

A QUANTUM THEORY OF MIND

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ABSTRACT

The purpose of this thesis is to show that any form of dualism is untenable, and to defend a form of identity theory which is compatible with the quantum theory of physics. Briefly, quanta are all that there is in the universe; it follows that a mental state is a quantum state of the brain apt for bringing about a certain sort of behavior.

In Chapter I the various mind-body theories are briefly presented and the failure of each noted. Herbert Feigl's discussion of the basic ambiguity of the terms "mental" and "physical" (as presented in The "Mental" and the "Physical") is summarized, with his criteria for a solution of the mind-body problem.

Various forms and interpretations of the statement of identity are explored in Chapter II. Statements are classified according to whether their truth results from logical necessity, linguistic necessity, causal necessity, or whether they are adventitious, or accidental. It is concluded that the present form of the identity theory states that the class of entities modified by the adjectival use of "mind" is entirely included in the class of entities modified by the adjectival use of the word "brain"; and that this is necessarily so as a result of the manner in which brains in fact operate, given the laws of nature as they are (regardless of whether they are known).

Chapter III contains a summary of quantum theory as it is currently held by most physicists, and descriptions of the laser phenomenon and holography are presented (a) as examples of the confirming evidence for quantum theory and (b) as relevant to a possible model of the brain and its functions.

An attempt is made to clarify the Heisenberg uncertainty principle and show its relevance to the problem.

The quantum theory of mind is presented and explained in Chapter IV, and an attempt is made to analyse various types of sensation statements in the light of mental events' being interpreted as quantum effects. The findings in parapsychology of L. L. Vasiliev of the University of Leningrad, and of Dr. Helmut Schmidt of the J. B. Rhine Institute are investigated as possible candidates for confirming or non-confirming evidence of the truth of the quantum theory of mind. The problem of intentionality is reviewed and a tentative solution presented. It is shown that most of the traditional mind-brain puzzles result from either (a) a faulty concept of mind, (b) an inadequate concept of matter, or (c) failure to pose questions unambiguously.

In the concluding chapter, a return to Herbert Feigl's postscript to The "Mental" and the "Physical" investigates in the light of the proposed theory the four "true but irreconcilable" propositions which Feigl quotes from the doctoral dissertation of Mrs. Judith Economos. It is concluded that none of the statements is, as stated, entirely true, and that if they are corrected or the questionable elements eliminated, they are no longer irreconcilable. Finally, the theory is subjected to Feigl's criteria for an acceptable solution to the mind-body problem. It is found that although there is insufficient evidence to state that the theory satisfies the criteria, there is no respect in which it clearly fails.

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INTRODUCTION

It is probably misleading to refer to the mind-body problem; rather there is a number of related, but separate problems which may be classified as: (a) linguistic, (b) logical, (c) problems related to dualist theories, (d) problems related to materialist theories. While solutions to (a) and (b) must be sought, it seems that the way will be more clear when we have a clearer idea of the domain within which we are working.

Philosophical writing tends to become mired in discussions of "category mistakes" and "conceptual confusions" so that the main issues of mental and physical are lost. The dualist fails because of the inadequacy of some form of action or interaction theory, or else from the prima facie improbability of some form of parallelism. The materialist fails when faced with intentionality, volition, and the apparent efficacy of consciousness.

It is usually presupposed that the concept "physical" is unequivocal and clearly understood, and that "mental" refers to something which is necessarily non-physical. What has not, so far as I can tell, been directly suggested, is that our concept of matter has been so inadequate as to be clearly erroneous--i.e., that the quantum theory of current physics is basically correct and adequate to explain all the phenomena of the universe including consciousness.

When a physicist writes:

In experiment, in theory, and even in philosophical implications, the study of particles seems to have blurred the dividing lines between matter and

interactions, between actor and actions,¹

then it is time for the philosopher to reassess some of his basic assumptions. Thus the purpose of this thesis is to show that any form of dualism must be untenable and to suggest a form of monism which one might call a "quantum theory of mind". I would avoid the term "materialism" on the ground that classical concepts of matter are bound to be misleading. It is an identity theory of the type Richard Rorty calls a "disappearance" theory. I am not claiming to have solved the mind-brain problem, but to have shown that there is no longer any good reason to doubt that a full and adequate explanation of what kind of referents lie behind such locutions as "I", "I think", "I sense" etc. will be found within the domain of quantum theory as it may reasonably be expected to be modified by empirical research.

¹Clifford E. Swartz, "Resource Letter on Subatomic Particles," American Journal of Physics Vol. 34, No. 12, December 1966

CHAPTER I

A SUMMARY OF UNACCEPTABLE SOLUTIONS

Everyone knows that 'mind' is what an idealist thinks there is nothing else but, and matter is what the materialist thinks the same about. The reader also knows, I hope, that idealists are virtuous and materialists are wicked.

-- Bertrand Russell, History of Western Philosophy

There is, unfortunately, a good deal more to be said on the subject than this; much of it having already been said, and most even less enlightening. However for present purposes I shall divide the mind-body theories into the classifications of monism and dualism. Monistic theories, which can include both materialism and idealism, can be subdivided into identity theories, of which there are numerous statements, and double aspect theories--not currently held in very high repute, and perhaps unjustly so held. The class of dualist theories may be subdivided into: interactionism, epiphenomenalism, parallelism, and the less likely occasionalism and preestablished harmony. I shall not discuss the latter theories on the ground that (a) they are empirically unverifiable, and (b) they are intuitively unsatisfactory.

Before proceeding any further in detail I should like to distinguish between, and for the purpose of this discussion define, the terms 'brain state', 'brain event', 'brain process' with their parallels in the mental realm. 'Brain event' I shall treat as primitive, referring to those electromagnetic phenomena which can be recorded by an electroencephalograph, at least some of which can be correlated with awareness, or

mental events; a brain process, then, will be a sequence of brain events which may or may not be connected causally but are temporally sequential; a brain 'state' is a unit which may involve one or more brain events and/or processes, and which may be correlated with states or units of awareness of the kind that the common man would describe as 'anger', 'pain', 'satiety', 'seeing a red spot', or 'believing that Bowser is at the door'. Thus there may be a number of mental events and/or processes making up the mental state we call pain.

Of the dualist positions only interactionism seems to have an immediate appeal. Parallelism, like interactionism, accepts that there are brain processes and mental processes, that for every mental process there is a corresponding brain process, and for a certain class of brain process there is always a corresponding mental process; but unlike interactionism, parallelism denies that there is a causal connection between them. However the parallelist is denying that constant conjunction is a necessary and sufficient condition for the cause-effect relationship since he accepts the constant conjunction, yet denies the causation. Parallelism proposes that physical events can cause physical events in sufficiently complex trains that the entire stimulus-response behavior of the human can be explained without reference to or necessity for a theory involving non-physical effects of physical causes, or physical effects of non-physical causes. This theory can be refuted on empirical grounds as pointed out by Michael Scriven.¹ The human brain can be stimulated by electric probe or by drugs (these external stimuli will cause brain events),

¹Michael Scriven, "The Limitations of the Identity Theory", Mind, Matter & Method, Feyerabend & Maxwell, ed., (University of Minnesota, 1966), p. 191

and certain mental events will invariably occur simultaneously. If we apply a certain alleged cause, A, at random within a determinable set of background conditions, $(c, c_1, \dots c_n)$, we inevitably get the alleged result, R. Since of the set of conditions, A, C, $C_1, \dots C_n$, which is jointly sufficient for R, A is the non-redundant member and also random, there can be no other factor, A', which is the actual cause of R and happens to be simultaneous with A.

This consideration, then, proving parallelism to be false, leaves open the possibility of epiphenomenalism. This position allows that mental phenomena are caused by physical (brain) phenomena, but denies that the train is reversible. On the surface this seems to be implausible simply on the ground that if the physical can cause what is assumed to be non-physical, there seems to be no obvious reason why the reverse should not be equally possible. For the epiphenomenalist the position of the mind with respect to the body - the position of mental events with respect to brain events - is analogous to that of a shadow to the body of which it is a shadow. The movement of the body causes the shadow to move, but the movement of the shadow has no causal efficacy with respect to the body. The difficulty of this sort of argument from analogy is that while it is undoubtedly absurd to suppose that a shadow could move its object, having said this we have said nothing at all about the mind-body relationship.

Among the considerations which give epiphenomenalism some initial plausibility are things like sleepwalking and any unconscious behavior that passes under this name. For if mind is characterised by consciousness or awareness, then anything that the body does during sleep, and of which we are not even semi-aware, can be considered as purely non-mental. Now practically every human activity which is normally carried out consciously

has also been done by people during their sleep, including the solving of complicated mathematical equations. The epiphenomenalist could say that such occurrences show the overdetermining nature of consciousness in volition. The argument from hypnotic states is less clear since one hesitates to say whether or not an individual is conscious in the normally accepted meaning of the word when he is in an hypnotic trance. There are so many kinds of trance and so many ways in which the operator can determine whether the subject will "remember" what he has been through, that it is difficult to decide what credence we will give to the replies of the subject to questions about his "experience".

It seems that the only way we can refute epiphenomenalism per se (as distinct from the degree to which it gets flushed away along the interactionism, or must be taken to be false if monism is proven to be true), is to show that there is at least one physical event, which was caused by a non-physical event, and this is as unlikely of proof as the reverse. Yet it does seem that it is a mental state (my pain), and not a set of electro-chemical reactions simpliciter, that sends me to the dentist when I have a toothache.

Interactionism assumes that minds belong to the class of entities that are non-physical, that minds are causally responsible for certain physical states of the brain, and that these and subsequent physical states are causally responsible for states of the mind. The problem of interactionism is not so much that of how non-physical events can cause physical events and vice versa, since there is nothing in the concept of cause and effect preventing anything from causing anything else, but rather the problem of providing a plausible explanation of the causal process.

The whole problem of what we mean by "mental" as opposed to "physical", with our reluctance to accept into our ontology things which cannot be given neat, spatio-temporal co-ordinates and yet are efficacious, render the dualistic approach to the mind-body problem repugnant to those with a highly developed respect for the empirical as opposed to the mystical. Unfortunately the sea of monism is not much smoother.

At least two theories pass under the title of identity theories, both of which would assent to the statement, "brain states (events/processes) are identical to mental states (events/processes)." The difference between the theories lies in whether the statement is to be considered as analytic or synthetic. The first interpretation is to be rejected because it says nothing about the world, but about language. We shall turn our attention to the philosophically interesting position which regards the statement of identity as synthetic. That is, it is a contingent matter of fact that the statements describing brain states describe the same states of affairs as those describing mental states, in the same way as statements describing the Morning Star have the same referent as those describing the Evening Star.

Hospers,¹ following C. D. Broad, objects to any kind of identity thesis on the ground that "how can your thought about Paris and a certain complicated brain state inside your head be literally the same thing, since the one has characteristics that the other has not?" In actual fact, of course, both Hospers and Broad are arguing only against the uninteresting identity thesis with this form of attack. The same argument might

¹John Hospers, An Introduction to Philosophical Analysis, (Englewood Cliffs, N.J., 1953, Prentice Hall Inc.) p. 321

well have been used by the ancients to prove mistaken the first person to state that the Morning Star and the Evening Star were the same thing. After all, they might have said, the Morning Star is seen only in the morning and in the eastern sky, whereas the Evening Star is seen in the evening and in the western sky--obviously they have different characteristics, therefore they cannot be the same. It will be argued that 'when' and 'where' are not the kind of characteristics we are speaking of when we say that one has characteristics that the other has not; they are characteristics of the observer or of his situation, or of the situation in which the phenomenon is observed. This aspect can be separated in consideration of a phenomenon like the planet Venus; but what of the situation we are concerned with in which the phenomenon we want to observe is that with which we observe it?

Let us take another example in which this objection cannot be made. Consider the 36th president of the United States and the owner of the LBJ ranch. It is not a characteristic of the 36th president of the U.S.A. per se that he be a cattle owner or a tall Texan or many other things that are characteristic of the owner of the LBJ ranch. It will be argued that insofar as Lyndon B. Johnson was as a matter of empirical fact the 36th president of the U.S.A. and he is a Texan, etc., then these are in fact characteristics of the 36th president of the United States. This, however, is known only after the contingent fact is known that L.B. Johnson was the 36th president of the U.S.A. Similarly the opponent of the identity thesis would have to make the same move if it were (or could be) shown that as a matter of empirical fact brain states are identical to mental states. And it is just this that the supporter of identity must hold: that the identity is logically contingent and the statement of identity a synthetic statement.

But it is more than merely empirical identity that we are concerned with; if the identity thesis is true, knowledge of it demands certain conceptual shifts not required by the LBJ example. Knowledge of "pure" empirical identity adds to or modifies accepted concepts, but does not require changes in the concepts themselves. Knowledge of mind-body identity, if it is true demands that we form a new concept of what is referred to by the terms, "mind" and "body" in the same way that knowing that lightning is nothing more than an electrical discharge requires a new concept of lightning.¹ Evidence that such conceptual shifts may be required is seen in the findings of experimental work in particle physics such that such statements as the following have been made:

In experiment, in theory, and even in philosophical implications, the study of particles seems to have blurred the dividing lines between matter and interactions, between actor and actions.²

It was this statement, containing as it does a concept of the physical so foreign to the classical concept, that has led to the following attempt to find a solution to the mind-body problem within the confines of Quantum Theory. Such a solution must, of course, be monistic, although I would hesitate to call it materialistic since it rejects classical materialism. It is an identity thesis, but it demands more than mere empirical identity.

Against identity, C.D. Broad argues that it is palpable nonsense to try to reduce statements of the form "There is something which has the

¹cf. Michael Scriven, op. cit., pp. 191-192

²Clifford E. Swartz, "Resource Letter on Subatomic Particles" American Journal of Physics, Vol 34, No. 12, Dec. 1966.

characteristic of being my awareness of a red patch" to statements of the form "There is something which has the characteristic of being a molecular movement",¹ and that such a reduction would be necessary if the identity thesis were true. He argues that it would make perfectly good sense to ask of a molecular movement if it is swift or slow, straight or curved etc., but that such questions about the awareness of a red patch are nonsensical. But about this approach I would ask first: is "to know what it is to be aware of a red patch" the same as to know "what an awareness of red patch" is? I would suggest not, since although I know perfectly well what it is to be aware of X, I do not know what an awareness of X is, (in the same way that while I know what it is to be in love, please don't ask me what love is--I don't know). Yet the criticism of identity which is being advanced depends on the two statements having the same meaning and on our apprehension of the meaning of the first giving significance to the second which, I suggest, may be meaningless (at least within our current conceptual scheme). Secondly, if our current concepts are faulty, it may be perfectly good sense to ask of 'an awareness' (whatever that may be), "Is it swift or slow?" etc.

There are two monistic theories which travel under the name of double aspect theories but which are in reality quite different in their basic propositions. The first we might call the semantic double aspect theory, and the second the third substance theory. I shall discuss the two separately.

1. Semantic Double Aspect Theory: Such a thesis suggests that "brain state" talk and "mental state" talk are simply two different

¹C. D. Broad, The Mind and its Place in Nature, (Littlefield Adams & Co.) 1925, p. 622

linguistic conventions for describing the same set of phenomena. In essence such a theory presupposes identity of a materialistic sort such that our physiological conventions are reasonably adequate modes of description, but that psychological conventions, while undoubtedly useful, may be misleading insofar as they take for granted mental states that are basically different from physical states. The position states that the mind-body controversy is similar to the situation which exists in the linguistic conventions used to refer to ordinary physical objects such that the physicist describes a table in terms of the subatomic particles and their relations to one another, the atoms and the manner in which they are combined to form molecules, and the motions and characteristics of all of these so that considered together they reflect light, exhibit stability and offer resistance in the ways characteristic of tables. The common man has a different set of linguistic conventions to describe the same table, and an artist, designer, or cabinet-maker might have yet others--all dependent, of course, upon the conventions of the common man. It is the apparent disparity between the two conventions that originally made atomic theory difficult for the common man to contemplate since it required important conceptual shifts such as, for example, the shift in the concept of solidity. That there is no longer any doubt that when the physicist speaks of the microstructure of matter he is speaking of the same "stuff" as we are speaking of when we talk about tables is the nub of the semantic double aspect thesis; the requirement is that common parlance must simply come to grips with the empirical findings. In short, this theory is a restatement of the 'interesting' identity thesis with the added proviso that the 'problems' of mind-body are linguistic.

2. Third Substance Double Aspect Theory: This position, whose historical bases are well known, states that mind and body, or the mental and the physical, are the two knowable aspects of a third basic substance (i) as yet unknown or (ii) perhaps unknowable. The standard objection to (ii) is that in its attempt to solve the mind-body problem it creates a greater problem in that although we can talk about the head of the coin or the tail of the coin, it seems that we cannot talk of the coin itself; the self, which is the object of our search in the mind-body debate, is not only unknown but unknowable. What the proponent of this theory is willing to accept, the critic highlights as its weakness--that nothing can meaningfully be said about the central issue of the mind-body problem, the self. The critic sees that the only way out of this weakness is for the double aspect theorist to admit that we have two different linguistic conventions, physiological and psychological, and that these two conventions describe not only different characteristics but also different types of characteristics. Then, charges the critic, there is no justification for the belief that the two conventions describe the same thing. The force of this criticism would be reduced if and when a one-one correspondence is found between mental states and brain states, between psychological conventions and physiological conventions; while such a correspondence seems more and more likely with increases in the knowledge given to us by the empirical sciences, such findings only reduce, not nullify the force of the criticism.

What remains is that if this version of the double aspect theory maintains that the "third substance" is unknowable and/or ineffable, then the theory does not attempt a genuine solution to the mind-body problem. It does suggest a theory of linguistic or conceptual conventions, but we

are no closer to knowing what the 'self' is, or what the relation is between one aspect and the other. It is just this relationship which any adequate theory must elucidate.

A third substance theory is not fruitless, however, if it can make some significant statements about the third substance. The common man has a set of linguistic conventions whereby he speaks of trees, lamp-standards and puddles in the road; classical physics has a set of linguistic conventions concerning indivisible atoms and molecules in rapid motion which, it is claimed, describe the same entities we normally refer to as trees, lamp standards and puddles in the road; since 1920 the quantum physicist has told us that the real world can be adequately described only with a whole new set of conventions having to do with quanta--entities that do not behave as do trees, lamp standards and puddles in the road, but whose behavior accounts for that of the familiar objects of our environment. Quantum theory, then, is a third substance theory (not, ostensibly, in the mind-body domain), which reconciles the conventions of the common man and of classical physics without introducing any entities which are in principle unknowable or ineffable. It is, therefore, the chief purpose of this thesis to suggest that an adequate mind-body theory, which satisfactorily accounts for the relationship between the various conventions (psychological, physiological, etc.,) will be found within the domain of quantum physics.

In The "Mental" and the "Physical", Herbert Feigl¹ sets out what he conceives to be the "requirements and desiderata for an adequate

¹Herbert Feigl, The "Mental" and the "Physical", (University of Minnesota Press, Minneapolis, 1958/67)

solution to the mind-body problem" which I shall attempt to summarize here as a guide not only to the systematic criticism of solutions already suggested, but also to the embryonic solution I wish to propose. These are:

1. Linguistic analysis: an adequate analysis of the terms "mental" and "physical" must be attempted such that we can be clear about what is meant as well as what is not meant by each.
2. Empirical Unity: an adequate solution must account for the unity indicated by current trends and experimental data of empirical research, including those of parapsychology.
3. Efficacy: we must at the same time be able to account for the efficacy (apparent or otherwise) of mental states which, although we may very well be deceived, gives every evidence of being more than just apparent. This will have to include an account of free will in whatever sense this can be made to conform to what is scientifically defensible.
4. Logic: The logical requirement concerns the necessity to recognize as synthetic or empirical the statements correlating brain states with mental states.
5. Epistemology: the epistemological requirements are threefold, and I quote from Professor Feigl:
 - (a) the need for a criterion of scientific meaningfulness based on intersubjective confirmability,
 - (b) the recognition that epistemology, in order to provide an adequate reconstruction of the confirmation of knowledge claims must employ the notion of immediate experience as a confirmation basis;... 'Acquaintance' and 'Knowledge by acquaintance', however, require careful scrutiny;
 - (c) the indispensability of a realistic, as contrasted to operationalistic or phenomenistic, interpretation of empirical knowledge in general, and of scientific theories in particular.
6. Reconciliation: the reconciliation of scientific and philosophical analysis--i.e. how shall we distinguish between:

MENTAL	and	PHYSICAL
Subjective		objective
nonspatial		spatial
qualitative		quantitative
purposive		mechanical
mnemic		non-mnemic
holistic		atomistic
emergent		compositional
intentional		"blind"; nonintentional

Two things will be evident at this stage; first that the solution toward which I am aiming lies within the framework of monism, and second, that a complete and exhaustive study of the problem within the framework suggested by Feigl would be beyond the scope of this essay, and that therefore I shall have to be content to sketch the lines along which I suspect the solution will be found, and to indicate the manner in which it might satisfy the criteria set out above.

A. It is generally conceded that what is 'mental' is subjective, and that the 'physical' is objective; but saying this really solves nothing since by 'subjective' we generally mean that which is mediated by psychological or 'internal' factors, whereas 'objective' refers to what is directly perceived, or directly known--what is "out there", independent. But surely this very statement contains a contradiction! We are directly aware of, we know (in the hard-boiled sense) only our own mental states. I do not seem to be able to be mistaken about my thoughts and emotions; I may be mistakenly angry, but I cannot be mistaken about the fact that I am angry; I may be mistakenly aware of a pool of water in the road ahead, (i.e. it may be a mirage), but I cannot be mistaken about being aware of the pool-like sensation. If there is anything "out there" existing independently of my mind, I cannot apprehend it as directly as I can my own mental states. Psychological literature is full of "objective" observations which one very strongly suspects have been mediated by the

mental states of the observer. In fact recent experiments in neurophysiology (which will be reported later) indicate that all observations are mediated by the totality of previous experience.

In short, the whole project of sorting out what is mental and what is physical on the basis of subjective and objective is fraught with confusion so long as the latter terms are understood in relation to what is directly accessible as opposed to what is indirectly accessible.¹ How else shall we distinguish between subjective and objective? If the purpose of the enterprise is to illuminate 'mental', consideration of mind-dependent or mind-independent will lead to circularity in assuming prior to the investigation that we know what 'mind' is.

We are inclined to fall back on some conception of subjective as private, and of objective as public. In this way, although there may be public manifestations of private events, for example the screams and writhings of someone experiencing a pain which is itself private, the pain itself must remain private in the sense that no one else can experience that particular sensation. Nor can another person's sensation, given the numerically identical stimulus (loud noise, falling timber), under the same circumstances (the timber strikes both A and B with the quantitatively same force on the same area of the body at the same time), be the numerically same pain. Furthermore there is no way of anyone's knowing whether A's pain is even qualitatively identical to B's pain, even when all the publicly knowable factors are known to be similar, and there is every

¹Wolfgang Köhler, "A Task for Philosophers", Mind, Matter and Method, Feyerabend & Maxwell, ed., (Minneapolis, University of Minnesota Press), 1966.

reason to suppose that they are not, since people are notorious in their disagreement over how such a pain should be described.

Yet it seems only a very weak sense in which anything can be called public. The lamp standard, or someone's cry of pain are called public. Public in the sense that anyone looking (or listening) will see (hear) the same thing; yet all that is genuinely constant is that anyone with the appropriate "set" will be affected in some way, for the lamp standard of which I am immediately aware is both quantitatively and qualitatively different from anyone else's. Thus to whatever degree the lamp standard is public it is also not available to direct apprehension, and to the extent that it is available to direct apprehension it is private. Are we, then, to define 'public' as that which is not available to direct apprehension? Surely not, since (a) this is clearly not the way the word is commonly understood, and (b) such a definition lets in too much.

Since the present approach seems to be leading nowhere, let us ask what is the significance of the distinction to the problem at hand. This seems to be considerable in that if there is in fact no clear-cut distinction between mental and physical, between public and private, such a state of affairs would mitigate against a dualist position. For dualism must maintain that minds and bodies, mental events and physical events, are clearly and certainly different and distinct. Yet there is, of course, a sense in which mental events and mental states are clearly and certainly distinct, and that is with respect to what we call awareness. Unfortunately the distinction is only one-sided, since while we might agree that all mental events fall within the class of that of which we are aware--

there can be no mental event such that no one is aware of it¹--it is less interesting to say that mental events are the only things of which we are aware, and quite unhelpful to say that everything else is the class of physical events. Perhaps the dualist will say that the class of those things of which we are not directly aware includes physical events. But are there no physical events of which we are directly aware? A headache may be caused by a certain cortical disturbance, and it will be argued that the cortical disturbance is one thing and the headache is another; but if there are no headaches without cortical disturbances of a certain kind, and no disturbances of this kind without headaches, are we not aware of the cortical disturbance? If the answer must be no, then we have reached the unhelpful conclusion that the terms 'mental state' and 'state of awareness' refer to the same phenomena each of which can be defined only in terms of the other. I conclude that if this kind of analysis is accepted, and the 'public' (objective?) is unknowable, then the dualist is forced into the position of extreme idealism which violates common sense and is contrary to the manner in which we do in fact view the world and on the basis of which we have succeeded in operating in our environment.

B. Mental events are taken to be non-spatial, while physical events are spatial. Undoubtedly we are as unwilling to say that pain caused by my ingrown toenail is 'in' my toe as we are to say that it is 'in' my head. The well-known examples of phantom limbs--the pains felt by people

¹cf. R. B. Brandt, "'F is a particular mental fact' is to mean the same as 'F is temporal, and something is directly aware of F'" "Doubts about the Identity Theory", Dimensions of Mind, Sidney Hook, ed., (New York, Collier Books) 1961, p. 62

who have undergone amputation, which appear to be in the nonexistent limb--clearly point to the fallacy of locating pains where they appear to be; yet if I have a pain in my toe I will resist anyone's suggestion that while it may be the toe that is injured, the pain is in my head. This area of discussion is too well known to bear repetition, yet two points seem worth mentioning.

(1) We are unwilling to deny any location at all to mental events; we seem bound to restrict them at least to the spatial co-ordinates of our bodies. That is, when I am in Manitoba my mental images seem to me to be there rather than in British Columbia, and when I return to British Columbia my conscious states seem, at each moment of the journey, to be generally locatable in that part of the terrain through which I am passing.¹

(2) If, as has been suggested, such questions (where is your pain?) are silly, then, (a) in what sense are they silly? and (b) why are they silly? If they are silly, why is it that I seem perfectly able to answer my physician when he asks where my pain is? (I can only think it fortunate that my psychiatrist does not ask where my dreams are!)

One reason for the silliness of these questions lies in their making a fundamental category mistake (which will be discussed in detail in chapter IV): pains simply are not the type of thing that can be located in this way any more than can motherhood, patriotism, or the number 1. This is not to say that pains, etc., belong to the same class of entities as motherhood, patriotism or the number 1, but that the same type of error is made if you ask their location.

In any case, it seems true that we do not locate our mental events very specifically, and perhaps we cannot do so, but we do set specific

¹Cf. G. E. Moore, Some Main Problems of Philosophy (New York, Collier Books, 1953), p. 19

limits within which we do locate them. The one exception to this involves the claims of parapsychology. If people can and do communicate over great distances, if people have in fact communicated with those whose bodies have ceased to exist (as living, human bodies), and if people can in fact 'see' what is not within their physical field of vision, then the statement is false; but it does not follow from this that there is no physical explanation of these phenomena, nor that dualism is necessarily true. Recent empirical investigation in parapsychology indicates that, while information may be transmitted from one mind to another, mental events themselves are very much attached to corporeal bodies. (Vide the work of L. L. Vasiliev referred to in detail later.)

C. The attempt to distinguish between the 'mental' and the 'physical' on the basis that mental states are qualitatively different from each other and from physical states, while physical states are quantitatively different, is also doomed to failure. Stated simply, the objection is this: there are qualitative differences and quantitative differences on both sides of the line. Pains may be strong or weak, they may be graded on an n-point scale such that even though they remain private, one pain may be recognized as so many degrees greater than another by the sufferer, and understood as such by another; the same may be said of the immediately experienced color sensations, sound sensations (both volume and pitch), and emotional experiences. It is, after all, on the basis of this directly perceived quantitative difference that we have built up our system of quantitative measurement in the physical sciences. For example: (1) the thermometer would have been neither conceived of nor calibrated without the quantitative differences in the raw feels that this is hotter than

that--the pain is greater when the water is boiling than just after the kettle was plugged in; (2) the ruler would not have been calibrated without the supposedly 'private' mental image of A such that B is farther to the right of it than C. Similarly, what it is that is measured by a galvanometer, voltmeter, ammeter, oscilloscope etc. must be qualitatively different, for how else would we judge that different instruments are appropriate to make the measurements?¹

With regard to this point, Feigl notes that these scientific variables are not directly experienced qualities, and asks if there is any good reason for restricting the term 'quality' to the phenomenally given. The illustration suggested by the oscilloscope is a good indication of a negative answer to his question. This is an instrument which measures both the frequency and amplitude of vibrations which correspond to the directly experienced pitch and loudness of sounds. Pitch and loudness are qualities of sounds which we distinguish; but the oscilloscope can record two distinct parameters with respect to the vibrations which are alleged to be the cause of our direct perceptions. How else are we to distinguish between the two measurements which the instrument records if not on the basis of quality? Thus it seems to make as good sense to speak of directly observed and physical quantities as it does to speak of mental and physical qualities; both locutions are meaningful.

D. The temptation, when discussing mechanical versus purposive distinctions, is to become enmeshed in the controversy over whether the lower

¹ Herbert Feigl, op. cit., p. 41

animals on the one hand, and computers on the other, have minds. (In the latter case it would be a question of whether or not computers could have minds since there do not yet appear to be any that tempt us to credit them with mental processes.) I would like to suggest, however, that even though the question is relevant it is quite unhelpful in the dispute between dualism and monism. Given the truth of the proposition "There is at least one non-human animal and there is at least one electromechanical computer such that each has a mind", two points can be made: (1) the relation between their 'minds' and their 'bodies' need not necessarily be the same as that which exists between the human mind and the human body; (2) all the problems which beset the mind-body problem with respect to human entities will arise with respect to these non-human entities, and their physical differences from humans will be of no greater help or relevance to the problem than the physical differences between me and my wife.

The evidence that other people have minds is of this general type; I have a mind, the behavior of others is similar to that behavior of mine which I conceive to be mind-generated, therefore there is a high degree of probability that they have minds also. It is the lack of two items in this regard that prevents us from granting minds to computers and the other animals: (a) a syntactically and semantically flexible means of communication, and (b) the capability of reflective thought. Our evidence for the existence of the latter depends, of course, on the former, and current investigation of killer whales and some other large species of marine life is aimed at discovering whether these creatures are intelligent to anything like the degree that humans are, and to which some investigators have suspected. But, as I suggest, regardless of the outcome of these investigations I cannot see that we will be much helped by them. In any case, purposive behavior in some sense or other--certainly in the sense of

being teleologically oriented--is exhibited not only by numerous animal species (many quite low in the scale of evolution), but also by plants, and by homing rockets and such inanimate mechanisms. The distinction between conscious versus non-conscious teleological orientation brings us full circle to evidence for the existence of consciousness.

E. Let us accept, as a starting point, C. D. Broad's definition of mnemonic versus non-mnemonic events such that "A non-mnemonic event would be one whose 'momentary' conditions all immediately precede it, and whose 'non-momentary' conditions are all continuous with it. A mnemonic event would be one which has at least one independently necessary condition which is separated from it by a finite gap of time."¹ I see no particular reason why this definition cannot be accepted, and if it is I cannot see how a consideration of the mnemonic as opposed to non-mnemonic constitutes a criterion for differentiating between the mental and the physical. Mnemonic causation, in some sense compatible with the above definition, has been accepted as common to all living organisms for over half a century, and the advent of the electronic computer shows it to be not only part of, but essential to the operation of these mechanical 'brains'; thus another alleged division necessary to the acceptance of a dualistic position must be rejected.

F. A consideration of the history of evolution on the one hand, and of the complexification of matter on the other, leads us to doubt that there is any clear distinction to be made from the idea that consciousness is

¹C. D. Broad, op. cit., p. 449

'emergent' while matter is purely compositional. There is in the micro-structure of matter and in the macro-structures an interesting continuum both from the point of view of complexity and also from the point of view of size. We are concerned here with the continuum of complexity whereby the subatomic particles are arranged in numerous ways from the numerical as well as "geometric" point of view to form the atoms of the traditional elements; these in turn combine in countless ways to form compounds which in turn exhibit a continuum of complexity such that there are molecules which exhibit both the characteristics of living cells and of non-living matter. The composition of the atoms of all the elements can be changed so that any element may become radioactive, indicating that radioactivity is a function not of certain rare elements, but of structure. As more and more research is carried out more and more blanks in the continuum are filled blurring the lines between 'elementary' particles and those which may not be elementary; between living and non-living; between plant and animal; between conscious and unconscious. There seems to be no place in the scheme of things for purely 'emergent' properties in the sense of "suddenly it's here". The potentiality seems to have been exhibited at previous stages in the continuum of complexity of matter. Consciousness may, after all, be a function of one structural dimension just as radioactivity is a function of another.

Thus the holistic-emergent/atomistic-compositional distinction between the 'mental' and the 'physical' does not seem to hold any more promise than the previous considerations.

G. One of the chief objections to any monistic theory gathers around what is called intentionality; it usually takes the form of a question

such as: we say that a person has a thought about castles in Spain, or a mental picture of a beautiful young girl, but what does it mean to say that he has a brain state about castles in Spain? or of a beautiful young girl? It seems to me that this oddity says a great deal more about our linguistic conventions than about the mind-body problem. A language is quite conceivable in which all such propositions as the above could be expressed without this particular difficulty arising. If, on the other hand, we are concerned with intentionally directed behavior, then the human organism is not alone in exhibiting such symptoms. A computer can be programmed to exhibit teleologically oriented choice behavior in the same sort of way as that which is seen to be shown by humans in similar situations.¹ Thus it appears that the problem of intentionality can be divided into (a) part of the "psycho-logical problem, i.e., part of the relation of psychological to the logical forms of discourse",² and (b) a behavioral aspect common to many non-human and even non-living entities.

I conclude that these oppositions (as listed in (6) page 13) do not allow us to make a satisfactory distinction between what we shall call 'physical' and what 'mental', that "X has a mind" must be analysed along the lines of "X is aware or is capable of being aware", and that any analysis of mental events, states or processes will not necessarily preclude the possibility of their being identical with certain specific types of physical states in the same sort of way in which radioactive hydrogen

¹Robert Ackermann, "Explanations of Human Actions", Dialogue, Vol. VI, No. 1, June 1967, pp. 22-27

²Herbert Feigl, op. cit., page 51.

is still hydrogen. That is, a specific structure of matter may exhibit awareness just as a specific structure of matter exhibits radioactivity. That this conception does not preclude the efficacy of states of awareness to change the behavior of the matter which exhibits it will be seen in a later chapter, just as it does not preclude the possibility of parapsychological phenomena having explanations within the framework of empirical science.

To the extent that any form of dualism requires that 'mind' and mental states be specifically different from physical states and matter, that no such specific differences have been demonstrated, and that if they were we would be at a loss to see how these fundamentally different entities could interact in any significant way, it seems that any form of dualism must be rejected as untenable.

CHAPTER II

THE STATUS OF IDENTITY STATEMENTS

Since we are seeking a solution to the mind-brain dispute both within the confines of Quantum theory and monism, and as there are numerous formulations of an identity theory, it is necessary both to clarify precisely what is entailed by the sort of identity I am proposing, and to state specifically what it is not. Thus I shall reject the two extreme positions: (1) that the identity results from strict logical necessity, and (2) that the identity is accidental. There are a number of intermediate formulations which will have to be explored in some detail, and as a preliminary exercise it may be helpful to classify statements in general with respect to their logical status.

A. LOGICAL NECESSITY: Under this head we may classify all statements of the form $p \supset p$ and $\sim(p \supset p)$, whose truth or falsity is logically necessitated by the rules of logic, as opposed to

B. LINGUISTIC NECESSITY: those statements like "All bachelors are male" and "Jones is a married bachelor" whose truth or falsity is logically guaranteed by the linguistic conventions rather than by any solely logical criteria. That is, it is the logical rules plus the linguistic rules that entail the truth or falsity of these statements.

C. CAUSAL NECESSITY: Statements of both fundamental and derivative laws¹ may be classified here on the ground that their falsity is necessitated by

¹ Cf. Carl G. Hempel and Paul Oppenheim, "The Logic of Explanation" in Feigl and Brodbeck, Readings in the Philosophy of Science, (New York, Appleton-Century-Crofts Inc. 1953).

some empirical fact, the laws of causality, and some logical rule. That is, if we postulate the truth of empirical laws and logical laws, then the truth of particular statements is assured. Conversely, if a particular statement follows from an empirical law, and is false, then the falsity of the law is established. For example: the Newtonian laws of motion entailed a particular orbit for the planet Mercury. Experimental evidence showed that this was not the actual orbit. It followed that Newtonian laws were inadequate, i.e., false.

The next two classes are vulnerable to numerous objections, particularly from hard-core determinists, who would claim that there are no such statements; however, since they are not crucial to the main argument I shall not trouble to defend them, as they are included for the sake of completeness and to demonstrate that the identity statement is not among them. We may refer to these classes as:

D. ADVENTITIOUS: statements of the type which sociologists might take for the laws of their 'science', such as "Power corrupts", which seem to have some very loose necessity, but whose truth or falsity being largely adventitious must be separated from the invariable statements of the previous classification.

E. ACCIDENTAL: At bottom of our spectrum we shall place those statements for whose truth or falsity there is no logical basis whatever. They may be exemplified by the subjective statements about one's mental states whose verification does not rest on any of the criteria of logic, linguistics or causality.

Now the truth of the statement of the identity of mental states and brain states must not follow solely from logical necessity. There is no contradiction in the two statements, "S has a mind" and "S does not have

a brain" although with our ever increasing knowledge of psychology and physiology such a conjunction becomes increasingly implausible. Such statements would be contradictory only if an analysis of "has a mind" were impossible without reference to the physical structures referred to in the description (not definition) of brains. But in fact we analyse "has a mind" more or less satisfactorily with reference only to consciousness or awareness; for just as in dreams we are aware of sounds though we hear none with our ears, of sights though we see none with our eyes, of tactual sensations though the appropriate receptors are not stimulated; so we can conceive what it would be to experience consciousness independent of the usual physical structures. Briefly, the conjunction of "S has a mind" and "S does not have a brain" does not amount to saying "S is conscious and S is not conscious", and is therefore not logically impossible even though it may be (in fact it is my contention that it is) empirically impossible to have a mind without having a brain.

But if the truth of the identity statement is not guaranteed by the laws of logic, we must also reject that its truth or falsity is necessitated by linguistic rules. First, if we define 'mind' or 'self' in terms of brains or neurophysical structures and processes, then we will have avoided the whole mind-body problem rather than solved it since the question can still be asked, but is this really what we mean by the term 'mind'? Second, the mind-brain identity statement would become analytic, and therefore tell us something about the language but not about the world; but the monist must be telling us something about the world, since otherwise the identity statement is patently false in virtue of the linguistic conventions to which we have become accustomed.

On the other hand we cannot go to the other extreme to say that the identity is accidental in the same way that "All the coins in Smith's

pocket are nickels" is, if true, accidentally so (and similarly accidentally false, if false). The problem here is that an identity of the kind exemplified might just as easily have been otherwise, whereas the monist wishes to state that mental states are brain states and could not possibly be otherwise given the world as it is and the laws of nature. This is not to say that there may not be beings on some other planet whose bodies may be made of, say, platinum and whose central control mechanism operates by means of some exotic property of the metal; of whom we shall want to say that mental processes are metallurgical processes.

Rather, a tenable identity theory must propose that the truth of the identity statement follows from or is rendered probable by the laws of nature as they are; the statement that such and such a brain state is a conscious state (if true) is necessarily true in virtue of the structure of brain tissue, the empirical laws governing such matter, and some logical principle, in the same way as radioactivity is the natural necessary result of certain atomic structures. Just as any material becomes radioactive when its atomic structure is suitable altered, so awareness results from the appropriate complexity of neurological structures by the operation of specific, discoverable laws.

If this is so then the concept of mind must be made to accord with the accepted data, and it will not be considered strange or deviant to make the same kind of statements about mental states as we do about brain states. One of the chief objections along this line has been that of intentionality: how can one say that a brain state is about something? For example, one may be able to correlate my seeing the Playmate of the Month with a certain set of neurological impulses, yet while it is perfectly good sense to say that I am thinking 'of' or 'about' the Playmate of the Month, it would be strange to say that the set of neurological

impulses was of or about her. However I do not see this as an insurmountable obstacle.

First let it be said that I am not here calling for the adoption of a "convention...whereby it would make sense to talk of an experience in terms appropriate to physical processes",¹ but for a conceptual shift of the type each one of us makes when he learns that the chair on which he is sitting is a seething mass of almost inconceivably small molecules all in furious motion.

Secondly, if the identity theory is true and the appropriate conceptual shifts have been made, then it obviously would make sense to say that such-and-such brain state was about the Playmate-of-the-month, nor would this be the sort of intentionality by convention which is involved when we say that this book is about the city of Ottawa, where the intentionality depends upon one's prior acceptance of the conventions of the symbols involved in writing. That is, there is no causal or nomic necessity about the relationship between the symbol "a" and the sound we utter when we pronounce the vowel, nor is there between the symbol "apple" and the thing represented by the symbol. The sort of intentionality I am referring to is that most aptly illustrated by an example from current technology. An electronic device has recently been developed for the use of the blind such that the blind man holds a flashlight-like object in his hand and points it at his surroundings. By means of a radar-like process a tone sounds in the earphone of the blind man, its tone rising and falling depending upon his distance from the object. A very slight modification of this instrument (actually made since the first draft of

¹J. J. C. Smart, "Sensations and Brain Processes", The Philosophical Review, Vol. 68, 1959, page 152

this chapter wherein the modification was predicted) allows the blind man to detect not only his distance from objects, but also to recognize their shapes and subtleties of form by means of the quality as well as the pitch and volume of the sound. He can now say of a sound in his ear, "This is the sound of a Gothic cathedral" or "This sound is about the statue of Venus de Milo."

Another example of non-conventional intentionality might be the graphic image on an oscilloscope resulting from the input of sound waves; it can be said of a certain pattern, this is a picture of C[#] played on a violin. Here the observer must learn that such-and-such a graphic image intends a given sound in a manner similar to that in which we learn that certain visual sensations intend danger or a fine day, not in the way that we learn that a specific image on a page refers to an apple.

The position I am proposing is similar in some respects to that of U.T. Place¹ for whom identity is a "general or universal proposition" as opposed to the particular sort of identity exemplified by the statement, "His table is an old packing case." I would add to Place's argument the stipulation that the statement "Mental events are brain events" is an empirical lawlike truth resulting from the natural laws governing complex neurological structures of a certain order.

J. J. C. Smart, following Place, points out² that an acceptable identity theory must admit identity in the strict sense, and I take this to mean that all the properties of mental states are properties of brain

¹U. T. Place, "Is Consciousness a Brain Process?", The Philosophy of Mind, V. C. Chappell, ed., (Englewood Cliffs, N.J., Prentice Hall, Inc., 1962)

²J. J. C. Smart, op. cit.

states. Jerome Shaffer objects to this statement of identity on the ground that "C-states (conscious states) cannot be identical with B-processes because they do not occur in the same place."¹ However, Shaffer seems to be unaware of the basic ambiguity of "where is?" questions: (a) what class of information is required by a "where is?" question, and (b) is the requirement informational or experiential? For example, if someone asks "Where do you live?" a set of spatial co-ordinates will constitute a complete and satisfactory answer. If someone asks "Where can I see a neutron?" the answer will have to include spatio-temporal co-ordinates of the type: when X and Y occur you may see the path left by a neutron at a point such that.... A very different situation is exemplified by the question asked by the owner of a new or unfamiliar auto, "Where is the right front corner of the car?" In this instance, as in that of the baby trying to find out where his hand is, the object in question is clearly visible; spatio-temporal co-ordinates are not required. What is wanted here is some kind of knowledge by experience; one learns, one is not told the "where is" in this latter instance. There may be other types of "where is?" questions; however, these three serve to point out that identity of place is not a simple concept. I may know where my kidneys are in a spatial sense, although I do not know where they are in the sense that I know where my hand is or where the right front corner of my car is as I swing in to a parking lot; situations simply do not frequently arise such that one needs to know where one's kidneys are in this latter sense, we are rarely interested in this fact; mental states are, I suspect, always

¹Jerome Shaffer, "Could Mental States be Brain Processes?" The Journal of Philosophy, Vol. LVIII, No. 26, Dec. 21, 1961, p. 813

located in the experiential sense, and thus we are taken unaware by the request for a spatio-temporal location.

It seems to me that Shaffer makes the dual mistake of failing to distinguish between what will be considered acceptable criteria for "where is?" questions, and then of stating categorically that it "makes no sense at all to talk about C-states as being located somewhere in the body"¹, then moving from this statement to the statement that C-states are not located in the same place as B-states. (1) If it makes no sense to speak of C-states as being locatable in the body, then it is equally meaningless to state that they are not, and thus his objection to the identity theory on the ground that the spatial requirement is not met fails insofar as, if he has shown anything, he has shown only that we cannot know whether or not it has been met. (2) What evidence does he adduce to support the senselessness of locating C-states? Perhaps it makes perfectly good sense, since obviously if the identity thesis should turn out to be true, then it must make sense (this is part of the conceptual shift referred to above). Undoubtedly it does make no sense to Shaffer himself, and I cannot argue with his private experiences; however I am sure there are many who, like myself, have always visualized thoughts and sensations as having some vague sort of location above and behind the eyes. Is this to say that the pain in my foot is located there? Well, why not; it certainly isn't in my foot as evidenced by the pain-in-the-foot type sensations reported by those who have no feet. At the risk of being charged with facetiousness, I will note that people with no heads do not report sensations of any sort!

¹ op. cit. page 815

We might ultimately want to say that sensations are not locatable --cannot be located; but what sort of 'can' is this? logical? empirical? or technical? or would it be more accurate to say that they have not been located rather than be committed to any sort of 'can'? Shaffer goes on to attack identity theorists on the ground that they have argued that "every argument for or against identification would apply equally in the mind-body case and in the electromagnetism case".¹ This, he claims, is not so since there are ways of locating electromagnetic radiations, but (by implication) there are no ways of locating mental events. Undoubtedly there was a great period of world history during which there were no known ways to locate electromagnetic radiations, and while this may for ever be the case with mental processes, I can see no necessity such as Shaffer implies. We assume that what the electroencephalograph records are brain processes; may it not be recording mental processes? We could grant that there are not now ways to locate mental events, that we cannot even conceive how one would go about locating them, without granting that they cannot (logically) be located. Yet surely Shaffer must have a logical "can" in his proposition implied by "this cannot be said in the mind-body case."²

Thus it is not so much the adoption of a new convention that is required as it is the recognition that the linguistic conventions governing mental states are not synonymous with those used to refer to brain states, in the same way that the linguistic conventions used in describing streaks of light (lightning) are not the same as those used to describe

¹Hilary Putnam, "Minds and Machines" in Sidney Hook (ed.) Dimensions of Mind, (New York, Collier Books, 1960), page 171

²Shaffer, loc. cit.

electrical discharges, although we do accept the strict identity of lightning and electrical discharges. That is, there is a one-to-one (or one-many) correspondence between what is seen when lightning occurs and the elements of the scientific description of electrical discharges. So just as the ancients could perfectly well describe lightning without knowing that it was an electrical discharge yet the statement of identity is not logically inconsistent, similarly the fact that they could describe their sensations without knowing anything about brain processes need not damage a theory of the identity of sensations and brain processes.

That there is such a correspondence between mental states and brain states seems evident from a number of empirical considerations.

1. If I hear a continuous high pitched tone, I may be in genuine doubt as to whether the sensation has its origin outside myself, and I can test by asking another person if he also hears the tone; perhaps I can plug my ears to see if the tone ceases; if it does not, then I conclude that the sensation is just like that which I experience when there is a sound-producing source within my audible range, yet, since there isn't, my experience must be entirely within my body.
2. Stimulation of the cerebral tissues with an electric probe results in the subject reporting certain specific experiences or sensations, and similar excitations result in similar sensations, as reported by Dr. Wilder Penfield of Montreal.
3. When the electrodes of an electroencephalograph are positioned so that they record the electrical impulses of the brain, there are certain patterns which are always associated with sleep, with dreaming, with waking states, and states of intense mental activity. The experiments of Karl Pribram, which are discussed at some length in Chapter IV, leave little doubt that further research in this area will allow the researcher to say with certainty

what the subject is thinking or sensing.

None of these examples gives greater support to the identity thesis than to epiphenomenalism, parallelism, or occasionalism; however, they may indicate that the problem is one posed by two sets of linguistic conventions rather than by the existence of two separate entities.

I wish to reject the idea (cf. the Smart - Stevenson dispute¹) that there are M - properties ("all and only those properties which the materialist wishes to allow in his physicalist scheme") and P - properties ("those defining properties for 'sensations' which prevent us from defining 'sensation' in terms of M - properties"), and suggest that if the identity theory is true the properties of brain events/states/processes can be described either in the linguistic conventions of the physical sciences (M - conventions) or of the common man when he describes his sensations with reference to the mind-independent entities (pace Berkeley) such as color, sound, shape, distance, etc., which he senses or appears to sense (P - conventions). Thus there should be (and indeed there does seem to be) for every locution in the P - convention, a corresponding locution in the M - convention--but, of course, not the converse. This is not to say that the one convention is reducible to the other in any sense stronger than that in which ordinary physical object language is reducible to the conventions of particle physics, although both sets of linguistic conventions are being used to describe trees, lamp standards and puddles in the road.

Thus my sensation statements are not statements about brain states any more than brain state statements are statements about sensations.

¹J. J. C. Smart, J. T. Stevenson, The Philosophical Review, Vols. LXIX and LXX

Rather, brain state statements and sensation statements are phrased in the appropriate linguistic conventions and describe the state of affairs of which I am aware when I sense. The criteria of appropriateness will be similar to those employed when we decide whether to speak of trees or conglomerations of atoms. And just as I cannot communicate my awareness other than with reference to so-called public objects or by means of words like 'pain, 'itch', etc. which have a conventional symbolism in the same way that 'apple' has; so the physico-psychologist must use a different set of conventions to describe his observation of my awareness--which is not to say that he is aware of my awareness (which would be silly), but that he can describe his awareness of my awareness only in a physical object language which will differ from mine only insofar as what I am aware of is the lamp post or the pain or the anger, while he is aware of some physical state of my body.

I have said that if the identity thesis is true its acceptance requires certain conceptual shifts; it may be profitable to investigate these shifts first from the point of view of discovering just what is involved, and secondly to see if the necessary shifts are acceptable. The conceptual rearrangement must be similar to that required by the discovery that lightning and electrical discharges are related in the way the monist claims for the mental and the physical. There do appear to be two differences (1) of degree and (2) of kind. Of degree in that the discovery of the identity of lightning and electrical discharges did not affect day-to-day parlance to any great degree. Few common expressions ceased to have meaning; some mythological formulae became quaint which otherwise may have 'reached' the common man with great force: "Zeus hurled his thunderbolt", and such phrases, which may very well have been treated metaphorically even

by those who received them. We do not, after all, mention either lightning or electrical discharges every day (unless we are research scientists engaged in a project) whereas expressions referring to mental states are integral to our conversation, so that it is rare to find anyone talking for five minutes without his using expressions like, "I have an idea," "I think," "You know," "I believe," etc. And as things currently stand, he would strongly resist the suggestion that these words referred only to neurophysical processes. (It is amusing, if not immediately relevant, to note that this resistance is weaker the less the individual has had to do with philosophy--the philosophical and religious ignoramus is an intuitive monist.)

The difference in kind of conceptual rearrangement is a result of the lack of competition in the lightning example in comparison with the number of theories currently held concerning the mind-brain problem. There is not, so far as I know, an historically venerable dispute, the lightning-discharge problem, as hotly debated as this which we are presently engaged in. That is, the establishment of the identity in the lightning example required only the establishment of a satisfactory set of concepts which replaced either nothing at all or a vague set of mythico-religious concepts quite unsatisfactory as to their explanatory value--and all this on one side of the identity, lightning. Whereas the mind-brain identity I am proposing require a genuine and full-scale rearrangement of the concept of 'mind'/'mental' as well as a modification in the concept of 'physical' when there are competing views being put forward by reputable scholars adducing formidable evidence and arguments.

It might be supposed that these differences are too great to be passed over lightly--the fact that previous to the establishment of the

lightning identity we did not have adequate concepts of the entities involved whereas we do seem to have perfectly acceptable concepts of both mind and matter. But are our current concepts clear? The dualist tends to stamp his foot impatiently at this point, like G. E. Moore or Samuel Johnson, and say that he knows very well what terms like 'physical', 'material' etc. mean, and that he is quite as clear about the difference between physical and mental or material and spiritual as he is between plant and animal, or organic and inorganic, living and non-living.

But of course the mention of these last three brings the adequacy of these distinctions sharply into question, since the findings of empirical investigations have shown them to be inapplicable at the extreme points of the scales supposedly identified by just these distinctions. Many extremely primitive life forms cannot clearly be classified as either animal or plant by the accepted criteria. Microbiologists no longer find a clear line between the organic and the inorganic. Recent controversy stemming from medical transplants has shown that even the distinction between living and dead in humans is difficult to define satisfactorily. The latter case is interesting insofar as, unlike the other distinctions which separate contraries, the life-death distinction separates a pair of contradictories. The inadequacy of the terms 'physical' and 'mental' themselves has been discussed at some length in Chapter I; and from these considerations one might be led to conclude that these classifications are appropriate only away from the extremes of a continuum, yet it is the extremes that are interesting and useful in making inferences as to the nature of things.

In his "Defence of Dualism" Curt Ducasse purports to distinguish clearly between physical/material and psychical/mental by means of the supposed inherent publicity of the former and the necessary privacy of the

latter; "Psychical events themselves are never public and never can be made so."¹ In italicising "themselves" Ducasse intends to emphasise the distinction between 'public' and 'being published', a distinction which, in this context, hardly seems necessary since I cannot imagine anyone objecting to the supposed privacy of mental events on the ground that they can be reported. The privacy, as I understand it, lies in that they are not directly experienced by anyone other than the individual who 'has' them. Now I suspect that this concept is not nearly so clear as it is generally supposed to be, for as C. D. Broad has pointed out² there is no logical contradiction involved in saying that one person may be directly aware of experiences that are not his own. In fact the hardware of current technology can be used to substantiate the conceivability of having non-veridical experiences of this kind even if one is disinclined to accept the reports of mediums. It is generally well known that electrical stimulation of certain areas of the cortex is accompanied by the subject reporting experiences which are indistinguishable from veridical experiences--e.g. a subject, on having a certain area of his cortex touched by an electric probe, may say, "I smell freshly cut onions" or "I see a castle in the moonlight". The electroencephalograph, on the other hand, records the electrical impulses of the brain in action. (or so it is supposed). Let us imagine a combination of the two devices such that A has the pick-up electrodes of an electroencephalograph attached to certain

¹C. J. Ducasse, "In Defense of Dualism", in Dimensions of Mind, Sidney Hook (ed), (New York, Collier Books, 1960) page 85

²C. D. Broad, Lectures in Psychical Research, (London, Routledge & Kegan Paul, 1962) p. 402. Note that it is relevant to the present argument that Broad is supporting a kind of dualism when he makes this point.

areas of his cortex, and B has the output electrodes attached to the corresponding areas of his cortex. Now let A experience a pain, or see a Goya, or hear a Bach fugue; it is not inconceivable that B will feel a pain, see a Goya, or hear a Bach fugue. It is further conceivable that he would be unable to distinguish the experiences from veridical experiences. In the sense that B was not in a position to see the actual Goya, that his hand, say, is uninjured, that his eardrums were not stimulated by the appropriate vibrations which normally accompany the hearing of the Bach fugue, the experience is not 'his'. Yet in the sense that neither A nor anyone else reported the experience to him, the experience is direct. And in the sense that the events did occur at the time B experienced them, the sensations are veridical. In some sense or other the sensations B is experiencing are qualitatively similar to A's; we can at least say that they are qualitatively different from those he has when he is in the presence of the harpsichord on which the fugue is being played--i.e. they have been mediated by A's aural structures and associated neural structures. However, I think one must hesitate to say that they are qualitatively identical since recent electroencephalic evidence suggests that sensations are affected at every point on the neurological pathway. Thus, in our hypothetical case, while 'what B is experiencing' will be the sum of the vibrations reaching A's ears plus his emotional set (determined by whatever memories he attaches to this fugue, his mood at the time etc.), his ability to make fine distinctions of timbre, and so forth; his experience must necessarily also be affected by his own emotional set (with respect to the music)--a factor which is absent from A's sensations. Perhaps we have allowed too complex an example to cloud the issue. The clear simplicity of a pin prick might better illustrate the point. We might be able

to grant in the above example, that B may experience what is a qualitatively identical sensation of a pin prick to A's, and that therefore the privacy of sensations was in question.

From a technically conceivable point of view, it is perhaps not too outlandish to imagine a feedback hookup between A and B such that there is serious question whether the sensations are numerically different or not! The whole point of this rather bizarre example is to point out that the supposed privacy of sensations may very well be (and be shown to be) adventitious, contrary to what Ducasse needs to maintain.

Briefly, if the identity theory is true, it will require a modified concept of the physical and of the mental such that, just as the features of lightning are causally explained by the nature of electrical discharges, so sensations would be causally explained by the nature of neurological discharges.

The assumption of a one-one correlation between mental states and brain states still leaves open the possibility of epiphenomenalism as having equal credibility to monism. The prime objection to epiphenomenalism lies in its denial of the causal efficacy of sensations or 'raw feels' (to use Feigl's term). And this, it seems to me, runs counter to everyday experience. While it is true that there are stimuli which, when encountered in the absence of consciousness (i.e. when I am asleep), produce behavioral responses similar to those produced when I am aware of a sensation (am sensing) such that awareness might be said to be an overdetermining correlate; there are others which result in behavioral responses only when there is a conscious sensation.

For purposes of clarity I shall digress at this stage to make it explicit that I shall refer to an event (state/process) as a mental event

only when some "I" is conscious of it. The terms "subconscious mind" and "unconscious mind" are of very dubious import. They have entered colloquial parlance from the psychologist's use of "the unconscious" and "the subconscious" as if these were elliptical expressions. That there are brain processes of which we are not aware will be accepted by anyone, and I would like to suggest that those processes or phenomena to which the psychologist refers by means of the above terms are brain processes/states/events simpliciter.

What is required as a refutation of epiphenomenalism is a clear-cut instance of a putative mental event giving rise to a physical event for which no other event can be proposed as a sufficient cause; or to put it another way, if there is a brain event (or any physical event) such that it cannot be accounted for in some other way than by reference to some mental event, then it would seem that we have a successful counter-example against epiphenomenalism.

For example, if I am pricked by a pin while I am asleep I will withdraw my hand just as if I had felt a pain, (i.e. I did not wake, therefore I was not conscious, therefore I did not feel pain--this relationship between awareness, sleep and dreams will be amplified later). In this instance it might be said by the epiphenomenalist that the pain (which I would have experienced had I been awake) is an interesting but quite inefficacious correlate of a non-psychological stimulus-response pattern. When the epiphenomenalist claims that the pain (mental event) is inefficacious, he must, to be consistent, admit no effects at all. How, then, does he account for reports of these mental events? Apparently they are not accounted for by the events of the type 'being pricked by a pin', since the latter can occur while the report denies the existence of a

sensation. Note the strange position in which the epiphenomenalist now finds himself. He must:

- (1) accept that there are mental events,
- (2) deny that mental events cause anything,
- (3) account for reports of mental events without reference to the mental events of which they are a report.

If the epiphenomenalist account of the mind-brain relationship is true, then there is nothing deviant, strange or in any way remarkable about an individual claiming conscious states which have not in fact occurred. Since my reports of conscious states are caused by factors other than the states themselves, then even though the mental states may be related to brain states in a one-to-one correspondence, may even be caused by the corresponding brain states, there is no reason in epiphenomenalism to suppose that the reports of conscious states are caused by the same brain states as caused the mental states, and therefore no reason to suppose that reports of mental states do in fact correspond to mental states!

It seems unlikely that the epiphenomenalist would want to accept the idea of reports of mental states being bandied about with such promiscuous disregard for the events they purport to report; such an account makes nonsense of the whole domain of discourse. What is the alternative? It would seem that the only alternative is to adopt the defense of parallelism at a different level; reports of mental events are related to mental events by a one-to-one correspondence--i.e. we can assume that when you report having a pain and are not consciously lying, that you are in fact experiencing a pain, (and not smugly enjoying your mental image of the Playmate of the month while everyone feels sorry for you). However, the instant that the epiphenomenalist takes refuge in this he has committed

the same error as the parallelist in accepting a faulty concept of causality. He has accepted the constant conjunction and contiguity while denying that the relationship is a causal one. If he admits (as he ought) that the relationship is causal, then it is not the case that mental events do not cause anything, and if they can be a cause of the reports of themselves, then they can cause anything else that is in the realm of empirical possibility.

Thus epiphenomenalism must be rejected on either one of two grounds: either (1) it misconstrues causality--reports of mental events are invariably preceded by the events of which they are reports but are not caused by those events; or (2) it denies the universally accepted relationship between reports of mental events and mental events themselves, allowing me to claim that I feel a pain when in fact I am not feeling a pain but am neither lying nor mistaken! Or if I am mistaken, the situation is very strange because of the further consequence of this alternative: every act of hearing myself speak is an act of verification, the result of which I may be unable to communicate. While it is true that people do sometimes say, "I didn't mean to say that," I believe that it is generally and correctly held that the analysis of this locution is of the form:

(a) I was thinking p, and

(b) it was imprudent to express p.

or alternatively:

(a) I thought and said, p, not realizing that it implies q

(b) The correct expression of the proposition I was trying to state would be p' which does not imply q.

Genuine mistakes do occur. The famous Freudian slip is a prime example for the epiphenomenalist who has accepted my second alternative. In such a case the individual is genuinely surprised at the sound that proceeds

from his mouth; he really had opened his mouth to say something quite different. Here the words apparently reflect a brain process for which there is no corresponding mental process. However, the frequency of these cases is relatively rare in proportion to the total quantity of locutions. They form an interesting exception to the rule. Whereas if epiphenomenalism were true such failures of communication should occur at least 50% of the time if not more (there being a greater number of locutions which do not reflect a given mental state than those which do).

Still with respect to the implausibility of epiphenomenalism, let us consider an example. Assuming that there are clearly distinguishable classes of events--mental and physical, and that we can agree on which are which, undoubtedly illusions or hallucinations would be classed as mental/psychical events. Now let us consider the case (and there are many on record) of a man driving his car along the highway who hallucinates a dog running into the path of his car; he swerves to avoid it (thereby having an accident, which is relevant only in that accidents have served to bring such cases to our attention). It may be argued that the whole series of events can be accounted for without reference to the putative mental event, 'seeing a dog'. But this is surely nonsense on a number of grounds. If we accept the materialist account of the situation, fatigue mechanisms have resulted in the excitation of certain neurons such that he 'thinks he sees a dog', and makes the responses which would be appropriate if there had been a veridical perception of a dog. The account, however, depends upon the element 'thinking he sees a dog', for without this element this case, and perhaps all human behavior, becomes totally inexplicable. 'Thinking he sees a dog' is essential to any explanation of the man's subsequent behavior, and of course this element is a paradigm case

of a mental event. Certainly it is logically possible that he might simply have swerved, and that the dog hallucination is an interesting but noncausal (overdetermining) factor in the case, but this is highly unlikely in the light of what we know about our own actions--which is not to say that we may not be mistaken in the assessment of our actions and their motives. Even if we grant that 'thinking he saw a dog' was caused by some malfunctioning of the circuitry of his brain (a brain state), the sensation (mental state) seems a necessary link in the causal chain explaining the subsequent brain states giving rise to the appropriate muscle reflexes such that he swerves the car, not simpliciter, but out of the path of the phantom dog.

At this stage it would seem that I am making a good case for interactionism; however it is my intention by this example only to demolish some of the initial credibility of epiphenomenalism which otherwise seems to have equal claim to monism for our acceptance. Insofar as (granting the fallibility of introspection) the subject would say, "If I had not 'seen' the dog, I would not have swerved," the mental event or sensation is not simply a concurrent or overdetermining factor, but a necessary one.

The monistic position is simpler on at least two grounds. First, it is simpler to postulate a causal chain of events, E_1, E_2, \dots, E_n which might be subdivided into those afferent brain events $A_1 \Rightarrow A_2 \Rightarrow A_\phi \Rightarrow$ a group of conscious brain events $C_1 \Rightarrow C_2 \Rightarrow C_\psi \Rightarrow$ a group of efferent brain events, $e_1 \Rightarrow e_2 \Rightarrow e_p$, leading by this chain to the action, than to postulate parallel to, or tangential to such a chain of brain events, a conscious event of a different order caused by one of these brain events yet itself causing nothing. There is, so far as I know, no precedent for this type of chain in the universe; every event to which science or the common man

turns its attention appears both to be caused by some prior event and to be the cause in turn of some further event. Again, that we have not observed such blind tangents in nature is no guarantee that there are none, nor that consciousness is not, perhaps, the sole exemplar of the phenomenon, but the probability is low. Secondly, for those who see a problem in causality in interactionism; how can a mental event cause a physical event?--an event of a different kind--there is the problem of this chain of physical events causing a non-physical event, as the epiphenomenalist wishes to classify mental events. In effect, however, this objection is not sound since it presupposes (as I have previously mentioned) an erroneous account of causality; there is nothing in the concept of causality to indicate that the events, entities, processes, etc. must be of the same order; on the contrary, empirical science and day-to-day experience are full of just such non-uniform causal chains, e.g., gravitational events cause electromagnetic events (non-gravitational events). Why, then, should not physical events cause non-physical events if, indeed, there are such things?

We have suggested as confirming evidence for monism the likelihood of an empirically verifiable, one-to-one correlation between sensations and brain states, and Ducasse¹ would argue that such a correlation presupposes the non-identity of brain states and mental states rather than the reverse. However, this presupposition, if it does indeed exist, seems irrelevant to the question, since there must be more instances of perfect correlations.

¹C. J. Ducasse, "In Defense of Dualism" in Dimensions of Mind, p. 86. It is sometimes alleged, of course, that their privacy too is only adventitious. But this allegation rests only on failure to distinguish between being public and being published. Psychological events can be more or less adequately published. That is, perceptually public forms of behavior correlated with occurrence of them can function as signs that they are occurring--but only as signs, for correlation is not identity. Indeed, correlation presupposes non-identity.

between variant observations of identities than of non-identities. For example, there is such a one-to-one correlation between physicists' descriptions of certain conglomerations of atoms and the common man's description of tables, and no one would want to suggest that the correlation either presupposed or indicated a non-identity. If there is such a linguistic presupposition, it is shown by the empirical evidence to be in error.

Is there a non-linguistic difference between a sensation and my awareness of a sensation? If there is, it follows that I can have sensations of which I am not aware, and this seems to lack prima facie credibility since any meaningful use of 'having a sensation' or 'sensing' seems to entail being aware of the sensation at that or some subsequent time. That is, while there are many instances of being in a painful situation without feeling any pain--preoccupation with something else, even 'willing' to block the pain successfully--but when at t_1 I am not aware of the pain, it seems reasonable to say that there is no pain even though I was aware of it at t_{1-n} and again at t_{1+n} . The possible objection to this lies in that, contra Wittgenstein, one can be unsure whether or not one is in pain. If one has suffered an injury such as a broken bone or severe cut, which is painful over an extended time, such as a matter of days or weeks, during which the pain is diminishing in intensity, there is a time when one may be asked, "Does it still hurt?" and there may be some doubt as to whether it does in fact still give the experience of pain. One has become so used to the situation that there may be doubt whether the injured member does still hurt or whether one has simply got into the habitual attitude of being in pain. Still, while one may be unwilling to name the sensation 'pain', there is no doubt that one either is or is not experiencing a sensation, and if one is not aware of it, there is no sensation.

From a neurological point of view, this has relevance only to the extent that there may be a correlation between reports of having a sensation and certain higher nerve centres exhibiting a certain level of activity. I am not saying that I am aware of brain states, but that my awareness is itself a brain state. If we were to find a one-to-one correspondence between specific brain states as empirically observable (EEGs), and reports of awareness, there would be no need to suppose the existence of two entities (brain states and sensations); indeed, an appeal to Occam's principle would indicate acceptance of the idea that there is only one set of entities. Whether we then adopt the linguistic conventions of neurophysiology or psychology will depend upon the exigencies of the total situation.

To sum up the logical nature of the statements of the identity; 'sensations are brain states', 'mental events are brain events' etc.; the copula is not that of synonymy, since this would involve the suggestion that the words 'mental' and 'physical' were interchangeable--an obvious howler. For even though there may be a very unclear distinction between the uses of these terms, and although there may be a very wide 'twilight zone' in which it is problematic whether a given state of affairs should be labelled 'mental' or 'physical', there can be no possibility that the two words which are generally considered antonyms are "in fact" synonyms. Nor is the copula quite like that of "his table is an old packing case" in which the implication remains that there are packing cases which are not tables, as well as tables which are not packing cases; for we do not wish to imply that there are mental events which are not brain events, or that there are (necessarily) brain events which are not mental events--although this is perfectly consistent with monism. Indeed, I should wish to assert that there are many brain events which are not mental events, e.g., all those brain events whose electrostatic correlative

is indicated by an electroencephalograph and which are not correlated with conscious states. I wish to claim, then, that the class of entities modified by the adjective 'mental' is entirely included in the class of entities modified by the adjectival use of 'brain'; and further that this is necessarily so as a result of the manner in which brains do in fact operate given the laws of nature as they are (regardless of whether they are known), together with the nature of matter, and that the explanation of this necessity will become more clearly evident as we learn more of the laws of nature particularly as they apply to those neural structures we call brains. Further, when the appropriate conceptual shifts have been made, the statement of identity would be a synthetic necessary statement--logico-empirically necessary rather than strictly logically necessary.

CHAPTER III

ON THE STUFF OF THE UNIVERSE

...doing philosophy in our day and age without regard to the problems and results of the sciences is--to put it mildly--intellectually unprofitable, if not irresponsible.

--Herbert Feigl, The 'Mental' and the 'Physical'
Postscript

To be coherent any monistic theory must accept some concept concerning the nature of the 'stuff' of the universe, and I propose to accept, as far as there is any agreement, the currently held concepts of the micro-structure of matter.

We are all familiar with the term 'molecule'--the smallest particle of any given compound or element which displays the physical and chemical properties without which it would lose its chemical identity; and the term 'atom'--the smallest particle of an element which can enter into a chemical reaction with another element; and with the thesis that atoms are themselves composed of electrons in rapid motion around the nucleus consisting of protons and neutrons. Recent high energy physics has demonstrated the existence of over 100 sub-atomic "particles": the family of proton-like entities called baryons because their mass is similar to that of the proton and neutron, (1.7×10^{-24} gm); a family of nuclear force agents, the mesons, whose mass lies between that of the proton and the electron; the leptons, the electron-like "particles" whose similarity to each other lies not in mass but in their weak interactions; and the massless bosons, including the photon (agent of electromagnetic force) and the graviton (agent of gravitational force). It is interesting to note that in

the first draft of this chapter it was admitted that the existence of the graviton was proposed although it had not yet been detected. However, in the 27 June, 1969, issue of Physical Review Letters, Joseph Weber of the University of Maryland reported detecting gravitational radiation--the first major step toward the detection of the graviton--a step as important as Heinrich Hertz's first crude detection of radio waves 80 years ago.

It will be objected at this point that these entities are theoretical only, and not observable in the same sense that tables, lamp standards and people are observable. The implication of this objection is that they are less real, and therefore they, and the inferences made on the premiss of their existence, do not have the same claim to our attention. Behind this criticism lies the (sometimes) unexpressed proposition that only those objects sensible to feeling and to sight are real, i.e., have an undisputed place in our material ontology. Of the two senses involved, feeling seems to rate priority; Macbeth denies the reality of the dagger because he cannot feel it; we do not dispute the existence of air because we can feel it (in wind) even though we cannot see it. But note that there is a different order of inference involved in the move from "I feel a sharp, cold sensation on my face" to the postulation of air as the cause of that sensation, than there is in the move from "I feel a typically hard, smooth sensation on my fingers, and I see the light reflected in a typical manner" to the postulation of a table. Grade school science texts are full of demonstrations of the existence of air (inverted bottle plunged into water, weight of an inflated football versus weight of collapsed ball, etc.), all of which depend upon the same type of inference, i.e., from the observation of a visible phenomenon to the existence of an

invisible entity. Yet philosophers do not retort that air is only a theoretical entity. But the type of inference is the same as that which operates in the inference of sub-atomic "particles" on the evidence of bubbles forming in a cloud chamber. Furthermore, accepting that there is an entity, air, allows certain predictions to be made which are invariably fulfilled. Similarly, the acceptance of the existence of the sub-atomic "particles" has allowed a similar set of satisfied predictions such that it seems reasonable to conclude that the ontological status of the sub-atomic particles is on a par with that of air.

In what precedes I have used the word "particle" hesitantly since its use by physicists is misleading to the uninitiated who associate the word with very small entities analogous to billiard balls. It is true that the physicist frequently uses the billiard ball as an analogy; however, to entertain the analogy as a satisfactory concept of the micro-structure of matter seriously hinders (if it does not render impossible) the appreciation of quantum theory.

WHAT IS A QUANTUM?

Quantum theory might be thought of as being born of the investigation of the phenomenon of light. To the investigator, light exhibited anomalous properties. The existence of interference patterns suggested a wave motion; in water, for example, an object (dropping pebble, canoe paddle) or an event (gust of wind) causes a disturbance in the medium which is transmitted through the medium by one component particle jostling its neighbor, and so forth as the wave spreads out. Two problems arose. (1) Unlike the waves in water and air, light travels through a vacuum (where there are no particles to jostle each other). (2) What kind of event caused the wave? Related to this latter problem is that

there are other experimental observations that indicate that light is the particle causing the wave; the energy of the light is not transmitted in a random fashion, but in "bundles". However these particles do not seem to have the familiar properties of size, shape, weight etc. of classical billiard-ball particles.

What, then, was light? What could exhibit some of the characteristics of both particles and waves, and yet be neither?

What Heisenberg said...was that a theory need not contain elements if they are not observable. It may contain them but it need not. Such elements, for example, as the position and velocity of a particle which would be required in a classical theory with Cartesian particles need not be retained if the world is a quantum world. The Cartesian electron that the classical man sees hidden in the shadow of its associated Schrödinger wave, he senses only in his imagination--trained from childhood like a truffle hound to sniff it out. But if he separates himself from the images in his mind and looks at the world, he will find, at least as far as we know, that there is no Cartesian electron obscured in the mist of its associated wave. The associated wave is all there is.¹

The photon, like the electron, is neither the particle causing the wave, nor the wave motion in a medium; it is the wave. It has properties, but they are not the properties familiar in the macrocosm, yet its properties are responsible for the observed properties of matter. This is the quantum. There are different quanta identified and differentiated by the properties of mass-energy, given in terms of the energy it would take to create them; electric charge, in terms of the charge of an electron; angular momentum, the property which separates the bosons (different ones of which can occupy the same space at the same time) from the fermions (whose angular momentum is expressed by $\frac{1}{2}$ -integral numbers, and which obey

¹ Leon N. Cooper, An Introduction to the Meaning and Structure of Physics, (New York, Harper & Row, 1968), page 510

the Pauli exclusion principle); isotopic spin, the property which differentiates between quanta which have different electro-magnetic interactions but are otherwise similar; strangeness, which accounts for the extraordinarily long life span of some quanta produced in high energy collisions; and finally half-life, a property of the unstable quanta produced in high-energy collisions such that at the end of the period called the half-life, one half of the particles of the given type remain (i.e., have not decayed into another quantum state).

Two points need to be noted here. (1) Quanta have properties as do the entities in the macrocosm with which we are familiar and on the basis of which so-called "common sense" concepts are based, but their properties are sufficiently different from those of the entities in the macrocosm that it is important not to be misled by the term "particle" which the nuclear physicist uses with such gay abandon. (2) It is these very properties, such as angular momentum, that account for the structure of the periodic table, and the macroscopic properties of matter.

The significance of this last point cannot be overstressed since this is the link between the quantum world and the world in which some 20th-century Dr. Johnson kicks viciously at the brick at his feet saying, as he rubs his smarting toe, "Don't tell me there's nothing there but 'associated wave forms'." The point is that the properties of the quanta determine the properties of the atoms which determine the properties of the brick and the foot such that when the last two make contact electrical discharges occur in the cell structure of the latter. Here we must leave the incident since this is not the time to trace those discharges or to explain why the good doctor gives vent to his pain. (Nor may we at this juncture hazard a guess regarding the locating of the pain!)

But the quanta are more than the determiners of the macroscopic properties in the foregoing simplistic sense; they are also the agents not only of the forces with which we are familiar in everyday life, but also of the nuclear forces with which the common man is not familiar (although in this "atomic age" he has become familiar with some of their products), and perhaps some forces which have not yet been observed or identified.

As far as we know, all observable phenomena come about as a result of some force, and as far as we know there are only four types of force: electro-magnetic force, gravitational force, strong nuclear force, and weak interaction. The first two are familiar and relatively well understood.

(1) Electro-magnetism: This is the force responsible for practically all of the observed phenomena of everyday life (light, radio, heat, chemical binding, springs, infrared and other commonly known radiations, etc.). In quantum theory the photon is the agent of electro-magnetism, that is, the quantum "particle" transmits electro-magnetic force from one entity to another. For the findings of recent high energy physics tend to support the Cartesian notion that all interactions between elementary objects take place as a result of contact--there is no "action at a distance".

(2) Gravity: This force is at once the one we know most about and at the same time the one we know least about. Newton described its action with sufficient accuracy that only minor corrections are required by Relativity and Quantum theory to account for observed anomalies. On the other hand, gravitational radiation was detected for the first time in the early months of 1969 and the agent of gravitational force, the graviton, has yet to be detected. Like electro-magnetic force, gravity is a long range force, but it is unlike electro-magnetism in that, at microscopic

distances, its effects are negligible.

(3) Strong Nuclear Force: When it was discovered at the early part of this century that the nucleus of the atom was composed of protons (positively charged), and neutrons (no charge), the question immediately arose; why did not the electrostatic repulsion between the protons cause the whole system to fly apart? It was recognized that another force, greater than that of electrostatic repulsion, must exist to hold these entities together. Just as man knew about and could use gravity and electromagnetism long before he could describe their action with the precision of mathematics, so we have learned to use the strong nuclear force although our quantitative understanding of it is seriously limited. This is a short-range force, affecting quanta with a separation of 10^{-12} cm. Outside this range the force rapidly falls to zero.

(4) Weak Interaction: This is the force responsible for the natural radioactive decay of nuclei, as well as the decay of many of the quanta discovered during the past 15 years. It is, as yet, relatively imperfectly understood, and cannot be described by mathematical equations such as describe the effects of gravity and electromagnetism.

Referring to this force as 'weak' interaction makes it necessary to comment on the relative strengths of the four forces supposed to account for all observable phenomena. If two protons are within 10^{-12} cm. the

Strong Nuclear Force

can be 100 times greater than the electromagnetic repulsion. The Weak Interaction is smaller than the Strong Nuclear Force by a factor of $\dots 10^{13}$. And the gravitational attraction, the weakest of all, is smaller than the Strong Nuclear Force by a factor of 10^{39} .¹

¹Clifford E. Swartz, Microstructure of Matter, (Oak Ridge, Tennessee, USAEC Division of Technical Information Extension), 1965, page 28

That gravity, the weakest of the forces, seems so strong to us is, of course, the result of its being a force that acts through a great distance so that we are not speaking of the interaction of two particles, but of large numbers of particles, and the "weight" we experience is the sum of all the gravitational attractions between all the particles making up the human body and all those making up the earth!

When it is said that these four--Gravity, Electromagnetism, Strong Nuclear Force, and Weak Interaction--are all the forces that exist, it will be objected that we are making an unwarranted assumption that the forces responsible for the observable and measurable phenomena are the only forces that exist. Hoards of psychologists, priests, mystics will ask: what about social force, will power, emotional force, spiritual force? These all appear to affect matter in observable ways. You can't (say the vociferous objectors) rule these forces out simply because they cannot be investigated with the hardware of the nuclear physics laboratory. There are three obvious lines of approach to this objection: (a) These so-called forces do not exist; (b) There is a fifth force--call it spiritual force; (c) To the extent that these interpersonal forces or interactions do exist and are clearly identifiable, they are derivative from the four above mentioned forces and can, in principle, be shown to be so.

(a) The denial can take a number of forms: (i) The so-called forces mentioned above are the purported causes of events and processes which can be explained without reference to entities like social pressure, love, hate, visions, etc. In effect, this form of materialism is akin to epiphenomenalism and is subject to the same refutation outlined in Chapter II. In denying that there are forces of this type, this alternative denies the efficacy of conscious states, and thus runs counter to experience. (ii)

In attributing events to these causes we are generalizing in the same way we do with a locution like "motherhood gave her a special charm", then making the mistake of giving motherhood the same ontological status as the subject of the grammatically similar sentence, "John gave her a diamond necklace". What this position is saying is, in effect, that 'love', 'will power', 'voices' etc. are names given to specifiable complex sets of physical events. However, it is an arbitrary claim; even if we were to grant that they were complex, there is no obvious reason for their components being of a different order. There may be other formulations of this alternative (a); however, it will be clear from the above that the position is, in effect, one of the extreme forms of materialism and open to all the standard objections.

(b) One may accept, as do the religious dualist, the mystic, and the spiritualist, a fifth type of force--a very mysterious form of interaction sometimes exhibiting itself in the form of mental telepathy, 'conversations' with the deceased, 'knowledge' of the future, telekinesis, the power of prayer, and so forth. There are two major difficulties in accepting this approach: (i) If all the phenomena can be satisfactorily and logically explained with reference to the better known and more universally accepted forces, it is not necessary to accept a fifth and in principle unknowable force to 'explain' them. It is not consonant with the simplicity principle. (ii) The history of man's knowledge of the universe is full of examples of various phenomena being thought to be separate, isolated and discrete entities which, on further investigation, prove to be different manifestations of a single phenomenon. For example, to the uninitiated, light, electricity and magnetism seem quite unrelated. Little is required to accept the connection between electricity and magnetism (although every school child exhibits surprise when it is first introduced--a conceptual

modification is required which was unexpected); it comes as more of a surprise to the high school or university student when he recognizes the connection between these phenomena and light. The recognition that it is the same facts about the nature of matter that are responsible for chemical composition, changes, reactions, differences in temperature, etc., requires a further conceptual modification which, in human history, was very slow in coming. In short, the principle of simplicity (Occam's Razor) suggests that one should search for a unifying principle at least until it has been shown to be non-existent.

(c) A more fruitful approach, and the one which a monist must accept, is that all phenomena are explainable by a satisfactory theory of the nature of the universe, and that if the Quantum Theory is satisfactory, it is capable of explaining these as well as the laboratory observations which it was constructed to explain. It may be argued that this approach will be unsatisfactory, both because the principles of a theory will be twisted to fit a domain outside that in which the theory was developed, and that the nomological problems involved may well prove insurmountable when one tries to draw together the terminology of physics, physiology, psychology and philosophy. To this I would reply, first, that it is not the case that the nature of the mind-brain lies outside the province of physics (this is the necessary claim of the monist), that the concept of mind as other than brain is untenable (Ch. II), and that nomological and linguistic problems will be solved if and only if the required conceptual framework is (1) clarified, and (2) in adequate agreement with the existing states of affairs.

It will be further argued that this approach commits the error of letting the term "physical" include so broad a domain that it covers every

phenomenon, no matter what it is like, and thereby wins an easy but empty victory. It is the purpose, however, of Chapter I, and the current investigation of the Quantum Theory of the microstructure of matter, to show that (1) there may be an intelligible difference between physical and non-physical, but (2) this does not imply a difference between physical and mental; (3) that the putative difference between mental and physical is far from clear, and (4) the concept of the physical which Quantum Theory forces us to accept can accommodate without contradiction phenomena of the type we generally classify as mental.

Empirical investigation of natural phenomena tends to follow a fairly consistent pattern; after qualitative investigation (e.g., Galileo's studies of falling objects) comes the quantitative investigation resulting in the mathematical statement of the laws governing the situation (e.g., Newton). Next comes the detection of the radiation of the force responsible for the phenomenon (Hertz's discovery of electro-magnetic radiation/Weber's discovery of gravitational radiation), and finally the detection and observation of the quantum agent of the force (e.g., the photon--agent of the electromagnetic force--and the mesons--agents of Strong Nuclear Force).

What is known in the domain of the microstructure of the universe might be put this way: (1) At least some of the quanta are agents of force. (2) There are quanta whose function has not yet been identified. (3) There may be forces not yet clearly identified (i.e., those involved in the domain of parapsychology). If these latter phenomena are authentic (particularly telepathy--see below), then they must be explainable by any complete theory. Such forces, if they exist, are either (A) manifestations of a known force, in which case (i) they are mediated by one of the known quanta in a manner not yet explained, or (ii) they are mediated by a

quantum object not yet discovered; or (B) manifestations of a fifth 'mysterious' force, in which case (i) and (ii) still apply with the proviso (a) the quanta must be in principle discoverable, (b) in the light of what is known about the quantum realm, they will probably be massless and have integral spin, i.e., not be bound by Pauli exclusion.

The actual business of drawing together Quantum Physics and Philosophy of Mind must be left to the next chapter, in preparation for which we must spend some more time with the empirical sciences.

THE RELEVANCE OF THE HEISENBERG UNCERTAINTY PRINCIPLE

Expressed simply, Heisenberg's indeterminacy principle states that the product of the imprecision in the momentum of a quantum object and the imprecision in the position is of the same order as Plank's constant, 6.6×10^{-27} erg-sec. Unlike a classical particle, one cannot both localize a quantum object and assign to it a precise momentum; it does not follow a path or orbit as does a classical particle.

The uncertainty is not meant in the psychological sense. It is intended to describe the nature of an object which does not possess both of the properties--position and momentum together, an object very loosely comparable to an atmospheric storm: spread over large distances, the winds are gentle zephyrs; confined in a small region it is a hurricane or a tornado.¹

What is significant in the above is that the quantum does not possess the classical properties of position and momentum (which is the product of mass and velocity), not that they cannot be calculated. If mental events are quantum effects, we shall not expect them to have the properties

¹Leon N. Cooper, An Introduction to the Meaning and Structure of Physics, (New York, Harper & Row, 1968), page 500. (Italics mine.)

possessed by billiard balls; we shall not expect mental images to have the same properties as images painted in oils on canvas.

HOLOGRAPHY

We have mentioned the argument that quantum objects are theoretical entities and as such cannot be given the same place in our ontology as the more familiar objects of our environment. However, this objection loses considerable force in the face of the predictive capability of the theory and the undisputable results of the application of the theory.

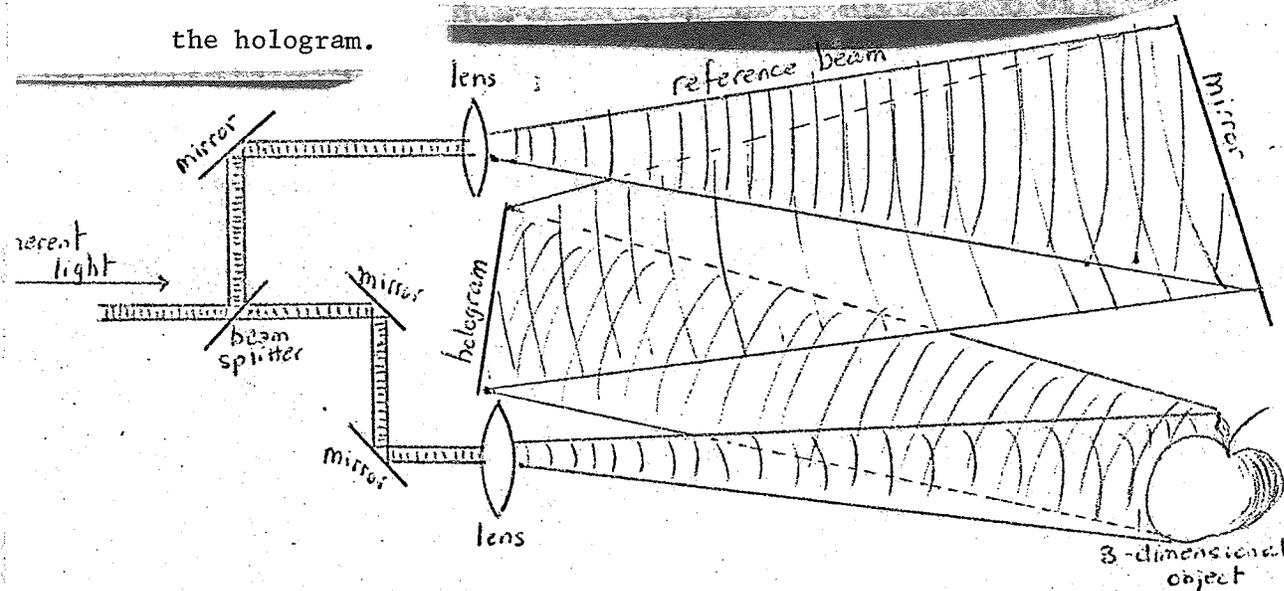
For example, the Rutherford concept of the atom consisted of electrons in orbit about a nucleus, obeying the classical laws concerning orbiting objects. This did not account for electromagnetic radiation, however, and Niels Bohr proposed that, unlike planets which can occupy any one of an infinite number of orbits, electrons were restricted to only those orbits for which the angular momentum was an integral multiple of Plank's constant divided by 2π ; further, that electromagnetic radiation was emitted (photons) only when an electron moved from one orbit (energy level) to another; the energy of the light radiated was equal to the difference in energy of the two levels between which the transition was made.¹ Now this is as arbitrary and "theoretical" (in the pejorative sense) a postulate as one could ask for; its only immediate claim to acceptance was that in the absence of anything better it explained most of the observed phenomena at the time (1913). In addition, it allowed the prediction of a number of lines not previously observed in the spectrum of hydrogen; they were subsequently observed. In more recent times the theory

¹Leon Cooper, op. cit., p. 463ff.

predicted a practical application which we shall trace because of its significance for the present topic.

The ordinary light by which I write this page, and under which you read it, is made up of random frequencies and intensities; it is thus incoherent. In 1960, making use of the Bohr concept of the structure of atoms, and reasoning that if the atoms of a substance were subjected to radiation by photons (either in the form of an electrical field, or light), the electrons would be put into higher energy levels by the influx of energy, but that they would rapidly jump back to the ground state, releasing the energy in the form of light which, because it was produced in this way, would be of the same intensity and frequency--i.e., coherent, T. H. Maiman built the first working laser which did, as predicted, emit coherent light.

This has, in turn, been used in the development of what is known as the hologram.



Coherent light from a laser is split by a semitransparent mirror, half of the beam being called the reference beam which is reflected by means of mirrors onto a photographic plate (transparency); the other half of the

beam is reflected onto any three dimensional object. Since the light of the reference beam will be completely in phase (the waves, so to speak, all in step), and the light reflected from the 3-D surface out of phase with respect to the reference beam (depending on whether it was reflected from the near surface, the far surface, or some point in between), the two beams in coming together will form an interference pattern on the photographic plate. (Such patterns have become quite popular in contemporary fashion.) The pattern bears no visible resemblance to the 3-D object, but when the transparency is viewed under illumination by coherent light or adequately filtered white light, an image of the original object will appear "behind" the transparency in three dimensions; that is, by walking back and forth in front of the transparency, the viewer will be able to see either side, or around the configurations of the image. (One is reminded of the cartoon of the middle-aged lecher, perched atop his TV set, peering down the dress-front of the sweet young actress--no joke with holography.)

What is significant in all this is: (1) The postulation of a theory is followed first by fulfilled predictions and then by practical applications; the theory must now take a more respectable place in our ontology than might otherwise be accorded it. It is true that there may be another theory that equally explains the observed phenomena, and that either of the two states of affairs may be the one which obtains in our universe, but this objection is, in extenso, fruitless. If there were such a competing theory, a crucial experiment or considerations of simplicity would decide the issue between them, as in the case in the choice of monism over its competitors. (2) Unlike photographs with which we are familiar, the hologram is not a picture of anything; one sees on the film an apparently meaningless swirling of lines, interference patterns similar to those seen

when sunlight falls on the oil-slick on the puddle beside your car; but under the appropriate stimulus, a three-dimensional recreation of the original object is seen. Some very familiar questions could be (fruitlessly) asked about this image. Where is it? It clearly isn't in or on the photographic film. Where is the image when the appropriate stimulus is withdrawn? i.e., where does it go? Even the question "what part of the film is responsible for the image?" has no answer, since if you cut the film in two, two similar images will result--all the information is stored in every part of the film so that the number of similar holograms that can be cut from one original is limited only by the texture of the film and the visibility of the resulting piece. Similarly, if you cut a piece out of the film, there will not be "a piece" missing from the image; e.g., if the image is that of a face, and you cut a hole in the centre of the film, the nose will not be missing from the image; only some definition will be lost from the whole image.¹

It is these familiar questions that lead us to our next step on this empirical digression from the mind-brain problem in philosophy.

NEUROPHYSIOLOGY

The next link in the chain was forged by Professor Karl Pribram of Stanford University, whose experiments and insights may throw some light on the problem of how the brain works, and thereby point the way to the clarification of the mists surrounding mind-brain identification. As I have suggested earlier, one of the chief prerequisites for successful identification is the making of conceptual shifts, and these may be

¹E. N. Leith and J. Upatnieks, "Photography by Laser" Scientific American, June, 1965.

necessitated by errors and/or inadequacies of our current concepts rather than simply by expediency. For example, we have, generally, a very confused idea of how we see, and an even less adequate idea of how we remember, even from the physiological point of view, much less from the philosophical view of the status of sensory and memory claims.

The simplistic view that images are formed on the retina of the eye, that they are transmitted by nerve fibres to some point in the occipital cortex where they are somehow "viewed" and interpreted, and then rerouted to storage in some other brain cells, was given considerable credence by the success encountered in "tracing" the impulses by means of electrical probes. The problem remained that when the pathways so traced were cut, the organism continued to see and to remember. The processes were impaired, it is true, but neither as much as they should have been if the "pathway" theory were correct, nor as much as was expected or could be explained within the confines of theory current at the time.

Although [the investigators] remained baffled by the "memory trace", they still felt they could describe the nerve pathways from a stimulus input...to a muscular response. The success of these studies often blinded the investigators to the fact that many of the presumed pathways could hardly be reconciled with Lashley's experiments dating back to the 1920's which showed that rats could remember and could perform complex activities even after major nerve pathways in the brain had been cut and after as much as 90% of the primary visual cortex had been surgically removed.¹

Pribram, as an amateur photographer, had just become interested in the phenomenon of holography, and reasoned that the hologram might provide the model for the way in which neural events produce complex patterns in

¹Karl Pribram, "The Neurophysiology of Remembering", Scientific American, January, 1969, Vol. 220, Number 1

the brain. One of his experiments on the road to the investigation of this theory took seven years to complete, and is worth recording at this point:

Monkeys were placed in front of translucent panel on which we could project either a circle or four vertical stripes. If, when the monkey saw the circle, he pressed the right half of the panel, he would be rewarded with a peanut. He would be similarly rewarded if he pressed the left half of the panel when the stripes appeared. Before the training begins we painlessly implant a number of tiny electrodes in the monkey's visual cortex. We then compare the electrical wave forms produced by the cortex during training with the wave forms produced after a high level of skill has been attained. We had expected that the wave forms would be different, and they were.

What we did not expect was that we would be able to tell from the wave form records whether the monkey saw a circle or vertical stripes, whether he responded correctly or made a mistake and, most surprising of all, whether he intended to press the right half or the left half of the panel once he was presented with the problem and before he initiated any overt response.¹

We must note first that all these differing responses took place in the visual cortex, and that therefore the signals representing the experience both modify and are modified by other "systems" within the brain (cf. we see what we want to see). Secondly, it is important to note that the investigators found that within the visual cortex different electrodes recorded different events. "Evidently," concludes Pribram, "what reaches the visual cortex is evoked by the external world but is hardly a direct or simple replica of it." The fact that information contained in the incoming signals is distributed over a wide region of the visual cortex led Pribram to the analogy with holography.

In simple terms, Pribram's theory is that the information received by the sense organs, having been transmitted to the brain by the familiar

¹Ibid.

electro-chemical process, has a "more or less lasting effect" on the protein molecules at the synaptic junctions which serve as a neural hologram from which an image can be reconstructed given the appropriate stimulus.

The dualist will clap his hands in glee at this, and say, "All very well, but in the hologram made by laser light on photographic film as in your "neural hologram", there must be an entity to see the picture--you admitted that the photographic plate was nothing but a jumble of interference patterns, and that your neural hologram is the electro-chemical state of the protein molecules in the brain; you have not suggested that there is a part of the brain that views these holograms, so you have no reason to reject my non-physical mind that views them."

A formidable problem indeed.

But (1) The dualist is using the words "see" and "observe" etc. in two distinctly different senses. He is accepting as a matter of fact what is really only an analogy. Because the human eye is necessary to receive the data contained on the holographic plate, he posits a mental "eye" to interpret and receive the neural hologram. But surely if there is a problem here, the dualist has simply backed it up one stage, and is in danger of a reductio ad absurdum. He can, of course, claim that since the mind is not physical, it is not bound by the restrictions and processes of physical objects. But in so claiming he must admit to using "see" in a different sense when he talks of seeing mental images, or admit to the reductio. If what he 'really' means by his use of observation words is the non-physical sense, then no one ever sees the external world; he sees only neural holograms. But this is contrary to experience; there is clearly a difference between seeing with the eyes open and contemplating mental images, which should not be so if this interpretation of the dualist case represents

the world as it is. Further, hallucinations, errors, intentions, etc., are generally taken as examples of non-physical events, yet by the previously reported investigations of Pribram, these can be identified specifically by means of EEG's--at least in the instance of monkeys; in man, being the more complex organism, one would expect only greater specificity. (2) Is it necessary to postulate a mind or brain process with respect to neural holograms analogous to the process of inspecting a photographic plate (whether a hologram or not)? The whole raison d'être of Pribram's analogy had nothing to do with the formation, physical structure or interpretation of holograms, but with the observed fact that just as every particle of the hologram contains all the information about the 3-D object of which it is a representation, so all (or at least many) of the synapses in the brain contain all the information received through the sense organs; and that just as you don't see a picture when you look at an unstimulated hologram although it contains the picture, so you must not expect to see Miss January when you look at the synapses in my brain. It becomes increasingly plausible that by connecting electrodes from these synapses to a suitably modified cathode ray tube, you may very likely see my mental picture of Miss January; mine in the sense that it would not be as pictured on the calendar, but as I see the picture. (Let us, however, tastefully turn down the volume.)

What seems evident at this stage is that the process of perception and cognition can be explained within the confines of quantum theory and without reference to entities outside the quantum world; that the production of mental images, memories and cognitions is as natural a process, and in principle just as quantifiable and predictable (given the nature of matter), as is the emission of radioactivity from certain complex atoms.

In the sense that a hologram is locatable on a photographic plate, mental pictures, pains, errors, memories, etc., are locatable in the brain; in the sense that the picture you see when looking at a hologram is remote from the photographic plate, so mental pictures, pains, etc., appear remote from any part of the brain.

To summarize briefly: what is known of the universe indicates that the basic "stuff" of which matter is composed are quanta; these quanta are neither matter in the simplistic sense, nor energy simpliciter; they may exhibit characteristics of both. Heisenberg's principle states that it is the nature of the quantum universe that the momentum (product of mass and velocity) and position of a single particle cannot be determined simultaneously; the reason that we appear to be able to do so with relatively large masses is that the errors inherent in Newton's equations become negligible when we are considering the inconceivably large number of quanta making up, say, a billiard ball. The success of the Quantum Theory can be appreciated by its ability to predict phenomena and to make possible the understanding and construction of the hardware of contemporary physics. The clearer understanding of what matter is allows us better to understand not only how the brain works, but also that it is capable of much more than simplistic, billiard-ball-matter would be capable of. The mind-brain question must be an attempt to discover how the world is. It is not a question to be settled a priori; nature may be any way; the task for the philosopher is to describe the criteria, and to some extent plan the experiments, which will allow the empirical scientist to discover which way it is, then to state the conceptual shifts (similar to those necessitated by Relativity Theory and Quantum Theory) which become necessary as a result of our increased knowledge.

CHAPTER IV

WHAT IS MIND?

You cannot locate [mental events] in the physical world, in front of your eyes or behind your eyes or anywhere else. Mental events are non-spatial; physical events are spatial.

(John Hospers, Introduction to Philosophical Analysis, pp. 296-7)

(1) Our brief encounter with Quantum Theory has shown that it is not the case that all physical events can be located spatially in the same sense that trees and lamp standards can be located. There are some physical events whose spatial location is vague in the extreme.

(2) It does not follow from the fact that there may be extreme difficulty in locating mental events, or even understanding what it would mean to locate them, that they cannot be located.

(3) If the non-spatiality of mental events (in the quotation) is intended as a stipulative definition, it is worthless from the point of view of philosophical investigation. If it is intended as the logical result of observed phenomena, it may be false.

(4) It is a palpable truth about mental events that at least some of them can be located with great precision in the temporal dimension; e.g., at 9:54:15 A.M., 14 April, 1970, I felt a sharp pain which lasted until 9:54:25. Similarly, we may be able to give an accurate measurement of the velocity of a quantum object while being quite unable to locate its position.

Thus the difficulty with the size of your mental picture of the Empire State Building is not essentially different from the problem with

the velocity and location of an electron, muon, or any other quantum object. In short, the classical distinction between "mental" and "physical" is incoherent; we have no criteria with which to differentiate them. If we cannot identify any characteristic of a mental state whereby it is essentially or logically different from a physical state, then there is no meaningful purpose in proposing the existence of a mind as something different from a brain.

Modifying D. M. Armstrong's thesis¹ we might say that a mental state is a quantum state of the brain apt for bringing about, but not necessarily resulting in, a certain sort of behavior. In the light of this, how are we to analyse statements like the following, whose referents are generally considered to be mental states or events:

- (a) I see a pine tree covered in snow
- (b) I feel a pain in my right ankle
- (c) I remember the look on S's face when the water hit him
- (d) I am trying to recall the name of my Grade I teacher
- (e) I was so engrossed in solving that problem that I was 'lost to the world'
- (f) I dreamed I was chasing Brigitte Bardot through fields of daisies
- (g) I intend to go skiing next weekend
or even
- (h) I intuit that A (who is in a lead-lined chamber) is telling me to
press switch No. 4

A caution: when I say that a mental state is nothing more than a quantum state of the brain..., I mean it in the same sense as I might say

¹D. M. Armstrong, A Materialist Theory of the Mind, p. 82

that a hologram is nothing more than a set of interference patterns on a photographic film such that.... The point being that the latter is quite clearly more than the set of interference patterns in terms of the image which appears when the hologram is given the appropriate stimulus, but questions like "where is the image?" "how big is the image?" are difficult if not impossible to answer.

We must add one further condition to our concept of a mental state/process/event--that it be conscious; as we have seen earlier there is little sense to be made of pains, perceptions, desires, etc. of which we are not ever aware. There are undoubtedly neurological events analogous to and closely approximating these states, but it seems clear that there is already a large body of empirical evidence to indicate that there are observable differences between conscious states and brain states of which we are not conscious. What this monistic position must hold is that (1) mental states are observable insofar as any physical state is observable, and (2) that they are states of awareness (e.g., I am aware of the hum of the air conditioning fan, but I am not giving it my whole attention). Awareness itself must be a property of neurological matter resulting from its quantum structure and the operation of laws of physics known but not fully understood, or laws not yet discovered.

Given the nature of consciousness (as far as we can comprehend it under circumstances where we are forced to use as the medium of inspection the very thing we are inspecting), it seems to have a great deal in common with the various forms of radiation: (1) numerous conscious processes can occur simultaneously in the same individual (cf. elementary particles which do not obey the Pauli exclusion principle); (2) the evidence indicating that conscious states can be transmitted from one individual to

another no longer admits reasonable doubt--see the experiments of V. M. Bechterev, L. L. Vasiliev, J. B. Rhine, Helmut Schmidt and others.¹ (3) Pascual Jordan, the German physicist and Nobel Prize winner, and Dr. B. Hoffmann, a former collaborator of Einstein, believe that a gravitational field is similar to the force which transmits telepathic information, in that both act at a distance and penetrate all obstacles. The investigations of L. L. Vasiliev and his colleagues at the University of Leningrad yielded the conclusion that

if the transmission of thought at a distance is effected by radiation of electromagnetic energy emanating from the central nervous system, then such electromagnetic energy must either be sought in the region of kilometer electromagnetic waves, or else beyond the soft X-rays....²

There are, however, good reasons for rejecting the latter two regions. But (1) this does not by any means exhaust the known radiations; (2) the brain does appear to be an electro-chemical mechanism;³ (3) interaction does take place between electromagnetic radiation and other forms of radiation--cf. light bent by the gravitational field of the sun.

Let us now return to our list of typical mental states (p. 73), and observe that there is little difficulty reconciling those like (a), (b), (c), (f), and perhaps (h) with this view of a mental state, as they are clearly stimulated by the external world, and can be causally related to subsequent bodily behavior (vocalizing, typing sentences, etc.).

¹L. L. Vasiliev, Experiments in Mental Suggestion, English trans., (Institute for the Study of Mental Images, Church Crookham, Hampshire, England, 1963).

²Op. cit., p. 142

³W. Penfield (1956), "Mental phenomena effected by means of cortical stimulation", Journal V.N.D. Vol. 6, 4

The situation is not quite so clear with regard to mental states which appear to be initiated "within the mind" or as the end product of a mental process. Examples (d), (g), (e), and again possibly (h) would be of this type. These, it seems, must be thought of as processes analogous both to the processes which go on within an electronic computer, and to those which operate a homing rocket. If we accept that purposive thought as well as purposive action does not occur except as a result of some stimulus which is a part of a causal chain having its origin external to the brain, then we can see mental states such as willing, intending, and introspection as events within a process rather than as isolated states. It is not the case that we suddenly, without any prior conditions, "want to go for a drink" or "decide to solve a quadratic equation". In fact the sort of random behavior or random thought patterns illustrated by the above are typical, if not paradigm cases of the abnormal or deranged mind; in fact it is not uncommon to say of someone whose thought processes are not in some sense logical consequences of external events that he has "lost his mind".

Thus it seems that for any normal mental state we can follow a chain of events, related causally, from an external stimulus, through the familiar neural pathways distributed over large areas of the brain, and altering the microstructure of the matter of the brain. That mental activity is accompanied by electromagnetic radiation--i.e. the result of atoms in an excited state (energy level greater than the ground state for that atom), is well established.¹ It is the present thesis that this alteration of the microstructure is a conscious state which is identifiably

¹L. L. Vasiliev, op cit., pp. 14-25; also pp.138-139

and observably different¹ from any unconscious brain state and which may in turn serve as the stimulus, or a necessary part, of further bodily changes. Here, of course, "necessary" is used in the sense that, given the universe as it is, the further bodily changes would not have occurred without the conscious state. It may be that no further changes occur external to the brain; alternatively, the energy levels may return to the ground state giving up photons to the atoms of the protein molecules at the synaptic junctions--thus the memory trace which, if the molecule is stimulated again, will reverse the process, re-creating the conscious state which produced it² (in varying degrees of exactitude, depending upon how much of the neural hologram is stimulated and what other changes have occurred in the interim.)

As soon as we introduce this 'choice point' (whether the brain state apt for bringing about certain behavior does bring it about, or brings about only a memory trace), the objection may be raised: but who makes the choice? Surely, it may be objected, the dualist's mind steps in from the 'outside' and determines which of the two possible outcomes occurs. We are not committed to this any more than we are committed to saying that homing rockets have minds and souls. The sensors of a homing rocket are constantly receiving information about the position and heading of the rocket. This information is fed into a simply binary mechanism preset to react in one of two ways: either the stimulus is of the type to bring about the triggering of the thrust mechanism, or it isn't. The wedge point here for the dualist is the word "preset", which the monist

¹See above, p. 68

²Karl Pribram, op. cit.

must explain as meaning, set by previous brain states either conscious or unconscious.

It may be objected that we are treating the human brain like a digital electronic computer with, at any given moment, only two choices; that this slot/hole approach leaves no room for the imagination, the great leaps of intuition, the visionary flashes of illumination so characteristic of the human mind and so notably absent from the products of the electronic computer. Is this conclusion justified? A very elementary understanding of both computer technology and brain structure indicates that it is not. The number of choices inherent in a binary system form a geometric progression whose limit is determined by the number of pieces of information that can be retained by the mechanism. At a given stage of any progress exactly $\frac{1}{2}$ of the total choices of that stage are open, and there is no reason why these may not also include choices which have previously been abandoned. In an electronic computer of considerable complexity the possibilities yielded by this simple process rapidly become inconceivably great; the complexity of the human brain exceeds that of current computers by a factor of 10^8 or greater; thus the binary concept need not be seen as a limiting factor at all. (The superiority of the electronic computer to the human brain lies in the speed with which it can "inspect" the choices at any level of the process.)

MENTAL/BRAIN STATES AS CAUSAL FACTORS IN PURPOSIVE BEHAVIOR

It may be useful to summarize D.M. Armstrong's argument contra Wittgenstein, Ryle, et al., regarding the logical possibility of mental states as a cause of purposive physical behavior. The thesis against which Armstrong is arguing¹ runs as follows: If event X is presented as

¹D. M. Armstrong, A Materialist Theory of the Mind, (London, Routledge & Kegan Paul, 1968), pp. 131 ff.

the cause of event B, then X and B must be two distinguishable events like the rising of a piston in a cylinder, and the compressing of air within the cylinder. Either event can be fully described without reference to the other. The connection between the two is contingent, discoverable by observation; as Hume showed about the cause-effect relationship, there is no logical connection. Intentions, it is argued, are not like this; there seems to be a logical bond between an intention and the occurrence of the situation intended. Armstrong points out that the same arguments could be used to show that brittleness is not a cause of glass breaking. Brittleness, like intentions, cannot be characterised or fully described without reference to its effect--a state apt for permitting breakage in certain circumstances. Brittleness does not logically necessitate the breaking of glass, but on the other hand it is more than merely a contingent fact that brittle things break under certain circumstances.

But there is nothing in these points to prevent us from arguing...that brittleness is an actual state of the glass, and so a causal factor in its subsequent breaking.¹

If I intend to strike somebody (to use Armstrong's example), my mind is in a certain state which can be described by introspection only in terms of the effect which it is apt for bringing about. Whether or not one accepts a monist or dualist account, this state has an individual identity, and it is a contingent fact that things of this type regularly precede my striking somebody. The apparent necessity of the connection between it and the effect is that I have no way of describing this entity other than in terms of the effect which it is apt for bringing about. A

¹D. M. Armstrong, loc. cit., p. 134

not dissimilar view is taken by Donald Davidson¹ in referring to the "quasi-intensional" character of this description. For Davidson,

R is a primary reason why an agent performed the action A under the description d only if R consists of a pro attitude of the agent towards actions with a certain property, and a belief of the agent that A, under the description d, has that property.

If the present monistic theory is true, there will be another way of describing these mental states--the pro attitude and the belief--without reference to the effect, but with respect only to the quantum description of the associated brain state. A roughly analogous situation may be seen in consideration of the identity of the gene and the DNA molecule; prior to the advances in biochemistry of the last decade, there was no way to characterise the gene other than by reference to the effect which it was apt for bringing about; in fact there might appear to have been a certain analyticity about the connection between the entity "gene" and the inherited characteristics which are its putative effects. Only recently, with the discovery and subsequent synthesis of the DNA molecule, has the identification been made such that it now makes perfectly good sense to say, "the gene is the DNA molecule", a locution which might be considered deviant prior to the above empirical discoveries. And note that (a) there is no change in the meaning of any of the words used in the locution in order to render a previously deviant expression non-deviant, and (b) none of the words has been 'given' a meaning; rather their use has been acquired through empirical research.²

¹Donald Davidson, "Actions, Reasons & Causes", in Free Will and Determinism, ed. Bernard Berofsky, (New York, Harper & Row, 1966), p. 221

²Cf. D. M. Armstrong, op. cit., chapter 6, and Hilary Putnam in "Minds and Machines", Minds and Machines, ed. Alan Ross Anderson, (Englewood Cliffs, Prentice Hall, Inc. 1964) p. 72

The type of research involved in the identification of the gene and the DNA molecule is similar to the type of research which must be involved in the identification of consciousness and its quantum agent. A more typical analogy would be C.F. Powell's identification of the π meson with Yukawa's "heavy particle", the agent of strong nuclear force. (It is interesting, with respect to the Russian experiments in para-psychology, to note that the decay product of the π meson, the μ meson, is capable of traversing large quantities of matter without making any collisions--being found deep in mine shafts, subway tunnels, etc.,--typically radiation-proof with respect to the better known quanta like the photon. Further, that should the quantum agent of consciousness turn out to be similar to the neutrino and anti-neutrino, products of the μ meson decay, they will be quite difficult to observe since, being uncharged quanta, they leave no tracks in cloud chambers, and their existence must be verified on the basis of conservation laws.)

It may reasonably be asked, what has all this to do with the traditional problems besetting mind-brain identification? Briefly, it is an attempt to fill in the blanks between the neurological account of behavior--even an electrochemical account--and the conscious states and processes which individuals experience and consider to be contingently necessary links in the causal chain which results in observable behavior: arm-raising, vocalisations, and the solution of algebraic equations. By pointing out that the philosopher's concept of matter has tended to be inhibited by classical Cartesian concepts, it is hoped that mental pictures, pains, and conscious processes like reasoning need not be thought of as incompatible with a totally physical universe. If it is argued that in order to make this transition I am giving a 'new' or deviant meaning

to words like 'physical', 'matter', etc., the reply must be that if the words are to have any meaning at all which is both coherent and corresponds to respectable empirical evidence, the meanings must be along these lines and not along the classical lines which, by the way, were questioned by Leibniz in his monadology. For whatever Leibniz's view of the universe may have lacked in air conditioning, he did predict the inadequacy of the nice, clean division of matter into animal, vegetable and mineral, a classification which subsequent empirical investigation has shown to be inadequate (there being macro-molecules which cannot be so classified).

This matter of the use of words has been discussed quite fully, and, it would seem, satisfactorily, by Hilary Putnam, and may be summarized:

...what makes this way [increase in scientific insight] of acquiring a use different from being given a use (and from "change of meaning" properly so called) is that the "new use" is an automatic projection from existing uses and does not involve arbitrary stipulation (except insofar as some element of "stipulation" may be present in the acceptance of any scientific hypothesis, including "The earth is round").¹

So far, the conceptual shifts have all been on the side of modifying the concept of the 'physical'; is it necessary to make any concomitant shift in the concept of the 'mental'? To some, but perhaps a lesser degree, yes. Extreme forms of dualism conceive of minds and spirits as only very marginally associated with bodies, and if a monistic theory is to be maintained, we must be more stringent than this; we can accept the logical possibility of disembodied minds while maintaining that it is an empirically verifiable and contingent fact that the minds we know--i.e., human minds--

¹Hilary Putnam, "Minds and Machines" in A. R. Anderson (ed.), Minds and Machines, (Englewood Cliffs, N.J., Prentice-Hall, Inc. 1964), page 93

are very closely associated with particular bodies.

One must ask of such statements as "Mental events are non-spatial", what is the basis? Is it part of, or does it follow from the definition of mind? It cannot be part of the definition or the whole project becomes uninteresting--at least as much so as discussions about unicorns. It must result (be assumed to come) from the logical problems surrounding consideration of certain mental states such as where a pain or a mental image or a cognition might be. But there are two very distinct ways in which these questions must be approached. In one sense they are just silly. They are silly because the questioner keeps shifting his ground in a pattern familiar from the childhood verbal game which might proceed:

A. What's that?

B. That's my car.

A. Oh, but it can't be a car. I see quite plainly it's a cardboard box.

B. Well, I'm pretending it's my car.

A. In that case, where are the headlights?

B. Right here, and here; can't you see them?

A. Those aren't headlights; they're tin cans!

B. They're my pretend headlights!

A. Well, how do you turn them on?

B. With this switch here; see?

A. They didn't come on.

B. Certainly they did!

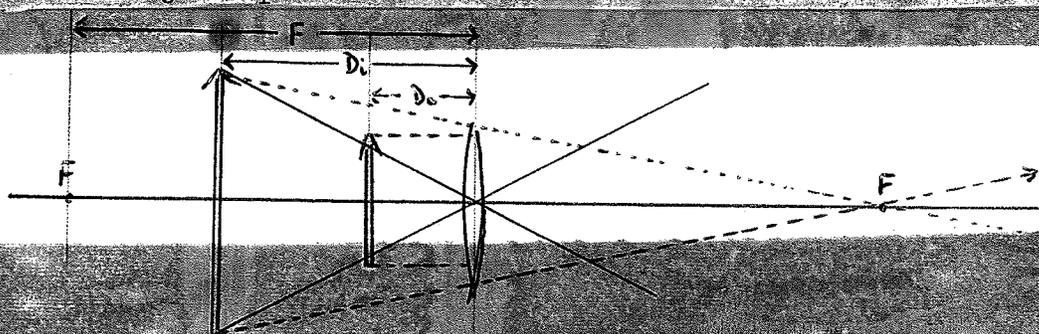
A. They can't have. If they had come on there would be light shining on the wall over there; there isn't, so they didn't come on.

We shall tiptoe from the room before the fisticuffs start and point out that A's questions and objections are silly because he alternately

accepts and rejects B's basic supposition; thus A, not B, is being illogical, although the application of formal logic will always support his objections, taken one at a time and without reference to the context.

Let us next look at the way in which questions like "where is your image of the Empire State Building?" are not silly, and in which there may be very good, unambiguous and empirically verifiable answers. Given a convex lens of known focal length, an object of known size, we can set them up as in the diagram below and predict with mathematical certainty both the position and magnitude of an image according to the formula:

$$\frac{1}{D_o} + \frac{1}{D_i} = \frac{1}{F}$$



Now the silly objections may still be made: that if you try to grasp the image, there is nothing there; A, who is standing on the left hand side of the lens, cannot see the image; it cannot be characterised without reference to the object of which it is the image; and so on. The fact is that these objections are not raised, first, because the parameters required for their prediction are quite simple; second, because it is readily seen that they are subject to simple mathematical formulae; and third, because the silliness of the objections is readily obvious. I suggest that mental images, pains and so on can be subjected to the same sort of scrutiny in that the pain in my foot is in my foot, and the fact that my foot may have been amputated three weeks ago is of no more relevance to the question than the fact that when you try to grasp the image in the lens example above, there

is "nothing there" (alternatively, there may be something else there which should prevent the possibility of the image being there--as in the case of an object lying on a heavy table, being viewed through a magnifying glass). Nevertheless, just as I can point to, and calculate mathematically, the position of the image (above), so I can point exactly to the pain in my foot (even if the foot is absent), and, I can see no reason why it should not be possible to calculate its position mathematically if the appropriate parameters (in terms of the complete description of the brain and nervous system) are known. That there will be more than the simple three variables of the lens example should be neither surprising nor daunting.

This may seem too bold and too unadvised a leap into conjecture. Let us, then, pose a simpler and quite common example. If I caught a big fish last summer, it might be quite natural for you to ask me to show you how big it was. The fish, of course, has long since gone the way of all flesh, but I shall readily hold out my hands and, if I am honest, critically adjust them until the space between them matches my mental image of the fish. Now in order to do this I must see my fish between my hands--otherwise there would be no point in correcting their position. Thus it makes perfectly good sense to say that at that time my mental image of the fish is located between my hands and is $14\frac{1}{2}$ inches long. Here the hologram model is doubly useful since it indicates the escape from the post-card-type view of mental images. Just as the set of interference patterns in a hologram carries more information than the picture alone (the light by which the hologram was made can be analysed precisely, distances in all three dimensions can be measured, etc.), so the neural hologram includes all the synapses which took part in the original experience of catching the

fish on a fine sunny day last summer. The same stimulus responsible for the mental image of the fish must at the same time bring out all the associated information such that there is no image-in-isolation, but a complete brain state part of which may consist of an image, part of the information regarding the circumstances surrounding the first occurrence of the state as a result of stimulation from the external world.

The above does not imply that my mind is out there between my hands, any more than the lens or its refractive capacities or the other means by which, and as a result of which, the image is seen at point P, is at point P. Similarly, my mental image of the Empire State Building, or any other object, is wherever it appears to be, regardless of any deviations in size or shape from the object of which it is an image, in the same way that the lens image differs from the object of which it is an image. The only conjectural leap is the suggestion that such mental entities can be predicted with mathematical certainty. The fact that we do not at present have the techniques for making these predictions is philosophically irrelevant so long as there is no logical reason why they cannot be made.

It will be objected that I cannot hold this and at the same time hold that mental states/processes/events are brain states/processes/events, since the brain is clearly located in the cranial cavity, and I have just located pains, images, etc. in places which may be remote from my head. But the point to be made is that in exactly the same sense as location questions are silly with respect to lens images, they are silly with respect to mental states, and for exactly the same reason--a category mistake has been made. They are not the sort of thing about which such questions can be asked; but this does not imply that they are non-physical any more than it implies that lens images are not entities in the physical world.

Thus the first shift that must be made in the concept of mind is the idea that mental events are necessarily non-spatial, for, having identified a persistent error, we see that they are no more non-spatial than many entities in the so-called physical world. We referred earlier to extreme forms of dualism which conceive of minds as only marginally associated with bodies, e.g., belief in re-incarnation, angels, gods, etc. It seems that a monist position must either (1) show these beliefs to be incoherent and/or logically untenable, or (2) if they are logically possible states of affairs show that they are compatible with a monist position. If (2) is the case, then it should be possible to set up some criteria whereby these beliefs may be tested to see whether they correspond to an actual state of affairs, or only to a universe which might exist, but which, if it exists, is not in fact the universe to which we belong.

ad(1) It seems fairly clear that disembodied minds are logically possible since three extreme situations can be considered to yield the same result: (a) The mind is something other than the brain--a non-physical entity; here no contradiction arises from the statement "There is a mind unconnected with a body". (b) The mind is the brain; brains may be transplanted from one body to another, and clearly exist in the interim. (c) There is no entity corresponding to the word "mind"; here the logical possibility of disembodied minds is on a par with that of deflowered unicorns. (Behaviorists may subscribe to either (b) or (c).)

ad(2) The purpose of the present thesis is to show that an adequate theory of the universe will explain every phenomenon; that if there are phenomena not explainable in quantum theory, then it is inadequate and must either be replaced or modified; specifically, quantum theory does appear to be adequate to explain any phenomena with which we are familiar. This, admittedly, is a very bold claim. It is explicit in quantum theory that

there are quanta such that their presence or absence at a given location at a given moment is a probability function; that quanta are all that there is in the universe, and that their properties (described in Ch.III) account for their individuality; that the sum of their properties accounts for all the observable entities and phenomena of everyday experience (chairs, barking dogs, T.V. images, and professors of philosophy). The detailed expansion of quantum theory is still far from complete, depending, as it does, on imperfect understanding of the phenomena to be investigated, and on technical advancement to make quantifiable observations possible. It is therefore not possible at this stage to give a detailed account of mental states/processes/events in terms of quantum theory; however it should be possible (a) to give an account of the general way in which the operation of a quantum universe would result in the reported phenomena such as consciousness, telepathy, precognition, telekinesis, pre-existence, existence after the decay of the body, dreams, visions, etc., if any or all of these occur; (b) to suggest what disconfirming evidence would show that mental states/processes/events do not fall within the domain of quantum theory either as it is presently formulated or as it might reasonably be expected to be modified.

ad (a). What is here claimed is that just as radioactivity is a natural phenomenon resulting from the operation of photons (the quantum of the electromagnetic field);¹ weight, falling, the bending of light under certain characteristic circumstances are the natural phenomena resulting from the operation of gravitons (the quantum agent of gravitational force);

¹Leon Cooper, An Introduction to the Meaning and Structure of Physics, page 593

so consciousness is the outcome of the operation of the laws governing a quantum of mental force (either already known but not so identified, or capable in principle of being discovered). Further, that consciousness, being a quantum state of matter, necessarily brings about further modifications; this would account, at the empirical level, for the observed fact that mental states (intentions, cognitions, memories, etc.) do act as causal factors in subsequent behavior. There is little difficulty for the theory in accommodating telepathy or (should a case be authenticated) telekinesis. In the unlikely event that claims of pre-existence were authenticated--although it is hard to see how such claims could be in principle authenticated without a minute knowledge of the experiences in this life of the person who subsequently makes the apparently authentic memory claim about events prior to the present life--some rather knotty logical and theoretical problems would result. In fact, this might provide the disconfirming evidence of the theory. Disembodied minds (souls) after life are quite consonant with the theory in a manner analogous to the light of a now non-existent star, which continues infinitely, connected to the star from which it emanated sine qua non, but disembodied in the sense that the star no longer exists.

What the theist can make of this theory is problematic; it does seem reasonable to suppose, however, that if there is an entity having the attributes of omniscience, omnipotence and benevolence, and if he communicates with man, he would use the same quantum agent. The problem will arise in the event that the quantum agent of consciousness is identified and no claims of divine presence can be confirmed.

ad (b). "Now to assert that such and such is the case is necessarily

equivalent to denying that such and such is not the case."¹ In the present consideration, to assert that the mind is the brain is to assert that the mind is not something other than the brain; and one way to understand the first assertion is to find what would be incompatible with its truth. We have suggested that an authenticated claim of pre-existence would seem to provide disconfirming evidence in that, given our clarified concept of matter, disembodied minds are not incompatible with mind-brain identity, but the suggestion that the mind might exist prior to the existence of the brain with which it is identified, or even that a mind might be associated with a different brain, does seem to be inconsistent with identity. By analogy, we have said (following Armstrong) that this identity thesis has many of the characteristics of the identity of the gene and the DNA molecule; now if it is claimed that the gene determining blue eyes is the DNA molecule with such and such structure, and then we find blue eyes associated with DNA molecules of different structure, we are surely bound to abandon the original identification. If it is objected that such claims of pre-existence (cf. Bridie Murphy) have been made with considerable weighty evidence in support of them, it should be pointed out that the investigations have not been carried out with any of the rigor demanded by respectable empirical research.

A very serious objection to this theory, and to quantum theory itself, is contained in the recent investigations of Dr. Helmut Schmidt of the Institute for Parapsychology at Duke University. It is an axiom of the theory that quantum processes cannot be predicted exactly, that is,

¹A. G. N. Flew, "Theology and Falsification", in Nagel & Brandt, Meaning and Knowledge, (New York, Harcourt, Brace & World) 1965, p. 51

it is impossible to predict with greater than 50% accuracy. Yet in experiments carried out at Boeing Research Laboratories in Seattle during 1967-68, ^{1,2,3} subjects who had previously reported 'psychic' experiences were able to predict the results of a quantum process with a score consistently higher than chance expectation, the probability of such a consistently successful score in the thousands of trials made being less than 10^{-10} . Dr. Schmidt concludes:

I believe that the experiments...indicate that the axiom [of quantum theory] is indeed wrong. This implies that quantum theory does not give, at least for systems that include human subjects, a complete description of nature.⁴

However, Dr. Gerald Feinberg of Columbia University has pointed out⁵ that quantum theory does in fact, contrary to previous belief, allow for the existence of subatomic particles that always travel faster than the speed of light. These he has called tachyons, and while none have yet been detected, the search has not yet been exhaustive. If tachyons exist, and if mental events (or even some mental events) are mediated by tachyon action, precognition would not violate the quantum theory, and it could still be considered a complete description of nature. It is not, however, my purpose to defend quantum theory, but to show that a monist solution to the

¹ Helmut Schmidt, "Precognition of a Quantum Process", in The Journal of Parapsychology, Vol 33, June 1969, Number 2, p. 99

² Ibid., "Quantum Processes Predicted?" in New Scientist, 16 October 1969, page 114.

³ Ibid., "Clairvoyance Tests With a Machine", in The Journal of Parapsychology, Vol. 33, No. 4, December 1969, page 300.

⁴ Ibid., "Quantum Processes Predicted?", loc. cit.

⁵ Gerald Feinberg, "Particles That Go Faster Than Light", in Scientific American, Vol. 222, No. 2, February 1970, p. 68.

mind-brain problem is not inconsistent with either quantum theory as it can reasonably be expected to be modified, or with the observed phenomena of our world. In this respect Dr. Schmidt has admitted in private correspondence that the tachyon concept would provide a satisfactory model for apparently uncaused events. Unfortunately, the existence of tachyons must be established before much can be made of this aspect of the theory. In the meantime it must be admitted that if it were shown (a) that tachyons do not, in fact, exist or (b) that whether they exist or not they could not possibly interact with the matter of the brain to affect the nucleic acid molecules, then disconfirming evidence would have been provided. It is a mark of respectability in a theory, however, that it can be confirmed or rejected by empirical evidence.

On this theory, conscious brain states must be observably different from brain states of which we are not conscious. In the event that no such differences could be observed, this would also have to be counted as disconfirming evidence. However, on this point the evidence is already at hand; electroencephalograms clearly show marked differences between brain states when the subject reports awareness and those in which he is not conscious. The epiphenomenalist attacks this on the ground that no amount of correlation between brain states and conscious states necessarily entails the identity--consciousness may simply be a gratuitous epiphenomenon. Here we may trade on Flew's parable of the gardener.¹ Our two explorers have come upon the plot of ground with its beautiful flowers and occasional weeds: A has suggested that there must be a gardener, and B has disagreed; they have set out to test the hypothesis, wired their electric fence, and brought in the bloodhounds. However, unlike the original

¹A. G. N. Flew, *op. cit.*, p. 50

story, a scream is heard and the bloodhounds give cry; but B finds other explanations than the proposed gardener. Similarly, the epiphenomenalist can always accept your evidence and claim that it is consonant with consciousness as a non-causal phenomenon. One may turn Flew's approach on the epiphenomenalist and ask what evidence, or even what sort of evidence, he would accept of behavior caused by a mental state (disconfirming evidence). If there is no conceivable situation in which a mental state could be said to cause subsequent behavior, then it is difficult to understand what an epiphenomenalist means by "mental states".

One difficulty in setting out possible disconfirming evidence of this theory lies in not knowing what kind of entity the quantum agent of consciousness (if such there be) might turn out to be. Quantum objects are either electrically charged or neutral; if we are looking for a charged quantum, the search may be relatively simple--depending on its radius of interaction, life, etc. An electrically neutral entity presents more difficulties since their existence is currently inferred on the basis of conservation laws and the observations of collisions of charged quanta.

We have conjectured that in future, technology may be able to place electrodes in (or near) a subject's brain and flash the subject's mental image of the Playmate-of-the-Month of a screen, thus rendering mental events intersubjectively observable. There is, of course, a sense in which what appears on the screen is not the subject's image, but a TV image, and therefore that what the observer sees is in no way the subject's. We can, however, admit this as consonant with a parallel consideration. A sample (a) of radium can emit certain radiation; a different sample (b) will emit similar radiation. The two radiations are different and distinguishable because they came from different sources; they may also be distinguishable because they are mediated by different mechanisms of obser-

vation (or the same mechanism different at t_1 from t_2 --perhaps in no other respect). This radiation (a) is not radiation (b), or to follow the analogy more closely, a's radiation is not b's radiation; but the only meaningful basis of differentiation may be with reference to the source. Returning: the TV picture of the Playmate-of-the-Month may be different from the subject's mental picture in no more interesting a sense than a's radiation is different from b's radiation--numerically different without being qualitatively different.

To the question, In dealing with the mind and brain, are we dealing with one entity or two different entities? the answer must be in the form of a clarification. In the sense that radiation is different from the mass from which it radiated, the mind might be said to be different from the brain with which it is associated; but just as radiation must have emanated from some mass, so mind without an associated brain cannot occur ('can' contingent rather than logical). And in the sense that radiation is the mass from which it emanated (the conservation laws apply), which is the only sense in which radiation becomes a meaningful object of contemplation, the mind is the brain.

This argument from analogy has the weakness of all such; to say that x is like y in certain respects, is neither to affirm nor to give evidence that x is like y. But the position of the monist in the mind-brain debate must always take as a base point the rule of parsimony, and show that the evidence and the logic of the situation are consonant with the theory. The force of the analogy lies in that if there are well documented occurrences in nature of phenomena no more astonishing than the explanation we are proposing of the mind-brain phenomenon, then what, other than some misguided and unwarranted feeling of superiority, would make us believe that the essential "I" is anything more than the total

state of my central nervous system? That this feeling of superiority is unwarranted is best shown by the following consideration: the powers of reasoning and comprehension are supposed by the dualist to be clearly cases of mental (as opposed to physical) processes; the structure and functioning of the brain, all the complex electrochemical interactions, are clearly physical; yet we have no really clear comprehension of how the brain operates, nor can we comprehend the overwhelming complexity of the human brain. Whence, then, the superiority of the mind that is unable to comprehend the observed complexity of that to which it is supposed to be superior?

CHAPTER V

CAN A QUANTUM THEORY OF MIND SOLVE ANY OF THE TRADITIONAL PUZZLES?

In his 1968 postscript to The "Mental" and the "Physical" Herbert Feigl quotes four propositions formulated by Mrs. Judith Economos in her doctoral dissertation, which she says "appear to be true but are difficult to reconcile with one another". Since they bring out some very vital features of the mind-brain controversy I shall quote them again here:

1. People have thoughts, sensations, etc., of which they are aware, but of which others are not aware except through the owner's reports or behavior; and these sensations, thoughts, etc., are not located in space, nor do they possess, produce, or consume energy or have mass.

(Italics mine)

2. There are in the world various objects, including contemporary human bodies, which are composed of elements which are located in space, which produce, possess, and consume energy and have mass; moreover the vocabulary of physical science seems sufficient to describe, and the laws of physical science seem sufficient to explain, the behavior of such objects.

3. People's sensations, thoughts, etc., affect their bodily movements and some events occurring to or in their bodies affect the people's sensations, thoughts, memories, etc.; and often when people's thoughts, sensations, etc., affect their bodily movements, this is because the people have so desired.

4. The concepts which we have of mental things or events on the one hand, and of material things or events on the other hand, are logically independent; that is to say, there is no demonstrable inconsistency in supposing a world in which there were material objects but no awareness, or conversely a world of awarenesses without anything fitting the description of matter.

The point of departure from which I would approach these propositions is the assertion that they appear to be true. I should like to suggest that they contain vital elements which are not true, and that

the difficulty of reconciliation is a direct result of the false elements.

1. There can be no question about the truth of the first proposition up to the semi-colon; however we have shown in Chapter IV that the spatial assertion is highly questionable if not clearly false. Is it clear that thoughts etc. neither possess, produce nor consume energy? Three things seem immediately clear: (a) the statement is empirically verifiable, (b) the scientific world has a duty to make the required investigations, and (c) the philosopher must accept the findings with whatever reservations are dictated by the nature of the experiments. Biologists have carried out extensive research toward the quantification of energy consumed in such activities as the flight of budgerigars and gulls.¹ While the hardware and the calculations would be considerably more complex in an experiment to discover (a) if thinking consumes energy, and (b) how much energy is consumed in the production of a thought, there does not appear to be any logical or theoretical objection to the carrying out of such an experiment. The dualist will object that such an experiment proves nothing since he denied neither the existence of brain processes nor possible one-one correlations between brain processes and mental processes. However, if dualism in all its forms can be defeated on other grounds (as I believe I have shown that it can), then the fact that electroencephalograms of conscious states are significantly different and more complex than those of unconscious states would lead one to suppose that there would be a similar difference in energy consumption, and that the difference was accounted for by the energy required to produce a thought. That there is at least a close connection between the energy intake of the body and

¹Vance A. Tucker, "The Energetics of Bird Flight", Scientific American, Vol. 220, No. 5, page 70

mental processes is indicated by such considerations as the very strange ideas frequently held by those on strange diets, or the fact that in starvation, unconsciousness precedes death--i.e., there are certain elementary brain processes still going on, but there is insufficient energy to support consciousness.

The second assertion made by Mrs. Economos' first proposition is that thoughts, sensations, etc. do not possess energy. This is dubious on the grounds of the ever growing evidence of telepathy. J. K. Feibleman, in his entry in Dictionary of Philosophy¹ defines energy as "the power by which things act to change other things"; an elementary physics text² defines energy as "the agent that brings about changes in matter"; the most recent texts make no attempt at definition. In any case it seems clear that if it is the case that thoughts do affect bodily movements (proposition no. 3), and/or thoughts are transmitted from one individual to another, then they do possess energy by definition. Further, experiments are conceivable (although probably not currently technically possible) whereby the energy could be measured.

Whether thoughts, sensations, etc. produce energy or not is much less clear, although it is interesting to note that this is implicit in such science fiction as John Wyndham's Chrysalids, and while it is not my intention to use science fiction as a support for philosophical argument, the situations which Wyndham conceives do not strike the reader as deviant either in or out of context. More convincing is the evidence of telepathy.

¹Dagobert D. Runes (ed.), Dictionary of Philosophy, Littlefield Adams & Co., 1966

²Alexander Taffel, Visualized Physics, (New York, Oxford) 1940, page 2

Finally, with respect to the first proposition, the assertion that thoughts do not have any mass seems quite irrelevant and certainly not one of the elements which is hard to reconcile with any of the other propositions. In the quantum world there are objects which have zero mass, and are nonetheless real, and nonetheless consonant with everything mentioned in the second proposition (the one with which proposition no.1 is presumed to be incompatible). There are also quantum objects such that two or more can occupy the same space simultaneously.

2. The second proposition can be accepted as a true statement with the proviso that when we say that human bodies (or any other bodies) are composed of elements "which are located in space" we are recognizing that (a) Newtonian laws are a specific application of quantum laws, (b) that neither set of laws is contradictory to the other, and therefore that (c) any wave or quantum effects will be so small that the probability that a person is at any place other than the classically calculated position is absurdly close to zero.¹

Once again, we must drive the wedge into the second clause of the proposition, for it is far from clear that the "vocabulary of physical science seems sufficient to describe, and the laws of physical science seem sufficient to explain, the behavior of such (human) objects." Physical science is a long way from being able to describe a complete causal chain from specific stimulus to specific response, and to predict human behavior in any sense more articulate than the "I knew he was going to do that" type of statement is still very far in the future. Nor is it clear that the vocabulary of physical science is as yet fully satisfactory for the explanation and description of physical events in general.

¹Leon Cooper, op. cit., page 514 ff.

Quantum theory is still very young; much remains to be explained, and that the explanations will require both conceptual shifts, new vocabulary or additional meanings for old words (like the extended meaning of "particle" which is so confusing to the classically trained mind), is obvious from such typical statements as the following:

...many of the properties of materials cannot really be understood using classical concepts. In a rough way, though, one can say that somewhere between the hydrogen atom and the planetary orbits systems begin to behave in a typically classical fashion; the boundary is not completely well marked; there are subtle penetrations of quantum effects into what might be thought to be completely classical domain. Thus, although quantum theory becomes classical theory, the region of transition, somewhat amoeba-like, has offered surprises to those who explore its edge.¹

Some of the surprises have been the anomalies in a specific heat (Maxwell), and Gibbs' paradox in statistical physics, both of which are intrusions of quantum effects into the domain thought to be classical.

The error in this second proposition, then, lies in the basic assumption (presupposition) that the behavior of all the non-human objects in the world is explained, or is explainable--has in fact been explained fully --with the language of the physical sciences. The truth of the matter is that the explanations are at present very far from full, whether we are speaking of man, mouse or molecule. We can no more predict the year, day or hour when the 200-foot cedar outside my window will die, than we can predict who will be the next president of the University of Manitoba. Yet the presupposition in the second proposition is that the physio-chemical laws governing the life of the tree are much better known than the sociological laws governing the election of university presidents.

¹Leon Cooper, op. cit., page 516

If this should be denied, the second presupposition underlying this second clause of the proposition is that even when the laws governing non-human objects are fully known they cannot by their very nature explain thoughts, sensations and the like. This presupposition is, if anything, more unjustified than its contradictory--that the full explanation of the world of objects other than thoughts, sensations, etc. will also explain thoughts and sensations. There is at least the historical evidence that scientific discovery has always brought a bonus, the concurrent explanation of some phenomenon which was not previously thought to be connected with the phenomenon under investigation.

With respect to the second of the true but irreconcilable propositions, we have shown first, that the primary clause can be accepted only with a proviso which makes it much more nearly compatible with the first proposition; and second, that the secondary clause is either false or so general as to be quite worthless in terms of drawing specific conclusions with respect to its compatibility or incompatibility with the first proposition.

3. The third proposition deals with the interaction of mental events and physical events and primarily with the problem of free will versus determinism. Regardless of one's philosophical position, whether with the convincing exposition of R. E. Hobart (Dickinson Miller), or the equally excellent rebuttal of Philippa Foot,¹ there does seem to be a problem of reconciling a universe in which the relations between different events are

¹R. E. Hobart, "Free Will as Involving Determinism and Inconceivable Without it", and Philippa Foot, "Free Will as Involving Determinism" in Bernard Berofski (ed.), Free Will and Determinism, (New York, Harper & Row), 1966

such that "every previous and subsequent event can theoretically be determined as a function of the given events during that time"¹ and a world in which people do make conscious choices between apparent alternatives (in the red-blooded sense of alternative).

I shall here make two important assumptions, one quite sound, and the other provisional: (A) that we live in a quantum universe which is describable within the framework of quantum theory as may be modified by subsequent observation; (B) that awareness is a quantum effect penetrating that part of the macrocosm we call our bodies. I shall point out further that in all discussions of free will versus determinism it is assumed that determinism entails predictability; this proposition, I shall later show, is open to question.

One of the first things we learn from quantum physics is that we are concerned with probabilities; specifically, it is not the case that if we know all the laws governing a quantum object we can determine its position. Rather, knowledge of and application of these laws allow us to determine the probability of finding the object within certain spatial co-ordinates. It is not that there is a missing piece of information such that if we had it we could make the 'final' calculation, but rather that it is the nature of the universe that quanta behave this way. Further, the properties of matter are the result of quantum properties. Thus the situation with respect to determinism may not be quite as simple as Russell conceived it. It may be true that every event can be determined as a function of previous and subsequent events, but in retrospect only. Let

¹Bertrand Russell, "On the Notion of Cause" in Our Knowledge of The External World (London) 1914, p. 221

us take an example from the physicist's laboratory. When a stream of charged quanta is directed at a target, the physicist can calculate the probability of these charged objects colliding with the target, and on the basis of this predict a certain number of collisions per unit time, with reasonable expectation of considerable accuracy. After each such collision has taken place he can describe what "particle" has collided with what, and describe the causal chain which has occurred. But to do this in advance in any terms other than probabilistic is not only technically impossible, but, as Heisenberg pointed out, logically impossible, given the basic postulates of quantum theory itself. Thus it may be that in the classical domain, determinism entails predictability; but in the quantum domain, to say that an event is determined is to say no more than that certain subsequent events are probable, and when the factors are sufficiently understood, to state the mathematical probability. Thus to say that an event is determined, at least in the quantum domain, is not to say that it is predictable; given an event E , the most one can logically predict is that the set of subsequent events, $e_1^S, e_2^S, e_3^S, \dots, e_n^S$ have the probabilities $P_1, P_2, P_3, \dots, P_n$.

Now this is clearly not what "the man in the street" thinks of as determinism, but then the quantum "particle" is not what the "man in the street" thinks of as a particle. If my assumption B, above, is true, and consciousness is a quantum effect, then we should expect it to behave according to the laws governing such phenomena; thus we should expect that conscious events and their subsequent events would be determined although logically not predictable. Thus if "I" am the conscious states connected to this observable body, then I determine my choices, volitions etc. (subsequent conscious states) just exactly as I believe I do. They are determined although not predictable.

If, when we claim to have free will, we mean no more than that we could have done otherwise than we did, then it is clear under this view that any choice could have been other than it was without in any way running counter to a deterministic analysis of mental events.

In discussing this point in "The Case For Determinism", Brand Blanshard¹ states:

The question of importance for us, then, is whether if acts of choice are dependent on physical processes at all, they depend on the behavior of particles singly or on that of masses of particles. To this there can only be one answer. They depend on mass behavior.

However, Blanshard takes too simple a view of the question. I submit the following considerations as evidence that there may be another answer than the one proposed by Blanshard:

- (1) Maxwell's specific heat anomaly, and Gibbs' paradox (see above), provide other examples of quantum effects in an otherwise classical domain.
- (2) A conscious event is a very complex event and may very well be composed of an agglomeration of quantum events as a hologram is composed of a multiplicity of apparently isolated pieces of information.
- (3) Physicist Helmut Schmidt considered the possibility of conscious interference with a quantum process sufficiently likely as to take it into account in analyzing the result of his experiments in clairvoyance.²

Let us now reassess Philippa Foot's discussion of the Hobart-Ayer et al. reconciliation of free will and determinism. Accepting

¹Brand Blanshard, "The Case For Determinism" in Sidney Hook (ed.) Determinism and Freedom in the Age of Modern Science, (New York, Collier Books, 1958), p. 25

²Helmut Schmidt, "Clairvoyance Tests With A Machine" in The Journal of Parapsychology, Vol. 33, No. 4, December 1969, p. 300

Russell's account of determinism as every previous and subsequent event being determined as a function of the given events at that time, she goes on to say:

This seems to be the kind of determinism which worries the defender of free will, for if human action is subject to a universal law of causation of this type, there will be for any action a set of sufficient conditions which can be traced back to factors outside the control of the agent.¹

We have seen that Russell's account of the universal law of causation is analogous to Newton's laws regarding planetary orbits--it is the specific application of a general universal law which relates previous and subsequent events as functions of the given event, determined but not predictable. Thus for any action, there is a set of sufficient conditions, any number of which may be conscious states of the agent, each carrying a set of subsequent states related only probabilistically to their antecedents; and since the agent is the sum of his conscious states, the conditions cannot be said to be wholly out of the control of the agent. Heredity may be out of his control, as is the objective environment; but the actual environment includes the agent and his previous choices. The key to the problem is the recognition that in the quantum domain, Russell's function is a probability function, and not, as has been supposed, a simple algebraic function.

It may be objected that I have reduced free will to a matter of pure random chance; that when I choose or decide to do an action in the fullest sense then I cannot know in advance what my decision will be; the decision is of no more consequence than the turn of a coin. Not so,

¹Philippa Foot, "Free Will as Involving Determinism", The Philosophical Review, LXVI, No. 4 (October, 1957), pp. 439-450

however; for by 'chance' we mean 'not subject to any causal laws', but I have shown that the causal laws are to be specifically identified only in retrospect, not because of a technical limitation but a logical limitation. Thus if my pals ask me to accompany them on a pub-crawl and I hesitate, I am making a decision; I, the sum of my conscious states, am weighing the advantages and disadvantages of accepting the invitation, I cannot know in advance what the decision will be (otherwise it would not be a genuine decision-making process); the decision is a function of a previous event (conscious and mnemonic); it is a probability function such that after the decision is made the determining factors may be identified, but such that it is in principle impossible to determine the decision in advance. That this does not involve a contradiction depends upon the acceptance of my assumption that in dealing with conscious events we are dealing with quantum effects in the "twilight zone" between the macrocosm, where classical laws are sufficient, and the microcosm which determines the nature of the macrocosm.

(4) The fourth true but incompatible proposition forming the basis of the mind-brain problem concerns the logical independence of mental events and material events. Just how this is relevant to the problem, I must confess, escapes me. It does not seem that the outcome of a discussion of the proposition can affect the solution to the mind-brain controversy one way or another. It is true that the "received" concept of 'mental' is such that we can conceive a universe in which there were no such events; similarly the "received" concept of 'matter' is such that we can conceive a universe in which there were mental events but nothing answering to the description of matter. But we have said from the outset that mind-brain identity must be a contingent matter; in the same way we can conceive of

a universe in which there were DNA molecules but no characteristics to be inherited, i.e., no living beings, animal or vegetable, and conversely a universe in which there were living beings with characteristics which were not inherited--or which were inherited by means other than DNA molecules.

That the "received" concepts of both the mental and material are far from adequate has been pointed out at length, and requires no further elucidation here; still, however, even when we recognize the empirical connection (that there may not be two phenomena, but only one--more complex than previously believed), it is still logically possible that there might have been two and that they might have been independent.

What I have shown in this section is that the four propositions formulated by Mrs. Economos as true and incompatible and forming the basis of the mind-brain problem, are either not true, or to the extent that they are true, not incompatible.

After all this there still seems to be a substantial gap between the description in physical science of a tree and my immediate experience of the tree; between the description (or possible description) of myself, and my immediate experience of myself. The question that must be answered is, is this gap totally accounted for by the difference between descriptions and "raw feels"? For just as the description of a tree is not a tree, so we must not expect the description of a conscious state to be the conscious state; nevertheless the description must be recognizable, and that is exactly what any attempt at characterization of awareness in terms of neurochemistry or even quantum physics is not! If someone says, "There it stood, its branches waving gracefully in the gentle breeze, the delicate new tendrils sweeping the ground like the caress of a feather duster," there seems to be no doubt that he is describing a weeping willow (or

perhaps a weeping birch). But if, on the other hand, I am told that A's such-and-such synapse is in such-and-such a state resulting from the impulse transmitted from the so-and-so dendrite, giving rise to the emission of such-and-such quantum particles, by what stretch of the imagination are we to guess that A has an itching left ear? At first thrust, this seems to do catastrophic damage to an identity thesis; the whole enterprise seems ready to founder. But does not our understanding of the first description depend upon prior knowledge of the meaning and use of the words used in it? And is there any reason why we wouldn't recognize the second description if we knew where the such-and-such synapse was located, what its function, and with what "raw feels" its being in such-and-such a quantum state is correlated? And there is nothing to be gained in the counter, "Then what you really mean is that he has an itching left ear," since the verbalizations are purely matters of convention; we are not deceived as to the composition of water because it is conventional to refer to it by the word "water" rather than as H_2O , any more than we are accused of facetiousness when we refer to the gene as DNA rather than deoxyribonucleic acid.

* * * *

It may be fruitful at this stage to return to Feigl's "requirements and desiderata for an adequate solution to the mind-body problem" noted in Chapter I and see if we have made any headway with respect to them.

1. Linguistic analysis: If our dip into the realm of quantum physics has shown us nothing else, it must have made it quite evident that the word "physical" has a much broader scope than is naively admitted by traditional or classical treatments. The physical involves the micro-structure of matter where the Cartesian billiard-ball models are neither meaningful nor illuminating; it may involve entities as difficult to conceive as quarks, suggested by Murray Gell-Mann, with non-integral charge

and baryon number! Specifically, a locution of the form, "There is an x such that x is a physical entity and x is not locatable in space" is not a deviant expression. The fact that it has been taken to be deviant, and can no longer be so considered, is due not to the word "physical" having taken on a new denotation, but rather to our increase in knowledge having altered the concept of what it is to be physical. In the same way, Mendel proposed the gene as the determiner of hereditary factors; he had no idea what a gene might be; in fact it is highly likely that he would have rejected the statement "the gene is a molecule" simply on the grounds of current contemporary ignorance of what a molecule was. The concept of the physical (and consequently the linguistic applications of the word) is rapidly widening to the point such that anything that happens is considered a physical phenomenon.

Thus from the point of view of classification of phenomena, it appears that we may be forced to consider the class of mental events as a sub-class of physical events rather than as a distinct class, in much the same way as Einstein's work showed that the phenomena of light and of electromagnetism are to be considered subclasses of electron behavior rather than as separate and distinct phenomena. Still, however, we must have criteria whereby the subclass of physical phenomena called mental phenomena can be distinguished, and the obvious condition is consciousness itself. If any conceptual shift is required here at all, it must be very subtle, since the only currently acceptable applications of the word "mental" which are not replaceable with "conscious" are those which analysis shows to be deviant. That we speak of conscious states and mental states interchangeably needs no elucidation here; there are, however, some questionable situations like "sub-conscious mind", "mentally ill" (= "consciously ill"?).

We have previously discussed the anomaly of the sub-conscious mind; while no one questions the idea of brain processes of which we are not aware, there seems to be little sense to be made of the idea of mental states of which we are not aware. Compare, for instance, this with the locutions "It just popped into my mind", meaning that I just became conscious of it; "I have it back there somewhere, but I just can't bring it to mind". Such locutions, much more common to the idiom than the post-Freudian "sub-conscious" talk, seem to underline the identity of mental and conscious, and relegate states of which we are not aware to simple brain states. However, not much can be allowed to rest on this approach, since the linguistic conventions of the time reflect only the scientific beliefs with which they are concurrent; cf. spleen, liver, and heart. One thing at least is clear, that a person who is considered mentally ill is certainly not (necessarily) consciously ill, but has an illness consisting in having abnormal, or abnormally related, conscious states. The locution, then, although it will probably remain in the language for some time, must be seen as a legacy from a period of relative ignorance rather than as an indication of the current concept of mind. (Cf. "a bolt of lightning" as reminiscent of Jove, throwing his thunderbolt, in Greek mythology.)

Crucial to this discussion must be the recognition that the identity statement, "Mental states are brain states", implies that all mental states are brain states and not all brain states are mental states. If the argument from intensionality is brought to bear--"How can a brain state (even a quantum brain state) be for anything?", e.g., a desire for a drink of beer--then the answer must be along the lines suggested by D. M. Armstrong, that there is no more problem in a quantum brain state apt for producing certain types of behavior directed toward the imbibing of

beer, than there is in quantum states of the electron apt for producing photon emission (light).

2. Empirical Unity: A complete theory of mind-brain identity must be able to explain (not explain away) not only the conditions under which conscious states arise from brain states, and the relation between consciousness and behavior, but also the facts (insofar as there are any-- and there do increasingly appear to be some) of parapsychology. That this has not yet been done is evident, and the burden must lie at present with the empirical scientist to supply the data with which the theorist can operate. To date high energy physics has of necessity confined itself to the building blocks of relatively simple elements, from which a fairly coherent account of the properties of the more complex elements is deducible. It may be expected to be some time before the application both of the knowledge and techniques can be turned toward the highly complex molecules which are the basis of living cells. However, recent discoveries of abnormalities in chickens raised near radar and microwave transmitting towers leads one to suspect that investigation, when it becomes technically possible, will not be unfruitful. It may be necessary to await the techniques for observing uncharged quanta before the events of parapsychology can be investigated, and in the interim we must plead guilty to the charge of speculation, although not to mere speculation. Certainly events more surprising than a conscious cluster of cells have been observed in the laboratory, and with all the increase of knowledge and understanding during the past few decades, evidence of "supernatural" phenomena has decreased rather than increased. What does seem evident, at least, is that even if we are unable to explain paranormal phenomena with the knowledge and techniques currently at hand, the phenomena which can be satisfactorily accounted for are so many and of so broad a character that it appears much more

likely that an explanation will lie in the domain of physical science than in the realm of the supernatural (assuming "supernatural" to be that which is in principle outside the domain of physical science no matter how large that domain might prove to be).

3. Efficacy: That mental states/processes/events are contingently necessary links in the causal chain from stimulus to response, together with an analysis of the free will vs. determinism issue such that empirical as well as philosophical reconciliation can be established, has been discussed elsewhere and need not be repeated here.

4. Logic: We have agreed earlier that in a satisfactory account of the mind-brain problem, the statements describing physical states of the brain and statements describing states of awareness, while intertranslatable, are not logically so; is this requirement fulfilled by the present thesis? Certainly the correspondence between given conscious states and brain states as observed by electronic means, or whatever means are devised in future, if such correspondences there be, will have to be discovered by empirical means and the connection is clearly contingent. But what will we say if, after such a set of translation criteria has been established, a subject who is in brain state ϕ (associated with seeing a red spot comprising $\frac{1}{4}$ of the visual field) reports hearing C[#] played on a violin? Are we to say he is mistaken? that the apparatus for determining brain states is malfunctioning? that the translation criteria are not complete? or that the subject is lying? The first thing to recognize is that any of these is a logically possible state of affairs, although what sense we can make out of the subject being mistaken about his awareness is quite unclear. For this is not equivalent to saying "I seem to be aware of a red spot but in fact I am not aware of a red spot"; it is equivalent to, "I seem to be aware of a red spot but in fact I do not seem to be aware of a red spot",

which is surely an instance of $p \cdot \sim p$. This consideration brings us face to face with the hornet's nest of problems surrounding incorrigibility, logically privileged access, etc.

D. M. Armstrong argues for the possibility of error with respect to one's own mental states, first on the ground that the slightest time lapse between one mental event and another introduces the possibility of error. If, for instance, I think that my nose was itching a fraction of a second ago, the itch and the thought constitute two distinct events, such that there is a logical possibility that I may be mistaken about the former. Convincing though it is, the argument is not a reflection of the situation envisaged in the previous paragraph. There, the subject is not reporting a conscious state which he experienced an infinitesimally small fraction of a second ago, but rather one which he is having NOW; and surely no one will argue that one does not have simultaneous states of awareness. Thus while it may be true that to report at t_2 that I had a pain at t_1 , even though $(t_2 - t_1) = 10^{-99}$ sec., may involve the logical possibility of error, this cannot be said of the situation in which I now report that I am now having (experiencing) an itching nose.

Armstrong's second attack is somewhat more cogent. Let us accept, he says, the report that you are now having an itching nose. But to what time does the word "now" refer? It takes time to utter the locution, "I am now having the sensation of an itching nose", and what logical guarantee is there that my memories are veridical during the time lapse involved in the utterance? The failure in this analysis, as in the previous one, lies in the fact that we are not concerned with whether or not a person's reports of conscious events are corrigible, but whether he can be mistaken at t_1 about his conscious state at t_1 . Thus while it is logically

possible to be mistaken about one's past mental states, no matter how small the gap between present and past, and it is not empirically possible to report them without the chance of error, it does not appear to have been shown that we can be mistaken about present mental states. There seems also to be a manner in which introspection gives us a firmer hold on "present" than any talk about reports concerning the present (resting on the problem of the time taken to say the word "now", and whether a sentence refers to the time of its initiation or termination, and the whole nest of "spurious present" problems). If we confine ourselves to A's knowledge of A's mental states at t , we can grant that he may have forgotten his mental states at t_{-1} , but admit that at t_{-1} he knew his mental states at t_{-1} , just as he cannot be in error at t_1 about his mental state at t_1 ; similarly at t_2, t_3, \dots, t_n . So regardless of the infinitesimally small value of $(t_1 - t)$, A can be said to have indubitable knowledge, at any given moment, of his own mental state(s).

Before leaving this point, let us observe two further considerations. First, Richard Rorty's observation that the infallibility concept turns out to be all but vacuous when the criteria for misjudging sensations turn out to be the same as the criteria for misnaming them.¹ Second, whence comes the much-touted publicity of brain states? To what extent can the whole interconnected and complex "state" of billions of brain cells, each one containing millions of protein molecules (the atoms of which may be in excited states), be called public? Certainly not in the same sense that the amaryllis on my window-sill is public.

¹Richard Rorty, "Mind-Body Identity, Privacy, and Categories" Stuart Hampshire (ed), Philosophy of Mind, (New York, Harper & Row, 1966) page 54

5. Epistemology: (a) the need for a criterion of scientific meaningfulness based on intersubjective confirmability. The first and most obvious thing to be said here is that if awareness is a quantum effect, then the discovery of its radiation will automatically bring with it the solution to the problem of intersubjective confirmability. That this is a very large and crucial "if" is admitted, and until it can be removed, there is nothing much to be said in the light of this theory that has not been said before; the need remains and must be fulfilled before the mind-body problem can be said to be solved. Further, it is a need which can only be met by a materialist solution of some variety or other. (b) It would appear that attempts to analyse knowledge claims of whatever type in propositional terms are doomed to failure. Perhaps two reasons might be advanced for this failure. (1) When I say "I know that p," the difference between this and my claim to believe that p is one of a certain doxastic attitude rather than the conjunction of any number of propositions of the form: p is the case, S has justification for believing p, etc., ad nauseam. The crux of this lies in the fact that any "acceptable" analysis of statements of knowledge claims must include the proposition that p is the case (or something roughly synonymous); but it is distressingly typical of our most carefully thought-out claims to knowledge that p is not the case; that we have later to admit, blushing, "Well, I thought I knew that p," or words to that effect. But at the same time, the state of mind was the same as if I had known, and it was the state of mind, in toto, which led to the original utterance (with all its characteristic bravado), "I know that p." For this reason, I suggest that an adequate analysis of knowledge claims must be in terms of the "mental set" (to use the psychologist's term) which accompanies the claim.

(2) It is generally agreed that knowledge is essentially propositional; certainly we have no method of conveying knowledge from one individual to another without formulating propositions; or if this is denied on the basis of telepathy or knowledge gained from pictures, etc., any item of knowledge can be expressed by means of a proposition (cf. the as-yet-undiscovered facts of the universe). One of the chief problems lies in the hiatus between the raw feel, the immediate awareness, say, of an Russellian atomic fact, and the formulating of the corresponding proposition. Bluntly, I must in some genuine sense 'know' the fact before I can formulate the proposition. And I am not confusing "proposition" with "sentence" here; we are surely all acquainted with the tripartite sensation of suddenly "seeing" something (the comic book light-bulb), recognizing the relationship existing between the atoms, then the "How-shall-I say-it" experience. This is not to deny that there is a fundamental relationship between knowledge and propositions, that true knowledge cannot be claimed unless there is a proposition that expresses it; but there must also be a germinal sense of 'knowledge' such that there is something which is being formulated in propositional terms. It may be argued that I am confusing 'proposition' with 'sentence' and 'sentence' with 'locution'; that one formulates sentences and not propositions. However it seems that introspection yields a relatively complex conscious process (leave, for the moment, any further processes in the electro-chemical domain of description) in response to such a question as, "Do you know where my ring is?" Or, "Do you know who is the prime minister of India?" You may instantly have an affirmative reaction--indication that you are aware that the piece of knowledge required is in fact at your command; then follows the searching process, the recognition (it may be a mental picture of the ring lying on

the kitchen window-sill, or a newspaper picture of Indira Gandhi), and finally the formulation of whatever locution is equivalent to "that the ring is on the window-sill". It is the recognition point that I wish to focus on in terms of non-propositional knowledge. In order to recognize the mental picture as the required piece of information, you must in some sense know it. And it is the conscious "eureka" experience which seems to me to be identical to the doxastic attitude which differentiates knowledge from belief irrespective of whether the proposition corresponding to the knowledge or belief is true or false.

Briefly, an adequate analysis of 'S knows that p' must include, along with all the restrictions on the evidential base, the fact of p or not-p, etc., the requirement of a certain doxastic attitude which may be (in fact, extension from the example quoted earlier on memory traces in monkeys, observable on an oscilloscope, indicates that it is) intersubjectively observable by means of electronic apparatus. It seems, in fact, much more likely that a satisfactory differentiation between knowledge and belief is possible in the language of science than in a linguistic analysis of the claims. I should be much more ready to accept that my brain is in a certain quantum state when I claim to know something, than to accept that I am giving assent to a number of propositions about the evidential base on which I have accepted truth of a proposition about the state of the universe. My brain states are observable; my conscious states are introspectible (and conceivably may some day become intersubjectively observable); I do not in fact inspect the evidential base when I make a knowledge claim, but I do frequently (especially if the claim is challenged) inspect the mental state--doxastic attitude--e.g., am I sure?

(c) Nothing, it seems, can be added to Feigl's last epistemological requirement until the evidence from empirical investigation makes

possible the "further postulates and correspondence rules".¹

7. Reconciliation: How shall we distinguish between

MENTAL	and	PHYSICAL
subjective		objective
non-spatial		spatial
qualitative		quantitative
purposive		mechanical
mnemic		non-mnemic
holistic		atomistic
emergent		compositional
intentional		"blind", nonintentional

First of all, the distinction must be viewed as analogous to the distinction between "canine" and "quadruped" rather than as analogous to that between "quadruped" and "biped"; we are looking for the criteria which will allow us to recognize the specific sub-class. In general mental events are that class of brain events which are conscious events; whether these are recognizable by means of electronic hardware remains to be seen, but the evidence favoring the affirmative is mounting daily.

The difference between subjective and objective may ultimately turn out to be specious. That my gate-post leans to the east is a putative objective fact; mine or anyone else's experience of the leaning gate-post is subjective. But to trade on Berkeley, what we mean by the locution "eastward-leaning gate-post" includes, if there is a percipient being there to observe, he will see a gate-post leaning eastward; that is, he will have the subjective(?) conscious experience of seeing the gate-post and that it leans toward the east. If it is an objective fact that the gate-post leans toward the east, then it is also an objective fact that a percipient being has a given experience; but this too remains

¹Herbert Feigl, op. cit., page 27

an unknowable Kantian noumenon unless we presuppose a second percipient being observing the first. Thus an infinite regress rapidly develops. By the subjective experience of the gate-post we are referring to an inner state of the percipient being with respect to some object of the universe other than itself (neglecting for the moment hallucinations). But the gate-post also has inner states which can be described in the language of science (as, I maintain, can those of the percipient being, with no nomological danglers), and these too may be states with respect to objects of the universe other than itself; i.e., there will be a certain amount of ionization of molecules in the gate-post with respect to the electromagnetic field within which it is located.

"Subjective" distinguishes the nature of the experience itself with respect to the manner in which A's experience of the gate-post is nonanalytically different from B's. And we must avoid the silly type of discourse here which gets involved in such questions as "How do I know that A's experience of the gate-post is not the type of experience which, if I had it, I would call an upsidedown post leaning west?" In one sense such considerations are silly because they cannot possibly yield any fruitful outcome; in another sense they strike at the heart of what subjectivity is all about. It is evident that all experience is mediated by the totality of the brain state--all previous experience, all previous brain states (conscious or not), as well as current states. But when this is recognized, then we recognize that so-called objectivity is unknowable in any sense whatever. Subjective states of affairs are known only to the single individual experiencing them; objective states of affairs are known by no one, ever. In this manner the presumed supremacy of the objective disappears.

The element which the whole discussion of objective versus subjective focusses on is the essential privacy supposed to be characteristic of a mental state as opposed to the publicity of at least some states in the non-mental domain. But if all we mean by this privacy is that a given experience cannot be had by anyone else, then the sense in which my experience of Mozart's Jupiter symphony is different from yours is not different from the sense in which my experience of the Mozart at t_1 differs from my experience at t_2 ; and it is a matter of observation that no such experience can be recaptured. The privacy which isolates one individual from another is the same as that which isolates an individual from himself at two different times. However, if the nature, in terms of natural science, of consciousness, is outlined in detail, the fact of privacy will be a clear consequence of its description. That is, if consciousness is a quantum effect resulting necessarily from the operation of the laws of physics on structures like that of the human brain, then for the same reason that no two brains are numerically identical, it would follow that no two conscious states could be identical, which seems to be all that we mean by the subjective/objective distinction.

Neither the spatial/nonspatial nor the qualitative/quantitative distinction needs further elucidation here; the spatial/non-spatial because it has been dealt with extensively elsewhere; the qualitative/quantitative because the theory being defended can rest quite happily upon Feigl's conclusion noted in Chapter I that it "makes perfectly good sense to speak of mental quantities and of physical qualities".¹

¹Herbert Feigl, op. cit., page 44

As I have shown previously, both Feigl and Armstrong provide what appear to be unassailable arguments showing that in the age of cybernetics and homing rockets, guided missiles, etc., there is no contradiction involved in the locution "teleological mechanism". And the only difference which can be suggested between such devices and the purposive behavior of humans lies in the consciousness of the process in the latter. The conceivability of the situation in which a computer reports that it is conscious is evidenced by the number of jokes and science fiction plots which depend upon this factor. And there does not seem to be any logical problem with the computer which reports awareness and substantiates it in all the familiar ways in which people indicate consciousness. With the recent synthesis of DNA it is now empirically possible, and possibly even technically possible, to synthesize an entire human being in the laboratory. That its reports of mental states would be accepted without question should be evident; however, the extreme dualist would probably deny it a "soul". What such a dualist could possibly be referring to is a mystery, and brings us to invoke the principle of difference. Given a normal human being conceived and developed in utero, and another the result of laboratory synthesis, have them raised and educated under externally identical conditions (either in a nursery or in a foster home in which the "mother" does not know either which is which or that one is in any way paranormal). How is the dualist going to distinguish between them? What question(s) will he ask that must necessarily decide between them? If the dualist is also a theist who believes in an after-life he may claim that he must wait to see which one experiences the after-life. However, it is not necessary for a dualist to believe either in the existence of gods or of an after-life, and even this would then be denied

him. (Not, of course, that he could have conveyed his findings to the rest of us with any degree of certainty--certainty could come only if the quantum theory of mind had previously been empirically shown to be correct!)

The nest of considerations that forms the holistic/atomistic, emergent/compositional basis for a differentiation of mental and physical is quickly disposed of in terms of quantum theory. One of the important contributions of quantum physics has been to show that the laws which govern given entities in isolation are not the laws which govern the highly complex structures of which those entities are a part.

Herbert Feigl anticipates in Section IV of The 'Mental' and the 'Physical' that "once quantum dynamics is able to explain the facts and regularities of organic chemistry (i.e., of non-living but complex compounds) it will in principle also be capable of explaining the facts and regularities of organic life."¹ What I have tried to do in this essay is to spell out in more specific terms the manner in which this may turn out to be, and the way in which the solutions to the various problems which constitute 'the' mind-body problem may be found.

¹Herbert Feigl, op. cit., p. 47

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