responses to criticism and revision, and to create new forms of understanding. It is the exercise of that rational capacity that explains the theories.

Ethics, though more primitive, is similar. It is the result of a human capacity to subject innate or conditioned pre-reflective motivational and behavioral patterns to criticism and revision, and to create new forms of conduct. The capacity to do this presumably has some biological foundation, even if it is only a side-effect of other developments. But the history of the exercise of this capacity and its continual reapplication in criticism and revision of its own products is not part of biology. Biology may tell us about perceptual and motivational starting points, but in its present state it has little bearing on the thinking process by which these starting points are transcended.

There may be biological obstacles to the achievement of certain kinds of moral progress. Without question there are psychological and social obstacles, and some of them may have biological causes. That does not make them insurmountable. They must be recognized and dealt with by any moral theory that is not utopian. But this recognition does not amount to acceptance of a biological foundation for ethics. It is no more than an acknowledgment that morality, like any other process of cultural development, must reckon with its starting points and with the nature of the materials it is attempting to transform.

11

Brain Bisection and the Unity of Consciousness

I

There has been considerable optimism recently, among philosophers and neuroscientists, concerning the prospect for major discoveries about the neurophysiological basis of mind. The support for this optimism has been extremely abstract and general. I wish to present some grounds for pessimism. That type of self-understanding may encounter limits which have not been generally foreseen: the personal, mentalist idea of human beings may resist the sort of coordination with an understanding of humans as physical systems, that would be necessary to yield anything describable as an understanding of the physical basis of mind. I shall not consider what alternatives will be open to us if we should encounter such limits. I shall try to present grounds for believing that the limits may exist – grounds derived from extensive data now available about the interaction between the two halves of the cerebral cortex, and about what happens when they are disconnected. The feature of the mentalist conception of persons which may be recalcitrant to integration with these data is not a trivial or peripheral one, that might easily be abandoned. It is the idea of a *single* person, a single subject of experience and action, that is in difficulties. The difficulties may be surmountable in ways I have not foreseen. On the other hand, this may be only the first of many dead ends that will emerge as we seek a physiological understanding of the mind.

To seek the physical basis or realization of features of the phenomenal world is in many areas a profitable first line of inquiry, and it is the line encouraged, for the case of mental

phenomena, by those who look forward to some variety of empirical reduction of mind to brain, through an identity theory, a functionalist theory, or some other device. When physical reductionism is attempted for a phenomenal feature of the external world, the results are sometimes very successful, and can be pushed to deeper and deeper levels. If, on the other hand, they are not entirely successful, and certain features of the phenomenal picture remain unexplained by a physical reduction, then we can set those features aside as *purely* phenomenal, and postpone our understanding of them to the time when our knowledge of the physical basis of mind and perception will have advanced sufficiently to supply it. (An example of this might be the moon illusion, or other sensory illusions which have no discoverable basis in the objects perceived.)

However, if we encounter the same kind of difficulty in exploring the physical basis of the phenomena of the mind itself, we cannot adopt the same line of retreat. That is, if a phenomenal feature of mind is left unaccounted for by the physical theory, we cannot postpone the understanding of it to the time when we study the mind itself – for that is exactly what we are supposed to be doing. To defer to an understanding of the basis of mind which lies beyond the study of the physical realization of certain aspects of it is to admit the irreducibility of the mental to the physical. A clearcut version of this admission would be some kind of dualism. But if one is reluctant to take such a route, then it is not clear what one should do about central features of the mentalistic idea of persons which resist assimilation to an understanding of human beings as physical systems. It may be true of some of these features that we can neither find an objective basis for them, nor give them up. It may be impossible for us to abandon certain ways of conceiving and representing ourselves, no matter how little support they get from scientific research. This, I suspect, is true of the idea of the unity of a person: an idea whose validity may be called into question with the help of recent discoveries about the functional duality of the cerebral cortex. It will be useful to present those results here in outline.

II

The higher connections between the two cerebral hemispheres have been severed in men, monkeys, and cats, and the results

have led some investigators to speak of the creation of two separate centers of consciousness in a single body. The facts are as follows.[1] By and large, the left cerebral hemisphere is associated with the right side of the body and the right hemisphere with the left side. Tactual stimuli from one side are transmitted to the opposite hemisphere – with the exception of the head and neck, which are connected to both sides. In addition, the left half of each retina, i.e. that which scans the right half of the visual field, sends impulses to the left hemisphere, and impulses from the left half of the visual field are transmitted by the right half of each retina to the right hemisphere. Auditory impulses from each ear are to some degree transmitted to both hemispheres. Smells, on the other hand, are transmitted ipsilaterally: the left nostril transmits to the left hemisphere and the right nostril to the right. Finally, the left hemisphere usually controls the production of speech.

Both hemispheres are linked to the spinal column and peripheral nerves through a common brain stem, but they also communicate directly with one another, by a large transverse band of nerve fibres called the corpus callosum, plus some smaller pathways. These direct cerebral commissures play an essential role in the ordinary integration of function between the hemispheres of normal persons. It is one of the striking features of the subject that this fact remained unknown, at least in the English-speaking world, until the late 1950s, even though a number of patients had had their cerebral commissures surgi-

[1] The literature on split brains is sizeable. An excellent recent survey is Michael S. Gazzaniga, *The Bisected Brain* (New York: Appleton-Century-Crofts, 1970). Its nine-page list of references is not intended to be a complete bibliography of the subject, however. Gazzaniga has also written a brief popular exposition: 'The Split Brain in Man', *Scientific American*, CCXVII (1967), 24–9. The best general treatment for philosophical purposes is to be found in several papers by R. W. Sperry, the leading investigator in the field: 'The Great Cerebral Commissure', *Scientific American*, CCX (1964), 42; 'Brain Bisection and Mechanisms of Consciousness', in *Brain and Conscious Experience*, ed. J. C. Eccles, (Berlin: Springer-Verlag, 1966); 'Mental Unity Following Surgical Disconnections of the Cerebral Hemispheres', *The Harvey Lectures*, series LXII (New York: Academic Press, 1968), pp. 293–323; 'Hemisphere Deconnection and Unity in Conscious Awareness', *American Psychologist*, XXIII (1968), 723–33. Several interesting papers are to be found in *Functions of the Corpus Callosum: Ciba Foundation Study Group No. 20*, ed G. Ettlinger (London: J. and A. Churchill, 1965).

cally severed in operations for the treatment of epilepsy a decade earlier. No significant behavioral or mental effects on these patients could be observed, and it was conjectured that the corpus callosum had no function whatever, except perhaps to keep the hemispheres from sagging.

Then R. E. Myers and R. W. Sperry introduced a technique

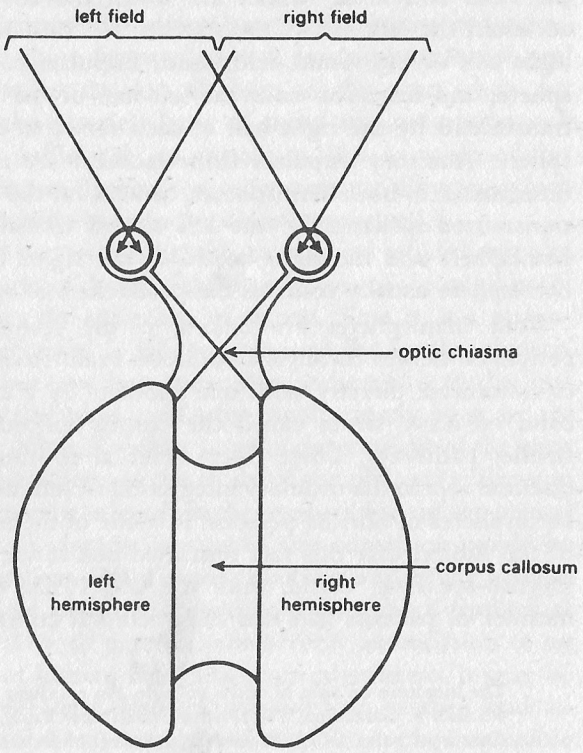

Fig. 1 A very schematic top view of the eyes and cerebral cortex.

for dealing with the two hemispheres separately.[2] They sectioned the optic chiasma of cats, so that each eye sent direct

[2] R. E. Myers and R. W. Sperry, 'Interocular Transfer of a Visual Form Discrimination Habit in Cats after Section of the Optic Chiasm and Corpus Callosum', *Anatomical Record*, CXV (1953), 351–2; R. E. Myers, 'Interocular Transfer of Pattern Discrimination in Cats Following Section of Crossed Optic Fibers', *Journal of Comparative and Physiological Psychology*, XLVIII (1955), 470–3.

information (information about the opposite half of the visual field) only to one side of the brain. It was then possible to train the cats in simple tasks using one eye, and to see what happened when one made them use the other eye instead. In cats whose callosum was intact, there was very good transfer of learning. But in some cats, they severed the corpus callosum as well as the optic chiasma; and in these cases nothing was transmitted from one side to the other. In fact the two severed sides could be taught conflicting discriminations simultaneously, by giving the two eyes opposite stimuli during a single course of reinforcement. Nevertheless this capacity for independent function did not result in serious defects of behavior. Unless inputs to the two hemispheres were artificially segregated, the animal seemed normal (though if a split-brain monkey gets hold of a peanut with both hands, the result is sometimes a tug of war.)

Instead of summarizing all the data, I shall concentrate on the human cases, a reconsideration of which was prompted by the findings with cats and monkeys.[3] In the brain-splitting operation for epilepsy, the optic chiasma is left intact, so one cannot get at the two hemispheres separately just through the two eyes. The solution to the problem of controlling visual input is to flash signals on a screen, on one or other side of the midpoint of the patient's gaze, long enough to be perceived but not long enough to permit an eye movement which would bring the signal to the opposite half visual field and hence to the opposite side of the brain. This is known as tachistoscopic stimulation. Tactile inputs through the hands are for the most part very efficiently segregated, and so are smells through the two nostrils. Some success has even been achieved recently in segregating auditory input,

[3] The first publication of these results was M. S. Gazzaniga, J. E. Bogen, and R. W. Sperry, 'Some Functional Effects of Sectioning the Cerebral Commissures in Man', *Proceedings of the National Academy of Sciences*, XLVIII (1962), pt 2, 1765–9. Interestingly, the same year saw publication of a paper proposing the interpretation of a case of human brain *damage* along similar lines, suggested by the earlier findings with animals. Cf. N. Geschwind and E. Kaplan, 'A Human Cerebral Deconnection Syndrome', *Neurology*, XII (1962), 675. Also of interest is Geschwind's long two-part survey of the field, which takes up some philosophical questions explicitly: 'Disconnexion Syndromes in Animals and Man', *Brain* LXXXVIII (1965) 247–94, 585–644. Parts of it are reprinted, with other material, in *Boston Studies in the Philosophy of Science*, vol. IV (1969). See also his paper 'The Organization of Language and the Brain', *Science*, CLXX (1970), 940.

since each ear seems to signal more powerfully to the contralateral than to the ipsilateral hemisphere. As for output, the clearest distinction is provided by speech, which is exclusively the product of the left hemisphere.[4] Writing is a less clear case: it can occasionally be produced in rudimentary form by the right hemisphere, using the left hand. In general, motor control is contralateral, i.e. by the opposite hemisphere, but a certain amount of ipsilateral control sometimes occurs, particularly on the part of the left hemisphere.

The results are as follows. What is flashed to the right half of the visual field, or felt unseen by the right hand, can be reported verbally. What is flashed to the left half field or felt by the left hand cannot be reported, though if the word 'hat' is flashed on the left, the left hand will retrieve a hat from a group of concealed objects if the person is told to pick out what he has seen. At the same time he will insist verbally that he saw nothing. Or, if two different words are flashed to the two half fields (e.g. 'pencil' and 'toothbrush') and the individual is told to retrieve the corresponding object from beneath a screen, with both hands, then the hands will search the collection of objects independently, the right hand picking up the pencil and discarding it while the left hand searches for it, and the left hand similarly rejecting the toothbrush which the right hand lights upon with satisfaction.

If a concealed object is placed in the left hand and the person is asked to guess what it is, wrong guesses will elicit an annoyed frown, since the right hemisphere, which receives the tactile information, also hears the answers. If the speaking hemisphere should guess correctly, the result is a smile. A smell fed to the right nostril (which stimulates the right hemisphere) will elicit a verbal denial that the subject smells anything, but if asked to point with the left hand at a corresponding object he will succeed in picking out, for example, a clove of garlic, protesting all the while that he smells absolutely nothing, so how can he possibly point to what he smells. If the smell is an unpleasant one like that

[4] There are individual exceptions to this, as there are to most generalizations about cerebral function: left-handed people tend to have bilateral linguistic control, and it is common in early childhood. All the subjects of these experiments, however, were right-handed, and displayed left cerebral dominance.

of rotten eggs, these denials will be accompanied by wrinklings of the nose and mouth, and guttural exclamations of disgust.[5]

One particularly poignant example of conflict between the hemispheres is as follows. A pipe is placed out of sight in the patient's left hand, and he is then asked to write with his left hand what he was holding. Very laboriously and heavily, the left hand writes the letters P and I. Then suddenly the writing speeds up and becomes lighter, the I is converted to an E, and the word is completed as PENCIL. Evidently the left hemisphere has made a guess based on the appearance of the first two letters, and has interfered, with ipsilatral control. But then the right hemisphere takes over control of the hand again, heavily crosses out the letters ENCIL, and draws a crude picture of pipe.[6]

There are many more data. The split brain patient cannot tell whether shapes flashed to the two half visual fields or held out of sight in the two hands are the same or different – even if he is asked to indicate the answer by nodding or shaking his head (responses available to both hemispheres). The subject cannot distinguish a continuous from a discontinuous line flashed across both halves of the visual field, if the break comes in the middle. Nor can he tell whether two lines meet at an angle, if the joint is in the middle. Nor can he tell whether two spots in opposite half-fields are the same or different in color – though he can do all these things if the images to be compared fall within a single half field. On the whole the right hemisphere does better at spatial relations tests, but is almost incapable of calculation. It appears susceptible to emotion, however. For example, if a photograph of a naked woman is flashed to the left half field of a male patient, he will grin broadly and perhaps blush, without being able to say what has pleased him, though he may say 'Wow, that's quite a machine you've got there'.

All this is combined with what appears to be complete

[5] H. W. Gordon and R. W. Sperry, 'Lateralization of Olfactory Perception in the Surgically Separated Hemispheres in Man', *Neuropsychologia*, VII (1969), 111–20. One patient, however, was able to say in these circumstances that he smelled something unpleasant, without being able to describe it further.

[6] Reported in Jerre Levy, 'Information Processing and Higher Psychological Functions in the Disconnected Hemispheres of Human Commissurotomy Patients' (unpublished doctoral dissertation, California Institute of Technology, 1969).

normalcy in ordinary activities, when no segregation of input to the two hemispheres has been artificially created. Both sides fall asleep and wake up at the same time. The patients can play the piano, button their shirts, swim, and perform well in other activities requiring bilateral coordination. Moreover they do not report any sensation of division or reduction of the visual field. The most notable deviation in ordinary behavior was in a patient whose left hand appeared to be somewhat hostile to the patient's wife. But by and large the hemispheres cooperate admirably, and it requires subtle experimental techniques to get them to operate separately. If one is not careful, they will give each other peripheral cues, transmitting information by audible, visible, or otherwise sensorily perceptible signals which compensate for the lack of a direct commissural link. (One form of communication is particularly difficult to prevent, because it is so direct: both hemispheres can move the neck and facial muscles, and both can feel them move; so a response produced in the face or head by the right hemisphere can be detected by the left, and there is some evidence that they send signals to one another via this medium.)[7]

III

What one naturally wants to know about these patients is how many minds they have. This immediately raises questions about the sense in which an ordinary person can be said to have one mind, and what the conditions are under which diverse experiences and activities can be ascribed to the same mind. We must have some idea what an ordinary person is one of in order to understand what we want to know whether there is *one or two* of, when we try to describe these extraordinary patients.

However, instead of beginning with an analysis of the unity of the mind, I am going to proceed by attempting to apply the

[7] Moreover, the condition of radical disconnection may not be stable: there may be a tendency toward the formation of new interhemispheric pathways through the brain stem, with the lapse of time. This is supported partly by observation of commissurotomy patients, but more importantly by cases of agenesis of the callosum. People who have grown up without one have learned to manage without it; their performance on the tests is much closer to normal than that of recently operated patients. (Cf. L. J. Saul and R. W. Sperry, 'Absence of Commissurotomy Symptoms and Agenesis of the Corpus Callosum', *Neurology*, XVIII (1968).) This fact is very important, but for the present I shall put it aside to concentrate on the immediate results of disconnection.

ordinary, unanalyzed conception directly in the interpretation of these data, asking whether the patients have one mind, or two, or some more exotic configuration. My conclusion will be that the ordinary conception of a single, countable mind cannot be applied to them at all, and that there is no number of such minds that they possess, though they certainly engage in mental activity. A clearer understanding of the idea of an individual mind should emerge in the course of this discussion but the difficulties which stand in the way of its application to the split-brain cases will provide ground for more general doubts. The concept may not be applicable to ordinary human beings either, for it embodies too simple a conception of the way in which human beings function.

Nevertheless I shall employ the notion of an individual mind in discussing the cases initially, for I wish to consider systematically how they might be understood in terms of countable minds, and to argue that they cannot be. After having done this, I shall turn to ordinary people like you and me.

There appear to be five interpretations of the experimental data which utilize the concept of an individual mind.

(1) The patients have one fairly normal mind associated with the left hemisphere, and the responses emanating from the nonverbal right hemisphere are the responses of an automaton, and are not produced by conscious mental processes.

(2) The patients have only one mind, associated with the left hemisphere, but there also occur (associated with the right hemisphere) isolated conscious mental phenomena, not integrated into a mind at all, though they can perhaps be ascribed to the organism.

(3) The patients have two minds, one which can talk and one which cannot.

(4) They have one mind, whose contents derive from both hemispheres and are rather peculiar and dissociated.

(5) They have one normal mind most of the time, while the hemispheres are functioning in parallel, but two minds are elicited by the experimental situations which yield the interesting results. (Perhaps the single mind splits in two and reconvenes after the experiment is over.)

I shall argue that each of these interpretations is unacceptable for one reason or another.

IV

Let me first discuss hypotheses (1) and (2), which have in common the refusal to ascribe the activities of the right hemisphere to a mind, and then go on to treat hypotheses (3), (4), and (5), all of which associate a mind with the activities of the right hemisphere, though they differ on what mind it is.

The only support for hypothesis (1), which refuses to ascribe consciousness to the activities of the right hemisphere at all, is the fact that the subject consistently denies awareness of the activities of that hemisphere. But to take this as proof that the activities of the right hemisphere are unconscious is to beg the question, since the capacity to give testimony is the exclusive ability of the left hemisphere, and of course the left hemisphere is not conscious of what is going on in the right. If on the other hand we consider the manifestations of the right hemisphere itself, there seems no reason in principle to regard verbalizability as a *necessary* condition of consciousness. There may be other grounds for the ascription of conscious mental states that are sufficient even without verbalization. And in fact, what the right hemisphere can do on its own is too elaborate, too intentionally directed and too psychologically intelligible to be regarded merely as a collection of unconscious automatic responses.

The right hemisphere is not very intelligent and it cannot talk; but it is able to respond to complex visual and auditory stimuli, including language, and it can control the performance of discriminatory and manipulative tasks requiring close attention – such as the spelling out of simple words with plastic letters. It can integrate auditory, visual, and tactile stimuli in order to follow the experimenter's instructions, and it can take certain aptitude tests. There is no doubt that if a person were deprived of his left hemisphere entirely, so that the only capacities remaining to him were those of the right, we should not on that account say that he had been converted into an automaton. Though speechless, he would remain conscious and active, with a diminished visual field and partial paralysis on the right side from which he would eventually recover to some extent. In view of this, it would seem arbitrary to deny that the activities of the right hemisphere are conscious, just because they occur side by side with those of the left hemisphere, about whose consciousness there is no question.

I do not wish to claim that the line between conscious and unconscious mental activity is a sharp one. It is even possible that the distinction is partly relative, in the sense that a given item of mental activity may be assignable to consciousness or not, depending on what other mental activities of the same person are going on at the same time, and whether it is connected with them in a suitable way. Even if this is true, however, the activities of the right hemisphere in split-brain patients do not fall into the category of events whose inclusion in consciousness depends on what else is going on in the patient's mind. Their determinants include a full range of psychological factors, and they demand alertness. It is clear that attention, even concentration is demanded for the tasks of the concealed left hand and tachistoscopically stimulated left visual field. The subjects do not take their experimental tests in a dreamy fashion: they are obviously in contact with reality. The left hemisphere occasionally complains about being asked to perform tasks which the right hemisphere can perform, because it does not know what is going on when the right hemisphere controls the response. But the right hemisphere displays enough awareness of what it is doing to justify the attribution of conscious control in the absence of verbal testimony. If the patients did not deny any awareness of those activities, no doubts about their consciousness would arise at all.

The considerations that make the first hypothesis untenable also serve to refute hypothesis (2), which suggests that the activities of the right hemisphere are conscious without belonging to a mind at all. There may be problems about the intelligibility of this proposal, but we need not consider them here, because it is rendered implausible by the high degree of organization and intermodal coherence of the right hemisphere's mental activities. They are not free-floating, and they are not organized in a fragmentary way. The right hemisphere follows instructions, integrates tactile, auditory and visual stimuli, and does most of the things a good mind should do. The data present us not merely with slivers of purposive behavior, but with a system capable of learning, reacting emotionally, following instructions, and carrying out tasks which require the integration of diverse psychological determinants. It seems clear that the right hemisphere's activities are not unconscious, and that

they belong to something having a characteristically mental structure: a subject of experience and action.

V

Let me now turn to the three hypotheses according to which the conscious mental activities of the right hemisphere are ascribed to a mind. They have to be considered together, because the fundamental difficulty about each of them lies in the impossibility of deciding among them. The question, then, is whether the patients have two minds, one mind, or a mind that occasionally splits in two.

There is much to recommend the view that they have two minds, i.e. that the activities of the right hemisphere belong to a mind of their own.[8] Each side of the brain seems to produce its own perceptions, beliefs, and actions, which are connected with one another in the usual way, but not to those of the opposite side. The two halves of the cortex share a common body, which they control through a common midbrain and spinal cord. But their higher functions are independent not only physically but psychologically. Functions of the right hemisphere are inaccessible not only to speech but to any direct combination with corresponding functions of the left hemisphere – i.e. with functions of a type that the right hemisphere finds easy on its home ground, like shape or color discrimination.

One piece of testimony by the patients' left hemispheres may appear to argue against two minds. They report no diminution of the visual field, and little absence of sensation on the left side. Sperry dismisses this evidence on the ground that it is comparable to the testimony of victims of scotoma (partial destruction of the retina), that they notice no gaps in their visual field – although these gaps can be discovered by others observing their perceptual deficiences. But we need not assume that an elaborate confabulatory mechanism is at work in the left hemisphere to account for such testimony. It is perfectly possible that although there are two minds, the mind associated with each hemisphere receives, through the common brain stem, a certain amount of crude ipsilateral stimulation, so that the speaking mind has a rudimentary and undifferentiated appendage to the left side of its visual field, and vice versa for the right hemisphere.[9]

The real difficulties for the two-minds hypothesis coincide with the reasons for thinking we are dealing with one mind – namely the highly integrated character of the patients' relations to the world in ordinary circumstances. When they are not in the experimental situation, their startling behavioral dissociation disappears, and they function normally. There is little doubt that information from the two sides of their brains can be pooled to yield integrated behavioral control. And although this is not accomplished by the usual methods, it is not clear that this settles the question against assigning the integrative functions to a single mind. After all, if the patient is permitted to touch things with both hands and smell them with both nostrils, he arrives at a unified idea of what is going on around him and what he is doing, without revealing any left–right inconsistencies in his behavior or attitudes. It seems strange to suggest that we are not in a position to ascribe all those experiences to the same person, just because of some peculiarities about how the integration is achieved. The people who *know* these patients find it natural to relate to them as single individuals.

Nevertheless, if we ascribe the integration to a single mind, we must also ascribe the experimentally evoked dissociation to that mind, and that is not easy. The experimental situation reveals a variety of dissociation or conflict that is unusual not only because of the simplicity of its anatomical basis, but because such a wide *range* of functions is split into two noncommunicating branches. It is not as though two conflicting volitional centers shared a common perceptual and reasoning apparatus. The split is much deeper than that. The one-mind hypothesis

[8] It is Sperry's view. He puts it as follows:
Instead of the normally unified single stream of consciousness, these patients behave in many ways as if they have two independent streams of conscious awareness, one in each hemisphere, each of which is cut off from and out of contact with the mental experiences of the other. In other words, each hemisphere seems to have its own separate and private sensations; its own perceptions; its own concepts; and its own impulses to act, with related volitional, cognitive, and learning experiences. Following the surgery, each hemisphere also has thereafter its own separate chain of memories that are rendered inaccessible to the recall process of the others (*American Psychologist*, XXIII, 724.)

[9] There is some direct evidence for such primitive ipsilateral inputs, both visual and tactile; cf. Gazzaniga, *The Bisected Brain*, ch. 3.

must therefore assert that the contents of the individual's single consciousness are produced by two independent control systems in the two hemispheres, each having a fairly complete mental structure. If this dual control were accomplished during experimental situations by temporal alternation, it would be intelligible, though mysterious. But that is not the hypothesis, and the hypothesis as it stands does not supply us with understanding. For in these patients there appear to be things happening *simultaneously* which cannot fit into a single mind: simultaneous attention to two incompatible tasks, for example, without interaction between the purposes of the left and right hands.

This makes it difficult to conceive what it is like to *be* one of these people. Lack of interaction at the level of a preconscious control system would be comprehensible. But lack of interaction in the domain of visual experience and conscious intention threatens assumptions about the unity of consciousness which are basic to our understanding of another individual as a person. These assumptions are associated with our conception of ourselves, which to a considerable extent constrains our understanding of others. And it is just these assumptions, I believe, that make it impossible to arrive at an interpretation of the cases under discussion in terms of a countable number of minds.

Roughly, we assume that a single mind has sufficiently immediate access to its conscious states so that, for elements of experience or other mental events occurring simultaneously or in close temporal proximity, the mind which is their subject can also experience the simpler *relations* between them if it attends to the matter. Thus, we assume that when a single person has two visual impressions, he can usually also experience the sameness or difference of their coloration, shape, size, the relation of their position and movement within his visual field, and so forth. The same can be said of cross-modal connections. The experiences of a single person are thought to take place in an *experientially* connected domain, so that the relations among experiences can be substantially captured in experiences of those relations.[10]

[10] The two can of course diverge, and this fact underlies the classic philosophical problem of inverted spectra, which is only distantly related to the subject of this paper. A type of relation can hold between elements in the experience of a single person that cannot hold between elements of the experience of distinct persons: looking similar in color, for example. Insofar as our concept of similarity of experience in the case of a single person is dependent on his experience of similarity, the concept is not applicable between persons.

Split-brain patients fail dramatically to conform to these assumptions in experimental situations, and they fail over the simplest matters. Moreover the dissociation holds between two classes of conscious states each characterized by significant *internal* coherence: normal assumptions about the unity of consciousness hold intrahemispherically, although the requisite comparisons cannot be made across the interhemispheric gap.

These considerations lead us back to the hypothesis that the patients have two minds each. It at least has the advantage of enabling us to understand what it is like to *be* these individuals, so long as we do not try to imagine what it is like to be both of them at the same time. Yet the way to a comfortable acceptance of this conclusion is blocked by the compelling behavioral integration which the patients display in ordinary life, in comparison to which the dissociated symptoms evoked by the experimental situation seem peripheral and atypical. We are faced with diametrically conflicting bodies of evidence, in a case which does not admit of arbitrary decision. There is a powerful inclination to feel that there must be *some* whole number of minds in those heads, but the data prevent us from deciding how many.

This dilemma makes hypothesis (5) initially attractive, especially since the data which yield the conflict are to some extent gathered at different times. But the suggestion that a second mind is brought into existence only during experimental situations loses plausibility on reflection. First, it is entirely *ad hoc*: it proposes to explain one change in terms of another without suggesting any explanation of the second. There is nothing about the experimental situation that might be expected to produce a fundamental internal change in the patient. In fact it produces no anatomical changes and merely elicits a noteworthy set of symptoms. So unusual an event as a mind's popping in and out of existence would have to be explained by something more than its explanatory convenience.

But secondly, the behavioral evidence would not even be explained by this hypothesis, simply because the patients' integrated responses and their dissociated responses are not clearly

separated in time. During the time of the experiments the patient is functioning largely as if he were a single individual: in his posture, in following instructions about where to focus his eyes, in the whole range of trivial behavioral control involved in situating himself in relation to the experimenter and the experimental apparatus. The two halves of his brain cooperate completely except in regard to those very special inputs that reach them separately and differently. For these reasons hypothesis (5) does not seem to be a real option; if two minds are operating in the experimental situation, they must be operating largely in harmony although partly at odds. And if there are two minds then, why can there not be two minds operating essentially in parallel the rest of the time?

Nevertheless the psychological integration displayed by the patients in ordinary life is so complete that I do not believe it is possible to accept that conclusion, nor any conclusion involving the ascription to them of a whole number of minds. These cases fall midway between ordinary persons with intact brains (between whose cerebral hemispheres there is also cooperation, though it works largely via the corpus callosum), and pairs of individuals engaged in a performance requiring exact behavioral coordination, like using a two-handed saw, or playing a duet. In the latter type of case we have two minds which communicate by subtle peripheral cues; in the former we have a single mind. Nothing taken from either of those cases can compel us to assimilate the split-brain patient to one or the other of them. If we decided that they definitely had two minds, then it would be problematical why we did not conclude on anatomical grounds that everyone has two minds, but that we do not notice it except in these odd cases because most pairs of minds in a single body run in perfect parallel due to the direct communication between the hemispheres which provide their anatomical bases. The two minds each of us has running in harness would be much the same except that one could talk and the other could not. But it is clear that this line of argument will get us nowhere. For if the idea of a single mind applies to anyone it applies to ordinary individuals with intact brains, and if it does not apply to them it ought to be scrapped, in which case there is no point in asking whether those with split brains have one mind or two.[11]

[11] In case anyone is inclined to embrace the conclusion that we all have two minds, let me suggest that the trouble will not end there. For the mental operations of a single hemisphere, such as vision, hearing, speech, writing, verbal comprehension, etc., can to a great extent be separated from one another by suitable cortical deconnections; why then should we regard *each* hemisphere as inhabited by several cooperating minds with specialized capacities? Where is one to stop? If the decision on the number of minds associated with a brain is largely arbitrary, the original point of the question has disappeared.

VI

If I am right, and there is no whole number of individual minds that these patients can be said to have, then the attribution of conscious, significant mental activity does not require the existence of a single mental subject. This is extremely puzzling in itself, for it runs counter to our need to construe the mental states we ascribe to others on the model of our own. Something in the ordinary conception of a person, or in the ordinary conception of experience, leads to the demand for an account of these cases which the same conception makes it impossible to provide. This may seem a problem not worth worrying about very much. It is not so surprising that, having begun with a phenomenon which is radically different from anything else previously known, we should come to the conclusion that it cannot be adequately described in ordinary terms. However, I believe that consideration of these very unusual cases should cause us to be skeptical about the concept of a single subject of consciousness as it applies to ourselves.

The fundamental problem in trying to understand these cases in mentalistic terms is that we take ourselves as paradigms of psychological unity, and are then unable to project ourselves into their mental lives, either once or twice. But in thus using ourselves as the touchstone of whether another organism can be said to house an individual subject of experience or not, we are subtly ignoring the possibility that our own unity may be nothing absolute, but merely another case of integration, more or less effective, in the control system of a complex organism. This system speaks in the first person singular through our mouths, and that makes it understandable that we should think of its unity as in some sense numerically absolute, rather than relative and a function of the integration of its contents.

But this is quite genuinely an illusion. The illusion consists in

projecting inward to the center of the mind the very subject whose unity we are trying to explain: the individual person with all his complexities. The ultimate account of the unity of what we call a single mind consists of an enumeration of the types of functional integration that typify it. We know that these can be eroded in different ways, and to different degrees. The belief that even in their complete version they can be explained by the presence of a numerically single subject is an illusion. Either this subject contains the mental life, in which case it is complex and its unity must be accounted for in terms of the unified operation of its components and functions, or else it is an extensionless point, in which case it explains nothing.

An intact brain contains two cerebral hemispheres each of which possesses perceptual, memory, and control systems adequate to run the body without the assistance of the other. They cooperate in directing it with the aid of a constant two-way internal communication system. Memories, perceptions, desires, and so forth therefore have duplicate physical bases on both sides of the brain, not just on account of similarities of initial input, but because of subsequent exchange. The cooperation of the undetached hemispheres in controlling the body is more efficient and direct than the cooperation of a pair of detached hemispheres, but it is cooperation nonetheless. Even if we analyze the idea of unity in terms of functional integration, therefore, the unity of our own consciousness may be less clear than we had supposed. The natural conception of a single person controlled by a mind possessing a single visual field, individual faculties for each of the other senses, unitary systems of memory, desire, belief, and so forth, may come into conflict with the physiological facts when it is applied to ourselves.

The concept of a person might possibly survive an application to cases which require us to speak of two or more persons in one body, but it seems strongly committed to some form of whole number countability. Since even this seems open to doubt, it is possible that the ordinary, simple idea of a single person will come to seem quaint some day, when the complexities of the human control system become clearer and we become less certain that there is anything very important that we are *one* of. But it is also possible that we shall be unable to abandon the idea no matter what we discover.

12

What is it like to be a bat?

Consciousness is what makes the mind–body problem really intractable. Perhaps that is why current discussions of the problem give it little attention or get it obviously wrong. The recent wave of reductionist euphoria has produced several analyses of mental phenomena and mental concepts designed to explain the possibility of some variety of materialism, psychophysical identification, or reduction.[1] But the problems dealt with are those common to this type of reduction and other types, and what makes the mind–body problem unique, and unlike the water–H_2O problem or the Turing machine–IBM machine problem or the lightning–electrical discharge problem or the gene–DNA problem or the oak tree–hydrocarbon problem, is ignored.

[1] Examples are J. J. C. Smart, *Philosophy and Scientific Realism* (London: Routledge & Kegan Paul, 1963); David K. Lewis, 'An Argument for the Identity Theory', *Journal of Philosophy*, LXIII (1966), reprinted with addenda in David M. Rosenthal, *Materialism & the Mind–Body Problem*, (Engelwood Cliffs, N.J.: Prentice-Hall, 1971); Hilary Putnam, 'Psychological Predicates', in *Art, Mind, & Religion*, ed. W. H. Capitan and D. D. Merrill (Pittsburgh: University of Pittsburgh Press, 1967), reprinted in *Materialism*, ed. Rosenthal, as 'The Nature of Mental States'; D. M. Armstrong, *A Materialist Theory of the Mind* (London: Routledge & Kegan Paul, 1968); D. C. Dennett, *Content and Consciousness* (London: Routledge & Kegan Paul, 1969). I have expressed earlier doubts in 'Armstrong on the Mind', *Philosophical Review*, LXXIX (1970), 394–403; a review of Dennett, *Journal of Philosophy*, LXIX (1972); and chapter 11 above. See also Saul Kripke, 'Naming and Necessity', in *Semantics of Natural Language*, ed. D. Davidson and G. Harman (Dordrecht: Reidel, 1972), esp. pp. 334–42; and M. T. Thornton, 'Ostensive Terms and Materialism', *The Monist*, LVI (1972), 193–214.