

THOUGHT WITHOUT VERBAL EXPRESSION

Can we think without words? At first, the question is surprising, and the answer is most often, “No.”

This response is quite understandable. Words and thought are so closely connected in our mental activity that they appear almost indissociable, since if we follow an introspective process, it is not possible for us to analyze our reasoning and our feelings without having recourse to words. Moreover, man’s verbal expression is not only a means of communication; it is also an instrument of progress for the mind, without which the mind would not be able to attain the very high levels of abstract and conceptual thought that are proper to it. No one would dream of minimizing the important influence of words on thought. It is more correct to magnify it as Paul Valéry did: “The honor of man, blessed speech.”

However, thought is possible without words: there are very complicated activities that do not employ language for their realization; moreover, language is a restraint for some activities. My purpose here is to give some examples of this phenomenon,

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to discern what kind of mental activities are involved and to approach the cerebral mechanisms thus put into operation.

Speech and thought are words whose semantic radiations are almost boundless. We go so far as to say that flowers and the computer have a language and that, of course, the computer has an intelligence! It is therefore necessary to give a specific meaning to the two words here in order to clarify the discussion. As far as language is concerned, it is a simple matter. It is a question of human speech, and it is distinguishable from all other expression by at least three characteristics. First, it is composed of semantic signs and logical connections that are totally arbitrary for the young brain that receives them and accepts in the same way all languages relative to its linguistic environment; this is in opposition to the so-called language of animals, made up of universal signs transmitted by genetics. Second, it is a creation, in the sense that with thirty-two phonemes and some thousands of words, man may express an infinity of ideas. Finally, it answers a personal intention, that of communicating a thought to another person, whether it is what one is thinking, or, very often, what one is not thinking. This motivation does not exist in the systems of communication established through conditioning and experience between animals of the same and of different species, nor does it exist in electronic machines.

Thought is more difficult to define. We will use the term in its broadest sense: thought covers the ensemble of psychic activities—to give attention, to remember, to imagine, compare, judge and reflect, are ways of thinking. We no longer require that it be subjective: dreams and the subconscious belong to thought. We no longer attribute thought only to man; it exists among the higher animals, but nothing can fix the limit beyond which it is not thought and when the mental phenomenon appears. We will base our reflections on animal psychology, on ontogenesis of the intelligence and on cerebral pathology.

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In the phylogenetic order, innate behavior gradually yields to learned behavior and even to reasoned conduct. Since all acquired behavior is built on past experience, the experimental situations

of learning enhance the growing complexity of behavior of which animals are capable; in other words, the birth of intelligence and the development of the processes that are the first stages of thought. We can enumerate only some of these faculties of the animal brain: the mental representation of the task to be done; the putting into relationship of the elements of an environment, they themselves variable, in terms of which the animal deduces the suitable action; the strategy in terms of probability—for example, when a monkey must press one or the other of two keys to obtain a reward, which is not difficult since one of the keys gives the reward in 100 percent of the cases and the other respectively in 70 and 30 percent of the cases; the possibility for the monkey to conceive an abstraction, that of similarity and difference, for example, to learn to grasp among three objects the one that is different from the two other similar objects and to generalize this idea, that the different object is so in form or color; the elaboration of a concept, that of a triangle whatever may be its spatial disposition and color, a striking example if we remember that Kant chose the triangle to illustrate the conceptual thought of man: a form in three dimensions, whatever its physical variables may be.

A mental representation, an idea of relationships, strategy in terms of probabilities, generalization, conceptualization, we will agree, are thought processes that develop outside of all language. Different learning procedures have permitted their isolation, but there is a situation described forty years ago by Köhler in which the problem presented to the chimpanzee “Sultan” assembles them all, and more: Sultan, hungry in his cage, sees a banana hanging from the ceiling. His height does not permit him to reach it; seeing boxes and sticks on the floor of the cage, he climbs up on a box and fails. He then places one box on top of another, climbs up and again fails; he uses a stick and still fails; he puts two sticks together—they are expressly made for that purpose—and balanced on the boxes he can finally take the banana and eat it. The successive stages of this performance offer more than analogies with what we call logical reasoning, even if this reasoning is applied to material instruments. What is lacking in this exploit of the chimpanzee is perhaps not a language to reinforce his thought but certainly

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a language to tell us about it.

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Now let us come to man. The infant does not acquire the rudiments of speech until after one or one and a half years of age. However, who would say that the infant—perhaps even newborn—does not think? Common sense attributes the beginning of a thought to the smile of the child when he recognizes his mother; to certain of his cries; to his observation of the objects he manipulates in his hands; and, a little later, to his toys. Psychoanalysis gives still more importance to his mental life in the domain of affectivity and in that of the initial organization of what will be his personality. I will not go into this field too rich in doctrines that cannot be verified. On the other hand, the work of Jean Piaget has renewed the ideas on the development of the intelligence of the child. In one of his late works, he expresses it thus: “About forty years ago, at a time when I believed in the strict relationship between thought and speech, I rarely studied anything but verbal thought. Since then various studies have taught me that there is a logic of coordination of actions deeper than the logic attached to language... it is on these insufficiencies of language that I will principally dwell, because if everyone perceives its contribution, whose finally decisive importance I recognize, one too often forgets the part of action and operatory intelligence itself.”

Before any speech, the infant develops the first degrees of its intelligence, basing them on actions that gradually have the value of a concept generalizable to an ensemble of actions, from which comes the name of sensory-motor schemes which was given them by Piaget. By interiorized combinations of these schemes, the little child becomes able to understand a situation immediately. For example, he learns to discover how to take objects that are variously hidden from him by the observer. Later, speech on its way to being acquired or already acquired is not sufficient to solve some concrete problems. Among many others, the experiment called “preservation of liquids” clearly shows that its successful outcome does not depend on language but on the conclusion of an internal logic governing the develop-

ment of actions. Thus, before the age of seven or eight years, a child will think that the amount of liquid in a glass increases or decreases according to whether it is poured into a narrow glass or a wide glass. The child has only judged the exterior aspect given by the height of the liquids. However, he has all the vocabulary necessary for understanding the experiment. After seven or eight years, he will be able to say that the quantity of water has not changed, not because his vocabulary is enriched but because the development of his logical reasoning permits him to annul the apparent transformation in volume of water after it is poured. To give verbal rules in such a case would be of no use. The solving of the tests depends on the level of intelligence. Later, the role of language increases in importance: it is a necessary but not sufficient condition for the completion of logical structures. There are innate anatomo-functional systems in the brain that under the pressure of the linguistic environment permit the acquisition of speech, but there are also systems of a more general reach that under the pressure of the environment permit the development of cognitive activities. They are independent, even if there are reciprocal influences between them.

In this regard, deaf-mutes and persons blind from birth furnish important information. For the first, the learning process of language begins only at five years of age, and the acquired speech remains below the norm; now, intellectual development is marked by only a simple delay, quite inferior to that of speech. Moreover, it follows the same stages of elaboration as that of normal children. It is not the same for the blind: these acquire oral language normally but have serious difficulty in succeeding in tests permitting the appreciation of the operatory capacities of their intelligence. This difference is explainable: speech is not the source of logic, it is one of its products. As for visual information, it has a major role in the elaboration of schemes and the constitution of logical structures.

What happens with those persons who are deaf and blind from birth? The answer is difficult. These cases are rare, and generally the brain is also the victim of the pathological process. The case of Marie Heurtin is always cited, as well as that of Helen Keller, but we are not sure of a total auditive and visual lack in those cases. However, these subjects think, and their

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ability to think has nothing to do with the delay and limits of their capacity for linguistic communication. In this regard, there is a disturbing pathological fact: audio-muteness. Here is the case of a child followed by one of my collaborators, Jean-Louis Signoret. At birth his brain perhaps suffered a meningeal hemorrhage. The child, now twelve years old, developed normally except for speech. He utters only a large number of phonemes with intonation and now and then a word. He understands the speech of others so little that he cannot designate pictures of objects in terms of words pronounced by the examiner. He is not deaf; he identifies normally familiar sounds and those of musical instruments. His intelligence, as judged by tests on non-verbal intellectual efficiency, is normal. There can be no doubt that the child thinks. His affectivity is vibrant and his personality suitable for life in society, without the mediation of speech. Even if the “how” of the mechanism of his thought is difficult to explain, the fact remains and must be accepted.

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The alterations that occur in the adult brain furnish other examples of a dissociation between language and thought. We have chosen three examples. The most classic is the aphasia brought on by a lesion of the left hemisphere of the brain in a right-handed person. A more or less serious disorganization of speech follows. It is true that the loss of comprehension or the loss of expression does not mean that what we agree to call “interior language” is destroyed, because these disturbances may be the consequence of a lesion that in the first case affects the decoding systems of the auditive message and in the second case of the systems that assure the organization and realization of articulation. The same reasoning is valid for written language. Today, various experiments permit us to avoid these snares and to know to what extent language itself is affected. What about the intellectual activities of those in which language as a symbolic or semiotic function is disorganized or, indeed, lost? There is an old debate in which are opposed, after more than a century, those who maintain that aphasics have a deterioration of their intelligence and those who defend the more or less

perfect integrity of the latter. Obviously, no one claims that verbal thought is preserved. The problem concerns only non-linguistic intellectual activity. In my opinion, it has received a scientific solution. Psychometric tests and experiments (those of Piaget) have shown that there is no correlation between aphasia and success or failure in these different tests. Aphasia alone does not entail a diminishing in general intelligence. *A fortiori*, it is not the consequence. If there are aphasics whose overall intelligence has deteriorated, it is because the cerebral lesion is not limited to the regions called linguistic but has extended to other regions whose integrity is necessary for the accomplishment of non-linguistic tasks. In the majority of cases, aphasics continue to have a behavior adapted to the situations in which they find themselves; they are aware of their infirmity; their moral suffering is experienced according to their personalities—which remain unchanged—from resignation to despair. Certain mathematicians and physicists are able to solve problems whose difficulty impresses not only the neurologist examining them. The same is true for chemists.

Artistic creation merits a particular mention. Maurice Ravel, become aphasic, was still capable of remarking the slightest error in the music he listened to but was never able to compose again. Perhaps this deficit was due to the extent of the cerebral lesions. The Soviet scientist A.R. Luria cites the case of a musician who, in spite of his aphasia, continued to compose, his music being, it seems, better than before the cerebral accident. Let us now look at the case of a painter, Gernez, who had a deserved fame in the schools that followed Impressionism. At fifty-two, he was abruptly deprived of speech and paralyzed on the right side of his body. After a period of illness, in spite of his hemiplegy and his aphasia, he began to paint again. The characteristics of his style had not changed and perhaps they had gained in intensity. Professor T. Alajouanine, his friend, was at his side for years. Here are some of the reflections he gathered from the artist transcribed according to the rules of French grammar: "There are two men in me: one who paints, who is normal while he paints, the other, who is rambling, who is lost, who does not grasp life...I say very badly what I mean to say... There is in me one who grasps the real, life; there is the

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other who is lost in the abstract... When I paint, I am outside my existence, my view of things is even more intense than before; I catch on, I find everything again. There are two men in me: one who is caught by reality in order to paint; the other, the imbecile who cannot make himself clear with words... it is strange, I have begun to paint again, great pastels that are more living than real life." A striking duality between verbal thought and another activity, visual and affective, which we will agree to recognize as, all the same, a part of man's thinking.

There is a pathological situation just the inverse of the above, namely, a disorganization of thought while speech is normal. It is the result of lesions affecting the frontal lobes of the brain. The role of these lobes is to exercise a function of regulation and control over all behavior of a certain complexity. Let us take the example of a problem in arithmetic, even a simple one. The task requires the gathering of data, the establishment of a strategy or a program and the control of all the stages of its execution. This is what these patients have lost. If the examiner decides to guide the patient step by step (in other words, lend him his own frontal lobes) the patient will succeed in solving the problem. These facts do not illustrate the existence of a thought without language but the inefficiency of a language without the organization of thought.

The last example offered by cerebral pathology is truly fascinating. Everyone knows that the brain is composed of two hemispheres that are connected by fasciculi, the most important forming the *corpus callosum* composed, in man, of more than two million fibers. Their role is to transfer information from one hemisphere to the other, so that these reciprocal exchanges permit the two hemispheres to function as a whole. In the animal, a learning process that, through various technical procedures, is only *a priori* elaborated by one hemisphere is elaborated also in the other hemisphere, since each piece of information received and each response of the animal is transmitted by the *corpus callosum* to the other hemisphere. It is sufficient to divide the *corpus callosum* in order that the learning process is carried out only in the hemisphere that receives the information.

A little more than ten years ago in the United States a neurosurgeon, Bogen, and a psychologist, Sperry, hoped to ameliorate

the suffering of patients with severe epilepsy by separating their *corpus callosum* and other commissures with more accessory roles. This was called *split-brain*, an expression that caught on. It follows that the two hemispheres are totally disconnected so that their activity becomes independent. It also follows that the functions of each hemisphere may be studied individually. It is a captivating problem: we know that the left hemisphere in the right-handed person encloses the system of speech, gestures, analytical and conceptual thought, but what are the functions of the right hemisphere, whose qualification of secondary clearly expresses the small part attributed to it in the superior activity of the brain? First of all, we must understand the experimental situation: when an object is placed in the right hand, the central nervous paths crossing the median line, information is transmitted and treated by the left hemisphere. When the object is placed in the left hand, it is the right hemisphere that gathers the information. It is the same for visual information. The situation in this case is more complex because of the sweeping movement of the eyes that permits the two hemispheres to receive all visual information. In fact, some technical procedures are sufficient—the fixing of the eyes on a median point and the presentation of images flashed for a quarter of a second—to be assured that the stimulation affects only one visual field and thus arrives at only one hemisphere.

In these conditions, all tactile or visual information addressed to the left hemisphere is recognized and of course named. Addressed to the right hemisphere, they cause no verbal response; the subject even denies having felt an object or having seen an image, but he speaks with his left hemisphere that was not informed. However, these objects and these images are perfectly identified by the right hemisphere. The proof of this is that for the left hand, that is, through the right hemisphere, the subject again finds the felt object and designates on a board with a number of images those that had been projected in the right hemisphere. This information is memorized, because the subject, after a long delay, succeeds without difficulty in the same performances. Moreover, the right hemisphere is able, outside of any language, to elaborate a concept. Let us take the example of a key. The picture of a small car key is projected

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in the left visual field, thus in the right hemisphere, and the subject must with his left hand search among other objects that are hidden from him an object belonging to the same category: in this case, his hand does not grasp small objects that resemble the key because of their size but takes a large key similar to those used for a cellar door. Thus it is in relation to the concept of a key that the subject reacts.

In the many experiments that call upon visual discrimination and construction in space of different forms in two or three dimensions, the right hemisphere is capable of performances that are highly superior to those of the left hemisphere. When cards are flashed on which dots are disposed without order and the patient is asked to find the same number of dots on cards on which they are regularly aligned, the normal subject passes this test up to six or seven dots. That is, his brain is able, without counting, to comprehend a number and to modify its spatial disposition to find it again in a new configuration. If these patients are subjected to this experiment, and we have done this, the left hemisphere does not go beyond three dots and the right hemisphere achieves the same performances as with the normal subjects. Without a doubt, the left hemisphere tends to count the number of dots (which is impossible, given the brief time of the flash); this verbal constraint leads to failure. The right hemisphere cannot count; it disposes of other mechanisms to manipulate space, and these are the ones that intervene in the normal subject, but none of us realizes this fact.

Another experiment merits our attention: the recognition of faces. Using images called chimeric, composed of two different half-faces and projected in a quarter of a second, Trevarthen and Levy, as well as ourselves with our collaborators, were able to put the two hemispheres into competition, each of them receiving only half a face. If we ask the patient to verbally describe which face he has seen, he answers, often in an embarrassed way, by describing in every case the half-face he saw with his left hemisphere. Now, if we ask the patient not to talk but to point out the face he saw among the many faces in front of him, without hesitation he indicates the face of which he saw only half with his right hemisphere. In this last experiment, the two hemispheres are put into competition, and it is the right hemi-

sphere, without speech, that is dominant. If we wish to understand these results better, we must call upon another fact of cerebral pathology: the loss of recognition of faces, a syndrome at the origin of which there is always a lesion of the occipital lobe of the minor hemisphere (Hécaen and Angelergues). The disturbance is so massive that the patients do not recognize themselves in photographs or on the television screen that directly transmits their own faces. In this case, only the left hemisphere has a normal activity. All information that comes to it tends to be analyzed and formulated in terms of language, but this method is not efficient in the matter of physiognomy. If we try to describe verbally a physiognomy—not only that of human faces but also that of animals and automobiles—it is difficult to recognize the person in question, while in a 125th of a second the operation is successful in the right hemisphere. One last remark on this point: occipital lesions of the left hemisphere entail a non-recognition of pictures of objects having a name in language. Then, what must be thought about this patient affected with such a lesion, who thus treated visual information with the right hemisphere, that I observed along with François Chédru? In front of reproductions of six famous paintings she recognized neither the church, nor the field, nor the prairie, nor the Pierrot, but said immediately, “Well! Here are two Van Goghs!” The style of a painter leads to numerous verbal commentaries, but its intrinsic nature is difficult to verbalize. Mostly, it is the right hemisphere that has elaborated the montages that permit us to know and recognize it and, who knows, to be more or less sensitive to it.

These facts lead to the proposal of a general explanation of the functional organization of the brain that may be summarized thus: up until about the age of two, the two hemispheres are equal in power. Then the genetic fact of hemispheric dominance intervenes, fixing in the left hemisphere of the right-handed person the logic of language to the point that all information tends to be treated in its terms. An advantage? Yes, as far as a certain form of analytic and conceptual thought is concerned, but a restriction for other activities, especially artistic, of which we cannot say that they are not under the jurisdiction of man’s

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thought and are developed in a natural way in the hemisphere deprived of language.

How many questions arise from that! Does the right hemisphere subtend affective reactions? A photograph of a female nude was shown to the right hemisphere of a split-brain young American woman. She smiled. When questioned, she answered that she had seen nothing, but she spoke through her left hemisphere. The projection was repeated several times. She laughed and, embarrassed, hid her face in her hands. She continued to say she had seen nothing and finally accused the "funny machine," the projectors and recording apparatus that were in front of her.

Our personality is neither simple nor homogeneous. That goes without saying. However, may it have distinctive traits according to the hemisphere being considered? Gazzaniga, who observed the first split-brain patient at length, a patient universally known by his initials, W. J., reports the following anecdotes: one day W.J. tried to hit his wife with his left arm while his right arm tried to oppose the blow and protect the wife. Another day, walking with W.J., Gazzaniga saw him pick up an axe with his left hand, in a menacing way. Gazzaniga got out of the way fast and recounted with humor that he wished to prevent American justice from determining which of the two hemispheres could have been held responsible for a crime. I would add, also, which of the two hemispheres deserved a medal.

It is certain that each of our two hemispheres has a different way of acting, but how do they cooperate? Or, on the contrary, do they oppose each other? It is likely that unconsciously and in a probably natural way we use them alternatively with respect to the task to be accomplished. In the future, can we overdevelop the functional capacities of the one or the other? I understand the interest in this question. Actually, it is in the domain of futurology.

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If we have dwelt upon this subject, it is because it offers us new insights on the organization of the cerebral systems that underlie the functions of our psychic individuality. However, let us make no mistake. There is thought without speech, thought that precedes and goes beyond it; it is obviously not

supported by only the right hemisphere. That would be too simple. The entire brain takes part in it. I wish to speak of creativity, whether it is a question of a new idea, the imaginary, the artistic creation, the emotional power of a memory or of mathematical thought. Language was certainly necessary for Archimedes to present the facts of the problem, but the sudden emergence of his discovery was produced outside any confusion of verbal thought. It sprang forth without his being conscious of the permanent action of the mechanisms of his thought. It was later that he formulated it. Was language involved when Jules Verne imagined his worlds? When Picasso turned forms upside down, "I do not look, I find," he affirmed. In physics, Einstein emphasized the non-verbal process of his thought: his concepts presented themselves at first under the form of "physical entities"... "more or less clear signs and images," that he endeavored to associate. These elements offered "a visual and sometimes muscular character." "It was only at the following stage that I laboriously had to look for conventional terms and signs" to express them.

Is it not the same for many literary productions? In this matter, my reference has been used so often that I am somewhat embarrassed to offer it again. It is a question of that slow and difficult resurgence of a mass of experience of Marcel Proust of which we recall here only minuscule fragments that pervert the text: "And as soon as I recognized the taste of the madeleine dipped in the tea that my aunt used to give me... immediately the old gray house on the street, where her room was, came... to fuse itself with the little pavilion in the garden...; and with the house, the town, from morning to evening and for all time, the square where I was sent before lunch, the streets where I ran errands, the roads we took if the weather was good." And Proust, after having compared his thought process to the unfolding of small Japanese paper flowers in water, continues: "...even now all the flowers of our garden and those of Swann's park, and the water-lilies of the Vivonne, and the good people of the village and their little houses, and the church and all Combray and its surroundings, all take on form and solidity, town and gardens, all have come out of my cup of tea." The emotion of the reader is held on the one hand by the genius of the literary expression of

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Marcel Proust, but who can minimize this world of thought that erupted in him before any language, for himself and for others.

Since we began with a quotation from Paul Valéry, celebrating language, we would like to conclude by evoking other passages from his *Cahiers* that are severe criticisms: "The preexistence of words... restricts, in the germ itself, our mental production... shapes this thought more than it expresses it and even develops it in a different direction from the initial one." Further on, he says our nature leads us to believe that "what cannot be said, and well said, does not exist." Finally, in the abridgment of Judith Robinson, "Men have infinitely more trust in ideas consecrated by language than those, often much more important, that remain to be discovered above and beyond all familiar words."

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