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THE SENSORY WORLD WITHIN, AND MAN AND DOLPHIN\*

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I am taking the liberty of lecturing here in the same spirit in which I wrote the book MAN AND DOLPHIN. In that book I assume that a layman is anyone with an open mind and a broad view. Some of my scientific colleagues, in order to avoid this label, look at my writing with a narrow view and a closed-down mind. This, of course, automatically disqualifies them from being called laymen.

The medical researcher, of necessity, is influenced to a considerable extent by his medical colleagues. The man receiving medical training is forced to broaden his view intellectually, emotionally, morally and ethically. He bears the brunt of the responsibility for the well-being of members of his own species; when he takes such responsibility he must undergo many disillusionments about Homo sapiens. However, the reward usually outbalances the disillusion. He may arrive at a position in which he evaluates certain aspects of human activities with more objectivity than probably any other type of scientist.

Other kinds of scientists, especially in the biological sphere, focus their attention down on a small narrow area, sometimes but not always, to the detriment of the wider view. Some such persons tend to penalize those who use a non-Baconian approach to scientific research. Let me quote from Professor Donald Hebb's Hugglings Jackson Memorial Lecture in which he said, "it is clearly implied that scientific investigation proceeds first by the collection of facts and arrives secondly at generalizations from the facts.

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Speculations and the a priori postulate are both ruled out. This is the classical view deriving from Bacon and it has been known for some time to be false. No research that breaks new ground will be done in this way. The collection of facts from which to generalize demands the guidance of imaginative speculation." One may add that imaginative speculation must be disciplined by integrative feedback with new facts as they are discovered.

In this lecture the segment of research which I discuss sometimes encroaches in the area of imaginative speculation. I touch upon that which makes us essentially human beings rather than something else. We are in a sense dealing with ancient philosophical problems with a somewhat new and sometimes a refreshing approach. As opposed to the ancient Greeks, for example, we are freed up to a certain extent from attribution of certain qualities of ourselves, of reality, and of animals, to a multiplicity of gods and goddesses and their influences. Possibly some of the things which we have discovered in the last few years could have been discovered by the ancient Greeks or Minoans. If they did discover some of the things that we know today, which are apparently of recent origin, they may have buried it in their particular beliefs among priests, secret cults and myriads of gods. Plato said that the nurslings of Kronus spoke to the beasts. Today we may question whether the nurslings of Kronus were men or dolphins, or both.

First let us examine ourselves, then the dolphins, then our developing and past relationships with the dolphins. How do we know each one of us ourself? How do we know each other outside of one's self? How do we know the members of other species other than that of Homo sapiens? Experimental work is being done in each of the areas covered by the above three questions. Research is being done on individuals who are isolated from their fellow man from all other creatures and isolated, as far as it is possible,

from the physical realities which usually surround us. Pictures of such individuals are beginning to be developed as transmitted to us from each of them. After several hundreds of hours suspended in dark, silent, warm tanks of water with adequate breathing apparatus, one can tell one's fellow man something of the world within one's self. Alternatively if one has spent many months in the Polar night alone or sailing across one or more of the oceans of the world alone, or has been in an orbiting satellite alone, one can give one's fellow man a richness of internal experience that few people in a civilized world, with its demands, can approach today. Such experiences are of value to medical men in that capable, intelligent human beings can tell them the kinds of experiences which a normal functioning person can undergo under these extreme circumstances. This gives to the medical man an additional bit of perspective on his patients which he can acquire in possibly no other way.

I have been through experimental circumstances of a few hours duration similar to the ones given above. Others are going through these today. Of course such experiments are not as long or as intensive as those of the Polar and sailing variety. However, they do arm one's imaginative speculation by integrative feedback of certain unassailable facts about the mind of man. We can explore in the laboratory the sensory world within by such techniques. Once this world has been explored by a given individual, he sees the world about him in a new and sharpened perspective, including his fellow man.

One's world view is radically modified by the research on one's own inner frontier. Each of us has such a frontier inside. Surprisingly enough, a person undergoing such research on himself can find new information within himself. Such person may suddenly realize several items of what may

be ancient wisdom, which are not quite so obvious any more, as follows:

1. The members of one's own species are the most important nonself systems in the whole universe.

2. One's relationships with members of the opposite sex are basic to one's life, liberty and the pursuit of happiness.

3. One cannot create or discover beyond what is in one's self without communication with outside reality and with others.

4. The communication with others consists of at least the following: gestures, speech, embraces and cooperative creation of things, of other human beings, and of social institutions.

5. It is through speech and cooperative creation that we come to agree more or less about third parties and about physical reality.

6. We know no other species in these ways.

7. We do not know if any other species knows physical reality and us in any of these ways.

8. If we are deprived of the company of our fellow man any other living species from spiders upwards, receives our love and affection in our isolated state.

9. Such love and affection may occur in the universe only in the human species; this is yet to be subjected to experimental tests.

Let me make some definitions:

Animals are those other motile living organisms with whom we do not yet exchange knowledge by speech, gestures, embraces and cooperative creativeness.

Humans are those living organisms which include one's self, with whom each of us does exchange or potentially can do so, at least in principle, in the above ways.

How do we know one another within our own species? In childhood we store each in his own brain definite models which function and work and which gradually become more complex as we develop, models of other humans and of other animals. We each pass through a dark, mysterious and lonely phase of "no communication." This phase occurs before we learn to speak and to understand our native tongue. Our native tongue to be. In this dumb phase we store models of others (not dumb) communicating with one another. We are surrounded in our childhood by communicating adults, faced with their communications in a nonunderstanding way. One of our childhood aspirations is to explain how the sounds made by one adult causes another to respond in kind or in complicated action. We test them, the adults, with noises of special kinds. Some such noises elicit responses from the adults, others do not. (One of the universal distress calls of the human is a baby's cry.)

Most of us never do explain how the adults communicate. We learn to communicate with them ourselves, slowly and painfully. As we learn, new worlds inside and between others open to us and the problem of explanation of how we speak no longer exists. We leave behind us the dumb inanimate realities which we had peopled with the so many "animate" intelligences which we neglect later.

We also leave behind the apparently unspeaking animals. We never did learn even one of their languages. We learned the language only of our own species. We developed empathy, sympathy, and concern for the other speaking humans. For the unspeaking beast, as we mature, we develop only an objective affection, some pity and a bit of scorn. For the larger ones we reserve fear because with them we cannot speak and we cannot control their behavior except under special circumstances. We come to identify speech

capability with reasoning and cognitive power. With increased complexity of speech in others we give respect. With decreased or undeveloped speech goes loss or lack of respect. No animal has the respect we reserve for fellow humans. How did the human species learn to speak? The true picture, of course, is lost in prehistory. We have only skulls, bones and artifacts from which to reason out a possible picture.

In the book MAN AND DOLPHIN I present a theory that at a certain crucial period the brain of man reached a critical threshold size which allowed the development of complex language. Previous to this epoch man's smaller brained progenitors did not have speech and were unable to communicate predictive and descriptive matters at a distance. Thus cooperative creation and destruction were limited to an emoting, moblike social group. As the brain became large enough to develop speech, speech developed quite spontaneously. The first coordinated speaking groups of humans separated themselves out, managed to abolish their nearest rivals and leave us with the present gap in the brain sizes between that of the gorilla and that of modern man. Our ancestors destroyed those without language who competed with them. Today we conserve those who speak a complex language but institutionalize or otherwise control or even eliminate those who do not speak or are incapable of it. Speech probably started something less than about five hundred thousand years ago; art started at least 40,000 years ago, and writing began approximately 7,000 years ago.

Why should speech appear at a critical brain size? Modern complex language consists of an extremely large number of unique sound patterns stored within the brain substance, stored somewhere, somehow not yet clearly enunciated. The large brain is capable of extremely rapid relational juggling between the mental symbols of these sounds. Such a brain has developed a

fantastically dexterous control of very complex phonation and respiratory muscle systems in the body. In addition a large brain is able to test hypotheses among alternatives generated by the sounds that are heard and the sounds that are transmitted in answer. This fantastic number of rapid references in association in storage we cannot yet duplicate by means of artificial machines.

Those without this fabulous capability, other species, are isolated and confined in institutions or bred on farms for our food, or hunted and killed or are captured and put in a zoo for the entertainment of the human species.

Let us now return to the isolation, solitude and confinement experiments and experiences mentioned above. I wish to so return in order to give you somewhat of a perspective on what we are doing with dolphins and an attempt to arouse your empathy for their position with respect to that of man.

Deprived of the exchanges with others, what happens to each of us who do speak and who do exchange ideas? Isolation experiences, that is the solitary Polar, sailing, prison and experimental ones, as we said above, give us some answers to this question. Without human exchanges one survives if reality provides oxygen, body food, shelter, proper temperatures, and so forth. One survives if provocations of pain, of fear, of anger, are not too frequent, too long in duration, or too intense for the particular human involved. One survives if rewards internal and/or rewards external can be found frequently enough, intense enough and long enough. In the absence of external rewards and punishments internal rewards and punishments become all important.



One can detect such internal activities through an analysis of that which happens to one in isolation. First of all there is self talking; one talks to one's self endlessly and eventually demands silence for certain periods for one's self. There is a revivification of the models of other human beings - this revivification can become so intense that it is almost as if this person were partially present. There are enhanced struggles with previous struggle materials; one's mental wrestling continues until there is resolution of one's own conflicts with the internalized wrestlers. Eventually, in those that survive, there is a resolution of internal paradoxes and one abolished what I call 'mental time wasters'. A greater respect in regard for one's self, and for one's fellow man develops as well as in an increased humility in the face of the unknown. One eventually realizes that one carries a very large fraction of the unknown within one's own mind and brain.

At first in these experiences, there are vividly imagined satisfactions; what's missing is recreated. However, this is a transition phase before one begins to accept the 'emptiness,' the 'evenness,' as Admiral Byrd called it, and the 'aleness' of one's surroundings. When restored to exchanges with one's own species, there is an enhanced appreciation and a vigorous reanimation of transactions of all sorts. In the long term, however, this calms down considerably and one is left with strong resolutions to do only that which is important with the rest of one's life. As a footnote to the above discussion I wish merely to repeat that which one can read at the bottom of the prescription bottle received from one's druggist; I wish to give you the advice given in the advertisements of one of the ethical drug houses, "seek the advice of your physician." Do not prescribe solitude, isolation and confinement for yourself. Finally a cliché, "a doctor who

treats himself has a fool for a doctor and a fool for a patient." One may not agree with these clichés, but it is popular these days to emit them "so that the public will not panic."

Let us consider some aspects of scientific research on man and dolphin. I cannot somehow separate man from the dolphin in giving you an account of our research with the dolphins. I chose that title for my book because we are men and they are dolphins and during our research on them we must constantly be reminded of the fact. Several of my colleagues continue to forget it and write as if they are not men but some sort of Greek gods sitting "on Mount Olympus' wintry top." Our limitations within our own minds must be brought to our research with the dolphins. The dolphin as it were forces us to broaden our point of view and to modify it repeatedly. Those of you interested in the detailed picture of what we have been doing can read our published scientific papers and the book mentioned above. Here I wish to present that which we were talking about at the beginning of this lecture. We asked, how do we know ourselves, how do we know one another, and now let us ask, - how can we learn to know another species, the dolphins? Obviously we cannot learn to know the dolphins without being close to them. I have a rather humorous picture of some current "scientific" attempts to know the dolphins and whales which I will describe to you.

Man rushes around in the air in airplanes, rockets, helicopters and blimps. He rushes around on the surface of the sea in row boats, destroyers, hydrofoils, and air boats. Recently he has begun to rush around at high speed under the sea in huge metal containers known as nuclear submarines. The dolphin-eye view of the human race probably has a good deal of humor in it. They probably hear all of our ships approaching, our airplanes approaching, or our nuclear submarines approaching and say to one another,

"here come those invaders from outer space again." They too have their UFOs.

Seriously, however, a man alone in the sea naked as a dolphin is almost totally helpless. A dolphin stranded on land is in a similarly distressed situation. These two facts make for very poor communication between these two species. In the sea we are naked and afraid or bottled up, and on land the dolphins are immobile and terror-stricken.

In our laboratory we are trying to correct these alienating influences. We have found that dolphins and man respond best to one another in shallow water. The shallow water allows the dolphin to continue his swimming activities without too great advantage over the walking, standing or sitting man in the same water. The man can keep his head above water and the dolphin can keep his flippers and fins below water so that he can propel himself. This seems to be the key to most of our findings, this background requirement. We literally rub one another's noses against one another and meet on terms in which each of us still has sufficient of his normal power so as to allow cooperative activity and yet is sufficiently handicapped in the exercise of those powers so as not to abuse them, humorously or otherwise.

There are examples of wild free dolphins who have come to man from the sea such as Opo in New Zealand and in the cases of the boys and the dolphins among the Greeks; but most of the time a wild dolphin prefers the freedom of the broad seas to becoming entangled with the peculiar species that insists in living on land. I hasten to add for those skin divers who have made friends with the dolphins that there are some unusual human beings as there are unusual dolphins - human beings who go out and seek contacts with the wild ones in their native habitat.

We call our laboratory a place where the dolphins are allowed a very close look at the human race. We then observe the resulting effect on this other species. The effects are many and our time is getting short so I will restrict myself to one aspect of these effects.

In 1957 I discovered the ability of these animals to produce the sounds of our speech. These experiments were done for totally other reasons. (We were exploring the large brain in these animals by means of electrical stimulation through implanted electrodes). Recently during the past two years we have been able to explore this effect (without the use of electrodes and without the stimulation of certain portions of these animals' brains artificially). In brief we have completely confirmed and improved on the 1957 discovery and find this production of human-like sounds is more than just mimicry. A dolphin can produce clear words and can use them as demands for rewards and in other transactions.

Recently we have been examining in some detail the process and the emissions of our animal Elvar. Elvar is a 3½ year old male Tursiops truncatus, the bottlenose dolphin (whose common American name is 'porpoise'). Elvar has acquired a vocabulary of approximately 20 understandable English words. Let me modify this statement - a vocabulary of 20 English words with many variants of each of these words.

Elvar insists on playing games of pronunciation and taking a word like "more" and making many variations on its pronunciation. Elvar dissects a new word into its component sounds and reproduces each sound separately. With each new word he starts at the extremely high dolphin frequencies which are normal to this species (4 to 20 kilocycles per second). He also tends to shorten up the word that he is emitting at high frequency. If one slows down the tape (4, 8, or 16 times) the lowest frequencies drop near to the high

human ones and the word lengthens out to the normal human length. This initial phase of the high frequency emission may change to a phase in which he translates from his frequency domain into our frequency domain.

Let me give you a specific example from one of our tapes. My assistant has said, "more Elvar", Elvar comes back with something that sounds like "moa" a pause and "var" both sounds in the upper human frequency domain and in the human time domain. He then puts it together in the delphinese domain of a higher frequency and says a very short condensed very high pitched version which I can hardly copy, "more Elvar" running it all together. It sounds very much like a very small child saying it extremely rapidly. He then lowers the frequency and extends the duration and says very clearly "more Elvar" in a voice that sounds like a small child at a normal rate of delivery.

Sometimes he says the word that the human says so rapidly after the human that one could barely detect the pause without slowing down the tape. An example of this is a "bye bye" when Alice leaves the laboratory. She says "bye bye" and his "bye bye" comes so close on the heels of hers that it was only a few milliseconds between the end of her transmission and the beginning of his.

Faced with a new human voice Elvar modifies his output to encompass some of the new aspects: changing the operator from that of a female human voice to a male human voice causes Elvar to emphasize the new aspects of the new voice. An example is the episode in which I taught him a new word, "water." He took it apart and submitted portions of it to me; apparently at the beginning was stumped by the ending "r." My "r" is much more vibrant and low pitched than was that of the previous female operator. He finally resolved this by emitting a series of rapid clicking sounds.

These are brand-new findings in a new scientific field, of unknown

consequences and unknown utility. I wish to emphasize that until we believed that the animal could do it and demanded this kind of performance from him, he did not do it. Insofar as we know this is not a spontaneous production on the part of the wild dolphin. It may have happened in the past that the dolphins have tried to speak to other human beings. I could imagine a Greek shepard boy listening to a dolphin trying to talk in Greek 1000 B.C. and thinking that the god Apollo was talking through the dolphin.

We have come a short way on a new apparently long path. The path is so startlingly new that we know not where it leads. What the eventual speech powers of the dolphins (large or small, from Phocaena to Orca) is and will become and will reveal is still in the realm of "imaginative speculation" of Professor Hebb. It will be several or many years before this new field of research which we have opened will be adequately explored by us and by others. A few dolphins and a few human beings in our Institute are finally dedicated to testing one another's abilities in English and in Delphinese. So far the dolphins are ahead; our production of Delphinese is very poor indeed.

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