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HISTORIES OF THE INTERNET AND THE WEB

"There are half a dozen books on the Internet in existence, written by people who were not there when it was developed. It is tempting to begin a piece of work on the subject by quoting the old adage: 'Everything you know is wrong!'" (Jacques Vallée, *Au Coeur d'Internet*, Balland, 2004, p. 20).

Just fifty years ago, in 1966, Charles Herzfeld released to the *Advanced Research Projects Agency* the funds which would allow the IPTO department (*Information Processing Techniques Office*) to launch the Arpanet project; twenty-five years ago, in 1991, the British computer scientist Tim Berners-Lee announced the invention of the Web on line in *Newsgroups* - the discussion forums of the Usenet community¹; twenty years ago, in 1996, Brewster Kahle founded *Internet Archive*, an organisation whose stated aim was to archive the World Wide Web... The history of the Internet is a recent one, focused on a permanently-moving object that is neither finished nor fixed². This history must also confront the living memories of those involved, and the way this innovation is viewed by contemporary society – for many people it is the embodiment of the “digital revolution” – as well as the more or less wide definitions of its limits.

So as not to discriminate between the different meanings and approaches to the Internet and its history, this anthology reports on a variety of historiographical trends and research work. Some of them limit their frame of reference to the network of networks and its protocol aspects. Others offer a broader analysis of digital cultures. The technical players, but also the visionaries of the early stages have pride of place, particularly in the sources gathered together in the first part of this *Living Book*. But the sources which follow also recognise the importance of economic, social and political factors, which means that this history is not dominated by an exclusively technical and “insider” approach. Indeed, the actors who have created the history of the Internet are not only those who designed its technical architecture and are celebrated in the *Internet Society's Internet Hall of Fame*, even if their role was a founding one (see the text by Leiner, Cerf et al.). Other contributors to this history are those who, through their eclectic, unconventional, politically aware and dedicated vision forged its imaginative worlds and cultures – people like John Perry Barlow and his resounding *Declaration of Independence of Cyberspace* in 1996. Some research, particularly the work carried out by Eric von Hippel³, has highlighted the idea that digital innovation and usage are the products of co-construction and cannot be understood from a purely top-down perspective. Users also play a role in this history. They are the “designers-users” who were active in its initial stages, followed by the early adopters who, in the 1990s, faced the arrival of neophytes on the networks they helped to develop (see the paper by Nicolas Auray).⁴

Finally, they are the people discovering the Web, creating their own personal pages ([article by Olivier Trédan](#)), consulting the directories ([paper by Tom Haigh](#)) and making specific digital cultures their own ([article by Jason Eppink](#)).

The third part is largely devoted to the history of the *World Wide Web*, and this of course converges with the history of the Internet. However, it does not totally merge with this history, either as regards its rhythm or its origins. The historiography of the Web and the methodologies and sources used to write about it are also different. It is of course possible to find common roots in the vision of the “founding fathers”, particularly the vision expressed in the idea of libraries of the future or the [Memex of Vannevar Bush](#). But it is necessary to take account of the time lapse (the Web was invented in the late 1980s) and of notable differences in the profiles of innovators, entrepreneurs and users (from the “designer-user” in the early stages of the Arpanet project to the general public which enthusiastically embraced the Web in the 1990s).

Through a selection of sources and research papers, which implies choices and leaves in the shade certain aspects that we would also have wished to highlight (history of national research networks, spams, FAI, etc.), this anthology provides a glimpse of the variety of actors, trajectories, approaches, methodologies and writings which form the histories of the Internet and Web. It is organised into three parts which tend to reflect a chronological progression: from Arpanet to the Internet, then from the Internet of its early adopters to the interest shown in it by the political class leading to the first stages of wider governance, and finally from the Web to its democratisation within the general public in the early 2000s. It reflects the dynamism of a historiography “under construction”, inspired by approaches that can draw on the history of techniques, innovation and the media, on Science and Technology Studies, information and communication sciences, digital humanities, archaeology of the media and on Internet and Code Studies.

Questions about the History of the Internet and Web

- **Why be interested in the question?**

Why should we be interested in Internet history? The answer is for at least three reasons. First, in order to understand the digital world as it is at present – to get behind the scenes and origins of a network of networks which has become ever more complex and, within just a few decades, seeped into every area of our daily lives, both personal and professional, reframing our cultures and modes of communication. It has created or given fresh impetus to commercial and media giants and challenged our societies with ethical, legal, political, economic and diplomatic questions. Secondly, to rediscover the values and imagination which were at the origins of network communication, the women and men who, behind the techniques and equipment, made these innovations possible, and thus gain a clearer notion of the trajectories which led to the practices we take for granted today. And finally, to examine the “Americanness” of a major innovation, which largely originated in the United States and is both a product and cause of American power, now controlled by the giants of the Web, who are mainly American.

The history of the network of networks was long presented as the result of a military project

originating in the United States, but the reality turns out to be much more complex, both as regards its origins and its development. This history cannot be written exclusively from the North-American angle, nor is it linear. It is not the product of a few minds which are thought to have implemented a stable, well-defined project. Rather, it is a meeting of aspirations, influences, researchers and engineers, entrepreneurs, producers and users who, in the space of a few decades, seized upon an innovation that was open, flexible and malleable and then made it their own, sharing it, shaping it, and sometimes diverting it.

- **Debates and controversies**

These kinds of actors are naturally not without controversy in the short history of the Internet. Paternity battles rage, particularly around the invention of email. Evidence of this can be seen in the passionate debates surrounding Shiva Ayyadurai's claims to be presented as the inventor of email. These aspirations have received firm replies from historians, backed up by sources, asserting that there is not one single inventor. They have put forward numerous strands of evidence, including in particular the crucial ones presented by Ray Tomlinson. But, on the whole, it is the origin of the project which has become a source of debate. This was the case during Barack Obama's second campaign for re-election to the presidency. In the summer of 2012, an article by Gordon Crovitz in the *Wall Street Journal* entitled *Who really invented the Internet?* created a polemic, because it attributed the Internet's success to the firm Xerox. The author was thereby minimising the place of government and of public funding in the development of the network of networks, but at the same time playing down the role of the Arpanet project and even of scientists. Another sign of the new attention being given to digital media and their uses was a 2006 article in *Time* paying homage to Internet users: its title was *"You – Yes, You – Are TIME's Person of the Year"*. It noted that *"In 2006, the World Wide Web became a tool for bringing together the small contributions of millions of people and making them matter"*, insisting on a model of bottom-up co-construction and innovation which cannot fail to interest historians.

The historiographical debates revolve around the Internet's historic actors and their respective roles, as well as the contributions made by the military (see [Janet Abbate's article](#)), the [1970s counter-culture](#), free software and the open culture which characterises the Internet and the Web (paper by [Christopher Kelty](#)). They also touch on the place of [business people and commercial practices](#) in a network of networks which at its outset escaped the demands of the market, and on decentralisation and the division of power within the network, all of which reveal [geopolitical](#) tensions. These historical problems have direct repercussions on contemporary issues, such as the neutrality of the Internet, questions of transparency or privacy (see [Sandra Braman's article](#)), the responsibility of intermediaries for the content they convey and/or host, or indeed the governance of the Internet.

The Sources of the Internet

The emergence of the Arpanet in the second half of the 1960s, then the Internet ten years later was the result of a lengthy and particularly complex innovation process, marked by the intertwining of different socio-technical traditions and heterogeneous networks of actors, all

with separate histories. To search for a unique point of origin for such an innovation is therefore doomed to failure. One needs from the outset to include a multiplicity of origins and factors which, in the precise context of the American mid-1960s were to converge and crystallise into this unprecedented data processing network. In the foreground is the long history of communication techniques, marked by the triple search for speed, efficiency and precision in information transmission. But we also need to bear in mind the longing for hypertext knowledge, the resonance of cybernetics, the innovation of time-sharing in data processing, the context of the Cold War, the rise of hippy counter-culture, the new management styles in American scientific research, and so forth. It is impossible here to develop each of these histories; they are all part of the emergence of Arpanet and explain its subsequent development⁵.

- **Cybernetics, “incrementation”, time-sharing...: the precursors of the Internet**

In any long-or medium-term observation, Arpanet should also be set in context with regard to the history of tools, systems and scientific information networks. From Father Marin Mersenne’s correspondence network between European scholars in the 17th century to Paul Otlet’s International Network for Universal Documentation or Vannevar Bush’s hypertext system, [the famous Memex](#), to the communication network for researchers known as Arpanet we can trace a historic lineage that is very long and takes many forms. It reappears in 1960s America with the posing of a general set of problems encompassing research on hypertexts, group messaging services, human-machine interfaces, information sharing, online communities, and so on. What is the common denominator of these different themes, expressed in the writings of researchers like Paul Otlet, Vannevar Bush, [Douglas Engelbart](#), [Joseph Licklider](#), [Ted Nelson](#), Robert Fano and many others? It can be summarised by the notion of “quest for efficiency” in the research, production and dissemination of scientific and technical information: how to improve information tools, how to “augment” (according to Engelbart’s expression) human intellectual capacity, how to use these new machines called computers for producing, processing and transmitting information, how to achieve a better sharing of research work, etc. This quest for efficiency was one of the mainsprings of Arpanet, which was essentially a network *avant la lettre* for communicating, sharing and collaborating to reap the benefits of group intelligence between researchers. But Arpanet was just a step on the way to solving this set of problems, which would be more fully developed in 1989 with the invention of the [World Wide Web by Tim Berners-Lee](#), who explicitly made reference to Bush and to the pioneers of hypertext.

Although today the histories of the Internet and Web give rise to often stormy controversies and arguments, and although they are apprehended through a variety of sources, approaches and methodologies, a narrative framework is nevertheless starting to be commonly recognised. This generally has its source in the 1950s, going back to cybernetics and time-sharing.

There are numerous signs confirming the importance of cybernetics and information theory in the origins of Arpanet. Not only did Wiener’s cybernetics constitute the new research paradigm for most of the researchers who inspired the Arpanet (beginning with Licklider), but it was also a powerful social framework. Indeed, it enabled laboratories, teams and networks of researchers to be created and structured, working together from the 1950s onwards,

notably at MIT⁶. Nor should we forget its ideological aspect, which was a real matrix for the “utopia of communication” as Philippe Breton has shown⁷. In short, the Arpanet, and after it the Internet can simply not be understood without taking into account the influence of Wiener’s cybernetics⁸.

Although the place of cybernetics in the history of the Internet is well known, the role of technical innovation in computer operating systems is much less so. It is, however, just as essential, because without the invention of time-sharing, developed by the young John McCarthy⁹ in the second half of the 1950s, it would in all probability not have been technically possible for Arpanet to see the light of day. Time-sharing contrasted with the then dominant model of batch processing, i.e. the model of “heavy” information processing, bound by calculation and entirely in the hands of computer scientists and builders. It was the technical expression of another view of the computer, designed as a machine for communicating, a technology of intelligence and a tool for aiding decision-making. Inspired by cybernetics and intersecting with hypertext projects, the movement around time-sharing made a strong contribution in the early 1950s to the emergence of “interactive computing”, and the psychologist Joseph Licklider would be one of its most brilliant representatives. If we look at the period from the 1950s to the late 1960s, Arpanet appears both as the outcome of this particular research movement and the starting point of a new computer science, that of the networked computer – an outcome, because the network was developed as an explicit extension of the many time-sharing projects burgeoning in different American universities in the early 1960s (notably at MIT with the MAC Project). It was partly built by the same researchers and, most importantly, for the same purposes, namely simultaneous computer access by several users and the sharing of resources. There are direct, close and multiple links between the time-sharing of the pivotal 50s-60s period and Arpanet, which may be considered as one of the jewels in the crown of this model of interactive computing. Interactive computing then left the MIT laboratories in the late 1950s, with time-sharing; it journeyed via Engelbart’s research on interfaces at Stanford and the invention of the mouse, but also via work on graphics systems; then, following the creation of Arpanet, it continued its progress both through the development of the personal computer and the appropriation of networks by users, before finally exploding upon the general public with the Web.

- **Towards a proliferation of computer networks**

Although the Arpanet project was certainly funded by the ARPA (*Advanced Research Project Agency*), a military agency, it was not set up in order to “resist a nuclear war”. Robert Taylor, the then director of the IPTO (*Information Processing Technology Office*, operating inside the ARPA) launched the idea of a network in February 1966, primarily to improve long-distance communication with the thirty or so MIT computer science researchers who had contracts with the ARPA (the “ARPA’s Contractors”) and above all to encourage these to share their computer resources, which at the time were very costly. In April 1967, the young Larry Roberts, recruited to see this project through to a successful conclusion, announced to the researchers rather undiplomatically: “We are going to build a network and you are going to participate in it. And you are going to connect it to your machines. By virtue of that we are going to reduce our computing demands on the office”¹⁰. There was no sign of military motives at the start of the Arpanet project, as is confirmed by the pioneers themselves (see the paper by Leiner, Cerf et al.). The Arpanet was built by the firm Bolt, Beranek and Newman, one of the most innovative high-

technology companies of the time; they would make some of the equipment as well as providing the technical specifications needed for the network. Arpanet saw the light of day in autumn 1969, through the progressive connecting-up of four nodes in the first four universities chosen by the ARPA/IPTO: UCLA (the University of California in Los Angeles), the SRI (Stanford Research Institute) at Stanford, UCSB (the University of California in Santa Barbara) and the University of Utah.

With its four functioning nodes, Arpanet began to operate in December 1969, breaking with previous architectures, especially those developed by computer industrialists. Whereas these latter were mainly centralised and proprietary, only able to run machines and equipment made by the same builder, Arpanet was on the side of openness. It thus enabled computers made by different builders to communicate by means of a sub-network composed of IMPs (*Interface Message Processors*). It also made the innovative choice of packet switching. This technique consists of cutting the messages into packets of data in order to circulate them more easily and efficiently within the network.

This choice of packet transmission would also be one of the technical foundations of the Internet. Paul Baran, Leonard Kleinrock and the British Donald Davies had each separately developed the initial idea for this in the early 1960s, in the context of the Cold War crisis. Paul Baran, an American engineer, was then working for a well-known American security agency, the *Rand Corporation*, and between 1962 and 1965 he made a proposal to the Pentagon for a distributed military network project, which never saw the light of day (Baran himself abandoned the project in 1965)¹¹. Later, this project would become confused with Arpanet, thus creating the rumour which is still very widespread on the web, about the Internet's military origins¹². In reality, the only common feature between the Arpanet project and that of Paul Baran was packet transmission and the distributed nature of the network. In fact, in 1961-62, Leonard Kleinrock, the second inventor of packet transmission, developed a vision similar to that of Paul Baran (without being aware of the latter's work) but for civil purposes linked to time-sharing. It is noteworthy that Kleinrock was one of Arpanet's major players at UCLA, whereas Baran never directly took part in the project.

In Europe, these approaches were also undergoing research and experimentation, notably at the *National Physical Laboratory* in the United Kingdom (with Donald Davies) and in France, with Louis Pouzin at the Institut de recherche en informatique et automatique [Institute for Research in Computer Science and Automation] (see the article by François Fluckiger). The Cyclades network¹³, for which Louis Pouzin was the project manager, was to have repercussions well beyond the few years of its existence (1971-1979). In 1974, the Americans Vinton Cerf and Robert Kahn integrated several of Pouzin's ideas into what would become TCP/IP (*Transmission Control Protocol/Internet Protocol*). This protocol meant that not only was it possible to interconnect machines made by different builders and make them interact with one another, but it was also now possible to interconnect different networks. This made Internet "the network of networks", two years after the first public demonstration of Arpanet in 1972.

Indeed, computer networks, based on packet transmission, proliferated during the 1970s: AlohaNet at the University of Hawaii, TELENET - a commercial network launched by BBN, PRNet (Packet Radio Net) - a radio network funded by ARPA, CYCLADES, USENET, BITNET, CSFNet, and so on. The major issue of the 1970s was "inter-networking", i.e. the interconnection of heterogeneous networks, which was to give its name to... the Internet.

Operational on a few networks in the late 1970s, the TCP/IP protocol became the standard for Pentagon networks and was installed on Arpanet on 1st January 1983, giving a real kick-start to its dissemination. Also in 1983, Arpanet was split up into two parts: one branch, MILNET, was strictly military, while Arpanet became a purely civil network, used by the academic and scientific community. The latter found that applications such as electronic mail and file transfer, as well as computational power-sharing, provided answers to its needs. The *National Science Foundation*, through its network NSFNet, supported the movement in favour of TCP/IP, which it adopted in 1985. At the same time, the Internet was also growing due to the development of local business networks and the use of network communications instigated, for example, on Usenet (a network developed in 1979 by students in North Carolina).

- **All roads did not lead to the Internet: some alternative routes**

The Internet is built on open organisation, based in particular on the *Request for Comments* which embodies the distributed and egalitarian aspect of the debates. But the sources and research papers selected for the first and second parts of this history also reveal tensions and arguments, and show that other networks and technical solutions might have been presented as credible alternatives.

The testimony of Alexander McKenzie draws our attention to the power struggles being played out within the *International Network Working Group*, formed in 1972 at the time of Arpanet's first public demonstration. One can clearly see the power games developing. *Andrew Russell's* paper and the one by *Martin Campbell-Kelly and Daniel Garcia-Swartz* deal explicitly with the struggles within the networks, technical cultures and areas of innovation. These found particular expression in the 1980s and early 1990s confrontation between Internet and OSI supporters¹⁴. The *Open Systems Interconnection* had a seven-layered architecture and was developed within the ISO (*International Organization for Standardization*). This organization wanted to adopt a more ecumenical approach and have a broad exchange of views within the traditional standardisation bodies. Also of note here is the conflict between the computer science world and the world of telecommunications in their attitudes to packet switching. The telecommunications world, which in many countries held the communication infrastructures, was reticent with regard to TCP/IP technology, as indeed it was towards the French network, Cyclades, with its datagrams approach. It preferred its own solutions, namely virtual circuits and the X.25 protocol, which was adopted in 1976¹⁵.

This tension between the worlds of computer science and telecommunications ran from the 1970s until the 1990. However, it was only one of the elements explaining the presence and development of several networks (see the article by *François Fluckiger*). We also need to take account of national frontiers, which led to developments that were not always compatible. The British, for example, made very specific protocol choices in their research network Janet. These different networks were often impermeable to one another, and in the early 1990s they formed a real mosaic, particularly in Europe. Nevertheless, in the 1980s and 1990s they had a common target, which was the academic and scientific community.

But the growth of the networks was not only technical; it was also social and cultural. Over the course of the 1980s, personal computer equipment was developed, while in France the

Minitel became widely used, blazing a trail in the use of online services (but based on telematics). *The Well* community, communication within Usenet, and also commercial services like *The Source* or *Prodigy*, created in 1984 and 1985 respectively, were spaces where discussion groups and/or the first online services flourished.

- **The era of the Web and of its massive expansion**

The truly massive growth in the use of networks and of the Internet in particular occurred over the course of the 1990s and the early 2000s thanks to the development of the *World Wide Web*. Several visionaries like Vannevar Bush with [the Memex](#) or [Ted Nelson with Xanadu](#) opened up the way for hypertext, one of the foundations of the system developed by British computer scientist [Tim Berners-Lee](#) at the European Organization for Nuclear Research (CERN) at the turn of the 1980s to 1990s decade. Its technical specifications were made freely and openly available and this ensured its wide dissemination. Mosaic, one of the very first graphical navigators, was co-designed by [Marc Andreessen](#) of the University of Illinois in 1993, and this too helped popularise the Internet and Web. It was followed by Netscape (1994), to which Marc Andreessen, now installed in Silicon Valley, also contributed, and then by Internet Explorer (1995).

Along with the Web, and after an initial tendency to privatise infrastructures, which Janet Abbate¹⁶ has analysed in detail, the Internet also became the object of commercial and political attention. While in the United States, [following the example of Al Gore](#), and then in Europe, optimistic speeches about information superhighways and the information society were escalating, the Internet and the Web could no longer remain free from commercial cravings. In 1995, when Microsoft launched MSN and Windows 95 and the war of the navigators was beginning, several future Web giants like Amazon, eBay and Yahoo! set out to conquer the Web. It took less than a decade for the services now most frequently consulted on the Web to emerge: Google in 1997, Wikipedia in 2001 and Facebook in 2004, just at the time when [Tim O'Reilly was popularising the expression Web 2.0](#).

It was the end of [the "independence of Cyberspace"](#) which [John Perry Barlow](#) had proclaimed in his 1996 declaration. The tensions were palpable between the non-commercial roots of the Internet, tending towards openness, distribution and peer-to-peer contact, and the development of "vertical" systems that were more asymmetric, the domain of *Pure Players* whose success was sometimes unequivocally brazen. Tax evasion, patent wars, surveillance, "Balkanisation" of the Web and Internet created by GAFAM¹⁷, along with demands for the right to be forgotten, a more balanced governance of the Internet and preservation of its neutrality – all these figure among the current concerns and debates which are decisive for the future.

Texts, actors and seminal moments

Who invented the Internet? Who holds the keys to the Internet? What sources, which actors should be given prominence in order to write a history of the Internet and Web that does full justice to its labyrinthine origins, trajectories, twists and turns, evolutions and continuities?

- **Texts by the founders and founding texts**

Fifteen or so sources are highlighted here, representing so many landmarks in an adventure which is technical, economic, political and social all at the same time.

These texts are often considered to be seminal ones, having served as reference points and inspiration, both in their time and well beyond, for those involved in the development of these new technologies. Regularly referred to, they have passed into posterity and become part of the heritage. The most influential ones are those dating from the period before the 1980s, which are imbued with cybernetics and the visions of the future expressed by Norbert Wiener, Vannevar Bush, Douglas Engelbart and Ted Nelson.

These “major texts” are matched by others that are more rooted in their time. In their own way, they are also visionary, but more pragmatic and part of their context, like those of [Al Gore](#). His views on information superhighways would cross the Atlantic to be exemplified in Europe in the writings of Martin Bangeman or Gérard Théry in strategic and guidance reports.

These accompanying texts were not only produced by political actors, or at least not those involved in state politics. Twenty years ago, in his Declaration of the Independence of Cyberspace, John Perry Barlow expressed a vision of the Internet which won over many of those involved in the early stages of network communication – it was the vision of a new frontier and area of freedom. This new, pioneering spearhead of creativity was the vehicle for the imaginary worlds, utopias and values that [Michael and Ronda Hauben described in *Netizens*](#) written during the same period, when the Web was already changing the habits and publics of the Internet. And the expression “Web 2.0” was invented by [Tim O’Reilly](#), who had that instinct for a slogan that was characteristic of a number of contemporary digital players. Like other expressions, for example those proclaimed by Chris Anderson in *Wired*, it gained great popularity and stimulated polemic and controversy.

Visions of the founding fathers; political, economic, scientific or societal visions of the linkmen, mediators and digital players... This necessarily incomplete panorama would be still less complete if it did not also make a place for memory and for the technical signs of development in the network of networks and the Web. The writings of John McCarthy, Tim Berners-Lee and Marc Andreessen, and the [Requests for comments](#) which form the technical memory of the negotiations played out within the “republic of engineers” are also essential reference points.

These polyphonic sources set the tone for a history of the Internet and Web which, on the research side too, is written in several voices.

- **A historiography experiencing full expansion and renewal**

The research papers in this *Living Book* have been chosen because they are freely accessible. Furthermore, a certain number of research papers that are undeniably pioneering and significant have been excluded from this work. The choices, however, have not been made by

default. They were also guided by the wish to bring together a variety of authors from among the most recent as well as from the earliest history of the Web and Internet (one thinks in particular of the 1999 article by Patrice Flichy, whose book *L'Imaginaire d'Internet*, like Janet Abbate's *Inventing the Internet*, remains essential reading). The works chosen deal with different geographical areas, the intention being to show that research into the history of the Web and Internet is now thriving in Europe too. We do not doubt that our readers will have other texts to recommend which will enrich this *Living Book*.

Several points emerge from our choices, which seem to reflect some major trends in current historiography:

As was noted by William Dutton, Tom Haigh and Andrew Russell in the introduction to their special issue, "Histories of the Internet" in the journal *Information and Culture*: "*The Internet which is invented in Abbate's book, and the other works mentioned, is the Internet as understood circa 1994, not the incomparably broader Internet of 2014. Bridging this gulf is not simply a matter of extending Abbate's story further in time, to encompass later episodes such as the browser wars of the mid-1990s or the rise of smartphones, tablets, and social media*"¹⁸. When Janet Abbate analysed the Internet at the turn of the decade 1990s/2000, her attention was focused on the construction of the network of networks, as well as on the way in which Arpanet gave way to the Internet and the tendencies at work in the progressive march towards privatisation. At the same time, Patrice Flichy closely examined virtual communities and the values uniting the early stages of *Netizens*, described by Michael and Ronda Hauben and Howard Rheingold in *Virtual Communities*. Fifteen years later, topics such as spams, analysed in the work of Finn Brunton, or GIFs and memes, to which the *Journal of Visual Culture* devoted a special report, show that objects of digital culture which sometimes take the most trivial forms can become productive research subjects. These approaches were inspired by the influences of media archaeology, visual studies and also STS, stimulating analysis of recurring forms and the interweaving of human and technical intentionality.

From first focusing on the Internet's initial stages in the United States, the history of networks then became wider. Research findings reintroduced a variety of actors, many of them European, into the non-linear course of this history. This research highlighted the geopolitical and sociotechnical issues that were expressed in the choice of protocols (see the article by [Andrew Russell](#)) and in the debates about governance of the "network of networks" ([paper by Milton Mueller](#)). The attention given to a history of networks which widens the focus, so as not to concentrate exclusively on the United States or the Internet, has also allowed other innovations and experiments to be reintroduced, like that of the Minitel¹⁹, thus avoiding a teleological approach.

The texts were selected to reflect a variety of problems and scales. Digital forms of a vernacular Internet, sometimes "hand-made", have been examined by Jason Eppink; these are counterbalanced by wider portrayals, such as the one outlined by François Fluckiger. His close analysis of the events he followed is complemented by a reading from the point of view of current – or future – controversies and concerns by [Sandra Braman around the notion of privacy](#). Andrew Russell dissects the controversy of the 1980s and 1990s which set the partisans of *Open Systems Interconnection* against those who favoured TCP/IP. [Alex McKenzie's](#) account also describes the confrontation between projects which were technical but also political. In 1999, [Milton Mueller](#) highlighted the governance issues around the attribution and management of domain names. [Tom Haigh reveals the early stages](#) in the euphoric

period of the Internet bubble when he deals with the birth of directories and the large groups investing in the search for information on the Web; this is matched by an examination of the very diverse roots of digital values, imaginations and cultures. Both Christopher Kelty and Dominique Cardon, in the preface to the work which Fred Turner devoted to Steward Brand, highlight the libertarian and still open roots of an Internet whose complexity of origins has continued to provoke analysis. [Martin Campbell-Kelly and Daniel Garcia-Swartz give a broad overview of these origins](#) and of the interweaving of several possible readings of the birth of the Internet. These readings are particularly indebted to the work of [Janet Abbate on the development of packet switching at the time of the Cold War](#) and to [Patrice Flichy's study of the role of the academic world](#), as well as to research on the influence of the counter-culture and of digital cultures developed within other networks such as The Well, the BBS, Bitnet, the Minitel exchanges, and so on. It is no longer a history but histories of the Internet which are emerging, as is stressed by Tom Haigh, William Dutton and Andrew Russell²⁰; these histories sometimes focus their attention on the communities which, from Arpanet to Internet, created a culture of communication and decisive standardisation, and sometimes on the different groups which latched on to the Internet (academics, industrialists, business people, linkmen, users, etc.).

Users are discussed in the first two sections of this history, but these are largely self-referential users. They use the network... to talk about the network and work on its development. But before long *Netizens* appeared and caused original forms of communication mediated by computers to emerge, either within Usenet forums or in more specific communities. More ordinary users are profiled in the third section, at the moment of the Web's turning point. Described by Paul Ceruzzi²¹ as the missing link in the Internet's success, the Web is also indebted to the [success of the graphical web browser Mosaic](#); this gave a more user-friendly aspect to the uses imagined by the British computer scientist Tim Berners-Lee. The *World Wide Web* marked a switch towards democratisation of the Internet and of its usage (messaging services, forums, Web navigation, file transfer, and so on). GIFs, personal pages developed in Geocities or Mygale in France... the [articles by Jason Eppink and Olivier Trédan](#) testify to the interest of case studies and approaches made through specific subjects and milieus. They enable us to grasp the abundant activity just starting up on the Web. The emerging digital cultures, marked by the heritage that has gone before, also set "oldies" against "newbies", those neophytes who, in the second half of the 1990s, invaded the spaces which until then had been the sole province of restricted circles. What in the United States was dubbed *Eternal September*, in reference to the arrival in 1993 of students on AOL and the Internet – not without arousing mistrust and a few hardening of attitudes in the communities of origin – is [captured by Nicolas Auray](#). He also introduces an astute reading of the political, legal and governance issues which were beginning to trouble the early French communities confronted by network usage. These tensions between generations of users, these questionings are to be found in the Usenet forums (notably maintained by Google), but also within the Web archives. In 2016 the Internet Archive foundation created by Brewster Kahle celebrated its twentieth anniversary. The Web archives, as new sources now opening up to the Web historian, raise methodological and epistemological questions (see the [article by Niels Brügger](#)) and invite us to reflect on what history offers to the understanding of the Internet and Web, but also on what the Internet and Web do to the writing of history.

Selected resources for wider reading

Articles, books and theses:

- Abbate, Janet: *Inventing the Internet*, Cambridge MA 1999.
- Ankerson, Megan: *Historicizing Web Design: Software, Style, and the Look of the Web*, in: Staiger, Janet; Hake, Sabine (Hg.): *Convergence Media History*, New York, London 2009, S. 192–203. Online: www.academia.edu, <https://www.academia.edu/1564716/Historicizing_Web_Design_Software_Style_and_the_Look_of_the_Web>, Stand: 01.12.2016.
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- Dulong de Rosnay, Mélanie; Musiani, Francesca: *The preservation of digital heritage. Epistemological and legal reflections*, in: *ESSACHESS – Journal for Communication Studies* 5 (2(10)), 22.12.2012, S. 81–94. Online: www.essachess.com, <<http://www.essachess.com/index.php/jcs/article/view/169>>, Stand: 02.12.2016.
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- Guédon, Jean-Claude: *La force de l'intelligence distribuée*, in: *La Recherche* 328, 2000, S. 16–22.
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- Merzeau, Louise: *Faire mémoire des traces numériques. E-dossier de l'audiovisuel : sciences humaines et sociales et patrimoine numérique*, Ina, 2012, <<http://www.ina-expert.com/e-dossier-de-l-audiovisuel-sciences-humaines-et-sociales-et-patrimoine-numerique/faire-memoire-des-traces-numeriques.htm>>, Stand: 02.12.2016.
- Mussou, Claude: *Et le Web devint archive. Enjeux et défis*, in: *Le Temps des médias* (19), 27.11.2012, S. 259–266.
- Paloque-Berges, Camille: *L'imaginaire du « grand public » au tournant du Web (1993-1997)*, in: *Revue française des sciences de l'information et de la communication* (7), 01.07.2015. Online: rfsic.revues.org, <<https://dx.doi.org/10.4000/rfsic.1478>>, Stand: 02.12.2016.
- Rebillard, Franck: *La genèse de l'offre commerciale grand public en France (1995-1996). Entre fourniture d'accès à l'Internet et services en ligne « propriétaires »*, in: *Le Temps des médias* (18), 29.06.2012, S. 65–75.
- Salter, Anastasia; Murray, John: *Flash. Building the interactive web*, Cambridge MA 2014.
- Schafer, Valérie: *Des réseaux et des hommes. Les réseaux à commutation de paquets : un enjeu pour le monde des télécommunications et de l'informatique françaises (des années 1960 au début des années 1980)*, Doctoral thesis in Contemporary History, Université de Paris 4, 2007.

Schafer, Valérie: *Des réseaux et des hommes. Les réseaux à communications de paquets : un enjeu pour le monde des télécommunications et de l'informatique françaises (des années 1960 au début des années 1980)*, 2007. Online: www.theses.fr, <<http://www.theses.fr/2007PA040161>>, Stand: 21.04.2017.
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Serres, Alexandre: Aux sources d'Internet: L'émergence d'ARPANET, PHD Thesis, Université Rennes 2, 2000. Online: tel.archives-ouvertes.fr, <<https://tel.archives-ouvertes.fr/tel-00312005/document>>, Stand: 02.12.2016.

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Websites and electronic resources:

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¹ Usenet is an American network developed in North Carolina in the late 1970s. It served as a medium for the first discussion forums.

² Feenberg, Andrew; Friesen, Norm (Hg.): (Re)Inventing The Internet : Critical Case Studies, Rotterdam 2012, S. 9.

³ Hippel, Eric von: *Democratizing innovation*, Cambridge MA 2006.

⁴ See also Paloque-Berges, Camille: L'imaginaire du « grand public » au tournant du Web (1993-1997), in: *Revue française des sciences de l'information et de la communication* (7), 01.07.2015. Online: rfsic.revues.org, <<http://www.dx.doi.org/10.4000/rfsic.1478>>, Stand: 24.07.2016.

⁵ Serres, Alexandre: Aux sources d'Internet. L'émergence d'ARPANET, Thèse de Doctorat, Université Rennes 2, 2000. Online: tel.archives-ouvertes.fr, <<https://tel.archives-ouvertes.fr/tel-00312005/document>>, Stand: 24.03.2017.

⁶ Massachusetts Institute of Technology.

⁷ Breton, Philippe: *L'utopie de la communication. Le mythe du «village planétaire»*, Paris 1992.

⁸ See in particular Wiener, Norbert: *Cybernétique et société. L'usage humain des êtres humains*, Paris 2014 (Points Seuil Sciences). And Wiener, Norbert: *La cybernétique. Information et régulation dans le vivant et la machine*, Paris 2014 (Sources du savoir).

⁹ John McCarthy would become famous mainly for being one of the founding fathers of Artificial Intelligence, together with Marvin Minsky.

¹⁰ Norberg, Arthur L.: Oral history interview with Lawrence G. Roberts, in: Charles Babbage Institute, Center for the History of Information Processing, University of Minnesota, 04.04.1989. Online: conservancy.umn.edu, <<http://conservancy.umn.edu/handle/11299/107608>>, Stand: 21.04.2017. Audio tape and transcript, p. 8.

¹¹ On the detailed history of Paul Baran's project, see in particular Hafner, Katie; Lyon, Matthew: *Les sorciers du Net. Les origines de l'internet*, Paris 1999.

- ¹² Ceruzzi, Paul E.: Aux origines américaines de l'Internet : projets militaires, intérêts commerciaux, désirs de communauté, in: *Le Temps des médias* (18), 29.06.2012, S. 15–28. Online: Cairn.info, <http://www.cairn.info/resume.php?ID_ARTICLE=TDM_018_0015>, Stand: 21.04.2017.
- ¹³ Schafer, Valérie: *Des réseaux et des hommes. Les réseaux à communications de paquets : un enjeu pour le monde des télécommunications et de l'informatique françaises (des années 1960 au début des années 1980)*, Thèse de Doctorat en Histoire contemporaine, Université de Paris 4, 2007. Online: www.theses.fr, <<http://www.theses.fr/2007PA040161>>, Stand: 21.04.2017.
- ¹⁴ See also Guédon, Jean-Claude: *La force de l'intelligence distribuée*, in: *La Recherche* 328, 2000, S. 16–22.
- ¹⁵ The datagrams method consists in circulating packets of the same message by different routes within the network, before reassembling them to re-form the message when they reach their destination. Virtual circuits represent another option in packet switching: the packets of data follow one another along the same path. Schafer, Valérie: *La France en réseaux. 1: La rencontre des télécommunications et de l'informatique (1960-1980)*, Paris 2012.
- ¹⁶ Abbate, Janet: *Privatizing the Internet. Competing Visions and Chaotic Events, 1987–1995*, in: *IEEE Ann. Hist. Comput.* 32 (1), 01.2010, S. 10–22. Online: ACM Digital Library, <<http://dx.doi.org/10.1109/MAHC.2010.24>>, Stand: 21.04.2017.
- ¹⁷ The group of Web giants: Google, Apple, Facebook, Amazon and Microsoft.
- ¹⁸ Haigh, Thomas; Russell, Andrew L.; Dutton, William H.: *Histories of the Internet: Introducing the Special Issue of Information and Culture*, SSRN Scholarly Paper ID 2517598, Social Science Research Network, Rochester, NY 31.10.2014. Online: <<http://www.tomandmaria.com/Tom/Writing/HistoriesOfTheInternetDRAFT.pdf>>, Stand: 21.04.2017.
- ¹⁹ Schafer, Valérie; Thierry, Benjamin G.: *Le minitel. L'enfance numérique de la France*, Paris 2012.
- ²⁰ Haigh, Thomas; Russell, Andrew L.; Dutton, William H.: *Histories of the Internet: Introducing the Special Issue of Information and Culture*, SSRN Scholarly Paper ID 2517598, Social Science Research Network, Rochester, NY 31.10.2014. Online: <<http://www.tomandmaria.com/Tom/Writing/HistoriesOfTheInternetDRAFT.pdf>>, Stand: 21.04.2017.
- ²¹ Ceruzzi, Paul E.: Aux origines américaines de l'Internet : projets militaires, intérêts commerciaux, désirs de communauté, in: *Le Temps des médias* (18), 29.06.2012, S. 15–28. Online: Cairn.info, <http://www.cairn.info/resume.php?ID_ARTICLE=TDM_018_0015>, Stand: 21.04.2017.