

On Privacy, Causes, and Contingencies

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Radical behaviorism may be distinguished from other varieties of behaviorism, notably methodological behaviorism, by the way it accommodates private events in causal explanations of behavior. That is, in an operational sense, radical behaviorism accommodates private phenomena in the context of the three term contingency of reinforcement with regard to their discriminative function, their nature as responses, or their reinforcing function. In any case, any contribution of a private phenomenon is presumably linked at some point to a prior public event that has endowed the private phenomenon with its functional significance.

When one first begins to study radical behaviorism systematically, one is likely to encounter the statement that radical behaviorism may be differentiated from other kinds of psychology on the basis of the position taken with respect to private events. Although such a statement may be true, the statement is not likely to have a significant impact on anyone who does not already appreciate why a position on privacy should be important. Why in fact should a position on privacy be important? Presumably, after the smokescreen created by methodological concerns related to "intersubjective verifiability" and "objectivity" has cleared (Skinner, 1945, pp. 292-293), a position on privacy is important in the context of causal analyses of behavior: what role is to be given to private phenomena in causal explanations of behavior, particularly in the human case? Indeed, behavioristic criticisms of mentalistic approaches entail in large measure criticisms of the particular kind of causal role implicitly or explicitly assigned to private phenomena (see Moore, 1981, p. 63). Radical behaviorism seems to have developed a unique conception of privacy in regard to causal explanations, and it seems appropriate to consider certain of the more salient features of that conception, if only to clarify them.

Perhaps the compound term "private event" may not be the most precise way to characterize our concerns. According to behavioristic usage, the term "public" means something that is, and the term "private," something that is not, accessible to the verbal community (Skinner, 1964, p. 107). The skin often correlates with the boundary between the two cases, and although the skin may not constitute the definitive boundary, it works well enough to suffice in casual discourse. Unfortunately, such usage roughly maps onto the lay usage of the terms physical and mental. The lay usage of the terms mental and physical presumably implies a bifurcation of nature into two mutually-exclusive ontological realms, but such a bifurcation is absent in radical behaviorism. Accordingly, it may be a little too simple to paraphrase the behavioristic alternative by noting that there is indeed only one world, the world of matter that is dealt with by such other sciences as biology and physics, because then the word matter and a position of materialistic realism may not be especially meaningful (Skinner, 1969, p. 248). In some cases the behavioristic position may even be misunderstood as a concession that another world exists in some sense, and that this other world must be dealt with in a special way by a science of behavior, if a science of behavior can deal with it at all (Skinner, 1953, p. 258). In any case, if we are concerned with the dimensions of the things studied by psychology and the methods relevant to their study, then presumably we are also

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strongly interested in, and may have taken a materialistic position on, the nature of the stuff of which the world is made and whether it is made of one stuff or two.

What about the term "events?" As Schnaitter (1981) has noted, events are intractable things, ranging from particle interactions to the "big bang," with key pecks, lever presses, the decline and fall of the Roman Empire, and presumably also toothaches and orgasms, in between. But we as behaviorists tend to formulate behavioral things of causal interest to us in terms of contingencies, and so it may be useful to recast the issues before us. In particular, it may be useful to recast the issue of the relation between privacy and causal analyses of behavior by addressing the operational issues of private responses, private stimuli, and private consequences.

PRIVATE RESPONSES

Behavior and Physiology

A private response, of course, is an instance of behavior. When one is talking about behavior, one is presumably talking about neuromuscular and neuroglandular activities of the organism that are correlated with a stimulus. Thus, Skinner (1938) states "behavior is that part of the functioning of an organism which is engaged in acting upon or having commerce with the outside world By behavior, then, I mean simply the movement of an organism or its parts in a frame of reference provided by the organism itself or by various external objects or fields of force" (p. 6). Behavior is further identified as either operant behavior or respondent behavior. Operant behavior is behavior whose probability is attributable to its consequences, whereas respondent behavior is behavior whose probability is attributable to the presentation of specific eliciting stimuli (Catania, 1979).

Admittedly, what is to be taken as an instance of behavior by the aforementioned criteria is somewhat unclear. For example, is digestion then to be counted as private behavior, i.e., a response that

occurs because of a food stimulus in the gut? Is respiration then to be considered as a private response, attributable to the presence of oxygen in the lungs? It is extraordinarily difficult to answer such questions as these, because they concern the very boundary between physiology and psychology. One of the characteristics of living organisms is that certain changes occur when an organism comes into contact with features of the environment. In the sense that radical behaviorists use the term behavior, respiration and digestion are more properly classified as physiological processes, rather than as behavioral processes. Consider the descent of a falling body from an airplane. This descent may be examined by physicists who look, for example, at the relation between speed and duration of the fall, as they might with any other falling body. The fall is certainly something the organism is doing, yet few would argue that the fall is the subject matter of psychology. The factors responsible for the being up in the plane, for jumping from the door, and so on, are probably the appropriate subject matter for psychology, but describing the course of descent in relation to time is probably not.

The issue, then, is not whether the response can be classified as behavior on the basis of its topographical features, but rather on the basis of why the response occurs, i.e., on the basis of the interactions involved. Behavioral processes can, of course, be superimposed over physiological processes. One can hold one's breath past the time at which one would ordinarily breathe in. One can also breathe more rapidly than ordinarily. However, physiological processes are also superimposed over behavioral processes: eventually, one will resume breathing after holding one's breath because one has lapsed into unconsciousness. The factors participating in each interaction are appreciably different and lead accordingly to different classifications. Similarly, different external stimuli may inhibit digestion, produce ulcers, and so on, in which case we are presumably talking again about the superimposition of a behavioral process upon a physiological pro-

cess. As before, one classifies whether or not a given activity counts as response as a function of the participating factors.

Private Respondents and Private Operants

It follows from the foregoing that by private responses we ordinarily mean private respondents and private operants. What is a private respondent? Salivating with one's mouth closed would presumably count, but perhaps of greater interest is the variety of autonomic responses resulting from coming into or terminating contact with reinforcing, aversive, and punishing stimuli.

What is a private operant? We generally mean here covert activity related to overt activity. In fact, the response may have actually been acquired in an overt form. It may be covert in its current instance for a variety of reasons. It may be more conveniently executed in its covert form. It may avoid aversive consequences associated with behaving publicly. Or, the stimuli that would ordinarily occasion a response in overt form may be weak and deficient, with the result that the covert form appears. Specifically, in the case of private operants the response may be verbal in nature, although there is no reason to subsume all private operants under Watson's heading of "subvocal speech" (see also Moore, 1980, p. 463, and Skinner, 1957, p. 435).

Implicating neuromuscular or neuroglandular activities means that when a response has occurred, physiological systems within an organism's body may have been active in some way. Most commonly, responses are "executed" with an entire integrated physiological system, and, particularly with operants, the response typically achieves some public effect. Nevertheless, the response may involve execution at a variety of different levels and so may be of interest to psychologists in a variety of different ways. Perhaps it is appropriate to place these levels on a continuum: At one end of the continuum is the response as it is executed in a public way, and at the other, the incipient or inchoate stages of the response. In between are covert forms of

the response executed with more or less the same physiological apparatus as overt forms, although on a reduced scale or magnitude (Skinner, 1957, p. 438). The circumstances that determine the different forms of a response are presumably those identified in the paragraph above.

It is perhaps premature to attempt to designate in a comprehensive way the neurophysiology according to which private responses are executed. Whether anything like a CNS substratum is involved (Moore, 1980, p. 463; Skinner, 1957, p. 435) or whether supplemental activities combine with pristine activities to determine the final response form (Moore, 1980, p. 467) is not presently clear. One might talk of button pushing as publicly executed and then talk of smaller scale EMG potentials, but what about perceptual phenomena from such a perspective? Skinner talks frequently about interpreting seeing as a behavioral process (e.g., Skinner, 1969, p. 251), and indeed it may be useful to so interpret it, but does such an interpretation mean that the visual system is really something like a funny kind of biceps? Confirming knowledge from neurophysiology will presumably put the entire account in good order (see Roland, 1982; Roland, Larsen, Lassen, & Skinhoj, 1980; Roland, Skinhoj, Lassen, & Larsen, 1980), although it may be useful to elaborate the analysis now at the conceptual level in an attempt to give the neurophysiologist some more solid clues what to look for (Skinner, 1969, p. 283). In this heuristic sense, we may now offer an analysis of the functional significance of such private responses. To achieve such an analysis, we may begin with the matter of private stimulation.

PRIVATE STIMULATION

With regard to private stimulation, three important cases may be identified. One is discriminative stimulation arising from private operants or private accompaniments of public operants. A second is discriminative stimulation arising from private respondents or from private accompaniments of public respondents. A

third is discriminative stimulation arising from normal physiological functioning, such as the cases of feelings, sensations, and the development of other conditions attendant upon our being sentient creatures that come into contact with biologically relevant stimulation or in the cases of internal aches, pains, injuries, trauma, and other conditions associated with our physiological well-being. Alternatively stated, we are concerned here with private stimulation arising from our own behavior or from internal conditions relevant to our biological welfare. The elaboration of private stimulation in the above way implies that the importance of such stimulation derives from the extent to which it enters into contingencies that control subsequent operant behavior, verbal or non-verbal, public or private.

In the Skinnerian argument, private stimuli acquire discriminative control by virtue of a special history involving public differential reinforcement from members of the verbal community. A recent review article has summarized the process, and noted its importance (Moore, 1980). Thus, the argument is that private stimuli may be considered causal in the sense that they contribute to discriminative control over a succeeding response. However, the notion of discriminative control is not equivalent to the notion of exclusive antecedent causation, where causal efficacy is fully vested in the antecedent condition in the manner of the reflex arc. Any robustly discriminative control exerted by the private stimulus may be traced back through the private stimulus to other conditions that have resulted in the acquisition of control by that private stimulus. Thus, Skinner notes with respect to covert behavior, that "the private event is at best no more than a link in a causal chain, and it is usually not even that. We may think before we act in the sense that we may behave covertly before we behave overtly, but our action is not an 'expression' of the covert response or the consequence of it. The two are simply attributable to the same variables" (Skinner, 1953, p. 279; see also Moore, 1975, p. 129).

An organism can confront aspects of its own behavior because it possesses the requisite interoceptive and proprioceptive systems. These systems are the medium of contact. Discriminative control cannot be established without contact by way of such a medium. Just as one cannot verbally report whether a light is on or off when one is blindfolded and hence deprived of a medium of contact, one can't verbally report what one is doing at any particular stage of an activity without stimulation in a medium that provides contact with that stage. Of course, even with a medium of contact, special contingencies, especially regarding the verbal community, must prevail to circumvent the problem of privacy (Moore, 1980; Skinner, 1945).

Particularly in the case of private operant behavior, what we are concerned with is indicated in the lay vocabulary by such words as thinking, problem solving, reasoning, and recall. The behavioristic argument is that one's private behavior may come to function as a source of discriminative stimulation, just as one's public behavior may come to act as a source of discriminative stimulation. The argument is that behavior involves the activity of some physiological structure within the body somewhere. The interoceptive and proprioceptive nervous systems may therefore be considered the medium of contact with that behavior. Just as we make contact with our public behavior via our exteroceptive systems, so do we make contact with our private behavior via our interoceptive/proprioceptive systems (Skinner, 1974, Chapter 2, Chapter 13).

Now, the neurophysiological mediating activity that provides continuity from early stages to later in the temporally extended activity of (a) motor systems, (b) of sensory systems, or (c) between sensory and motor systems, as in (a) Hullian rg-sg mechanisms, (b) the movement produced stimuli of Watson and Guthrie, or (c) any of a variety of theoretically inferred mediating devices such as those proposed by Spence is not what we ordinarily mean by this sort of private stimulation. In many cases, what are being

proposed are nothing more than neurological explanatory fictions, in an effort to salvage the reflex-arc model of antecedent causation. Even if such activity is meaningful, there is some doubt as to whether we have the requisite interoceptive/proprioceptive systems to give us contact with this sort of activity (Skinner, 1974, Chapter 13). If the activity is relevant at all, it is presumably relevant to a science of muscle physiology or kinesiology for its motor aspects or sensory physiology for its sensory aspects, rather than to a science of psychology. Unfortunately, the way that such activity has traditionally been invoked by theorists gives it the status of a solely sufficient antecedent physiological cause, or the physiological correlate of a solely sufficient mental cause, of behavior. This sort of invocation seems especially true of information processing or cognitive approaches to psychology, and one might question whether anything even remotely related to that proposed by cognitive psychologists will ever be found within the skin. Several years ago Skinner (1969) noted "that an adequate science of behavior must consider events taking place within the skin of the organism, not as physiological mediators of behavior, but as part of the behavior itself" (p. 228). This statement was presumably occasioned by Hull's proposal of rg-sg mechanisms, but its applicability may actually be somewhat greater. Certain activity going on inside the skin may be considered as within the domain of psychology to the extent that it contributes independent variables that enter into the contingencies that control the behavior in question, and that contribution is an empirical issue. Accordingly, the mere fact that some activity occurs within the skin doesn't mean that the activity can only be considered as within the domain of physiology or that if an attempt is made to bring it into the domain of psychology, it must be invoked as a physiological cause of behavior, or as the physical correlate of a mental cause.

There is a corollary to the above position, however; the corollary is that the psychologist interested in a causal expla-

nation of behavior need not feel compelled to account for every bit of activity that goes on within the skin. Some of that activity is properly and legitimately within the domain of physiology, and may remain there. Some day we will know what happens when a stimulus impinges upon the skin of an organism, what happens inside the organism after that, in a series of stages the last of which is the point at which the organism operates upon the environment and ultimately changes it. But all these inner events will be accounted for with techniques of observation and measurement appropriate to the physiology of the various parts of the organism, and the account will be expressed in terms appropriate to that subject matter. The physiological account of behavioral processes will not replace, but rather complement, the functional account that specifies the controlling contingencies, and surely the verbal behavior of the psychologist will be more effective when confirmed by greater physiological knowledge (Skinner, 1972, p. 269, p. 309).

Private stimuli may become involved in private sensory or perceptual behavior when we come into contact with that behavior via interoceptive/proprioceptive systems, as when we note that we are concentrating or focusing our attention upon something. Occasionally, it may happen when "we see that we are seeing," although a more accurate rendition of this case might be that "I see that my overt behavior is under the control of a visual discriminative stimulus, rather than under the control of an auditory or olfactory stimulus." Private perceptual behavior *per se* (dreaming, imagining, visualizing) includes supplemental activity not in the sensory track with which we make contact via associated interoceptive/proprioceptive systems. The perceptual behavior is evoked, not by the object customarily perceived, but rather via the supplemental source of stimulation, which was present when the object customarily seen was seen originally. There may also be some contribution from exteroceptive stimuli that bear resemblance to the originally perceived object

or stimuli that have accompanied the originally perceived object through the process of stimulus generalization; such a contribution is not necessarily a matter of private stimulation. Accordingly, not every instance of perception need be construed as a matter of private stimulation.

Skinner also talks about "conditioned seeing" and "operant seeing" as examples of private perceptual events (Skinner, 1953, p. 266–275). Skinner's treatment of "conditioned seeing" in these sections implies it is a respondent process: "A man may see or hear 'stimuli which are not present' on the pattern of the conditioned reflex: he may see X, not only when X is present, but when any stimulus that has frequently accompanied X is present" (p. 266). Such a treatment implies seeing X when X is actually present is an unconditional respondent. Perhaps it is more useful to classify such a response as simply coming into physiological contact with a visual stimulus, a process that can be affected by the superimposition of a behavioral process. And, the behavioral process that is superimposed is an operant process, not respondent. That is, the private perceptual response occurs because of its consequences, not simply because it succeeds a stimulus to which it may be related in a Pavlovian way (e.g., Moore, 1980, p. 466). The response may be a generalized response, but it is nevertheless an operant response. Seeing X when X is actually there is simply something that a person with a visual system does, much as a person with a gut absorbs food when food is actually there or with lungs absorbs oxygen when oxygen is actually there. However, behavioral processes may be superimposed upon such phenomena. Suppose, for example, a flash of light is assigned the role of an unconditioned stimulus in a conditioning experiment such that it occupies a part of the visual scene. An otherwise neutral stimulus, in a Pavlovian arrangement with the light flash, might come to elicit the response of occupying the visual scene, as does the unconditional stimulus. If subjects were exposed to such a sequence of events with the neutral stimulus su-

perimposed, a conditioned seeing effect might take place when the scene would be disrupted by the brief bleaching out. This effect on seeing might involve respondent processes, but it is somewhat different from the one that Skinner identifies. The response is not simply rhodopsin bleaching, but rather a response that more centrally involves the nervous system.

One kind of operant seeing at the private level produces discriminative stimuli that prove useful in executing further behavior of either a public or private nature. Skinner poses the following problem, the solution to which is presumably facilitated by private operant seeing:

Think of a cube, all six surfaces of which are painted red. Divide the cube into twenty-seven equal cubes by making two horizontal cuts and two sets of vertical cuts each. How many of the resulting cubes will have three faces painted red, how many two, how many one, and how many none? . . . [T]he solution is easier if we can actually see the twenty-seven small cubes and count those of each kind [B]ut many people solve the problem visually without visual stimulation In this example, one may see the larger cube, cut it covertly, separate the smaller cubes covertly, see their faces, count them subvocally, and so on Presumably, much of this behavior is similar in form to . . . overt manipulation . . . ; the rest is discriminative behavior . . . , which is similar to the behavior that would result from overt manipulation (Skinner, 1953, p. 273).

Moreover, as Skinner (1953, p. 273–274) notes, there are great differences among individuals in the extent to which private seeing has been established and in the ability to come under its control. Perhaps the larger issue, however, is the physiological basis for such private activity. Presumably, much of the strength of the behavioral account of such private activity will ultimately be derived from an increased understanding of the anatomy and physiology involved.

A number of diverse issues concern the relation between the term "knowledge" and private phenomena. For example, it should not be supposed from the foregoing argument that the mere presence of coordinated private activity is equivalent to self-knowledge. Again, consider Skinner:

In throwing a ball, we time a sequence of responses by the stimulation which our own movements generate. Here, the reinforcing contingencies are determined by the mechanical and geometrical exigencies of throwing a ball, and since a reinforcing community is not involved, the question of accessibility to the behaving individual does not arise (Skinner, 1953, p. 261).

Thus, for radical behaviorists, it is one question to know how to throw a ball; it is another to know how to describe what is involved in throwing one. Presumably, the linking of early stages of throwing a ball with the later stages is what takes place as ball-throwing is learned. The neurophysiological activity between early and later stages is not necessarily a private response in a sense in which the psychologist is interested. We are talking here about a special kind of neuromuscular activity. Of course, the psychologist is interested in what occasions and reinforces the ball throwing, and an account of the neuromuscular activity as such will complete the picture, but that neuromuscular activity is more properly within the domain of physiology.

Similarly, as Day (1969a, p. 319; 1969b, p. 501) has noted, an ontological problem often arises when words taken to express our knowledge of something are taken as an at least partial identification of the inherent nature of the object of knowledge or as a statement of what the object of our knowledge is. Accordingly, our verbalizations about something are taken as expressing an identification of one or another aspect of the permanent structure of reality. The problem, conspicuously linked to Descartes, pertains particularly to reifying terms generally thought to refer to psychological processes and even more particularly to reifying terms thought to refer to *private* psychological processes. The problem comes when such words as attending, inferring, observing, trying, deciding, perceiving, knowing, understanding, remembering, and the like are taken as terms that identify psychological states, acts, or processes that correctly map the inherent underlying nature of psychological reality. A particularly troublesome issue has to do with employing the gerundive form of a term in the effort to avoid

the pitfalls of the nominal fallacy (see Moore, 1975, p. 124, 136). For example, instead of using the word attention, a speaker might use the word attending, and so try to avoid certain ontological problems concerned with the nature of attention as a private phenomenon. Woodworth (1938) was at least partly on the right track in proposing that: "When the experimentalist speaks of memory, he refers not to a 'faculty' but to the act or process of remembering" (p. 5). This proposition has the happy consequence of bringing a psychological process into the domain of a behavioral analysis.

However, the proposition is not entirely satisfactory. At the very least, it implies a certain discontinuity among the processes so identified by the various terms. If one is supposed to say sensing instead of sensation and perceiving instead of perception, then what counts as sensing and what as perceiving? Are two acts or processes identified, or just one? What is their relevance to subsequent behavior? What is their relevance to stimulus control? Are we talking about implicit responses, subtle orientational responses, ecological adjustment responses, or what? To the extent that the act or process is pre-behavioral, what is its role in a causal analysis? All too often, despite the grammatical good intentions, the terms seem to end up as reified, fictitious, antecedent causes of behavior. The issue is not so much that an important aspect of a behavioral process has not been identified, but rather the issue turns upon an understanding of verbal processes in speakers, particularly when private phenomena are spoken about.

Even if the relevance of Skinner's analytical three term contingency is acknowledged, the psychological concept concerned with a private phenomenon is all too often taken as referring exclusively to the middle term. A well-intentioned desire to maintain a behaviorally oriented analytical framework has fractionated the stream of behavior, so that the analysis has the appearance of being behavioral although it genuinely is not. For example, the term attending need not be construed as itself designating a kind

of implicit pre-behavioral process that leads to the development of stimulus control, but rather as a term that is occasioned by the controlling relation that exists between an antecedent discriminative stimulus and the response in question (Skinner, 1953, p. 122ff). Thus, the term is occasioned by features of the relation between the first *two* terms of a contingency, not simply by features of only the middle term (see also the analysis of memory in Catania, 1979, p. 307ff).

In a similar vein, many traditional accounts of behavior often devolve into the postulation of certain epistemologically-loaded private entities that are then presumed to have functional significance. From the point of view here, such nominally private entities (beliefs, attitudes, opinions, etc.), upon operational analysis, presumably are terms that refer to strengths of behavior or to other effects of contingencies and reinforcers. The terms have nothing to do with occurrent private stimuli in the sense implied here, nor need we take the methodological behaviorist's position that they reflect private phenomena that may be measured in terms of brain states, neural states or rating scales. Similarly, such other terms as cognitions, intentions, subjective impressions, and the like, upon operational analysis, presumably are terms that refer to discriminative control arising from a person's own verbal responses, probably covert and perhaps even at an incipient stage. In other words, such terms characterize the extent to which one's own verbal behavior, either public or private in form, contributes to contingencies controlling subsequent behavior and may be analyzed as such.

The verbal behavior of scientists is particularly relevant in this regard. Traditional accounts of scientific verbal behavior often involve appeals to such nominally private phenomena as hypothetical constructs, intervening variables, and the like. More importantly for present purposes, such accounts claim that logical devices of this sort exist only for the experimenter/researcher/scientist, and their role is to facilitate explanations

and understanding of events; they should not necessarily be understood as causes of the behavior of the subject. The use of such logical devices is often justified with the assertion that the private phenomena are in the experimenter's head, not the subject's head (Wasserman, 1981, p. 249), and that in any case, phenomena in the subject's head can't be admitted to science because science admits only objectively verifiable phenomena, and phenomena in the subject's head cannot be objectively verified. Moreover, according to the claim, scientists overcome the problem with their own private phenomena by making the phenomena public and intersubjectively verifiable, and hence respectable for science, through the principle of operationism. As has been noted previously (Moore, 1980, p. 470; 1981, p. 59), this traditional account unfortunately entails the notion that scientists possess a kind of raw undifferentiated panorama of events in their consciousness, a set of sensations called immediate experience, which they then carve up by means of a set of logical operations and to the products of which operations they assign logical symbols, ultimately manifested as scientific words, terms, concepts, and the like. The mentalism inherent in this position, resting ultimately upon the view of human nature known as the copy theory, can scarcely be disguised. As noted elsewhere, the mentalism derives not so much from any appeal to mentalistic causes of the subject's behavior, but rather from an appeal to mentalistic causes of the scientist's explanatory behavior (Moore, 1981, p. 65; Skinner, 1945, p. 271). From the present point of view, any valid contribution of private phenomena in these cases presumably arises from the contribution of covert verbal processes to the scientific behavior under consideration, rather than from alleged preverbal operations in a mental domain.

PRIVATE CONSEQUENCES

What about private consequences? Schnaitter (1978) has discussed this issue extensively, but a slightly different line

of reasoning might be followed as an alternative. A physiological psychologist, of course, is intimately interested in the nature of physiological changes wrought by the reinforcement operation, but few behaviorists can claim to be physiological psychologists. Although there surely are important physiological changes that occur inside a hungry rat's skin when its response produces a food pellet, most behaviorists are more interested in a functional account of the relation between environmental events and the response in question. It therefore seems important to identify three cases relating to private consequences: (a) the process of positive reinforcement, (b) the process of negative reinforcement, and (c) the process of punishment. Let us now examine these processes and assess the role of private phenomena in each case.

Positive Reinforcement

Our textbooks tell us that in the prototypical case of positive reinforcement, a response produces a stimulus that would have otherwise remained absent, and the response increases in frequency because of this contingent relation (Catania, 1979). The appearance of the reinforcing stimulus may have a number of effects beyond strengthening the response that produces it, however. Perhaps the most convenient way to characterize these effects is by saying that the reinforcing stimulus itself produces a number of private effects when the organism comes into contact with it. Perhaps these phenomena might even be called private respondents, or perhaps they might simply be designated as matters of interest to physiologists concerned with the totality of the physiological response to a reinforcing stimulus. In any case, it is important to distinguish between, on the one hand, the strengthening effect of the reinforcing consequence upon the response that produced it and, on the other hand, the responses that occur when the organism simply comes into contact with the reinforcer. According to a functional account, the feelings produced by a reinforcer do not strengthen the response that

produces the reinforcer. This position does not deny that persons may experience orgasms when engaging in sexual activity, that a massage does not feel good, that intoxicants do not produce a feeling called euphoric, or that ice cream does not taste sweet. Such cases may be understood as involving simply the nature of that contact with the reinforcer. It is, of course, yet another question to ask how a person comes to label the condition that arises in such cases. This question concerns the stimulus control exercised by the internal condition over a subsequent verbal response, rather than any causal relation between a response and an internal sensation produced by the reinforcing stimulus. Thus, the relevant stimulus may be whatever is in the ice cream that produces its sweet taste, given that the ice cream supports the response in question. The distinction between the response that produced the reinforcing stimulus and the physiological effects attendant upon coming into contact with the reinforcing stimulus further circumvents intractable questions such as whether food reinforces metabolic process and whether oxygen reinforces respiration.

In some cases, positive reinforcers derive a certain effectiveness from motivating operations, such as deprivation. Deprivation from food is commonly said to produce a feeling of hunger, and from water, thirst. The existence of such feelings is often given response initiating properties as well, and the terms "need" and "drive" are often applied. The issue is not so much whether such feelings exist, but rather their role in a functional analysis. If public operations such as deprivation produce private conditions felt as hunger and so dispose a person to eat, then we have a causal chain consisting of three links: (a) deprivation, (b) private condition, and (c) activity leading to eating. The private condition felt as hunger may therefore be understood as a function of the deprivation operation performed upon the person from without. If the second link (the private condition) is an orderly function of the first (deprivation) and the third (activity leading to

eating) is an orderly function of the second, then the first and third links must also be related in an orderly way (Skinner, 1953, pp. 33–35). Thus, positive reinforcers that reduce deprivation do not derive any causal effectiveness from the feelings so affected, but rather from contingencies of survival that have selected organisms that are sensitive in prescribed ways to the prevailing environment.

The issue of conditioned reinforcement is also presumably relevant here. Positive conditioned reinforcers are often stimuli that reliably precede contact with other positive reinforcers. We note that one's behavior may be a source of discriminative stimulation, and there seems to be no good reason why one's behavior, either public or private, cannot be a source of conditioned reinforcing stimulation as well; e.g., "A better case can be made for identifying thinking with behaving which automatically affects the behavior and is reinforcing because it does so. This can be either covert or overt" (Skinner, 1957, p. 438). Daydreaming and fantasizing presumably are sources of such conditioned reinforcing stimulation. It is unclear whether and to what extent one's own behavior should be called self-reinforcing, in the sense that doing something that characteristically achieves reinforcers becomes a functionally autonomous source of reinforcement, quite apart from the reinforcer that is achieved. Professor Herrnstein (1977) has suggested that species specific responses may be such a functionally autonomous source, but Professor Skinner (1977) has taken issue with the suggestion. We further note that an infant's babbling may be automatically reinforcing to the extent it resembles sounds made by caretakers when administering to the infant, but this process is presumably related to generalization involving acoustic properties of public conditioned reinforcers. Private words of praise, feelings of satisfaction when a difficult job is completed, and associated phenomena are presumably additional examples of automatic conditioned reinforcing stimulation. However, in such cases it is important to remember that such private stimulation has acquired its

effectiveness because of certain relations to public phenomena, and presumably such private stimulation does not unconditionally possess primary reinforcing capability (Skinner, 1957, pp. 440–446).

Negative Reinforcement

Our textbooks tell us that in the prototypical case of negative reinforcement, the response terminates or prevents from occurring a stimulus that would otherwise be in effect, and the response increases in frequency because of this contingent relation (Catania, 1979). The presence of the aversive stimulation prior to the response is of particular importance to our analysis here. This case seems to involve a wide range of phenomena, certainly to include the reduction of shock by a response, taking pills or getting shots that are commonly called pain killers, scratching an itch on one's nose, relieving one's bladder when it is full, and going to the dentist to see about a toothache. The presence of such aversive stimulation produces a variety of internal states and conditions. As before, the question is their role in a functional analysis. Perhaps a more precise way of addressing the issue is to ask what is the source that is producing the internal aversive stimulation in the first place, and how does the response in question affect the source of this stimulation? If the source of the stimulation is exogenous and the response affects this source, then there is little question that a public process is involved. We may scratch at the locus of an itch and by so doing reduce an unpleasant feeling, but according to a functional analysis we are affecting either the exogenous source of the aversive stimulation by brushing away the irritant or the vestige of contact with that source that is responsible for the itch in the first place.

What if the source of the aversive stimulation is endogenous, as in toothaches, bruises, internal trauma, and distressingly full bladders? Well, what about toothaches? A toothache is presumably a private source of aversive stimulation. For a public analog, the application of energy

to a foghorn produces a response in the diaphragm mechanism of the foghorn, and acoustic energy is transmitted via propagation of air waves to the ear and from the ear to the brain via the auditory nerve. The stimulus is the acoustic energy emanating from the foghorn and not necessarily the stimulation in the auditory nerve. The stimulation in the auditory nerve is simply part of the physiological activity that occurs when we come into contact with the stimulus. The air is the medium of contact with the stimulus. In the case of toothaches, a pathological agent (bacteria) produces toxins that inflame certain cells, but the response of our interoceptive systems to these toxins is simply the way in which we came into contact with this condition. It may not be especially helpful to call it a behavioral process, at least at this point. The application of energy to the foghorn is presumably equivalent to the application of the toxins from the pathological agent to the cells of interest. The response of the diaphragm is presumably equivalent to the response of the nerve cells we call inflammation. The air-to-auditory nerve continuity is presumably equivalent to the interoceptive system that makes contact with the stimulating state of affairs, i.e., the inflammation and resulting stimulation. In the case of the foghorn, we call the stimulating state of affairs sound. In the case of inflammation, we call the stimulating state of affairs a toothache. In both cases, our nervous systems respond to changes in energy. For the foghorn, the change in energy is public. For the toothache, the change in energy occurs around certain cells and is private.

Presumably, the central issue now becomes how the response affects contact with the endogenous source of aversive stimulation. Taking a pill or a shot to relieve the pain is to come into contact with an exogenous public stimulus, a third variable, that itself modifies contact with the internal source of the pain. Perhaps pain of this sort is best understood as a phenomenon associated with motivational operations, analogous to feelings produced by deprivation. Similarly, we

empty our bladders, but such a response is at least potentially public. Private processes are involved in the sense that the locus of contact with the motivating, aversive state of affairs is beneath the integument.

A further interesting case of this regard is biofeedback in the control of migraine headaches. Perhaps the principle by which biofeedback works entails generating private stimuli that evoke responses incompatible with migraine headaches. Such self-controlling responses are presumably instances of self-instruction or self-mands. It is unclear whether biofeedback, or even meditation, involves processes other than engaging in covert operant behavior that generates supplemental stimulation of this sort. The difficulty of the technique, even when facilitated by instrumental amplification, gives ample testimony to the reality of the problem of privacy.

What about negative conditioned reinforcement and other forms of conditioned aversive stimulation, as in the feelings called anxiety and guilt? Presumably, the strengthening of a response that terminates or avoids such feelings entails the process of negative reinforcement. However, as with the corresponding case of positive conditioned reinforcement, the issue is not so much whether they exist or not—the internal states surely do. The issue is how do the states relate to public phenomena, and how do the responses so strengthened affect the environment either inside or outside the skin? Presumably at one point or another a public process is involved.

The existence of endogenous aversive stimulation, either conditioned or unconditioned, prior to the response is commonly supposed to be a drive inducing phenomenon, and by virtue of this effect, is supposed to have response-initiating properties as well, similar to those assigned to the feelings of deprivation. Presumably it is important to distinguish between, on the one hand, the physiological effects of motivational operations and ongoing aversive stimulation and, on the other hand, the strengthening effect of terminating the motivating condition

upon the responses in question. The feelings noted above are collateral effects of coming into public contact with aversive stimulation. Some of the other feelings are produced by motivating operations related to exogenous public operations. In any case, the changes involving the public state of affairs seem to be the source of the negative reinforcement, not changes in the feelings that accompany the process.

As before, it is yet another question to inquire how a person comes to label the internal condition that exists prior to the response in cases of negative reinforcement. Again, this question concerns the stimulus control exercised by the private condition over a subsequent verbal response, and any causal question centers on how the private condition occasions a verbal response about it, rather than whether changes in feelings per se reinforce responses. Moreover, to ask if a person knows what to do about the pain is to inquire into whether a person can verbalize contingencies related to an escape response. To ask whether persons know they are in pain is presumably to inquire into the current probability of an escape response or else to inquire into whether an internal condition is exercising appropriate stimulus control over the term "pain." All of these questions are of course separate inquiries; there is no necessary relation of one answer to another.

Punishment

The final case involves punishment. Our textbooks tell us that in the prototypical case of punishment, a response produces a stimulus that otherwise would not have occurred, and the response decreases in frequency because of this contingent relation (Catania, 1979). As in the case of positive reinforcement, there are two important effects to consider: the decremental effect on the response that produces the punishing stimulus and the constellation of responses that occurs when the organism comes into contact with the punishing stimulus. Many times punishers produce a condition described as painful, and indeed the stimulation is

similar to that discussed in the case of negative reinforcement above. It is yet another thing to say that the decremental effect occurs because of the feeling of pain. Presumably the decremental effect occurs for the same reasons as the strengthening effect of positive reinforcement: appropriate mechanisms related to the survival of the species have been selected in the course of the evolution of the species. Organisms that are not sensitive to the consequences of these actions have a reduced probability of survival. The issue in a functional analysis is not so much whether punishment involves pain, or whether pain is aversive, but the role of the stimulation that is producing the pain in the first place.

SUMMARY AND CONCLUSIONS

In summary, it seems that private phenomena are involved in the causal analysis of behavior primarily through their participation in controlling contingencies. In some cases private phenomena may serve as the source of discriminative stimulation and in others, as conditioned reinforcing or conditioned aversive consequences. However, even this contribution is conditional upon certain kinds of public experience, such as differential reinforcement from the verbal community in the private stimulus control case and association with an exogenous source of reinforcement in the case of private consequences (cf. Zuriff, 1979). Can all three terms of a contingency, stimulus-response-reinforcer, ever be private? Presumably, they all three can, as when we stifle a sneeze or deal with migraine headaches via biofeedback training, but it should be recognized that such instances owe their robustness at some point to a prior public process, one that has endowed the stimuli with their relevant functional properties, as discussed above. Hence, private contingencies presumably do not produce behavior in and of themselves. A difficulty arises when one attempts to invoke private phenomena in causal explanations without some plausible specification of the process by which the private phenomena acquired their

functional role. To do so without such a specification is to offer at best only a spurious explanation of behavior. Thus, from the behavioristic perspective private stimuli do not seem to have been invested with any inevitable power to cause subsequent behavior in the sense of solely sufficient, antecedent mechanical causation (i.e., in the sense of the reflex-arc).

When feelings and sensations are involved in the causal analysis of non-verbal behavior, their relevance is not so much that they themselves may be considered causal, but rather their relevance is with regard to what caused the feelings and sensations in the first place. Accordingly, certain classes of behavior are not driven by feelings of hunger; rather, such behavior is made more probable by the motivating operations that produce the feeling called hunger. Drinking is not caused by thirst; it is functionally related to operations that cause the condition felt as thirst. Consummatory behavior is not reinforced by reductions in feelings of hunger and thirst, but rather by what reduces those feelings. In sum, reinforcers may be said to be effective not because of their ability to produce good feelings or alleviate unpleasant feelings, although they may indeed possess such ability, but rather because evolutionary pressures during the history of the species have selected organisms that are sensitive in the observed way to the environmental consequences of their actions.

Perhaps one final word is appropriate. No doubt certain of the above "naive physiologizing" is producing some discomfort in readers, for example, when there are appeals to physiology to try to support an analysis of the discriminative functions of certain stimulation, as in toothaches, but then other matters of physiology are relegated to the physiologists, as in the case of the physiology of sensation and of reinforcement. If so, perhaps the operational spirit of the behavioristic argument will at least be accepted, given the recognition that an increased understanding of physiology can only expand our knowledge by providing a surer foundation for the analysis.

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