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Behaviourism, phenomenology and holism in psychology: a scientific analysis

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With some important exceptions scientific procedure has up to now been directed toward discovering causal relations between events. Science so pursued is essentially reductive and explains complexity in terms of emergent properties. The important exceptions to such procedures have considered as primitives, systems which establish a structure or state. Transitions from one structure or state to another are characterized by perturbation, relativity and the reasonableness of the characterization. In psychology, behaviorism is the expression of the causal approach to science while phenomenological and existential approaches express the relativistic, structural approach. In psychology, this latter type of procedure has become confounded with yet another, a wholistic, which is just beginning to be recognized as a legitimate scientific pursuit. It is suggested that transformations characterize wholistic science and that such transformations can be as rigorously specified as causal relations.

Behaviorism and psychology

The behaviorist revolution is completed. Its success is heralded in the numerous texts that proclaim psychology to be the study of behavior. We need now only to get on with our experiments, for all is well in our world.

Or is it ? Do the series of theoretical statements ranging from Watson's *Psychology from the Standpoint of a Behaviorist* through Gilbert Ryle's *The Concept of Mind* to Skinner's most recent *About Behaviorism* really accomplish a science of psychology ? Do the observations and experiments undertaken under the banner of behaviorism really address the problems and issues raised by philosophical inquiry ? And, further, do these observations and experiments really encompass all of the problems and issues that concern psychologists ?

The time appears right to ask these questions because the behaviorist revolution is indeed completed and its successes and failures can be reasonably assessed. Behaviorism as a vital scientific discipline continues to grow both in maturity and in new applications outside psychology.

Perhaps in this statement can be found the key to assessment. When a biologist observes behavior in an assay of a biochemical constituent of the brain, does he automatically become a practicing psychologist ? When a computer scientist attempts to simulate his thought processes on an information-processing program is he addressing a problem that does not concern psychologists because he is not observing or controlling behavior ? And what about the experimentalist who measures the

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electrical conduction of the skin, the heart rate, the movement of eyes or the electrical responses of the brain in a problem-solving situation? Is he measuring 'behavior' and if he is or is not does that matter with regard to whether he is pursuing psychology?

As an answer to these questions, another may be posed. Has it perhaps been a mistake to identify behaviorism with psychology? Behaviorism is a discipline—the study of behavior has its set of problems such as the definition of what constitutes behavior. As a discipline it has already made fantastic contributions to technology and the understanding of the behavior of animals and of men and women. And there is no reason why scientific psychology should not be *based* on such an understanding of behavior.

But there are limits to understanding achieved solely through the observation and experimental analysis of behavior. These limits are especially apparent when problems other than overt behavior are addressed, problems related to thought or to decisional processes, to appetitive and other motivational mechanisms, to emotions and feelings and even to imaging and perception. These problems make up a large bulk of the interests that bring students to the study of psychology, and at least one behaviorist (Skinner, 1976) has grouped them under the rubric 'covert behavior'. Being 'covert' they need to be enacted to be studied (Miller, Galanter & Pribram, 1960). Enactment in overt behavior is, however, only one avenue of study—others such as computer simulation or the recording and analysis of brain electrical activity may prove just as effective in achieving scientific understanding—perhaps even more so when used in combination with behavioral enactment.

In a very real sense, therefore, psychology as a science reaches out beyond behaviorism to these covert processes. Ordinarily, these covert processes have been labelled 'mental' and there is no good reason to abandon this label. Our perceptions such as vision and hearing are mental processes. Our feelings of emotion and motivation are mental, our intentions and decisions are mental and, as we shall see, even our actions are mental.

Psychology as the study of mental life, as William James and George Miller have called it, is biologically rooted—one aspect of *life* is studied. As such it aspires to be a conventional science. The problem lies in providing a useful definition of what is mental. Could not such a definition be derived from an analysis of behavior (and, if so, perhaps a more concrete terminology substituted). But, as already noted, problems of definition also plague behaviorism.

Some confusions

Psychology as a behavioral science and as the science of mental life needs therefore to have clearly defined what is meant by behavior and what is meant by mental. Here, the approach will be taken that confusion has plagued psychology because both the term 'behavior' and the term 'mental' have remained ambiguous. Each term has in fact been used in two very distinctly separate ways and the distinctions have not been clearly kept apart.

To begin with, the meaning of the term 'behavior'. When a behaviorist ordinarily analyses 'behavior' he is studying a record of responses emitted by an organism in a specified situation. The record can be studied in any location; it could have been produced in any of a number of ways by any number of different 'response systems'—arms, legs, beaks, etc. The behavior under study is an environmental consequence of any of these response systems (Pribram, 1971).

At other times, however, 'behavior' is understood to mean the pattern of the organism's movements, or of his endocrine or neural responses in a situation. This definition of behavior is especially common to biological behaviorists such as ethologists, but it is also invoked by psychologists (even staunch behaviorists) when they begin to address the problems of covert behavior.

What then is the concern of a science of behavior? Are its laws to be formulated on the basis of descriptions of the behaviors of organisms or the behaviors of organ (response) systems? Classically, the laws describing the behavior of organ systems have been the province of physiology. There are physiologists (and physiological psychologists) who believe that a lawful description of brain processes should be co-ordinate with the laws derived from observations of behavior. These physiologists may well be correct but because the brain is contained within the organism such identifications fall easy prey to the category errors warned against by Kant, by Russell and Whitehead and by all subsequent critical philosophers. In a strict sense a brain cell does not 'see' its 'visual' receptive field, the cell responds to excitation of its dendritic (receptive) field which results from luminance changes that have been transduced into neuroelectric potentials by retinal receptors. Perhaps the behaviorist will be content when the laws of behavior and those describing brain function coalesce—but that has not been the tenor of those who espouse the establishment of a science of behavior, separate from physiology.

The mentalists have not fared much better than the behaviorists in stating clearly what psychology, the study of mental life, is to be about. Are mental processes to be identified on the basis of verbal reports of introspection? Are they, therefore, the contents of introspection? Or are mental processes the resultants of an organism's being-and-acting-in-the-world as Whitehead, Husserl, the phenomenologists, *Gestalt* psychologists and existentialists would have it? Or are the contents of introspection nothing more than these resultants of being-(or acting)-in-the-world? If they are, what then is the difference between what a behaviorist calls covert behavior and the existentialist calls mental? Logically there is none.

Some differences

However, though logic can find little to distinguish an existential psychologist from a sophisticated behaviorist, historically the gap is great between how each goes about constructing his science. The behaviorist, as already noted, is devoted to objectively observable discrete behavioral responses—he makes inferences, yes, but these inferences must be operationally and explicitly tied to the environmental manipulations that produce these discrete observable behaviors of organisms.

By contrast, phenomenologists, *Gestalt* psychologists and existentialists analyze subjective experience. Contrary to opinions expressed by some behaviorists, these investigators do not eschew observation. Nor do their concepts, when derived scientifically, lack in operational rigor. As with behaviorists, the operations to which these concepts are tied are operations performed on the environment, not on the organism. Thus, they share the interests of psychophysicists. As psychologists, they use these operations to attain concepts about subjective experience (as reported verbally or inferred from non-verbal communication) instead of using them to attain laws describing behavior.

It is this remoteness of the measurable dependent variable from what is being studied that makes the mentalists' job more difficult than that of the behaviorist. But inference from observable events to non-observable ones is a commonplace in the natural sciences. Quantum and nuclear physicists have built precise models of the micro-universe from observing the effects of events on measurable variables rather than by observing the events themselves. Physiological chemists often postulate the presence of a biologically active substance from the effect it has, many years before that substance is identified chemically. In like manner a mentalist may investigate hunger, visual illusions or states of consciousness with the aim of modelling these experiences via their observed effects on reports of their occurrence or of finding a neuroelectric response to be co-ordinate with the experience.

Thus, a science of mental life is as likely to become rigorous and respectable as a science of behavior. This does not mean that the models of psychological experience and the laws of behavior will prove to be similar, any more than the models of quantum physics resemble the laws of mechanics. Psychology therefore can readily encompass both levels of inquiry—and perhaps other levels such as explorations of social communication, as well. Biology as well as physics has its molecular and molar divisions—why not psychology?

Stated in this fashion behaviorism becomes essentially a reductive endeavor. True, current behaviorists do not view themselves as reductionists. Skinner and others have repeatedly claimed that they are descriptive functionalists. But description entails the possibility (though not the necessity) of reduction (Pribram, 1965). By contrast, a phenomenal or existential approach eschews this possibility.

Phenomenal-existential mentalism is rooted in being-in-the-world. Basically, therefore, there is an upward—or perhaps better stated as an outward—reach, if experience is considered the starting point of inquiry. Experience is of a piece with that which is experienced. Issues of self, of intention and intentionality are derivative and always include a being-in-the-world approach to solution. Phenomenal and existential approaches thus share with social psychology the derivation of self or person from the being-in-the-social world.

Causes and reasons (structure)

There is another important and related distinction that separates behaviorism from a phenomenal-existential approach to psychological issues. The experimental analysis of behavior searches for *causes* in a tried and true scientific fashion. Skinner is interested in the environmental contingencies that *cause* reinforcement to occur. Other behaviorists are utilizing such reinforcing stimuli to *cause* a modification in behavior.

The existential-phenomenal approach is entirely different. At its most lucid, it is concerned with the *structure* of experience-in-the-world (Merleau-Ponty, 1963). It is perhaps significant that when George Miller, Eugene Galanter and I enlarged our compass and became *subjective* behaviorists we titled a book *Plans and the Structure of Behavior*, while Merleau-Ponty, attempting a precise formulation of existentialism, authored *The Structure of Behavior*. An analysis of structure does not involve a search for causes. Structure is multiply determined and has many *reasons* for being.

Existential-phenomenal psychology has not up to now been very clear in its methods. I suggest that multidimensional analyses (factor analysis, principal components analysis, step-wise discriminant analysis) might serve well as tools to investigate the *structure* of experience-in-the-world. Linguists have also provided models of analysis: after all, structuralism derives from the social and linguistic analyses of de Saussure (1922).

Another conceptual tool that could prove useful to existential-phenomenal psychology comes from physics. In looking upward in a hierarchy of systems, Einstein found relativity. The larger view showed that the local calculations were dependent on context. Is not this the everyday experience of the phenomenologist? The contextual dependency of experience is what makes its *structure* so rich, but this very richness makes its structural relationships so difficult to specify. Relativity (whether the special or the general theory) is difficult enough to grasp for physical systems—how much more difficult will it be for the psychological?

Holograms and transformation

Recent discoveries in the brain sciences augur yet another approach to psychology that is utterly different from the behavioristic and phenomenal-existential. This approach has more in common with that of the mystics, the depth psychology of Carl Jung (1960) and the more recent transpersonal conceptualizations (see, e.g., Tart, 1977). It is also kin to the views expressed by philosophers such as Leibnitz in the Monadology and by Whitehead (1958). Many modern physicists have espoused similar concepts to explain observations made at the quantum and nuclear levels of inquiry: David Bohm (1971, 1973) and Wigner (1969) to name two of the foremost.

Holography was initially seen as a powerful metaphor to explain the distributed nature of memory traces in the brain (Pribram, 1966). Clinical or experimental lesions of neural tissue do not remove specific memories: Lashley (1960) in his paper on the search for the engram despaired of comprehending the biological basis of memory organization because of this resilience of learned behavior to brain damage. But a hologram has just these properties: a holographic store, the photographic film, can be injured or cut up into small pieces and an image can still be reconstructed from any of the pieces—thus the name *hologram*: every part contains sufficient information to characterize the whole.

Holograms are blurred records of images and objects. Each point of light is spread over the entire film as is every adjacent point. However, the blur is an orderly one and the set of mathematical expressions that define the blur (such as the Fourier transform) are often called spread functions. A good way to conceptualize the nature of the spread is to visualize the concentric circles of ripples made by a pebble thrown onto the smooth surface of a pond. Throw in two pebbles and the spreading concentric circles will cross each other and create interference patterns; throw in a handful of pebbles and when the interference patterns are at their maximum, take a photograph of the surface of the pond. That photograph is a hologram.

Because the spread of ripples, waves, can be precisely specified, it is possible to recreate the location of impact of each pebble by performing the inverse of the mathematical operation (the spread function) that described the creation of interference patterns. The procedure is similar to that performed by NASA when an orbiting camera is taking a photograph of the surface of Venus or Mars. The photograph is a blur but because the speed of the camera relative to the planet is known, that 'speed' can be subtracted out and a clear image obtained.

Holograms thus provide a ready instrument for spreading—distributing—information which can easily be retrieved by performing the inverse of the transform by which the hologram is constructed. In fact, when Fourier transforms are used, the same mathematical equation describes the initial transform and its inverse. Thus by repeating the *same* procedure an image of an object is obtained.

Why bother with these transformations? What are the attributes of holograms that make them so useful? There are many, but the most important for understanding brain function are: (1) the readiness with which images can be reconstructed from a distributed store; (2) the resistance of a distributed store to injury; (3) a fantastic advantage in computing power: practically instantaneous cross and auto-correlations are possible (this is why in X-ray tomography calculations are made in the Fourier domain); (4) a tremendous increase in storage capacity—recently a billion bits of retrievable information has been stored in a cubic centimeter of holographic memory; (5) the fact that images constructed from one part of the hologram are recognizably similar to those constructed from another (translational invariance); (6) the facility for associating two 'images' in the holographic store and retrieving both in the absence of one—i.e. when only one of the previously associated images is present, illumination of it and the hologram will reconstruct the other, as is the case in associative recall.

This is an impressive list of attributes that can go a long way in explaining hitherto persistent puzzles of brain functioning in memory and perception. But is there any evidence that the brain actually encodes sensory input in a holographic fashion? Over the past decade such evidence has been coming out of the researches of many laboratories and I have reviewed it elsewhere (Pribram, 1974). Essential is the fact that the mathematical descriptions of sensory processes fit those that describe holography (e.g. Ratliff, 1961, 1965; Bekesy, 1967) and that the cells of the sensory channel and brain cortex have actually been shown to encode in the holographic domain (Campbell & Robson, 1968; Glezer, Ivanoff & Tscherbach, 1973; Pollen & Taylor, 1974; Robson, 1975; Schiller, Finlay & Volman, 1976; De Valois, Albrecht & Thorell, 1978*a*, *b*; Movshon, Thompson & Tolhurst, 1979*a*, *b*, *c*; Pribram, Lassonde & Ptito, 1979). The evidence is impressive and the experimental results obtained by De Valois and his students have specifically tested alternative interpretations and have left little doubt as to the validity of the earlier results.

A hologram, as noted above, encodes 'ripples' made by a disturbance (a pebble, a sensory input). Ripples are vibrations, waves and the evidence is that individual cells in the brain cortex encode the frequency of waves within a certain bandwidth. Just as the strings of a musical instrument resonate to a specific range of frequency so do the cells of the brain cortex. Many hitherto ununderstandable sensory and motor functions can best be explained in terms such as frequency analytic mechanisms—sensitivity to the spectrum of vibrations and fluctuations of energy in the physical environment and within the organism itself (Pribram, 1971).

It is here that contact with physics is made. David Bohm (1971, 1973) has pointed out that the discrepancies in conceptualization that lead to the complementarity between particles and waves arise because, since Galileo, we have relied almost exclusively on *lenses* for our views of the physical macro- and micro-universe. He asks, what if we looked at the world through gratings which produce holograms—i.e. took seriously the frequency domain as a possible organization of the universe? Lenses focus, they objectify, particularize and individuate. Holograms are the result of holonomic processes which distribute energy and provide for a wholistic organization in which each part represents the whole and the whole implies each part. Bohm calls the lens view of reality the explicate, and the holonomic view the implicate order.

If brain and the physical universe are seen to share this implicate holonomic order, then each portion of the order, each organism, for instance, must in some sense represent the whole universe. In turn, the universe must imply each organism, each of us. Physicists have been drawing such conclusions for a half century (see, e.g., Capra, 1975), but they are new to biologists and experimental psychologists. Such conclusions are extremely difficult to comprehend and therefore frightening. In addition, they sound so much like those described by mystics on the basis of their transcendental experiences that hard-headed scientists are apt to shy away from formulations that are derived from an enterprise so totally different and foreign to the ordinary scientific method.

Still, the facts must be explained and the holonomic explanation is a powerful one. A good deal of this power comes from its *precision*. For the first time a wholistic conceptualization can be made as rigorously and mathematically precise as a particularistic one. For psychology such precision is a necessity since its data are so varied. As noted above, behaviorism provides precision by searching for *causes*. Existential-phenomenal psychologies, if they are to attain precision must enact form in reasonable *structures* that explicate experience. Holonomic, i.e. holistic, psychology depends on discovering *transformations* for its precision. By specifying the transfer functions involved in moving from one state to another, the holistic approach is made as scientifically respectable as any other. Explicitly adding structure and transformation to the search for causes is long overdue and imperative if scientific conceptualizations are to deal with the richness of problems raised by the advances in scientific technology.

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