9 The Expanding Memory

In the preceding chapter we considered the uniquely human phenomenon of exteriorization of the organs involved in the carrying out of technics. In that context it is not without interest to review the problems that arose when machines began to be endowed with the properties of a nervous system and a preestablished "consciousness" of their actions. The question of the relationship between the species and the ethnic group again arises in this context, but this time it does so in terms of instinct, intelligence and "artificial intelligence" or species-related memory, social memory, and "mechanical memory." To discuss a machine in the same way as a living organism may seem unwarranted. To do so from a purely zoological standpoint would be pointless, but some purpose is served, I think, by taking such an approach within an ontological perspective. We can then dispense with fractionating the human by choosing only those pieces that correspond to scientific systematology. Had Descartes, who opposed the human being as the embodiment of intelligence to the animal as a "machine," known about present day electronics, he might well have spoken of the machine as an "animal." From a different point of view, we can refer to the obscure fantasies of the bulk of humankind. Reduced to their bare bones, the plots of newspaper cartoons and comics the world over always involve the same three characters beast, man, and robot; where the cartoons are American inspired, the evolutive progression is, revealingly enough, the following: bison, gorilla, cowboy, scientist, astronaut, robot. Each of the main stages beast-man-thinking- machine leads on to the next via the transitional stages of the thinking beast (gorilla), man-as-muscle (cowboy), man-as-brain (scientist), man-as-machine (astronaut), and machine-as-man (robot). That being so, the question arises whether the collective imagination might serve as the source for a classification that would help us to understand the evolution of the human community.
258

We have already commented on the fundamental fact relating to human memory: Like tools, human memory is a product of exteriorization, and it is stored within the ethnic group. This is what distinguishes it from animal memory, of which we know little except that it is stored within the species. Animal, human, and mechanical memory differ from each other in some essential respects. Animal memory is formed through experience within narrow genetic channels prespecialized by the species, human memory is constituted through experience based on language, and mechanical memory is constituted through experience within the channel of a preexisting program and of a code based on human language and fed into the machine by a human being. Mechanical memory is not without some points of resemblance to animal memory: A kind of species-related preconditioning exists in all types of machines, but the operating program is dictated in a wholly instinctive manner because it materially preexists the action, whose every twist and turn is plotted in advance. Seen in this light, the machine comes a good deal nearer to the standard definition of instinct than does the animal itself.

Within a functional perspective, then, the three forms of memory can be regarded as distinct but comparable. Human inherited memory is preexistent within the genetic group, and the reason why human beings do practically nothing "by instinct" is that, unlike animals, they have not received a hypothetical atavistic memory. The animal's experience uses a small keyboard that has been tuned in advance, leaving practically no room for personal variants, whereas human beings have a large keyboard at their disposal and can assimilate and embroider upon the many series of programs handed down to them by society. Seen from this angle, mechanical memory is half way between the two in that the electronic machine uses only a small keyboard but receives an "education" in the form of the programs dictated to it.

Transmission of Programs

The history of the collective memory can be divided into five periods: that of oral transmission, that of written transmission using tables or an index, that of simple index cards, that of mechanography, and that of electronic serial transmission.

Oral Transmission

A group's body of knowledge is the basic constituent of is unity and is personality. The transmission of this intellectual capital is the necessary precondition for the group's material and social survival. Transmission is effected through the same hierarchy as operating sequences.
[p 258]
259

Mechanical operating sequences are part and parcel of the common memory of families. They are performed in all material and moral episodes of daily life and are recorded in the personal memory of individual during childhood by means of processes in which the role of language is not necessarily the most important. The same cannot be said of less frequent or exceptional practices that, in all societies without writing, are stored in the memory of specialists elders, bards, priests, who in traditional human groups discharge the highly important function of maintaining the group's cohesion.

The recording of knowledge is connected with the development of oral literature and of figurative representation in general; it will be dealt with in part III. In the most general sense practical, technical, and scientific knowledge is rarely recorded in literature of any kind, although it normally forms part of a context in which magical and religious matters are not clearly separated from practical ones. In agricultural societies and so far as artisanal tasks are concerned, the social structuring of crass plays an important role: This applies as much to the blacksmiths of Africa and Asia as to European corporations before the seventeenth century. The training of apprentices and the preservation of craft secrets are taken care of within each of the ethnic group's social cells. At this level, which is that of primitive peoples as well as of quite recent agricultural societies, the contents of technical memory are not systematically organized in anyway. To put it more precisely, each group of operating sequences or each sequence forms a more or less independent whole including actions to be copied as well as oral instructions.

Early Written Transmission

Writing did not spring into existence by chance; after thousands of years of maturing in systems of mythographic representation, linear notation of thought emerged together with metals and slavery (see chapter 6). Nor were the initial contents of linear notation a matter of chance: They were accounts, records of debts owed to gods or to others, series of dynasties, oracular pronouncements, lists of penalties. The limited and very poorly documented nature of the earliest texts is a constant source of disappointment to the ethnologist: How much more we would know if the Sumerians had left us some cookery recipes, hints on etiquette or woodworking, or metalworking manuals! But in point of fact it is unimaginable that writing should have been invented for such purposes, traditionally consigned to oral memory. The first concern of evolution is with the new, and in order to be felt as "new," early metallurgy itself would have had to fail completely outside the scope of existing
[p 259]

260

mechanical practices. It would have had to be an exceptional operation unconnected with any established gestural sequence, which a manufacturing technique clearly could not be. Or else writing would have had to mature without an object for centuries in order to acquire the means of recording what had only recently become suitable material for notation, as unlikely a hypothesis as the earlier one. The collective memory would not have broken out of is traditional cycle at the birth of writing except in order to deal with matters that in a nascent social system were felt to be of an exceptional kind. Therefore it is not by chance that what was written down was not what is made or experienced in the normal course of evens but what constitutes the very bones of an urbanized society where the nodal point of the autonomic system is the interchange between producers be they celestial or human and rulers. Innovation was concerned with the upper end of the system and selectively encompassed financial and religious acts, dedications, genealogies, the calendar -those things within the new structures of the city that could not be completely consigned to memory either through gesture sequences or through products.

Only a few characteristic elements of science in is infancy were consigned to written memory. The earliest references of this order, whether in Mesopotamia, Egypt, China, or pre-Columbian America, relate to the calendar and to distances. Primitive peoples before the settlement of agriculture did not lack knowledge about time and space, but both of these took on a new meaning from the moment when the capital city became the pivot of the celestial world and of humanized space.

As the instrument for storing words and phrases in the memory of generations became more efficient, the keeping of records developed and spread to deeper strata of knowledge. But even in classical antiquity, the sum total of facts that could be transmitted to future generations was limited by the hierarchy of social values to certain well-defined areas: religious, historical, and geographical texts, together with philosophy, accounted for the main bulk of written material. In other words, the basic theme was the connection between the divine and the human, and within that framework the material to be committed to memory concerned the threefold problem of time, space, and the human being. Agriculture cropped up in poems whose main subjects were the seasons, and architecture in descriptions where cosmic space was identified

with palaces and temples. Mathematics and music, emerging at the same time as medicine, were the first scientific subjects in the full sense of the word, but they too were haloed with magic and religion.
[p 260]
261

Finding One's Way Around a Text

Until the invention of printing, in the West as in China, the distinction between oral and written transmission is difficult to draw. The main body of knowledge was buried in oral practices and in techniques. Only the uppermost part of knowledge, is framework unchanged since antiquity, was set down in writing, to be reamed by heart. During the centuries that lay between Homer or Yu the Great and the first western or oriental printed manuscripts, the concept of reference developed together with the growing mass of recorded facts. But each piece of writing was a compact sequence, rhythmically broken up by seals and marginal notes, around which the readers found their way like primitive hunters by following a trail rather than by studying a plan. The spoken word had not yet been converted into a system of orientation tables. We saw earlier that the conversion of the two-dimensional mythogram not reducible to a phonetic phrase into a linear series of alphabetic signs represented the freeing of speech and at the same time a certain restriction of the individuals symbolizing power: With the advent of printing a further conversion, soon to become indispensable because of the abundance of texts, began to take place.

The texts set down in ancient or medieval manuscripts were intended to be committed to the reader's memory for life, at least firmly enough to enable readers to find their way around the manuscript with ease. There was also of course written material of a more mundane kind letters and contracts, just as in the earliest days of writing but involving larger sections of the population but these were kept in the possession of the persons concerned or of notaries, and practical problems of orientation did not arise. The same is by no means true of printed matter, which soon went beyond the range of traditional subjects. Readers not only obtained access to an enormous collective memory whose entire contents they could not possibly register but were also frequently confronted with new material. A process of exteriorization of the individual memory then began to take place. The work of finding one's way around printed material was done from outside. For centuries, dictionaries and glossaries had offered some possibilities of orientation; Chinese writing with is phoneticized mythograms, as well as the Greek and Latin scripts, had provided readers with means of orienting themselves along the traditional thread of successive ideographic or phonetic signs. But the dictionary provides only a narrow outlet for written memory, a form of knowledge that is both linearized and fragmented and therefore incompatible with the processes of sustained thought.
[p 261]

262
The eighteenth century in Europe marked the end of the ancient world in printing as well as in technology. It saw the old tradition at is richest as well as the first stirrings of the process of change still going on today. Within the space of a few decades the social memory had engulfed in books the whole of antiquity, the history of the great peoples, the geography and ethnography of a world now definitely acknowledged to be round, philosophy, law, the sciences, the arts, the study of technics, and a literature translated from twenty different languages. The ever-widening stream still flows today, but at no moment in human history did the collective memory dilate more rapidly than in the eighteenth century in Europe. This is why all possible methods of equipping readers with a preconstituted memory were already to be found at that time.

The dictionary reached its limits with the encyclopedias of every kind that were published for the use of manufacturers or artisans as well as of pure scholars. In the latter half of the eighteenth century, technical literature began to flourish. Every subject was explored, and the descriptive vocabulary still in use today began to form. The dictionary is a highly developed form of external memory in which thought is broken down into an infinity of fragments; the "Great Encyclopedia" of 1751 is a series of short manuals encased in a dictionary. The level of the art of documentation was then as high as that of mechanical animation: The automaton reached is peak when actuated by separate cams that endowed each of is organs with a fraction of memory; the encyclopedia is a fractional alphabetically arranged memory each of whose isolated mechanisms contains an animated part of the whole of memory. The relationship between Vaucansson's automaton and the French encyclopedia is contemporary was the same as that between today's electronic machine and integrated memory.

In sequentially arranged works the eighteenth century made use of practically every known method, in particular the medieval method of the marginal note (which still survives today) in order either to sum up a paragraph or to provide references, with the latter being more often consigned to footnotes. An alphabetic index at the end of the volume, already fairly common in the sixteenth century, became an almost standard

feature.

The most interesting development from our point of view was the direct opposite of alphabetical indexing and affected the contents of the work as a whole. As early as the Middle Ages, and more or less universally from the sixteenth century onward, the margins of a book had served to provide summaries of the contents of each page or paragraph, and a brief list of contents had been supplied (without pagination) at the beginning of the volume. Little by little book presentation began to be organized

[p 262]

263

in such a way as to help readers find their way around an unfamiliar volume. That is exactly the function of an external memory. The process took place along two tracks, each developing until the early twentieth century. One consisted in having each chapter preceded by a summary, the other in including a table of contents before or after the main body of the work. The former was a residue of the old attitude whereby a considerable personal memory input was expected from readers and, barring a few exceptions, has today disappeared. A summary at the head of each chapter after a list of contents at the head of the volume was a logical stage in the detailed discovery of the volume's contents, but the trend has been to turn the table of contents into something resembling a mythogram a significant assembly of symbols in which the eye and the intelligence are not obliged to follow the rectilinear progress of the written text. To achieve this status, the table of contents has had to divest itself of all syntactic elements and now contains only freestanding words that serve as signposts for readers. In the sphere of printed matter, we have not gone any further than this point, first reached two centuries ago. As in all other spheres the spearhead of evolution has shifted; it is no longer in the book, which survives as the documentary infrastructure, but in documentary material freed from any context.

Index Cards

By the nineteenth century the collective memory had expanded to such proportions that the individual memory could no longer be expected to store the contents of whole libraries. The need became apparent to organize the inert "thought" contained in the printed "brain" of the collective by means of an additional fabric upon which a highly simplified picture of the contents could be projected. Above all else, the constituent cells of this new fabric had to be capable of indefinite enrichment and reconstruction in a manner appropriate to every type of documentary research. The eighteenth and part of the nineteenth century had still made do with notebooks and catalogs. These methods were succeeded by the card index, which did not begin to be properly organized until the early twentieth century. In is most rudimentary form it already represents a real exteriorized cerebral cortex: A simple set of bibliographical index cards will lend itself to many adaptations in the hands of is user, becoming an author or subject index, a geographical or a chronological one with every possible permutation to meet requirements as particular as the place of publication or the dimensions of inset plates. This is still more obvious in the case of card indexes containing scientific information, where each documentary component can be rearranged at will in relation to all other components. Actually the
[p 263]
264

parallel with the cerebral cortex is in some respects misleading, for if a card index is a memory in the strict sense, it is a memory lacking is own means of recollection and has to be brought into the researcher's visual and manual operating field before it can go into action.

Punched Cards and Electronic Memory

A further step forward was taken by making the card index contain several sets of cards, perhaps of different colors, so that a second network of references was added to the first basic one, or better still by using punched cards. Books in their "raw" state are comparable to hand tools: However sophisticated their presentation, the reader's full technical participation is still required. A simple card index already corresponds to a hand-operated machine: Some of the operations have been transformed and are now contained in potential form in the index cards, which are the only things the reader needs to activate. Punched index cards represent yet another stage, comparable to that of early automatic machines. Whether they are cards with marginal perforations that have to be activated by hand or cards of some other kind requiring mechanical or electronic sorting, the principle of the punched-card index is always the same: The data are converted by means of a binary code (positive = no perforation, negative = open perforation), and

a sorting device separates the cards according to a set of questions, releasing only those that produce an affirmative response. The principle is that of the Jacquard loom, and it is curious to note that documentary material waited for more than a century to follow in the footsteps of weaving. But although the mechanism is the same, the degree to which it is exploited is entirely different. The punched strips of the weaving loom express answers, whereas each perforated index card corresponds to a possible question. A punched card index is a memory-collecting machine. It works like a brain memory of unlimited capacity that is endowed with the ability not present in the human brain of correlating every recollection with all others.

No progress beyond this stage has so far been made except in the matter of proportions. The electronic brain, although it employs different and more subtle processes, operates on the same principles. Theoretically devices using perforations or integrators (generally associated with the former) can compete with the brain in terms of the ability to compare. They can on a gigantic scale and within a negligible period of time process a mountain of data to achieve a well-defined end, and they can produce every possible answer. If provided with the data needed for an oriented
[p 264]
265

choice, they can weigh those answers and enrich such preestablished weightings with judgments based on experience drawn from precedents stored in their memory. The electronic integrator's superiority over the card index is derived from the amount of data it can process within a very short period through the simultaneous action of several selection centers capable of checking and correcting their own output, whereas the most efficient cards in existence, having a data density of 20,000 per card or 10,000,000 per 500 cards, skill require the operator's direct participation and considerably more time. The artificial brain of course is still in is infancy, but we can already be sure that it will be more than just a nine days' wonder with limited applications. To refuse to see that machines will soon overtake the human brain in operations involving memory and rational judgment is to be like the Pithecanthropus who would have denied the possibility of the biface, the archer who would have laughed at the mere suggestion of the crossbow, most of all like the Homeric bard who would have dismissed writing as a mnemonic trick without any future. We must get used to being less clever than the artificial brain that we have produced, just as our teeth are less strong than a millstone and our ability to fly negligible compared with that of a jet aircraft.

The tradition that holds the human brain responsible for human achievements is a very old one. The human species adjusted with equanimity to being overtaken in the use of is arms, is legs, and is eyes because it was confident of unparalleled power higher up. In the last few years the overtaking has reached the cranial box. Looking fans in the face, we may wonder what will be left of us once we have produced a better artificial version of everything we have got. We already know, or will soon know, how to construct machines capable of remembering everything and of judging the most complex situations without error. What this means is that our cerebral cortex, however admirable, is inadequate, just as our hands and eyes are inadequate; that it can be supplemented by electronic analysis methods; and that the evolution of the human being a living fossil in the context of the present conditions of life must eventually follow a path other than the neuronic one if it is to continue. putting it more positively, we could say that if humans are to take the greatest possible advantage of the freedom they gained by evading the risk of organic over-specialization, they must eventually go even further in exteriorizing their faculties.

If electronic machines learned one day to write perfect plays and paint inimitable pictures, some serious questions would have to be asked about the future of the human species. By learning how to love they would definitively settle our hash as a zoological species. Before we project into the future a picture that may well be

[p 265]

266

false, I propose in the last part of this book to consider an area as yet untouched by the machine, for we have all along gone round inside a triangle formed by the hand, the word, and the sensory-motor cortex and have shuttled back and forth between the human and the monkey in search of what cannot be shared with the rest of the zoologically or mechanically animated world.

[p 266]