10

Consciousness

by E. D. Adrian

Trinity College, Cambridge, England

One can scarcely come to a meeting of this kind without being reminded of the basic problems that have shaped Western philosophy, the problems of substance and shadow, reality and appearance, mind and matter. They are problems that have been debated since Plato and they have led to all the main developments of philosophic doctrine. As natural scientists I expect most of us prefer to remain uncommitted: our own picture of the universe is clearly not the whole truth but it has been too useful to be far from it and it can always be adapted to include fresh evidence. Yet if we are physiologists it may be difficult to maintain this Olympian detachment. If we are concerned with the sense organs and the central nervous system we are bound to be aware of the difficulties which arise, or have arisen in the past, in relating activities which seem to be shared by the body and the mind.

In his book on *The Analysis of Mind,* Bertrand Russell said this: "Few things are more firmly established in popular philosophy than the distinction between mind and matter. Those who are not professional metaphysicians are willing to confess that they do not know what mind actually is or how matter is constituted, but they remain convinced that there is an impassable gulf between the two and that both belong to what actually exists in the world." It would seem then that the physiologist has that impassable gulf to face as soon as he allows himself to look up from his apparatus.

But Russell wrote that more than forty years ago. I am not at all sure that it is still the popular belief that mind and matter cannot be mixed. There may be a few elderly simple people who are still convinced of the gulf, but the philosophers of our time have all argued so persuasively against it that most of us are prepared to admit that our conviction of it

might have been due to some misunderstanding. However much we distrust the metaphysicians, we cannot overlook the fact that the gulf between mental and material can scarcely be called self-evident. It is, or used to be, anathema in the USSR and there must be a large number of the human race who have never suspected its existence.

The change in popular opinion in the twentieth century seems to have been due, in part, to the influence of Mach and William James and the spread of the experimental method into psychology. At all events, by the beginning of the century it was becoming more respectable for psychologists to use some kind of monism as a working hypothesis and even to be whole-hearted behaviorists. McDougall in England kept the flag of dualism flying for a time, but the controversy was becoming a back number by 1914 when the interest had shifted to the more romantic areas revealed by Freud.

Since that time, metaphysicians of all shades have shown a notable unanimity in rejecting the dualist position. They are agreed that the layman's separation of mind and matter will never do and they have given no support to the physiologists who assert that a thought is not the kind of thing which can be expected to depolarize a membrane. They tell us that those who hold such views have no clear conception either of mind or of matter and have been led into error by theological dogma and the ambiguities of language.

Unfortunately their agreement in rejecting dualism has not been coupled with agreement in accepting anything else. Various compromises have been put forward, things or processes which can be viewed as physical or mental according to their context, like Whitehead's *Structures of Activity*, or Russell's *Sensibilia* or Broad's *Sensa*. It is discouraging to find that each of these explanations, which seems so logical when we read it, should fail to satisfy more than the few professional critics whose explanation has been on the same lines; yet it is some encouragement to learn of so many different ways of escape from the mind-body dilemma, and scientists can say, rather patronizingly, that in metaphysics the advance is bound to come by disputation rather than by experimental evidence.

Now physiology and psychology are experimental sciences and they have advanced considerably in their proper spheres during the present century, but have they done any better than metaphysics in bringing mental activity into the same picture as matter, or, alternatively, in showing that it is bound to be excluded? Certainly not much better, but at least it can be said that the gulf has been narrowed, that they have brought mind and matter closer together.

It has never seemed to be necessary to go outside the elastic frame of natural science in describing the action of the sense organs and the signals they send to the brain, but now we can add that there is no need to invoke

extraphysical factors to account for any of the public activities of the brain itself. Nowadays a mechanical man could certainly be built to do all, or almost all, that we do ourselves. Someone would have to design and make it, but it could be made to behave as intelligently as we do. The "Universal Turing Machine" can turn its band to any problem. Machinery, in fact, could be constructed to produce most of the facets of human behavior—far more than would have been dreamt of in the period when Condillac imagined the statue coming to life. The comic papers do not exaggerate. Our present-day statue could be designed to speak its thoughts, to answer our questions, to express anger or joy, to recognize friends, form habits and solve problems. It could be made to report introspections and to tell us its hopes and fears.

According to Ross Ashby, and I think we must accept what he says, a machine made on his plan could equal the human brain in the search for knowledge. Naturally there would be differences; unless great pains were taken in its design, we should not expect the robot brain to be so flexibly organized, its different departments might not be so well integrated, and quite apart from such failings we should recognize it as part of a machine and not of a man because it would be made of metals and plastics instead of living cells. We have to admit, however, that to this extent the behaviorist hypothesis seems adequate. As far as our public behavior is concerned, there is nothing that could not be copied by machinery, nothing therefore that could not be brought within the framework of physical science.

Yet for many of us there is still the one thing which does seem to lie outside that tidy and familiar framework. That thing is ourself, our ego, the I who does the perceiving and the thinking and acting, the person who is conscious and aware of his identity and his surroundings. As soon as we let ourselves contemplate our own place in the picture we seem to be stepping outside the boundaries of natural science.

It was William James's rejection of consciousness that made everyone more critical of this particular ghost. He saw no need for separating the thinker and the thoughts and reported that his own search for the "I" revealed only feelings of tension, chiefly in the mouth and throat. At that time, Bergson's philosophy was in the ascendant, and as late as 1911 Bergson maintained that we have a direct and communicable knowledge of our own consciousness. For James, however, consciousness was not an entity but a function, simply the function of knowing.

There are, of course, logical or linguistic difficulties about assigning any meaning to the statement, "I am immediately aware that I am conscious," or even, "I know my own mind." In fact, one has only to read any of the numerous books and papers and reports of symposia in the past ten years to realize the various muddles we are in when we try to give pre-

cision to arguments about consciousness or mind. Ryle has made much of these in arguing against the dualist position, the ghost in the machine. But, in general, the psychologists seem to be much more troubled by the grammatical and logical difficulties than are the philosophers. These are on the whole more tolerant and anxious to rescue whatever meaning our statements contain.

How then are we to account for our conviction that we have an immediate awareness of ourselves and that this is the one thing which a machine could not copy?

I used to regard the gulf between mind and matter as an innate belief. I am quite ready now to admit that I may have acquired it at school or later. But I find it more difficult to regard my ego as having such a second-hand basis. I am much more certain that I exist than that mind and matter are different.

Apart from those who are insane, "out of their mind," one does not come across people who do not believe in their individuality, though there are many who do not believe in the separation of mind and matter. Belief in one's existence seems to depend very little on deliberate instruction.

But here we have to rely on evidence which must be derived by introspection. We could construct a machine which would tell us that it was conscious, but we should not believe it. When our fellow men say they are conscious, we believe them because they are much more like ourselves; but we know that many of their ideas and ours have been planted in them and in us by parents or schools fellows; and, for all we know, some of our beliefs about our minds and our awareness may have been acquired in that way. The "I" that I know has been exposed to all the influences of the outside world since my birth. If we wish to reach through to the mind, the individual that has been influenced, we might try to discount all these extraneous factors by comparing the introspections of a great variety of people.

This is easier said than done, for it is usually necessary to elicit introspective reports by direct questioning and it is then more than likely that the report will be unintentionally influenced by the questioner. The horses of Elbefeld were accustomed to giving their master the answer he wanted and the human subject can be equally obliging when the answer will do no one much harm. Questions about the ego need careful framing and impersonal asking if they are to avoid the danger of suggesting the answer which would fit our particular beliefs. It was partly this unreliability of introspective reports which made the behaviorists disregard consciousness in their study of human activity.

Now, in the study of the human ego, introspections are almost all that we have to guide us, but some of the difficulties may not be as serious as

we may think. The particular difficulty that the questioner may influence the answer recalls the uncertainty principle in physics, which limits the knowledge we can gain about any individual particle. Observation of that particle is bound to affect its position and velocity, but this does not make it impossible to define the behavior of a system made up of a large number of particles. In a similar way, some kind of statistical treatment might help to compensate for the disturbing effect of the questioner who asks us to report our private data.

Few of us would wish to embark on large-scale statistical comparisons of introspective data, but there are various problems in the psychosomatic field which seem to be badly in need of such treatment. It may be too much to expect that we shall ever find a way of submitting the theories of Freudian psychoanalysis to tests as exacting as those we should use in physics. In our present state of knowledge, it may be more illuminating to express the conflicts of the spirit by parables and myths than by weights and measures—and in any case it would now be very difficult to find people in the Western hemisphere who have not been already biased by popular opinion.

But there is a field of some promise, where the data are less emotionally charged, and it is one more closely related to particular physiological events. This is the field of perception, and I shall mention developments in that field which may be relevant to the problem of our conscious activities, though they might also be used to illustrate the weakness of introspective evidence. There was one, concerned with what is called eidetic imagery, which is in danger of being forgotten nowadays; it dates from the period when German psychology was still under the inspiration of Kraepelin's psychiatric classification and the psychologists then were particularly anxious to divide humanity into different bodily, mental, and temperamental types, the asthenic the pyknic, the schizoid, and so on. Kretschmer's book on *Physique and Character* was published in 1921. Not long after, Jaensch, at Marburg, began to study the perceptual images following optic stimuli and found that they could be used as a guide to the mental and constitutional type. His work on eidetic images roused great interest, for he described them as something between sensations and images. Like physiological after-images, they are always seen in the literal sense, but we do not all see them. They are more often reported by literary or artistic Frenchmen or Spaniards than by scientific Britons or Americans. Sometimes they are little more than sensations and are then seen, like after-images, in the complementary colors; sometimes they are more like memory images, with more detail and variety and appearing in the original colors. Jaensch said that eidetic imagery of this latter kind was rare among average adults, but much commoner in children, and that the eidetic disposition is correlated with nationality, with the particular kind

of school teaching, and with certain constitutional factors depending on the thyroid gland.

He found that in schools in certain districts, 85–90 per cent of the children were eidetics. He considered that some of his colleagues had failed to recognize the eidetic type and pointed out that the difference between actually seeing and merely imagining is particularly clear when the eidetic image develops gradually. "Now I see this . . . ," "Now that is beginning to appear," children will say, pointing to a particular spot on the screen. "I know that . . . was also there, but I do not *see* it." In spite of the critics [Allport, *Brit. J. Psychol., XV,* 1924], Jaensch maintained that eidetic phenomena were easily recognizable and reproducible. He was able to develop theories of perception and of education based on their occurrence.

For a time it looked as though Jaensch had discovered something which might be an important bridge between the physiological processes of sensation and the resulting mental experience, but the emphasis was on its value in typology. The general impression seems to have been that, although eidetic imagery exists, Jaensch went too far in thinking that a particular type of response was at all characteristic of the mental and bodily type. The nature of the image seems to depend much more on the situation than on the individual, though it may well be a valuable clue to the way in which visual material is incorporated in the mental organization.

At present, at all events, the study of the body image seems a much more profitable line to follow. It brings together the psychologist, the psychoanalyst, and the clinical neurologist, and it is usually associated with the name of Paul Schilder who was all three. He made observations on eidetic imagery and hypnagogic visions, but was particularly concerned with images dealing with the subject's body and limbs in relation to the outside world, with the boundary between the body and its surroundings, with its relations with space and time and movement. It is to some extent his preoccupation with our ideas of ourselves in relation to the world that distinguishes Schilder's description of the body image from that of earlier workers, Head for instance. The conclusion he reaches is that the body image is constructed gradually, by trial and error. Consciousness is not an independent phenomenon, but consists of the process of trial and error in perception and thought "until the object and the outside world is reached. Consciousness is the attempt to bring experience within a context, we may call this context the ego, from an analytic point of view." The ego, in fact, is a synthesis of our experiences from birth (or before it).

His book *The Image and Appearance of the Human Body* has the subtitle *Studies in the constructive energies of the psyche,* and some of it is hard going for those who are not at home in a Freudian landscape. Some

of it also revives our mistrust of introspective reports, particularly when they have been elicited by someone who was clearly a quick-witted and sympathetic examiner with views of his own.

For instance, when Schilder deals with the physiological basis of the body image, he says that "our tactual perception of the skin is felt distinctly below (about 2 cm below) the surface of the optic perception of the body. When we touch an object and gradually diminish the pressure exerted on it, the object and the space between the object and the skin disappear but the sensation in the skin remains. There is at the same time a distinct sensation that the skin is bulging as if reaching for an object."

I have to admit that I do not recognize this description in my own sensations, and there are other passages where, although I can recognize what he describes, I suspect that I should not have done so without his prompting. He quotes, for instance, the reports of six subjects who were asked to imagine a white line, of others asked to describe their sensations in an elevator descending rapidly and then coming to rest. I will not tell you the reports, for you would then be biased for or against them.

Nor shall I try to summarize the more theoretical treatment he undertook, his views on the libidinous structure of the body image and on the difference between his attitude and that of Gestalt psychology. But his views on the physiological basis of the body image include a great many observations made from a more direct physiological and clinical standpoint. He believed that there is no action in which the postural model of the body does not play an important part, and "No sensory experiences that lack spatial qualities." (The term *perception* means that something is going on in space.) Effort or experiment leads to more unified space experience. The body image too is constructed gradually; it can be changed by clothing, by spectacles, or a walking stick. "When people wear enormous masks at the Carnival in Nice they are not merely changing the physiological basis of their body image, but are actually becoming giants themselves."

Schilder does not regard the body image as more than one essential ingredient of the ego, though, like the ego, it is organized by memory and experiment and cannot be maintained without constant effort. I am not convinced that I have understood his description of consciousness as a social act dependent on the resistances of the world, that it consists in "trying to see the context of our experiences by comparing those we find in our outer and inner world." I can only recommend his two books, *Mind, Perception and Thought* and *The Image and Appearance of the Human Body*. Although I cannot follow all the arguments and think some of the evidence is not convincing, at least he makes it clear that our ego and our awareness have many features which are related to bodily events. He makes it very difficult to maintain the belief in an impassable gulf between mind and body.

I am not sure whether more observations on these lines can lead us much further, for what is most needed is corroborative evidence based on data which are not merely reports of introspection but are open to public observation. Fortunately we have evidence of a different kind in the studies of Baldwin, Piaget, and others on the development of intelligent behavior in the child. The picture which Piaget draws is again of a gradual process of establishing the boundary between the self and the external world. He distinguishes first a phase of "absolute realism," where there is no boundary at all, when the child is exclusively concerned with things and confuses himself and the world; then the phase of "immediate realism," where the instruments of thought, names, and words are distinguished from the things but are situated in them. This may last up to eight or nine years, to be followed by the stage of "mediate realism," where they are not in the things but in the body, and finally by the adult phase of "subjectivism," where the thoughts are within ourselves.

Piaget finds that the child's awareness of their own thoughts takes place invariably after the age of seven or eight. It is dependent on social factors through contacts with others. He quotes an interesting passage from Edmund Gosse's account of his own childhood. He had lied to his father and not been found out: he suddenly realized not only that his father was not infallible but that there was a secret belonging to Edmund Gosse and to someone who lived in the same body with him. "There were two of us and we could talk together. It is difficult to define impressions so rudimentary, but it is certain that it was in this dual form that the sense of my individuality now suddenly descended upon me."

Piaget points out that as long as the child believed in his father's omniscience, his own self was nonexistent, in the sense that his thoughts and actions seemed to him common to all. The moment he realized that his parents did not know all, he straightway discovered the existence of his subjective self. It shows how the consciousness of self is not a primitive intuition but results from a dissociation of reality and shows also to what extent this dissociation is due to social factors, to the distinction the child makes between his own point of view and that of others.

There is, of course, a large element of introspection in such evidence, but not in the evidence which shows that it may be seven years or more before the child's ideas of space, size, and direction are organized. Without that organization the distinction between the self and the world can scarcely be as definite as it will be in the adult. That particular ingredient of the ego must be built up by experience. I have to admit that this seems to have little relevance to the question whether a machine could ever become conscious, but it does seem to me to make the question less important.

I will try to sum up the position as I see it now. William James said that his search for the ego revealed only feelings of tension, chiefly in the

mouth and throat. No doubt his thoughts took shape to the accompaniment of slight movements of verbalization. Nowadays we should expect to find the whole sensory input from exteroceptors and proprioceptors contributing to the tension, and it is probably better to think of the ego as a summary of the whole structure which has built up the individual since the child began to answer to its name.

But words like "structure," "organization," or "pattern" can often give a false sense of scientific respectability, and they have been used too often as a way of escape from our difficulties. It will be better to avoid them and to end up by giving you the general conclusions reached by the distinguished neurologist Francis Schiller, at a symposium on Brain and Mind in 1951. His paper is called "Consciousness Reconsidered." He is led to conclude that exclusively physiological and exclusively introspective accounts of the subject are incompatible and give rise to artifacts. Although they are complementary, integration of knowledge is hard to achieve because their points of reference and scales of observation are wide apart. "Consciousness" is a logical construction. The ego is a convenient abbreviation, an abstract of a multiplicity of objects from which it is developed. It arises when unconscious processes are integrated; its base line in the individual and in the animal kingdom is arbitrary.

That seems to me to be a reasonable position to have reached. It differs little from Schilder's and Piaget's in essentials. The physiologist is not forced to reject the old fashioned picture of himself as a conscious individual with a will of his own, for the position allows some kind of validity to the introspective as well as to the physiological account.

It admits that the two are incompatible but does not maintain that they must always be so. It would certainly be absurd to suppose that the scientific account will not be altered. Physics has synthesized ideas which once seemed quite incompatible and will probably do so again with great profit; possibly our picture of brain events or of human actions may be changed so radically that in the end they will account for the thinker as well as his thoughts.

DISCUSSION

Chairman: PROFESSOR GRANIT

THORPE: We have heard from Lord Adrian of the prevalent philosophical attitude reflected in the phrase "the ghost in the machine." I shall be referring to this subject myself in a talk to be given at a later session. But I would like in this connection to quote here and now a few sentences illustrating the

opposite view from a recent lecture by a distinguished Oxford logician, Professor William Kneale.* Kneale says "We must retain the Platonic notion of mental events which are distinct from anything in the physical world and manifest a special kind of connectedness. The occurrence of such events is part of what we ordinarily intend to assert when we speak of the existence of mind and a presupposition of all the more interesting things we want to say about them."

ADRIAN: That is an example of the swing of the pendulum.

HINSHELWOOD: I have just a very brief question to ask Lord Adrian. I wonder whether he would feel that self-consciousness ceases to be wholly lacking in the public quality that he spoke of when one takes into account the immense degree of coherence that can be achieved in the checking and cross-checking, and in all the variations that can be played upon this checking, in our communications with other people, and in our comparison of our feelings and experiences with theirs. All the elaborate mechanisms of human communication which evolution has produced contribute to this end. It would seem, therefore, that in this way our own consciousness does begin to gain that public quality that Lord Adrian thinks important. I would like to know what he feels about this point of view.

ADRIAN: I think that is quite true, there must be a great deal of corroborative evidences in any verbal reports that we make in that respect and they are public in a sense, but there is a great deal of uncertainty, I think in what we do say, because we are so untruthful, when questioned about our sensations, and when we have no particular certainty about what our sensations are and where or whether we remember something.

ECCLES: I would like to follow up Professor Thorpe's quotation by pointing out that a psychologist, John Beloff, has recently published a book in England entitled *Existence of Mind*, which is a most pointed and effective attack on Rylean philosophy. He there makes the statement that philosophers such as Ryle utilize such a cheap gibe as "the ghost in the machine," when attempting to discredit the brain-mind problem.

ADRIAN: I wish I knew more about the present developments in metaphysics and philosophy in Great Britain and in America. The interest seems to have gone largely into Wittgenstein's ideas and into logical studies, and rather left this question of mind and matter. So that was one reason why I was quoting one of the earlier philosophers who flourished in my young days.

SPERRY: I want to go back to the statement that we can build a mechanical man that can do everything that we can do. I wonder if our engineers are really that far along. There is a view that holds that consciousness may have some operational and causal use and from which it follows that in order to build a machine like the brain one would do well to plan to incorporate consciousness in the design.

ADRIAN: We should do better by incorporating consciousness, but I am merely quoting the people who design theoretical machines.

* Kneale, *On having a mind*, Cambridge [1962].

TEUBER: Unless I misunderstood Lord Adrian, he has specified at least one principal condition in order to make this computer get the first glimpse of consciousness; it would have to tell a lie. Was not that what you said?

ADRIAN: Yes! I would not have said that you could make a machine which would say it was conscious, although it was not: that would be a lie.

TEUBER: I thought of your beautiful citation from Edmund Gosse, Juvenilia.

ECCLES: I would like to invert the present discussion by asking as a neurophysiologist, why do we have to be conscious at all? We can, in principle, explain all our input-output performance in terms of activity of neuronal circuits; and, consequently, consciousness seems to be absolutely unnecessary. I don't believe this story of course; but at the same time I do not know the logical answer to it. In attempting to answer the question, why do we have to be conscious? it surely cannot be claimed as self-evident that consciousness is a necessary requisite for such performances as logical argument or reasoning, or even for initiative and creative activities.

PENFIELD: I had in mind to ask whether the robot could, in any conceivable way, see a joke. I think not. Sense of humor would, I suspect, be the last thing that a machine would have. But I would like to go a little farther and refer to something which I brought out in my own paper this morning: Each man "programs" his own brain by focusing and altering his attention, especially in childhood. In a sense, each individual mind is creating the brain mechanisms, establishing the brain connections that are functional. He does this by the selection of things to which he attends. It is easier to think of it during the earlier years of childhood. The child is establishing the functional pattern of connections. If the brain is tested later by electrical stimulation, it becomes evident that he has done one thing in one part of his cortex and another thing in another. In a sense, the child's mind is stepping in and creating the machinery of the brain.

I throw that concept in hoping for discussion, since there was no time allowed for discussion after my paper.

ADRIAN: That is rather the motion when I think of the consciousness being built up by effort, which children I think first put forward.

CHAIRMAN: I suppose this ends the discussion for the time being, and I suppose that many of us will agree that most of the really important things we perform are quite unconscious.