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Some Historical and Conceptual Relations among Logical Positivism, Operationism, and Behaviorism

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Historical and conceptual relations among logical positivism, conventional operationism, and behaviorism are examined from the standpoint of Skinner's radical behaviorism. Although logical positivism and conventional operationism sought the formulation and application of an epistemology based strictly upon physicalistic principles and experiential verification, the application of that epistemology in psychology has resulted in the perpetuation, rather than the resolution, of a number of mentalistic, if not outright dualistic, problems.

According to Passmore (1967), logical positivism is the name characterizing the set of philosophical ideas advanced by a group of scholars called the Vienna Circle, who met in Vienna during the 1920s and 1930s to discuss the changing nature of scientific knowledge. Although the special impetus for the Circle's discussions lay in the epistemological challenge posed by quantum mechanics and relativity theory in physics, its members addressed a wide range of problems, and the approach to scientific knowledge that they advanced turned out to be extraordinarily influential, in that it had a profound impact upon scientific knowledge generally, in disciplines far beyond just the physical sciences. Indeed, one of the disciplines in which the impact of logical positivism was especially conspicuous was psychology, which was going through a conceptual revolution of its own, comparable in many respects to that which was occurring at about the same time in physics. This revolution was behaviorism. As noted elsewhere (e.g., Day, 1976, p. 68), during the 1930s, the subject matter and methods of psychology were undergoing massive reformulation, and behaviorism, logical positivism, and operationism were all involved. The aim of the present paper is to examine historical and conceptual relations among logical positivism, operationism, and behaviorism, with an eye toward assessing certain of their mutual influences, their similarities, and their differences.

LOGICAL POSITIVISM

Background

As indicated above, in the first two decades of the present century, the science of physics had been thrown into turmoil by the twin revolutions of relativity theory and quantum mechanics. A host of unobserved entities of uncertain status were being proposed as explanations for a variety of newly emerging phenomena at something called the "atomic" level. No longer was it meaningful to claim that scientific knowledge possessed an enduring, absolute quality, based upon direct observation of natural events. Rather, scientific knowledge appeared to depend on particular frames of reference within which a scientist operated. Largely in response to such developments in physics, then, the members of the Vienna Circle set out to assess the respects in which a fundamentally empirical approach to scientific knowledge was still to be recommended (see also Suppe, 1974, and Turner, 1967, for additional historical background).

Although the Circle was headed by a philosopher (Schlick), many of its members were not formally trained in philosophy, but rather were trained in mathematics and physics (e.g., Carnap and Godel); one was even an economist

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(Neurath). In any case, irrespective of their particular intellectual backgrounds, the members of the Circle did not see themselves so much as creating any new school of philosophical thought, but rather as continuing to work within the broadly interpreted tradition of empiricist philosophy already associated with Hume, Comte, Mach, Mill, Poincare, Duhem, Russell, and Wittgenstein. Thus, the members of the Circle saw themselves as synthesizing important elements of skepticism, empiricism, phenomenalism, pragmatism, constructionism, and mathematical logic into a new "philosophy of science," by means of which both new and old scientific concepts might be evaluated, reinterpreted, and if necessary, corrected.

Basic Tenets

Logical positivism was essentially concerned with epistemology, that is, with the nature and limits of human knowledge. As an epistemological position, logical positivism therefore involved statements on the interrelations among science, philosophy, logic, and metaphysics, particularly regarding claims to knowledge, and on the conditions under which linguistic assertions about nature are to be considered as meaningful, so that they may serve as a foundation for the aforementioned claims to knowledge.

Logical positivism evolved over the years, with different members of the Circle emphasizing different features from a set of basic concerns (cf. Schlick vs. Carnap vs. Neurath on physicalism in Passmore, 1967, pp. 55–56), hence the position should not be regarded as some static enterprise that remained unchanged from its inception. Indeed, political pressure from Naziism forced the members to disperse during the 1930s, primarily to the U.S. and England, where their work was taken up, elaborated, and perhaps subtly altered by philosophers in those countries who claimed some continuity of interest. Thus, logical positivism should be understood as a complex position, despite the present attempt to simplify it. Allowing for these considerations, the following is offered as a consensus representation of the basic tenets of logical positivism (Passmore, 1957, 1967; Suppe, 1974; Turner, 1967). As such, logical positivism holds:

(a) that the methods of science are the only route to valid knowledge, and that the methods of science start with establishing the meaning of a proposition about nature by specifying the method of its experiential verification; propositions that can not be experientially verified are simply meaningless for science;

(b) that science is nothing more than the conceptual reflection upon the contents of a scientist's immediate experience, and that scientific statements should therefore be interpreted as propositions that report what is given in the scientist's immediate experience;

(c) that claims to knowledge predicated upon metaphysically given, a priori elements are to be rejected, since these claims can not be experientially verified;

(d) that all science may be unified under the analysis of how scientists operate upon the contents of their immediate experience, and how they employ physicalistic definitions (i.e., intersubjectively verifiable procedures and intersubjectively verifiable readings from meters, dials, and counters) in support of their concepts; and

(e) that language is a syntactical system for structuring knowledge, and that an understanding of the expression of that knowledge entails an understanding of the roles of logic and syntax in matters of construction, substitution, transformation, reduction, and proof.

As indicated in the summary above, an essential feature of this position is the rejection with a vengeance of metaphysical speculation as a basis for any claim to knowledge. Philosophy was to be regarded as an analytical activity aimed at clarifying the nature of an epistemological enterprise, rather than metaphysical speculation that provided a basis for an epistemological enterprise. Thus, the logical positivists took the position that such statements as, "There is an absolute reality that is beyond space and time," were esentially meaningless nonsense, which could not be argued as either true or false. Such statements posed pseudo-problems that could not even be meaningfully addressed, since they could not be resolved by any known method of experiential verification. In short, logical postivism insisted upon direct experiential contact with nature as a basis for claims to knowledge. The intelligibility of sub-

stances and forces that exceeded the domain of scientific investigation, the demarcation line for which was established by sensory experience, was denied. The immediate implication of this program for scientific procedure was that questions of "Why?" were typically rejected as posing pseudo-problems, insofar as they were interpreted as inquiries into metaphysical powers and forces. The preference was to reformulate questions of "Why?" into questions of "How?," which then could be answered on the basis of observational data (see Baum, 1974, pp. 449–450).

Logic and syntax were central in logical positivism because they specified the permissible operations and manipulations according to which actual, working knowledge was to be wrought from the contents of propositions, again under an assumption that the implication or inference of the logical argument could be verified experientially. In practice, scientific statements were held to be meaningful only to the extent that deductions were possible that were testable in the form of predictions that could be matched against experiential sense data. Hence, the logical positivists held (see Turner's, 1967, discussion of Hempel, p. 275) that the scientific enterprise should consist essentially of the following steps:

(a) formulating some universal covering law that itself contained propositions or statements of relationships, under the ever-present restriction that the terms and concepts contained therein were defined in terms of their empirical meaning;
(b) deducing implications of the law, given statements expressing the antecedent conditions; and
(c) checking to see if those implications accorded with sense data.

Note that scientific explanation and scientific prediction under the foregoing position are taken to be symmetrical processes, in the sense that they have the same formal structure. The description of the event that has been scientifically explained, or the description of the event that has been scientifically predicted, may be seen as actually the conclusion to the deductive argument that has one or more universal covering laws among its major premises, and features of the experimental situation among its minor premises. [Technically, of course, predictions differ from explanations in that the truth of the covering law is what the scientist is trying to determine. When predictions do not accord with sense data, the law as expressed is held to be refuted. When predictions do accord with sense data, scientists are tempted to claim their proposed law is confirmed, but as Popper (1959) later pointed out, to accept such evidence as confirming the truth of the law is to commit the fallacy of affirming the consequent. Perhaps scientists should say that the law is "corroborated."]

Logical Positivism, Operationism, and Psychology

Viewed in historical perspective, logical positivism may be seen to have exerted an enormous impact upon science in general and upon the development of American psychology in particular, which during the 1920s was in its own state of epistemological turmoil owing to the tension between the vestiges of classical structuralism and an emerging pragmatic, functional, behavioral orientation to psychology. A few words on the relation between logical positivism and psychology would now seem appropriate. According to Boring (1950, pp. 653–659), the initial locus of the impact of logical positivism upon psychology was Harvard University. Herbert Feigl, a member of the Circle, came on fellowship to Harvard in 1930 to work in the philosophy of science. Feigl was particularly interested in pursuing the ideas of P. W. Bridgman, the Harvard physicist, who had published *The Logic of Modern Physics* in 1927. In this book, Bridgman had espoused a principle that would come to be known as operationism: A scientific concept is synonymous with the corresponding set of experimental operations by which it might be measured in a laboratory. Feigl had seen the important continuity between operationism and logical positivism, namely, that the measurement operations in the laboratory constituted the method of experiential verification that gave meaning to scien-

tific terms, and he introduced the Harvard psychologists to Bridgman's ideas, to logical positivism, and to operational procedures in general. Through seminars and laboratory lunches, the Harvard psychologists gradually became acquainted with the new way of doing science, and eventually the old structural psychology concerned with consciousness, private experience, and introspection gave way to a new, "scientific," "objective" psychology, ostensibly concerned only with objectively verifiable stimulus operations and behavioral data. Logical positivism and operationism thereby became virtually synonymous as cornerstones of the new scientific epistemology. Although the new psychology derived from operationism and logical positivism during the 1930s was not exactly monolithic, given the diversity of people that were involved (e.g., Boring, Stevens, Bergmann, Spence, Tolman, McGeoch, Pratt, and Hull), American psychology can at least be said to have undergone a monumental revolution as a consequence of the appearance of operationism and logical positivism upon the intellectual scene. Indeed, the influence remains, because for many contemporary psychologists, the doctrines of logical positivism and operationism are taken virtually to *define* science (see Day, 1969, pp. 490–491, and 1980, pp. 255–257).

LOGICAL POSITIVISM, OPERATIONISM, AND BEHAVIORISM

Some General Similarities

At first glance, logical positivism and conventional operationism seem to have much in common with Skinner's radical behaviorism as a philosophy of science (see Baum, 1974; Killeen, 1976; and Zuriff, 1980, for arguments that radical behaviorism as a philosophy of science may not be so different from the philosophy espoused by more traditional figures in psychology, such as Spence and Stevens). Indeed, Skinner himself had initially been encouraged by the ostensible rejection of the mental and subjective, by the rejection of mental explanatory fictions, and by the formulation of psychological issues in terms of behavior. He felt his doctoral thesis was essentially an "operational analysis of the reflex," and he explicitly acknowledged the intellectual influence of Mach and Bridgman in his early work (e.g., Skinner, 1979, pp. 161–163). Skinner's first book, *The Behavior of Organisms* (Skinner, 1938), similarly acknowledged a certain influence of positivism and proposed a descriptive behaviorism: "the system set up in the preceding chapter may be characterized as follows. It is positivistic. It confines itself to description, rather than explanation. Its concepts are defined in terms of immediate observations . . ." (Skinner, 1938, p. 44). Skinner also acknowledged a distinction, derived from Comte's positivism, of a difference between sciences in which experimental intervention is and is not involved (see Skinner, 1972, p. 297). Skinner's point, of course, was that a science of behavior was the sort of science in which experimental intervention aimed at manipulation and control could be carried out, and psychology should therefore be considered like such other sciences as physics and chemistry, rather than like astronomy or taxonomical biology. Other common features among behaviorism, logical positivism, and operationism could be said to include the rejection of explanations that appeal to supernatural, mystical, or animistic causal powers and forces; an emphasis on the importance of the description of observable phenomena, particularly as expressed in the form of quantitatively verifiable functional relations; and a focal concern with practical, pragmatic matters related to prediction, manipulation, and control of actual events, rather than with the elaboration of nominally metaphysical structures.

Some General Differences

In retrospect, an alternative historical interpretation of events during the 1930s is that logical positivism and operationism became prominent at a time when Skinner was keenly interested in establishing a behavioristic alternative to the

prevailing mentalism. Logical positivism and operationism appeared to offer the possibility of a new start, using a fresh set of concepts secured from the analysis of newly emphasized data, and Skinner was enthusiastic about that possibility. However, Skinner's early enthusiasm was based upon an interpretation of the possibilities offered by logical positivism and operationism that was quite different from what was to become the mainstream position. According to Skinner's interpretation, the behavioral revolution began in the United States with Watson's embrace of Pavlov's principle of the conditioned reflex and the addition of the existing notion of "habit" to it. The result was a kind of S-R psychology. Watson then argued vigorously that this conceptual framework was the appropriate one in which to interpret all behavior. Throughout the 1920s and into the first part of the 1930s, the early behaviorists then extolled the virtues of the objectivity of this approach and attempted to work the framework it provided. However, as Skinner (1969, p. 4) suggests, despite the benefits of Watson's arguments, it was not easy to show plausibly that all behavior could be accommodated in such terms. Not all responses were antedated by the kind of stimuli required, nor were all kinds of stimuli producing the required responses. The problem was particularly acute in the analysis of human behavior, as in the analysis of what were called images and verbal reports about subjective states. By the middle 1930s, the S-R framework began to be challenged, as well it needed to be, but the challengers simply relocated the determiners of behavior inside the organism. What emerged were variations on S-O-R psychology, where various "organismic" variables were postulated to alleviate the obvious shortcomings of S-R psychology, but still retain some semblance of objectivity. This position was never good behaviorism, but it was often resorted to by behaviorists themselves, insofar as it was an expedient resolution to a critical problem. Moreover, the postulation of these organismic variables was made all the more attractive by logical positivism and operationism, which implicitly made legitimate the postulation for explanatory purposes of any sort of organocentric act, state, mechanism, or process, provided some intersubjective measure could be made of the concept. As Skinner saw it, the dimensional problems created by the postulation of such terms, rather than their constructional nature per se, were the central issue.

Throughout the 1930s, Skinner was busy developing his own program for a science of behavior, particularly in the area of distinguishing operant from respondent behavior. His verbal behavior in *The Behavior of Organisms* clearly shows the vestiges of his early concern with the reflex (see Day, 1969, p. 490, and Moore, 1983, pp. 317–318), but is not at all indicative of subsequent stages in his position. In any case, by 1945 and Boring's Symposium on Operationism, Skinner had finally had enough, and he formally let fly at the folly of the mainstream position, which he caustically designated as "the operationism of Boring and Stevens" and "methodological behaviorism." Indeed, Day (1969, pp. 490–491) has noted that Skinner's (1945) contribution to that symposium is a "bitter repudiation" and a "forceful indictment" of what logical positivism and operationism had become for psychology. Given Skinner's later position on logical positivism and operationism in psychology, then, it may be well not to make too much of the similarities mentioned above. With the foregoing as a historical perspective on the 1930s, some fairly general conceptual differences may now be noted between Skinner's interpretation and the mainstream position (see Stevens, 1939, and Boring, 1950, chapters 24 and 25, for a presentation of the mainstream position; see Moore, 1975, 1981, for further analysis of that position).

According to the mainstream position, the behavioral revolution was primarily important as a methodological revolution, wherein only accurate, verifiable public data were to be used in psychology. This methodology was seen as the antidote to the problems of classical

structuralism, in which the focal concern was with establishing an account of the realities of conscious mental functioning from the building blocks of introspective reports. Under the auspices of logical positivism and operationism, the mainstream position during the 1930s came distressingly to entail establishing that same account out of the building blocks of intersubjectively verifiable stimulus operations and behavioral data (cf. Stevens, 1939).

As indicated above, Skinner's contrasting interpretation was that logical positivism and operationism would aid the behavioral revolution by forcing the re-examination of the observational bases of certain important concepts. Skinner contended that the mainstream position essentially involved postulating concepts that were cherished for extraneous and irrelevant reasons, and then after the fact asserting that some public phenomenon could be taken as the representation of that concept. What Skinner called for was the very careful, step by step derivational approach, of observation first and construction second. He felt Mach's treatment of the concept of force in physics was illustrative, and attempted to apply the same techniques in his own analysis of the concept of the reflex. There was no doubt that it was possible to set up acceptable operational definitions of subjective terms commonly thought to be essential in psychology, but such a project was just a patch-up job. A genuinely operational analysis would reveal that talk about the subjective concepts in psychology derived from a vast vocabulary of ancient and non-scientific origin, as well as from other influences traceable to the lay culture, history, philosophy, and linguistics.

In the program as Skinner envisioned it, hypotheses, theories, and deductive implications were not to be rejected *per se*. Newton showed the value of these techniques, even given his theological proclivities. Rather, what was to be rejected was the belief that by hypothesizing fictions one could effectively pursue knowledge of anything, irrespective of what measurements might be made. The logical positivists and operationists implicitly assumed that any term was just a logical category, constructed by the scientist, and that the important consideration was to establish what did and did not count as a measure of it. The logical positivists and operationists assumed license to construct any kind of entity, and hence they kept in psychology all the old mentalistic explanatory fictions. Instead, Skinner argued, the doctrines of logical positivism and operationism should be employed to assess the extent to which terms were or were not derived from actual contact with experimental operations. If the terms were derived from such contact, they could be left in. If they were not, and Skinner felt most terms from subjective psychology were not, then they could be discarded in favor of concepts that worked. A thorough house-cleaning was in order.

Similarly, Skinner called for a psychology that used terms from the dimensional system of physics and biology, but Skinner's physicalism differed from that of the logical positivists and operationists. For the logical positivists and operationists, physicalism was the thesis by which mental phenomena were to be instantiated in physical terms. "Sensations," to the extent they were mental phenomena, were therefore to be accommodated by referring to neurophysiological brain states, which were physical phenomena that could be measured, at least in principle. Although the logical positivists and operationists tried not to, they tacitly assumed there was another dimension beyond the physical, even though phenomena from this dimension could not be part of science; rather, only physical phenomena could be part of science, and scientific laws had to be expressed strictly in terms of physical phenomena, without regard to phenomena ostensibly in the mental dimension. This approach is perhaps not so conspicuous in the operationism of Boring and Stevens, although it is conspicuous in the work of Bergmann, who unselfconsciously endorsed psycho-physiological parallelism (Natsoulas, 1984).

In contrast, Skinner's physicalism is

something akin to metaphysical materialism, if it should be called a metaphysical position at all. Skinner (1969, p. 248) himself identifies the linguistic difficulty of saying there is only one world, the world of matter, because then the word "matter" is not especially useful. Perhaps it is most meaningful to say that Skinner's physicalism represents a combination of (central state) materialism, (naive) realism, and no doubt several other -isms as well, although in such unique combination as to make it different from any -ism taken in isolation.

Nevertheless, Skinner's physicalism does not hold that such phenomena as sensations should be understood as simply the observation of a brain state. To touch a hot stove hurts; observing pointers indicating brain stimulation is another matter, concerned with another (i.e., visual) form of stimulation. The latter form of stimulation may yield valid information about the first, but it is not identical with the first. There is no reason to suppose that because events occur inside the skin they have non-physical dimensions. Skinner's physicalism is therefore not a reductionism related to meter readings of neurophysiological brain states, nor does it consist of uncritically accepting the term "mental" as necessarily establishing the existence of a non-physical dimension, just because it is a word often used in contrast to physical. The word "mental," just as any other word, is occasioned by "physical" discriminative stimuli, and the issue is how to formulate the process by which such stimulus control is exerted. To paraphrase and annotate a selection from Skinner (1945, p. 294), the distinction between public and private is by no means the same as that between physical and mental. That is why methodological behaviorism [which, because of a commitment to truth by agreement, is obliged to reject the meaningfulness of anything upon which two people cannot be brought into agreement as metaphysically speculative and ineffable; under this criterion, public becomes physical and private becomes synonymous with mental and metaphysical] is very different from a radical behaviorism [which does not make the dimensional attribution and can thereby distinguish between public and private on the basis of the number of persons who have access to the event in question, but keep both sorts of events as physical]. Hence, when Skinner contends his toothache is just as physical as his typewriter, though not public, he is arguing against the implicit dimensional problems created by logical positivism and operationism, particularly as manifested in the operationism of Boring and Stevens, as in saying that toothaches, by virtue of being private [subjective or mental] experiences in a non-physical dimension, can only be meaningfully dealt with by assessing the extent to which some physicalistic procedure, such as a rating scale, verbal report, or meter/pointer reading, may serve as the referential index to what is meant by the term. If one cannot come up with an acceptable account of the processes by which a vocabulary descriptive of a toothache is acquired and maintained, then there is no recourse but to fall back upon Cartesian dualism.

Certain writers (e.g., Martin, 1978) have noted an apparent inconsistency in Skinner's writings over the years—at times he appears to be endorsing logical positivism and operationism and at others criticizing them. Indeed, Martin (1978) has suggested that Skinner may be a kind of methodological behaviorist himself. An alternative interpretation of Skinner's verbal behavior is that over the years, Skinner has been grinding many axes, and that he has inadvertently expressed himself in troublesome ways. At times (Skinner, 1945, 1953), he is objecting to ordinary, lay culture mentalism and to something like a structural psychology, based upon introspective methods. This form of argument is especially prevalent in Skinner's early writing, when he was advocating the possibility of a behavioral science that employed empirical, objective methods and that formulated events in a naturalistic, physical, and materialistic dimension. This possibility, of course, is just what logical positivism was concerned with, and so it seems as though Skinner is allied with

the same position he criticizes. At other times, however, Skinner argues in favor of a behavioral science that employs empirical, objective methods, but he is not endorsing such an approach as a means to an end, namely, as the point of entry into the pursuit of events going on somewhere else, in some other dimension, at some other level of observation, to be described in different terms, which is the agenda of the logical positivist and the conventional operationist. He is instead arguing in favor of a descriptively consistent science, where behavior is dealt with as a subject matter in its own right. Skinner has unfortunately jumped back and forth across these several issues, and it is not immediately clear at times (see especially Skinner, 1974, chapter 1) which one is he pursuing, hence the unclarity.

Some More Specific Differences

A more specific set of differences between Skinner and both the logical positivists and operationists concerns the "closet mentalism" inherent in the way the logical positivists and conventional operationists formulate the verbal behavior of scientists, and the way the logical positivists and operationists identify the contribution of private phenomena to that verbal behavior as scientists predict, control, and explain. In brief, analysis of the positivistic position suggests that in seeking to circumvent the problems of an outright metaphysical dualism, the conventional operationists and logical positivists have embraced an alternative that might be called an "epistemological dualism" (Boring, 1950, p. 667), and that this alternative is not entirely free from its own epistemological and ontological difficulties. We may now turn to an examination of these difficulties.

The referential nature of language. First, the conventional operationists and logical positivists have assumed that human language is essentially referential. Words have become entities that are attached to other entities called meanings. The meanings are of course private in principle, but can be reduced to the relation between a designating linguistic symbol and a corresponding set of public observations, in order to establish agreement about that to which the symbol refers. It follows from this assumption that humans possess the capacity for a private language that enables them to describe the contents of immediate experience and the logical operations that are carried out upon the contents. This conception of a private language with a set of private logical rules is absolutely fundamental to the general orientation to epistemological issues associated with conventional operationism and logical positivism, and Skinner, along with Wittgenstein (see Day, 1969), has found this conception of privacy untenable. Accordingly, Skinner's writings over the years reflect a great concern with expressing his own conception of privacy (for further discussion of the behavioristic conception of privacy, see also Moore, 1980, 1984).

The distorted role of linguistic construction. Second, the view of science that has evolved, concerning constructs that are created in the mind of the scientist and then tested via public experimentation, seems to distort the role of linguistic construction and hypothetico-deductive techniques. Not only are words viewed as referential, but new terms with new meanings are viewed as being created by means of logical operations. These new terms, of course, are typically designated as "logical constructs," "theoretical entities," "hypothetical constructs," or "intervening variables." The problem is that important aspects of scientific behavior go unexamined, as in "Where do the constructs, propositions, hypotheses, or covering laws come from in the first place, and what precurrent activities will extend the generality of a scientist's account?" It seems to go unrecognized that much of science is directly observed as the verbal behavior of scientists—indeed, all of scientific theory is observed as verbal behavior—and that an attempt to understand the factors that operate to make scientists generate their theories in the way that they do might be useful. In more behavioristic terms, the concern is not with identifying events, either public or

private, that act as discriminative stimuli in the emission of scientific verbal behavior. As Skinner said, the operationists and logical positivists are not genuinely operational because they do not truly abandon fictions, in formulating the behavior of either the experimenter or the subject (see further discussion in Schoenfeld, 1969, pp. 336–338; Skinner, 1945, pp. 292–293, 1969, pp. ix–x; Day, 1980, p. 227 ff.). All manner of mentalistic entities may be brought in, under the guise of "scientism" because some objective technique may be argued as standing for the term. However, the fact remains that the scientists are still implicitly endorsing an S-O-R approach, and loading up the organism with mentalistic entities that are cherished for irrelevant and extraneous reasons. Even Boring (1950, p. 660) and Stevens (1939, p. 231) readily conceded that all the old mentalistic entities could be included in the new psychology under the umbrella of operationism.

Truth by agreement. Third, the logical positivists have become so involved with establishing "truth by agreement" that agreement itself becomes of central concern, not whether scientists are getting anywhere with their control over nature. A means–end reversal occurs, where agreement, which is supposed to be a means for evaluating knowledge, becomes an end in itself. Any meaningful analysis of what scientists actually do when they operate successfully on nature is overlooked, in favor of the promulgation of a rather formal set of methodological prescriptions concerning what scientists *should* be doing in order to be successful. As Skinner (1945) said, an alternative criterion according to which the "truth" of a scientific concept might be assessed is pragmatic, that is, whether scientists can accomplish the useful things they want to accomplish by "using the concept." Success, rather than agreement, is what breeds contentment (see also Day, 1980, p. 234–237).

Solipsism and personal knowledge. Fourth, logical positivism and operationism conceive of knowledge as a sort of personal possession, to which the scientist has a kind of privileged access. Unfortunately, this position does not really resolve the problem of solipsism (see also Skinner, 1969, p. 227). Given the premise that there is a mental dimension of immediate experience that contains a personalized copy of the public world, how can one be sure that the observation of public phenomena is valid? If all one can ever observe is a mental copy called immediate experience, how is it a resolution to appeal to a public operation when the public operation is technically not what is seen anyway? Claims of knowledge, then, seem to entail the appeal to some Ultimate Authority from a superordinate dimension; one just has to come with the proper supplication, that is, with publicly observable data.

Ironically, the logical positivists and operationists have come to invoke the very set of metaphysical phenomena they set out to reject. Far from avoiding the transcendental distinction between mind and matter, or between experience and reality, the logical positivists and operationists have actually encouraged it, despite their intentions to the contrary. They have assumed that events relevant to the analysis of human action (in this case, the human action of doing science) actually are going on somewhere else, in some other dimension, at some other level of observation, to be talked about, if at all, in different terms. Words are taken as somehow expressing knowledge about the inherent nature of an ultimate Platonic or Kantian reality that is different from the world of experience. This reality is in a logico-theoretical dimension, and ultimately some transcendental Mind has to be invoked to know "things-in-themselves" as they exist in this reality.

Inability to deal with abstract phenomena. Fifth and perhaps most troublesome, the logical positivists have conceded there is a diverse but highly important set of topics related to human conduct (ranging from occurrent private events to ethics and values) about which a science of behavior can have nothing valid to say, at least not without resorting to wholly implausible contrivances. In rough terms, the logical positivists ap-

pear to assume that, if the metaphysical can not be experientially confirmed, any issue on which two persons can not be brought into manifest agreement based on a common sensory experience must also be metaphysical, and hence unapproachable by science. The expedient resolution is to have science be concerned with concrete facts rather than values, with intersubjectively verifiable data rather than ethical principles. The consequence is that important aspects of human conduct are insulated from scientific consideration. As Skinner (1953, 1957, 1971) has argued repeatedly, these aspects may be meaningfully interpreted in light of the findings of a scientific analysis of human behavior. They do not have to be defined as the subject matter of other disciplines, simply because one view of science has formulated them as issues upon which a science of behavior must be silent simply because no single palpable referent can be found to command agreement.

SUMMARY AND CONCLUSIONS

In summary, it seems most meaningful to say that what Skinner took from operationism and logical positivism is the assumption that science entails the behavior of scientists. From such an assumption, the operational analysis of science entails the analysis of the contingencies that influence the behavior of the scientist. Perhaps certain of the elements in the contingencies will prove to be private; if so, their private nature is no reason to exclude them from consideration, or to say that when science is analyzed these phenomena must be characterized differently from public phenomena. Presumably, one of the important aims of science is to produce a set of generically prescriptive statements regarding the kind of action that may be taken to achieve a desired outcome, often though not exclusively, through intervention, manipulation, and control (Skinner, 1974, chapter 14). An illumination of the factors that act upon scientists as they develop such statements is what a science of science could be about. Constructed verbal behavior will presumably play a major role in this process (Skinner, 1957, chapter 18), but the way to approach the issue is in terms of a causal analysis of the verbal behavior of the scientist, even when private stimuli may be involved. To paraphrase Skinner (1945, p. 277), if it turns out that the resulting view of scientific verbal behavior challenges our preconceptions about the ostensible supremacy of logic and truth value, then so much the worse for logic, which will also have been accommodated by the analysis.

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