

CONSCIOUSNESS IN ANIMALS

by Tim Appleton

The fact that the Science and Religion Forum met at Durham during April 1975 is a good starting point in our thinking about consciousness. Before arriving there, we all had to do some careful planning; we all had to ask some very basic questions and perhaps had to satisfy ourselves (and maybe others) that the topics on the program were worthwhile or interesting. We had to ask ourselves whether we could really afford the time. Could we fit two whole days into our already busy programs? Those of us with young families probably had to convince ourselves that we could justify leaving our wives to cope with the children on their own. We may have had second thoughts about attending a meeting which may be outside our own professional concerns. Is it right, for instance, that our employers pay us when we are gadding about the country attending meetings such as this? Some of us may have had a struggle with the financial question: Can I really afford to come? Or can I ask my employer to pay? I am sure that all of us who attended that meeting (or similar meetings) have asked at least some of these questions before making up our minds.

You are probably wondering what all this is leading to. What is he going to talk about, will I understand it? Some of you will already have built up a mental image of the topic. Some of you will already have very clear-cut ideas on the subject. I, for the moment at least, am doing the talking and you are listening. But the message which comes from me to you is not just one of words; my words are colored by your own imagination; they may even be rejected altogether. When we come to the discussion, I hope you will add words of your own, words which communicate to me and others in this room your own thoughts.

During this introduction we should have already noticed two main

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things. First, there is the question of language. What I have said so far is (I hope) intelligible; we have a common language. Second, I am aware of myself, that I am trying to communicate some ideas. But I am also aware of you. I am aware that you are physically in the same room as I am, and I am aware (and perhaps afraid) that I am sharing ideas with you. These are the two main themes which concern me—language and awareness; both are essential parts of the concept of consciousness.

What I have said so far has been entirely anthropomorphic—that is, it is concerned with man and is seen from man's point of view. What we must now try to do is to see if we can apply these two criteria to animals other than man. And we cannot help being biased, we cannot totally avoid the anthropomorphic attitude. Neither can we say with any certainty that this or that animal does or does not possess consciousness. We cannot really tell what a dog is thinking because we are not ourselves that dog. We cannot even really confirm our guesses because we cannot ask the dog the right questions, we do not know the language, we do not have the means of communication. We would need to be like the legendary Dr. Doolittle to be sure and even then we would not be certain that our questions were the right ones.

A form of language is therefore essential. Communication between individuals really requires two things. (1) The one who wants to communicate with others must possess the necessary apparatus and be capable of using some form of intelligible transmission, and (2) those who want to receive that message must be capable of physically receiving and interpreting that message. But the form of language need not necessarily be an auditory signal; it could be chemical, tactile (by touch), visual, electrical, and so on.

Even single cells are capable of using language. Single-cell organisms such as the amoeba, euglena, or chlamydomonas usually reproduce asexually—that is, they simply duplicate all the necessary parts and then divide into two identical daughter cells. The result is that large numbers of such cells are identical, they all possess the same genetic makeup, there is no chance for variation. Sexual reproduction is the essential component of genetic variation. There must be the opportunity for mixing of the genetic material from genetically different individuals from the same species (and I use the word species in the most generalized sense). There is then an opportunity for a random splitting of the combined genetic material resulting in daughter cells which are not genetically identical.

The question which such fusion or conjugation of individuals raises is this. How do two chlamydomonas cells recognize each other? Is it by some chemical language which each recognizes; is it by touch, by

texture, stickiness, by shape, or what? Clearly, there must be some crude form of language or else chlamydomonas cells would fuse with amoeba cells, and this they clearly do not do naturally. There must be some form of language between like individuals.

But there is also a recognition of chemical language between unlike individuals. Time-lapse photography has shown that the white cells in the blood are attracted by chemicals produced by foreign bodies such as bacteria or even lumps of beef extract. The white cells rapidly migrate over comparatively large distances to home in on the foreign body and engulf it. But they completely ignore those cells in the blood which they recognize as being "friendly," such as other white cells or the red blood cells and platelets.

Language also plays an important part in the mating rituals of many animals. Some of this language might be termed positive language and is designed to attract members of the opposite sex from the same species. Sometimes this language is in a visual form such as the elaborate display of the male peacock; others may be forms of auditory language such as the croaking of the bullfrog or the violent clicking of the cricket; other forms of language depend on the ability to recognize different smells such as the smell produced by the female cockroach or the smell produced by many animals when in heat. All these forms of language are clearly designed to attract mates so that the future of the species is secured.

But there is also what may be described as "negative" language in some courting rituals. The black face mask of the hooded gull is used as a language of threat, and, before mating can take place, the female gull has to convince the male that the overt display of the hood is not one of threat at all. This she does by reverting to what may be described as gull baby language. She walks around the male, pecking gently at the base of the beak in exactly the same way that the gull chicks do when trying to persuade the adult bird to regurgitate its food. The result is that the male almost becomes broody and regurgitates the food for the female. Pairing then takes place.

Even the lowly honeybee indulges in a complex form of communication—it uses a visual form of language to tell the other bees where the feeding place is to be found. On returning to the hive, the honeybee performs a kind of figure-of-eight dance on the vertical axis of the honeycomb inside the dark hive, the other bees frantically trying to copy the waggle dance. The direction and orientation of the waggle-run across the intersection conveys the direction of the food discovery. In the hive the direction is relative to the vertical; in flight it is relative to the sun. Thus a following bee must recognize and transpose the angle of the dance to the vertical to an angle relative to the

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sun when it sets out to locate the discovery that the scout has announced.¹

We have looked very briefly at some forms of language, some simple, some complex, some in single cells, some in higher organisms. But is this language a form of speech? Can we really say that these individuals are talking (in the widest meaning of the word) to each other?

WASHOE

I want now to look at some very recent work on training chimpanzees to "talk." Some of you may have seen a delightful program on television recently about the chimpanzee "Washoe." William H. Thorpe deals with experiments of this sort in great detail.²

There have been several attempts to train chimpanzees to use human language, the best known of which was carried out by K. G. Hayes and C. Hayes with a young chimp called "Vicki."³ In six years Vicki managed to utter only four words, and these only approximated English words. The vocal apparatus and vocal behavior of chimps is just not suited to a vocal means of communication. Chimps do make many different sounds which are usually associated with moments of excitement. Undisturbed chimps are usually very silent in captivity.

Two other workers, R. A. Gardner and B. T. Gardner, adopted a female chimpanzee at an age between eight and fourteen months and proceeded to teach this animal a gesture language called American Sign Language (ASL).⁴ This is a language which is extensively used between deaf-and-dumb human beings and is systematically taught to deaf children in the United States. It is entirely different from the deaf-and-dumb language in Britain, which is essentially a method of spelling. The ASL is a language composed of manually produced signs which are "strictly analogous to words as used in spoken languages." All the observers in this experiment were normal, hearing individuals who had learned ASL themselves.

The basic situation was as follows. The young chimp named Washoe was kept in a room which was typical of a normal human dwelling, including items which would make life as interesting as possible. There was, however, no attempt to make Washoe into a normal member of a human family. During her normal waking hours Washoe was always in the presence of one or more human companions. Although these companions were perfectly normal, hearing/speaking individuals, no spoken word was used. All communication between humans and Washoe, or between humans, was by sign language—ASL or, in exceptional cases where ASL was inappropriate (i.e., for technical or unusual words), finger spelling was

used. Vocal communication was allowed only for nonverbal sounds such as laughter, cries of pleasure, or displeasure. Unpleasant sounds were used to frighten Washoe away from forbidden places. If the human observers wanted to attract Washoe's attention, they clapped their hands or used some other form of staccato sound.

A normal human baby indulges in a great deal of babbling, cooing, and jabbering. Mothers often talk to, croon, or even imitate the sounds of their babies. The baby soon learns that if the sounds he makes approximate closely the sounds that mother makes, he will be rewarded by increased interest, affection, cuddling, and so on. In this way the baby prepares itself for the acquisition of primitive language.

When the Gardners started their work on Washoe, they expected that she, too, would indulge in a form of babbling, not with sounds but with movements of the hands in the form of random gestures. It was thought that out of these random gestures she might almost "accidentally" hit upon a sign which would evoke a pleasurable response from her human companions. This did not really happen. She certainly used her hands a lot to explore her environment, to play with toys, etc. Manual babbling was encouraged as much as possible, and one word which was learned as a result of the babbling was the ASL "word" for funny. Washoe was always fond of touching her own nose and the noses of her companions with her index finger; she found it exciting. The ASL sign for funny is the brushing of the side of the nose with extended index and second finger. Washoe added a variation of her own by snorting at the same time as making the gesture. Furthermore, she started using her sign for funny in funny situations without any prompting by her observers. Not only did she acquire a larger number of ASL signs, but she made up some signs herself which approximated the correct ASL signs. Other signs which she used were her own inventions, and these were often quite different from the signs which she had been taught: These were often associated with the difficulty in finding direct equivalents between ASL and an English word. Let me quote an example from Thorpe:

The experimenters sometimes could not find an ASL equivalent for an English word which they wished to use. In such cases they would adapt a sign of ASL for the purpose; the sign for "bib" was one of these cases. They happened to use the ASL sign for "napkin" or "wiper" to refer to bibs as well. The sign is made by touching the mouth region with the open hand and a wiping movement. During the eighteenth experimental month, Washoe began to use this sign appropriately for bibs, but it was still unreliable. "One evening at dinner time, a human companion was holding up a bib and asking Washoe to name it. She tried 'Come-gimme' and 'please', but did not seem able to remember the 'bib' sign that we had taught her. Then, she did something very

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interesting: with the index fingers of both hands she drew the outline of a bib on her chest starting from behind her neck where the bib should be tied, moving the index fingers down along the outer edge of her chest, and bringing them together again just above her navel." The authors remark, "A high level of cognitive ability must be possessed by a creature that can represent the concept of a bib by drawing an outline on its chest with its fingers."⁵

In another experiment the observers tested Washoe's reactions when a small doll was placed in different situations. Washoe had always referred to this doll as "baby" by using the appropriate ASL sign—a rocking motion of the folded arms. In one test they placed the doll in Washoe's drinking mug expecting the response—baby in mug or cup. Washoe went further than this and used the ASL signs to indicate "baby in *my drink*" although the mug was completely empty of fluid. Such a response required four separate signs in the correct sequence.

Washoe has learned over one hundred signs in a period of from three to four years and is still able to communicate with her permanent companions today. Experiments with chimps who have been reared from birth (remember that Washoe was between eight and fourteen months) have been even more successful, having well over three hundred signs. Later experiments have proved even more positive partly due to the fact that learning started at a much earlier age and partly because much of the sign-language teaching was carried out by actually deaf-and-dumb observers who were more conversant with the ASL and so were able to teach a clearer and more correct sign language. Washoe's companions were normal, speaking individuals who had learned ASL but who were not so fluent or precise as the true deaf-and-dumb person who relies on this means of communication throughout his normal life. In later experiments the spoken word was also permitted, but the chimps could reply only by ASL.

Another chimp was taught to use a different means of communication by a different group of workers. In this case the means of communication was through a computer which responded only to correct demands and which recorded all the demands and responses, including errors. Thus the chimp was able to punch in a message such as, "Please machine gimme apple," and the computer would trigger off the supply of an apple if the message was correct. If any of the words were omitted or out of sequence, the computer would flash a fault sign. Even if the full stop was omitted, the fault was indicated.

The observer had his own computer console and was able to talk to the chimp and observe the behavior through the Perspex walls of the cage. If he wanted to enter he would ask for permission from the

chimp, "Please, Lana, can I come in," to which Lana would reply in the affirmative or negative or even "soon." If the observer entered and deliberately programmed the computer from Lana's terminal incorrectly, Lana would erase the false message and then reprogram the computer correctly, giving the apple prize to the observer.

These examples are obviously very exciting and suggest that man is not the only animal who is able to enter into some form of meaningful communication with another individual. Furthermore, this kind of language communication is quite different from the kind of language which we were considering earlier. But where the languages which we have been thinking about—and especially the language of Washoe—may differ from human communication is in its intent or purpose.

AWARENESS

We must now turn our attention to the question of awareness. Can we credit animals with the same sort of awareness which we attribute to humans? Can we even begin to expect that an intelligent animal such as a chimp can be involved in the same sort of thought processes which we indulged in at the beginning of the discussion? Can animals perhaps use abstractions in the same way in which we do?

The evolution of man is not just concerned with his physical or bodily evolution; it goes further than this. Man's evolution has, as it were, accelerated outside the realms of organic evolution because man has developed certain abilities which other animals may lack. He is able to take a critical look at the world around him and to look at and think about himself in the context of his surroundings. Because he has developed these attributes, he is able, to a very large extent (alarmingly so at times), to interfere with his own evolution and his environment. As A. R. Peacocke said: "If behaviour is included with structure and function among the elements contributing to 'complexity,' then man, with his diversity of behaviour, and at different historical periods, must surely qualify as the most complex of all living creatures. But this is only if his behaviour, which is the outward expression of consciousness, is to count. Otherwise, he possesses the same degree of complexity as other mammals of comparable size."⁶

Included in this term "complexity" is man's ability to educate himself and to develop his intelligence to such an extent that he becomes aware of himself and of the inevitable fact that he will die. The concept of time—past, present, and future—has become an important part of his consciousness.

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Theodosius Dobzhansky has this to say about awareness:

Man has intelligence, like other animals, which permits him to use thought processes for the attainment of immediate, practical aims: but man has another mental quality which the animal lacks. He is aware of himself, of his past and of his future, which is death; of his smallness and powerlessness; he is aware of others as others—as friends, as enemies or strangers. Man transcends all other life because he is, for the first time, life aware of itself. Man is in nature, subject to its dictates and accidents, yet he transcends nature because he lacks the un-awareness which makes the animal a part of nature, as one with it.⁷

But we cannot with any degree of certainty say that animals do not possess perhaps some of these attributes: There is an element of continuity which we should not ignore. Those of us who have owned dogs or cats or some other domesticated animal are often tempted to suggest that something of man's thought processes exist in animals; we can never know for certain because we cannot actually enter into the minds of those animals. I myself feel that animals do possess perhaps a primitive form of man's attributes; perhaps this is sentimentality, I do not know. An animal certainly avoids danger through instinct or perhaps out of experience. It remembers how unpleasant it was when it *was* caught a few days ago, and how it struggled to escape. A dog learns that it is "wrong" to chew the furniture or his master's slippers because it has learned through painful experience that such actions usually result in a beating but not because the dog has any concept that it is antisocial. Man's awareness is more than this; it is closely associated with his awareness of himself as part of a community and, however much he tries to evade the subject, as one who will die. Either one must assume that death marks the end of life in its totality and that nothing exists after that point which resembles life as we know it in the "here and now," or one acknowledges that death is but a turning point where one form of life ceases and another begins. Man's awareness has led him to contemplate his future. The way one behaves during life is brought about by one's awareness that death is bound to take place. The ethic has evolved. This must surely be one of the basic differences between our consciousness and that of animals. If the element of continuity does exist, then man with his ethic must treat the whole of the natural world with greater respect and responsibility. He must show that he really can be a good "steward."⁸

NOTES

1. William H. Thorpe, *Animal Nature and Human Nature* (London: Methuen, 1974), p. 88. This is an important work covering the whole question of man's part in nature. Much of the background material for this paper derives from this book.

2. Ibid.
3. K. G. Hayes and C. Hayes, "Imitation in a Home-raised Chimpanzee," *Journal of Comparative and Physiological Psychology* 45 (1952): 405-59.
4. R. A. Gardner and B. T. Gardner, "Two-Way Communication with an Infant Chimpanzee in Behavior of Non-Human Primates," in *Behavior of Non-Human Primates*, ed. A. Scheier and F. Stollnitz (New York: Academic Press, 1971).
5. Thorpe, p. 288.
6. A. R. Peacocke, *Science and the Christian Experiment* (London: Oxford University Press, 1971), p. 97.
7. Theodosius Dobzhansky, *The Biology of Ultimate Concern* (London: Fontana, 1971), p. 69.
8. For further reading, I suggest Carl P. Swanson's *The Natural History of Man* (Englewood Cliffs, N.J.: Prentice-Hall, 1973). This book, a personal account of a professor of botany, tackles the questions, What is man, How did he get there, and Where is he going?