G. Liestøl, A. Morrison & T. Rasmussen (eds), Digital Media Revisited (Cambridge, MA: MIT Press, 2003.

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On Distributed Society

The Internet as a Guide to a Sociological Understanding of Communication

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As early as 1960, the Internet pioneer J. C. R. Licklider stated, "In due course [the computer] will be part of the formulation of problems: part of real-time thinking, problem-solving, doing of research, conducting of experiments, getting into the literature and finding references. . . . And it will mediate and facilitate communication among human beings" in Hauben and Hauben 1998: chap. 6). Licklider expressed the hope that the computer "through its contribution to formulative thinking . . . will help us understand the structure of ideas, the nature of intellectual processes" (chap. 6). The "most important present function of the digital computer in the university should be to catalyse the development of computer science" (chap. 6), he said.

And so it did. As the ARPANET and other network experiments unfolded in the 1960s and 1970s, the computer as a medium inspired the transition of computer science toward information science. I think it is possible and potentially constructive to go even further. In due course, to paraphrase Licklider, one important function of the Internet may be to inform our "formulative thinking" about society itself. The Internet may help to catalyze not only the development of computer and information science, but sociology and social theory as well. In what follows, "innovation" will refer precisely to applying the Internet as a design or as an inspiration for the understanding of what society is.

This may appear to be a strange and perhaps somewhat awkward approach. Yet I think that if such a theory exists (or ideas that lead to such a theory in the future), it may be worthwhile to address the ways such a perspective may enlighten our understanding of the Internet and its social significance, at least on a general level. If central features of the Internet do in fact provide insights into the understanding of society, we may have at our disposal a more focused optics for observing structural changes as the Internet penetrates social activities.

I am in no way suggesting that the Internet has turned society into a global technological system carrying with it utopian or dystopian futures, as in the tradition of Jacques Ellul and, in part, Herbert Marcuse. On the contrary, only if we keep society and the Internet conceptually distinct from each other may we heuristically play with the Internet structure as a theoretical idea or model of society. I propose to go one step back and to look for sociological insights that seem most compatible (commensurable) with the logic of the Internet. I will simply suggest, as a heuristic idea or thought experiment (in an attempt at being innovative), that central features of the history and anatomy of the Internet may transcend the technological and then may point toward central aspects of society as well. Or so as to avoid mechanistic or naturalistic fallacies, central features of the Net may direct us toward basic ideas that are addressed in the discourse of sociology. I would like to suggest that the Internet, by its technical development and structure, hints at what I like to call a "distributed society."

But why should the technical solutions that make up the Internet lead us to more sophisticated knowledge about communication and society in general? One answer is that the explosive success of the Internet indicates some sort of "compatibility" between the development of the Net and the transformation of the societies in which it operates. After all, ARPANET and later the Internet and other information-technological changes are as much social as technical innovations. In other words, the general evolutionary forces that lie under the innovation and development of computer technology and the Net also affect social change. If we want to approach the Internet's rapidly growing significance for general social

change, it seems logical to begin with the success of the Net. It is also worth noting that both society and sociology seem to converge in an increasing focus on communication. First, society is turning more and more toward information and communication as vital aspects of the economy. Notions such as the postindustrial society, the information society, and the network society illustrate this new turn. Second, sociology, as well as human thought in general, has gradually turned toward language (the linguistic turn) as a focal point of research. The next step, I believe, is the contextualizing of language in a more general concept of communication. This is latent in the social theory of Jürgen Habermas and explicit in the sociology of Niklas Luhmann (1928–1998). Consequently, studies of the Internet may inform a concept of communication that is highly relevant for the information sciences as well as the social sciences. And in the next instance (as is my underlying purpose of addressing this) such insights about the nature of modern communication may help us to understand the social significance of the Internet in contemporary society.

In this chapter, then, I shall draw upon some elements of the history of the Internet to approach sociological insights. I shall do this by briefly recapitulating selected stages or episodes in the social history of the Internet to draw some parallels to sociological theory. I shall discuss a communication perspective on society, the relationship between communication and its environment, the relationship between communication systems, and the nature of "human-society interface." I address phenomena in the history of networking, such as packet switching, layering, and the controversy over standardization.

Particularly, I would like to argue that technical features in the history of ARPANET and later on the Internet indicate a *systems-theoretical perspective* on society, and of course, on the Internet in that society. Luhmann modifies structural-functional sociology, general systems theory and cybernetics to show that communication always produces social *systems* of various kinds (interactions, organizations, function systems), which produce and reproduce themselves through sequences of communication. Since it is impossible to fully articulate his general theory here, I can only briefly indicate the importance of communication in the self-production of societal function systems, such as art, politics, economics, and science. The self-steering nature of the system (autopoiesis) implies that the system is autonomous; it produces itself through its communicative elements, in contrast to what that communication observes as environment. For example, political communication (through the symbolic medium of power) distinguishes itself from the sciences, which communicate through the symbolic medium of truth. Communication concludes preceding communication and enables connecting ones. In this way, communication always reproduces the difference between the system and its environment and reproduces itself as autopoietically and operatively closed. Through this autopoiesis, the system is deemed to increase complexity as it expands and more relationships develop or become possible. But the system also develops abilities for handling this complexity, by introducing representations of the difference to the environment into the communication of the system (reentry). Function systems relate by observing each other, communicating about each other internally, and linking structurally to each other, but not by communicating. Together, all social systems and protest movements make up society.

Communication, Nothing but Communication

Partly because of the popularizing of the theory by Warren Weaver, Claude Shannon's *Mathematical Theory of Communication* (1949) received considerable attention in a number of academic disciplines. At the time, there was a general feeling that Shannon's theory finally made communication theory into something that could be applied scientifically and that it transformed communication theory from guesswork into science through the quantitative measure of the effectiveness of communication (Hauben 2000). As John Durham Peters (1999: 23) notes, the new theory brought forth a host of concepts and understandings in a number of sciences like psychology, psychiatry, biology, and therapy. Concepts like feedback, information, coding, storing, signaling, and control became part of the vocabulary in management science, economics, computer science, and communication studies. In fact, this tendency seemed to express a quest for a unifying science, latent since Descartes, as a compensation for the unstoppable differentiation of academic thought.

The enthusiasm about communication research sparked by Shannon's theory paved the way for new ideas about the relationship between

humans and computers in the 1950s, especially at MIT. Licklider, the visionary head of the Information Processing Techniques Office in ARPA in the mid-1960s, turned ARPA's attention in the area of computers away from control and command research and toward communications. The focus on the computer as a machine was transformed into a focus on computer networks. As the ARPA completion report states, "the ARPA theme is that the promise offered by the computer as a communications medium between people, dwarfs into relative insignificance the historical beginnings of the computer as an arithmetic engine" (in Hauben 2000: chap. 7).

Shannon's communication model stresses that what is of importance in terms of communication is whether or not a message that has been transmitted reaches its destination. To calculate the probability of this, Shannon distinguished among signals (which are transmitted), noise (which reduces the signals), channel (which transmits the signals), and messages (which are sent and received). What is critical in this model is the nature of the signaling. If, in relation to the other variables, the signaling or coding is well adjusted, the messages are most likely to reach their destination. But Shannon's model is a model of analog communication. The problem of noise, which analog line switching attempted to solve through introducing ever more efficient exchanges, was approached differently by the ARPA project. Neither perfect transmission of signals nor transmission without noise was imagined. In fact, only by assuming noise could communication and its contingency be understood. Transmission was more realistically handled through redundancy of routing alternatives and the retransmission of packets (perhaps through different routers) until all were received and reassembled into messages. This was possible only through a feedback or error mechanisms that continually informed the sender of the fate of each packet. If transmission was successful, more signals were transmitted. If transmission was less successful, fewer signals were transmitted. In fact, the ARPANET project toned down the aim of perfect transmission as a challenge for computer communication research in favor of tackling problems related to detecting errors and retransmission.

Similarly, from the point of view of social communication, Luhmann argues that communication is not about transmission through the means of a medium, since the sender does not give up anything that the receiver acquires. Furthermore, communication is not about the ability of the sender to get his message across, but about the understanding of the receiver. What is received may be quite different from that which was sent. The identity of a message lies in the *reception* of the message. For Luhmann, communication is not about transmission but a result of three selections: information, utterance (*mitteilung*), and understanding (*verstehen*). Communication emerges only if all three selections are made. Information is the selection of something in the world that can be uttered in some way. Information is the meaning construction of something that potentially can serve as a message. It actualizes something from the infinite latency of human existence. Next, an utterance or message must be selected, which refers to the expression of the information in some distinct fashion, through some language or image, through the telephone or television, etc. An utterance is interpretable as a selection. Only when an utterance is produced does the third selection, understanding, come into play. Understanding refers to the change in the state of the one who receives the utterance. Understanding is a selection based upon a distinction between information and utterance. For more communication to follow, however, the receiver must confirm or manifest herself through some reaction to the information or utterance of the sender. Therefore, there is always something in communication that works to enable new communication (through questions, friendliness, provocations, appeals, etc.). Social systems can reproduce themselves only if communication follows preceding communication. This is precisely the constant challenge for modern communication. It cannot rely fully on moral and normative support, as did communication in traditional society.

Communication is therefore notoriously unreliable and contingent. Luhmann's term "double contingency" refers to the idea that the communication process is open to interruption in at least two places: if the sender ignores selecting information or an utterance and if the receiver fails to select or act on the understanding. Communication may always break down, and in fact, it often does. Contrary to Habermas, Luhmann argues that there is no rationality embedded in communication, only vulnerability. Support for communication is supplied from the environment in the shape of media, culture, and a number of other social phenomena that

society invents to keep itself going. In such a perspective, sociology should not hide in idealized versions of communication but should assume noise. Only with such a realistic approach can sociology be truly critical. In this way, sociology may uncover how communication takes place in spite of its improbability. From a technical point of view, this was the challenge of packet switching and distributed routing. If sociology follows the ideas of the early ARPANET days, I would argue, the sociological emphasis moves away from the intention of the sender and the normative and pragmatic reason of the message toward communication as flow or process, emphasizing the medium that keeps communication going.

Communication and Survivability

More scientifically speaking, what *is* the problem of communication? In an early ARPA memo, Licklider writes: "Consider the situation in which several different centers are netted together, each center being highly individualistic and having its own special language and its own special way of doing things. . . . Is it not desirable or even necessary for all the centers to agree upon some language or, at least, upon some conventions for asking such questions as 'What language do you speak?' At this extreme, the problem is essentially the one discussed by science-fiction writers: How do you get communications started among totally uncorrelated sapient beings?" (in Hafner and Lyon 1996: 38).

Not only is the problem formulated by Licklider essential in science fiction, but it is important for sociology as well. The sociologist might have reformulated it as follows: "How does society enable communication in a world of complexity and contingency, in a world that no longer is morally integrated through the taken for granted–ness of the authority of ancestors, God, or the nobility?" Communication no longer has anything to fall back on but itself. So how is risky and improbable communication made less improbable? Licklider's way of posing the problem (communication as something complex, contingent, and even improbable) stems from multiple sources like Norbert Wiener's cybernetics, various responses to the communication theory of Claude Shannon, and subsequent basic systems research in the 1950s. For example, the notion of feedback suggests not only that sociability implies the constant interplay of viewpoints and arguments, that is, as communication, but also that such a communication-oriented society is an unstable society. As Wiener pointed out in several contexts, the more information, the more *misinformation* and risk of break-down. Let me illustrate some aspects of this understanding of communication with the case of Paul Baran's well-known research on distributed networks, published in a collection of papers in 1964.

In the early 1960s, and as part of the flexible response strategy of the United States during the Cold War, robust and survivable communications networks were a widely recognized ideal. The flexible-response strategy required that political leaders be able to continue to communicate during nuclear crisis. At the Rand Corporation, Baran worked on the problem of combining survivability and high capacity for three years. A central principle in Baran's theory was "distributed communications," the technique of which differed from those of traditional telecommunications systems, which relied on hierarchical layers of exchanges. In the traditional system, each user (phone) was connected to only one local switching node, and each local switching node served a large number of users (Abbate 1999). As opposed to this, distributed communications (or distributed networks) signified many switching nodes and many links attached to each node. The system built in a high degree of network redundancy to make it more difficult to isolate users. Knocking out some nodes could not paralyze the whole network. The improbability of communication through long-distance networks was thereby made less improbable.

The principle of store-and-forward switching, which Baran adapted, made it possible for information to follow different routes to its destination. Each "message block" was labeled with information about addressee and address, and this was passed on from one switching node to another. Baran developed this further into what was to be called *packet switching*. Messages were transmitted in digital form and could be recognized as voice, text, or computer data. They were all binary digits, or bits. These bits were sent in fixed-size message blocks. Each block carried its address as well as other control information. Each block that made up a message was routed independently, and the message could be reconstructed at the local switching node so as to be comprehensible to the receiver.

Baran's point was that this method of packet switching increased the survivability of the network, in that routes could be changed locally

at any moment. There was no central command center, nor were there preset routes of communication. This increased potential survivability, which according to Baran is "a function of switching flexibility" (Abbate 1999: 13). In fact, Baran replaced the well-established principle of reliability with that of "link redundancy," which again would better serve the aim of survivability. Whereas AT&T worked on increasing the reliability of the telephone network (diminishing error rates) by making each switching node as reliable as possible, Baran provided redundancy of lower-quality nodes to compensate for errors.

The principle of packet switching and distributive routing resulted in a design that could work under less than perfect conditions. It did not aspire to perfection, as did line switching. In other words, where communication is vulnerable and often fails, one cannot work for or presuppose ideal conditions. Rather, the role of the system is to make improbable communication possible.

Distributed routing and packet switching signified an entirely new way of thinking about telecommunications. The number-one priority was no longer to reach perfectibility in the switching by working to reduce noise and error rates. Communication was now viewed as something that always was, and always would be, risky and improbable. The ideological climate of the Cold War probably contributed to this idea of communication as something risky. Communication needed a plan B, that is, alternative ways and routes to reach its destination. From a *traditional* telecommunications point of view, communication was something that worked more or less perfectly, and the challenge was to improve all the switches so as to reach a noise-free system. From a *computer* communication point of view, communication was something that would always break down now and again. According to this view, ways should be available to ensure communication under risky conditions. The approach stressed realism rather than idealism, robustness rather than elegance, with emphasis on the workable rather than the perfect.

Like Luhmann's communication theory, this was *not* a view that in any way saw communication as of less importance or value than in other perspectives. On the contrary, this approach implied that in times of crisis as well as in modern civil life, communication is even more important than computing. In times of trouble, the primary purpose for computers would be to support data transmission. Large, high-capacity computer nodes were not imperative, but many computers were. Communication was seen to be too important to be perfect. What was important was that communication work, meaning that in most cases communication is succeeded by more communication.

Baran's *On Distributed Communication* was published in 1964 but did not receive wide attention until the late 1960s. It is interesting that this work was carried out within a military framework and justified by defense-strategic considerations. Military concerns and priorities were the driving forces behind ARPANET throughout the 1960s and far into the 1970s. "The use of new communication media was meant to make it easier to tailor command and control systems to specific military environments. . . . The idea that network protocols should be simple and adaptable derived in part from the military's continued concern with survivability" (Abbate 1999: 144). It is correctly observed that the Internet was not built in response to a market or popular demand, but that "the project reflected the command economy of military procurement, where specialized performance is everything and money no object, and the research ethos of the university, where experimental interest and technical elegance take the precedence over commercial application" (Abbate 1999: 145).

Baran's scenario of a possible nuclear disaster should *not* be seen as an exception to normal conditions of communication, but rather as an extrapolation of the risk that is *always* at play in social communication. This is in accord with Luhmann's sociological perspective, stressing communicative vulnerability, which, so that communication may be sustained, leads to technological and symbolic media, along with culture. Technical media make it possible to maintain communication in a large-scale and globalized world; symbolic media supply communication with language or language games that make understanding a less improbable task. Culture supplies communication with themes, that is, something to communicate about. Also, in contrast to line switching, the structure of packet switching proposed communication as nonhierarchical, symmetrical, and functional.

By linking Baran's ideas to Luhmann's, we may see that the military view of communication (as in constant danger of breakdown) can be re-

garded as applicable to *all* communication. Imagining communication during times of crisis and disaster crystallizes what applies to communication in general but is hidden behind the seeming naturalness of daily life. Communication is constantly subject to "disaster." From this constant threat, two theoretical positions may be identified. The first is the one that hopes and works for a world of perfect communication (socialism, perfect democracy, unrealized modernity). The second considers risk and contingency to be embedded in communication itself and thus seeks to modify damage by backup measures.

Most theories of communication, notably the Chicago school, but basically all humanistic versions of communication, seem to be compatible with premodern features of society (social integration, society as action, norms, values, as a moral whole). Luhmann's theory is one important exception. If we now switch to the technical world, predominant perspectives on communication seem to parallel the traditional telecommunication model of analog line switching (as opposed to digital packet switching), which did not operate with a basic distinction between content and communication. In this view, content (electromagnetic pulses) were to be transported from user to user through a switched network of sufficient quality to keep the noise below a certain level. In spite of the heavy critique that has been directed toward linear models of communication (from Shannon's model onward), from the tradition of human communication, transmission is still what is stressed.

In the ARPANET project, communication was seen as contingent and risky. What mattered was that the packets transmitted reached their destination and formed a comprehensive message. ARPANET did not view communication as following preestablished transmission hierarchies. This enabled the project to come up with ideas on packet switching and distributed network communication among servers, rather than focusing on perfect end-to-end transmission.

Communication in a World of Diversity

Another example of the "letting go" approach of the Internet is the controversies over standardization in the 1980s. The transmission control protocol/Internet protocol (TCP/IP) was the official standard for communication at the beginning of the 1980s, but only one among many others. Its principle on internetworking was new and expressed a quite different view on computer communication from that developed through more authoritative channels, notably the CCITT, which produced the X25 standard in 1976. By the early 1980s, the freely available TCP/IP had been in use for several years, and an international Internet community was already vibrating.

CCITT, a branch of the UN International Telecommunication Union, was dominated by the public telecoms and expressed a tradition of analog line switching. Representatives from the British, French, and Canadian telecoms headed the group that developed the X25 recommendation. Consequently, X25 assumed that one central body would be responsible for the maintenance of the computer networks that the Internet would connect. Whereas TCP/IP assumed that each node in a network would be responsible for its own transmission and that control and error recovering would be functions of the servers, X25 assumed that such a central function would lie in the network, thus within the telecom's operational responsibility. As public agencies, they could not simply delegate important functions to private servers beyond their reach. As a telecommunications recommendation, X25 assumed that the transmitting network could maintain the quality necessary for the transmission. The public telecoms did not want users to operate some of the protocols in the X25. Also, X25 operated with simple gateway solutions, since it assumed that the networks that would be connected were homogenous and would use X25. The existing differences between networks were seen as a problem that would be eliminated by the official standard.

TCP/IP had different preferences. As it was a standard only for those explicitly interested in decentered networking, it did not need to take on public obligations. It simply assumed that the hosts could perform the signaling and control functions, independent of the network itself. It did not assume transmission without errors; on the contrary, it assumed problems to be normal. TCP/IP derived from the computer-based world of risky communication, which emphasized mobility, flexibility, and relatively low investment.

The differences between the two standards were later to be resolved through the OSI model. But the Internet has long since confirmed itself as

drawing on a new and different perspective of computer communication. Communication needs support, rather than impossible dreams of perfection. The Internet has left the old world of homogeneity and, along with it, the notion that standards mean central standards for all steps in the transmission process. Certainly, the controversy over standards can also be seen as a conflict between private initiative and government responsibility and between American and European interests in dominating the telecommunications field. In a more general sense, this illustrates that telecommunications no longer means what some control body defines it as, but that it has become something much closer to communication itself and thus a question of how to independently communicate effectively about everything. The Internet suggests that communication between computers will increasingly be as diverse and changeable as human language itself. One does not regulate oral language: it is up to each one of us to make ourselves understood through the medium of language.

Communication and Agency

If the packet switching of the ARPANET was an answer to the vulnerability and complexity of communication, it also added to these problems. The decision to use packet switching for ARPANET transmissions was a risky one. The technique would increase the uncertainty and complexity of the system design. Communications professionals reacted with hostility to this decision. Packet switching seemed too difficult to be performed reliably and automatically. Another factor that added to the complexity was the great variety of computers that the network was expected to connect. Machines from IBM, DEC, G.E., and UNIVAC were involved, as were unique experimental computers like the ILLIAC supercomputer. Since they were all incompatible, complex programming for accessing data from other computers was required. From a conventional telecommunications perspective, this looked like a severe weakness of the ARPANET design. The heads of the project, however, regarded this as a strength and as a research challenge that would have to be met. The future of networking would be heterogeneous. An architecture designed to accommodate a variety of computer models enabled the Internet design to adapt to an unpredictable future of digital technologies.

The solution to this problem of diversity was to find a way to ignore it! The first step was to decide that all host computers should implement a standard set of rules, called message protocols, for handling network connection. This would help to overcome the problem of incompatibility among different types of computers. But it also created a big complexity problem for the local sites, which had to add these protocols to the various computers. New technical solutions were required.

As Abbate (1999) notes, "the ARPANET's approach to routing reflected its designers' commitment to exploring new techniques and building a high-performance network, even at the price of creating a system that was, at times, difficult to understand and control" (62). Still, the idea of distinguishing between host and communication layers served to reduce complexity. Each of the host computers was attached to a subnet of minicomputers that acted as the host computer's interfaces to the network. It was no longer the hosts but the minicomputers, or interface message processors (IMPs), that would be the nodes of the network and would handle the packet-switched networking. The subnet design created a functional division of labor between switching nodes and the communication (IMPs), on the one hand, and the hosts, which were responsible for the content of the communication, on the other. Communication could now be processed by a single type (or some few types) of minicomputers, which allowed many different hosts to be connected. The ARPANET team began to see the system as being divided into two layers: there was a *communications* layer, consisting of packet-switching IMPs connected by leased telephone lines, and a *host* layer, which would coordinate interactions between host processes and provide user services.

This two-layer model was later to be extended to three and then to more layers. The host layer was later separated into a host layer, which was designed only to set up communications between hosts, and an application layer, which provided specific services like remote log-in and file transfer. This further served to eliminate the need for each specific application to set up host connections, which made it easier to produce applications. It also increased the usability of the network and the resources available. The distinction between host and application layers was later to be abandoned, when the TCP/IP protocol was introduced. But it was the beginning of the idea of differentiating functionally among layers in

digital telecommunications, as in the later ISO model. The success of ARPANET's version of layering made layering a widely used principle in construction of other networks (Abbate 1999: 80), and to a large extent, it is precisely this principle that enables everyone to go on- and offline, to select among a wide variety of applications, and to use a wide variety of terminals. User-friendliness and availability, in other words, rests on the distinction between applications and networking. This distinction allows for the two elements to be linked more flexibly. The system moved from ambitious integration (as in the case of the analog line switching of the PTTs) to flexible compatibility. The point here is that this model was viewed as a way to reduce complexity by making distinctions between content or services and communication (switching and distributed routing). This proved to be the functionally best way to resolve the problems of diversity and complexity to which the choice of packet switching had led.[1]

The novel thinking in the ARPA project with regard to handling computer diversity points to an interesting way of looking at social communication in general, again departing from most humanistic approaches. An exception here is sociological systems theory. One radical conclusion from Luhmann's communication perspective is that humans (psychic systems) belong to the environment of society. Human beings (consciousness, bodies) are not *in* society. As Luhmann often puts it, consciousness can be reproduced only by consciousness (thoughts), and society can be reproduced only by communication. Thoughts enable communication but are not in it. This allows Luhmann to construct a theory of communication systems and to concentrate on communication problems. He does this by asking Licklider's question: how is contingent communication among different people, strangers and over distance, possible in a complex world? What in communication triggers further communication? What error mechanisms are operative? As I have indicated, these are the questions that were asked in the ARPANET project and led to a number of innovative resolutions. The focus was on protocols and mechanisms that enabled repeated messages in case of breakdown. The terminals and their human operators enabled communication, but as we have seen, they were not part of the network as such.

Another approach to this is epistemological: what society is can only be described or observed by someone. At the most general level what society is can only be observed by society itself. Consequently, self-descriptions are always involved. Sociology, for instance (as a discipline dedicated to observe society and located among the disciplines of the sci-ences), produces descriptions (analysis, research) of society in society. Nat-urally, this lack of ontological grounding in an understanding of society leaves us with formidable epistemological challenges. If society is a product of descriptions, then the only meaningful element of society we are left with is these descriptions themselves, hence, communication. Society, then, is the product of all previous and possible communication.

One single human being cannot communicate. Two or more human beings can communicate, or rather, they *enable communication* through their selections of information, utterances, and understandings. As men-tioned, Luhmann views communication as a synthesis of the selections of information, utterance, and understanding. It is important to note that Luhmann moves away not only from a transmission perspective, but also from the sender and, in part, the receiver. The three selec-tions made in communication are produced by the communication itself. Decisions by human beings (utterances, replies, etc.) are executed on the basis of communication. Communication is always an effect of preceding communication.

From this it appears that society is communication and that what is not communication belongs to the environment of society. After all, it makes little sense to say that society consists of human bodies, trees, or computer terminals. Society never catches a cold, never needs insulin, and never thinks. Luhmann asks: Does the society consist of arms, legs of thoughts or enzymes? Does the barber cut the hair of society? Similarly, we may add: Does society work or not work? Does it need to be upgraded? We may be tempted to suggest that it certainly does, but only metaphori-cally. Society cannot but upgrade (differentiate, restabilize) itself through communication.

This view does not indicate a downgrading of the individual, since the environment of society is as important for society as society itself. This means that society is not—is no longer—something of which each individual is a part or of which computers and transmission networks are part. Today, the individual can say yes or no to what the modern society offers if the structural conditions allow it. Modernity signifies the emanci-

pation of the individual from society. The individual may act as if collec-tively involved, but his or her mind may go its own ways. Individuals think, technologies function, and society communicates. Without sustain-able communication, there can be no defense, no commercial activity, no scientific possibilities, and no society. What does not communicate be-longs to the environment of society.

Second-Order Communication

The Internet is a network of networks, and a network of networks of networks consisting of an enormous quantity of terminals and hosts. How many, no one knows. Not even the Internet knows, and it does not need to know. What the Internet is concerned about, so to speak, is that bits reach their addressee. To see this, we need to distinguish between an oper-ative and a monitoring level. As we have seen, the routing of bits in the Internet follows the principle of distributed control. Communication does not simply take place, however; it also monitors itself in that communica-tion. Lost communication is observed, and new communication is retrans-mitted. But the Internet cannot see threats (spam, viruses) that cannot be seen through its inherent monitoring mechanisms.

These points can be traced in Luhmann's theory as well. For Luh-mann, communication always appears as operations and observations. In operations, there are elements in communication processes that produce the system communicatively. But in modern society, communication is also observation. Communication always observes (comments upon, refers to, reacts to, etc.) other communication, as it is always itself observed. Communication always observes other communication, that is, reflection. Society then is communication about communication: second-order com-munication. The human sciences, journalism, politics, and so on contrib-ute to the self-observation and self-descriptions of society. This is intended to add transparency and a clearer view of the horizon of possibilities and alternatives. But this again, of course, furthers new complexity. Through second-order communication, social systems observe themselves. This en-ables some degree of flexibility and control of the increasing complexity in their environments. But social systems cannot see themselves outside their own communication. The system never gets access to its "true nature." In Luhmann's terms, social systems can never see what they cannot see that they cannot see.

World Society from Integration to Couplings

In early 1973, a project on internetworking developed that suggested how the networks initiated or supported by ARPA could be interlinked into what was to appear as one network. The project and the then-established International Network Working Group worked to reach an informal and international agreement on Internet standards. The crucial premise in the project was that digital technology and various networks needed to interconnect if they were to have a central role in the future. Other projects in France, Britain, and the United States worked on similar problems. At a seminar at Stanford University in 1973, Vint Cerf and Robert Kahn introduced what they called the transmission control protocol (TCP), which subsequently became the standard host protocol on every network built by ARPA. The protocol deviated from the ARPANET solution in that more advanced error recovery mechanisms were introduced. It also revised the two-level model involving a host layer and a communication layer. The new solution was motivated by the fact that if the number of networks in the ARPANET were to increase substantially, the internetworking would break down without a common protocol. The TCP would also create the illusion of one network, which would facilitate the network's use. As British Internet researcher Donald Davies noted in the 1960s, user-friendliness is all about simulation. To this we may add that a user interface simulates communication as easier than it is.

As a solution to what was called the multiple-network problem, the Internet ended up embodying the idea of open-architecture networks. The architecture of the Internet does not dictate the choice of individual networks but enables internetworking with other networks through a meta-level (Leiner et al. 1997). This move to open architecture signified the beginning of the end of ARPANET and the beginning of an Internet that allowed for other networks to link up.

The innovation of TCP marks another step toward loosening up elements of the network to rely on a more flexible and independent system. The choice of packet switching and distributed networking was the

first such step. The host-IMP distinction was the second, and the interconnection of dissimilar packet networks was another. At the time, the world of networks was already becoming rather diverse; there were different solutions operating in France and Britain. The question was no longer how to integrate several networks into one, but how to transmit computer data on heterogenous networks without requiring substantial changes in the networks. This was a formidable challenge. As Ronda Hauben (2000) comments: "Different networks mean that there can be different packet sizes to accommodate, different network parameters such as different communication media rates, different buffering and signalling strategies, different ways of routing packets, and different propagation relays. Also dissimilar networks can have different error control techniques and different ways of determining the status of network components" (note 16). The question was: how could network architecture allow such diversity?

This was the "Hobbesian" question posed within the world of information science, and the answer was not to give all power to a Leviathan in the shape of telecommunication giants. Nor was it to impose impossible demands about normative order and homogeneity of terminals or common-user-interface regulations. Rather the answer was autonomy and coupling in the shape of a common network communication protocol created by the Network Working Group. The open-architecture environment meant that each distinct network was independent of the others. There was no global operations control (Leiner et al. 1997). Second, if a packet did not make it to its destination, it would not be reconstituted by the network, but simply retransmitted from the source. Third, black boxes (gateways, routers) connected the networks, without interfering with the particular flows of bits that they transmitted. Gateways connected two or more networks and allowed packets to pass from one network to another. They relied on local networks to handle information about the overall network and about changes in other networks. Gateways were another mechanism that emphasized the distributive character of the Net by localizing particular functions to particular elements of the network, and so reducing, or rather controlling, the complexity that emerged from the growth and diversity of technology.

Host addresses were introduced. These specified the name of a particular network and the host in that network. This enabled packets to be directed to a particular host. The address system facilitated the division between the networks and the gateways (Abbate 1999: 129). Later, in 1978, the TCP protocol was further differentiated into two separate parts, one host protocol (TCP), and one Internet protocol (IP), which made the system more robust and simplified the connection of new networks. The successful connection of ARPANET with the two other packet-switched networks PRNET and SATNET in 1977 represented the beginning of the Internet as an operating internetwork.

Today, the Internet can be seen as a global distributed system of interconnected networks allowing a wide range of communication sequences to occur and at the same time supervising, controlling, or monitoring this communication to maximize the success of transmissions. Read sociologically, the Net seems to suggest a society consisting of mutually autonomous, operatively closed systems—social systems that reproduce themselves—that are not morally integrated as in premodern times, but simply coupled through structural couplings. The Internet suggests a global society of societies without global control. It suggests a world communication system of outdifferentiated systems (networks) and a system of systems of systems that are no longer normatively integrated into one overarching structure but interlinked through gateways.

Conclusion

I have, by means of brief, historical illustrations, suggested in this chapter that the Internet, if read sociologically, can be viewed as a guide to *a distributed society*, to draw upon Baran's term. I have argued that sociological systems theory may be what the Net itself "recommends" if read as a sociological model. This may not be very surprising, as Luhmann explicitly develops his work from general systems theory (von Bertalanffy) cybernetics (von Foerster) and also theory of living systems (Varela, Maturana). Historically, general systems theory and cybernetics in particular constitute a common ground for sociological systems theory and for understanding the ingenuity of the pioneers of ARPANET and the Internet. This again may suggest that systems theory is a promising way to go for a sociological understanding of the Internet and society. To put this somewhat boldly, the creation of the ARPANET can be seen as a way of resolving the incompatibility between the traditional line switching of the telephone network and the then-emerging world of circuit technology in computers. Similarly, sociological systems theory may serve as a body of sociological thought resolving the incompatibility between humanistic, agency-oriented sociology and the modern, complex world society of self-referential communication.

In spite of this metaphorical thinking, interplaying autopoietic systems and the Internet, it is essential not to confuse technical and social realms. We should not compromise with regard to technological concepts that in themselves have no place in descriptions of human communication (homeostasis, feedback, control), forcing upon us an image of society as a technological system. Conversely, I do *not* consider the Internet to be a social system. Whether the Internet should be regarded as a technical system, I shall leave to others to debate more fully. I have simply argued that the Internet suggests that society should be observed as a social system of social systems. Internet design indicates a sociological systems perspective, which stresses communication rather than action, differentiation rather than unity, structural couplings and compatibility rather than normative integration. It suggests that society is a world society.

I have limited my discussion to the symbolic side of the Internet and considered only its plausibility as a map or design for a sociological theory of society, this in order to reach at a constructive platform for understanding of the actual role of the Internet in society. As all sectors of society increasingly put information and communication on the Internet, the role of the Net needs to be studied both in terms of general theory and with empirical specificity. Both the Internet and society are consequences of historical contingencies, as well as of evolution. Both the Internet and society could have been different under different historical conditions. Yet neither technical media nor society could avoid being faced with ever more complexity, communication, difference, and instability that in one way or another needed to be handled. One of the reasons that the Internet may serve as an adequate model of society is precisely that it has developed in response to the general, functional differentiation of society.

The background for the widespread adoption and diffusion of the Net can be understood in terms of its compatibility with modern society.

The Internet developed through processes of functional differentiation in its technical world in ways that are reminiscent of the turn to functional differentiation in the social world and that made the world modern. As a technical system, telecommunications had from the start a social and human environment that it developed in relation to. This cannot be truly understood, however, unless we think of the modernization process as an evolution of communication. It seems to me that we need to reconsider some controversial ideas in sociology associated with concepts like evolution, society as a system of communication systems, autopoiesis or self-reference, and second-order cybernetics. Sociology needs to overcome its system phobia to understand what transforms society today.

In the context of Luhmann's sociology, I think the Internet can be viewed as a category of technical dissemination media that *mediates* system communication (organizations, personal interaction, or function systems like science, politics, or art). It mediates all kinds of communication, from children's games, financial markets, journalism, and artistic experimentation to scientific publication. From here I think sociology should begin its observations of the Internet. Similar to what Luhmann calls generalizable symbolic communication media (truth, power, money, love, trust, etc.), the Internet is a set of media that manipulate system communication in time and space. An important question, then, is how the Internet influences the various kinds of communication in its temporal, social, and topical dimensions of meaning. Through its speed, multimediality, hypertextuality, interactivity, and so on, the Internet favors certain communication patterns and discourages others.

We live in a world society with tremendous capacities for both personal and impersonal relationships, because it has become possible to communicate with people around the world about all kinds of topics, through a wide variety of media. As Luhmann (1998c) writes, society "affords more opportunities both for impersonal and for more intensive personal relationships. This double adaptive capacity can be further expanded because present society is, as a whole, more complex, can more effectively regulate interdependencies between different forms of social relations and is better able to filter out potential disturbances" (13). Technical and symbolic media of communication have developed that allow for innumerable networks, independent of knowledge of the individuals involved, their social status, their social context, morality, integrity, and so on. Luhmann continues: "Never before has a society exhibited such improbable, contingent dependencies, which can neither be held to be natural, nor interpreted solely on the basis of one's knowledge of other people" (13). Right here, the world society engages the Internet in the transformation of itself.

Note

1. It is also interesting to note that the technique of layering became a way to manage social relations in addition to its function of reducing technical complexity. Abbate (1999) notes that "designing a subnet to operate independent of the hosts made the network more robust, eased the technical task of the BBN [Bolt, Beranek, and Newman] team and allowed the team to maintain control over the design and operation of IMPs" (63). Thus this indicates another form of compatibility, that between the technical and the organizational aspects of the project. A model that stressed function distinctions in the network also became a way to sort out organizational matters.

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