers and sometimes they themselves claimed that the image would replace writing, the videotext would supplant the press, offices would be paper-free and the cable would be the downfall of mass media since everyone would henceforth be able to express themselves without recognized intermediaries. Understandably, with this discourse on the communication revolution repeated every time a new medium starts to appear, attentive observers sometimes have the impression that history is stuttering. Does that mean that the Internet is just a passing fad that will have little impact on social customs?

Developments in the US or, closer to home, in Scandinavian countries seem to contradict such sceptical views.

Rather than comparing these two arguments, we might consider the Internet to be a "self-realizing prophecy": by repeatedly convincing ourselves and others that it is going to be the main tool of a new society, we actually make it happen. Talking about the technology often amounts to doing it, or at least diffusing it. This hypothesis has the advantage of folding an imaginary dimension, usually overlooked, into the analysis. Like other new technologies, the Internet is often conceived of in terms of the relationship between the technological and the social, without due regard to all the mediations between the two. Yet by considering that the imaginary dimension of the communication revolution accompanies and boosts diffusion of the Internet, we also fail to explain why the same association did not exist for other new technologies. Above all, we dissociate the Internet from the communication revolution, as if they were two distinct elements, thus overlooking the entire historical process in which this innovation was elaborated. Now, imagination has been involved not only in the diffusion of this new technology, but also in its conception. It is one of the elements of a common culture binding designers and users. Of course it would be wrong to search in designers' utopian discourse for the seeds of the technology, ready simply to grow. Such utopia are resources mobilized by actors to promote their projects, much like known physical phenomena or existing social practices. All actors are only partially guided by their initial projects. Moreover, this discourse does not appear at the origins of an innovation only; it accompanies its development and takes into account changes of direction and points of view. It articulates designers' positions to those of users, in a complex web where each party leans on the other's position and modifies it at the same time.

Many utopia flourished in the earliest stages of the Internet. Some belonged to the counter-culture or the world of hackers, others to the world of politics or business, and others to academic research. In this article I shall limit myself to the imagination of the scientific community which was at the origin of the Internet and which, for nearly 20 years, played a key part in its creation and development. This community not only conceived of a system of network computing, it also created and used it.

It was in the world of information technology research that the first socio-technological frame of the Internet was constructed. This frame served, and still does, as a reference for defining today's mass Internet. In my study I drew on documents defining the main features of the technological project and its uses, and on texts describing the first effective uses of the Internet, with conclusions on likely future development and impact. In order to avoid retrospective constructions, opinions based on hindsight, as far as possible, I mainly used texts written before or during the creation of the Internet. While analysing these writings I also studied the technological choices of academic computer specialists and the uses they opted for. These choices either concretized discourse in the form of a technology or challenged it. My study is divided into four consecutive stages: definition of the concept of network computing; setting up of the network and its uses; creation of a single world network; and, finally, hypertext projects and apparatus for accessing information.

From calculation computing to network computing

If we are to understand the intentions of the creators of the Internet, we need to consider the situation of computer science in the early fifties and sixties, in relation to which they defined their approach.

Time-sharing computers and man-computer symbiosis

At the end of the 1950s computers were still rare (only about 5,000 in the world) and expensive, and access was never direct. After writing their programmes, programmers used punch cards to load them onto their machines. If the programmes ran as expected they would take the results and hand the machine over to the next person. If, however, there was a mistake, they would have to adjust the programme and reintroduce it later. Computers were therefore simply tools for doing the calculations presented to them. Moreover, the central processing unit (CPU) was active for part of the time only. To improve the performance and efficiency of the calculation, computer scientists conceived of time-sharing, in which machines would carry out several tasks simultaneously, thereby giving all users the impression that they were using the computer independently. For Maurice Wilkes, lecturer at Cambridge, "time sharing will enable the super-fast machines now being constructed to be fully loaded" (Wilkes, 1960, cited by Norberg & O'Neill, 1996: 81). Other researchers saw this technological change as an opportunity to modify computer scientists' work. "[They will] communicate directly to the high-speed elements, to add instructions, to change a program at will or to obtain additional answers from the machine on a time-sharing basis with other programs using the machine simultaneously" (*Ibid*: 82)[1]. Finally, in a broader sense, some saw time-sharing as interactive use of a computer not by a single programmer but simultaneously by several, each with a specific terminal subservient to the machine (slave-master relationship).

The concepts of communication and interaction with computers that appeared along with initial reflection on time-sharing were also present, although less systematically, in Joseph Licklider's programmatic article "Man-Computer Symbiosis". This psycho-physiologist who worked with computer specialists as an expert on the human factor had the opportunity of using one of the first mini-computers, the PDP-1. With this machine, which was far smaller than any other computer at the time, it was possible to enter programmes and data on a strip of paper, so that interaction became possible. "The PDP-1 opened me up to ideas about how people and machines like this might operate together in the future", he recalled in the eighties (Rheingold, 1985: 138). These ideas were gathered together in his article, in which he reflected on the process of intellectual work, noting that "thinking time was devoted mainly to activities that were essentially clerical or mechanical [… and] that can be performed more effectively by machines than by men". The solution, he suggested, could be "to create a symbiotic relation between a man and a fast information-retrieval and data processing machine, however, it seems evident that the cooperative interaction would greatly improve the thinking process" (Licklider, 1990: 5). He then suggested a research programme to achieve that goal.

The following year, at a conference held at MIT on the future of computer technology, Licklider again described what computers could do for intellectual work: "In due course it will be part of the formulation of problems; part of real-time thinking, problem solving, doing of research, conducting of experiments, getting into the literature and finding references … And it will mediate and facilitate communication among human beings" (Greenberger, 1962: 205). Licklider's project broke away from a prevailing standpoint at the time, which considered that the computer ought to be an autonomous intelligent tool capable of replacing the human brain. John von Neumann, one of the founding fathers of computer technology as we know it today, had in fact designed his machine as a copy of the human brain, which

[1] From the MIT Computation Center "Progress Report Number 4 of the Research and Educational Activities in Machine Computation by the Cooperating Colleges of New England" 1958.

would eventually be able to replace man[2]. The idea of man-machine symbiosis, argued by Licklider, is totally different. Similar ideas were expressed by the linguist Y. Bar-Hillel (*Ibid*: 324) who, at a conference at MIT, delivered a paper on man-machine dialogue.

Two years after publication of his article, Licklider was put in charge of the Information Processing Techniques Office (IPTO) by the Advanced Research Projects Agency (ARPA), the new Defence Ministry research agency. From the outset he gave a series of lectures on computers for military purposes, in which he argued that "a computer should be something anyone could interact with directly, eliminating computer operators as the middlemen in solving their problems" (quoted by Hafner & Lyon, 1996: 36). At ARAP he had a substantial research budget for developing fundamental research in the academic environment. He used the programmatic guidelines of his paper to get his former university colleagues in Boston to agree to certain projects. "I wanted interactive computing, I wanted time-sharing. I wanted themes like: computers are as much for communication as they are for calculation"[3] (quoted by Norberg & O'Neill, 1996: 97). That was how, with his help, MIT computer specialists launched the Mac (Multiple Access Computer) project aimed at enabling a large number of users to use the same machine. Licklider was so enthusiastic about the project that he took charge of it shortly after leaving ARPA. The MAC project was more than a new generation of computer technology, it was a more collective way for computer scientists to practise their profession. Programmers were confronted with their colleagues' work, which got them thinking about writing programs that others could reuse. As Fernando Corbato and Robert Fano, the first leaders of the MAC project, wrote: "the time-sharing computer system can unite a group of investigators in a cooperative search for the solution to a common problem, or it can serve as a community pool of knowledge and skill on which anyone can draw according to his needs" (Corbato & Fano, 1966, cited in Hauben & Hauben, website, chapter 5).

It was with this project and similar research conducted in other universities, especially in California, that the idea of a computer network or of an inter-galactic computer network, as described by Licklider, started taking shape. To illustrate the concept, Licklider took the example of a researcher with a set of digital data to analyse, who tries by trial and error to find the curve that will accurately explain the data. In order to do so he will try different available

[2] On this point see Breton (1995)
[3] Licklider interview at Charles Babbage Institute.

programmes, and once he has found the right curve, he will archive everything so that the connection established between the results of the experiment and the theory may be accessible to other researchers. This network project also contained the wish to construct common tools for an entire research community, and to build on the experience and computer programs of all its members. In Licklider's opinion, this goal could best be achieved by developing research on man-machine interaction , time-sharing and computer networks (Licklider, 1963). Seven years later he reviewed his action:

> "After joining Project MAC [in 1967], I began to realize that the then-prevalent man-computer communication via typewriter was rather far removed from the fast-response graphic interaction of which my dreams were made and that the 'on-line community' was not so much a community of users as an in-group of computer programmers… It seems to me that the efforts of the 1960s fell somewhat short of what is needed and achievable in very close man-computer interaction […] and quite short of the dream of an 'on-line community' " (Licklider, 1970, quoted by Norberg & O'Neill, *op.cit.*: 111).

Although Licklider's visions had not yet become reality, significant research had been done in the 1960s. The fruit of that groundwork was to be reaped in the following decade in the areas of interface tools and network computing.

Interface and enhancing intelligence

In the early 1970s a number of technological perspectives similar to those of Licklider appeared in the writings of various specialists, particularly mathematicians or computer scientists who recommended "close man-computer interaction" (Ulam, 1960) or imagined computers as "extending man's intellect" (Ramo, 1961). But it was unquestionably Douglas Englebart, a Californian researcher, who considered the question in greatest depth. According to Howard Rheingold's hagiographic account, when Englebart entered Stanford Research in 1957, he presented "his ideas on getting computers to interact with people, in order to augment their intellect.

> - How many people have you already told about that? asked [his interlocutor]
>
> - None, you're the first I've told.
>
> - Good. Now don't tell anyone else. It sounds too crazy. It will prejudice people against you." (Rheingold, 1985: 180).

Despite this warning, Engelbart wrote an ambitious document on the subject, entitled "Augmenting Human Intellect". In the introduction he described the project:

> "by 'augmenting human intellect' we mean increasing the capability of a man to approach a complex problem situation, to gain comprehension to suit his particular needs, and to derive solutions to problems. Increased capability in this respect is taken to mean a mixture of the following: more-rapid comprehension, better comprehension, the possibility of gaining a useful degree of comprehension in a situation that previously was too complex, speedier solutions, better solutions, and the possibility of finding solutions to problems that before seemed insoluble" (Engelbart, 1962: 1).

After describing the characteristics of human intelligence, he showed that computers could be used to increase performance. He saw them not as calculating machines, but as tools for symbolic manipulation; that was how they would be able to augment intellectual capacities. He believed that machines should enable people to perform very simple intellectual operations, such as writing and correcting a written text. Individuals could thus spend less time drafting texts and devote part of their energy to more complex intellectual tasks. The best way of organizing or reorganizing words in a text was by being able to touch them, to transform them manually. "Symbols with which the human represents the concepts he is manipulating can be arranged before his eyes, moved, stored, recalled, operated upon according to extremely complex rules – all in very rapid response to a minimum amount of information supplied by the human, by means of special cooperative technological devices" (*Ibid*: 23). His interest in these small material devices led Engelbart to focus on interfaces[4].

The question of graphics was already of interest to ARPA. In 1962 Sutherland, Licklider's successor at the military research agency, developed the first graphics software package, Sketchpad. After his appointment at the head of ARPA he financed Engelbart's research team, called the Augmented Human Intellect Research Center. Their laboratory developed and tested individual work stations linked to a computer on a time-sharing basis. Each of the stations had a visual display unit and several dialogue tools: alphanumerical keyboard, mouse and five-key chord keyset. Other interfaces that had been tried, such as the light-pen, were not retained. The principle of "windows" by "cutting a hole" in the screen and seeing an image in that space was tested. But the laboratory's most original feature was that it not only produced technological tools, it also ran experiments with them. "Thus the research group is also the subject group in the experiment (…) This 'bootstrap' group has the interesting assignment of developing tools and techniques to make it more effective at carrying out its assignment" (Engelbart & English, 1968: 2). For instance, after using the word-processor, one of the designer-users noted: "I find that I write faster and more freely, pouring thoughts and trial words onto the screen with much less inhibition, finding it easy to repair mistakes or wrong choices" (Engelbart, 1968: 40). Experimental uses were not only individual but also collective. For example, certain documents were accessible collectively on the computer system. Similarly, the laboratory experimented with on-line conferences, commented on at length in a new reference document co-signed by Licklider and Taylor, at the time head of the computing department at ARPA. "In a few years … men will be able to communicate more effectively through a machine than face-to-face. That is a rather startling thing to say, but it is our conclusion" (Licklider & Taylor, 1968). They also introduced the idea of on-line communities.

> "They will be communities not of common location, but of *common interest* (…) The impact of that fact will be very great both on the individual and on society. First, life will be happier for the on-line individual because the people with whom one interacts most strongly will be selected more by commonality of interests and goals than by accident of proximity. Second, communication will be more effective and productive, and therefore more enjoyable." (*Ibid.*: 38-40).

The computer network

While time-sharing had enabled a group of about one hundred computer scientists to use the same machine, the computer network seemed to be the next step allowing thousands of users to share the same resources. ARPA, in particular, wanted to link up the 17 research centres with which it was working. Tome Marill, who conducted one of the first experiments linking two computers, commented: there is no "common ground for exchanging programmes, personnel, experience, or ideas"[5] (cited by Hafner & Lyon, 1996: 68). In 1966 he launched the first study on this subject. The report concluded that "the principal motivation for considering the implementation of a network is that a user of any cooperating installation would have access to the programs in the libraries of all the other cooperating installations" (Marill, 1966, cited by Norberg & O'Neill, *op.cit.*: 162). Similar projects were also developed by the

[4] For a study of the interfaces conceived by Engelbart, see Bardini, 1998.
[5] Letter from Tom Marill to Lawrence Roberts.

computer manufacturers IBM and Control Data. In 1968 Control Data opened an international network called Cybernet, connecting a number of computing centres (Norberg & O'Neill, *op.cit.*: 162). However, these computer companies had a different vision of computing; they developed computer-dependent software, ruling out all communication between different machines. They had also opted for a star-shaped structure, with a centre and a periphery, where sites were not all equal.

Towards the end of 1966 the directors of ARPA agreed to Taylor's plan to build a computer network. Taylor justified the project by the fact that it would obviate the need constantly to buy new equipment for university departments working for the Pentagon. Each team would thus have access to the most powerful computers and to machines or programs produced by other manufacturers (for at the time different computers were incompatible) (Hafner & Lyon, 1996: 41-42).

Apart from this wish to enhance the productivity of spending on computers, there was also the goal of strengthening cooperation between computer scientists. Robert Fano, one of the leaders of the time-sharing project MAC, subsequently recalled "friendships being born out of using somebody else's program, people communicating through the system and them meeting by accident and saying 'oh, that's you'. All sorts of things. It was a non-reproducible community phenomenon" (IEEE Annals, 1992: 35, cited by Hauben & Hauben, website, ch.6). It was precisely these communities that Licklider and Taylor wanted not to reproduce but to extend. In their 1968 article they note:

> "Today the on-line communities are separated from one another functionally as well as geographically. Each member can look only to the processing, storage and software capability of the facility upon which his community is centered. But now the move is on to interconnect the separate communities and thereby transform them into, let us call it a supercommunity. The hope is that interconnection will make available to all the members of the communities the programs and data resources of the entire supercommunity" (Licklider & Taylor, 1968: 31-32).

To implement this project the ARPA team made highly innovative technical choices concerning networks. Unlike the telephone where the user is given a connection for a certain amount of time, Lawrence Roberts, the project leader, opted for transmission by packets, which seemed better suited to computerized data. Each message was divided into small packets of data which were then transmitted in a fraction of a second on the telephone network, not necessarily by the same route. Upon arrival the message was reconstituted. This system had several advantages: first, it meant that users did not have to rent a specific telephone line for long periods since packets of different origins could be mixed; secondly, it was highly flexible because in the event of problems on a line, messages could automatically be re-routed on another. This network architecture seemed to have been inspired by research carried out at MIT by Leonard Kleinrock (1964) and, to a lesser extent, by a report written prior to that by Paul Baran from Rand Corporation for the Defence Department. The latter report had a very different aim, however, in so far as the authors' mission had been to design a network capable of withstanding a Soviet nuclear attack[6].

Roberts made a second essential choice: he decided to place a specific computer, the Interface Message Processor (IMP), as the interface between the network and the host computers. This technical architecture left a large degree of autonomy to each computer site which could organize itself as it wished, regarding equipment and software, and could even create a sub-network linking several machines. The only constraint was the need to be able to link up to the IMP. These technical choices to decentralize would be repeated in the organization of work required for the development of a network to be called ARPANET or "Resource Sharing Computer Networks".

Arpanet was built by a small Boston company BBN which had close ties to the MIT. BBN did not involve itself in technical problems posed by data exchange beyond the IMP, considering that they were the universities' responsibility. Unlike the time-sharing system where the central computer and its terminals were like master and slaves, in Arpanet the host computers were on an equal footing. Communication protocol between hosts therefore had to be defined in a cooperative manner. The universities entrusted young graduates or students with the task of developing these protocols. A task force (Network Working Group), consisting of representatives from the four universities concerned[7], was soon formed on a cooperative and egalitarian basis. To highlight these principles the minutes of its meetings were called

[6] Some authors have concluded, somewhat hastily, that the ARPA network was built to enable the US army to maintain communication links in the event of Soviet attacks. In fact, as indicated above, this network was primarily intended to link up the different university computing centres working for ARPA – which is very different. We note, however, that once it had been built the network was also used by the military. On the connection between ARPA and the Rand project, see Norbert & O'Neill, *op.cit.*: 161 and Hafner & Lyon, *op.cit.*: 76-77.

"Request for Comments" (RFCs). This was an open system ("notes may be produced at any site by anybody"(Requests for Comments, 3 April 1969)[8]) in which the rules of the game were set from the start. The content was open, without any constraint on presentation: "philosophical positions without examples or other specifics, specific suggestions or implementation techniques without introductory or background explication, and explicit questions without any attempted answers are all acceptable" (*Ibid.*). This was a scientific world where scientific skills predominated over hierarchy. "We hope to promote the exchange and discussion of considerably less than authoritative ideas" (*Ibid.*), said the authors of the founding text.

Twenty years later, one of the participants in the Network Working Group attested to this way of working:

> "For me, participation in the development of the ARPAnet and the Internet protocols has been very exciting. (…) There were a lot of very bright people all working more or less in the same direction, led by some very wise people in the funding agency. The result was to create a community of network researchers who believed strongly that collaboration is more powerful than competition among researchers" (Braden, 1991: 3-4).

Development of a network of computer scientists

A tool for exchange

Arpanet did not remain in the experimental stage for very long. A year after its creation, in January 1970, the network already consisted of 13 research centres. In April 1972 this figure has swelled to 23, and by July 1975 to 57. In 1971 the project leader Lawrence Roberts considered the network to be operational and decided that "true user activity could usefully begin" (Roberts, 1973, cited by Norberg & O'Neill, *op.cit.*: 176). The first application proposed by the network was file transfers. Thus, as originally planned, it became possible to use the computer resources of other research centres. Shortly afterwards an electronic mail system was developed. Although an e-mail programme did already exist in time-sharing

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[7] University of California, Los Angeles (UCLA); Stanford; University of California, Santa Barbara; and University of Utah.

[8] http ://www.isoc.org/ftp/rfc/0000/rfc3.txt

computers, it took on an entirely new dimension when users were geographically distant. This use of Arpanet was highly successful. According to an ARPA study, in 1973 e-mail accounted for three-quarters of all traffic on the network (Hafner & Lyon, *op.cit.*: 194). Observers at the time commented that "a surprising aspect of the message service is the unplanned, unanticipated, and unsupported nature of its birth and early growth. It just happened, and its early history has seemed more like the discovery of a natural phenomenon than the deliberate development of a new technology" (Myer & Dodds, 1976:145, cited by Hardy, 1996). E-mail spread all the more naturally because it allowed users to short-circuit what they called "the teletypewriter priesthood of traditional electronic mail systems, such as Telex, TWX, and most facsimile services" (Panko, 1977: 21, cited by Hardy, *op.cit.*). Despite this success, e-mail was not mentioned at the time in the different presentations of Arpanet, as if it were not serious enough for a scientific network or, on the contrary, as if this usage had become so natural that it were not worth mentioning.

It was only later, in the late seventies, that this new practice was discussed, prompting Licklider to revise his analyses. Whereas in 1968 (see above) he foresaw the development of on-line communities and machine-mediated communication, ten years later, in a new document written with Albert Vezza, he compared the computer network to the telephone and demonstrated its superiority:

> "It soon became obvious that the Arpanet was becoming a human-communication medium with very important advantages over normal U.S. mail and over telephone calls […] The formality and perfection that most people expect in a typed letter did not become associated with network messages, probably because the network was so much faster, so much more like the telephone […] Among the advantages of the network message services over the telephone were the fact that one could proceed immediately to the point without having to engage in small talk first, that the message services produced a preservable record, and that the sender and receiver did not have to be available at the same time" (Licklider & Vezza, 1978: 1331).

This informal electronic communication was particularly intense because use of the network was free (IMPs had no billing function[9]) and messages were exchanged between people who knew one another. Thus, in 1975 Arpanet had about 1,000 electronic addresses (Norberg & O'Neill, *op.cit.*: 178) and most of the traffic was local. An estimated 60 to 80 percent of the messages at the time were transmitted by people belonging to the same geographic site (Panko, *op.cit.*: 21). An Arpanet community was thus formed. As an "Arpanaute" remarked: "The closed community of the Arpanet and its research orientation yield a situation different from what could be expected outside" (Myer & Vittal, 1977: 21). Some started to imagine that this new medium could possibly be diffused outside, and create new social relations: "We in the ARPA community (and no doubt many others outside it) have come to realize that we have in our hands something very big, and possibly very important. It is now plain to all of us that message service over computer networks has enormous potential for changing the way communication is done in all sectors of our society: military, civilian government, and private" (Myer & Dodds, *op.cit.*: 145). Although this project took over ten years to realize, Arpanautes started in the latter half of the 1970s already to explore non-academic uses. Two Californian researchers created the game Adventure, the first computer version of Dragons and Dungeons, a highly complex role-play game (Hafner & Lyon, *op.cit.*: 205-208).

All said and done, Arpanet was used primarily to communicate, rather than to supply computer resources from a distance as its promoters originally intended[10]. It was as if the designers of the network wanted to maintain the type of cooperation they had developed when defining the technical system. This is a very specific characteristic of the new medium. Not only were its designers its main users for a long time, but the cooperative model on which its design was based constituted the actual content of its use.

A tool for cooperation

In parallel with the construction of Arpanet, Licklider's reflection and Engelbart's experiments, a trial Computer Assisted Conference was held in 1970. Once again, the system had been developed with public funds, not from the military but from a government agency responsible for dealing with emergency situations. The Emergency Management Information System and Reference Index (EMISARI) was used to control the freezing of prices and wages decided by the Nixon administration. The idea was for participants to have access to the same data, for data to be transmitted from the regions to Washington, for them to be annotated, and

[9] On this point see Abbate, 1993.
[10] I am referring here only to academic use of Arpanet which was its main use and the one with the most media coverage. Arpanet was, however, also used by the military. From 1975 the network was run by the Defence Communications Agency. In 1982, 40 percent of all sites were military. In 1984 the military part was separated to form Milnet (Mc Kenzie & Walden, 1991).

then for deferred, distant debates to be held. Eighty terminals linked by the telephone network participated in the operation. Murray Turoff, one of the main designers of this project, commented a few years later: "I think the ultimate possibility of computerized conferencing is to provide a way for human groups to exercise a 'collective intelligence' capability" (Amara *et al.*, 1976, cited by Rheingold, *op.cit.*: 308).

We have here a computer tradition that I have not yet mentioned: the management tool. Turoff adds another dimension, that of a device which, by connecting people, creates collective intelligence. At the time certain computer scientists developed operations research tools for corporate use, that is, methods of calculation used to choose parameters linked to one another by different constraints, for maximizing a mathematical function – a common situation in economics and management. Turoff was also in search of an optimum, although he thought that computers could be used to achieve it not through mathematical calculation but by making cooperation between individuals more effective. Such cooperation, however, required long and complex learning about the tools. The EIES (Electronic Information Exchange System) program, which replaced EMISARI, required eight hours of training and 20 hours of practice (Feenberg, 1986: 7).

Despite the highly confidential nature of this system, Murray Turoff published a book with Starr Hiltz in 1978, entitled "The Network Nation, Human Communication via Computer". In the preface the authors described their vision of the future:

> "We believe that [computer conferences] will eventually be as omnipresent as telephone and as revolutionary, in terms of facilitating the growth and emergence of vast networks of geographically dispersed persons who are nevertheless able to work and communicate with one another at no greater cost than if they were located a few blocks from one another" (Hiltz & Turoff, 1978: XXV).

Indeed, of all the communication technologies invented in the twentieth century, none were adapted to group communication. Computer conferencing, on the other hand, enabled everyone to send and receive information at the time and place of their choice.

> "These systems allow a person meaningful, frequent, and regular communications with five to ten times more people than is possible with current common communication options […] When such systems become widespread […] we will become the Network Nation, exchanging vast amounts of both information and social-emotional

> communications with colleagues, friends and strangers who share similar interests, who are spread out all over the nation" (*Ibid.*: XXVII-XXIV).

The book then presents effective or expected uses of computer conferencing: teaching, political debate, family relations, friendships, science and technology, and management. The latter uses were considered in more detail. In the scientific field, small communities of researchers specialized in a particular domain constituted what certain sociologists called "invisible colleges" (Crane, 1972). Researchers met one another from time to time at conferences, exchanged preprints and cooperated on certain projects. Computer conferencing seemed particularly well-suited to this type of cooperation. By contrast, in the corporate world it often met with resistance. "By changing the communication channels in an organization, […] we are also threatening the power of those whose positions in the organization depend on control over the generation and dissemination of the information that flows through these channels. Such an innovation is thus likely to be seen by many as a usurpation, a threat" (Hiltz & Turoff, *op.cit.*: 49). Behind the computer conference project appeared another ambition, that of reshaping labour relations. It is probably this hope of reform that explains the book's success. The computing magazine *Byte*, for example, presented EMISARI as the founding software: "the history of computer conferencing after EMISARI reads like the Bible's first chapter of Mathew: EMISARI conceived […] Discussion. Discussion begat EIES. EIES begat Participate …" (Meeks, 1985: 170). The origins of computer conferencing thus became a legend in itself!

Use of network computing for scientific work was also theorized, in the same year as Network Nation, by Joshua Lederberg. This Nobel prizewinner for medecine was a skilled user of computers and, in his own words, "an enthusiastic user" of Arpanet. He explained how, thanks to e-mail and the circulation of files, network computing enabled scientists to work more efficiently. He showed that it had numerous advantages compared to the telephone. Based on an experiment in the medical research field, he pointed out that this new technology "has been indispensable for the division of labor in drafting and criticizing complicated research proposals: twenty people may be closely involved in a product of 250 print pages" (Lederberg, 1978, 1997: 168).

This experiment with cooperative scientific work was carried out at roughly the same time by Lynn Conway, engineer at Xerox Park. Conway was the leader of a community of researchers in micro-electronics, and wanted to define a new method for designing chips. The network made it possible to disseminate knowledge fast in the community concerned and to integrate immediate modifications: "the network provides the opportunity for rapid accumulation of sharable knowledge" (Conway, 1981, in Stefik, 1997: 155). This system simultaneously facilitated collaboration and intense competition: "Students and researchers at MIT, Stanford, Caltec, Berkeley, etc. could visualize the state of the art of each other's stuff. These factors stimulated competition, which led to many ambitious projects" (*Ibid*: 156). Fifteen years later Mark Stefik, who published this text, considered that it was a paradigmatic example illustrating the stories of the Tower of Babel and Pentecost. Before Lynn Conway's project, specialists in micro-electronics were all working on their own, with different tools. The highlight of the operation was its creation of a common language for describing chips. As a result, by the end of the project a scientific community existed. This process of collaboration/competition made possible by Arpanet also facilitated the constitution of the network, as shown above. Thus, scientific cooperation was situated at the very core of the Arpanet.

A community of computer scientists, Unix

In the 1970s most academic computer scientists used a computer language developed by Bell laboratories, called Unix[11]. This computer operating system was created for the needs of Bell, then the country's major research centre for the electronics industry. Since US legislation prohibited AT&T, the parent company of Bell laboratories, from marketing computer products, Bell sold Unix licenses very cheaply to the universities, its usual partners. The transaction was virtually non-commercial since AT&T supplied only the source code, without any documentation. Some universities published Unix manuals as a way of appropriating the new software. This principle of open diffusion enabled the academic world to suggest or even to make amendments to programs, which could then be circulated throughout what was to become the Unix community. This mode of cooperative research was, moreover, part of software creators' projects. One of them recounted 15 years later:

> "What we wanted to preserve was not just a good programming environment (…) but a system around which a fellowship could form. We knew from experience that the

[11] Unix is a distant descendent of the MIT time-sharing project, MAC (see above). In 1964 MIT formed a partnership with General Electric and Bell laboratories to write an operational computer language, Multics. In 1969 Bell labs withdrew from the project and developed Unix.

> essence of communal computing, as supplied by remote-access, time-shared machines, is not just to type programs into a terminal instead of a keypunch, but to encourage close communication" (Richtie, 1984: 1578, cited by Hauben & Hauben, website, ch. 5).

In this context a group of Unix users (Usenix) from different universities started to form.

In 1978 a new version of Unix provided for the transmission of files from one machine to another. The protocol was called UUCCP (Unix to Unix Copy Program). Bell laboratories were the first to use this new function, but the network also spread to the universities (Quarterman, 1990: 253). Unlike Arpanet, the network used only telephone lines.

Usenet, the poor man's Arpanet

In the late seventies and early eighties, students from Duke and North Carolina universities adapted the UUCP protocol to allow for document transmission. They launched a network between the two universities, called Usenet, short for "Unenix Network", although they had also thought of calling it Chaosnet or Spidernet (*Ibid.*: 244). The designers of this network, who presented their project at Usenix conferences, pointed out in one of their papers that: "a goal of Usenet has been to give every Unix system the opportunity to join and benefit from a computer network (a poor man's Arpanet, if you will)" (Daniel *et al*., 1980, cited by Quarterman, *op.cit.*, 243). The aim of Usenet was thus to facilitate cooperation within a community of computer scientists not connected to Arpanet. The documents exchanged, called articles, were grouped together in what were called newsgroups, as in newsletters. These newsgroups were in fact files into which the computer system sorted all articles sent on a given subject, and then sent to the people registered as members of the group.

This new computer network grew extremely fast. In 1982, three years after its creation, 400 sites were linked to Usernet (Spafford, 1988). During the same period Arpanet had only 200 sites. The reason for Usenet's growth was that it catered for a potentially far larger community, Unix users, and subsequently all computer specialists since the acronym Usenet changed its meaning to "User's Network". This community, excluded from Arpanet, managed in spite of all to build a bridge between the two networks in 1982. "Usenautes" thus had access to the newsgroups that already existed on Arpanet. Traffic subsequently rose to about 50 texts (articles) per day (*ibid.*).

Owing to the archives that were constituted (Jones *et al.*: website) it was possible to retrieve messages, examine group lists and thus get an idea of the use made of the network. Over half of the groups were involved in computing or the organization of the network itself. Authors of new software used the network to make their work known. Everyone could ask for information or advice. Since the demand was collective, the requester's chances of receiving a reply were increased. Moreover, because this reply was archived, it could also serve other users.

Distribution of newsgroups by subject in 1982

in %

	Usenet	Arpanet
Computing	40	56
Organization of newsgroups	12	9
Science & Technology	14	13
Leisure	15	9
Sport	8	-
Debate, miscellaneous	11	13
N° of newsgroups	92	23

The newsgroups were also opportunities for debate on the respective advantages of a new system or protocol. There were, for example, groups on the bugs in different versions of Unix or on problems with the Usenet / Arpanet connection. Within Arpanet a group discussed a new protocol, the Tcp/Ip, subsequently to become a key element in the definition of the Internet. Non-professional uses also appeared, although more frequently on Usenet than on Arpanet which still lay in the shadow of the military. The subjects debated primarily concerned science and technology, which was hardly surprising for engineers, mathematicians, astronomers and specialists in transport techniques. Even leisure activities were considered from a technical point of view: hackers, computer games (chess, video games), electro-acoustic music. Both networks also included a group of science-fiction fans and groups on diverse subjects such as classified advertisements, job seeking, funny stories, and so on, as well as debates on subjects of general interest (e.g. taxes, suicide). These uses were not fundamentally different from those of the Arpanet mailing lists[12]. Ray Tomlison, who developed the first message service software for this network, commented that "for most of the people with access to e-mail, the word 'computer' figured prominently in their resume. Topics ranged from bug reports and meeting announcements to recipes for pretzels"[13]. Arpanet mailing lists, like Usenet newsgroups, also allowed for the publication of electronic journals. The head of a conference on computer networks, held in 1976, commented: "it is interesting to note that many of the abstracts and several complete papers were delivered via electronic mail […] This practice is becoming quite common for some journals and newsletters, and is proving to be a viable medium for such tasks" (Austin, 1976, quoted by Hardy, *op.cit.*: 29). Indeed, the idea of electronic journals started to circulate in the computing world. People started talking of a virtual journal (Roistacher, 1978), and one of the subjects of the "net.usenix" newsgroup was the creation of an electronic newsletter on Unix[14]. Computer specialists on Unix were used to working together: "people often look at each other's code, comment on it in person and through interuser communication facilities, and take pieces of it for their own use. The ideas of programming teams and egoless programming fit into the Unix environment well, since they encourage sharing rather than isolation" (Kernighan & Mashey, 1981: 20, cited by Hauben & Hauben, *op.cit.*: ch. 9). In this context of sharing and collective writing "some programs have always been 'owned' by one or two people, many others have been passed around so much that it is difficult to tell exactly who wrote them" (*ibid.*).

Even in the groups not working on computing as such, it was never very far away. Thus, in "human-nets", "netters" talked of their own use of the network.

> "I think/feel that computer communications (done between humans via computers) lie somewhere between written and verbal communications in style and flavor. There is an ambience of informality and stream-of-consciousness style that pervades it but coupled with ideas that are well thought out (usually) and deeper in insight than average verbal communications" (Sends, 1981).

Usenet was not only the medium of intellectual interaction between computer specialists, but also the result of continuous technical cooperation. Whereas Arpanet was financed and

[12] Arpanet had launched "Messages services groups" (MsgGroups) in 1975.
[13] Ray Tomlinson, interview, 10 April 1996, quoted by Hardy, *op.cit.*: 29.
[14] Article of 8 April 1982 (Usenet Oldnews Archives).

developed by ARPA, with the support of a group of computer scientists, Usenet was an independent initiative, a cooperative structure without its own funding. The administrators of the system were computer specialists who participated on a voluntary basis, freeing space on their computer hard disks to record messages (news) and organizing the transfer by telephone. Some machines, to which users of small sites could connect to retrieve the newsletters to which they subscribed, became the backbone of the system. The most important points in the backbone[15] were either academics or worked for the two firms that played a key part in the development of Unix: AT&T and Digital Equipment Corporation (DEC)[16]. The activity of the site was, however, largely dependent on the person in charge of the operation, and the site would sometimes lose its importance when that person moved on[17]. The institution left things to happen rather than initiating the operation. "Much of the netnews distribution within Bell labs is done without any explicit approval", commented a Netter (Hauben & Hauben, *op.cit.*: ch.10, p.16). Sometimes the heads of the operation even had to give of themselves: "when I was at cincy [Cincinnati University] we had a HARD fight to get the administration to pay the bill" (*ibid.*).

Usenet, from computer debate to free public debate

Growth in the number of groups required reorganization in the hierarchy of group names. This was undertaken in 1986-87. Six main themes were selected. The first two items corresponded to academic subjects: computing – the field in which Usenet was founded – and science. The following three concerned non-professional themes: society (social and possibly political debates), recreation (leisure, hobbies) and, lastly, miscellaneous comprising mainly classified advertisements. Finally, news concerned organizational debates on Usenet itself. A seventh domain, talk, was created for debates on controversial subjects. The administrators of the servers saw this as a way of grouping together controversial forums which they would be able to censor. Thus, despite the existence of this area of free talk, the administrators could refuse to distribute certain forums. A system of parallel distribution was therefore set up. That was how the third subject domain, called 'alternative', was born. Brian Reid, who played an essential part in the creation of this parallel device, justified his choice as follows: "in

[15] An organizational backbone since in Usenet, unlike Arpanet, the standard telephone network is used, rather than special links.
[16] DEC was created by two MIT computer scientists. It had a policy of selling its mini-computers to universities at very low prices. These consequently constituted the majority of machines running on Unix.
[17] Http ://www.vrx.net/usenet/history/bjones.net-explodes.txt p.6 (message from Gene Spafford).

retrospect, this is the joy of the alt network: you create a group, and nobody can kill it. It can only die, when people stop reading it […] I don't wish to offer an opinion about how the net should be run […] nobody has any control over it, regardless of what opinions they might have" (Reid, 1993, cited by Hardy, 1996: 13). This libertarian position, which played a key role in the new development of Usenet, was nevertheless moderated by the fact that the site administrators' selection of newsgroups was, on the whole, accepted. "Usenet has adjusted in the past to this site by site selection of hierarchies. It has made Usenet less unified and more patchy over time, but that's part of the anarchy and freedom Usenet has always striven for"[18].

The new division of subject domains accompanied a change in Usenet. The number of newsgroups swelled and scientific themes became relatively less important. In 1987 there were 250 newsgroups, in June 1992 this figure had risen to 3,260[19]. 'Recreation' was the field in which the most articles were received (25 percent). Those forums with the most readers proposed lists of jokes: rec.humor.funny (220,000 readers) and rec.humor. 'Computing' came second, with 21 percent of the articles sent. 'Alternative' accounted for 16.5 percent of the documents transmitted[20], and the most frequently visited forums were alt.sex (220,000 readers) and alt.sex.stories, as well as certain heterodox academic subjects such as hypertext. The domains 'society', 'talk' and 'science' received 10, 5 and 4 percent of all articles, respectively. Finally, although the categories 'miscellaneous' and 'talk' received few articles, they were read by a large number of people. The two groups with the most readers were classified advertisement forums (misc.jobs.offered and misc.forsale) with 280,000 and 250,000 readers, respectively. The groups news.announce.newusers and news.answers, which provided advice to new users, each had over 100,000 readers[21]. Thus, the scientific forums which accounted for the major share of Usernet activity in 1982 accounted for between a third and a quarter only, ten years later. Usenet became a site for open debate, above all. Exchange was, however, unequal. According to a survey carried out in 1994 on six newsgroups, only one to two percent of the people registered had sent a message during the month. Of those messages, about half were answers. Only one third of the initial messages initiated an exchange; the rest remained unanswered[22].

[18] Post from tower@bu-it.bu.edu October 26, 1990 http ://www.vrx.net/usenet/history/bjones.net-explodes.txt p.17
[19] Source: Zakon, R., website.
[20] But 30 percent of the files transmitted. This difference is probably due to the fact that there were many files with pictures.
[21] Source: Brian Reid, Usenet Readership Reports for June 92, articles 3653 and 3724 of news.lists
[22] Source: Sproull & Faraj, 1995: 71.

In spite of everything, Usenet, because of its open organization and the diversity of subjects addressed, was to be the first computer network in the academic world to open up to the outside. The first inter-connections were made in 1988.

Towards a world research network

From Csnet to Nsfnet

Arpanet, as we have seen, linked up only a small number of university computing departments (an eighth in 1979). Its success led academic authorities to consider the construction of a network for all the universities concerned. In 1974 already the National Science Foundation (NSF) advisory committee concluded a report on the subject by recommending a service that "would create a frontier environment which would offer advanced communication, collaboration, and the sharing of resources among geographically separated or isolated researchers" (quoted by Hafner & Lyon, *op.cit.*: 240). This proposal was not, however, accepted. In 1977, Wisconsin university developed the small Theorynet network which provided about a hundred computer scientists with e-mail. Two years later the same university, in collaboration with others, proposed to the NSF the construction of a Computer Science Research Network (Csnet). The project was approved in 1981, after much discussion, and became operational in the following year. Different levels of services were proposed, from e-mail to data transfer. In 1983 the network linked more than half the university computer science departments and in 1986 all of them.

Two east coast universities, in cooperation with IBM, launched the Bitnet network in 1981. The acronym initially stood for "Because It's There", relating to the fact that the protocol was already present on IBM computers, but was subsequently changed to "Because It's Time" (Quarterman, *op.cit.*: 364). This project was strongly supported by the association Educom. Bitnet, like Csnet, developed pathways to interconnect with Arpanet. In the mid-1980s the wish to be linked to a computer network was expressed in other university departments and this new mode of communication started to spread outside computer science departments. The NSF designed a new Nsfnet network opened in 1985, organized on three levels. A national backbone, financed by the NSF, linked five supercomputers which could be used by other universities, and about 12 points of interconnection. These provided the interface with regional networks which had to find their own funding. Finally, each university built a local network on its own site, mostly with NSF grants. The Foundation, which wanted to promote the network in all the disciplines, demanded that "the connection (…) be made available to ALL qualified users on campus" (quoted by Leiner *et al.*: 8).

Internet or the meta-network

Development of the Arpanet required the creation of more robust and universal protocols than those defined at the beginning. Robert Kahn, one of the main members of the BBN team that had set up the Arpanet, had subsequently taken charge of another ARPA project consisting of the construction of a network of data transmitted in packets, by ground or satellite radio links. It soon appeared that each of these networks had its own peculiarities and that the Arpanet protocol could not be applied to all. Kahn, with Vint Cerf who was one of the main designers of the preceding protocol, conceived of "an internetworking architecture", that is, a meta-protocol by means of which networks designed differently would be able to inter-function. The concept of an open architecture left each network totally autonomous so that it would not have to change its existing mode of operation; the meta-protocol concerned only the exchange between networks. The first principles were defined in a text published in 1974 (Cerf & Kahn, 1974: 627-641). The basic idea was similar to that chosen for the transport of goods by container: all the boxes are identical and can contain very different objects, which then circulate on different networks (train, cargo, truck). In the present case, the computer data (texts, sounds or images) are encapsulated in packets or datagrams.

The detailed elaboration of the protocol mobilized Arpanautes fully for a fair amount of time. The system chosen had two parts: the Transmission Control Protocol (TCP), responsible for fragmenting messages into packets at the start and reconstituting them on arrival, detecting transmission errors and sending back missing elements, and the Internet[working] Protocol (IP), rresponsible for organizing the circulation of packets and providing each host machine with an address in order to organize the routing. The TCP/IP protocol was tested in 1977. In 1980 it was chosen by the Defense Ministry and on 1 January 1983 Arpanet switched to the new system[23] which was henceforth called the Internet[24]. In the same year the computer

[23] See B. Leiner *et al.*, website.
[24] J. Quarterman gives the following definition: "The Internet is an internetwork of many networks all running the TCP/IP protocol" (*op.cit.*: 278).

science department at Berkeley, which had played an important part in the diffusion of Unix in the academic community, created a TCP/IP version for Unix. Suddenly the new protocol became accessible to 90 percent of all university computer science laboratories (Norberg & O'Neill, *op.cit.*: 185). At MIT researchers subsequently developed a version for PC.

The year 1983 also saw the split of Arpanet into two networks, Milnet for military use and a new Arpanet for research, which was to link up to Csnet. Nsfnet chose from the outset to use the Tcp/ip protocol. Thus, in the mid-eighties Internet managed to federate a large part of the computer networks in the US.

The links that had been created also extended well beyond national borders to foreign universities, thus creating an international network. From 1975 Arpanet had established a satellite link with the UK. Usenet linked up to Canada in 1981 and then to Europe in the following year. The authors of one of the first books on Usenet was thus able to say in 1986: "your link to the Unix network becomes your link to the world and the world's link to you" (Tolido & Dougherty, 1986: 11). In the mid-eighties Bitnet and Csnet established links with Europe and Japan. The international computing network thus had connections to US universities. All this together formed what John Quaterman, in 1990, in the first reference book published on computer networks, called the matrix.

> "The *Matrix* is a worldwide metanetwork of connected computer networks and conferencing systems that provides unique services that are like, yet unlike, those of telephones, post offices, and libraries. It is a major tool in academic and industrial research in computer technology, physics, and astronomy, and increasingly in biological, social, and other sciences" (Quaterman, *op.cit.*: xxiii).

Access to knowledge

The founding fathers of the Internet conceived not only of a network of cooperation and exchange between machines (file transfers) and people (message services, newsgroups) but also of one providing access to universal knowledge. Thus, when Licklider joined ARPA he wrote a paper on future libraries. In the preface he cited an article by Vannevar Bush which, although published in 1945, guided his thinking twenty years later. Bush, who had developed an analogue calculator, had been in charge of the administrative services running the scientific war effort. After the war he wanted to ensure that the scientific cooperation developed during the conflict would be kept alive. The main problem was that "publication has been extended far beyond our present ability to make use of the record" (Bush, 1945, section 1). Bush considered that the hierarchical organization of information in existing libraries did not correspond at all to the functioning of the human mind, for our thinking is above all by association; it advances in a "web of trails" (*Ibid.*, section 6). He therefore suggested grouping together documents and mechanizing information searches. He designed an individual work station called Memex, used to consult all sorts of data recorded on microfilm. Users keyed in the references of the document they wished to consult and were then able to move about in the text (skip pages, return to contents page, etc.) and to move on to other, related documents. Readers could create their own index and indicate links between documents. All this was, however, purely speculative.

Although Licklider's ideas were along the same lines, the technological context had changed: the computer age was dawning. He thought of replacing the book with a device that would make the physical transportation of data unnecessary and that could be used to process it. Computer technology was the appropriate solution. He imagined that in the year 2000 the average individual

> "may make a capital investment in an 'intermedium' or 'console' – his intellectual Ford or Cadillac – comparable to the investment he makes now in an automobile, or that he will rent one from a public utility that handles information processing as Consolidated Edison handles electric power. In business, government and education, the concept of 'desk' may have changed from passive to active: a desk may be primarily a display-control station in a telecommunication-telecomputation system – and its most vital part may be the cable ('umbilical cord') that connects it, via a wall socket, into the procognitive utility net" (Licklider, 1965, in Stefik, 1997: 27).

This utopia was partially experimented in the late sixties, in Engelbart's Augmented Human Intellect Research Center (see above). In a book entitled *Dream Machines*, a brilliant young computer whiz described Engelbart's contribution to experimentation on information retrieval: "Whatever you want to look up is instantly there, simultaneously interconnected to everything else. It should be connected to source materials, footnotes, comments and so on (…). All handling of paper is eliminated." He concluded with: "In building his mighty system he points a new way for humanity" (Nelson, 1974, 1988: DM 46-47). This fascination with the Stanford master did not, however, prevent him from also having a critical view. Nelson questioned

Engelbart's rigorous hierarchical organization of documents. For at least ten years he had been thinking about a non-sequential organization of texts that he called hypertext[25]. An author could thus write in a non-linear way by proposing branches or alternatives. Nelson's main idea was a great hypertext "consisting of everything written about a subject or vaguely relevant to it, tied together by editors in which you may read in all directions you wish to pursue. There can be alternative pathways for people who think different ways", and added a little further on: "the real dream is for everything to be in the hypertext" (*ibid*.: DM 45). He called his project Xanadu, with reference of course to Coleridge's poem about a magical world where nothing is ever forgotten, but also to the house of Orson Welles' Citizen Kane. The aim was to provide everyone with "a screen in your home from which you can see into the world's hypertext libraries" (*ibid.*: DM 56). Nelson and his assistants tried to create a powerful software package that would enable readers to create their own links with extracts or whole texts. The system had to function both ways, so that readers could not only follow the links accompanying the text but also find all the texts with links to the one they were busy reading. The basic idea was, in a sense, to clearly set out all connections between knowledge. Both Nelson's attempts in the 1980s to develop his software were unsuccessful. Gary Wolf concludes an extremely well documented article on this adventure with the following: "Today, with the advent of far more powerful memory devices, Xanadu, the grandest encyclopedic project of our era seemed not only a failure but an actual symptom of madness" (Wolf, 1995: 202).

In 1988, when Nelson was launching his second attempt to write the Xanadu software, Robert Kahn and Vinton Cerf, the fathers of the Tcp/ip protocol, published a document on the digital library (Cerf & Kahn, 1988; extract published in Stefik, *op.cit.*: 33-38), proposing the creation of a network of interconnected libraries. When users cannot find what they are looking for in the local data base, their requests are routed to distant digital libraries. One of the key elements of the project was the concept of an intelligent agent called a "knowbot". These agents were to locate and retrieve information in a huge, complex and heterogeneous network of libraries, and could also constitute a sort of cognitive filter that let through only selected information with a certain degree of precision.

[25] The first public presentation of this concept was at the Association for Computing Machinery congress in 1965.

The Web

It was at the European Nuclear Research Centre (CERN) in Grenoble, France, that a hypertext document system was developed in 1990. The aim of Tim Berners-Lee, the main author of the project, was to meet the documentation needs of a large research centre in which information is fragmented and decentralized, and where teams are constantly changing. He wanted to produce operational software suited to researchers' needs.

> "The problem of information loss may be particularly acute at CERN, but in this case (as in certain others), CERN is a model in miniature of the rest of the world in a few years' time. CERN now meets some problems that the rest of the world will have to face soon. In ten years there may be many commercial solutions to the problems above, while today we need something to allow us to continue" (Berners-Lee, 1989).

This view was expressed in another text by Tim Berners-Lee and Robert Cailliau. Their project consisted neither of intervening on information nor of organizing it hierarchically, but of establishing links between it:

> "The texts are linked together in a way that one can go from one concept to another to find the information one wants. The network of links is called a web. The web need not be hierarchical, and therefore it is not necessary to "climb up a tree" all the way again before you can go down to a different but related subject. The web is also not complete, since it is hard to imagine that all the possible links would be put in by authors. Yet a small number of links is usually sufficient for getting from anywhere to anywhere else in a small number of hops. The texts are known as nodes. The process of proceeding from node to node is called navigation. Nodes do not need to be on the same machine: links may point across machine boundaries. Having a world wide web implies some solutions must be found for problems such as different access protocols and different node content formats […] Nodes can in principle also contain non-text information such as diagrams, pictures, sound, animation, etc. The term hypermedia is simply the expansion of the hypertext idea to these other media" (Berners-Lee & Cailliau, 1990).

To organize this navigation, users needed a browser or navigator enabling them to select information and display it on the screen. This software, that its author called the World Wide Web, was ready in 1991. It included a HyperText Markup Language (HTML) for describing documents and another language called the HyperText Transfer Protocol (HTTP) for managing and transferring them. The documents were placed in servers with a URL (Uniform Resource Locator) address. Soon the World Wide Web software was circulating on the Internet. The international community of nuclear physicists started to use it to share documentation. Hypertext specialists who obtained the information in the "alt-hypertext" newsgroup examined it and created other navigators, the most well-known of which is Mosaic, written by Marc Andreessen at the National Center for Supercomputing Application (NCSA), University of Illinois.

The republic of computer specialists

Over a period of 20 years, from the opening of the Arpanet to the invention of the Web, a very particular process of innovation was underway. Unlike many other technologies, the Internet with its various components was developed almost exclusively in the academic world. This research led directly to operational devices, thus short-circuiting, in a sense, the traditional step of transfer to industry. Such an exceptional process was possible only because computer scientists were the first users of their own inventions, and because those inventions were based essentially on computer programmes, that is, intellectual work, something academics can provide. For them, the object was not only to steer computer science in a new direction, towards networks, but also to endow themselves with the working tools (message services, cooperative devices, collective documents) that they needed and the market could not provide.

This short-cut between research and use, which merged the two positions, was reinforced by the fact that the development of tools and their uses enhanced the productivity of scientific work. As computer scientists linked up computers in a network for exchanging information, the very content of their dialogue concerned the construction of that same network. This type of virtuous circle was possible only because they were outside the ordinary world, the market society where production and consumption are totally separate.

While these academics, richly endowed by ARPA and the NSF, were able to create an environment so favourable to the realization of their project, they also modeled it in terms of their own practices and representations of modes of sociability. The operation was carried out by a group of young researchers who saw the university as a peer group. The social organization of the Internet therefore has the following four characteristics:

- *Interaction and cooperation is first and foremost between specialists.* These specialists do not necessarily meet in their laboratory or university. They are distance colleagues who constitute an "invisible college", publish in the same journals, meet at the same conferences, and sometimes travel from laboratory to laboratory. This invisible college, which initially included some industrial laboratories such as Bell laboratories or Xerok Park, was to design the Internet along the same lines and thus to meet their own needs. Pioneers such as Licklider[26] were to call this social organization a community of interests; others such as Turoff[27] spoke of a network nation.

- *It is a community of equals* where the status of each member is based essentially on merit, evaluated by peers. But unlike the classic university tradition, this evaluation is not only by legitimate authorities (commissions, journals, etc.) but also by ordinary colleagues who test, comment on and improve proposals. The debate is therefore wide open and cannot be closed by any authoritative argument. Information flows freely. Arpanet Requests for Comments and newsgroups are the manifestation of this adhocracy.

- *Cooperation is an essential element, at the core of this scientific activity*. Computer software is something too complex to be created by a single individual; it requires teamwork. This collaboration is more intense when the aim is to network computers deliberately designed to differ. Corbato and Fano (1966) had already observed the existence of such cooperation in time-sharing computing, and Richtie (1984), one of the creators of Unix, also noted this principle of cooperative work. Turoff (Amara *et al.*, 1976) and Lederberg (1978) showed the effectiveness of Arpanaute communities. The fast flow of information allowed for a high level of transparency, which in turn facilitated cooperation. Yet as Lynn Conway (1981) notes, transparency also helped to intensify competition between teams.

- *It is a world apart, separate from the rest of society*. The campus is a world on its own, a pathway for students between adolescence and the adult world, between school and the professional world; a place of innovation and experimentation for academics, where computer technology was to reign. Richard Cyert, chancellor of Carnegie Mellon university, commented in 1984: "the great university of the future will be that with a great computer system"[28]. Backed by IBM, he embarked on the construction of a network of 7,500 terminals (Roszak, 1986: 58).

[26] See Licklider & Taylor, 1968.
[27] See Hiltz & Turoff, 1978.
[28] *Wall Street Journal*, November 30, 1984, p.18, quoted by Roszak, 1986: 60.

These academic computer networks and, more particularly, Arpanet, seemed to certain participants (Myer & Vittal, 1977) to be a closed community, separate from the rest of the world. In their history of the Arpanet, John King, Rebecca Grinter and Jeanne Pickering (1996: 9-35) use the metaphor of a mushroom town called Netville, protected for a long time by the Great Divide. In the mythology of the conquest of the West, it separated the conservative East from the West with its freedom and abundant new opportunities. To conquer new technological opportunities, pioneers in the computer field needed to be protected from the old world by the Great Divide. This boundary was codified in the form of rules reserving use of the network for certain laboratories and then, subsequently, for the academic world. Nsfnet thus developed an "Acceptable Use Policy" which specified that the network was intended exclusively for US research and teaching institutions. By extension, the network was opened to foreign universities (provided they opened their sites to US universities), to private firms' research centres collaborating with the academic world, and to para-university institutions. Other commercial uses were not accepted (Hauben & Hauben, website, chapter 12). The republic of computer specialists could thus function, sheltered from the outside world.

Conclusion: Birth and force of a myth

While some regretted the decline of Netville emerging on the horizon, with the risk of seeing the republic of computer scientists disappear, others were persuaded that they had developed new tools to serve not only academics but society at large. Thus, Ed Krol who had drafted a first document introducing his young colleagues to use of the Internet, published a lengthier version in 1992, intended for a broader public. "Ten years ago" he wrote "personal computers took computing out of the realm of the technical gurus to the public at large […] the Internet is on the verge of bringing about the same transition" (Krol, 1995: 2). In another guide, Adam Gaffin and Mitchell Kapor spoke in the same terms as Licklider about interest communities and added:

> "The oldest of these communities is that of the scientists, which actually predates computers. Scientists have long seen themselves as an international community, where ideas were more important than national origin. It is not surprising that the scientists were the first to adopt the new electronic media as their principal means of day-to-day

> communication. I look forward to a day in which everybody, not just scientists, can enjoy similar benefits of a global community" (Gaffin & Kapor, 1991: 8-9)[29].

The general interest books that were to start appearing in the 1990s – and of which the two mentioned above were just the first examples – largely defended the idea that the model of sociability developed in the academic world around and through the Internet could also be applied in the ordinary world. The principles of fair trade and free circulation of information in the framework of a cooperative network managed by its users, who constitute the heart of the socio-technological frame of the academic Internet, would, they thought, spread with the new technology. There is, in a sense, an Internet nature that has no reason to change in a different social context.

This discourse impacted strongly on the future of the Internet. In fact it proposed a framework of interpretation and action for network computing and showed what could be done with the Internet and how. This frame was all the more powerful in so far as it described communication practices that actually functioned in the academic world and to which access could be organized. By becoming a new Internaute, one does not only become a user of network computing and of communication or information retrieval tools; one also enters into another social world where relations between individuals are equal and cooperative, and information is free.

This view is indeed somewhat strange, for society is not a cybercampus. Inequalities in skills (in the use of computing and the production of discourse), of a far greater dimension than in the academic world, has appeared. The principle of gratuity has faded with the need to finance certain resources through media-type means (subscriptions, advertising, etc.). But the initial model has also lasted. Forums for the public at large have been set up, information collated by universities is consulted by different users, and ordinary individuals create sites where they present information that is sometimes of great value. Thus, the model of communication within the scientific community is, in spite of all, a framework for interpretation and action that is only partly unsuited to the new reality of the Internet. During the 1990s it has provided a repertory of uses and behaviours on the Internet. All said and done, both yesterday and today the power of the social imagination has been one of the key components of the birth and development of cyberspace.

[29] This guide was published in the form of a book entitled *Everybody's Guide to the Internet*, MIT Press, 1994.

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II The network ideology

During the seventies and eighties, the initial designers of the Internet were also the first users. Their framework of uses was mainly that of the academic field (for Arpanet) or the counter-culture (for BBS). They dreamt of a world where people could exchange information freely from one side of our planet to another, where on-line communities replaced local communities, and where computerized conferencing afforded the possibility of practising a "collective intelligence". Design, uses and ideologies were unified by the same perceptions in the academic world and the counter-culture.

During the nineties there was a spilt in these closed worlds. Designers left the university to work in private companies and the Internet became a mass consumption product with widely varied users. A new discourse about network computing and its impact on society was produced by specialists working for computer journals or news magazines. The Internet *imaginaire*[*] was no longer that of computer scientists; it had become a mass phenomenon. The *digerati* (digital generation), as the digital intelligentsia called themselves, diffused an Internet model of common interest communities, thus creating a "network ideology". But this new Internet myth was not completely beyond reality, for the digerati were totally familiar with the design of these technologies and their first uses. They acted as mediators between designers and users, organizing the connection but also building the socio-technical framework of the Internet. It was they who initiated debate on a digital society.

[*] myth, utopia, ideology or collective vision; product of the collective imagination

Virtual communities, the founding myth

In 1993 Internet was put on the media agenda for the first time. At the beginning of the year *Time* magazine published a feature called "Cyberpunk". After recalling the link between cyber culture and the counter-culture, the article discussed computer viruses, virtual reality, rave parties, drugs (ecstasy) and … The Well, the most well-known Californian BBS[30]. In particular, it cited Howard Rheingold, pioneer journalist in the electronic community: "We're replacing the old drugstore soda fountain and town square, where community used to happen in the physical world"[31]. In contrast to those traditional communities, Rheingold spoke of the "virtual community" – the title of his book published at the end of the year.

In September, when the information highway project – debated extensively during the previous year's presidential election campaign – was in a bad way, *Newsweek* published a feature on on-line life[32]. One of the experiences presented was The Well. Rheingold signed an article, an extract from his forthcoming book, in which he emphasized the fact that virtual communities were not utopias since they had actually been created. The book, *The Virtual Community*, was a best-seller[33], selected by *Business Week* as one of the books of the year. It was the first book on the Internet that was neither technical nor a practical manual. The author discussed at length The Well and his own experience as a newsgroup user and host. He also presented other electronic communities such as Arpanet. Through his account he constructed a representation of the Net in which virtual communities brought together people from all corners of the globe, many of whom remained attached to their locality. These individuals developed conversations that were as intellectually and emotionally rich as those in real life, in a world of balanced interaction between equals. The Net was presented as helping to recreate a social link and to breathe life into public debate and, more generally, into democratic life.

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[30] Following this article, *The Well* hosts received many messages asking them: "Is this the cyberspace?". (Source: Mark Dery, *Flame Wars.* Duke University Press, Durham, 1994, p.6-7)

[31] Philip Elmer-Dewitt, "Cyber punk", *Time,* February 8, 1993, p. 60

[32] Barbara Kantrowitz, "Live Wires", *Newsweek,* September 6, 1993, pp.42-49.

[33] At first 35,000 copies were printed. The following year the book was printed in paperback.

Rheingold's book thus proposed one of the founding myths of the Internet. We know that for Roland Barthes, a myth is in a sense an underlying sign, a meta-language[34]. He takes as signifier an existing sign and makes it signify something else. Rheingold similarly took the electronic community and invisible college as socio-technical frames and placed them in a sphere different from that of ordinary sociability. In other words, he said that what was good for counter-culture communities or for universities was good for society as a whole – as if the change of social sphere would not fundamentally modify the situation. By putting the Internet at the heart of contemporary society, a new process of socio-technical construction was inevitably triggered. Rheingoldian mythology overlooked that phase.

Rheingold founded a new utopia. The idea was no longer, as in the 1970s and '80s, to try out a technical project and to activate a small groups of academics around it, but to offer North-American society as a whole the large-scale realization of new communication relationships which until then had been experienced in small groups. It is hardly surprising, therefore, that the media used Rheingold as a reference to talk of a universal Internet, and that they proclaimed him the "first citizen of the Internet"[35]. It is similarly understandable that all those who wanted to launch out into the Internet business studied The Well which they considered as the prime example of a virtual community, "hoping to divine the magic formula that made it so special, so captivating, so unique" when in fact it was little more than a social experiment[36].

With the publication of Rheingold's book and articles in news magazines, a new Internet *imaginaire* appeared. Initially, this may seem to have been a quantitative development. Whereas discourse on the Internet had previously been diffused in closed circles (computing, counter-culture, etc.), by more or less confidential media, from 1992-93 it had a place in the mass media. This was the beginning of a classic phase in the development of a technology: mass diffusion following laboratory research and early trials. In this fairly traditional perspective in the sociology of techniques[37], discourse on the new technique is considered simply as a tool to

[34] Roland Barthes, *Mythologies.* Le Seuil, collection Points, Paris, 1970, p.195-202.
[35] An expression found in one of the critiques in the presentation of his book on the site Amazon.com.
[36] Katie Hafner, "The Epic Saga of The Well", *Wired,* May 1997, p.100.
[37] Everett Rogers, *Diffusion of Innovations.* The Free Press, New York, 1983. For a critical analysis, see Patrice Flichy, *L'innovation technique*. La découverte, Paris, 1995.

facilitate its diffusion. Yet the technical *imaginaire* is not something apart from the innovation process, attending it; it is an integral part of it. Let us see how this collective technical imagination was constituted.

Internet for all

The first literature specifically on the Internet for the lay public consisted of handbooks for beginners, first found in bookshops in 1992. These books, written by computer specialists with extensive experience in the new medium, but intended for the general public, offered a wealth of practical information on how to access and surf the Web. But they also provided precise representations of this new technique. *Zen and the Art of the Internet* opens with the following statement: "We are truly in an information society". A few lines down the author describes the future internaut: "You have at your fingertips the ability to talk in 'real-time' with someone in Japan, send a 2,000-word short story to a group of people who will critique it for the sheer pleasure of doing so, see if a Macintosh sitting in a lab in Canada is turned on, and find out if someone happens to be sitting in front of their computer (logged on) in Australia, all inside of thirty minutes"[38]. Ed Krol was less lyrical: "once logged on to the Internet, you have instant access to an almost indescribable mass of information […] Through the message service and news, you can use another type of resource: the skills of people throughout the world, some of whom share your interests"[39] [our translation from the French]. He thus conveyed the idea of a sharing of information that was omnipresent in The Well. Moreover, the title of Krol's book (*The Whole Internet users Guide and Catalog*) was an explicit reference to the *Whole Earth Catalog* and the counter-culture[40].

These guidebooks catered for a public of academic non-computer specialists and professional users. But Krol foresaw an evolution: "Ten years ago" he wrote, "PCs

[38] Brendan P. Kehoe, *Zen and the Art of the Internet. A Beginner's Guide to the Internet.* Prentice Hall, Englewood Cliffs (New York), 1992, p. 3

[39] Ed Krol, *Le monde Intenet. Guide et ressources*. Editions O'Reilly International Thomson, Paris, 1995, p. XXIV (US edition 1992)

[40] A far shorter version of this guide had been published in 1989 under the title *The Hitchhiker's Guide to the Internet*, in the framework of Requests for Comments (n° 1118) on the Internet.

took computer use from the realm of technical gurus to the world of the public at large […] the Internet is on the point of effecting the same transition"[41] – and his guide had a wide readership, with over 750,000 copies sold. *The Internet Companion*, published in late 1992, was also intended for a larger public constituting "the network community". This community was defined as follows: "The Internet has always been and will always be a key part of the research and development community, but the increase in access and the network's potential for becoming the basis for worldwide communication between people in all walks of life cannot be ignored by the rest of us"[42]. As an example, a boxed section in the same book recounted the story of two students who met and then married – thanks to the Internet! To show how this extension of the internaut community was going to affect everyone, the authors warned their readers in the introduction: "If you want to stay current in the nineties, and even into the next century, you need to learn about the Internet". In the following year this broader diffusion was noted by the author of *Internet Starter Kit for Macintosh*: "people are connecting to Internet because the Internet is becoming more than just an elite club of technoweenies, it has become a virtual community in and of itself"[43]. This electronic community, which was attracting an ever-larger public, needed a guide, as Al Gore – then campaigning fervently for information highways – pointed out in the preface to *The Internet Companion*: "for too many people the Internet has been uncharted territory, and as a result they have hesitated to explore the vast potential of networking. I trust this book will change that"[44].

All these manuals proposed fairly coherent representations of the Internet as a tool for academic work that could be proposed to a broader public for searching for information, producing documents and working with people throughout the world. In this way users could participate in virtual communities, as clearly shown by Mitch Kapor in the preface to another guide available on the Net before being published as a book: "The oldest of these communities is that of the scientists, which actually predates computers. Scientists have long seen themselves as an international

[41] *Ibidem*, p.2.
[42] Tracy LaQuey and Jeanne Ryer, *The Internet Companion. A Beginner's Guide to Global Networking.* Addison-Wesley, Reading (Massachusetts), 1993, p.9
[43] Adam Engst, *Internet Starter Kit for Macintosh.* Hayden Books, Indianapolis, 1993, p. 13
[44] T. Laquey, p. VI

community, where ideas were more important than national origin. It is not surprising that the scientists were the first to adopt the new electronic media as their principal means of day-to-day communication. I look forward to a day in which everybody, not just scientists, can enjoy similar benefits of a global community"[45]. We find here all the components of the Internet myth as described by Rheingold.

In the autumn of 1993 the major media which had spread the virtual communities myth started to see the Internet as a means of mass communication. "Is Middle America ready for the Internet?" asked *Business Week*[46], while *Time* noted that "suddenly the Internet is the place to be"[47]. In the spring of 1994 *Business Week* went further: "hardly a day goes by when there isn't some story in the paper or on the tube hyping the Internet"[48]. These journalists were partly surprised by this success, for the Internet culture seemed distant from that of the public at large. *Business Week* cited the president of the on-line service Prodigy who "calls Internet a Wild West show that will never become the backbone of a national data superhighway unless it's usable by mere mortals"[49]. *Time* presented the Internet as "an anarchistic electronic freeway"[50], and in another issue the same journalist, Philip Elmer-Dewitt, cited a consultant for whom "if there is a soul of the Internet, it is in that community [of hackers]"[51]. This argument was in line with the feature that Elmer-Dewitt had already published the previous year on the cyber-punk. It can be seen as a clear illustration of the ambiguous attitude of *Time* towards the counter-culture. The magazine presented it as a key element in the evolution of American society; it granted it a lot of space[52] and became a sort of mouthpiece for this social movement. Yet at the same time it denounced the movement's anti-authority and anarchic behaviour. *Time* and the other news magazines consequently changed the way they presented the Internet. After the period of

[45] Adam Gaffin and Mitchell Kapor, *Big Dummy's Guide to the Internet*, 1991 http://www.thegulf.com/InternetGuide.html p. 8-9. This guide was published in the form of a book under the title *Everybody's Guide to the Internet.* MIT Press, 1994
[46] Evan Schwartz, "The Cleavers Enter Cyberspace" *Business Week*, October 11, 1993 p. 142
[47] Philip Elmer-Dewitt, "First Nation in Cyberspace" *Time*, December 6, 1993 p. 62
[48] Edward Baig, "Ready to Cruise the Internet?" *Business Week*, March 28, 1994 p. 180
[49] *Business Week*, October 11, 1993, p. 142
[50] *Time*, December 6, 1993, p. 62
[51] Philip Elmer-Dewitt, "Battle for the Soul of the Internet" *Time*, July 25, 1994 p. 53
[52] In March 1995, *Time* published another special issue entitled "Welcome to Cyberspace" featuring an article by Stewart Brand with the title "We owe it all to the hippies" and the sub-title "Forget antiwar protests, Woodstock, even long hair. The real legacy of the sixties generation is the computer revolution".

promotion of Rheingold's electronic communities came the denunciation of anarchic behaviours. Many articles presented the Internet as a medium for pirating and pornography. My study reveals that these two topics constituted roughly half of all articles on the Internet in *Time* and *Newsweek*, and about one-eighth of those of *Business Week* in 1993 and 1994[53].

But the news magazines also fulfilled an educational role by explaining how to use the new medium. "Internet seems to be everywhere, but frankly, you're still puzzled about what it means to you" wrote *Business Week*[54]. A few months later Katie Hafner wrote a paper in *Newsweek* entitled "Making sense of the Internet", with the sub-title "You keep hearing about cyberspace. But what is it, exactly? What's the best way to try it out? And do you really need to care?"[55]. For those who did not have the possibility of logging onto the Net at work, articles advised people to subscribe to the on-line services that were to become the main access providers and thus get a new lease on life. The new Internet utopia was thus to find a new way to become real.

But the advent of the new internauts often generated conflict. *Internet World*, from 1992 to 1994 the only magazine on the Internet for the general public, published a story in November 1994 headed: "Aliens among us. A horde of new users from America Online, Compuserve, Genie and Prodigy is coming onto the Internet"[56]. This magazine, which published popularised and thought-provoking articles, also wanted to be the mouthpiece of real internauts. In the same issue it published an article denouncing the biased image that the media gave the Internet: "judging by what you read in the press, you'd think the Internet was primarily a morass of newsgroup in-fighting, purpoiled programs and pictures, retro ex-hippy anti-establishment types and cyber-cowboys and gun-slingers"[57].

The Internet general public, presented ambivalently by the commercial media, gradually changed. In 1994 *Net Guide* published a description of potential uses of the Net under the heading "Your map to the Services, Information and Entertainment on

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[53] *Time*: 9 articles of which 3 on sex and 2 on pirating. *Newsweek*: 14 articles of which 1 on sex and 6 on pirating. *Business Week*: 8 articles of which 1 on pirating.
[54] *Business Week*, March 28, 1994 p. 180
[55] Katie Hafner, "Making Sense of the Internet" *Newsweek*, October 24, 1994 p. 46
[56] *Internet World*, November-December 1994, pp.82-84
[57] Daniel Dern, "Painting the Right Picture" *ibidem* pp. 99-101

the Electronic Highway", highlighting recreational uses more than any of the guides published in previous years had done: "you can start relationships, fire off insults, publish your own writings. You can get help on your screenplay. You can get updates on the TV soaps you've missed. You can play games […] You can search through libraries around the world […] You can lose yourself in a new medium and a new world"[58]. A few pages down, the guide answers the question "do I really need it?" with "you'll be part of an active, expanding community of people exploring [...] the information frontier"[59]. Once again, this was the same discourse as that of The Well: by participating in this pioneering experience, one tries out a new form of community. Yet a new orientation of Internet was also emerging, owing primarily to the success of the Web and the diffusion of Mosaic: a medium for consultation. The advertising banner: "Netguide is the TV guide to Cyberspace" is clearly indicative of this development.

Netiquette

As indicated above, the arrival of new internauts in the forums and, more particularly, on Usenet, often caused conflict due to inappropriate contributions. Yet the wish to formalise the rules of electronic communications had been expressed on the Internet early on. In 1985 two computer scientists who were thoroughly familiar with electronic mail wrote a report at the request of the National Science Foundation, on the ethics and etiquette of electronic mail. The question of etiquette seemed particularly important to them, "because certain standard social norms must be reinterpreted and extended to cover this quite novel medium"[60]. These ideas were very soon codified and rules of electronic savoir-vivre circulated on Usenet. General principles of any social interaction (identifying oneself, thinking of one's interlocutor, contributing new ideas, etc.) were found alongside rules pertaining to the written media (read before answering, don't answer in the grip of emotion, etc.) or to electronic media (choose the

[58] Michael Wolf, *Net guide.* Ramdom House, New York, 1994 p.1
[59] *Ibidem* p. 10
[60] Norman Shapiro and Robert Anderson, *Towards an Ethics and Etiquette for Electronic Mail*. Rand Corporation , Santa Monica (California) 1985 p. 4

right newsgroup, control the feeling of ubiquity, think that messages are archived, etc.) and, more precisely, to the format of messages (give a title, be brief, etc.)[61]. "Net etiquette" was to become netiquette for short. Articles dealing specifically with this question and intended for new users were published, primarily in electronic form. In a biblical tradition, some proposed "the ten commandments for computer ethics"[62].

This netiquette gradually became a code of chivalry that real internauts respected and got others to respect. As indicated in *Zen and the Art of the Internet*, "there are many traditions with Usenet, not the least of which is dubbed netiquette"[63]. Virginia Shea, who devoted a book to this question, tried to define the term: "Etymologically, it comes from the French word for 'ticket'. If you know the etiquette for a particular group or society, you have a ticket for entry into it". As she noted further on, the aim of her book was "to give you a 'ticket' to the cyberspace. 'Netiquette' is the etiquette of cyberspace"[64].

Ed Krol used another metaphor for Internet etiquette: "justice of the West". "When the West was young" he wrote, "there was a set of laws for the United States, but they were applied differently west of the Mississippi. Since the network is at the outposts of technology, the justice of the West also applies to it"[65]. For these new pioneers, there were two fundamental ethical principles, individualism and the protection of the network, that had to be linked. As soon as the practices of certain users disrupted the normal functioning of a part of the network, pressures of different intensities were exerted on them. Internauts thus practised self-discipline, for "if these problems, instead of finding a solution within the network community, flow over into the press or Congress, no one will stand to gain"[66].

To become an internaut it was therefore necessary to abide by the rules of savoir-vivre or certain linguistic forms[67] used by the oldest members of the community, academics

[61] One of the first presentations on paper of these rules are found in John Quarterman, *The Matrix.* Digital Press, 1990 pp. 34-37
[62] Arlene Rinaldi, *The Net. User Guidelines and Netiquette*, July 1992
http ://www.listserv.acsu.buffalo.edu/c...A2=ind9207&L=nettrain&F=&S=&P=1383
[63] B. Kehoe p. 43
[64] Virginia Shea, *Netiquette.* Albion Books, San Francisco, 1994 p. 19
[65] E. Krol p. 42
[66] *Ibidem* p. 45
[67] Smileys, symbols indicating the emotive weight of a word, are another way of showing one's familiarity with the Internet.

and researchers. One thus took a "ticket" to join the community or at least to develop practices similar to theirs. Netiquette was designed to promote harmonious debate, moderate controversy and the search for consensus and, on the other hand, to exclude violent debate, which was anathema (sending "flames"). This was a traditional code of conduct in the academic community, considered necessary for the functioning of invisible colleges. By proposing these rules as valid for any electronic social interaction, new internautes' identification with the academic model was reinforced. Netiquette was often mentioned in forums to call to order recalcitrant users and enhance the feeling of belonging to the Net. That is what made it different from other codes of conduct. It participated in the symbolic creation of the electronic community and as such was another element in the construction of the Internet myth.

Digerati and cyber-elite

Wired: the cyber magazine

Alongside introductory books to the Internet and the first articles in the general press, another type of literature appeared which developed a far broader *imaginaire* concerning the entire computing world. In January 1993, when the public at large was timidly starting to link up to the Net and information highways were at the centre of the political agenda, a new magazine was launched in San Francisco: *Wired*. Like their first sponsor, Nicholas Negroponte (director of MIT's Media Lab), the founders, Louis Rossetto (managing editor) and Jane Metcalfe (president), were persuaded that computer technologies were going to trigger a real revolution. Apart from the universal Internet that some were promoting, computing was infiltrating all human activities, professional and personal, intellectual and artistic alike. To the question asked in the editorial headed "Why *Wired*?", Rossetto answered: "because the Digital Revolution is whipping through our lives like a Bengali typhoon [...] and because the computer 'press' is too busy churning out the latest PCInfoComputingCorporateWorld iteration [...] to discuss the meaning or context of social changes so profound their only parallel is probably the discovery of fire [...] *Wired* is about the most powerful people on the planet today – the Digital Generation".

The tone was set: *Wired* was to be the standard-bearer of the new computer culture. As Metcalfe later said: "What we are really talking about is a fundamental shift in society that is being led by technology but is infiltrating every aspect of society [...] *Wired* is really about change. It's led by technology, absorbed by business, and spread by artists. But it's not about technology"[68]. This new magazine was not only the tribune for new ideas on the computer revolution, it also had a new layout that was a milestone in the history of press magazines. Articles were presented in the same way as advertisements, with slogans over photos or omnipresent graphic illustrations. Photos were often manipulated and represented anything from landscapes or people to printed circuits or computer terminals. The picture rarely had an illustrative function; it was in constant interaction with the text, sometimes even making it difficult to read. This layout was similar to that found shortly afterwards on web sites or CD-Roms. It was even judged sufficiently innovative to be exhibited in the San Francisco Museum of Modern Art. *Wired* was more like *Rolling Stone* than like an intellectual journal, and this resemblance was not only formal. It was also a standpoint deliberately adopted in the cultural field. *Newsweek*, which announced the launch of the magazine, noted that Rossetto's aim was to create the *Rolling Stone* of the computer generation[69]. Two years later Paul Keegan noted: "like *Rolling Stone* in the '60s, it has become the totem of a major cultural movement"[70].

One of the appealing aspects of the magazine related to the fact that Rossetto managed to gather around him a group of intellectuals and journalists who came to be known as the cyber-elite. Kelvin Kelly, former editor-in-chief of the *World Earth Review*, occupied the same position at *Wired*. Steward Brand, founder of the *World Earth Review* and of The Well was also on the editorial committee, as was Rheingold. Many editors were members of The Well.

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[68] Quoted by John Brockman, *Digerati. Encounters with the Cyber Elite.* Hardwired, San Francisco, 1996 p. 221
[69] John Schwartz, "Propeller Head Heaven. A technie Rolling Stone" *Newsweek*, January 18, 1993 p. 62
[70] Paul Keegan, "The Digerati! Wired magazine has triumphed by turning mild-mannered computer nerds into a super-desirable consumer niche" *New York Times Magazine*, May 21, 1995 p. 39

We also find journalists from other backgrounds, like Steven Levy, editorialist with *Newsweek*, Joshua Quittner, journalist with *Time*, John Markoff, correspondent for the *New York Times* in Silicon Valley and R.U. Sirius, editor-in-chief of the New Age magazine *Mondo 2000*. Two science fiction novelists, William Gibson – the first person to use the term "cyberspace", in his novel *Neuromancer* – and Bruce Sterling, also participated in the undertaking, as did creators using new technologies, such as Jaron Lanier and Brenda Laurel. Lastly, consultants, specialists in forecasting, like Esther Dyson and Paul Saffo, were also there. In fact forecasting had a place of honour in the magazine. For example, the fifth issue featured a long interview with Alvin Toffler whose thinking directly inspired Rossetto: "This is the mainstream culture of the 21st century. It's a new economy, a new counterculture and beyond politics. In 10 or 20 years, the world will be completely transformed. Everything we know will be different [...] I think Alvin Toffler's basically right: we're in a phase change of civilizations here"[71]. Rossetto's esteem for the futurologist seems to have been mutual, for Toffler commented: "I think the readers of *Wired* are a unique resource for the country"[72]. And indeed, as Paul Keegan noted: "the genius of *Wired* is that it makes the Digital Revolution a self-fulfilling prophecy, both illuminating this new sub-culture and promoting it – thus creating new demand for digital tools, digital toys, digital attitudes"[73].

Rosetto and Metcalfe had a lot of difficulty finding capital to launch their magazine. Many publishers thought the market was too limited. As one of them said: "if you get out of Silicon Valley there are not a lot of places where you find that psychographic group"[74]. But contrary to all expectations, *Wired* immediately had a vast readership: 110,000 digerati (digital generation) after one year in existence[75], 230,000 after two years[76] and 450,000 after four[77], that is, nearly half the readership of the first popularised technical magazines such as *PC World*. These readers were people with a passion for the Internet and other digital media. We find among them many

[71] Quoted by P. Keegan p. 39
[72] Kelvin Kelly, "Anticipatory Democracy", an interview with Alvin Toffler in *Wired,* July 1996
[73] Quoted by P. Keegan p. 40
[74] Quoted by J. Schwartz, p. 62
[75] Barbara Kantrowitz, "Happy Birthday: Still Wired at one" *Newsweek*, January 17, 1994 p. 38
[76] P. Keegan p. 39
[77] *San Francisco Chronicle*, May 8, 1998, p. A20

professionals of these new technologies: computer scientists, multimedia designers, artists, etc.[78]

Forecasting club and association to defend computer freedoms

The cyber-*imaginaire* appeared not only in the media but also in think-tanks. In 1988 Stewart Brand, along with futurologists who had worked for Shell and graduates from Stanford Research Institute, formed a forecaster's club which they called the Global Business Network (GBN). This institute sold services to firms and administrations. As one of its clients commented: "the network is a curious blend of scientists, musicians, artists, economists, anthropologists, and information technology gym rats who form a mosaic by which us capitalists can view our business environment and even our company"[79]. GBN was thus to act as an interface between the business world and heterodox future scenarios in which information technologies and ecology were to have prime importance. Apart from a small core of permanent members, the institute used a network of experts. It used The Well to organise a private teleconference between its experts and to host its presentation on what would later be called a web site. *Wired* developed close ties with GBN and the magazine's forecasts owe a lot to the institute. About ten members of GBN were on the magazine's editorial committee. Four of them were on the cover pages of the 17 first issues.

While GBN developed forecasting on the information society and provided a link with thinking in the business world, another, more political, line of thought was established with the Electronic Frontier Foundation. At the origin of this association lay an event that marked the computer specialist community. In 1990 the FBI launched an inquiry that implicated a large number of hackers suspected of pirating software. John Barlow, former hippie (lyric writer for Grateful Dead) and computer journalist, Mitchell Kapor, co-founder of the computer company Lotus (later sold), and John Gilmore, another hacker who had got rich from computing[80], decided to found an association to defend

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[78] The average reader was 37 years-old and has an income of US$122,000 (source: *San Francisco Weekly,* 1996)

[79] Dan Simpson, quoted by Joel Garreau, "Conspiracy of Hertics" *Wired,* November 1994, p. 157

[80] John Gilmore was one of the first employees of the computer company Sun Microsystem, and was paid mostly in stock options. A few years later he sold his shares and was able to live off the interest.

freedom in cyberspace. The Electronic Frontier Foundation (EFF) was "established to help civilize the electronic frontier; to make it truly useful and beneficial not just to a technical elite, but to everyone; and to do this in a way which is in keeping with our society's highest traditions of the free and open flow of information and communication"[81]. More precisely, it defended individual cases and its Washington office lobbied the government and Congress. Kapor, an habitué of The Well, naturally opened a conference on the foundation in the Californian BBS. The founders moreover considered The Well to be "the home of the Electronic Frontier Foundation"[82]. The EFF was also complementary to *Wired*. It provided the magazine with one of its main topics and *Wired*, in turn, constituted an excellent tribune for the association. Two of the three founders, half the board of directors and the legal adviser (Mike Godwin) wrote in the magazine. Jane Metcalfe was also elected to the board.

Thus The Well, the Global Business Network, the Electric Frontier Foundation and *Wired* all had a lot in common. By clicking on the name of one of the actors of these institutions, one often found oneself in another institution, in the hypertext of the cyber imagination. Referrals were constant as each institution supported the others. GBN contributed its forecasting and its contacts with big business, EFF its political project and struggle to defend the freedom of internautes, *Wired* its ability to format and adhere to the cyberpunk culture. Steward Brand, one of the main links between these institutions, summarized the relations of all these projects with the counter-culture when he noted: "one advantage of working with survivors of the '60s is, we've had an experience in creating utopias. We've had our noses rubbed in our fondest fantasies"[83].

The editors of *Wired* and members of the Electronic Frontier Foundation or of the Global Business Networks were not only, like the editors of popularised manuals, the agents of the diffusion of Internet. They saw themselves above all as an elite, as the avant garde of the information society. Different lists of the people who would count in the future information society were published in the press[84]. Journalist and literary

[81] Electronic Frontier Foundation, *Mission Statement* http://www.eff.org/EFFdocs/about_eff.html

[82] Bruce Sterling, *The Hacker Crackdown.* Bantam, New York, 1993 p. 238. On the history of the Electronic Frontier Foundation, see also H. Rheingold pp. 256-260

[83] Quoted by Joshua Quittner, "The Merry Pranksters Go to Washington" *Wired,* June 1994, p.140

[84] See, for example, "The Net 50". "They're supplying the vision, the tools and the content that are getting millions of people to turn on their modems", *Newsweek*, December 25, 1995, pp.42-46.

agent John Brockman published a digerati "Who's Who" in 1996. The forty or so people selected included computer scientists, entrepreneurs and intellectuals, among others (about ten editors of *Wired* were included). As Steward Brand said: "elites are idea and execution factories. Elites make things happen; they drive culture, civilization"[85].

Thus, this cyber-elite included many intellectuals and journalists. Although these specialists of discourse were not cut off from innovators, it was nevertheless they who, in the mid-1990s, produced the collective vision of the information society. The digerati's discourse contained the new forms of politics, economy and definition of the self that emerged with the digital revolution.

The digerati's ideology was finally spread by the mass media in 1995. The editorialist of *Time* noted that "most conventional computer systems are hierarchical and proprietary; they run on copyright software in a pyramid structure that gives dictatorial powers to the system operators to sit on top. The Internet, by contrast, is open (non proprietary) and rabidly democratic. No one owns it. No single organization controls it. It is run like a commune with 4.8 million fiercely independent members (called hosts). It crosses national boundaries and answers to no sovereign. It is literally lawless […] Stripped of the external trappings of wealth, power, beauty and social status, people tend to be judged in the cyberspace of Internet only by their ideas"[86]. *Newsweek* made 1995 Internet Year. It opened its year-end issue with the following phrase spread across four pages "this change … everything", and the editorial described the Internet as "the medium that will change the way we communicate, shop, publish and (so the cybersmut cops warned) be damned"[87].

Conclusion

These discourses impacted strongly on the future of the Internet. In fact they proposed a framework of interpretation and action for network computing and showed what could be done with the Internet and how. This frame was all the more powerful in so

[85] Quoted by J. Brockman, p. XXXI
[86] *Time* Special Issue, March 1995: 9
[87] *Newsweek*, Special double issue, 2 January 1996

far as it described communication practices that functioned in the academic and counter-culture worlds, and to which access could be organized. By becoming a new Internaut one not only became a user of network computing and of communication or information retrieval tools; one also entered into another social world where relations between individuals were equal and cooperative, and information was free.

This view is indeed somewhat strange, for society is not a cybercampus nor a cybercommune. Inequalities in skills (in the use of computing and the production of discourse), of a far greater dimension than in the academic world, have appeared. The principle of gratuity has faded with the need to finance certain resources through media-type means (subscriptions, advertising, etc.). But the initial model has nevertheless lasted. Forums for the public at large have been set up, information collated by universities is consulted by different users, and ordinary individuals create sites where they present information that is sometimes of great value. Thus, this model of communication is, in spite of all, a framework for interpretation and action that is only partly unsuited to the new reality of the Internet. During the 1990s it provided a range of uses and behaviours on the Internet.