analysis of hedonistic and consumerist modernity as the horizon of human happiness (the first volume was published in 1947, the second in 1962, and the third in 1981). Mills and Lefebvre concurred in denouncing the alienation in societies represented by the superpowers on both sides of the Iron Curtain.

3 *Information Theory*

The mathematical theory of communication played a crucial role in the transposition of models from the exact sciences to the communication field. The notion of 'information', based on communication devices developed during World War II, definitively took on the status of a calculable symbol. It thus became the 'strong currency' which allowed for free conceptual trade among disciplines.

1 Information and system

Shannon's formal model

In 1948, the American scholar Claude Elwood Shannon (born in 1916) published a monograph entitled *The Mathematical Theory of Communication* as part of the research produced by the laboratories of Bell Systems, a subsidiary of the telecommunications firm American Telegraph & Telephone (AT&T). The following year, this monograph was published by the University of Illinois, along

with the comments of Warren Weaver, who had coordinated research on large calculators during World War II.

Shannon, a mathematician and electrical engineer, had joined Bell Laboratories in 1941 and worked on cryptography there during the war. His work on secret codes helped develop the hypotheses found in his mathematical theory of communication.

Shannon proposed a framework for a 'general system of communication'. In his view, the problem confronting communication was 'to reproduce at a given point in an exact or approximate way a message selected at another point'. In this linear schema with poles indicating the beginning and end of the process, communication is based on a chain of constituent elements: the source of information which produces a message (such as speech on the telephone); the encoder or transmitter, which transforms the message into signals allowing transmission (e.g., the transformation of the voice by the telephone into electrical oscillations); the channel, which is the means used to send the signals (e.g., the telephone cable); the decoder or receiver, which reconstructs the message from the signals; and the destination, which is the person who or thing that receives the message. Shannon's aim was to outline a mathematical framework which would make it possible to quantify the cost of transmitting a message or communication between the poles of the system in the presence of random disturbances designated as 'noise', which were undesirable because they prevented 'isomorphism' or complete correspondence between the two poles. In order to make the communication process as inexpensive as possible, the transmission was to take place using the least expensive possible conventional signals.

This theory was the outcome of research begun in the 1910s by the Russian mathematician Andrei Markov in his theoretical study of chains of symbols in literature. In 1927, Ralph V.L. Hartley further developed the theory in the United States by proposing the

first accurate measurement of information about the transmission of symbols – the forerunner of the bit (binary digit) and the language of binary opposition. In 1936, the British mathematician Alan Turing designed a machine capable of processing this information. Shannon's theory was also preceded by the work of John von Neumann, who helped build the last large-scale electronic calculator prior to the computer. The computer was developed between 1944 and 1946 in response to the US Army's search for a means of measuring ballistic trajectories, and through the work of Norbert Wiener, a former teacher of Shannon and the founder of cybernetics, which he defined as the science of command and control.

Whether the communication process involves relations among machines, among biological creatures or within social organisations, it follows a linear pattern that makes it a stochastic process, that is, a process affected by random phenomena occurring between a transmitter that is free to choose the message to be sent and the destination that receives the information with its constraints. This was, in any case, the view that researchers in many disciplines quickly adopted once Shannon's book was published. They borrowed his notions of information, transmission of information, encoding, decoding, recoding, redundancy, disturbance and free choice. With this model, the social sciences adopted the assumption of the neutrality of the 'transmitting' and 'receiving' instances. The information source, the starting point of communication, forms the message, which is transformed into 'information' by the transmitter, which codifies it and sends it on to the other end of the chain. What interested Shannon was the logic of the process. His theory in no way takes into account the meaning of the signals, in other words, how they are understood by their receiver, or the intention behind their transmission.

This conception of the communication process as a straight line

between a starting point and a point of arrival was to influence very different and even radically opposed schools and currents of research on the means of communication. It was the underlying assumption of all functional analysis of 'effects' and profoundly influenced structural linguistics (see Chapter 4.2). The new complexity that the sociology of the media progressively brought to this formal model by introducing other variables (see Osgood et al., 1957; Westley and McLean, 1957; Berlo, 1960; Schramm, 1970) continued to respect this beginning-to-end schema. These variables refined but did not essentially change the model, in which 'communication' was taken as self-evident or a given.

Shannon's final model generated an approach that reduced technology to the level of an instrument. This perspective made it impossible to formulate any conceptual framework in which technology was defined in terms other than calculations, planning and prediction.

The first-generation systems approach

The emergence of the notion of 'information' cannot be dissociated from biological research. When Shannon formulated his mathematical theory of communication, the field of biology had just begun incorporating the vocabulary of information and codes. In 1943, Erwin Schrödinger (1887–1961) used it to explain the models of individual development contained in chromosomes. Since then, the organising power of the information analogy has been a part of every major invention in this field: the discovery of DNA as the basis of heredity by American scientist Oswald Avery in 1944; the demonstrations of its double-helix structure by biologists Francis Crick in Great Britain and James Watson in the United States; and research on genetic codes carried out by the three 1965 French Nobel prize-winners, François Jacob, François Lwoff and Jacques

Monod. In formulating his theory, Shannon had clearly borrowed from the biology of the nervous system. In turn, the mathematical theory of communication provided specialists in molecular biology with a conceptual framework to account for the biological specificity or uniqueness of the individual (Jacob, 1970).

In 1933, in a work entitled *Modern Theories of Development*, biologist Ludwig von Bertalanffy laid the foundations for what he would later formalise 'systems theory', whose principles provided a tool for strategic action during World War II. Bertalanffy used the term 'function' to refer to 'vital or organic processes insofar as they contribute to the maintenance of the organism'. Thus, both the systems and functionalist approaches shared the same basic concept: that of function, indicating the primacy of the whole over its parts.

The aim of systems theory was to understand the totality and the interaction between elements rather than linear causal sequences, and to grasp the complexity of systems as dynamic wholes made up of many changing relationships.

Political science was one of the first disciplines in which systems theory was applied to questions of mass communication. Political life was considered a 'system of behaviour'; the system was seen as distinct from its social environment and yet open to its influences. The variations recorded in the structures and processes within the system could be interpreted as efforts made by various parts of the system to regulate and cope with tensions coming either from the environment or from within the system; the system's capacity to control those tensions depended on the presence and type of the feedback received by political actors and decision-makers. Politics was viewed as a system of input and output, shaped by interaction with the environment, which responded by adapting itself with greater or lesser success. The responses of the system depended on the speed and accuracy with which information was collected

and processed. This description of the systems approach was used by US political scientist David Easton in *A Framework for Political Analysis* (1965), a work testifying to the rise of information as a research tool in the comparative study of political systems. Another US political scientist, Karl W. Deutsch, had begun the process of appropriating information theory in the early 1950s by applying it to international relations (*Nationalism and Social Communication*, 1953). Ten years later, he presented another application of systems theory in *The Nerves of Government: Models of Political Communication and Control*.

Researchers more directly known as theoreticians of mass communication and public opinion were the next to discover the advantages of the systems model, which they applied in studies on the process of political decision-making (Lasswell, 1963; Bauer et al., 1964). The practical aim of these studies was to develop an operational understanding of some of the stakes of the Cold War: the balance of power, collective security and world government. The pressure for practical expertise was so strong that Ithiel de Sola Pool, a professor at MIT, was called upon by the Pentagon to develop a model for counter-insurgency strategies in Southeast Asia and Latin America. It was known as 'Agile-Coin', 'Coin' being the contraction of 'counter-insurgency'.

Other spin-offs of the systems model were less determined by the international context. In the same period of the 1960s, for example, Melvin De Fleur used it to increase the complexity of Shannon's linear diagram by bringing to the fore the role played by feedback in the 'social system' made up of mass communication means as a whole. 'Each medium', he postulated, 'is an independent social system in itself; but taken as a whole, the media are linked to each other in a systematic way' (De Fleur, 1966). Each of these entities is represented as having two sub-systems, responsible respectively for production and distribution; each includes a

constellation of actors with their various 'role systems'. Among the actors were to be found, in particular, advertising agencies, market-study and audience-rating companies, and organisations for regulation and arbitration. The maintaining of 'system balance' was seen to condition the content. In the first half of the 1970s, Ithiel de Sola Pool further developed systems theory by applying it to the analysis of new scenarios for organising political life made possible by the development of cable television technology (Pool, 1974).

In France, Abraham Moles (1920–92), an engineer and mathematician, placed his theoretical project for 'an ecology of communication' under the banner of both Shannon's mathematical theory and the analyses of Norbert Wiener. Communication was defined as 'the action of making an organism or system located at a given point R partake in the experiences (*Erfahrungen*) and stimuli of the environment of another individual or system located in another place and time, by using the items of knowledge they have in common'. The ecology of communication is the science of the interaction of different species within a given field. The 'varieties of communication, whether close or remote, fleeting or recorded, tactile or aural, personal or anonymous, are varieties that actually react towards each other within the closed space of twenty-four-hour daily life or the social space of the planet' (Moles, 1975). Such an ecology should have two different branches. The first would take as its unit the individual being and be concerned with the interaction of its modes of communication in the temporal sphere, or sphere of time assessment, and its spatial sphere, referring to movements in a given territory. The second branch would refer to the organisation of systems of transaction between beings, the formation of connections within the logosphere, the conditioning of the planet by the many channels that put messages into circulation and the sedimentation of those messages in places of recorded memory such as archives and libraries.

2 Cybernetics

Entropy

In 1948, the year in which Shannon published the first version of his theory, his former professor, Norbert Wiener, published *Cybernetics or Control and Communication in the Animal and Machine*. In this work, he offered a glimpse of the organisation of future society based on what he claimed would soon be the new raw material: 'information'. While he looked forward to the realisation of the new ideal of an 'information society', which he called a 'new utopia' (Breton and Proulx, 1989; Breton, 1992), he nevertheless warned against the danger of its being perverted. Entropy, nature's tendency to destroy what is ordered and precipitate biological deterioration and social disorder, constituted the main threat. Only information, the machines that process it and the networks they weave can fight the tendency towards entropy. 'Just as the amount of information in a system is the measure of its degree of organisation,' wrote Wiener, 'so the entropy of a system is the measure of its degree of disorganisation; one is simply the negative of the other.'

Information must be able to circulate. The information society can only exist if there are no obstacles to exchange. It is by definition incompatible with embargoes or secrets, unequal access to information or its transformation into a commodity. The advance of entropy is directly proportional to the decline of progress. Contrary to Shannon, who refrained from any commentary on the evolution of society, Wiener, still in shock from the return to barbarianism represented by World War II, denounced the dangers of entropy and irrevocably condemned 'anti-homeostatic factors' in the form of tightened control over the means of communications in society. 'That system which more than all others should contribute to social homeostasis', he wrote, 'is thrown directly into the hands of those most concerned in the game of power and money.'

The 'Invisible College'

In the 1940s, a group of American scholars from disciplines as diverse as anthropology, linguistics, mathematics, sociology and psychiatry adopted a position diametrically opposed to Shannon's mathematical theory of communication, which was coming to be accepted as the reference in the field. The story of this group, known as the 'Invisible College' or the 'Palo Alto School' (named after a small suburb of San Francisco), began in 1942 under the impetus of anthropologist Gregory Bateson, who joined forces with Birdwhistell, Hall, Goffman, Watzlawick and others. Turning away from the linear communication model, they started from the retroactive, circular model proposed by Norbert Wiener. They asserted that the mathematical theory should be left to the telecommunications engineers by whom and for whom it was designed whereas communication should be studied by the social sciences using their own model. Yves Winkin has summarised the novelty of their position quite well:

> According to [the Palo Alto School], the complexity of even the smallest situation of interaction was such that it was impossible to reduce it to two or three 'variables' operating in a linear fashion. Research in communication had to be conceived in terms of levels of complexity, multiple contexts and circular systems. (Winkin, 1984)

In this circular vision of communication, the role played by the receiver is just as important as that of the transmitter. Using concepts and models taken from the systems approach as well as from linguistics and logic, the Palo Alto team tried to account for

the overall situation of interaction and not merely study a few variables taken in isolation. They developed three hypotheses. First, the essence of communication resides in relational and interactive processes (the elements themselves are less important than the relationships between the elements). Secondly, all human behaviour has communicative value (relations, which respond to each other and mutually imply each other, may be seen as a vast system of communication); by observing the succession of messages taken in their horizontal context (the sequence of successive messages) and their vertical context (the relation between the elements and the system), it is possible to arrive at a 'logic of communication' (Watzlawick et al., 1967). Finally, psychiatric disorders are a sign of disturbed communication between individuals who carry the symptoms and the people around them.

The notion of isolated communication as a deliberate, conscious, verbal act, which underlay functionalist sociology, was replaced by the idea of communication as an ongoing, social process involving a number of behavioural modes: speech, gestures, facial expressions and the physical space between individuals. The Palo Alto researchers studied gesture (kinesthetics) and interpersonal space (proxemics) and showed how mishaps in human behaviour reveal problems in the social environment. Analysis of context took the place of the analysis of content. Communication was understood as an ongoing process occurring at several levels, and in order to grasp the meaning emerging from it, researchers had to describe the way the various modes of behaviour operate in a given context.

In 1959, Edward T. Hall, a member of the group, published his first work, entitled *The Silent Language*. He based his approach to the difficulties of intercultural communication on personal observations in the field as an officer in a regiment of African-American

soldiers during World War II, and, later on, as a trainer of diplomatic personnel. Laying the foundations for proxemics, Hall's book highlighted the various languages and codes, the 'silent languages' that characterise every culture: the languages of time, space, material possessions, modes of friendship and of reaching agreement. All these informal languages are the source of 'culture shock', the incomprehension and misunderstanding arising between people with different codes, who, for example, attribute different symbolic meanings to the rules of spatial or temporal organisation.

It was not until macrosociological models came under fire in the 1980s and sociologists returned to the analysis of proximity that the decisive contribution of all the members of the Palo Alto School to the theory of communication as interaction was finally recognised.

'One cannot not communicate'

In 1977, Paul Watzlawick discussed the meaning of some of his analyses in an interview with Carol Wilder, published in the *Journal of Communication* (vol. 28, no. 4, 1978).

Wilder: The first axiom in *Pragmatics* – 'One cannot not communicate' – has a fine aesthetic ring to it and brings to mind some of the tacit dimensions of communication, but some have argued that it expands the boundaries of what constitutes communication beyond any useful or meaningful grounds.

Watzlawick: Yes, this has been said. And it usually boils down to the question: 'Is intentionality an essential ingredient of communication?' If you are interested in the exchange of information on what we call the conscious or voluntary, deliberate level then, indeed, the answer is indeed 'Yes.' But, I would say, if you take

our point of view and say that all behavior in the presence of another person is communication, I should think you have to extend it to the point of the axiom.

To give you an example, many years ago I was at a symposium on communication in the Rocky Mountains. It took place in a resort composed of bungalows and every bungalow had two rooms. The dividing wall was rather thin and a dear friend and colleague of mine was in the adjoining room. After lunch one day I went to take a nap, but I wasn't sleeping yet when I heard him come into his side. And then he began doing something that sounded as if he was doing a little tap dance. I realized he didn't know I was in my room, but this behavior enormously influenced mine because I realized that he must have been thinking he was alone. As a consequence, I had to lie very still until he left again, because if I had moved he would have been very embarrassed. So in that situation there was an absolute lack of intentionality, but, so far as I was concerned, an enormous impact upon and restriction of my behavior.

Wilder: Then perhaps I could ask the converse question: Is there any behavior that you would not characterize as communicative?

Watzlawick: Well, if there's nobody around, you are up against the old question: 'Does the tree that falls in the wood make a noise if there's nobody to hear it?' For communication to take place, there has to be at least one other person. Yes, I would have to agree that there is such a thing as communication with what the psychoanalysts would call 'introject'. I can have a dialogue going on in my mind with a significant person in my life. But for the purposes of our work, I would rather stay away from researching it. Not because I don't think it exists, but rather because I don't think it can, in any reasonable sense, be

utilized or measured or investigated. I know it's a coward's way out, but there you are.

You see, when I talk about these things, I talk about them as somebody who wants to do therapy. I'm not primarily interested in the purely esoteric aspects of something. What interests me is its usefulness.