States of Consciousness and State-Specific Sciences

The extension of scientific method to the essential phenomena of altered states of consciousness is proposed.

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Blackburn (*1*) recently noted that many of our most talented young people are "turned off" to science: as a solution, he proposed that we recognize the validity of a more sensuous-intuitive approach to nature, treating it as complementary to the classical intellectual approach.

I have seen the same rejection of science by many of the brightest students in California, and the problem is indeed serious. Blackburn's analysis is valid, but not deep enough. A more fundamental source of alienation is the widespread experience of altered states of consciousness (ASC's) by the young, coupled with the almost total rejection of the knowledge gained during the experiencing of ASC's by the scientific establishment. Blackburn himself exemplifies this rejection when he says: "Perhaps science has much to learn along this line from the disciplines, *as distinct from the content,* of Oriental religions" (my italics).

To illustrate, a recent Gallup poll (*2*) indicated that approximately half of American college students have tried marijuana, and a large number of them use it fairly regularly. They do this at the risk of having their careers ruined and going to jail for several years. Why? Conventional research on the nature of marijuana intoxication tells us that the primary effects are a slight increase in heart rate, reddening of the eyes, some difficulty with memory, and small decrements in performance on complex psychomotor tests.

Would you risk going to jail to experience these?

A young marijuana smoker who hears a scientist or physician talk about these findings as the basic nature of marijuana intoxication will simply sneer and have his antiscientific attitude further reinforced. It is clear to him that the scientist has no real understanding of what marijuana intoxication is all about (*3*).

More formally, an increasingly significant number of people are experimenting with ASC's in themselves, and finding the experiences thus gained of extreme importance in their philosophy and style of life. The conflict between experiences in these ASC's and the attitudes and intellectual-emotional systems that have evolved in our ordinary state of consciousness (SoC) is a major factor behind the increased alienation of many people from conventional science. Experiences of ecstasy, mystical union, other "dimensions," rapture, beauty, space-and-time transcendence, and transpersonal knowledge, all common in ASC's, are simply not treated adequately in conventional scientific approaches. These experiences will not "go away" if we crack down more on psychedelic drugs, for immense numbers of people now practice various nondrug techniques for producing ASC's, such as meditation (*4*) and yoga.

The purpose of this article is to show that it is possible to investigate and work with the important phenomena of ASC's in a manner which is perfectly compatible with the essence of scientific method. The conflict discussed above is not necessary.

States of Consciousness

An ASC may be defined for the purposes of this article as a qualitative alteration in the overall pattern of mental functioning, such that the experiencer feels his consciousness is radically different from the way it functions ordinarily. An SoC is thus defined not in terms of any particular content of consciousness, or specific behavior or physiological change, but in terms of the overall patterning of psychological functioning.

An analogy with computer functioning can clarify this definition. A computer has a complex program of many subroutines. If we reprogram it quite differently, the same sorts of input data may be handled in quite different ways; we will be able to predict very little from our knowledge of the old program about the effects of varying the input, even though old and new programs have some subroutines in common. The new program with its input-output interactions must be studied in and of itself. An ASC is analogous to changing temporarily the program of a computer.

The ASC's experienced by almost all ordinary people are dreaming states and the hypnogogic and hypnopompic states, the transitional states between sleeping and waking. Many other people experience another ASC, alcohol intoxication.

The relatively new (to our culture) ASC's that are now having such an impact are those produced by marijuana, more powerful psychedelic drugs such as LSD, meditative states, so-called possession states, and autohypnotic states (*5*).

States of Consciousness and Paradigms

It is useful to compare this concept of an SoC, a qualitatively distinct organization of the patterning of mental functioning, with Kuhn's (*6*) concept of paradigms in science. A paradigm is an intellectual achievement that underlies normal science and attracts and guides the work of an enduring number of adherents in their scientific activity. It is a kind of "super theory," a formulation of scope wide enough to affect the organization of most or all of the major known phenomena of its field. Yet it is sufficiently open-ended that there still remain important problems to be solved within that framework. Examples of important paradigms in the history of science have been Copernican astronomy and Newtonian dynamics.

Because of their tremendous success,

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paradigms undergo a change which, in principle, ordinary scientific theories do not undergo. An ordinary scientific theory is always subject to further questioning and testing as it is extended. A paradigm becomes an implicit framework for most scientists working within it; it is the natural way of looking at things and doing things. It does not seriously occur to the adherents of a paradigm to question it any more (we may ignore, for the moment, the occurrence of scientific revolutions). Theories become referred to as laws: people talk of the law of gravity, not the theory of gravity, for example.

A paradigm serves to concentrate the attention of a researcher on sensible problem areas and to prevent him from wasting his time on what might be trivia. On the other hand, by implicitly defining some lines of research as trivial or nonsensical, a paradigm acts like a blinder. Kuhn has discussed this blinding function as a key factor in the lack of effective communications during paradigm clashes.

The concept of a paradigm and of an SoC are quite similar. Both constitute complex, interlocking sets of rules and theories that enable a person to interact with and interpret experiences within an environment. In both cases, the rules are largely implicit. They are not recognized as tentative working hypotheses; they operate automatically and the person feels he is doing the obvious or natural thing.

Paradigm Clash between "Straight" and "Hip"

Human beings become emotionally attached to the things which give them pleasure, and a scientist making important progress within a particular paradigm becomes emotionally attached to it. When data which make no sense in terms of the (implicit) paradigm are brought to our attention, the usual result is not a reevaluation of the paradigm, but a rejection or misperception of the data. This rejection seems rational to others sharing that paradigm and irrational or rationalizing to others committed to a different paradigm.

The conflict now existing between those who have experienced certain ASC's (whose ranks include many young scientists) and those who have not is very much a paradigmatic conflict. For example, a subject takes LSD, and tells his investigator that "You and I, we are all one, there are no separate selves." The investigator reports that his subject showed a "confused sense of identity and distorted thinking process." The subject is reporting what is obvious to him, the investigator is reporting what is obvious to him. The investigator's implicit paradigm, based on his scientific training, his cultural background, and his normal SoC, indicates that a literal interpretation of the subject's statement cannot be true, and therefore must be interpreted as mental dysfunction on the part of the subject. The subject, his paradigms radically changed for the moment by being in an ASC, not only reports what is obviously true to him, but perceives the investigator as showing mental dysfunction, by virtue of being incapable of perceiving the obvious!

Historically, paradigm clashes have been characterized by bitter emotional antagonisms, and total rejection of the opponent. Currently we are seeing the same sort of process: the respectable psychiatrist, who would not take any of those "psychotomimetic" drugs himself or sit down and experience that crazy meditation process, carries out research to show that drug takers and those who practice meditation are escapists. The drug taker or meditator views the same investigator as narrow-minded, prejudiced, and repressive, and as a result drops out of the university. Communication between the two factions is almost nil.

Must the experiencers of ASC's continue to see the scientists as concentrating on the irrelevant, and the scientists see the experiencers as confused (*7*) or mentally ill? Or can science deal adequately with the experiences of these people? The thesis I shall now present in detail is that we can deal with the important aspects of ASC's using the essence of scientific method, even though a variety of nonessentials, unfortunately identified with current science, hinder such an effort.

The Nature of Knowledge

Basically, science (from the Latin *scire*, to know) deals with knowledge. Knowledge may be defined as an immediately given experiential feeling of congruence between two different kinds of experience, a matching. One set of experiences may be regarded as perceptions of the external world, of others, of oneself; the second set may be regarded as a theory, a scheme, a system of understanding. The feeling of congruence is something immediately given in experience, although many refinements have been worked out for judging degrees of congruence.

All knowledge, then, is basically experiential knowledge. Even my knowledge of the physical world can be reduced to this: given certain sets of experiences, which I (by assumption) attribute to the external world activating my sensory apparatus, it may be possible for me to compare them with purely internal experiences (memories, previous knowledge) and predict with a high degree of reliability other kinds of experiences, which I again attribute to the external world.

Because science has been incredibly successful in dealing with the physical world, it has been historically associated with a philosophy of physicalism, the belief that reality is all reducible to certain kinds of physical entities. The vast majority of phenomena of ASC's have no known physical manifestations: thus to physicalistic philosophy they are epiphenomena, not worthy of study. But insofar as science deals with knowledge, it need not restrict itself only to physical kinds of knowledge.

The Essence of Scientific Method

I shall discuss the essence of scientific method, and show that this essence is perfectly compatible with an enlarged study of the important phenomena of ASC's. In particular, I propose that state-specific sciences (SSS) be developed.

As satisfying as the feeling of knowing can be, we are often wrong: what seems like congruence at first later does not match, or has no generality. Man has learned that his reasoning is often faulty, his observations are often incomplete or mistaken, and that emotional and other nonconscious factors can seriously distort both reasoning and observational processes. His reliance on authorities, "rationality" or "elegance," are no sure criteria for achieving truth. The development of scientific method may be seen as a determined effort to systematize the process of acquiring knowledge in such a way as to minimize the various pitfalls of observation and reasoning.

I shall discuss four basic rules of scientific method to which an investigator is committed: (i) good observation; (ii) the public nature of observation; (iii) the necessity to theorize logically; and (iv) the testing of theory by observable consequences; all these constitute the scientific enterprise. I shall consider the wider application of each rule to ASC's and indicate how unnecessary physicalistic restrictions may be dropped. I will show that all these commitments or rules can be accommodated in the development of SSS's that I propose.

Observation

The scientist is committed to observe as well as possible the phenomena of interest and to search constantly for better ways of making these observations. But our paradigmatic commitments, our SoC's, make us likely to observe certain parts of reality and to ignore or observe with error certain other parts of it.

Many of the most important phenomena of ASC's have been observed poorly or not at all because of the physicalistic labeling of them as epiphenomena, so that they have been called "subjective," "ephemeral," "unreliable," or "unscientific." Observations of internal processes are probably much more difficult to make than those of external physical processes, because of their inherently greater complexity. The essence of science, however, is that we observe what there is to be observed whether it is difficult or not.

Furthermore, most of what we know about the phenomena of ASC's has been obtained from untrained people, almost none of whom have shared the scientists' commitment to constantly reexamine their observations in greater and greater detail. This should not imply that internal phenomena are inherently unobservable or unstable; we are comparing the first observations of internal phenomena with observations of physical sciences that have undergone centuries of refinement.

We must consider one other problem of observation. One of the traditional idols of science, the "detached observer," has no place in dealing with many internal phenomena of SoCs. Not only are the observer's perceptions selective, he may also affect the things he observes. We must try to understand the characteristics of each individual observer in order to compensate for them.

A recognition of the unreality of the detached observer in the psychological sciences is becoming widespread, under the topics of experimenter bias (*8*) and demand characteristics (*9*). A similar recognition long ago occurred in physics when it was realized that the observed was altered by the process of observation at subatomic levels. When we deal with ASC's where the observer is the experiencer of the ASC, this factor is of paramount importance. Knowing the characteristics of the observer can also confound the process of consensual validation, which I shall now consider.

Public Nature of Observation

Observations must be public in that they must be replicable by any properly trained observer. The experienced conditions that led to the report of certain experiences must be described in sufficient detail that others may duplicate them and consequently have experiences which meet criteria of identicality. That someone else may set up similar conditions but not have the same experiences proves that the original investigator gave an incorrect description of the conditions and observations, or that he was not aware of certain essential aspects of the conditions.

The physicalistic accretion to this rule of consensual validation is that, physical data being the only "real" data, internal phenomena must be reduced to physiological or behavioral data to become reliable or they will be ignored entirely. I believe most physical observations to be much more readily replicable by any trained observer because they are inherently simpler phenomena than internal ones. In principle, however, consensual validation of internal phenomena by a trained observer is quite possible.

The emphasis on public observations in science has had a misleading quality insofar as it implies that any intelligent man can replicate a scientist's observations. This might have been true early in the history of science, but nowadays only the trained observer can replicate many observations. I cannot go into a modern physicist's laboratory and confirm his observations. Indeed, his talk of what he has found in his experiments (physicists seem to talk about innumerable invisible entities these days) would probably seem mystical to me, just as many descriptions of internal states sound mystical to those with a background in the physical sciences.

Given the high complexity of the phenomena associated with ASC's, the need for replication by trained observers is exceptionally important. Since it generally takes 4 to 10 years of intensive training to produce a scientist in any of our conventional sciences, we should not be surprised that there has been very little reliability of observations by untrained observers of ASC phenomena.

Further, for the state-specific sciences that I propose should be established, we cannot specify the requirements that would constitute adequate training. These would only be determined after considerable trial and error. We should also recognize that very few people might complete the training successfully. Some people do not have the necessary innate characteristics to become physicists, and some probably do not have the innate characteristics to become, say, scientific investigators of meditative states.

Public observation, then, always refers to a limited, specially trained public. It is only by basic agreement among those specially trained people that data become accepted as a foundation for the development of a science. That laymen cannot replicate the observations is of little relevance.

A second problem in consensual validation arises from a phenomenon predicted by my concept of ASC's, but not yet empirically investigated, namely, state-specific communication. Given that an ASC is an overall qualitative and quantitative shift in the complex functioning of consciousness, such that there are new "logics" and perceptions (which would constitute a paradigm shift), it is quite reasonable to hypothesize that communication may take a different pattern. For two observers, both of whom, we assume, are fluent in communicating with each other in a given SoC, communication about some new observations may seem adequate to them, or may be improved or deteriorated in specific ways. To an outside observer, an observer in a different SoC, the communication between these two observers may seem "deteriorated."

Practically all investigations of communication by persons in ASC's have resulted in reports of deterioration of

communication abilities. In designing their studies, however, these investigators have not taken into account the fact that the pattern of communication may have changed. If I am listening to two people speaking in English, and they suddenly begin to intersperse words and phrases in Polish, I, as an outside (that is, a non-Polish speaking) observer, will note a gross deterioration in communication. Adequacy of communication between people in the same SoC and across SoC's must be empirically determined.

Thus consensual validation may be restricted by the fact that only observers in the same ASC are able to communicate adequately with each other, and they may not be able to communicate adequately to someone in a different SoC, say normal consciousness (*10*).

Theorizing

A scientist may theorize about his observations as much as he wishes to, but the theory he develops must consistently account for all that he has observed, and should have a logical structure that other scientists can comprehend (but not necessarily accept).

The requirement to theorize logically and consistently with the data is not as simple as it looks, however. Any logic consists of a basic set of assumptions and a set of rules for manipulating information, based on these assumptions. Change the assumptions, or change the rules, and there may be entirely different outcomes from the same data. A paradigm, too, is a logic: it has certain assumptions and rules for working within these assumptions. By changing the paradigm, altering the SoC, the nature of theory building may change radically. Thus a person in SoC 2 might come to very different conclusions about the nature of the same events that he observed in SoC 1. An investigator in SoC 1 may comment on the comprehensibility of the second person's ideas from the point of view (paradigm) of SoC 1, but can say nothing about their inherent validity. A scientist who could enter either SoC 1 or SoC 2, however, could pronounce on the comprehensibility of the other's theory, and the adherence of that theory to the rules and logic of SoC 2. Thus, scientists trained in the same SoC may check on the logical validity of each other's theorizing. We have then the possibility of a state-specific logic underlying theorizing in various SoC's.

Observable Consequences

Any theory a scientist develops must have observable consequences, and from that theory it must be possible to make predictions that can be verified by observation. If such verification is not possible, the theory must be considered invalid, regardless of its elegance, logic, or other appeal.

Ordinarily we think of empirical validation, of validation in terms of testable consequences that produce physical effects, but this is misleading. Any effect, whether interpreted as physical or nonphysical, is ultimately an experience in the observer's mind. All that is essentially required to validate a theory is that it predict that "When a certain experience (observed condition) has occurred, another (predicted) kind of experience will follow, under specified experiential conditions." Thus a perfectly scientific theory may be based on data that have no physical existence.

State-Specific Sciences

We tend to envision the practice of science like this: centered around interest in some particular range of subject matter, a small number of highly selected, talented, and rigorously trained people spend considerable time making detailed observations on the subject matter of interest. They may or may not have special places (laboratories) or instruments or methods to assist them in making finer observations. They speak to one another in a special language which they feel conveys precisely the important facts of their field. Using this language, they confirm and extend each other's knowledge of certain data basic to the field. They theorize about their basic data and construct elaborate systems. They validate these by recourse to further observation. These trained people all have a long-term commitment to the constant refinement of observation and extension of theory. Their activity is frequently incomprehensible to laymen.

This general description is equally applicable to a variety of sciences, or areas that could become sciences, whether we called such areas biology, physics, chemistry, psychology, understanding of mystical states, or drug-induced enhancement of cognitive processes. The particulars of research would look very different, but the basic scientific method running through all is the same.

More formally, I now propose the creation of various state-specific sciences. If such sciences could be created, we would have a group of highly skilled, dedicated, and trained practitioners able to achieve certain SoC's, and able to agree with one another that they have attained a common state. While in that SoC, they might then investigate other areas of interest, whether these be totally internal phenomena of that given state, the interaction of that state with external, physical reality, or people in other SoC's.

The fact that the experimenter should be able to function skillfully in the SoC itself for a state-specific science does not necessarily mean that he would always be the subject. While he might often be the subject, observer, and experimenter simultaneously, it would be quite possible for him to collect data from experimental manipulations of other subjects in the SoC, and either be in that SoC himself at the time of data collection or be in that SoC himself for data reduction and theorizing.

Examples of some observations made and theorizing done by a scientist in a specific ASC would illustrate the nature of a proposed state-specific science. But this is not possible because no state-specific sciences have yet been established (*11*). Also, any example that would make good sense to the readers of this article (who are, presumably, all in a normal SoC) would not really illustrate the uniqueness of a state-specific science. If it did make sense, it would be an example of a problem that could be approached adequately from both the ASC and normal SoC's, and thus it would be too easy to see the entire problem in terms of accepted scientific procedures for normal SoC's and miss the point about the necessity for developing state-specific sciences.

State-Specific Sciences and Religion

Some aspects of organized religion appear to resemble state-specific sciences. There are techniques that allow

the believer to enter an ASC and then have religious experiences in that ASC which are proof of his religious belief. People who have had such experiences usually describe them as ineffable in important ways—that is, as not fully comprehensible in an ordinary SoC. Conversions at revivalistic meetings are the most common example of religious experiences occurring in various ASC's induced by an intensely emotional atmosphere.

In examining the esoteric training systems of some religions, there seems to be even more resemblance between such mystical ways and state-specific sciences, for here we often have the picture of devoted specialists, complex techniques, and repeated experiencing of the ASC's in order to further religious knowledge.

Nevertheless the proposed state-specific sciences are not simply religion in a new guise. The use of ASC's in religion may involve the kind of commitment to searching for truth that is needed for developing a state-specific science, but practically all the religions we know might be defined as state-specific technologies, operated in the service of a priori belief systems. The experiencers of ASC's in most religious contexts have already been thoroughly indoctrinated in a particular belief system. This belief system may then mold the content of the ASC's to create specific experiences which reinforce or validate the belief system.

The crucial distinction between a religion utilizing ASC's and a state-specific science is the commitment of the scientist to reexamine constantly his own belief system and to question the obvious in spite of its intellectual or emotional appeal to him. Investigators of ASC's would certainly encounter an immense variety of phenomena labeled religious experience or mystical revelation during the development of state-specific sciences, but they would have to remain committed to examining these phenomena more carefully, sharing their observations and techniques with colleagues, and subjecting the beliefs (hypotheses, theories) that result from such experiences to the requirement of leading to testable predictions. In practice, because we are aware of the immense emotional power of mystical experiences, this would be a difficult task, but it is one that will have to be undertaken by disciplined investigators if we are to understand various ASC's.

Relationship between State-Specific Sciences

Any state-specific science may be considered as consisting of two parts, observations and theorizations. The observations are what can be experienced relatively directly; the theories are the *inferences* about what sort of nonobservable factors account for the observations. For example, the phenomena of synesthesia (seeing colors as a result of hearing sounds) is a theoretical proposition for me in my ordinary SoC: I do not experience it, and can only generate theories about what other people report about it. If I were under the influence of a psychedelic drug such as LSD or marijuana (*3*), I could probably experience synesthesia directly, and my descriptions of the experience would become data.

Figure 1 demonstrates some possible relationships between three state-specific sciences. State-specific sciences 1 and 2 show considerable overlap.

The area labeled O_1O_2 permits direct observation in both sciences. Area T_1T_2 permits theoretical inferences about common subject matter from the two perspectives. In area O_1T_2, by contrast, the theoretical propositions of state-specific science number 2 are matters of direct observation for the scientist in SoC number 1, and vice versa for the area T_1O_2. State-specific science number 3 consists of a body of observation and theory exclusive to that science and has no overlap with the other two sciences: it neither confirms, denies, nor complements them.

It would be naively reductionistic to say that the work in one state-specific science *validates* or *invalidates* the work in a second state-specific science; I prefer to say that two different state-specific sciences, where they overlap, provide quite different points of view with respect to certain kinds of theories and data, and thus complement (*12*) each other. The proposed creation of state-specific sciences neither validates nor invalidates the activities of normal consciousness sciences (NCS). The possibility of developing certain state-specific sciences means only that certain kinds of phenomena may be handled more adequately within these potential new sciences.

Interrelationships more complex than those that are illustrated in Fig. 1 are possible.

The possibility of stimulating interactions between different state-specific sciences is very real. Creative breakthroughs in NCS have frequently been made by scientists temporarily going into an ASC (*13*). In such instances, the scientists concerned saw quite different views of their problems and performed different kinds of reasoning, conscious or nonconsciousness, which

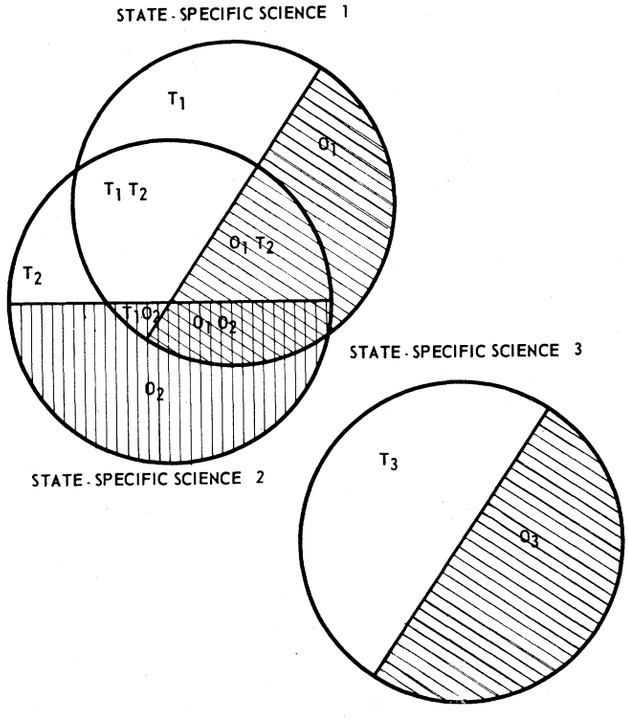

Fig. 1. Possible relationships between three state-specific sciences. The area labeled O_1O_2 is subject matter capable of direct observation in both sciences. Area T_1T_2 consists of theoretical (T) inferences about subject matter overlapping the two sciences. By contrast, in area O_1T_2, the theoretical propositions of state-specific science number 2 are matters of direct observation for the scientist in state of consciousness number 1, and vice versa for area T_1O_2. State-specific science number 3 consists of a body of observation and theory exclusive to that science.

led to results that could be tested within their NCS.

A current example of such interaction is the finding that in Zen meditation (a highly developed discipline in Japan) there are physiological correlates of meditative experiences, such as decreased frequency of alpha-rhythm, which can also be produced by means of instrumentally aided feedback-learning techniques (*14*). This finding might elucidate some of the processes peculiar to each discipline.

Individual Differences

A widespread and misleading assumption that hinders the development of state-specific sciences and confuses their interrelationships is the assumption that because two people are normal (not certified insane), their ordinary SoC's are essentially the same. In reality I suspect that there are enormous differences between the SoC's of some normal people. Because societies train people to behave and communicate along socially approved lines, these differences are covered up.

For example, some people think in images, others in words. Some can voluntarily anesthetize parts of their body, most cannot. Some recall past events by imaging the scene and looking at the relevant details; others use complex verbal processes with no images.

This means that person A may be able to observe certain kinds of experiential data that person B cannot experience in his ordinary SoC, no matter how hard B tries. There may be several consequences. Person B may think that A is insane, too imaginative, or a liar, or he may feel inferior to A. Person A may also feel himself odd, if he takes B as a standard of normality.

In some cases, B may be able to enter an ASC and there experience the sorts of things that A has reported to him. A realm of knowledge that is ordinary for A is then specific for an ASC for B. Similarly, some of the experiences of B in his ASC may not be available for direct observation by A in his ordinary SoC.

The phenomenon of synesthesia can again serve as an example. Some individuals possess this ability in their ordinary SoC, most do not. Yet 56 percent of a sample of experienced marijuana users experienced synesthesia at least occasionally (*3*) while in the drug-induced ASC.

Thus we may conceive of bits of knowledge that are specific for an ASC for one individual, part of ordinary consciousness for another. Arguments over the usefulness of the concept of states of consciousness may reflect differences in the structure of the ordinary SoC of various investigators.

Another important source of individual differences, little understood at present, is the degree to which an individual may first make a particular observation or form a concept in one SoC and then be able to reexperience or comprehend it in another SoC. That is, many items of information which were state-specific when observed initially may be learned and somehow transferred (fully or partially) to another SoC. Differences across individuals, various combinations of SoC's, and types of experience will probably be enormous.

I have only outlined the complexities created by individual differences in normal SoC's and have used the normal SoC as a baseline for comparison with ASC's; but it is evident that every SoC must eventually be compared against every other SoC.

Problems, Pitfalls, and Personal Perils

If we use the practical experience of Western man with ASC's as a guide, the development of state-specific sciences will be beset by a number of difficulties. These difficulties will be of two kinds: general methodological problems stemming from the inherent nature of some ASC's; and those concerned with personal perils to the investigator. I shall discuss state-related problems first.

The first important problem in the proposed development of state-specific sciences is the obvious perception of truth. In many ASC's, one's experience is that one is obviously and lucidly experiencing truth directly, without question. An immediate result of this may be an extinction of the desire for further questioning. Further, this experience of obvious truth, while not necessarily preventing the individual investigator from further examining his data, may not arouse his desire for consensual validation. Since one of the greatest strengths of science is its insistence on consensual validation of basic data, this can be a serious drawback. Investigators attempting to develop state-specific sciences will have to learn to distrust the obvious.

A second major problem in developing state-specific sciences is that in some ASC's one's abilities to visualize and imagine are immensely enhanced, so that whatever one imagines seems perfectly real. Thus one can imagine that something is being observed and experience it as datum. If one can essentially conjure up anything one wishes, how can we ever get at truth?

One way of looking at this problem is to consider any such vivid imaginings as potential effects: they are data, in the sense that what can be vividly imagined in a given SoC is important to know. It may not be the case that anything can be imagined with equal facility, and the relationships between what can be imagined may show a lawful pattern.

More generally, the way to approach this problem is to realize that it is not unique to ASC's. One can have all sorts of illusions, and misperceptions in our ordinary SoC. Before the rise of modern physical science, all sorts of things were imagined about the nature of the physical world that could not be directly refuted. The same techniques that eliminated these illusions in the physical sciences will also eliminate them in state-specific sciences dealing with nonphysical data—that is, all observations will have to be subjected to consensual validation and all their theoretical consequences will have to be examined. Insofar as experiences are purely arbitrary imaginings, those that do not show consistent patterns and cannot be replicated will be distinguished from those phenomena which do show general lawfulness.

The effects of this enhanced vividness of imagination in some ASC's will be complicated further by two other important problems, namely, experimenter bias (*8, 9*), and the fact that one person's illusion in a given ASC can sometimes be communicated to another person in the same ASC so that a kind of false consensual validation results. Again, the only long-term solution to this would be the requirement that predictions based on concepts arising from various experiences be verified experientially.

A third major problem is that state-specific sciences probably cannot be developed for all ASC's: some ASC's may depend on or result from genuine deterioration of observational and reasoning abilities, or a deterioration of volition. Those SoC's for which state-specific sciences might well be developed will be discussed later, but it should be made clear that the development of each science should result from trial and error,

and not from a priori decisions based on reasoning in our ordinary SoC's.

A fourth major problem is that of ineffability. Some experiences are ineffable in the sense that: (i) a person may experience them, but be unable to express or conceptualize them adequately to himself; (ii) while a person may be able to conceptualize an experience to himself he may not be able to communicate it adequately to anyone else. Certain phenomena of the first type may simply be inaccessible to scientific investigation. Phenomena of the second type may be accessible to scientific investigation only insofar as we are willing to recognize that a science, in the sense of following most of the basic rules, may exist only for a single person. Insofar as such a solitary science would lack all the advantages gained by consensual validation, we could not expect it to have as much power and rigor as conventional scientific endeavor.

Many phenomena which are now considered ineffable may not be so in reality. This may be a matter of our general lack of experience with ASC's and the lack of an adequate language for communicating about ASC phenomena. In most well-developed languages the major part of the vocabulary was developed primarily in adaptation to survival in the physical world.

Finally, we should recognize the possibility that various phenomena of ASC's may be too complex for human beings to understand. The phenomena may depend on or be affected by so many variables that we shall never understand them. In the history of science, however, many phenomena which appeared too complex at first were eventually comprehensible.

Personal Perils

The personal perils that an investigator will face in attempting to develop a state-specific science are of two kinds, those associated with reactions colloquially called a bad trip and a good trip, respectively.

Bad trips, in which an extremely unpleasant, emotional reaction is experienced in an ASC, and in which there are possible long-term adverse consequences on a person's personal adjustment, often stem from the fact that our upbringing has not prepared us to undergo radical alterations in our ordinary SoC's. We are dependent on stability, we fear the unknown, and we develop personal rigidities and various kinds of personal and social taboos. It is traditional in our society to consider ASC's as signs of insanity; ASC's therefore cause great fears in those who experience them.

In many ASC's, defenses against unacceptable personal impulses may become partially or wholly ineffective, so the person feels flooded with traumatic material that he cannot handle. All these things result in fear and avoidance of ASC's, and make it difficult or impossible for some individuals to function in an ASC in a way that is consistent with the development of a state-specific science. Maslow (*15*) has discussed these as pathologies of cognition that seriously interfere with the scientific enterprise in general, as well as ordinary life. In principle, adequate selection and training could minimize these hazards for at least some people.

Good trips may also endanger an investigator. A trip may produce experiences that are so rewarding that they interfere with the scientific activity of the investigator. The perception of obvious truth, and its effect of eliminating the need for further investigation or consensual validation have already been mentioned. Another peril comes from the ability to imagine or create vivid experiences. They may be so highly rewarding that the investigator does not follow the rule of investigating the obvious regardless of his personal satisfaction with results. Similarly, his attachment to good feelings, ecstasy, and the like, and his refusal to consider alternative conceptualizations of these, can seriously stifle the progress of investigation.

These personal perils again emphasize the necessity of developing adequate training programs for scientists who wish to develop state-specific sciences. Although it is difficult to envision such a training program, it is evident that much conventional scientific training is contrary to what would be needed to develop a state-specific science, because it tends to produce rigidity and avoidance of personal involvement with subject matter, rather than open-mindedness and flexibility. Much of the training program would have to be devoted to the scientist's understanding of himself so that the (unconscious) effects of his personal biases will be minimized during his investigations of an ASC.

Many of us know that there have been cases where scientists, after becoming personally involved with ASC's, have subsequently become very poor scientists or have experienced personal psychological crises. It would be premature, however, to conclude that such unfortunate consequences cannot be avoided by proper training and discipline. In the early history of the physical sciences we had many fanatics who were nonobjective about their investigations. Not all experiencers of various ASC's develop pathology as a result: indeed, many seem to become considerably more mature. Only from actual attempts to develop state-specific sciences will we be able to determine the actual SoC's that are suitable for development, and the kinds of people that are best suited to such work (*16*).

Prospects

I believe that an examination of human history and our current situation provides the strongest argument for the necessity of developing state-specific sciences. Throughout history man has been influenced by the spiritual and mystical factors that are expressed (usually in watered-down form) in the religions that attract the masses of people. Spiritual and mystical experiences are primary phenomena of various ASC's: because of such experiences, untold numbers of both the noblest and most horrible acts of which people are capable have been committed. Yet in all the time that Western science has existed, no concerted attempt has been made to understand these ASC phenomena in scientific terms.

It was the hope of many that religions were simply a form of superstition that would be left behind in our "rational" age. Not only has this hope failed, but our own understanding of the nature of reasoning now makes it clear that it can never be fulfilled. Reason is a tool, and a tool that is wielded in the service of assumptions, beliefs, and needs which are not themselves subject to reason. The irrational, or, better yet, the *a*rational, will not disappear from the human situation. Our immense success in the development of the physical sciences has not been particularly successful in formulating better philosophies of life, or increasing our real knowledge of ourselves. The sciences we have developed to date are not very human sciences. They tell us how to do things, but

give us no scientific insights on questions of what to do, what not to do, or why to do things.

The youth of today and mature scientists in increasing numbers are turning to meditation, oriental religions, and personal use of psychedelic drugs. The phenomena encountered in these ASC's provide more satisfaction and are more relevant to the formulation of philosophies of life and deciding upon appropriate ways of living, than "pure reason" (*17*). My own impressions are that very large numbers of scientists are now personally exploring ASC's, but few have begun to connect this personal exploration with their scientific activities.

It is difficult to predict what the chances are of developing state-specific sciences. Our knowledge is still too diffuse and dependent on our normal SoC's. Yet I think it is probable that state-specific sciences can be developed for such SoC's as auto-hypnosis, meditative states, lucid dreaming, marijuana intoxication, LSD intoxication, self-remembering, reverie, and biofeedback-induced states (*18*). In all of these SoC's, volition seems to be retained, so that the observer can indeed carry out experiments on himself or others or both. Some SoC's, in which the volition to experiment during the state may disappear, but in which some experimentation can be carried out if special conditions are prepared before the state is entered, might be alcohol intoxication, ordinary dreaming, hypnogogic and hypnopompic states, and high dreams (*18*). It is not clear whether other ASC's would be suitable for developing state-specific sciences or whether mental deterioration would be too great. Such questions will only be answered by experiment.

I have nothing against religious and mystical groups. Yet I suspect that the vast majority of them have developed compelling belief systems rather than state-specific sciences. Will scientific method be extended to the development of state-specific sciences so as to improve our human situation? Or will the immense power of ASC's be left in the hands of many cults and sects? I hope that the development of state-specific sciences will be our goal.

References and Notes

1. T. Blackburn, *Science* **172**, 1003 (1971).
2. *Newsweek*, 25 January 1971, p. 52.
3. An attempt to describe the phenomena of marijuana intoxication in terms that make sense to the user, as well as the investigator, has been presented elsewhere. See C. Tart, *On Being Stoned: A Psychological Study of Marijuana Intoxication* (Science & Behavior Books, Palo Alto, 1971).
4. C. Naranjo and R. Ornstein, *On the Psychology of Meditation* (Viking, New York, 1971).
5. Note that an SoC is defined by the stable parameters of the pattern that constitute it, not by the particular technique of inducing that pattern, for some ASC's can be induced by a variety of induction methods. By analogy, to understand the altered computer program you must study what it does, not study the programmer who originally set it up.
6. T. Kuhn, *The Structure of Scientific Revolutions* (Univ. of Chicago Press, Chicago, 1962).
7. Note that states of confusion and impaired functioning are certainly aspects of some drug-induced SoC's, but are not of primary interest here.
8. R. Rosenthal, *Experimenter Effects in Behavioral Research* (Appleton-Century-Crofts, New York, 1966).
9. M. Orne, *Amer. Psychol.* **17**, 776 (1962).
10. A state-specific scientist might find his own work somewhat incomprehensible when he was not in that SoC because of the phenomenon of state-specific memory—that is, not enough of his work would transfer to his ordinary SoC to make it comprehensible, even though it would make perfect sense when he was again in the ASC in which he did his scientific work.
11. "Ordinary consciousness science" is not a good example of a "pure" state-specific science because many important discoveries have occurred during ASC's, such as reverie, dreaming, and meditative-like states.
12. N. Bohr, in *Essays, 1958–1962, on Atomic Physics and Human Knowledge* (Wiley, New York, 1963).
13. B. Ghiselin, *The Creative Process* (New American Library, New York, 1952).
14. E. Green, A. Green, E. Walters, *J. Transpers. Psychol.* **2**, 1 (1970).
15. A. Maslow, *The Psychology of Science: A Reconnaissance* (Harper & Row, New York, 1966).
16. The ASC's resulting from very dangerous drugs (heroin, for example) may be scientifically interesting, but the risk may be too high to warrant our developing state-specific sciences for them. The personal and social issues involved in evaluating this kind of risk are beyond the scope of this article.
17. J. Needleman, *The New Religions* (Doubleday, New York, 1970).
18. C. Tart, *Altered States of Consciousness: A Book of Readings* (Wiley, New York, 1969).

PaleoIndian Settlement Technology in New Mexico

Both intercultural and intracultural variations in settlement are defined by an archeological survey.

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The portion of the central Rio Grande Valley dealt with in this article comprises some 3000 square miles of relatively unbroken plains and plateau-type terrain near Albuquerque, New Mexico (Fig. 1A). Long the scene of both professional and amateur archeological activity, the valley is known to have been occupied continuously for at least 12,000 years. Recently, a formal archeological survey was conducted to investigate evidence of variation in the settlement locations of the Paleo-Indians who occupied the area some 7,000 to 10,000 years ago. The boundaries of the region are well-defined topographically by mesas and mountain ranges, which facilitates its study as a geomorphologic and ecological entity.

Evidence derived from surface collections made prior to the formal survey indicated occupation of the area by at least four PaleoIndian cultures: Clovis, Folsom, Belen, and Eden (Cody complex). The Clovis, Folsom, and Eden manifestations closely parallel those found elsewhere in the Plains area (*1*). The Belen type appears to be related to the "parallel-flaked" Plano horizon, specifically to the Milnesand and Plainview projectile point types, and may be a local variant of this generalized category (*2*).

Because of the considerable size of the central Rio Grande Valley, and its potential for providing information regarding PaleoIndian settlement patterns, it was necessary to employ a survey

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