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Invited Lecture

ANIMAL AND HUMAN COMMUNICATION

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A few years ago, I believe it was in 1967, your Society asked me to predict the future of Acoustics. I was not very clairvoyant, because I had not foreseen the fact that, after this first trial, I would have to appear before you once again. I am astonished at the capability of your acoustic filter, for even, after having made, with my bad English, a first acquaintance, you come back for more. There are only two possible explanations to this: either you are not the same people as in 1967, or your auditive system is capable of integrating signals, having a high level of distortion.

As a member of the French Acoustical Society, I appreciate the honour which your Council has bestowed upon me, in inviting me here, especially at this time in our history when, although we have the Concord in common, we also have the discord of the Common Market.

I am not quite sure that the topic I have chosen is treated with all the objective rigour that one would wish, and this subject has already been discussed by a large number of my illustrious predecessors. Indeed, to speak of animal communications and human language, is more often the object of philosophical speculation than of experimental science.

I will stay in this traditional line of thought having neither Aldous Huxley's wit, nor, to my knowledge, a Victorian bishop who would to-night, excite my natural impertinence -

The animal kingdom, as a whole, is full of examples of types of communication, whose functions are essentially the establishment of individual relationships. Acoustics, however is not always the unique basis for information transfer; other physico-chemical systems can play as important a role: for instance, facial mimics, position of an organ (the tail of the dog), erection of an organ, or of specialized hairs, electrical discharges, colour changes, modification in the general posture of the body, emission of odours, and so on.

Since most of you are probably not biologists, and to make the rest of my talk clearer, I would like to give you a few examples of such non-verbal communication.

In some monkeys, the tail position is an exact indication of the rank: highest is high in the air, lowest under the belly. In some rodents, courting is accomplished when the male, standing on its hind legs, sends a strong stream of urine on the female. In

many fishes, colour of the scales changes during courtship, anger, and rivalry; emission of chemical signals are also too well known in insects, fishes and mammals, to go into them. Less common is, for instance, the marking of the rank order and the territory of a rabbit by the size and height of their faeces heap, or the scent marks deposited by beavers and deer at each corner of their territory.

Thus you can see that animals can communicate information with a number of different techniques. But generally we have only a sign system, a semeiotic, a zoo-semeiotic, and of course this does not constitute a language. We will come to that.

Interesting at the moment, is to examine which of the different systems of information at their disposal, each animal species will use as most important in the type of behaviour they are engaged in. I can only give you a few examples to trigger your curiosity. In many cases, the animal responds only to one out of the different signals of possible communication, paying no attention to, and excluding all other modes. For instance; a surgically deaf turkey will brood its eggs, but as the chicks are born, she will kill them, for she needs the acoustical signal of the chicks for recognition. Visual signals are inefficient. In a similar way, a hen seeing one of her chicks under a glass box, will leave it and wander off with her other chicks, while she will stay around indefinitely if she hears it crying his distress call, even though she cannot see it. A young chick, in turn, will crouch near a loudspeaker emitting a hen's call, even if its own, but mute mother is brought within a half metre of him.

One of the problems of studying animal communication systems is that techniques and instrumental technology usually compel scientists to isolate one of them, while in nature they form a whole. Acoustical signals, which are, at the present time, the best known are an example of this segregation for technological reasons.

The big leap made by acoustical recording and measuring techniques has brought us to consider acoustical communication in animals as the most important means of exchange of information, as indeed it is with humans; whereas it was perhaps merely the easiest to analyse, with the facilities of play-back, and the simplest to synthesize artificially.

This reminds me of an item included in the "Key to Scientific Research Literature", published in an American Journal. What the author wrote was: "the operant conditioning technique was chosen to study the problem ...."; what he really meant was: "the fellow in the next lab already had the equipment set up". Or again: "it is clear that much additional work will be required before a complete understanding of the question is obtained"; what he really means: "I don't understand it".

Well, it is clear also that animals, men included, exchange signals in a complex context which we find difficult to untangle for we cannot reach the ego of an insect, or that of an elephant, and it is too easy to explain the whole behaviour of animals through what we know of our own.

The temptation, however, was great to try to acquire a common language with the animal world, to be able to have this understanding, and ever since Orpheus, man has often tried to teach an animal how to speak, which is a sure sign of our pride and

anthropomorphism, since it would have been more logical, I believe, for us to try to learn an animal language ourselves.

Be this as it may, all such ventures have, to this day, been unsuccessful, for such imitations as those of parrots and mynah birds, however good they may be, can in no case be considered as a learned true language.

Such experiments on chimpanzees, which, as the nearest non-human primates, should be the most susceptible of learning our language, have all been failures. All they have ever been able to learn were three words.

But this very trial, shows that we have forgotten how different the chimp's world can be from ours.

This animal is essentially engaged in communication by gesture and mimicry. Even man has much more non-verbal communication than was previously thought. Besides gestures and attitudes, he also has whistling languages, like those found in the Canary Islands, in France and in Turkey, or he may use codes such as deaf and dumb sign language, or even another form of symbolism, such as mathematics, and (why not) "say it with flowers"!

Thus language cannot be strictly limited to acoustic communications as one has been tempted to do, when thinking only of humans. The best demonstrations of this are the two very recent experiments, the purpose of which was to teach a chimpansee a non-verbal language.

Two separate American scientific groups, that of Gardner in 1969, and Prenack and his team in 1970, have taught, by two different procedures, a non-verbal communication system to two female chimps, Washoe and Sarah.

Washoe "Gardner" learns deaf and mute sign language, and Sarah "Prenack" the use of symbolic objects to designate nouns, adjectives and pronouns.

They have both proved to be capable of learning the correlation between an object and its symbolic representation (which means a semantic of the word) and then, to associate symbols, to combine them in sentences, and thus to be capable of syntactic organisation (Sarah anyhow), in which the function of each word depends on all the others. These criteria are found essential in defining the human language.

Like the human infant, the Gardner chimp Washoe, gave evidence that some of the early signs were acquired by delayed imitation of the signing behaviour of her human companions, but very few, if any, of her early signs were introduced by immediate imitation. Manual babbling was directly fostered and did increase in the course of the research. A number of signs were introduced by instrumental conditioning.

Washoe acquired and could use spontaneously and appropriately, after 22 months, more than 30 signs. The ones acquired earliest were single demands. Most of the later signs have been names for objects which Washoe has used, both as demands and as answers to questions. Washoe readily used noun signs to name pictures and objects, as well as actual objects, and has frequently called the attention of her trainers to pictures and objects by naming them.

Once acquired, the signs have not remained specific to the original referents, but have been transferred spontaneously to a wide class of appropriate referents.

From the time she had eight or ten signs in her repertoire, the chimp began to use them in strings of two or more.

Some of the combined forms that Washoe has used may have been imitative, but many have been inventions of her own. She has acquired "I - me" and "you". When these occur in combinations, the result resembles a short sentence.

Washoe was able to demonstrate spontaneous naming, spontaneous transfer to new referents and spontaneous combinations and recombinations of signs.

Sarah, the other chimp, has learned more than one hundred and twenty words, which she tells, by showing a number of coloured ideograms of different forms and colours, each having been assigned either a noun, a verb, an adjective, or an adverb.

Assembling them, she can thus express abstract concepts, using names for objects, colour and feeling. She organizes them in six-word sentences, according to syntax, and perfectly integrated in a symbolic and semantic system.

Let us define what is a language. As far as I am concerned, it can be characterised succintly by the following aspects:

Language is always learned.

It depends on a combination of indivisible elements according of rules peculiar to each tongue (syntax).

It can express abstract ideas, temporal notions in the direction of the past and out into the far future.

The vocabulary, the collection of signals, is open, that is infinite.

These characteristics fit perfectly what we know of the way Sarah expresses herself. It is, of course, non-perfect, and one can still wonder about the extent of the chimp's complete capacities; but, if one studies the vocabulary of the least evolved human groups, for example the natives of the Kalahari desert, simple food gatherers and hunters, they have a vocabulary estimated at eighty words, and their communication system is so embedded in posture and gesture, that they have difficulty communicating in the dark. This is no commentary on any limitation of the Kalahari's intelligence, but reflects the utter and monotonous simplicity of his environment and daily activity.

In a way, the vocabulary learned and used by Sarah is already more important than that of these desert men.

We must therefore come to the conclusion, that language, in its intellectual attributes, is no longer the unique functional character reserved to the human brain, since a non-human brain is shown to be able to acquire the principles of language, in terms of analysis, of understanding the syntactic structure of a sentence, of importing the total semantic domain of words, be it concrete or abstract.

But, in the wild, it might be different, because the animal "umwelt" is different from our own, like the world of Kalahari man is different from our world.

Can one say that in the wild, animals show a use of language in their sign communication system?

Non-human primates have a range of sounds conveying distinguishable meaning, between 20 and 40, and with a fair degree of specificity. A warning call occurring and recorded when a leopard threatens a primate group is not confused with a warning call recorded when the herd has spotted a snake. Played back to the primate group, they assume postures and behaviours appropriate to the appearance of these threats.

However, the behavioural traits of animal communication cannot be ordered like a genetic tree, and the phylogenetic relations among vertebrates, derived from comparative morphology, are not reflected in the taxonomy of their communicative behaviour, as far as we know it.

Many species have evolved highly specialized systems, such as the honey bee, many bird species and possibly dolphins.

Neither these systems nor a dog's reponse to human verbal command, represent primitive stages of human communication.

Nor is there evidence that the natural communication system of monkeys and apes constitutes a gradual approximation toward language.

The empirically-determined primitive beginnings of language in man (in 18 months old infants, or in feeble-minded individuals) are behaviourally very different from the signals that animals emit for each other, but with the wisdom of the animal nature, how can we know they need a true language?

Many animal communication systems are probably evolutionary offshoots, as is man's and cross-specific comparisons must be carried out with great caution.

Numerous are the linguists who have tried to find a Darwinian phyllogenesis, with a view to working out a theory of the origin of languages. I personally think it is more helpful to find a phyllogenesis of the intellectual capacity for language in general, without restraining oneself to the only form of the human vocalic language, but including all forms of communication that fit the criteria we saw a few minutes ago, leaving to each species its own characteristics, morphological as well as communicative.

We know much too little of animal communication up to now to apply any of the criteria we defined as necessary to make a true language, to any animal. We were, up to these very last experiments on chimps, unable, for lack of means of testing, to know if an animal was capable of expressing abstract ideas, or if he had notions of past and future. Now, we know they have those capacities from this common code learned in home-raised condition with man. But do they use it? Have they found in their natural environment and society, the need for developing a real language?

This is a line for future research.

Another would be to study the brain development, to see which of the different phylla would be capable of such communicative developments.

We have known, for several years, that electrical stimulation of certain brain centres in insects, frogs, birds, and some mammals, releases the emission of acoustical signals totally identical to naturally-produced signals.

They are already genetically programmed. In man, nothing such as this is possible, apart from perhaps instinctive vocalisations, which do not belong to language. This is a fundamental difference with almost all animal systems, in which these signals are generally innate.

A functional dyssymmetry exists in the human brain at the anatomical level. This dissymmetry, among other things, characterizes Broca's area 44, the language centre; also we know that if this zone is eliminated surgically, rather early, another one is reconstituted elsewhere.

The brain volume, as a function of the number of nervous connections, probably has a certain relationship with our problem, even if through certain pathological cases, we know that micro-brains are capable of the characteristics of language.

If one goes on, down the evolutionary scale, seeking the basic grounds of our own capacities, we find that unfortunately the entire evolutive series which separates us from primates has disappeared. This extends from Australo-pithecus to Neanderthal and Oro-Magnon. All we have recovered is a few bones and some stones which is not much to rebuild a fundamental past.

No doubt we can attribute a form of language to the early Homo Sapiens, who, in my country among others, engraved and painted the walls of the caves in the Perigord with symbolic figures. This could only have been done by thinking beings, and thus speaking beings.

Palaeontologists have presented some evidence that language is concomitant with tool work. Among those, the Frenchman Leroy-Gourand, who has expressed some very pertinent points of view on the association of speech and tool-making, a phenomenon linked with bipedalism and brain development.

The latter permit us to consider, that the advent of language could have been located at the level of the Australo-pithecus, at least under as rudimentary a form as that of their stone chips.

But, from its very origin, this collection of signals would have to be considered infinite, owing to the possibility of combinations of signs which leads to an open vocabulary. This is the first condition of this acoustical communication system which differentiates it from all those of other animal species, at the present state of our knowledge.

Most certainly, on a strict anatomical, phonatory and auditory plane, there is a satisfactory evolution between the phylum of primates and ours.

Chimps, and other non-human primates, which are on the other branch of the evolutionary tree, have, just as we do, the basic possibilities for linguistic capacities, but do not have our vocalic abilities (at least, I hope they do not and will never have it).

Finally, let me say that, we have actually, in the state of scientific knowledge of animal behaviour, no final, or even major argument, to propose to specialists for supporting the theory of a perfectly unbroken philogeny between the fundamental principles of any animal communication systems and human language. After all, if the experiments with the chimps are of utmost importance for having revealed, at their level, unsuspected properties of their brains, the subjects were home-raised by man outside their natural and social context. As far as we know, none of these monkeys use this capacity in their natural behaviour.

This is why we will reserve, for the moment, the term pseudo-language for the most evolved animal acoustic communication, as have done, up to now, our illustrious predecessors such as Buffon, who, in his Historie Naturelle, rejects the possibility of a principle of animal language in the human sense of the word.

It is quite possible that dolphins, whose language we are only starting to decipher, and monkeys, for which a new method of study has been evolved, will be the starting point of new discoveries on this important topic, which must not be considered on vocal grounds anymore, but only on intellectual ability.

At the end of this lecture, I would like to remark that biologists use a term to define what organ or function in living beings grows in a way, such that the evolutionary goal is carried too far and its redundancy conducts the species to, more or less, long term extinction. This is what we call hypertely, and I believe I am, with Aesop, the second to think that this word can be used for human language. The more one reflects about human language, and the more one sees to what excess its utilisation leads the species, one has the right to wonder if this function, however perfect it may be, does not merit having the attribute of being "hypertelic". In fact, this hypertely is that of the brain, and manifests itself by an hyperfunctioning of its secretions, the conceptual thoughts underlying language.

It can be said, in a way, that if language is the best of things, it contains within itself the seeds of the autodestruction of our species, and by this right, it is then equal to the worst of things, which is what the Greek fabulist said around two thousand and fifty years ago.

I leave to each one of you the care of reflecting on this aphorism, even if you only retain the paradoxical side of it, and to come to your own conclusions, according to your philosophy, and perhaps your optimism.

Contd. References on next page...

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