

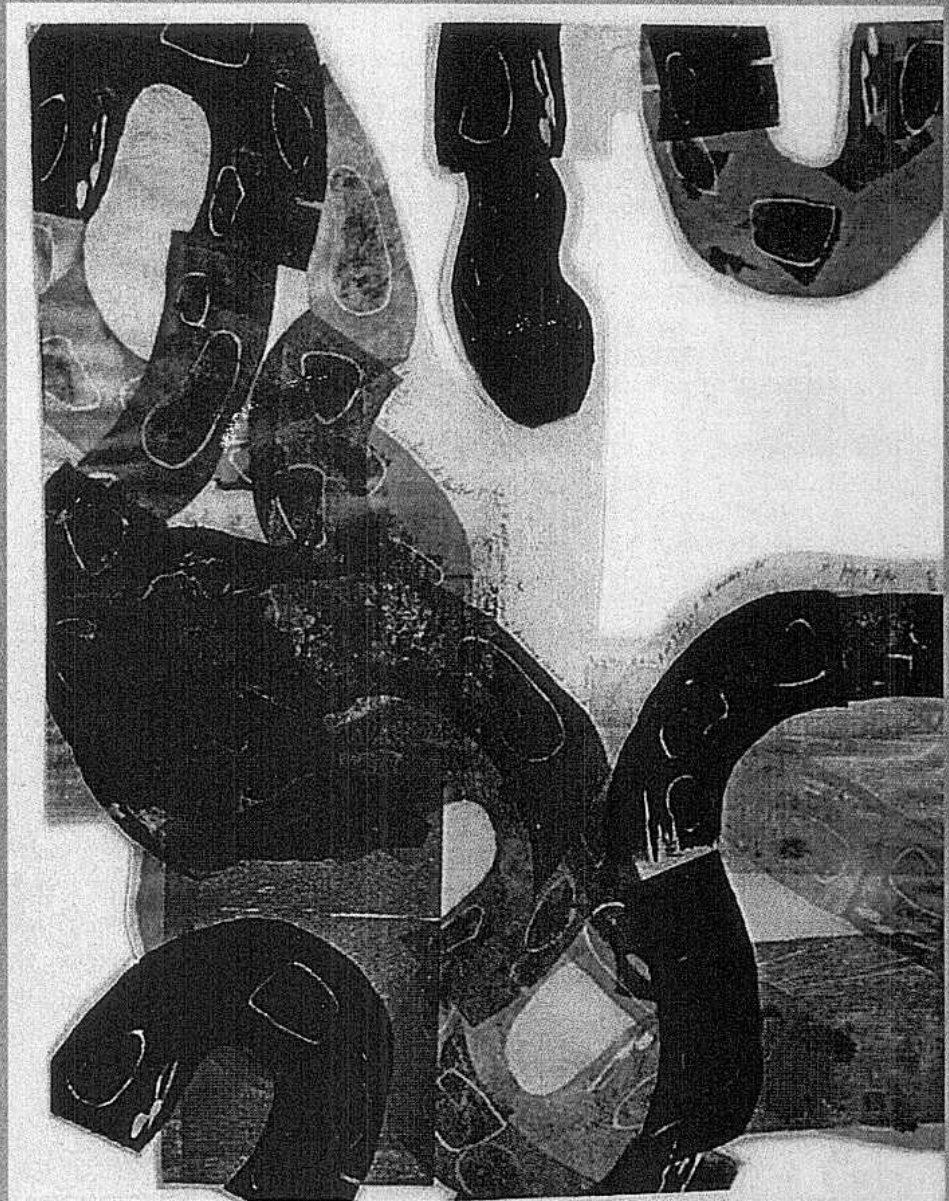
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# The Internet as a Self-Organizing Socio-Technological System<sup>1</sup>

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The Internet is generally considered as a global technological system of networked computer networks, as the network of networks working with TCP/IP. Such definitions see the Internet as a purely technological system, they forget that knowledgeable human activities make the Internet work, the technological structure can't be separated from its human use and the permanent creation and communication of meaningful information through the Internet. The technical process of data transmission in the Internet known as routing is a mechanistic one. Self-organizing systems involve certain degrees of freedom, chance, irreducibility, unpredictability, and indeterminacy, hence when considering the Internet a purely technological system, it can't be characterized as self-organizing. Social self-organization is a self-referential, mutual process where structural media and human actions produce each other. The Internet is a global socio-technological system that is based on a technological structure consisting of networked computer networks that works with the help of the TCP/IP protocol and stores objectified human knowledge, human actors permanently re-create this global knowledge storage mechanism by producing new informational content, communicating in the system, and consuming existing informational content in the system; the technological infrastructure enables and constrains human communication. The Internet consists of both a technological infrastructure and communicating human actors. Together these two parts form a socio-technological system, the technological structure functions as a structural mass medium that produces and reproduces networked communicative actions and is itself produced and reproduced by communicative actions. The technical structure is medium and outcome of human agency, it enables and constrains human activity and thinking and is the result of productive social communication processes. Important qualities that are connected with the Internet as a socio-technological system are Open Source, Virtual Reality, globalization, and many-to-many dialogue. Traditional mass media have been based on one-to-many-communication, whereas the Internet is based on many-to-many-communication. Hence the Internet has a large intrinsic democratic potential. In the terminology of Vilém Flusser it can be said that it could support a shift from discursive media society to dialogic media society.

Keywords: Internet, society, social self-organization, Virtual Reality, Cyberspace, World Wide Web (WWW)

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## 1. Introduction

The aim of this paper is to show that the Internet should not be considered as a purely technological system, but as a socio-technological system, and that concepts of social systems and the media that are based on self-organization theory are suited as a foundation for doing so. First I will point out that technological conceptions of the Internet are insufficient (part 1). Then I will outline some foundations of the self-

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1. Human Strategies In Complexity (<http://www.self-organization.org>) Research Paper

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organization of the self-organization of the media and social systems (part 2), I will argue based on this foundation that the Internet is a self-organizing socio-technological system (part 3), and I will show that virtual reality, globalization, and many-to-many-dialogue (in the sense of Vilém Flusser) are central aspects of the Internet (part 4). Finally I will make a short conclusion (part 5).

As an introduction and as a foundation for a theoretical consideration, I want to recapitulate some general knowledge about the Internet.

It is well known that the Internet originated from the ARPANet, a decentralized military computer-based communication network that was set up in the 1960ies by the US government and was expected to survive a nuclear attack. Important Internet-based applications have been e.g. Telnet, FTP, Gopher, LISTSERV, Archie, Finger, IRC, Talk, Usenet, MUD, Email, X.500, WHOIS, WAIS, Veronica, Ping, Netserv, Netfind, Knowbot, Hytelnet. Probably the best known and most influential Internet-based technology is the World Wide Web (WWW) that has been created by Tim Berners-Lee at CERN in 1990. This concept allows a user-friendly browsing in a shared information space by making use of a Web browser like Mosaic, Internet Explorer, Netscape, Lynx, Viola, Opera, Mozilla, or Safari. The user friendliness of the WWW is one of the factors that has contributed to the massive boom of the Internet.

The Internet is generally considered as a global technological system of networked computer networks, as the network of networks. The Federal Networking Council has defined the Internet in 1995 as the global information system that

1. is logically linked together by a globally unique address space based on the Internet Protocol (IP) or its subsequent extensions/follow-ons; 2. is able to support communications using the Transmission Control Protocol/Internet Protocol (TCP/IP) suite or its subsequent extensions/follow-ons, and/or other IP-compatible protocols; and 3. provides, uses or makes accessible, either publicly or privately, high level services layered on the communications and related infrastructure described herein.

The RFC 2026 of the Internet Engineering Taskforce (IETF) has a similar definition that sees the Internet as “a loosely-organized international collaboration of autonomous, interconnected networks, supports host-to-host communication through voluntary adherence to open protocols and procedures defined by Internet standards“. Such concepts define the Internet as a purely technological system, they forget that knowledgeable human activities make the Internet work, the technological structure can't be separated from its human use and the permanent creation and communication of meaningful information through the Internet. Hence we should define the Internet as a global socio-technological system that is based on a technological structure of networked computer networks that works with the help of the TCP/IP protocol and is used by human beings in order to share and communicate knowledge. The Internet consists both of a technological and a social-communicative realm. The technological part enables and constrains human communication and is itself produced and permanently reproduced by the human communicative part. I don't agree with the



argument that the Internet is a technological system that is structurally coupled to social systems so that the technological Internet and social communication system mutually form environments for each other (Palacios, 2003). The specific social systems are themselves networks of communication and networks of networks, they form themselves a social Internet. Hence I wouldn't use the term Internet in a narrow technological sense, but in the broad sense of a network of networks that consists of a technological subsystem (a network of computer networks) and a social subsystem (a network of social communication networks). The two subsystems of the Internet form environments for each other and are structurally coupled, but this takes place within a connecting whole that we call the Internet.

Self-organizing systems are systems where the elements interact in such a way that order that can't be reduced to single elements and that isn't mechanistically predetermined in its character and function emerges. General principles of self-organization include control parameters, critical values, fluctuation and intensification, feedback loops and circular causality, non-linearity, bifurcation points, selection, emergence of order, downward causation, information production, fault tolerance, openness, symmetry breaking, inner conditionality, relative chance, complexity, cohesion, systemness, hierarchy, globalization and localization, and unity in plurality (Fuchs, 2003g). There are physical, biological, and social forms of self-organization that have differing degrees of freedom and autonomy. All self-organizing systems are proactive systems where the point of emergence and the form and function of the emerging structures are not predetermined. Pure technological systems such as computers lack the proactivity necessary for self-organization. In computers the input to an application mechanistically predetermines the output, computers are mechanistic, non self-organizing systems. Computers (such as in a network like the Internet) don't communicate with each other and human beings don't communicate with computers because computers don't have the ability to make structural couplings and representations of human beings, they are mechanistic passive systems without the proactivity necessary for communication. Hence my main argument in this paper is that in order to consider computer-networks such as the Internet as self-organizing, one needs to focus on the social embeddedness of technology.

The technological part of the Internet is based on the TCP/IP protocol that defines how data packages are created and integrated and where they shall be addressed to. Routers are computers that link component networks, they hold routing tables. A data package sent over the Internet includes an address where to send the package. When a router is confronted with a data package, the router looks up a part of this address in the routing table and sends the package to the next router that repeats the same operation. Routing tables specify where depending on the destination of a data package, a specific routing computer shall send the package. TCP/IP enables the linking of heterogeneous networks, it is a transmission technology that is independent from the underlying transmission technology. Internet hosts, i.e. computers that store digital data that is included in the Internet, have domain names (e.g. cartoon.iguw.tuwien.ac.at), the address space of the WWW is organized

hierarchically. These names are translated into 32-bit numeric identifiers (IP addresses) by a specific service called the Domain Name System (DNS). Application programs (like Netscape or Outlook) send requests to the DNS to convert the domain names the users type into an input field (e.g., a URL like <http://cartoon.iguw.tuwien.ac.at/christian/> or an e-mail address like [christian@iguw.tuwien.ac.at](mailto:christian@iguw.tuwien.ac.at)) into Internet addresses. When a host demands data from another host or sends data to another host, the IP addresses of the sending host and the destination host along with the specific data that is broken down into several packages is sent to the router. The router determines with its routing table to which router the data package must be sent. There are several hops until the data is finally transmitted to the destination host, in each hop the data package is transmitted to a router that is closer to the. The routing tables are used to determine the next hop. To each network connected to the Internet a network identification number (ID) is assigned by the Internet Network Information Centre (NIC), the IP addresses of all hosts connected to this network contains this network ID. Furthermore each IP address contains a host ID that is specified by the local network manager.

The technical process of data transmission in the Internet is a mechanistic one. The computer programs running on a router determine exactly where an incoming data package must be sent to as well as alternative routes if the primary, secondary, etc. route should be unavailable. The Internet is a technologically decentralized network, but this is not a sufficient condition for considering it as self-organizing<sup>3</sup>. In self-organizing systems there is a strong element of freedom, chance, irreducibility, unpredictability, and indeterminacy. In Internet communication, each data package is numerically organized in bits, for each incoming data package identified by 32 bits for the source host and 32 bits for the destination host, an exact output is produced by the router, this output consists of 32 bits that identify the next router. Given the conditions of available routers, it is predetermined which output will be produced. Hence the operations are not emergent, but mechanically reducible to computational logic. Concerning its technological structure, the Internet is not a self-organizing, but a mechanical system.

In order to consider the Internet theoretically as a self-organizing systems, it is favourable to next take a look at some existing systemic approaches that have dealt with the Internet.

Peter Bøgh Andersen (1998) argues that the WWW is a new type of self-organizing technical system<sup>4</sup> because it is based on recursive processes between clients and servers, chaotic browsing processes in the long run strive for identifiable attractors (certain web pages that are well indexed in search indexes, have a good

3. Sady Plant is wrong in arguing that the Internet is self-organizing because there is no centralized control of it. "No central hub or command structure has constructed it....[it is a] multiplicitous, bottom-up, piecemeal, self-organizing network which...could be seen to be emerging without any centralized control" (Plant, 1997, p. 49). Such an analysis sees the Internet as a purely technological system.
4. The title of the essay of Sandra Braman (2000) sounds promising and one expects to read why the Net is a self-organizing system. She simply lists some aspects of self-organization and the information economy, but doesn't show why the Net should be considered as a self-organizing system.

design, etc.), bifurcation takes place when new WWW attractors come and old ones go, self-reference is created by the syntactic structure of URLs and by Web spiders, there is a self-similar structure of the WWW that is based on client-server-communication, there is self-repair due to the updating of links and the deleting of dead links by spiders, the Internet is differentiated into subsystems, it is dynamic and can't be controlled by one central intentional agency, and it can itself strongly facilitate its own reproduction, development, and repair.

Andersen fails to show how the WWW is reproducing itself because he analyses Web processes as independent from human users and argues that the essential actors in the Web are software programs like clients, servers, spiders, and agents. Hence he says e.g. that clients and servers are communicating and that the WWW is a "technical autopoietic system" (Andersen, 1998, p. 38). "Although it is ultimately people that actually make things happen on the net, the complex result of their millions of activities is beyond individual planning; qua complex system the net acquires properties that force its users to new actions and inventions that they would never have thought of, had it not existed" (Andersen, 1998, p. 38).

That the Internet can't be individually controlled is not an argument against its social character. Even when software spiders create new links, update search engines, etc., the Web can only become a meaningful semantic space by human activity. No computer program can create meaningful information, the production of meaning is an essentially human activity, a technological system can't produce meaning. When there is a technological network of data that is maintained by software agents, but not used by a single human, there is no self-organization because the agents' activities are fully determined whereas human activities are shaped by unpredictability, creativity and chance. The WWW is a socio-technological system consisting of networked computer networks that enable the social networking of human communication and the human creation and distribution of meaningful information.

Andersen stresses the social character of the Internet: "But whereas the social and psychic systems mutually presuppose each other, no society without minds, no minds without society. The Internet unilaterally presupposes social and psychic systems. The latter can easily exist without the former, the former not without the latter" (Andersen, 1998, p. 38). Nonetheless he argues that the Internet is a technical autopoietic system, whereas I stress that only social activity as a constitutive feature of the Internet and the WWW makes them self-organizing systems and that hence the Internet shouldn't be conceived as a technological system, but as a social system where human interaction and human activity results in the storage of knowledge. For me the Internet is not a system that links computers, but a socio-technological system where a network of computer networks is used for linking and supporting the interactions of human beings. Hence the Internet does have both a social and a technological part and the social one is the decisive one for the self-organization of the Internet.

All purely technological systems are mechanical systems, but self-organizing systems are non-mechanical systems. Hence it is necessary to stress the central importance of human actors in the WWW in order to consider the latter as self-

organizing. Talking about the Internet, the WWW, Cyberspace, Virtual Reality, etcetera means not only talking about networked technologies, but also about networked communication, knowledge, human values, and culture. The self-organization of the WWW is mediated and enabled by human agency, human communication at a distance is mediated and enabled by the technological structure of the Internet.

Heylighen and Bollen (1996) argue that the WWW could develop into a “super-brain” or “associative memory” if learning algorithms could be generalized in such a way that the WWW permanently learns from its users. “The brain of the users themselves would become nodes in the Web: stores of knowledge linked to the rest of the Web, which can be consulted by other users or by the Web itself” (p. 919). The advantage of this super-brain would be that one could use the unlimited knowledge and intelligence of others in order to solve problems. The WWW is a giant storage mechanism of human knowledge, but this doesn’t mean that it is a brain itself. The networked communication of human beings mediated by the Internet results in new emergent results. The WWW is based on human activities, without human activity it is a dead, mechanic, non-self-organizing system. If it were technologically possible to link human brains directly with the Web, this would indeed enhance the dynamic structure of the Web, the Web would become a medium that links human brains not indirectly, but directly. But I doubt that such a system would under the social power conditions we are facing today develop into a super-brain because such a system would have to display collective intelligence and collective wisdom. It is very likely that it would be used to manipulate, control and homogenize individuals and to facilitate the domination of certain groups by other groups. Heylighen and Bollen don’t take into account the fact that in a highly stratified society, the vision of a “super-brain” has totalitarian implications that remind us of George Orwell’s *1984*. The WWW is not a global brain, it is not a biological phenomenon, but a socio-technological system where networked computers enable the indirect linkage of human brains. Linkage here means that human beings make use of the system in order to communicate and co-operate.

Considering the Internet as technological system or as global brain doesn’t take into account that it is a socio-technological system that is based on human activity and where computer networks mediate human communication.

The Internet is fundamentally comprised of flesh and blood, millions of people with varying degrees of technological sophistication, of different ethnicities, with a variety of beliefs and values, who are using the Internet for a diverse set of reasons. It is through the complex interrelations among the assorted human actors and the machines by which they are interlinked that the Internet self-organizes. (Granic & Lamey, 2000, p. 96)

I suggest considering the Internet as a self-organizing socio-technological system. For doing so, I first have to point out some foundations of a theory of social self-organization.



## 2. The Media and Social Self-Organization<sup>5</sup>

Social analysis has to start from real, sensual living human beings that produce in a society and enter social relationships. Societal structures don't exist externally to, but only in and through human agency. By interaction of human actors, new social qualities and structures can emerge that cannot be reduced to the individual level. This is a process of bottom-up emergence that is called agency. Emergence in this context means the appearance of at least one new systemic quality that cannot be reduced to the elements of the system. So this quality is irreducible and it is also to a certain extent unpredictable, i.e. time, form and result of the process of emergence cannot be fully forecasted by taking a look at the elements and their interactions. Structures also influence individual actions and thinking. They constrain and enable actions. This is a process of top-down emergence where new individual and group properties can emerge. The whole cycle is the basic process of systemic societal self-organization that can also be called re-creation because by permanent processes of agency and constraining/enabling a system can maintain and reproduce itself (see fig. 1). It again and again creates its own unity and maintains itself. Societal structures enable and constrain actions as well as individuality and are a result of actions (which are a correlation of mutual individuality that results in sociability).

Re-creation denotes that individuals that are parts of a system permanently change their environment. This enables the system to change, maintain, adapt and reproduce itself. What is important is that the term re-creation also refers to the ability of all humans to consciously shape and create systems and structures, an ability that is based on self-consciousness and, in Anthony Giddens' terminology, the reflexive monitoring of action. Societal systems are re-creative ones because they can create new reality, the socio-cultural human being has the ability to create the conditions for his further evolution all by himself. Creativity means the ability to create something new that seems desirable and helps to achieve defined goals, it's a central feature of communicative action.

Figure 1: The self-organization/recreation of social systems



Termining the self-organization of society re-creation acknowledges as outlined by Giddens the importance of the human being as a reasonable and knowledgeable actor

5. For a more detailed discussion of the foundations of a theory of social self-organization see Fuchs (2002, 2003a-g, 2004).



in sociology. Giddens himself has stressed that the duality of structure has to do with re-creation: "Human social activities, like some self-reproducing items in nature, are recursive. That is to say, they are not brought into being by social actors but continually *recreated* by them via the very means whereby they express themselves as actors" (Giddens, 1984, p. 2). Saying that society is a re-creative or self-organising system the way we do corresponds to Giddens' notion of the duality of structure<sup>6</sup> because the structural properties of societal systems are both medium and outcome of the practices they recursively organize and both enable and constrain actions (for the relationship of Giddens' theory of structuration and social self-organization see Fuchs, 2003e).

A medium is a structural entity that helps organizing a relationship between two entities in a self-organizing system. Via a medium a relationship between parts of a system and/or system and environment is produced in order to enable the self-organization of the whole system. Etymologically the term medium stems from the Latin *medius* which means in the *middle*, the *middle one*. Media have to do with mediation. Social media mediate the social relationships of human being. They are employed in social relationships of living, social actors.

Social structures can be found in all societal areas: in technology, ecology, economy, politics and culture. *Tools* are means employed for reaching defined goals, *natural resources* organised by humans are necessary in order to reach these goals, *property* enables the production of use values and the satisfaction of needs. *Decision power* is necessary in order to orient processes and achieve decision-based results, *definitions* (norms, values) serve as means of reflection and assessment of the concrete human existence. Hence in society we find technological, ecological, economic, political and cultural structures that mediate the relationships of human beings and hence the reproduction of social systems. They are both medium and outcome of social actions, they constrain practice, but also enable practices that result in new structures and the differentiation of already existing ones. We argue in favour of a broad concept of the media that is neither confined to the technological realm nor solely to social systems. Media can be found with different characteristics in all complex, self-organizing systems (cf. Fuchs & Hofkirchner, 2003), here we focus on the basic characteristics of social media:

- Media store and fix knowledge about society and simplify human action because due to their existence certain foundations of actions don't have to be permanently (re)produced, but can be accomplished by making use of media. Media reduce the complexity of society. They are carriers of knowledge and a foundation of the spatial and temporal extension of social systems. Social media are storage capacities in society which enable the existence of institutional forms which persists across generations and shape past experiences that date back well beyond

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6. "According to the notion of the duality of structure, the structural properties of social systems are both medium and outcome of the practices they recursively organise" (Giddens, 1984, p. 25) and they both enable and constrain actions (ibid., p. 26).

the life of any particular individual. Not only technological systems form social media, but also markets, money, commodities, power, laws, rules, values, traditions, and norms.

- Media enable the continuity of social reproduction over space and time, they result in a spatial and temporal “distanciation” of social relationships without loss of continuity. But media also produce special modes of proximity and hence sublimate distance by re-embedding spatio-temporally disembedded relationships.
- Media are a foundation of practice and enable a certain mobility
- Media mediate, organize and co-ordinate social relationships, communication, knowledge management, production, co-operation, competition, domination, decision processes, the discursive establishment of norms and values, and the production and materialization of ideologies
- Media connect actors, individuals and groups.
- Special skills, rules, organizational forms and norms are necessary for using media (media literacy). Media put forward certain forms of usage and exclude others.
- Media mediate and change human perception.
- Media are symbolic systems and referential systems (e.g., technologies refer to purposes, property refers to material possibilities and positions, power to decisions, definitions to life-styles and taste).
- Media have material-substantial and ideational aspects. For example, in computer mediated communication (CMC) the technological distribution as well as the produced content are important.
- Media enable new experiences that transcend the immediate experience of corporeal presence.
- Media dissolve on the one hand temporalities and spaces, but on the other hand also produce new spaces and temporalities.
- Media don't come into existence by chance, but in certain historical situations and due to certain social and cultural needs and interests. Media have their own history.
- Media are referring to objective reality, but these references are not simply reflections and mappings of reality, but also contain new meanings and contents. Media unite different contexts, e.g. different subjective value schemes in face-to-face communication or different cultural contexts in virtual discussion boards. Mediation means frequently that realities are disembedded from their context of production and re-embedded into new contexts. For example, in the Internet and in a film-montage elements that stem from different contexts can be embedded into a new context that contains new, emergent meanings that can't be found in one of the single elements.
- Media employ principles of order. For example, linearity is a principle of order of the book, networking and linking are order principles of hypertext, and precision is an order principle of the medium money.
- Media contain certain meanings, ideologies, myths and worldviews.

In modern society, the development of technological media, i.e. tools and machinery, has been advanced in order to organize economic production more

efficiently. The history of modern society is also the history of technologies that have become continuously more rapid and have increasingly enabled the disembedding of social relationships. Due to the enlargement of the scope of technological media (railway, telegraph, public transport, mass transport, telephone, radio, automobile, airplane, TV, fax, computer, etc.) the flexibility of social relationship increases.

During the Fordist mode of societal development that was based on mass production and mass consumption the mass media have emerged as a relatively autonomous and functionally differentiated subsystem of society. The beginnings can be found earlier with the establishment of the press; radio, film and television have propelled the development of the system of the mass media. In this system, ideologies are produced and distributed, it is a diffusion channel of knowledge, news, ideologies and views. The mass media form an autopoietic or self-organizing system that is organized around the permanent production of topical news about the state of the world. The mass media don't map objective reality exactly, they construct social realities that distort objective reality due to the subjective views, interests and complex relationships that are contained in this system. The system of the mass media produces imaginary representations of reality, it doesn't simply construct one of many legitimate realities as claimed by constructivist sociologists like Niklas Luhmann (1996), it rather produces and distributes various views of objective reality that are different from reality as such to certain degrees. This is due to the fact that the mass media have a high degree of power in modern society that privileges their views of reality and creates dominant forms of reality construction. The system of the mass media can be considered a subsystem of the cultural subsystem of society. Mass media are organized around certain technological media (printing press, radio technology, television, computer etc.) that are embedded into social institutions. Hence the term mass media doesn't simply denote certain technologies, but social relationships that make use of technological media in order to organize themselves and to reach certain goals. The mass media are closely structurally coupled with the economic, political and technological subsystems of society, they can achieve their goals only by making use of technological, economic, political and cultural media. Institutions of the mass media frequently (especially within deregulated social and institutional settings) also pursue economic interests and make use of technological media in order to achieve these aims, i.e. they sell knowledge and news as commodities.

We should employ the term *mass media* because technologies are used in order to reach a large number of people. Audience ratings are an important economic aspect of the mass media. A central characteristic of the existing organization of the mass media is that the main contents are controlled and produced by a relatively small number of people and groups, whereas the number of recipients is much larger. It does no longer make sense to distinguish subsystems of the mass media such as printed media, film, radio, TV because the convergence of technologies and media institutions takes place. Due to digitalization and technological networks it is possible to digitally unite several classical media. Such a combination of scripture, audio, images, video, music, communication and body enables a multi-modal dimension of the mass media. The

technological structure of the Internet as a new technological medium is a typical expression of the convergence of technological media. Media organizations make use of technological convergence in order to expand the scope and distribution of their contents.

Social media don't operate fully separated from each other. Human beings make permanently use of different media (also at the same time) in order to organize their daily life and reach certain goals. Technologies, organized natural resources, property, decision power and definitions don't exist fully autonomous from each other, they rather as a totality constitute the structural characteristics of all social systems. In order to exist, the human being must make use of different media: technological ones (language, scripture, computer etc.), ecological ones (natural resources), economic ones (goods, money, etc.), political ones (laws, elections, rules etc.), and cultural ones (norms, values, traditions). The system of the mass media embeds technological media institutionally, but it is also based on economic, political and cultural media. Its aim is the production and distribution of knowledge and topical news that frequently take on ideological and economic forms.

Based on these foundations of social self-organization, it is possible to now theoretically consider the Internet as a self-organizing system.

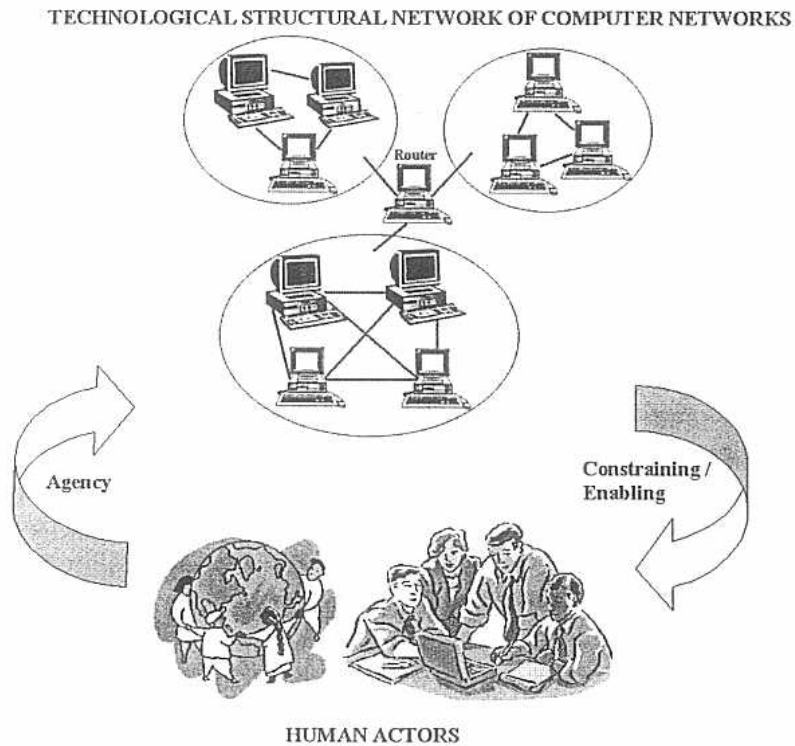
### **3. The Internet as a Self-Organizing Socio-Technological System**

Based on such a concept of social self-organization, a definition of the Internet that is not purely technological can be given. The Internet is a global socio-technological system that is based on a technological structure consisting of networked computer networks that works with the help of the TCP/IP protocol and stores objectified human knowledge, human actors permanently re-create this global knowledge storage mechanism by producing new informational content, communicating in the system, and consuming existing informational content in the system; the technological infrastructure enables and constrains human communication. The self-organization of the Internet is based on a self-referential loop of self-organization (see fig. 2): In a top-down process the existing technological structure that stores objective human knowledge enables human activity, i.e. there is the subjectification of objective knowledge in human brains when one consumes knowledge that is represented in the Internet or communicates with other human beings via the Internet. In this sense the technological structure mediates human activities and results in emergent aspects of thinking and action. In a bottom-up-process human beings communicate and act in such a way that the knowledge stored by the technological structure changes, is actualized and extended. Here objective knowledge emerges from the co-operation of human actors, the actors co-ordinate their communication in such a way that parts of their subjective knowledge are synergetically shared and coordinated in such a way that new embedded and objectified emergent knowledge that is stored in the technological structure appears. This double process of bottom-up-emergence of objective knowledge and top-down-emergence of subjective knowledge constitutes



the basic productive loop that is characteristic for the self-organization of the Internet system. The Internet consists of both a technological infrastructure and communicating human actors. The technical structure is medium and outcome of human agency, it enables and constrains human activity and thinking and is the result of productive social communication processes. The technological structure/part of the Internet enables and constrains human communication and is itself produced and permanently reproduced by the human communicative part of the Internet. The Internet consists of a technological and a social part that both have a networked character. Together these two parts form a socio-technological system, the technological structure functions as a structural mass medium that produces and reproduces networked communicative actions and is itself produced and reproduced by communicative actions. Not the Internet is a mass medium, only its technological part functions as a reflexive communication medium.

Figure 2: The Self-Organization of the Internet as a Socio-Technological System



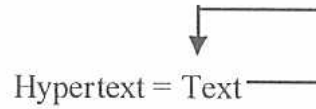
Emergence in the WWW means emergence of new websites. The structure of the Web changes dynamically, pages disappear, reappear in alternative forms, are mirrored on other servers, new pages appear, etc. The detailed structure of the Web can't be known, predicted, and controlled to a full extent, its complexity steadily

increases with its growth. This complexity can be measured by the number of websites and links in the WWW. When a new website is introduced, it is embedded into the existing Web and extends the latter. In order for a web page to be "visible" in the Net, links must be created that lead from and to this web page. Hence each web page is based on other websites, search engines, link lists, etc., but it can't be reduced to them (except in the case when one page is an exact mirror of another) because it has its own specific content and structure. Hence one can say that in the self-organization of the WWW, new web pages emerge out of other web pages. The Web "is continuously expanding, moving, and transforming itself. The World Wide Web is a flux" (Lévy, 2001, p. 140). But this emergence and self-organization of the WWW is not a purely technological process, it is in need of active, knowledgeable human actors who create the structure of the WWW, links, new websites, etc. and browse the web. Without human beings, the Web is a dead mechanical entity that is non-self-organizing. One can only speak of the self-organization of the WWW when one considers the WWW not a technological system, but a socio-technological system where human beings make use of a technological medium in order to communicate. The Web grows and self-organizes only through human activity. The metaphor of the Internet as a carpet that is woven and permanently re-woven by millions of people that are distributed all over the world describes Cyberspace's dynamic nature. It is a carpet of networked, shared meaningful information that permanently re-creates itself and permanently re-emerges.

Websites are written in a specific language, the Hypertext Markup Language (HTML). Users make use of tools like Dreamweaver, FrontPage, Homesite, etc. in order to produce HTML-code. A hypertext is a network of informational nodes that contain informational pieces (texts, images, sounds, videos, animations) and are interlinked. The hypertext has a distributed nature, it can consist of texts, images, sounds, videos, animations, etc. (hence one also speaks of hypermedia) that are not necessarily stored on one computer, but all over the WWW, and of links to web pages that are distributed over the WWW. Links from all over the WWW lead to a hypertext, it can be produced jointly and at a distance by making use of co-operative work systems, it can be used and maybe extended or changed by people who are distributed all over the world. The hypertext is essentially dynamic, fluid, transitory, it has no fixed place. A specific hypertext forms a node in the Web that develops dynamically in such a way that links from and to this hypertext frequently appear and disappear.

Creating links is the essential operation of networking. The WWW is a self-referential medium in the sense that when a new link is created the system refers to itself by actualizing its content. Each web-page refers to a number of other web-pages that again refer to other web-pages etc. Self-reference is the essential nature of the hypertext, by creating links a hypertext is connected to a hypertext, the hypertext system of the WWW is referring to itself. Self-reference is based on human activities, on the creation of new hypertexts that are embedded into the existing system. The interlinked structure of the WWW defines possible paths that are discovered by active human beings that browse the Web and create their own personal path. "A hypertext is

a matrix of potential texts, only some of which will be realized through interaction with a user" (Lévy, 1998, p. 52). A hypertext system reproduces itself by the permanent self-reference of the category text:



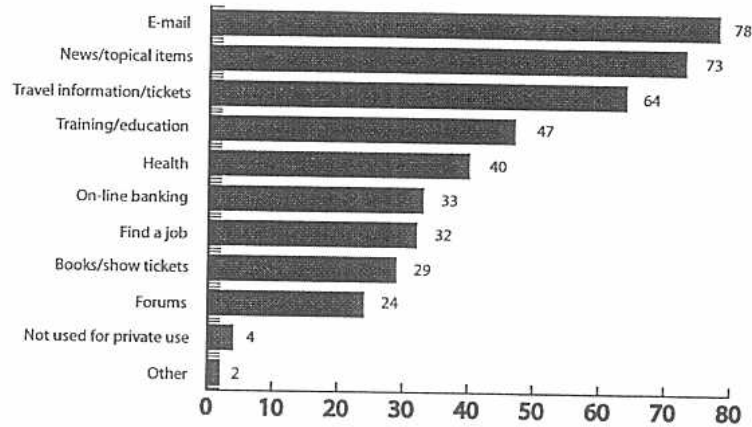
Designing a web page is an essentially human creative, not only a technological, activity. Not only the production of new web sites is a central feature of the self-reproduction of the Internet, also its permanent usage as well as computer-mediated human communication are very important. Certain subsystems of the Internet like specific chats, bulletin board systems, newsgroups, mailing lists, etc. can maintain themselves only due to the fact that human actors make use of the technological structure as a medium of their symbolic exchange. As long as they communicate, the Internet is alive and organizes itself. The order of the system emerges due to communicative synergies. As soon as they stop using it, the specific self-organizing subsystem of the Internet breaks down. It might still be available technologically, but without meaningful communicated information it is not self-organizing. There is also the possibility that the self-organization of such a subsystem ends because it is technologically disconnected from the Internet. The Internet and the WWW consist of many different self-organizing spaces that are organized around special interests. Many of these subsystems are interlinked, they are not fully communicatively autonomous.

Due to its globally distributed, decentralized technical structure, small causes can have large effects in the Internet and can amplify themselves through the Net. Probably the best examples are computer viruses that spread over the Internet. These small pieces of code can do hardly any damage in a non-networked, local computer environment, but it can cause a lot of damage at distant places when it enters the Internet. The same is true for communication, communicating specific information over the Internet can under certain circumstances cause social transformation in many distant places. The Internet enables action- and communication-at-a-distance. An example (from Lubbers, 1997): When in 1995 Steven Fishman published data and a declaration in lieu of oath on the Dutch server Xs4all.nl that documented the dubious tactics of Scientology, the sect threatened to prosecute Fishman and the Internet Service Provider (ISP). It aimed at censoring how former members felt about the praxis of Scientology. After Scientology effected a search warrant of Xs4all's headquarters, a global campaign was started by making use of the Internet. People all over the world joined the coalition and mirrored the incriminated data. Hence Scientology was unable to sue all of these individuals and ISPs and finally had to abandon the lawsuit against Xs4all. This example shows that small events or pieces of data (like a single web page about Scientology) can spread over the Internet and cause large effects like a protest campaign that transforms society.

Some parts of the WWW remain stable for many years, whereas others change dynamically (e.g. databases—like a search-engine—available on the Internet that contain dynamic information).

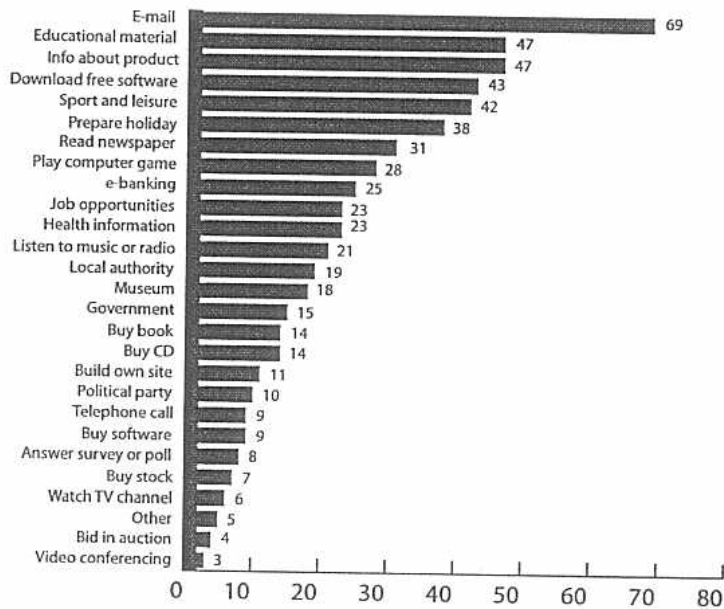
The social character of the Internet that I stress can also be confirmed empirically. Statistics show that e-mail, a social communicative use of the Internet, is the most popular usage form of the Internet in the European Union (Figures 3 & 4).

**Figure 3: Percentage of Internet Users using the Internet for Private Use by Selected Purposes, EU, 2002**



Source: Flash Eurobarometer 135, November 2002.

**Figure 4: Internet Applications in the Past Three Months**



Source: Eurostat 2003, p. 47, Base Internet users (n=3,069)



Next I would like to discuss some more concrete features of the Internet as a socio-technological system. The main ones in my opinion are that:

- the Internet is an open source system
- the Internet is a virtual reality system
- the Internet is a medium of the globalization of social relationships
- the Internet is a medium of many-to-many-dialogue

#### **4. Central Aspects of the Internet as a Socio-Technological System**

Important qualities that are connected with the Internet as a socio-technological system are Open Source, Virtual Reality, globalization, and many-to-many dialogue.

##### *4.1. Internet and Open Source*

In the Internet each consumer of information is also a potential producer and vice versa, with the Internet we see the emergence of the “prosumer.” Also each receiver is a potential sender and vice versa; and each reader a potential writer and vice versa. The traditional relationship of the author and the reader is broken up. The Internet is closely connected to concepts like Open Source, Open Content, Open Theory, etc. It fosters the networked, co-operative production of information, you can download existing code, data, images etc., reuse and improve it. The open source standards of the Internet software have in fact been one of the factors that have fostered its rapid growth. “The openness of the Internet’s architecture was the source of its main strength: its self-evolving development, as users became producers of the technology, and shapers of the whole network” (Castells, 2001, p. 27). Open source software is one of the key features of the Internet’s evolution.

##### *4.2. Internet and Virtual Reality*

Virtual Reality (VR) means a space where information is not stored in the human brain, but in computer networks, that enables human communication and activity at a distance. VR is an extension of human reality in the sense that is based on human beings, their actions and interactions, it is a socially created space that has a technological substratum and is inhabited by human beings. VR is not the opposite of reality and it doesn’t abandon reality. The experiences and practices we have through VR are real, hence Castells (1996) speaks of “real virtuality”. The culture of real virtuality would be “virtual because it is constructed primarily through electronically based, virtual processes of communication. It is real (and not imaginary) because it is our fundamental reality, the material basis on which we live our existence, construct our systems or representation, practice our work, link up with other people, retrieve information, practice our work, link up with other people, retrieve information, form our opinions, act in politics, and nurture our dreams. This virtuality is our reality” (Castells, 2001, p. 203). VR means a technological multiplication of reality, a simulation that constructs a new level of imagination and reality (Poster, 1995). VR is

characterized by three Is: immersion, interactivity, information intensity (Heim, 1998). Immersion means that virtual reality creates new human experiences, interaction means that the state of an application changes according to changes of the human body that are feed as an input into the technical system, information intensity means that a virtual world can offer special qualities like telepresence that show a certain degree of intelligent behaviour.

When we browse the WWW, we are immersed into an artificial space that we navigate by clicking links and entering commands with the help of interaction devices such as the mouse and the keyboard. Certain human senses are observed by the system in order to gather input and change the state of the system, the output that the system produces appeals at least to our eyes and ears, the computer digitally combines data that can appeal to several of our senses and it digitally converts input of multiple senses into data that is used for changing the system's state. Hence the computer is a multi-medium. Digitalization allows the convergence of text, sound, images, videos, animations, etc. Human-Computer-Interaction (HCI) involves a potentially endless feedback loop between the human user and the computer where the activity of a human being's sense organs changes the system's output and the output changes sensual human experiences. This process is the basic loop involved in interactivity. The WWW is not a fully immersive medium because our senses are not fully concentrated on interaction with the technology, you can see, hear, feel, smell, and taste stimuli that are not produced by the WWW while you are browsing. The Internet is a partly immersive system. Due to the fact that it allows certain degrees of immersion, interactivity, and information intensity it can be characterized as a system of virtual reality.

Full immersion can be achieved in a virtual reality system that makes use of 3D graphics, a data glove or data suit, and a head-mounted display. A fully immersive virtual reality system isolates the human senses totally from the outside environment, they are fully concentrated on interaction with the technology, the only sensual input into the body during the time of virtual experience is produced by the technology. The system exactly measures the user's position and movements and hence allows the user's control of artificial agents that move in a world that is presented to the user via the head-mounted display. The only thing he sees is the virtual world, it is not possible to observe the outside environment as it is when you surf the WWW. Frequently the virtual worlds are not purely artificial, but a simplified representation of reality. Examples are the virtual operating room and the virtual cockpit of a warplane. Mid-level immersion can be provided by the simulation of 3D spaces on a 2D monitor. This is e.g. the case in 3D arcade games like Duke Nukem or Silent Hill and VRML (Virtual Reality Modelling Language) spaces like cybertown.com.

Pierre Lévy (1998, 2001) argues that the virtual is not the opposite of the real, philosophically it would mean that which exists potentially rather than actually, a field of forces and problems that is resolved through actualization. Hence one can consider VR systems as objective systems that contain a mass of human knowledge that can be potentially actualized as subjective human knowledge. When one reads a piece of

information in the WWW, objective knowledge is transformed into subjective knowledge, potential subjective reality is actualized into actual subjective reality.

#### *4.3. Internet and Globalization*

Networked computer usage has resulted in a real-time globalization of social relationships, knowledge flows today transcend national borders, they result in the globalization, intensification, time-space-distanciation of social relationships and establish a more intensive and extensive interconnection of humans, they cause a sort of supra-territoriality, time-space compression, action at a distance, and accelerating interdependence (Giddens, 1990; Harvey, 1990; Held, McGrew, Goldblatt & Perraton, 1999; Robertson, 1992; Scholte, 1999). Knowledge is today quite substantially detached from territorial space, it cannot be situated at a fixed and limited territorial location, it operates largely without regard to territorial distance, it transcends territorial space. New knowledge-based technologies like the computer facilitate the de-localisation and disembedding of communication in the sense of the generation of spatial and temporal distance. One of the main characteristics of knowledge-based technologies is that they increase the speed of delivery of data massively and hence are a medium of the time-space distanciation of communication. They contribute to the disembedding and de-localization of social systems and relationships and hence reshape society. But they also further the re-embedding and localization of disembedded social relationships, e.g. the globally available information on the Internet is embedded into local cultural contexts of action by the recipients. Globalization and localization are intrinsically coupled, Roland Robertson (1992) has suggested the term "glocalization" for this phenomenon.

The 20th century has seen an unprecedented increase in intensity, extensity, and velocity of global communication that is closely related to the rise of radio, television, satellite transmission, the microelectronic revolution and digital fibre-optic cable networks/digital data processing. The transatlantic cable of 1866 reduced the time of transmission of information between London and New York by over a week, the telephone increased the velocity of messages by a few minutes, the Internet reduced it not much at all in comparison to the telephone (Keohane & Nye, 2000, p. 80). This doesn't imply that technological globalization is a myth, but that we should also stress qualitative aspects such as the reduction of the costs of information transport and new qualities of communication such as many-to-many-communication, interactivity, hyperlinking, digital compression, multimedia, conversion, simulated virtual realities, the decontextualisation and derealisation of communication, implications of computer mediated communication for the formation of identities, etc.

The common theme underlying Giddens' concept of disembedding (Giddens, 1990), Castells' concepts of timeless time and the space of flows (Castells, 1989, 1996, 1997, 1998, 2001), and Harvey's (1990) concept of time-space compression is that modern technologies such as the computer accelerate and increase the flexibility of social relationships. The history of modern society is a history of globalization and of the technological acceleration of transportation (of data, capital, commodities,

people) that makes the world a smaller place in the sense that it increasingly mediates social relationships more efficiently so that it appears like distances are disappearing. Technological progress has resulted in an increasing separation of the movements of information from those of its carriers, the movement of information gathered speed on a pace much faster than the travel of bodies (Bauman, 1998, p. 14). Especially transportation and communication technologies (railway, telegraph, broadcasting, automobile, TV, aviation, digital computer-based communication technology, and most recently digital network technology) have increased the speed of global flows of capital, commodities, power, communication, and information. The Earth has been increasingly transformed into a global communication network that affects all realms of society.

#### 4.4. Internet and Many-to-Many-Dialogue

The relationship of technology (as a subsystem of society) and society as a whole is a complex, non-linear one. The form of a certain technology doesn't determine linear social consequences, but if society is indeed self-organizing and complex one must assume that technologies can cause multiple, non-linear social effects that might even contradict each other. Technology influences society in non-linear ways, society technology in non-linear ways. The relationship of society and technology is shaped by complex, non-linear circular causality. The relationships of production, power, and ideology of society shape technology in various ways and condition its form and usage, technology itself influences the various realms of society in various forms. Concerning the relationship of Internet and society one can say that the Internet does have antagonistic social effects, it produces various tendencies that contradict each other and run counter to each other (Hofkirchner & Fuchs, 2003; Fuchs & Hofkirchner, 2003). Social interests shape technology, its invention, diffusion and application, in the entire process of its development, as its *raison d'être*. This, however, is insufficient to enslave technology completely. Sometimes it appears to resist our intentions by wholly or partly failing to do what is wanted of it, other times it not only fulfils our expectations but goes on to do other useful tasks which originally had not been anticipated. Informatization and computerization, thus, do not follow a predestined path, they are not fixed, but flexible, though their development can only be understood in the broader context of societal development. In the knowledge or information society the antagonistic character of the relationship of Internet and society can be found in the various subsystems of society: in the technosphere as antagonism between alliance technology and the Megamachine, ecosphere between computer-supported sustainability and computer-supported degradation of the environment, in the economy between information as open source good and as monopolized commodity, in polity between e-democracy and Big Brother, and in culture between computer-supported wisdom and computer-supported manipulation (Hofkirchner & Fuchs, 2003; Fuchs, 2003c). Hence a dialectical view of Internet and society argues that Internet today advances both opportunities and risks and that hence society should shape technology in such a way that it has desirable effects.



The WWW is a system that requires human activity, active human browsing, and active human knowledge creation for its existence and permanent reproduction. Each receiver is a possible transmitter. Nonetheless the Internet today is more a space of commerce and passive information consumption, but it has the potential to become a space of active, mutual, co-operative, inclusive information production. The Web is a space suited for "nomadic co-operation" (Lévy, 1997).

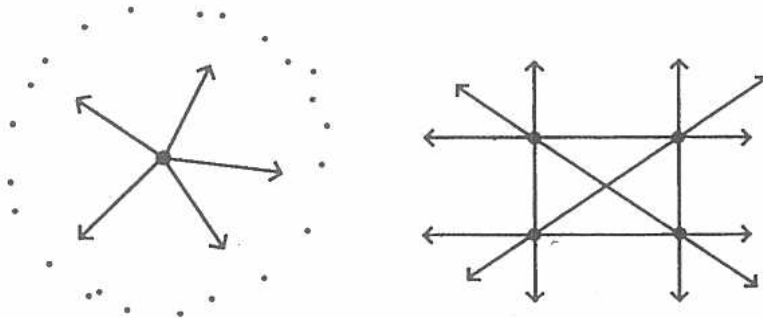
The Internet is technologically based on a decentralized network that forms a polydirectional medium of interaction where many-to-many-communication can take place. In comparison to traditional media that were based on one-to-many communication this is a new quality that has a fundamental political potential. Traditional media such as television, radio or printed media have a one-dimensional character, they only work in one direction from the sender to the receiver without possibilities for mutual interaction. The interactivity of the Internet can extenuate the elitist character of traditional media, there is a shift from one-to-many- to many-to-many- and all-to-all-communication. The technological networking of the world pits forward a new principle: all-embracing, participative, networked co-operation (cf. Fuchs, 2003a) and direct democracy in all realms of society. It is up to the human beings to change society in such a way that it can make full use of and realize the opportunities the Internet poses. Internet communication can support the emergence of a global public sphere and a global civil society.

Vilém Flusser (1996a, b) has distinguished between dialogic and discursive forms of communication. Dialogue would mean exchanging and sharing information in order to produce new information jointly and co-operatively, discourse would mean the distribution of existing information. Dialogues would be conservative and totalitarian because they would try to conserve and distribute existing information. The traditional media would operate in the form of amphitheatre discourses where there is one sending centre that functions as a channel that transmits information to the mass of passive receivers. Another form of communication would be network discourses that could mainly be found in daily life as gossip and spreading rumours. The existing communication structure would be dominated by a combination and synchronization of the amphitheatre discourses of the mass media and gossiping network dialogue. The amphitheatre discourses would program unambitious, manipulating information in the form of techno-images (symbolic patterns that signify linear texts that signify pictures that signify parts of the world, images that signify concepts/texts) that would be realized by the gossiping network dialogues in the life world. The character of network dialogue would be shaped and dominated by discourses.

In the times of the new media, there would not only be a potential for a new totalitarianism, but also one for a new level of human communication (Flusser, 1996b, p. 50) that means real human communication (p. 157). The TV could easily be transformed into a dialogic medium that functions like a telephone (p. 203) and enables a democratic cosmic village (p. 204). Adding feedback structures to existing mass media wouldn't be a technological problem (p. 226), doing so could open up

new possibilities for a cosmic creative dialogue (p. 228). Computer-based technologies would have the potential for transforming society into a new dialogic polis (pp. 286-299). Telematics (telecommunication+informatics) would have a democratic potential for helping to realize a fully dialogic society, a “telematic society” (Flusser, 1996a) that is not based on intercourse between techno-images and human beings, but on intercourse between human beings that is mediated by techno-images that enable democratic dialogue (Flusser, 1996a).

Figure 5: Amphitheatre discourse and network dialogue as two forms of communication



Source: Flusser, 1996b, pp. 27 & 32)

Flusser died in 1991, he didn't live long enough to see and describe the emergence of the Internet as a mass phenomenon. But he has clearly seen that computer-based networks pose both new opportunities and risks. The Internet forms on its technological level a system of networked dialogue, but on the social level society doesn't make adequate use of this potential because it is dominated by discourses in all realms of social life. Realizing the democratic potential of the Internet would mean that a technological system of network dialogue is coupled to a social system of network dialogue. The old system of amphitheatre discourse that still dominates society in all of its realms would be replaced by a democratic form of network dialogue. The form of network dialogue that Flusser describes as simplistic gossip and the spreading of “false consciousness” in the life world would be transformed into a form of network dialogue that is participatory, co-operative, inclusive, and direct democratic. Human beings would be enabled to shape their lives and decisions all by themselves, self-determination, permanent dialogical decisions and consensus democracy would become central aspects of the dialogical society. Social network dialogues would no longer be dominated by discourses, but would be fully dialogic and supported in their democratic character by a technological infrastructure that is organized itself as network dialogue.

Gilles Deleuze and Félix Guattari (1987) have introduced the concept of the rhizome. One of my hypothesis is that only a fully democratic, dialogic Internet forms a rhizome. Most authors who have analysed parallels between the Internet and the

concept of the rhizome have argued that due to its decentralized, networked technological structure the Internet is a rhizome (Burnett, 1993; Hamman, 1996; Koh, 1997). My argument is that one must also take a look at the social usage of the Internet, at the immanent social systems, in order to analyse whether the Internet is or is not or can be a rhizome. Considering the Internet as a purely technological system doesn't satisfy the quality of the rhizome that it is open and connected.

Principles of a rhizome are: the principle of connection and heterogeneity (i), the principle of multiplicity (ii), the principle of asignifying rupture (iii), and the principle of cartography and decalomania (iv).

Principle (i) means that any point of a rhizome can be connected to anything other, and must be. This is a description of a network structure as it can be found in the Internet. But a fully networked character of the Internet would have to include the inclusion of the excluded, i.e. the provision of free access for all and the dissolution of the digital divide. The hypertext structure of the WWW that is based on the principle of hyperlinking is a technological embodiment of the principle of connection. But the Net in its current form is not fully connective, it involves hierarchic dominating points and stratifying social hierarchies. A Net where all points are fully connected would be one without social hierarchies.

Principle (ii) means that there are no points or positions in a rhizome, only lines and that multiplicities are defined by the outside according to which they change in nature and connect with other multiplicities. This can be interpreted in such a way that the Internet can only be considered a rhizome if it is not seen as a closed technological system, but as an open system where technological structures are connected to social structures and the virtual subsystems and communities are all interconnected. The principle of multiplicity also implies that there should be no social hierarchies immanent in a rhizome, hence there would have to be free access to and free participation in the Internet for all in order to consider it as a rhizome. Today in the Internet there is not only the hierarchy of the digital divide constituted around the dichotomy of access/no access, there is also a hierarchy stratified around the dichotomy importance/unimportance that privileges commercial sites and under-privileges political, philosophical, cultural, social, communicative, etc. web sites. Hence for becoming a rhizome, the Internet would have to become more ambitious and pretentious and would have to abandon the domination of commercialized knowledge and contents in favour of more communicative action.

Principle (iii) means that rhizomes tend to de-territorialize lines of segmentation (i.e., a rhizome constitutes lines of flight down which it constantly flees). This principle reminds us of the fact that the Internet is a segmented space that is hierarchically organized according to lines of income, origin, gender, age, education, etc. It reflects the existing asymmetrical distribution of power in society and is a space of social conflict. Alternative movements like the Open Source movement or new protest movements make use of the Internet in order to constitute lines of social flight and to challenge mainstream segmentary lines. In order to become a rhizome, the segmentary lines of the Internet would have to be broken up, i.e. it would have to

develop into an inclusive, co-operative, participatory agora. Principle (iii) also means that a rhizome may be broken shattered at a given spot, but will start up again. This reminds us of the fact that the Internet can't be controlled or censored by single systems, such attempts are today continuously made economically and politically, but also continuously challenged.

Principle (iv) means that a rhizome is a map and not a tracing. A map is not an image from which reality can be traced, it is a changing flux that is permanently reconstructed. A map is oriented toward experimentation, in contact with the real, it fosters connections, removes blockages, advances maximum opening, is open, connectable, detachable, reversible, susceptible to constant modification, and it has multiple entry ways. This reminds us of the fact that the Internet is still dominated by the traditional discursive character of the mass media where there is a lack of possibilities for democratic participation, co-operation, and dialogical mutual interaction. The open standards (of e.g., TCP/IP), the Open Source movement, and a grassroots community with libertarian values have formed important parts of the history of the Internet. Hence openness is a fundamental value of the Internet, but this value has not been fully realized and there is a tendency to close off the Internet commercially. The Internet is embedded into societal systems of discourse, but puts forward the idea of many-to-many-dialogue. In order for the Internet to become a rhizomatic map, society and technology would have to strengthen their dialogic character. Dialogue means permanent change by co-operation and participation, it forms a map. Discourse means conservative stabilization and distribution of information, it forms a tracing where there is a lack of openness, modification, and connectedness. Moving from discourse to dialogue, from the tracing to map, from the segmented Internet to the rhizomatic Internet, from the segmented society to the rhizomatic society, means to realize the inclusive, co-operative, participatory, direct democratic potential that is immanent in the new media and to move from the conservative distribution model of information to the progressive model of the participatory constitution of information. The Internet has a rhizomatic potential, the human being can realize and build the rhizome.

## **5. Conclusion**

The Internet is not a technological system or mass medium. It requires human activity and communication in order to self-organize. It forms a socio-technological system where a technological structural network of computer networks that is based on the TCP/IP protocol functions as a mass medium of social activity and networked communication. This mass medium is a carrier of objective social knowledge that is permanently reproduced and reactualized through networked human communication.

The Internet is based on open source knowledge and constitutes a partly immersive form of Virtual Reality. It is interactive and advances the globalization of social relationships. Considering it as a human system has ethical implications: The possibility of many-to-many communication puts forward the principle of co-



operative, participatory democracy. Realizing this potential could strengthen the dialogic character of society.

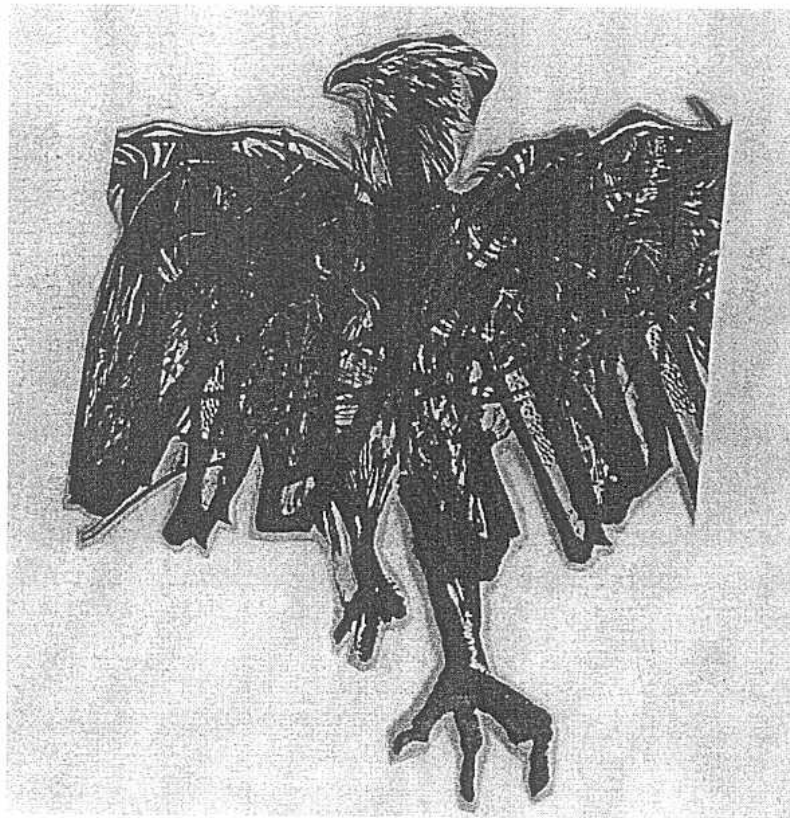
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### References

- Andersen, P. B. (1998). WWW as Self-organizing System. *Cybernetics & Human Knowing*, 5 (2), pp. 5-41.
- Bauman, Z. (1998). *Globalization. The human consequences*. Cambridge: Polity.
- Braman, S. (2000). *From Virtue to the Virtual: Art, Self-Organizing Systems, and the Net*. In S. B. Gibson & O. O. Oviedo (Eds.), *The emerging cyberculture: Literacy, paradigm, and paradox* (pp. 307-323). Cresskill, NJ: Hampton Press.
- Burnett, K. (1993). Towards a theory of hypertextual design. *Postmodern Culture*, 3 (2). Online: <http://www.wei1105.idv.tw/comp/article/hypert.htm>
- Castells, M. (1989). *The informational city: Information technology, economic restructuring and the urban regional process*. Cambridge, MA: Blackwell.
- Castells, M. (1996). *The rise of the network society: The Information Age* (Vol. I). Cambridge, MA: Blackwell
- Castells, M. (1997). *The power of identity: The Information Age* (Vol. II). Cambridge, MA: Blackwell
- Castells, M. (1998). *The end of millennium: The Information Age* (Vol. III). Cambridge, MA: Blackwell.
- Castells, M. (2001). *The Internet galaxy. Reflections on the Internet, business, and society*. Oxford: Oxford University Press.
- Deleuze, G., & Guattari, F. (1987). *A Thousand Plateaus: Capitalism and schizophrenia* (Vol. 2). Minneapolis: University of Minnesota Press.
- Eurobarometer. (2000). *Measuring Information Society, 2000*. Brussels: European Commission. (A Eurobarometer survey carried out for the European Commission by INRA (Europe)—European Coordination Office.)
- EUROSTAT. (2003). *Information Society Statistic—Pocketbook 2003*. Luxembourg: Off. for Official Publ. of the European Communities.
- Flusser, V. (1996a). *Ins Universum der technischen Bilder*. Göttingen: European Photography.
- Flusser, V. (1996b). *Kommunikologie*. Frankfurt/Main: Fischer.
- Fuchs, C. (2002). *Social information and self-organisation*. In R. Trappl (Ed.) *Cybernetics and Systems 2002: Proceedings of the 16th European Meeting on Cybernetics and Systems Research* (Vol. 1. pp 225-230). Vienna: Austrian Society for Cybernetic Studies.
- Fuchs, C. (2003a). Co-operation in complex, self-organising systems. *tripleC*, 1 (1), 1-52. (<http://triplec.uti.at/>)
- Fuchs, C. (2003b). *Dialectical philosophy and self-organisation*. In V. Arshinov & C. Fuchs (Eds.), *Emergence, causality, self-organisation* (pp. 195-244). Moscow: NIA-Priroda.
- Fuchs, C. (2003c). *Globalization and Self-Organization in the Knowledge-Based Society*. *tripleC*, 1, (2), 105-169. (<http://triplec.uti.at/>)
- Fuchs, C. (2003d). Some implications of Pierre Bourdieu's works for a theory of social self-organisation. *European Journal of Social Theory*, 6 (4), 387-408.
- Fuchs, C. (2003e). *Structuration Theory and self-organization*. *Systemic Practice and Action Research*, 16 (4), 133-167.
- Fuchs, C. (2003f). *The Role of the Individual in the Social Information Process*. In: *Entropy*, Vol. 5 (2003), No. 1., pp. 34-60.
- Fuchs, Christian (2003g) *The Self-Organization of Matter*. *Nature, Society, and Thought*, 16(3), 281-313.
- Fuchs, C. (2004). The antagonistic self-organization of modern society. *Studies in Political Economy* (73), 183-209.
- Fuchs, C., & Hofkirchner, W. (2003). *Studienbuch Informatik und Gesellschaft [Study Book Informatics and Society, in German]*. Norderstedt. Libri BOD.
- Giddens, A. (1984). *The constitution of society. Outline of the Theory of Structuration*. Cambridge: Polity Press.
- Giddens, A. (1990). *The consequences of modernity*. Stanford: Stanford University Press.
- Granic, I., & Lamey, A. V. (2000). The self-organization of the internet and changing modes of thoughts. *New Ideas in Psychology*, 18, 93-107.
- Hamman, R. B. (1996). *Rhizome@Internet: Using the Internet as an Example of Deleuze and Guattari's "Rhizome"*. Retrieved June 6, 2005 from <http://www.socio.demon.co.uk/rhizome.html>
- Harvey, D. (1990). *The condition of postmodernity*. Oxford: Blackwell.

- Heim, M. (1998). *Virtual realism*. New York: Oxford University Press.
- Held, D., McGrew, A., Goldblatt, D. & Perraton, J. (1999) *Global transformations*. Cambridge, MA: Polity.
- Heylighen, F., & Bollen, J. (1996). *The World-Wide Web as a super-brain: From metaphor to model*. In R. Trappl (Ed.), *Cybernetics and Systems '96* (pp. 917-922). Vienna: Austrian Society for Cybernetics.
- Hofkirchner, W., & Fuchs, C. (2003). The architecture of the information society. In J. Wilby & J. K. Allen, (Eds.), *Proceedings of the 47<sup>th</sup> Annual Conference of the International Society for the Systems Sciences (ISSS): Agoras of the Global Village, Iraklion, Crete, July 7<sup>th</sup>-11<sup>th</sup>, 2003*. (ISBN 0-9740735-1-2)
- Keohane, R. O., & Nye, J. S., Jr. (2003). *Globalization: What's new= what's not? (And so what?)*. In D. Held & A. McGrew (Eds.), *The Global Transformations Reader* (pp. 75-83). Cambridge: Polity. (Originally published in 2000 by )
- Koh, C.-F. (1997). *Internet: Towards a Holistic Ontology*. Dissertation Thesis. Murdoch University, Perth. Online: <http://www.mcc.murdoch.edu.au/ReadingRoom/VID/jfk/thesis/titles.htm>
- Lévy, P. (1997). *Collective intelligence*. New York: Plenum.
- Lévy, P. (1998). *Becoming virtual: Reality in the digital age*. New York: Plenum.
- Lévy, P. (2001). *Cyberculture*. Minneapolis: University of Minnesota Press.
- Lubbers, E. (1997). *Das müßt ihr uns erstmal nachmachen! Netzaktivitäten in Amsterdam*. In nettime (Ed.) (1997) *Netzkritik*. Berlin. Edition ID-Archiv. (pp. 167-176) [English version: *Netactivism*, retrieved June 6, 2005 from <http://www.xs4all.nl/~evel/report.htm>].
- Luhmann, N. (1996). *Die Realität der Massenmedien*. Opladen: Westdeutscher Verlag.
- Palacios, M. (2003). Internet as System and Environment in Cyberspace: Analyzing Digital Cities. *tripleC*, 1(2), 95-104. (Available online at <http://triplec.uti.at>)
- Plant, S. (1997). *Zeros and ones*. London: Fourth Estate.
- Poster, M. (1995). *The second media Age*. New York: Blackwell.
- Robertson, R. (1992). *Globalization: Global theory and global culture*. London: Sage.
- Scholte, J. A. (1999). Globalisation: Prospects for a paradigm shift. In: M. Shaw (Ed.), *Politics and globalisation* (pp. 9-22). London: Routledge.



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